FANNING HOWEY

# Project Manual

## South Putnam Middle School/High School Fieldhouse Addition

## South Putnam Community School Corporation
## Greencastle, Indiana

MKS
MICHAEL KINDER & SONS
PLAN | DESIGN | BUILD

Project No. 222152.03
Book 2 of 3
Divisions 02 - 13
May 23, 2024

**PROJECT TITLE PAGE**

South Putnam Middle School/High School Fieldhouse Addition

South Putnam Community School Corporation
Greencastle, Indiana

Project No. 222152.03

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END OF PROJECT TITLE PAGE

**CERTIFICATIONS PAGE**

TITLE AND LOCATION OF THE WORK

South Putnam Middle School/High School Fieldhouse Addition
1780 East U.S. Highway 40
Greencastle, Indiana 46135

NAME AND ADDRESS OF OWNER

South Putnam Community School Corporation
3999 South U.S. Highway 231
Greencastle, Indiana 46135

NAME AND ADDRESS OF ARCHITECTS/ENGINEERS

Fanning/Howey Associates, Inc.
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I hereby certify that the Project Drawings and the Project Manual were prepared by me or under my direct supervision and that I am a duly registered Architect/Engineer under the Laws of the State of Indiana.

FANNING/HOWEY ASSOCIATES, INC.
ARCHITECTS/ENGINEERS


Paul A. Miller, License No. AR10800161
Expiration Date: 12/31/2025

Date: May 23, 2024

END OF CERTIFICATION PAGE

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**INTRODUCTORY INFORMATION**

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# DIVISION 02

# EXISTING CONDITIONS

# SECTION 02 41 19 - SELECTIVE DEMOLITION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of building or structure.
   2. Demolition and removal of selected site elements.
   3. Salvage of existing items to be reused or recycled.

B. Related Sections include the following:
   1. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
   2. Division 01 Section "Cutting and Patching" for cutting and patching procedures.
   3. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.
   4. Division 31 Section “Earth Moving” for backfilling.

### 1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled. When permitted by the A/E, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

F. Asbestos-Containing Materials (ACM): Materials containing greater than 1 percent asbestos; however since OSHA regulates the removal of materials containing less than or equal to 1 percent asbestos even those containing less than 1 percent can be considered ACM.

### 1.3 MATERIALS OWNERSHIP

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

B. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

### 1.4 PREINSTALLATION MEETINGS

A. Predemolition Meeting: Conduct meeting at Project site.
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure.

3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 QUALITY ASSURANCE

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

B. Regulatory Requirements: Comply with governing National Emission Standards for Hazardous Air Pollutants (NESHAP) and EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
1. Mercury
a. Elemental mercury may be found in schools as follows:
1) Fluorescent and HID lamps contain mercury; EPA regulations require proper recycling and disposal of these lamps.
2) HVAC and other mechanical components may utilize mercury switches and thermostats; EPA regulations require proper recycling and disposal of such devices.
3) Elemental mercury is often found in school laboratories, occasionally in large quantities. Chemistry and physics labs may study its unusual properties, and labs may utilize mercury-containing devices such as thermometers and pressure gauges. EPA regulations require proper recycling and disposal of mercury from laboratories.
a) Improper handling of elemental mercury from the above sources could result in mercury spills.
4) Elemental mercury may contaminate building drainage systems, especially those drains serving laboratories. Often, plumbing traps and acid/neutralization tanks collect mercury that has been flushed down drains.
b. Suspected mercury spills and mercury removal projects need to be evaluated by experienced consultants or health professionals. Remediation of mercury hazards should be performed by experienced and trained environmental contactors in accordance with EPA and OSHA regulations.
2. Polychlorinated Biphenyls (PCB's)
a. Many schools in the United States have light ballasts containing PCBs. PCBs are contained within the ballast capacitors and potting materials.
b. Caulk may contain PCBs in buildings built from 1950 through the 1970's.
c. PCBs may have been used as an insulator and fire retardant in electrical transformers.
d. PCBs are regulated by the EPA under their Toxic Substances Control Act (TSCA). Materials containing PCBs must be disposed of properly.

C. Standards: Comply with American Society of Safety Engineers (ASSE/SAFE) A10.6 and NFPA 241.

1.6 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
1. Owner will remove items indicated before selective demolition.

C. Notify A/E of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

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 A/E and Owner. Owner will remove hazardous materials under a separate contract, unless otherwise noted.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.
      a. Exception: Provide alternative means of fire protection during demolition of existing fire-suppression systems.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

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

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to A/E.

E. Perform an engineering survey 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 selective demolition operations.
   1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs, or preconstruction videotapes, and templates.
   1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by demolition and salvage operations.
   2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Arrange to shut off indicated utilities with utility companies.

2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

## 3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.
2. Cease operations of public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.

D. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.
1. Refrigerant: Remove and store refrigerant according to 40 CFR 82 and regulations of authorities having jurisdiction.

E. Security: Provide adequate protection against accidental trespassing. Secure project after work hours.

## 3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches.
   5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
   7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   8. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by A/E, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

E. Below-Grade Construction: 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. Abandon below-grade construction outside this area.
   1. Remove below-grade construction, including basements, foundation walls, and footings, completely.

## 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete adjacent to Construction Indicated to Remain: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

B. Other Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
   1. Remove full size CMU without cutting, if possible, at areas to be patched. 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 patching. Install units with cut surfaces and, where possible, cut edges concealed.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove, unless otherwise noted.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
   1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI, unless otherwise noted.
      a. Do not utilize chemical agents.

F. Carpeting: During removal maintain ventilation at maximum capacity.
   1. Vacuum used carpet before removal.
      a. Use a vacuum bearing the CRI Seal of Approval “Green Label”. This label identifies vacuums that have been tested and meet minimum standards for dust containment, soil removal, and carpet appearance retention.
   2. Remove used carpets in large pieces, roll tightly, and pack neatly in container. Deposit only clean, dry carpet in containers. “Clean” is defined as free from demolition debris, asbestos contamination, garbage, and tack strips.
      a. Remove adhesive according to recommendations of the Carpet and Rug Institute (CRI).
   3. Vacuum the floor immediately after old carpet has been removed.
   4. Continue operating the ventilation system at normal room temperature for up to 72 hours.

K. Vinyl Fabric Wall Covering: Carefully remove existing vinyl wall covering avoiding removal of any layers of the existing substrate. Wet surfaces as required and cut existing wall covering into smaller areas to ease removal. Scraping the existing wall covering off may be required.
   1. Sand existing surfaces as required to remove residual adhesive, stains, and mildew.
   2. Cleaning with an adhesive removal product is acceptable if all residual material can be removed.
   3. Substrate surface shall be left clean, dry and sound ready to receive additional preparation required by the specified wall finish material.”

G. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

H. Fluorescent light fixture components shall be removed and recycled/incinerated as follows:
   1. Remove and store non-leaking non-electronic ballasts in sealed or labeled metal drums.
   2. Remove and store leaking non-electronic ballasts in separate sealed and labeled metal drums.
   3. Remove and store fluorescent lamps in cardboard lamp boxes labeled “Mercury Lamps for Recycling.” Lamps shall remain intact.
   4. Lamps and ballasts shall be transported to an EPA approved recycler. Non-electronic ballasts shall be incinerated. All other components may be recycled.

I. Thermostats with Mercury Switches: Remove mercury switch thermostats intact, if applicable. Containerize and transport thermostats to a wholesaler participating in a thermostat recycling program within 10 days.

J. Explosives: Use of explosives or cutting torches is not permitted.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING/PATCHING

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

B. Repair demolition performed in excess of that required. Return structures, substrates, and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.
   1. Refer to Division 01 Section “Cutting and Patching”.

END OF SECTION 02 41 19

# DIVISION 03 CONCRETE

**SECTION 03 06 30.01 - CONCRETE SCHEDULE**

SUBMIT THIS SCHEDULE TO CONCRETE SUPPLIER PRIOR TO BIDDING

| ITEM OR STRUCTURE | FINISH** | CONCRETE CLASS* AND OTHER REQUIREMENTS |
|---|---|---|
| Concrete not otherwise indicated | RfFm-Fn<br>SmFm-Fn,<br>if exposed | Class C |
| Trench footings, footings, and interior foundation and retaining walls | RfFm-Fn<br>SmFm-Fn,<br>if exposed | Class B |
| Foundation and retaining walls exposed to exterior | RfFm-Fn<br>SmFm-Fn, if exposed, UON Ab-Fn, where noted | Class C<br>Air entrained |
| Interior formed concrete exposed to view | SmFm-Fn, UON Ab-Fn, where noted | Class C<br>Not air entrained |
| Noncritical floors and floor slabs to receive mud-set mosaic and quarry tile | Flt-Fn | Class D<br>Provide synthetic fiber reinforcement for non-reinforced slabs on grade |
| Exposed interior floor slabs and carpeted floors, unless otherwise noted | Tr-Fn1 | Class D<br>Provide synthetic fiber reinforcement for non-reinforced slabs on grade |
| Interior floor slabs scheduled to receive thin-set flooring, resilient flooring and other flooring types, unless otherwise noted | Tr-Fn2 | Class D<br>Provide synthetic fiber reinforcement for non-reinforced slabs on grade |
| Interior floor slabs scheduled to receive wood flooring, and where indicated | Tr-Fn4 | Class D<br>Provide synthetic fiber reinforcement for non-reinforced slabs on grade |
| Exterior walks, stoops, steps, aprons, and curbs; exterior formed concrete exposed to view; exterior concrete not otherwise indicated | NsBrm-Fn<br>(Horizontal)<br>Grt-Cl-Fn (Vertical) | Class S<br>Air entrained |
| Exterior paving | NsBrm-Fn | Class S<br>Air entrained |
| Interior Curbs and Equipment Bases | Tr-Fn1 | Class B |
| Flowable Fill – Type 1 Utility Trench Backfill | N/A | 50-100 P.S.I. at 28 days<br>Unconfined compression strength per ASTM D4832 |
| Flowable Fill – Type 2 Under Foundations | N/A | 100 P.S.I. at 28 days<br>Unconfined compression strength per ASTM D4832 |
| | | |

| | | |
|---|---|---|
| Lean concrete fill under footings and encasement of underground utilities or connections | N/A | Class A |

*Refer to Section 03 30 00 – Cast-In-Place Concrete for Concrete Class mix design requirements

**Refer to Section 03 30 00 – Cast-In-Place Concrete for definitions of finishes.

END OF SECTION 03 06 30.01

## SECTION 03 06 30.02 - TYPICAL SLAB DEPRESSION LEGEND

| Specification Section | Material Description | Material Thickness | Slab Depression* |
|---|---|---|---|
| 09 64 66 | Wood Athletic Flooring - Strip | 25/32 inch | 2-1/8 inch |
| 09 65 66.01 | Weight Room Flooring | 18 MM | 3/4 inch |
| *Due to product variations, slab depressions must be verified with proposed finish system before slabs can be poured. | | | |

END OF SECTION 03 06 30.02

# SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for following:
   1. Exterior Concrete
      a. Ramps, steps, and stoops
   2. Interior Concrete
      a. Slab-on-grade
      b. Bases, curbs, risers, and steps
      c. Foundations, footings, pads, piers, columns, beams
      d. Recesses for floor finishes, where indicated.
      e. Building (Retaining) walls
   3. Provide other cast-in-place concrete and related work as indicated for complete and finished work, except concrete work specifically designated to be provided under Work of other Sections of these Specifications.

B. Related Sections include following:
   1. Division 07 Section “Joint Sealants” for sealing joints and penetrations in slab-on-grade or slabs below grade.
   2. Division 09 Finish sections for coordination with substrate requirements of finish materials.
   3. Division 10 Section "Metal Lockers" for coordination with locker base.
   4. Division 31 Section "Earth Moving" for underslab subgrade.
   5. Division 32 Section "Concrete Paving" for concrete pavement and walks.

### 1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with fly ash subject to compliance with requirements.

B. Water/Cement (W/C) Ratio: Ratio by weight of water to cementitious materials.

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

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

E. Permeability – Reducing Admixture (PRAH): Concrete admixture that reacts with calcium hydroxide created by the Portland cement reaction with water and the free water in concrete to eliminate the route of moisture migration and eliminate the free water chemically.

### 1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate with other trades to maintain protection of concrete surfaces scheduled remain exposed. Protect concrete surfaces from physical damage and staining that could result from subsequent construction operations and might compromise final concrete finish.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.

c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.
e. Special concrete finish subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint filler strips, semi-rigid joint fillers, forms and form removal limitations, shoring and reshoring procedures vapor barrier installation, anchor rods and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, methods for achieving specified floor and slab flatness and levelness and concrete protection.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including form coatings, fibrous reinforcement, fly ash, admixtures, curing materials, sealers, floor treatment, and vapor barrier.
1. Include installation instructions where applicable.
a. Vapor Barrier: Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
2. Admixtures: Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature of time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments. Prepare and submit design mixes for each type of concrete and flowable fill. Use an independent testing facility acceptable to A/E for testing compressive strength of proposed mix designs. Submit compression test results for each design mix. Test report shall clearly indicate design mix for which it applies. Each design mix shall indicate types of structures in which it is to be used.
1. Sample design mix submittal form is enclosed herein.

C. Steel Reinforcement Shop Drawings: Comply with ACI SP-066:
1. Placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Formwork Shop Drawings: Prepared by or under supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
1. Indicate dimension and locations of construction and movement joints required to construct structure in accordance with ACI 301.
a. Location of construction joints is subject to approval of A/E.
2. Indicate form liner layout and form line termination details.
3. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

E. Construction Joint Layout: Indicate proposed construction joints required to construct structure.
1. Location of construction joints is subject to approval of A/E.

F. Concrete Schedule: For each location of each class of concrete indicated in "Concrete Mixtures" article, include following:
1. Concrete Class designations.
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.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Material Test Reports: For following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
   2. Mechanical splice couplers.

B. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

C. Field quality-control test and inspection reports i.e. floor flatness and levelness.

D. Proposed curing schedule shall include method and duration.

1.6 QUALITY ASSURANCE

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

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Environmental Requirements: Manufacturer and Contractor shall conform to Federal, State, and Local V.O.C. (Volatile Organic Compound) Regulations in area where Project is located. Notify A/E in writing if variations to Specifications herein are required.

D. Laboratory Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing including mix design.
   1. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

E. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C 1077 and ASTM E 329 for testing indicating.
   1. Personnel conducting field tests shall be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

F. Regulatory Requirements: Comply with requirements of latest edition or edition approved by authorities having jurisdiction.
   1. ACI Publications: Comply with following unless modified by requirements in Contract Documents:
      a. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
      b. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
      c. ACI 347 “Recommended Practice of Concrete Formwork.”
      d. ACI 318, “Building Code Requirements for Reinforced Concrete.”
      e. ACI 211.1-91 "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete."
      f. ACI 212 “Chemical Admixtures for Concrete.”
      g. ACI 302.1R-89 "Guide for Concrete Floor and Slab Construction."
      h. ACI 304R-89 "Guide for Measuring, Mixing, Transporting, and Placing Concrete."
      i. ACI 305 “Hot Weather Concreting.”
      j. ACI 306 “Cold Weather Concreting.”

k. ACI 308 “Standard Practice for Curing Concrete.”
l. ACI 311.4R-95 "Guide for Concrete Inspection."
m. ACI 544.3R-08 “Guide for Specifying, proportioning, and Production of Fiber-Reinforced Concrete”

2. Concrete Reinforcing Steel Institute, “Manual of Standard Practice”.
3. ASTM Intl.:
   a. ASTM A 1064 “Standard Specification for “Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.”
   b. ASTM C33 “Standard Specification Curing Concrete.”
   c. ASTM C94 “Standard Specification for Ready-Mix Concrete.”
   d. ASTM C260 “Standard Specification for Air Entraining Admixtures for Concrete.”
   e. ASTM C494 “Standard Specification for Chemical Admixtures for Concrete.”
   f. ASTM C309 “Standard Specification for Liquid Membrane – Forming Compounds for Curing Concrete.”
   g. ASTM C779 “Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.”
   h. ASTM C1018 “Test Method for Flexural Toughness and First-Crack Strength of Fiber-Reinforced Concrete.”
   i. ASTM C1116 “Standard Specification for Fiber Reinforced Concrete and Shotcrete.”
   j. ASTM C1315 “Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.”
   k. ASTM E1155 “Determining Floor Flatness and Levelness Using F-Number System.”
   l. ASTM F609 “Standard Test Method for Using a Horizontal Pull Slip Meter (HPS).”

G. Concrete ramps and curbs shall be provided to conform to Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
   1. Detectable warnings shall conform to ADAAG.

H. Mockups: Cast concrete slab-on-grade panels to demonstrate typical joints, surface finish, texture, and standard of workmanship.
   1. Slab-On-Ground build panel approximately 225 sq.ft. (area within one set of control joints) in location indicated or, if not indicated, as directed by A/E.
      a. Divide panel into four equal panels to demonstrate saw joint cutting.
   2. Formed Surfaces: Build panel approximately 100 sq.ft. in location indicated or, if not indicated, as directed by A/E.
   3. Approval panels may become part of completed work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Concrete: Comply with ASTM C94 and ACI 301.

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

C. Vapor Barrier:
   1. Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
   2. Store materials in a clean, dry area in accordance with manufacturer’s instructions.
   3. Protect materials during handling and application to prevent damage or contamination.

1.8 FIELD CONDITIONS

A. Environmental Requirements.
   1. Floor and Slab Treatments: Follow manufacturer's recommendations for environmental requirements when using floor and slab treatments.
      a. Do not apply concrete densifier and chemical hardener when concrete temperature is below 35 degrees F or above 135 degrees F.

B. 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 temperature.
   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 temperature range required by ACI 301.
   3. Do not use frozen materials or materials containing ice or snow. Do not place concrete in frozen subgrade or on subgrade containing frozen materials.
   4. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
   5. Do not place concrete in contact with surfaces less than 35 deg F., other than reinforcing steel.

C. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1 and as follows:
   1. Maintain concrete temperature below 95 deg. F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without sanding water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
   2. Products: Subject to compliance with requirements, provide one of products specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. Requests for A/E's approval must be accompanied by "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 CONCRETE, GENERAL

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

2.3 FORM-FACING MATERIALS

A. Smooth-Formed Finished (Exposed) Concrete Form-Facing Material (As-Cast Surface): Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, fiberglass, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    a. High-density overlay, Class 1 or better.
    b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    c. Structural 1, B-B or better; mill oiled and edge sealed.
    d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

E. Chamfer Strips: Metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
1. Products:
    a. Greenstreak 622; Greenstreak
    b. Vinylex CSN-3/4; Vinylex Corp.
    c. CHM-75-75-110 Poly-Comp Plastic Chamfer; Sylvan Products
    d. CS-750 Chamfer Former; BoMetals Inc.

F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will 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 acceptable to form liner manufacturer.
3. Products: Subject to compliance with requirements, provide one of following:
    a. MasterFinish RL 211; BASF Construction Systems
    b. Crete-Lease 20-VOC; Cresset Chemical Co.
    c. Clean Strip J1EF; Dayton Superior Corporation
    d. Asphalt Release; Franmar Chemical, Inc.
    e. Bio-Form; Leahy-Wolf Co.
    f. Soy Form Release and Natural Form Oil: Natural Soy, LLC
    g. SOYsolv; SOYsolv
    h. Formshield WB; Tamms Industries
    i. SealTight Duogard II; W.R. Meadows, Inc.

G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1 inch to plane of exposed concrete surface.
2. Furnish ties that, when removed, will 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.

## 2.4 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed for bars No. 3 to 11, unless otherwise noted.

B. Epoxy-Coated Reinforcing Bars: ASTM A 615, Grade 60, deformed bars, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

C. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60, deformed bars, assembled with clips.

D. Plain-Steel Wire: ASTM A 1064, as drawn.

E. Deformed-Steel Wire: ASTM A 1064.

F. Epoxy-Coated Wire: ASTM A 884, Class A, Type 1 coated, as-drawn, plain-steel wire, with less than 2 percent damaged coating in each 12-inch wire length.

G. Plain-Steel Welded Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets. Note: Roll stock is not acceptable.

H. Deformed-Steel Welded Wire Reinforcement: ASTM A 1064, flat sheet.

I. Galvanized-Steel Welded Wire Reinforcement: ASTM A 1064, plain, fabricated from galvanized steel wire into flat sheets. Note: Roll stock is not acceptable.

J. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884, Class A coated, Type 1, plain steel.

2.5 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, ASTM A 775 epoxy coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.

D. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
   3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
   4. Over waterproof membranes and vapor barriers, use precast concrete chairs to prevent penetration of membrane.
   5. For footings, trench footings, slabs on grade, and grade beams use precast concrete bricks (f'c = 3000 psi min. at 28 days). (Concrete masonry bricks are not acceptable.)

F. Tie Wire: ASTM A 1064, annealed steel, not less than 0.0508 inch in diameter.
   1. Finish: Match finish of reinforcing type being tied, unless otherwise noted.

2.6 CONCRETE MATERIALS

A. Source Limitations: Obtain each type of class or cementitious material of same brand from same manufacturer’s plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Material: Use following cementitious materials, of same type, brand, and source, throughout Project:
   1. Coordinate with mix design for special finishes.
   2. Portland Cement: ASTM C 150, Type I or III, gray. Supplement with following:
   3. Limit fly ash to Class F if concrete expansion from alkali silica or alkali carbonate reactions are anticipated.
      a. Fly Ash: ASTM C 618, Class C or F.

C. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, uniformly graded not to exceed 1-1/2 inch nominal size per ACI 301. Provide aggregates from a single source to ensure uniformity in color, size, and shape with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials. Aggregates shall not be potentially reactive as defined in Appendix X1 of ASTM C33.
   1. Local aggregates not complying with ASTM C33, but which have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to A/E.
   2. Fine Aggregate: Clean, sharp, natural sand free from loam, clay lumps, or other deleterious substances.
   3. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
      a. Crushed stone, processed from natural rock or stone.
      **b.** Washed gravel, either natural or crushed. Use of pit or bank-run gravel is not permitted. No pea gravel, river gravel or slag aggregate is permitted in gymnasium concrete slab.
      c. Maximum Aggregate Size: Not larger than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourths of minimum clear spacing between individual reinforcing bars or bundles of bars.
      d. Exterior concrete shall have crushed limestone aggregate, complying with ASTM C33, Class 4S or better.
   4. Alkali-Silica Reaction: Comply with one of following:
      a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C 1293.
      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 C 1567.
      c. Alkali Content in 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 C 1293 and categorized in accordance with ASTM C 1778, based on alkali content being calculated in accordance with ACI 301.

D. Combined aggregate gradation for slabs and other designated concrete shall be 8%-18% for large, top size aggregates (1-1/2 inch) or 8%-22% for smaller, top size aggregates (1 inch or 3/4 inch) retained on each sieve size below top size and above No. 100.

E. Water: ASTM C 94 and potable, clean and free from oil, acid, alkali, organic or other deleterious substances and complying with ASTM C94.

## 2.7 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260 as indicated in Article "Concrete Mixtures for Building Elements".

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use admixtures containing intentionally-added chlorides.
   1. Water-Reducing Admixture: ASTM C 494, Type A.
   2. Retarding Admixture: ASTM C 494, Type B.
   3. Accelerating Admixture: ASTM C 494, Type C
   4. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
   5. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

6. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
7. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
8. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

C. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
1. Products:
   a. Axim Concrete Technologies; Catexol 1000CI.
   b. Cortec Corporation; MCI 2005NS.
   c. GCP Applied Technologies Inc. (formerly Grace Construction Products); DCI-S.
   d. BASF Construction Systems.; MasterLife CI 222.
   e. Sika Corporation; FerroGard-901.

D. Shrinkage Reducing Admixture
1. Eclispe; GCP Applied Technologies Inc. (formerly Grace Construction Products)
2. MasterLife SRA 20; BASF Construction Systems
3. Mix Water Conditioner; Apply Concrete Technology
4. Catexol 2000 SCA; Axim Concrete Technologies, Inc.
5. PMA-SRA; ProMix Admixtures

## 2.8 VAPOR BARRIER AND ACCESSORIES

A. Vapor Barrier:
1. Plastic Vapor Barrier
   a. Water Vapor Barrier: ASTM E-1745; meets or exceeds Class A.
   b. Permeance Rating: ASTM E-96 or ASTM F 1249; 0.01 Perms or less.
   c. Thickness of Barrier: ACI 302.2R-06; not less than 15 mils.
2. Products:
   a. Stego Wrap (15 mil) Vapor Barrier; Stego Industries
   b. VaporBlock 15/VaporBlock G; Raven Industries
   c. Perminator (15 mil); W.R. Meadows
   d. Viper Vaporcheck II (15 mil); Insulation Solutions Inc.
   e. Barrier-Bac VB-35 16 mil); Interplast
   f. Husky Yellow Guard (15 mil); Poly-America
   g. Tex-Trude Xtreme Vapor Barrier (15 mil); Tex-Trude, LP

B. Vapor Barrier Accessories
1. Seam/Transition Tape: Tape with pressure sensitive adhesive or double-sided adhesive. Minimum width 4 inches.
2. Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instruction.

C. Drainage Fill (Coarse):
1. Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel ASTM D 448; coarse-aggregate grading size 57; with 100 percent passing a 1 inch sieve and not more than 5 percent passing a No. 8 sieve.

## 2.9 CURING MATERIALS

A. Evaporation Reducer: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Products:
   a. Spray-Film; ChemMasters.
   b. AquaFilm; Dayton Superior Corporation.
   c. Eucobar; Euclid Chemical Company (The).
   d. Vapor Aid; Kaufman Products, Inc..
   e. Lambco Skin; Lambert Corporation.
   f. E-Con; Laticrete International, Inc..
   g. MasterKure ER 50; BASF Construction Systems.
   h. Evapre; Meadows, W. R., Inc..

i. Waterhold; Metalcrete Industries.
j. Monofilm; Nox-Crete Products Group, Kinsman Corporation.
k. SikaFilm; Sika Corporation, Inc..
l. Certi-Vex EnvioSet; Vexcon Chemicals, Inc..
m. TK-2120 TRI-FILM; TK Products, Division of Sierrra Corp..

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
1. Color:
a. Ambient Temperature below 50 deg. F.: Black.
b. Ambient Temperature between 50 deg F. and 85 deg F.: Any color or clear.
c. Ambient Temperature above 85 deg F.: White.

D. Curing Paper: Eight feet wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
1. Basis-of-Design: Fortifiber Building Systems Group.

E. Water: Potable.

2.10 SEALERS

A. Penetrating Anti-Spalling Sealer (Exterior ramps, steps, and stoops): Sealer shall be a siloxane-based compound or silane modified siloxane emulsion formulated to reduce chloride ion absorption/intrusion by 80 percent when tested in accordance with NCHRP #244, Test Method Series II tests. In addition, sealer-treated concrete shall exhibit no scaling when exposed to 125 cycles of freezing and thawing when tested in accordance with ASTM C 672. Tests shall be by an independent testing laboratory.
1. Products:
a. Baracade ME (VOC Compliant); Euclid Chemical Co.
b. Saltguard WB; PROSOCO, Inc.
c. Aquapel Plus; L & M Construction Chemical Co.
d. SpallGuard WB-10; ChemMasters
e. Sikagard 701W; Sika Corporation
f. Weather Worker J29; Dayton Superior Corporation
g. Intraguard/Pentreat 244-40; W.R. Meadows
h. V-Seal 102 Winter Guard; V-Seal Concrete Sealers and Concrete Coatings.

B. Floor Sealer: ASTM C1315, Type I, Class A and ASTM C309, Type I, Class A and B. Acrylic water-based urethane clear sealer, non yellowing, resistant to blush, and satin finish as recommended by manufacturer for preventing staining by waterborne and oil substances.
1. Products:
a. Everclear VOX (Acrylic Sealer); Euclid Chemical Co.
b. MasterKure CC 250 SB; BASF Construction Systems
c. Cure and Seal 1315 EF; Dayton Superior
d. Polyseal WB; ChemMasters

2.11 RELATED MATERIALS

A. Expansion and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, ASTM D 1752, cork or self-expanding cork, or ASTM 4819, Type II, or ASTM D 1622 closed-cell compressible foam, 1/4 inch maximum thickness.

B. Expansion Board Caps: High impact polystyrene caps for fiber board joint filler, designed to be removed after concrete has hardened and before sealants are applied.

C. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

G. Floor Slab Protective Covering: Eight feet with cellulose fabric.
   1. Basis-of-Design: McTech Group, Inc. or a comparable product as recommended by a specialty concrete finish manufacturer.

2.12 REPAIR MATERIALS

A. Epoxy Crack Injection Adhesive (Repair): ASTM C881, Type I, Grade 1, solvent free.
   1. Products:
      a. Sikadur 35 Hi-Mod LV; Sika Corp.
      b. Sure-Inject J56; Dayton Superior Corp.
      c. EUCO #452 LV; Euclid Chemical Co.
      d. MasterInject 1500; BASF Construction Systems.
      e. Pro-Poxy 100; Unitex

B. 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 C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   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 4100 psi at 28 days when tested according to ASTM C 109.
   5. Products:
      a. Ardex K-15; Ardex Inc.
      b. Econolevel; Dayton Superior Corporation.
      c. Skimflow ES; Dependable Chemical Co., Inc.
      d. EZ Level; TEC Specialty Products.
      e. Super FLO TOP; Euclid Chemical Co.
      f. Levelex; L & M Construction Chemical.

C. Repair Overlayment (Traffic-Bearing): Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   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 5000 psi at 28 days when tested according to ASTM C 109.
   5. Products:
      a. Level Topping; Dayton Superior
      b. Duracrete; L & M Construction

c. Wearflow; Dependable Chemical Co. Inc.
d. Ardex SD-T or K500; Arden Americas.

D. Patching Material:
1. Use to repair honeycombed, damaged, and other defective concrete.
a. Products:
1) Five Star Structural Concrete; Five Star Products, Inc.
2) MasterEmaco S477 CI; BASF Construction Systems
3) Civil/Structural V/O; Dayton Superior Corporation
2. Use to repair vertical or overhead surfaces
a. Products
1) Five Star Structural Concrete V/O; Five Star Products, Inc.
2) MasterEmaco S488 CI; BASF Construction Systems
3) Civil/Structural V/O; Dayton Superior Corporation
3. Where patching material is being placed in thicknesses greater than 2", it may be extended with pea gravel aggregate in accordance with the manufacturer's recommendations.

2.13 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent 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, unless otherwise noted.
a. Limit fly ash to 10 percent of special finished concrete where color is applied.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use 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 and accelerating admixture when required by low temperatures or cold-weather placement conditions.
**4.** Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
5. Use corrosion-inhibiting admixture in concrete mixtures, where indicated.
6. Use shrinkage reducing admixture in concrete mixtures, where indicated.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Class A Concrete: Use as a non-excavatable fill material underneath building foundations or where an inexpensive low strength concrete is required.
1. Compressive strength at 28 days: 3000 psi.
2. Minimum cement content: 423 lb/cu yd.
3. Maximum water-cement ratio: 0.58.
4. Air content: 5 to 7% where concrete will be exposed to exterior conditions.
5. Water-reducing admixture required
6. Slump: 6 to 9 inches

B. Class B Concrete: Use for building foundations, grade beams, curbs, and interior and exterior equipment bases.
1. Compressive strength at 28 days: 4000 psi.
2. Minimum cement content: 517 lb/cu yd.
3. Maximum water-cement ratio: 0.48.

4. Air content: 5 to 7% where concrete will be exposed to exterior conditions.
5. Water-reducing admixture required.
6. Slump: 5 to 8 inches

C. Class C Concrete: Use for column piers, columns, walls, retaining walls, and where concrete mix class is not otherwise indicated
1. Compressive strength at 28 days: 4000 psi.
2. Minimum cement content: 564 lb/cu yd.
3. Maximum water-cement ratio: 0.40.
4. Air content: 5 to 7% where concrete is exposed to exterior conditions. Limit air content for trowel finished floors to 3%.
5. Water-reducing admixture required.
6. Slump: 5 to 8 inches

D. Class D Concrete: Use for interior slabs on grade.
1. Compressive strength at 28 days: 3500 psi.
2. Minimum cement content: 470 lb/cu yd. (use 20% fly ash).
3. Maximum water-cement ratio: 0.45.
4. Air content: None added.
5. Water-reducing admixture required.
6. Substitute pea gravel coarse aggregate for concrete used to fill metal pan stair system stair treads and landings.
7. Slump: 5 to 8 inches

E. Class S Concrete: Use for exterior slabs on grade, stoops, sidewalks, curbs, and drives.
1. Compressive strength at 28 days: 4000 psi.
2. Minimum cement content: 564 lb/cu yd.
3. Maximum water-cement ratio: 0.45.
4. Air content: 5 to 7%
5. Water-reducing admixture required.
6. Coarse Aggregate: Crushed limestone
7. Slump: 5 to 8 inches, less than 2 inches for slip formed curbs.

2.15 PROPORTIONING AND DESIGN OF MIXES

A. Proportion mixes by either laboratory trial batch or field experience methods as specified in ACI 301, using materials to be employed on project for each class of concrete required.

B. Submit written reports to A/E of each proposed mix for each type of concrete at least 15 days prior to start of Work. Indicate with each mix design items or structures for which it is to be used. Do not begin concrete production until mixes have been reviewed by A/E. Submit following information:
1. Complete identification of aggregate source of supply.
2. Tests of aggregates for compliance with specified requirements.
3. Scale weight of each aggregate.
4. Absorbed water in each aggregate.
5. Brand, type, and composition of cement with product information.
6. Brand, type, and amount of each admixture with product information.
7. Amounts of water used in trial mixes.
8. Proportions of each material per cu.yd., including fibrous secondary reinforcement, if used.
9. Gross weight and yield per cu.yd. of trial mixtures.
10. Measured slump, with and without water reducer, if used.
11. Measured air content.
12. Submit compressive strength results from tests performed by an independent testing agency on at least 30 consecutive strength tests or two groups of tests totaling at least 30 within past 12 months. Supply standard deviation and average strength in accordance with Article 3.9 of ACI 301.
13. Identification number or name of mix to verify agreement with compression test reports.
14. Water/Cement Ratio

C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as accepted by A/E. Laboratory test data for revised mix designs and strength results shall be submitted to and must be accepted by A/E before using in work.

D. Maximum Water Cementitious Ratio: Concrete mixes shall be limited to water-cement ratios specified in Concrete Schedule in these Specifications (Division 03 Section “Concrete Schedule”). Water reducers and fly ash may be used to increase slump while maintaining or reducing water-cementitious ratio at or below maximums specified values, except where specifically prohibited in these specifications.

E. Concrete Batching: Add color pigments, where indicated, to concrete mix of concrete batch facility at amount recommended by manufacturer for each type of concrete.

2.16 FABRICATING REINFORCEMENT

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

2.17 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
   1. Addition of water to batch will be permitted only to regain target slump for particular mix design or with verification that design water/cement ratio has not been exceeded and only under direct control of concrete testing agency field representative. All water added at site to be noted on concrete field inspection report. All tests on concrete to be performed after water is added.
   2. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
   3. Mix proprietary materials in accordance with manufacturer’s instructions, including product data and product technical bulletins.
      a. Once specific mix design and sequencing of raw materials have been established, do not alter. Consistency of raw materials in each phase of mixing is most important element in making quality concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive concrete sealer. Do not apply over curing compounds. Notify A/E if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.2 PREPARATION

A. Preplacement Observation: Before placing concrete, observe and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other trades to permit installation of their work; cooperate with other trades in setting such work, as required.
   1. Observe soil at bottom of foundation systems, which will be subject to testing for soil bearing value by testing laboratory, as directed by A/E. Place concrete immediately after approval of foundation excavations.
   2. Observe underslab drainage course areas that were subject to testing for soil bearing value by testing laboratory as required by A/E. Place concrete immediately after approval of underslab compaction tests.

B. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
   1. Access to the work.

2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Security and protection for samples and for testing and inspection equipment at Project site.

C. Material placement for interior slabs on grade and exterior concrete stoops.
1. Install and properly support and anchor slab welded wire fabric.
2. Position waterstops and expansion joint fillers where indicated and as recommended by manufacturer. Special precautions shall be taken to avoid collapse during installation.

D. Under slabs-on-grade, place drainage course on prepared subbase and as follows:
1. Place drainage course on subgrades free of mud, frost, snow, or ice.
2. Compact 6 inch drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

E. Clean surfaces to receive coatings. Remove loose and foreign matter that could interfere with application or performance of sealer.

3.3 FORMWORK INSTALLATION

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 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.
a. For architectural concrete specified in Division 03 Section "Architectural Concrete", limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).
3. Side forms are not required at sides of trench footings or or footings unless specifically indicated. Contractor responsible for foundations is responsible to verify from Geotechnical Engineering Report included in this Project Manual that soil conditions allow use of earth-formed foundations. If soil conditions do not allow earth-forming, Contractor shall include cost of forming foundations in his bid.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces, where exposed to view.
2. Class C, 1/2 inch for rough-formed finished surfaces, unless otherwise noted.
3. Variation from plumb in lines and surfaces of columns, piers, walls, and arrises; 1/4 inch per 10 feet, but not more than 1 inch. For exposed corner columns, control joint grooves, and other conspicuous lines, 1/4 inch in a bay or 20 feet maximum; 1/2 inch maximum in 40 ft. or more.
4. Variation in sizes and locations of sleeves, floor openings, and wall openings, 1/4 inch.
5. Variations in footings plan dimensions, minus 1/2 inch and plus 2 inches; misplacement or eccentricity, 2 percent of footing width in direction of misplacement but not more than 2 inches; thickness reduction, minus 5 percent.

D. Construct forms tight enough to prevent loss of concrete mortar.
1. Minimize joints.
2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct 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 like, for easy removal.
4. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. 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.

H. Chamfer exterior corners and edges of permanently exposed concrete, unless otherwise noted.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in Work.
   1. Determine sizes and locations from trades providing such items.
   2. Obtain written approval of A/E prior to forming openings not indicated on Drawings.

J. Construction and Movement Joints
   1. Construct joints true to line with faces perpendicular to surface plane of concrete.
      a. Where joints divide footings and walls, joints shall have keyway formed. Keyways shall be 1/3 of thickness of element, shall extend to within 3 inches of ends of element and shall be at least 1-1/2 inch thick, unless otherwise noted.
   2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by A/E.
   3. Place joints perpendicular to main reinforcement.
   4. Locate joints for beams, slabs 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.

K. 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.

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

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

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

O. Earth Forming: Where footings are to be constructed in cohesive soils, Contractor may elect to earth form footings with approval of A/E. Earth forms shall be excavated to create vertical faces to detailed dimensions within a tolerance of plus 6 inches, minus 0 inch.

## 3.4 EMBEDDED ITEMS INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
   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's 303 "Code of Standard Practice for Steel Buildings and Bridges."

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.
    a. Cast in continuous dovetail anchor slots on vertical concrete surfaces where masonry abuts; 24 inches on center for parallel surfaces and at centerline of masonry for perpendicular walls.
5. Conduits and pipes of aluminum shall not be embedded in structural concrete unless effectively coated to prevent aluminum-concrete reaction or electrolytic action between aluminum and concrete.
6. Clean embedded items immediate prior to concrete placement.

## 3.5 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of 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, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place a minimum of 14 days and not until concrete has achieved 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 Work.
1. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable 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 A/E.

## 3.6 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

## 3.7 VAPOR BARRIER INSTALLATION

A. Vapor Barriers: Place, protect, and repair vapor barriers according to ASTM E 1643 and manufacturer's written instructions.
1. Place vapor barrier directly below slab and above drainage fill.
    a. Install vapor barrier material with largest dimension parallel with direction of pour.
    b. Face laps away from expected direction of concrete pour whenever possible.
2. Extend vapor barrier over footings and seal to foundation wall, grade beam, or slab at an elevation consistent with top of slab or terminate at impediments such as water stops or dowels. Seal around penetrations such as utilities and columns in order to create a monolithic membrane between surface of slab and moisture sources below slab as well as at slab perimeter.
    a. Seal top edge with continuous bead of high-grade mildew resistant silicone sealant or manufacturer’s tape.

3. Lap joints minimum 6 inches, or as instructed by manufacturer, and seal laps in accordance with manufacturer's recommendations.
4. Seal all penetrations (including pipes) with manufacturer's pipe boot or manufacturer's instructions.
5. Extend vapor barrier over tops of pile caps and grade beams to a distance acceptable to structural engineer and terminate as recommended by manufacturer.
6. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged areas 6 inches and sealing all four sides with tape.

3.8 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.
2. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

B. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
1. Weld reinforcing bars according to AWS D1.4, where indicated.

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 as indicated, placing bars in contact, and tightly tying wire.
2. Stagger splices in accordance with ACI 318.

G. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging.
1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice".
2. Lap edges and ends of adjoining sheets at least one mesh spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

H. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

I. Provide sufficient numbers of supports and of strength to support reinforcement in correct position. Do not place reinforcing bars more than 2 inches beyond last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

J. Reinforcing steel installed in continuous footings shall run continuous. This shall include specially shaped components with proper lap where corner reinforcing and step footings occur.

K. Provide additional reinforcing around required openings in footings and slabs having a one foot least dimension.

L. Support welded wire fabric in slabs-on-grade with precast concrete bricks at 2 feet spacing in both directions.

3.9 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete. Place joints at ends of pours and where placement operations are stopped for more than 1/2 hour, except where such pours terminate at expansion joints.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by A/E.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in middle third of spans. Offset joints in girders a minimum distance of twice beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at top of footings or floor slabs.
   5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control (Contraction) Joints in Slabs-on-Grade: Form weakened-plane control (contraction) joints, sectioning concrete into areas as indicated. Construct control (contraction) joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form control (contraction) joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control (contraction) joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form control (contraction) joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades with a triangular arbor configuration. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random control (contraction) cracks.
      a. For most concrete mixtures, this means sawing should be completed within first six to 18 hours and never delayed more than 24 hours. Early-entry saws are available which may allow cutting to begin within a few hours after placement.
   3. Control (contraction) joints shall be filled with self-leveling traffic grade sealant as specified in Division 07 Section “Joint Sealants” for following locations, unless otherwise noted:
      a. Exposed and concealed concrete slabs on grade with no additional floor finish or sealed concrete finish only.
         1) Sealant color shall match sealed concrete color.
      b. Concrete slabs on grade to receive wood floor system or Contractor may omit joints in slabs under wood flooring.
   4. Locate control (contraction) joints in slabs-on-ground, as indicated, if not shown, then so as to divide slab into sections with a maximum distance of 12 feet between control joints both directions, unless otherwise noted.
      a. For areas receiving a polished concrete finish decrease spacing of contraction joints to 10 foot each way.
         1) Area of contraction joints should be as close to square as possible.
   5. Contractor may elect to omit all control joints, where slabs are to be covered with a finish material, provided that all cracks that develop at greater than 1/64 inch width be filled with epoxy crack injection adhesive 60 days or more after slab placement.
      a. Exception: Do not omit control joints in slabs scheduled to be exposed.

D. Isolation Joints in Slabs-on-Grade: 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.

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 Division 07 Section "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: 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.

3.10 CONCRETE PLACEMENT

A. General: Comply with ACI 304, “Guide for Measuring, Mixing, Transporting, and Placing Concrete”. First day test pours shall be a maximum of 1000 sq.ft. total size to work out problems and to determine if adjustments are required to attain proper quality of work. Slab pours shall be limited to not greater than 18 feet in width.

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

C. Notify A/E and testing and inspection agencies 24 hours prior to commencement of concrete placement.

D. Do not add water to concrete during delivery, at Project site, or during placement unless approved by A/E, but not to exceed amount indicated on concrete delivery ticket.
1. Do not add water to concrete after adding water-reducing admixtures to mixture.

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

F. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   a. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. 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.
3. Concrete shall be completely discharged within 1-1/2 hours after entering conveying drum.
4. Pumping methods using steel or plastic pipelines will be permitted. Aluminum alloy lines shall not be used. Minimum pipe diameter allowed for pumping shall be 3 inches.
5. Pumped Concrete: Comply with ACI 304R.

G. 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 surface. Do not further disturb slab surfaces before starting finishing operations.
8. Do not further disturb slab surfaces before starting finishing operations.

3.11 FINISHING FORMED SURFACES

A. Rough-Formed Finish (SF-1.0): ACI 301 surface finish as-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
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.

B. Smooth-Formed Finish (SF-2.0): ACI 301 surface finish as-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
2. Remove projections larger than 1/4 inch.
3. Patch holes.
4. Surface Tolerance: ACI 117 Class B.
5. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, and to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish (Ab-Fn): Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
a. If sufficient cement paste cannot be drawn from concrete by rubbing process, use a grout made from same cementitious materials used in in-place concrete.

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

3.12 FINISHING FLOOR AND SLABS

A. General Information (Slabs-on-Grade): Requirements indicated are based upon latest FF/FL method. Bids for this work shall reflect these requirements and enforcement can be expected.
1. Comply with ACI 302.1R recommendations for screeding, restraightening and finishing operations for concrete surfaces. Do not wet concrete surfaces.
a. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Finished surface is to be free of trowel marks, uniform in texture and appearance and with surface leveled to tolerances indicated. Do not burnish trowel surface.
b. Elevated slabs shall comply with following floor flatness (FF) values. Floor levelness values will not apply to elevated slabs.
2. Finish surfaces to the following tolerances, in accordance with ASTM E 1155.

B. Float Finish (Flt-Fn) – Noncritical Floors: When bleed water sheen has disappeared and concrete has stiffened sufficiently to permit operation of specific float apparatus, consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening, until surface is left with uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.

1. Specified Overall Value: FF 20/FL 15.
2. Minimum Local Value: FF 14/FL 10.
3. Apply float finish to monolithic slab surfaces that are to receive a trowel finish**.**

C. Trowel Finish; General: After applying float finish, apply first troweling and consolidate concrete by hard or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor covering. Do not add water to concrete surface.
   1. Trowel Finish 1 (Tr-Fn1): Carpeted Floors, unless otherwise noted.
      a. Specified Overall Value: FF 25/FL 20.
      b. Minimum Local Value: FF 17/FL 14.
      c. Apply trowel finish to monolithic slab surfaces that are to receive carpet and noncritical floors where slabs remain exposed, such as mechanical rooms, metal stair pan fill, and topping over precast deck, unless otherwise noted.
   2. Trowel Finish 2 (Tr-Fn2): Floors with improved flatness/levelness requirements.
      a. Specified Overall Value: FF 35/FL 25.
      b. Minimum Local Value: FF 24/FL 17.
      c. Apply trowel finish to monolithic slab surfaces that are to receive thin-set flooring, resilient flooring, linoleum flooring, fluid-applied flooring, resinous flooring and other flooring types, unless otherwise indicated.
         1) At thin-set tile with all edges shorter than 15 inches, maximum allowable variation shall be 1/4 inch in 10 feet from required plane, with no more than 1/16 inch variation in 1 foot when measured from high points of surface. After surface is steel troweled, apply a fine broom finish.
         2) At thin set tile with at least one edge 15 inches in length or longer, maximum allowable variation in substrate is 1/8 inch in 10 feet from required plane, with no more than 1/16 inch variation in 2 feet when measured from high points of surface. After surface is steel troweled, apply a fine broom finish.
         3) At thin-set terrazzo tile floors, maximum permissible variation shall be 1/8-inch in 10 feet from required plane. After surface is steel-troweled, apply a fine broom finish.
   3. Trowel Finish 4 (Tr-Fn4): Wood and Resilient athletic flooring covered floors, and with other floor finishes as indicated in their technical sections and required by their manufacturers:
      a. Maple Flooring Manufacturers Association recommends the concrete slab troweled smooth and flat to a tolerance of 1/8” in 10’ radius, subject to approval of the MFMA Sport Floor Contractor and the following procedures are to be used to provide appropriate slab flatness requirement:
         1) Plot a 5 foot grid on slab surface.
         2) Using a 10 foot straight edge, move it perpendicular to plotted grid in both directions to identify all areas requiring correction. (Note: Use of a transit or laser alone does not include measurements between grid points.)
         3) High spots shall be ground level, and low spots filled in with approved leveling compounds by Contractor responsible for this Section to full approval of flooring installer. Fill must not become brittle, crack, or lose bonding to concrete slab. Fill must not be affected by loads applied to resilient pads, if present. In anchored system applications, fill must provide required P.S.I. strength and allow anchoring without breaking or sprawling when pins are installed.
   4. Exposed Surfaces: Use steel-reinforced plastic power trowel blades (in lieu of steel) to control dark burnish marks on plain concrete or surface to receive: stain, dye, shake-on, integral pigments, polished, or clear sealed.

D. Nonslip Broom Finish (NsBrm-Fn): Apply nonslip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom, perpendicular to main traffic route. Coordinate required final finish with A/E before application.

## 3.13 MISCELLANEOUS CONCRETE ITEMS INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete 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 base a minimum of 4-inches high unless otherwise indicated; and extend base not less than 6 inches in each direction beyond maximum dimensions of supported equipment unless otherwise indicated.
   3. Minimum Compressive Strength: 4,000 psi at 28 days, unless otherwise indicated.
   4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around 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 finished 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.

## 3.14 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 301 and ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
   1. Surfaces Scheduled to Receive Polished Concrete Finish: Protect appearance of concrete surface from physical damage and staining that could result from subsequent construction operations and might compromise final polished concrete finish.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. 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. Cure concrete containing color pigments in accordance with color pigment manufacturer’s instructions.
   3. If forms remain during curing period, moist cure after loosening forms.
   4. 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.

e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
1) Recoat areas subject to heavy rainfall within three hours after initial application.
2) Maintain continuity of coating and repair damage during curing period.

D. Curing Unformed Surfaces: Cure concrete according to ACI 308.1, by one or a combination of following methods:
1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:
a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of following:
1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
a) Lap edges and ends of absorptive cover not less than 12-inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), 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) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, following:
a) Water.
b) Continuous water-fog spray.
b. Floors to Receive Urethane Flooring:
1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.
c. Floors to Receive Curing Compound:
1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
a) Apply second coat to all surfaces with a direction of application at 90 degrees to first coat and to same rate of application.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing period.
4) After seven days and curing period has elapsed, remove curing compound as soon as concrete is not subject to rewetting.
a) Contractor shall "brush blast (shot)" surface. Process involves utilizing a self-contained shot-blasting machine, such as a Blastrac, that utilizes steel shot (170 of 230). By using this process, pores of concrete will open and floor will be cleaned, but leave a very light profile similar to International Concrete Repair Institute "CSP 1".
b) Curing compounds must be removed after concrete has cured.

## 3.15 TOLERANCES

A. Conform to ACI 117.

3.16 SEALER INSTALLATION

A. Anti-Spalling Sealer: All exterior slabs, unless otherwise noted, shall be sealed with specified penetrating anti-spalling sealer. Surface preparation of slabs and sealer application shall be in strict accordance with directions of manufacturer. Field service shall be provided, upon 5 days' notice, by manufacturer of sealer to assist contractor in obtaining maximum benefits of product under prevailing jobsite conditions. In addition, sealer representative shall attend pre-installation conference with A/E and contractor to discuss proper equipment and procedures.

B. Floor Sealing Coat: Apply to all exposed slabs that received curing and sealing compounds before turning over building to Owner.
   1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions, including slab preparation requirements. .
   2. Application. Apply at a uniform coverage with an individual handheld pump-up or airless sprayer, or by roller. Common garden-type sprayers should not be used. If applying by roller, use a short 3/8-inch nap, solvent resistant roller cover. First coat acts as a primer for second coat. Allow first coat to dry tack-free before applying second coat.
      a. Follow manufacturer's prescribed coverage rates.
   3. Apply second coat near completion of project after final cleaning.

3.17 JOINT FILLING

A. Prepare, clean, and install joint filler according to 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 joint clean and dry.

C. Fill control joints with self-leveling traffic grade sealant at following locations:
   1. Exposed slabs with no additional floor finish.
   2. Slabs to receive wood floor system.

3.18 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by A/E. Remove and replace concrete that cannot be repaired and patched to A/E's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half 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 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 in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. 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 will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by A/E.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include 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.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
    a. Treat nonmoving substrate cracks to prevent cracks from telegraphing (reflecting) through underlayment according to manufacturer’s written recommendations.
    b. Concrete Substrates: Mechanically remove laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond according to manufacturer’s written instructions.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to 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. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

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

1. Fill all cracks larger than 1/64 inch in both slabs-on-grade and elevated slabs with epoxy crack injection adhesive.

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

3.19 FIELD QUALITY CONTROL

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

B. 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 to Project site.

C. Inspections: Refer to end of this Section.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to 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.
   2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
      a. When frequency of testing will provide 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.
   3. Slump: ASTM C 143; 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. Perform additional tests when concrete consistency appears to change.
   4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
   6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   7. Compression Test Specimens: ASTM C 31.
      a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
      b. Cast and field cure for first 24-hours two sets of two standard cylinder specimens for each composite sample.
   8. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
      a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
      b. A compressive-strength test shall be average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
   9. 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.
   10. 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.
   11. Test results shall be reported in writing to A/E, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
   12. Nondestructive Testing: Rebound hammer, sonoscope, or other nondestructive device may be permitted by A/E but will not be used as sole basis for approval or rejection of concrete.
   13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by A/E. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by A/E.
   14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
   15. Correct deficiencies in Work that test reports and inspections indicate do not comply with Contract Documents.

E. Contractor shall measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

3.20 CONCRETE WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess concrete materials are Contractor's property. At completion of work, remove from Project site.

B. Excess Concrete Waste: Remove excess clean concrete waste that cannot be used as fill as described above, and other concreting operations waste, and legally dispose of off Owner's property.

3.21 PROTECTION

A. General, 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 unprotected concrete surfaces.
   5. Prohibit placement of steel items directly on concrete surfaces.
   6. Prohibit use of acids or acidic detergents over concrete surfaces.

B. Protect concrete that will remain exposed and has or will receive a floor or slab treatment or a curing and sealing compound with protective cover.

C. Slab Protection: Where concrete surface is scheduled to receive special concrete finish or remain exposed.
   1. Floor must be protected from following:
      a. Silicone chalks should not be used if at all possible. Red and yellow chalks are permanent dyes. Red chalks, black markers, wax pencils should not be used for framing. White or blue chalks are ok. Do not over mark for framing. Do not use silicone sprays to hold lines. Sprays repel stain and leave harsh, permanent scars on floor.
      b. Do not use, tape, glue, solvents, pine-sol, varnish, non-breathing plastics, liquid nail, silicone, plastics, nails, plumbers glue, foam insulation, bond release agents, flux, oils, grease, polyurethane, paint, markers (framers often write dimensions of doorways in marker on slab. They need to make notes on framing instead), grease sticks, spray paints, crayons, muriatic acid, and other chemicals both before and after staining.
   2. Do not allow to spill or sit on floor.
      a. It is important that wood, sheet goods, insulation boards, plywood, press board, drywall, sections of framing and like not lay on slab for extended periods of time. They can transfer resins and tannins into slab. This will alter moisture content in slab which leaves a pattern in finished floor. Cardboard should be placed between slab and stacked material to minimize any unwanted transfer. Also food, beverages, oil, glass, metal, paint, chalk, or primers. Be sure to check lifts tires for nails and screws, diaper all equipment from oil and grease drips, don't allow pipe cutting equipment on slab without protection.

3.22 REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

| VERIFICATION AND INSPECTION | CONTINUOUS SPECIAL INSPECTION | PERIODIC SPECIAL INSPECTION | REFERENCED STANDARD | IBC REFERENCE |
|---|---|---|---|---|
| 1. Inspection of reinforcement, including prestressing tendons, and verify placement. | --- | X | ACI 318: 3.5, 7.1-7.7 | 1910.4 |
| 2. Inspection of anchors cast-in-concrete where allowable loads have been increased or where strength design is used. | --- | X | ACI 318:8.1.3, 21.1.8<br>AISC 360: N7 | 1908.5<br>1909.1 |
| 3. Inspection of anchors post-installed in hardened concrete members. (See Note 2) | | X | ACI 318:3.8.6, 8.1.3, 21.1.8 | 1909.1 |

| VERIFICATION AND INSPECTION | CONTINUOUS SPECIAL INSPECTION | PERIODIC SPECIAL INSPECTION | REFERENCED STANDARD | IBC REFERENCE |
|---|---|---|---|---|
| 4. Verifying use of required design mix. | -- | X | ACI 318: Ch.4, 5.2-5.4 | 1904.2, 1910.2, 1910.3 |
| 5. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete. | X | -- | ASTM C172, C31 ACI 318.5.6, 5.8 | 1910.10 |
| 6. Inspection of concrete and shotcrete placement for proper application techniques. | X | --- | ACI 318: 5.9, 5.10 | 1910.6, 1910.7, 1910.8 |
| 7. Inspection for maintenance of specified curing temperature and techniques. | -- | X | ACI 318: 5.11-5.13 | 1910.9 |
| 8. Inspect formwork for shape, location and dimensions of the concrete member being formed. | --- | X | ACI 318:6.1.1 | --- |

Notes:
1. Where applicable, see IBC Section 1705.11, Special Inspections for Seismic Resistance
2. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with ACI 355.2 or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

END OF SECTION 03 30 00

# DIVISION 04

# MASONRY

**SECTION 04 20 00.00 - UNIT MASONRY**

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:
   1. Concrete masonry units (CMUs).
   2. Clay face brick.
   3. Mortar and grout.
   4. Reinforcing steel bars.
   5. Masonry joint reinforcement.
   6. Ties and anchors.
   7. Embedded flashing.
   8. Miscellaneous masonry accessories.
   9. Cavity-wall insulation.

B. Related Sections include the following:
   1. Division 03 Section “Cast-in-Place Concrete” for dovetail slots for masonry anchors.
   2. Division 07 Section “Fluid-Applied Air and Vapor Barrier” for fluid-applied membrane air barrier, vapor permeable.
   3. Division 07 Section “Sheet Metal Flashing and Trim” for formed reglets and for additional requirements for solder and sealant for sheet metal flashing.
   4. Division 07 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.
   5. Division 08 Section “Hollow Metal Doors and Frames” for installation requirements.
   6. Division 09 Sections “Tiling” and “Resilient Base and Accessories” for coordination of bullnosed CMU with height of wall base.

C. Products installed, but not furnished, under this Section include the following:
   1. Steel lintels and shelf angles for unit masonry, furnished under Division 05 Section “Structural Steel Framing”.
   2. Products furnished under Division 05 Section “Metal Fabrications”, including post installed anchors.
   3. Nailing blocks furnished under Division 06 Section “Rough Carpentry”.
   4. Hollow metal frames will be provided under Division 08 Section “Hollow Metal Doors and Frames”.
   5. Conduits and plumbing will be provided under Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning, Division 26 – Electrical, Division 27 – Communications, and Division 28 – Electronic Safety and Security.

1.2 REFERENCES

A. Definitions
   1. General: Definitions, glossary and terminology used in this Section are from the National Concrete Masonry Association TEK 01-04.
   2. CMU(s): Concrete Masonry Units.
   3. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.
   4. Cavity: A continuous air space between wythes of masonry or between masonry and its backup system.
   5. Cavity Mortar Protection: Used in conjunction with flashing and weep vents to provide a system to properly evacuate moisture from a masonry cavity wall by providing a continuous path for incidental moisture to escape from weep vents.
   6. Cavity Wall: A multiwythe non-composite masonry wall with a continuous air space within the wall (with or without insulation), which is tied together with metal ties.

7. Composite Wall: A multiwythe wall where the individual masonry wythes act together to resist applied loads. Transfer of stress between components of a member designed so that in resisting loads, the combined components act together as a single member.
8. Wall, Loadbearing: Wall that supports vertical load in addition to its own weight. By code, a wall carrying vertical loads greater than 200 lb./ft. in addition to its own weights.
9. Wall, Multiwythe: Wall composed of 2 or more masonry wythes.
10. Wythe: Each continuous vertical section of a wall, one masonry unit in thickness.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of masonry and masonry accessories with thermal and air barrier and other moisture protection work to provide a tested wall assembly.

B. Pre-installation Meeting: Conduct meeting at Project site. Note: As work progresses, additional pre-installation meetings might need to take place to coordinate installation of various components of exterior enclosure.
1. Meet with Owner, A/E, CM, testing and inspection agency representative, mason, and other installers whose work interfaces with or affect masonry.
2. Review methods and procedures related to masonry installation, including manufacturers' requirements and recommendations.
3. Review temporary protection requirements.
4. Review mockup and cleaning requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including but not limited to:
1. Cavity wall insulation.
2. Flexible flashing materials, including manufacturer’s written installation instructions.

B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes, including full return corner units.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI PRC-315, "Guide to Presenting Steel Design Details." Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end dam units, and other special applications.

C. Samples for Verification: For each type and color of the following:
1. Provide samples at the project site only.
2. Face brick, in the form of straps of five or more bricks.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
1. Masonry units.
a. Provide material test reports substantiating compliance with requirements, if requested.
b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include material test report for efflorescence according to ASTM C 67, and the following:
1) Compressive strength
2) 24 hour cold water absorption
3) 5 hour boil absorption
4) Saturation coefficient
5) Initial rate of absorption (suction)

d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing according to ASTM C 67 and a list of address of buildings in Project's area where proposed bricks has been used successfully and with a history of durability.

2. CMU: Upon regular presentation within past 12 months of representative units by approved manufacturer, a test report from an independent laboratory showing resultant weight, compressive strength (based on net area), and water absorption properties, as well as adherence to standards where so specified, for:
   a. Each proposed type and size of concrete masonry units.
   b. Test reports shall conform to ASTM C140 and shall include:
      1) Name of Manufacturer
      2) Date of Manufacture of Test Specimen
      3) Dimension Measurements (in.)
      4) Calculated Gross Area (sq.in.)
      5) Calculated Net Area (sq.in.)
      6) Total Load (lbs.)
      7) Net Unit Load (psi)
      8) Sample Weight (lbs.)
      9) Dry Weight (lbs.)
      10) Wet Weight (lbs.)
      11) Immersed Weight (lbs.)
      12) Density (pcf)
      13) Moisture Content (%)
      14) Absorption (%)
      15) Linear Shrinkage Coefficient (%)

a. CMU: Submit compression test results from an independent testing laboratory showing the compressive strength of each type and size of concrete masonry units delivered to the construction site during the first fifteen days of masonry construction. Submit additional tests from each type and size of concrete masonry units for each 10,000 sq.ft. of concrete masonry wall constructed. The independent testing laboratory is to select units to be tested from materials stockpiled on the Project site.

4. Cementitious materials. Include brand, type, and name of manufacturer.
5. Mortar admixtures.
6. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
7. Grout mixes. Include description of type and proportions of ingredients.
8. Reinforcing bars.
9. Joint reinforcement.
10. Anchors, ties, and metal accessories.
11. Flexible Flashing. Certification of compatibility by manufacturer, listing all materials on the Project with which the product and accessories may come into contact**.**

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
   2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement. For both fine and course grouts including complete identities and proportions of ingredients.
      a. Weight of each ingredient including water.
      b. Measured slump.
      c. Water/cement ratio.
      d. Sieve analysis for aggregates.

C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in TMS 402/602.

D. Certification: “Grouting and Reinforcing Certification” by the International Masonry Institute as a “Certified Grout Installer” or having successfully completed the IMI training and certification for “Grouting and Reinforcing Certification” or a similar program approved by A/E.

1.6 QUALITY ASSURANCE

A. Installer
1. Grouting and Reinforcing: All masonry grouting and reinforcing work shall be performed by masonry craft workers who have successfully completed the International Masonry Institute (1-800-IMI-0988) training course for Grouted and Reinforced Masonry Construction to similar program approved by A/E. Contractor may also perform work under the supervision of a “Certified Grout Installer” as long as supervisor is present at the time of each pour.
2. Flashing Assemblies: All masonry flashing assemblies shall be installed by masonry craft workers who have completed the International Masonry institute (1-800-IMI-0988) upgrade training course for “Masonry Flashing” or a similar program by flashing manufacturer approved by A/E.
    a. Instructor/Flashing Manufacturer’s Representative conducting training for flashing installation shall:
        1) Assist/review flashing at “mockup”.
        2) Pay at least one other visit to the Project site at the A/E’s direction.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not proceed with work prior to receipt of written acceptance of mock-up by A/E. Observation and evaluation of the mockup shall be by A/E, CM, General Trades Contractor and Masonry Contractor.
1. Build mockups for typical exterior wall(s) in sizes approximately 72 inches long by 60 inches high full and by full thickness, including face and backup wythes and accessories.
    a. General, exterior wall mockup shall be constructed to verify wall performance. Mockup shall demonstrate how components will integrate into the assembly and exhibit how the thermal and air barrier transition to various components, for example, wall transition to roof. Coordinate mockup with testing requirements of Air Barrier.
    b. Use step-back construction to expose the relationship of various wall components to each other. Components incorporated and exposed for observation shall include examples of:
        1) Facing units;
        2) Weeps, vents, cavity drainage material, and other accessories; including clean out ports;
        3) Mortar of the correct color(s) and strength(s);
        4) Backup wall construction;
            a) Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup; with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
        5) Joint reinforcing;
        6) Structural reinforcing, grouting, and accessories;
        7) Ties and anchors;
        8) Cavity insulation, air barriers and/or vapor retarders;
        9) Shelf angles and their supports;
        10) Bond beams and lintels;
        11) Flashings (including terminations, plane changes, and end dams); and
            a) Include air barrier veneer anchors, flashing, cavity mortar protection, and weep vents in exterior masonry-veneer wall mockup, where applicable.
        12) Masonry expansion and control joints

13) Include at least one switch or outlet box. If surface mounted items, such as exterior lighting, audio horns, or video cameras, will be installed in split-faced masonry, provide at least one example installation.

c. Include a sealant-filled joint at least 16 inches long in each exterior wall mockup.

d. Mockups shall include typical parapet/eave detail, transitions from wall to roof/roof to wall (flashing, thermal and air barrier transition details), and include the following typical wall penetrations:
   1) Entries/doors.
   2) Openings, i.e. storefront, curtainwall, and windows.
      a) First in place of each type opening installed shall leave portions of the perimeter exposed for inspection of fasteners and air barrier transitions. Some portions of mockup shall receive final sealant so it can be tested for air barrier compliance.
      b) Demonstrate blocking at openings, movement joints (sealant filled) minimum 1 to 4 inches.
      c) Demonstrate installation of lower corner of window opening at upper corner of exterior wall.
   3) Roof to wall transitions, including pitched roof to high wall transitions when applicable.
   4) Include an example of thru-wall penetration by each trade contractor including fire protection, plumbing, mechanical and electrical.

e. The mockup shall be photographed or recorded on video by the masonry contractor to be part of a presentation for groups of trade's people as they join project work force.

2. The mockup need not be fully constructed at one time, but construction and approval of each element shall precede the construction of its respective exterior wall components. The mockup shall mirror the building development starting with the foundation and ending at the top of the wall and its transition to the roof. Reviews will be scheduled around the weekly progress meetings. If required attendees are not present, then that phase will be delayed and rescheduled. Respective mockup phase shall be completed and approved before that portion of work starts at the building. Anticipated phasing:

   a. Phase One: Install the CMU backup wythe per the approved mockup drawing. The CMU backup wythe shall include rebar, centering clips, ladder reinforcing, grout, bond beam, and bearing plates.

   b. Phase Two: Install the embedded flashing in the presence of A/E, CM, General Trades Contractor and Masonry Contractor flashing manufacturer, and Owner's Testing and Inspection Agency. Embedded flashing shall include the flashing, all sealants and adhesives, termination bar, fasteners, end dams, and inside and outside corners.
      1) Pre-Installation Meeting for masonry veneer will be held on this date.
      2) Flashing will be reviewed and will require approval by all present.

   c. Phase Three: Review the exterior face of the CMU backup wythe prior to the installation of the air barrier / spray insulation. Install the air barrier / spray insulation in the presence of A/E, CM,and.
      1) Pre-Installation Meeting for air barrier / spray insulation will be held on this date.
      2) Air barrier / spray insulation will be reviewed and will require approval by all present.

   d. Phase Four: Install the masonry veneer per the approved mockup drawing.
      1) Masonry veneer will be reviewed and will require approval by A/E, CM, and Owner.

   e. Phase Five: Clean the mockup veneer.
      1) Pre-Installation Meeting for cleaning of masonry veneer will be held on this date.
      2) Cleaning of mockup veneer will be reviewed and will require approval by A/E, CM, and Owner.

3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.

4. Prior to starting general masonry cleaning, prepare mock-up for cleaning using the same cleaning materials and methods proposed for the Work, and under same weather conditions to be expected during cleaning. Obtain A/E's acceptance of visual qualities before proceeding with masonry restoration. Record cleaning process and results of all testing.
    a. Test materials and methods on samples of adjacent non-masonry materials for possible reaction with cleaning materials, except where materials and methods are known to have a deleterious effect on such materials.
    b. Allow a waiting period of the duration indicated, but not less than 7 calendar days, after completion of sample cleaning to permit a study of sample panels for negative reactions.
5. Protect accepted mockups from the elements with weather-resistant membrane.
6. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship. Panel shall be used as a standard of comparison for all masonry work built of same material.
    a. Approval of mockups is also for other material and construction qualities specifically approved by A/E in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by A/E in writing.
7. 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. Assume responsibility for acceptance of masonry units delivered to Project site being in compliance with specified ASTM requirements for chippage and dimensional tolerances.
    1. Inspect decorative units upon delivery to ensure color match with required materials and accepted mock-up panel.

B. Store masonry units on elevated platforms in a dry location to prevent contamination by mud, dust or materials likely to cause staining or other defects. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
    1. Cover masonry units at all times.
    2. Install decorative CMU as soon as possible after delivery.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
    1. Deliver cementitious and other packaged materials in unopened containers, plainly marked and labeled with manufacturers' names and brands.
    2. Handle cementitious materials in a manner that will prevent the inclusion of foreign materials and damage by water or dampness.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
    1. Stockpile and handle aggregates to prevent contamination from foreign materials. Store different aggregates separately.
    2. Store sand on tarps to keep ground water from wicking into sand.

E. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.
   1. Deliver flexible flashing materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
   2. Store flexible flashing materials as recommended by manufacturer. Keep away from open flame or sources of ignition.
   3. Protect insulation from physical damage. Handle boards carefully so corners are not broken off or boards otherwise damaged.

1.8 FIELD CONDITIONS

A. Refer to Division 01 Section "Product Requirements".
   1. Do not apply flexible flashing on wet or damp surfaces.
   2. Apply flashing to surfaces free of dirt, oils, lubricants, and other debris.
   3. Install flexible flashing materials at temperature above 40 deg. F. At temperature below 40 deg. F., apply primer in accordance with flashing manufacturer's recommendations, prior to installation of flashing.
   4. Do not use metal reinforcements or ties coated with loose rust or other coatings, including ice, which will reduce bond.

B. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress. Refer to Section 1.8B ("Masonry Protection") in TMS 402/602. Note: Protection is required by Building Code.
   1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
   2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
   3. Continue to cover walls until tie-in to roof is complete and top of wall is protected from water penetration.

C. This structure is designed to be self-supporting and stable after the building is fully completed. Protect masonry walls against wind damage by bracing as required until support of walls is integral with the completed building structure. This includes the addition of whatever temporary bracing, guys, or tie-downs that might be necessary. Such material is not shown on the Drawings. If applied, they shall be removed as conditions permit, and shall remain the Contractor's property.
   1. Safety: It is solely the Contractor's responsibility to follow all applicable safety codes and regulations governing this Work.
   2. Load application after building masonry columns, piers, or walls
      a. Do not apply uniform design floor or roof loading for at least 12 hours.
      b. Do not apply concentrated loads for at least 3 days.

D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

E. 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 NCMA TEK 03-01C. Comply with cold-weather construction requirements contained in TMS 402/602 with special emphasis on the following:
   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, but not less than 7 days after completing cleaning.
      a. To assure mortar temperatures between 40 degrees F and 120 degrees F until used, heat mixing water or aggregates when air temperature is between 32 degrees F and 40 degrees F. When the air temperature is between 25 degrees F and 32 degrees F, heat both water and aggregate.
      b. Do not heat water or sand above 160 degrees F.
   2. Comply with the requirements of the governing code and with the "Construction and Protection Recommendations for Cold Weather Masonry Construction" of the Technical Notes of Brick and Tile Construction by the Brick Industry Association (BIA) and International Masonry Industry All-Weather Council, “Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.”

F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602 and the following:
   1. Masonry construction performed when ambient temperature exceeds 100 degrees F (or 90 degrees F with wind velocities greater than 8 mph) shall conform to the following requirements:
      a. Store materials in cool, shaded location.
      b. Cover aggregate stockpiles with black plastic sheet to retard the evaporation of moisture.
      c. Cool reinforcing steel, metal accessories, wheelbarrows, mixers and mortar boards by flushing with water.
      d. Wet high-suction brick.
      e. Increase lime and/or cement content to maximum allowed under ASTM C270 for mortar type specified.
      f. Increase water content of mortar and grout as needed.
      g. Spread mortar beds no more than 4 feet ahead of masonry, and set units within one minute of spreading mortar.
      h. Moist cure masonry by water fog spray after tooled joints have set.
      i. Cover walls to retard evaporation.
      j. Schedule work to avoid hottest part of day.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany request for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate. Do not change source or brands of masonry mortar materials during the course of the Work.

2.2 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths ($f'_m$) at 28 days.
   1. Determine net-area compressive strength ($f'_m$) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in TMS 402/602.

B. Regulatory Requirements: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:
   1. TMS 402/602 “Building Code Requirements and Specification for Masonry Structures.”
      a. Maintain one copy of the standard in project field office at all times during construction. Contractor’s supervisory personnel shall be thoroughly familiar with this material as it applies to the project and shall be present at all times and direct work performed under this Section.
   2. National Concrete Masonry Association (NCMA)
      a. NCMA TEK Bulletin 03-01C “All Weather Concrete Masonry Construction”.
      b. NCMA TEK Bulletin 03-02A “Grouting Concrete Masonry Walls”.
      c. NCMA TEK Bulletin 03-08A “Concrete Masonry Construction”.
      d. NCMA TEK Bulletin 03-04C “Bracing Concrete Masonry Walls Under Construction”.
      e. NCMA TEK Bulletin 05-02A “Clay and Concrete Masonry Banding Details”.
      f. NCMA TEK Bulletin 07-01D “Fire Resistance Rating of Concrete Masonry Assemblies”.
      g. NCMA TEK Bulletin 08-02A “Removal of Stains from Concrete Masonry.”
      h. NCMA TEK Bulletin 08-03A “Control and Removal of Efflorescence.”
      i. NCMA TEK Bulletin 08-04A “Cleaning Concrete Masonry”.
      j. NCMA TEK Bulletin 09-01A “Mortars for Concrete Masonry.”
      k. NCMA TEK Bulletin 10-01A “Crack Control in Concrete Masonry Walls”.
      l. NCMA TEK Bulletin 10-02D “Control Joints for Concrete Masonry Walls – Empirical Method”.
      m. NCMA TEK Bulletin 10-03 “Control Joints for Concrete Masonry Walls – Alternative Engineering Method.
      n. NCMA TEK Bulletin 10-04 “Crack Control for Concrete Brick and Other Concrete Masonry Veneers”.
      o. NCMA TEK Bulletin 12-04D “Steel Reinforcement for Concrete Masonry”.
      p. NCMA TEK Bulletin 14-04B "Strength Design Provisions for Concrete Masonry."
      q. NCMA TEK Bulletin 14-07C "Allowable Stress Design of Concrete Masonry (2012 IBC & 2011 MSJC)."
      r. NCMA TEK Bulletin 19-04A “Flashing Strategies for Concrete Masonry Walls”.
      s. NCMA TEK Bulletin 19-05A “Flashing Details for Concrete Masonry Walls.”
      t. NCMA TEK Bulletin 19-07 “Characteristics of Concrete Masonry Units with Integral Water Repellent”.
   3. ASTM International:
      a. ASTM C33 "Standard Specification for Concrete Aggregates."
      b. ASTM C90 “Standard Specification for Loadbearing Concrete Masonry Units."
      c. ASTM C91 “Masonry Cement.”
      d. ASTM C140 “Standard Test Methods of Sampling and Testing Concrete Masonry Units.”
      e. ASTM C144 “Standard Specification for Aggregate for Masonry Mortar.”
      f. ASTM C150 “Standard Specification for Portland Cement.”
      g. ASTM C207 “Standard Specification for Hydrated Lime for Masonry Purposes.”
      h. ASTM C270 “Standard Specification for Mortar of Unit Masonry.”
      i. ASTM C426 “Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units.”

j. ASTM C 476 “Standard Specification for Grout for Masonry”.
k. ASTM C780 “Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.”
l. ASTM C979 “Standard Specification for Pigments for Integrally Colored Concrete.”
m. ASTM E514 “Standard Test Method for Water Penetration and Leakage Through Masonry”.

4. International Masonry Industry All-Weather Council (IMIAWC).
   a. “Recommended Practices and Guide Specifications for Cold Weather Masonry Construction – 1993”.
5. International Masonry Institute
   a. “Internal Bracing Design Guide for Masonry Walls Under Construction”.
   b. Detailing Series.
6. Underwriters’ Laboratory Inc. (UL)
   a. UL “Building Materials Directory”.
   b. UL 618 “Standard for Concrete Masonry”.
7. Brick Industry Association (BIA)
   a. BIA Technical Notes No. 1 – Revised 1992: All weather construction.
   b. BIA M1-88: Specifications for Portland Cement Lime Mortar for Brick Masonry.
   c. BIA Technical Notes No. 7 – Water Penetration Resistance – Design and Detail.
   d. BIA Technical Notes No. 18A – Accommodating Expansion of Brickwork.
   e. BIA Technical Notes No. 20 – Revised 1990: Cleaning Brick Masonry.
   f. BIA Technical Notes No. 27 – Revised 1994: Brick Masonry Rain Screen Walls.
   g. BIA Technical Notes No. 28B – Revised 1987: Brick Veneer.
   h. BIA Technical Notes No. 28C – Thin Brick Veneer.

## 2.3 MASONRY UNITS, GENERAL

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

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

C. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

## 2.4 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows:
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide bullnose units for outside corners and at sills, unless otherwise indicated or sill is indicated to receive additional finish materials.
      a. At base of wall and where indicated (first CMU course above floor), provide exposed square edge external corners. Above base transition square edge to the bullnose above by grinding.
      b. Provide bullnose unit with 1 inch radius bullnose (BN1), unless otherwise noted.
      c. Provide double bullnose units 1 inch radius bullnose (BN2) at top of half wall as indicated.
   3. Provide two core type masonry units where required to receive vertical reinforcing.
   4. Bond beam units shall be such that where two reinforcing steel bars are required in the bond beams, bars may be located not greater than 2-5/8 inch from both faces of the unit. Bond beam units that do not allow the two bars to be separated and to be within 2 5/8” of each face will not be acceptable.

B. Concrete Masonry Units: ASTM C 90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2,800 psi.
   2. Weight Classification: Normal weight.
   3. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

2.5 MASONRY LINTELS

A. Concrete Lintels: Not acceptable**.**

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from specially formed “U” shaped lintel units with reinforcing bars placed as indicated and filled with coarse grout. Open-bottom, bond-beam type units are not acceptable for use as reinforced lintels. Cure prefabricated lintels before handling and installing. Temporarily support built-in-place lintels until cured. Prefabricated lintels shall have a faux head joint pattern on their exposed faces, and shall have their top side clearly marked in the factory. Prefabricated lintels are to be installed such that the faux head joint pattern aligns with that of the surrounding masonry.

2.6 BRICK

A. General: Provide shapes indicated and as follows:
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
   2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
   3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
   4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: ASTM C 216, Grade SW, Type FBX or FBS.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi.
   2. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
   3. Modular: Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
   4. Application: Use where brick is exposed, unless otherwise indicated.
      a. Provide solid units and units with finish on multiple sides as required by configurations.
   5. Products: Refer to manufacturer and color noted on Drawings.
      a. Texture: Velour

2.7 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color(s) indicated.
   1. Alkali content shall not be more than 0.6 percent when tested according to ASTM C 114.

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

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 270, Type S.

D. Masonry Cement: ASTM C 91 veneer only.
   1. Products:
      a. Brixment or Velvet; Essroc, Italcementi Group.
         Mortamix Masonry Cement or Rainbow Mortamix Custom Buff Masonry Cement or White Mortamix Masonry Cement; Holcim (US) Inc.
      b. Magnolia Masonry Cement or Lafarge Masonry Cement or Trinity White Masonry Type S or Trinity White Masonry Type N; Lafarge North America Inc.
      c. Lehigh Masonry Cement or Lehigh White Masonry Cement; Lehigh Cement Company
      d. Richmortar; CEMEX.
      e. Miami Masonry Cement; Fairborn Cement Company.

E. Mortar Cement: ASTM C 1329.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
   1. Products:
      a. Bayferrox Iron Oxide Pigments; Bayer Corporation, Industrial Chemicals Div.
      b. True Tone Mortar Colors; Davis Colors.
      c. MasterColor; Master Builders Solutions.
      d. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.
      e. Prism Pigments, a Division of Mix Manufacturing, Inc.
      f. Euclid Chemical Company.
      g. Lanxess Corp.
      h. Acme-Hardesty Co., Acme-Shield Plus Admixture; Cargill.

G. Colored Cement Product: Packaged blend made from Portland cement and lime, masonry cement, or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
   1. Products:
      a. Colored Portland Cement-Lime Mix:
         1) Rainbow Mortamix Custom Color Cement/Lime; Holcim (US) Inc.
         2) Eaglebond; Lafarge North America Inc.
         3) Lehigh Custom Color Portland/Lime Cement; Lehigh Cement Company.
         4) Color Mortar Blend; Glen-Gery Corp.
         5) Salyor’s PLUS; Essroc.
         6) PCL; CEMEX.
      b. Colored Masonry Cement:
         1) Flamingo-Brixment; Essroc, Italcementi Group.
         2) Rainbow Mortamix Custom Color Masonry Cement; Holcim (US) Inc.
         3) Magnolia Masonry Cement; Lafarge North America Inc.
         4) Lehigh Custom Color Masonry Cement; Lehigh Cement Company.
         5) Coosa Masonry Cement; National Cement Company, Inc.
         6) Richcolor Masonry Cement; CEMEX.
         7) Miamicolor Masonry Cement; Fairborn Cement Company.
   2. Formulate blend as required to produce color(s) indicated or, if not indicated, as selected from manufacturer's standard colors.
   3. Pigments shall not exceed 10 percent of Portland cement by weight.
   4. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.

H. Aggregate for Mortar: ASTM C 144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
   3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color(s), where required for mix design.

I. Aggregate for Grout: ASTM C 404.
   1. Fine Aggregates: ASTM C404, clean, sharp, natural sand free from loam, clay lumps, or other deleterious substances.
   2. Coarse Aggregates: ASTM C404, clean, uncoated, pea gravel containing no clay, mud, loam, or foreign matter. Maximum aggregate size 3/4 inch.

J. Admixtures, General:
   1. No air-entraining admixtures or material containing air-entraining admixtures.
   2. No antifreeze compounds shall be added to mortar.
   3. No admixtures containing chlorides shall be added to mortar.

K. Cold-Weather Admixture: Non-chloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, ASTM C 1384, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Products:
      a. Accelguard 80; Euclid Chemical Company.
      b. Morset; GCP Applied Technologies.
      c. MasterSet AC 534 or MasterSet FP 20; Master Builders Solutions.

L. Water: Conform to ASTM C1602 for mixing water.

2.8 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60 (Grade 420).
   1. Size, length, and spacing shall be as indicated.
   2. Where No. 3 and larger are indicated, they shall be deformed steel, conforming to ASTM A615, Grade 60.
   3. Use #4 spacer bars at 48 inch spacing connected to longitudinal reinforcing bars in concrete masonry bond beams to hold bars in proper location.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
   1. Products:
      a. No. 376, 377, 378, or 379 Rebar Positioner; Heckmann Building Products Inc.
      b. #RB or #RB-Twin Rebar Positioner; Hohmann & Barnard, Inc.
      c. Figure-8, Double Figure-8, O-Ring or Double O-Ring Rebar Positioner; Wire-Bond.

C. Masonry Joint Reinforcement, General: ASTM A 951 and as follows:
   1. Provide welded wire units prefabricated in straight lengths of not less than 10 foot, with matching corner ("L") and intersection ("T") units.
   2. Fabricate from cold-drawn steel wire complying with ASTM A82, with deformed or embossed continuous side rods and plain cross-rods, with unit width of 1-1/2 to 2 inches less than thickness of wall or partition.
   3. Wire shall be galvanized in accordance with the following:
      a. Joint reinforcement, interior walls or exposed to relative humidity less than or equal to 75 percent
         1) ASTM A641, mill galvanized (0.10 oz. per sq.ft.)
      b. Wire ties or anchors in interior walls or exposed to relative humidity less than or equal to 75 percent
         1) ASTM A641 (0.35 oz. per sq.ft.)
      c. Joint reinforcement, wire ties, or anchors in exterior walls or a mean relative humidity exceeding 75 percent
         1) ASTM A153, Class B (1.50 oz. per sq.ft.)
      d. Sheet metal ties or anchors, interior walls or exposed to relative humidity less than or equal to 75 percent
         1) ASTM A653, G60 (0.60 oz. per sq.ft.)

e. Sheet metal ties or anchors in exterior walls or a mean relative humidity exceeding 75 percent
   1) ASTM A153, Class B (1.50 oz. per sq.ft.)
f. Steel plates and bars
   1) ASTM A153, Class B

4. For single wythe interior CMU walls, provide ladder type joint reinforcing fabricated with two W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Joint reinforcing shall be placed in every other CMU joint or not more than 16 inches o.c.
5. For interior walls consisting of CMU backup and face brick or CMU veneer, provide ladder type joint reinforcing fabricated with three W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Joint reinforcing shall be placed in every other CMU joint or not more than 16 inches o.c.
6. For multi-wythe interior walls consisting of two wythes of CMU, provide ladder type joint reinforcing fabricated with four W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Joint reinforcing shall be placed in every other CMU joint or not more than 16 inches o.c.
7. Multi-wythe exterior walls consisting of CMU backup, insulated cavity, and exterior face brick or CMU veneer.
   a. When both wythes are to be constructed simultaneously:
      1) Provide ladder type joint reinforcing fabricated with three W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Joint reinforcing shall be placed in every other CMU joint or not more than 16 inches o.c.
   b. When each wythe is to be constructed separately:
      1) Backup Wythe
         a) Provide adjustable ladder type joint reinforcing fabricated with two W1.7 or 0.148 inch steel side rods, W1.7 or 0.148 inch cross rods, 3/16 inch eyes and 3/16 inch double legged pintles. Longitudinal rods shall be spaced for each face shell of CMU; eye sections shall extend into wall's cavity, and pintles shall rest upon bed joints of veneer. Joint reinforcing shall be placed in every other CMU joint or not more than 16 inches o.c.
      2) Veneer Wythe (CMU)
         a) Provide ladder type horizontal joint reinforcing fabricated with two W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods continuous joint. Joint reinforcing shall be placed in every other CMU veneer joint or not more than 16 inches o.c.
   c. For multi-wythe walls in which the coursing in the face wythe does not align vertically with the coursing in the backup wythe use:
      1) Stone Tab 3700 with 1100 triangular ties; Wire-Bond.
      2) TIE-HVR-195VB; Hohmann & Barnard, Inc.
   d. For banding details in which CMU and clay masonry are combined:
      1) Refer to NCMA TEK 05-02A.
         a) Provide ladder type horizontal joint reinforcing fabricated with two W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Reinforce joints separating two different materials.
8. For foundation walls consisting of two wythes of CMU, provide ladder type joint reinforcing fabricated with four W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Joint reinforcing shall be placed in every CMU joint or no more than 8 inches o.c. Side rods shall align with face shells of CMU.
9. For single wythe foundation walls, provide ladder type joint reinforcing fabricated with two W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Joint reinforcing shall be placed in every CMU joint or no more than 8 inches o.c.
10. For joint reinforcing in walls, other than those described above, refer to Drawings for particular requirements.
11. All ladder type joint reinforcing shall have cross rods spaced at 16 inches o.c.
12. All ladder type joint reinforcing shall be lapped 6 inches minimum.
13. All ladder type joint reinforcing shall be discontinuous across movement joints.

2.9 TIES AND ANCHORS

A. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
   1. Ensure components and materials are compatible with specified accessories and adjacent materials.

B. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.
   1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 1064; with ASTM A 641, Class 1 coating, provide in interior walls where humidity is less than 75 percent.
   2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 1064; with ASTM A 153, Class B-2 coating, unless otherwise noted.
   3. Galvanized Steel Sheet: ASTM A 653, Commercial Steel, G60 (Z180) zinc coating, provide in interior walls where humidity is less than 75 percent.
   4. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153, unless otherwise noted.
   5. Steel Plates, Shapes, and Bars: ASTM A 36.
   6. Stainless Steel bars: ASTM A 276 or ASTM A 666, Type 304.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
   1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
   2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
   3. Wire: Fabricate from 3/16-inch diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls, except in spaces where relative humidity can be expected to exceed 75-percent relative humidity (showers, locker rooms) or where otherwise indicated.

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. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
   2. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.188-inch diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.

E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustments 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 0.187 inch diameter, hot-dip galvanized steel wire.

F. Partition Top anchors: 0.105-inch thick metal plate with 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.

H. Adjustable Masonry-Veneer Anchors: Provide screw-attached, masonry-veneer anchors with separate horizontal reinforcing .

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
   a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch.
   b. Anchor shall meet or exceed requirements for air leakage and water penetration established for Project.
2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
   a. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch thick, steel sheet, galvanized after fabrication.
   b. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch diameter, hot-dip galvanized steel wire.
   c. Products:
      1) 315-D with 316 or Pos-I-Tie or 213-2X; Heckmann Building Products Inc.
      2) HB-213 with 2X Hook or Adjusto-Tie; Hohmann & Barnard, Inc.
      3) 1004, Type III or RJ-711; Wire-Bond.
      4) Thermal-Grip Masonry Veneer Anchor Pos-i-tie: TRUFAST Walls.
3. Anchor Section: Corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and has gasketed, washer head or tape to protect hole in sheathing.
   a. Products
      1) Pos-I-Tie; Heckmann Building Products.
      2) SureTie; Wire Bond.
      3) X-Seal Anchor or 2 Seal Tie Veneer Anchor; Hohmann and Barnard.
      4) Thermal Grip MVA or Pos-i-tie: TRUFAST Walls.
4. Drill Screws: Provide either of the following types:
   a. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 diameter by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
      1) Products:
         a) Teks Maxiseal with Climaseal finish; ITW Buildex.
         b) Elco Dril-Flex with Stalgard finish; Textron Inc., Textron Fastening Systems.
         c) 4000 with Climaseal finish; Wire-Bond.
   b. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads.
      1) Products:
         a) Scots long life Teks; ITW Buildex.
         b) Teks Maxiseal with Climaseal finish; ITW Buildex.
         c) Elco Dril-Flex with Stalgard finish; Textron Inc., Textron Fastening Systems.
         d) SFS Stadler SX Fastener; Wire-Bond.
         e) SDS Style; TRUFAST Inc.

## 2.10 MISCELLANEOUS ANCHORS

A. Stabilization Anchors: Provide where masonry walls intersect concrete or existing masonry walls. Bonds masonry walls and restrains lateral movement while allowing expansion and control joints to perform as designed.

1. Products:
    a. Slip Set Stabilizer; Hohmann & Barnard, Inc.
    b. 1700; Wire-Bond.

B. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of dimensions indicated.

C. Intersecting Masonry Wall Joint Reinforcing: Where interior masonry walls supported on slabs intersect masonry walls, provide hot dip galvanized 1/2 inch by 16 gauge mesh ties spanning horizontally.
1. Products:
    a. #MWT Mesh Wall Tie; Hohmann & Barnard, Inc.
    b. Wire Mesh 269; Heckman Building Products.
    c. Wire Mesh Tie; Wirebond.
    d. Mesh Tie; MasonPro.

2.11 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
1. Reglets/Receivers: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with mitered and welded corners and junctions. Formed reglets must comply with requirements of Division 07 Section "Sheet Metal Flashing and Trim".
    a. Materials, provide one of the following:
        1) Stainless Steel: 0.0187 inch thick (fka 26 gauge).
    b. Masonry Type: Provide extension leg to extend to face of inner CMU wythe (or sheathing with a veneer wall configuration) with an off-set top flange.
2. Metal Terminations for Flexible Flashing: Fabricate from 26 or 28 gauge stainless steel. Extend into wall as indicated (but not less than 3 inches) and out to exterior face of wall. At exterior face of wall, bend metal down at an angle and back on itself for 3/4 inch to form a drip edge.
    a. Provide a bead of elastomeric silicone sealant between lintel and drip edge to prevent water from wicking back onto lintel.
    b. Provide hemmed edge turning back 180 degrees to be flush with face of veneer at base of wall only.
    c. Provide extend stainless steel termination as indicated on Drawings at base of masonry wall condition.
3. Stainless steel end dams may also be used in conjunction with flexible flashing.

B. Flexible Flashing: For flashing not exposed to the exterior, coordinate with air barrier system and use the following, unless otherwise indicated:
1. Provide one of the following:
    a. York 304 SA Self-Adhered, Stainless Steel; York Manufacturing, Inc.
    b. Gorilla Flash SS Peel and Stick Butyl; STS Coatings, Inc.
    c. IPCO Self-Adhesive Stainless Steel; Illinois Products, Inc.
    d. TK Self-Adhering Stainless Steel TWF; TK Products, Inc.
    e. Mighty-Flash-SA; Hohmann and Barnard Inc.
    f. Bond-N-Flash S.A.; Wire Bond
2. Characteristics/Properties
    a. Type: Stainless steel core with one stainless steel face with a butyl block co-polymer adhesive.
    b. Stainless steel type: 304, ASTM A 167.
    c. Adhesive: Block co-polymer.
    d. Size: Manufacturer's standard width rolls.

e. Performance attributes
1) Tensile strength, > 90,000 psi
2) Puncture resistance, > 2,500 pounds average
3) When tested as manufactured, product resists growth of mold pursuant to test method ASTM D 3273.

3. Accessories: Products shall be as recommended by flashing manufacturer
a. Polyether Sealant
1) UniverSeal US-100; York Manufacturing, Inc.
2) GreatSeal LT-100; STS Coatings, Inc.
3) R-Guard Joint Seam Sealer; Prosoco, Inc.
4) HB Sealant; Hohmann and Barnard Inc.
5) Quick Set Sealant; Wire Bond
b. Splice Tape/Transition Flashing (Self Adhered)
1) York 304SS; York Manufacturing, Inc.
2) IPCO Self-Adhering Stainless Steel Flashing; Illinois Products, Inc.
3) X-Seal Splice Tape; Hohmann and Barnard Inc.
4) Anchorseal Tape: Wire Bond
c. Corner and End Dams: Use only 26 gauge stainless steel pre-manufactured corners.
d. Water-Based Primer: Provide when recommended by manufacturer for application indicated.
1) Primer-SA; Hohmann and Barnard Inc.
2) Aqua Flash Primer; Wire Bond

C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07 Section "Sheet Metal Flashing and Trim."
1. Solder for Stainless Steel: ASTM B 32, Grade Sn96, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight. Sealant shall be approved by flexible flashing manufacturer for use with flashing.

D. Adhesives, Mastic, Sealant, 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.

E. Cavity Bridge: Stainless steel fabrication, Type 304 grade, 26 gauge. Provide pre-drilled holes as required for anchors to substrate
1. Size and Confirguration as indicated on Drawings.

F. Termination Bar: 26 gauge, minimum predrilled stainless-steel approximately 1-1/2 inch wide by 8 foot sections, 45 deg. lip at top for sealant, to be used at top of flashing to secure it to backup.
1. Acceptable Manufacturers/Products
a. T-2 Termination Bar; Hohmann & Barnard, Inc.
b. #4210 Termination Bar; Wire-Bond.
c. Stainless Steel Accessories 45; York Flashings.
d. Stainless Steel Termination Bar; IPCO.

## 2.12 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 or urethane.
1. Products:
a. Neo-Seal IV 2218-3/Everlastic 1056 Joint Filler; Williams Products, Inc.
b. #NS-Closed Cell Neoprene Sponge; Hohmann and Barnard, Inc.
c. Neocell; IPCO.

d. #NS-Closed Cell; National Construction Materials Corp.
e. Sandell's Closed Cell Neoprene; Sandell Construction Solutions.

B. Thermal Barrier (Break); Unfaced, Mineral-Wool Board Insulation: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
1. Nominal density of 4.4 lb./cu.ft.
2. Moisture Resistance; ASTM C 1104: Moisture Sorption, 0.03 percent.
3. Thermal Resistance; ASTM C 518: R-value/inch at 75 deg. F., 4.2 hr.ft.$^2$. F/Btu.

C. 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.

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

E. Weep/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(s) selected from manufacturer's standard.
a. Products:
1) Mortar Maze weep vent; Advanced Building Products Inc.
2) No. 85 Cell Vent; Heckmann Building Products Inc.
3) Quadro-Vent; Hohmann & Barnard, Inc.
4) Cell Vent, 3601; Wire-Bond.
5) Sandell's Cell Vents; Sandell Construction Solutions.
6) Cell Vent; MasonPro.
7) Cell Vent; Mortar Net Solutions.
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(s) selected from manufacturer's standard.
3. Adjustable Weep Vent: IPCO.
4. Stainless Steel Weep/Vent: Type 304 stainless steel.
a. York Manufacturing Inc.

F. Cavity Mortar Protection Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity. Installer shall select product thickness(es) in the field based on observed clear air space between cavity insulation and outer wythe. Clear air space shall not exceed selected product thickness by more than 0.40-inch. Where clear air space exceeds manufacturer's thickest available product by more than 0.40-inch, Installer shall insert a supplemental wythe of extruded polystyrene (XEPS) insulation on inner face, sized to make up the difference.
1. Provide one of the following types:
a. Profiled strips, 10-inches high, with dovetail shaped notches 7-inches deep that prevent mesh from being clogged with mortar droppings.
b. Rectangular strips, not less than 10-inches high, with or without dimpled surface, designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
c. Sheets or rectangular strips installed continuously from flashing to height indicated, to prevent weep holes from being clogged with mortar.
2. Products:
a. Mortar Break; Advanced Building Products Inc.
b. CavClear Masonry Mat; Archovations, Inc.
c. Mortar Web/Trap; Hohmann & Barnard Inc.
d. Mortar Mitt; Sandell.
e. Driwal Mortar Deflection/Driwall Masonry Vent System; Keene Building Products.
f. Mason ProNet DT; MasonPro.

g. Mortar Net; Mortar Net Solutions.
h. Weep-Net; York Manufacturing Inc.

3. Fabric Mesh to Prevent Clogging of Weep Holes (Option): Non-woven polyester fabric used as part of masonry cavity drainage systems with flashing, weep holes or weep vents. Drapes over interior side of weep holes/vents keeping them free of mortar and debris; routes water to flashing and to weeps by draining through body of product.
   a. Materials: Recycled polyester, free-draining mesh, made from polymer stands that will not degrade within cavity wall.
   b. Mold Growth Resistance: In compliance with ASTM D 3273 and ASTM G 21.

G. Grout Sample Box: When approved by the A/E, grout sample box shall be proven by tests to yield comparable compressive strength values to samples cast by traditional methods regardless of CMU moisture content. Box shall perform as a mold and transport/shipping container in one as specified by ASTM C 1019.
1. Basis-of-Design: Deslauriers, Inc.

H. Column Isolation: Around all steel columns in masonry walls, provide 1/2 inch minimum isolation material to prevent the masonry from coming in contact with the displaced column during loading and to prevent mortar from being within the same joint.
1. Products:
   a. Ceramar Flexible Foam; W.R. Meadows, Inc.
   b. Econ-O-Foam; Williams Products.
   c. Nomaboard; Nomaco Inc.
   d. Column Backboard; Williams Products.
   e. Column Wrap; MasonPro.

I. Grout Stop: Fiberglass, galvanized steel, or polypropylene screen.
1. Products:
   a. Metal Lath 268; Heckmann Building Products, Inc.
   b. MGS - Mortar/Grout Screen; Hohmann & Barnard, Inc.
   c. Grout Stop 3612; Wire-Bond.
   d. Grout Stop; MasonPro.

J. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 degrees F (minus 32 degrees C). Provide products with low compression set and of size and shape to provide a seal for compartmentalization.

## 2.13 CAVITY-WALL INSULATION

A. Extruded-Polystyrene Board Insulation with Increased R-Value: ASTM C 578, Type IV, but with an aged thermal resistance (R-value) for 1-inch thickness of 5.6 deg F x h x sq. ft./Btu at 75 deg F at 5 years; closed-cell product with a carbon-black filler and extruded with an integral skin.
1. Products:
   a. Cavitymate Ultra; Dow Chemical.
   b. Foamular, High-R-CW Plus; Owens Corning.
   c. Neopor GPS Smart Insulation; MBCC Group.
2. Water Absorption: maximum 0.1 percent by volume (ASTM C272-91).
3. Surface Burning Characteristic (ASTM C578-95).
   a. Flame Spread: 0.
   b. Smoke Developed: 155.

B. Polyisocyanurate Board Insulation: Not acceptable.

C. Adhesive: Type recommended by insulation board manufacturer for application indicated.
1. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

D. Sealant: As recommended by insulation board manufacturer for application indicated.
   1. Sealant for Sealing Joints: Product shall retard moisture penetration at insulation joint for a weather barrier at the outside surface of the insulation.

E. Joint Tape: As recommended by insulation board manufacturer for application indicated.

2.14 MASONRY CLEANERS AND ACCESSORIES

A. Preformed Expansion Joint Filler: Provide closed cell sponge neoprene expansion joint filler conforming to ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated.

B. Bituminous Coating: Cold applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D1187, Type II.

C. Masonry Cleaners: Provide one of the following cleaning products expressly approved for intended use by cleaner manufacturer and manufacturer of unit being cleaned as verified on “mock-up”.
   1. Job Mixed Detergent Solution: Solution of trisodium phosphate (1/2 cup dry measure) and laundry detergent (1/2 cup dry measure) dissolved in one gallon of water.
   2. Proprietary Acidic Cleaner: Manufacturer's standard strength, general purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned. Do not use products containing hydrochloric (muriatic acid, hydrofluoric acid, or ammonium bifluoride.
      a. For brick masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface acting acids, chelating, and wetting agents.
         1) Products:
            a) Sure Klean No. 600 Detergent; ProSoCo., Inc.
            b) 202 Detergent; Diedrich Technologies.
            c) NMD 80 New Masonry Detergent; EaCo Chem, Inc.
      b. For dark colored brick masonry not subject to metallic oxidation stains, use formulation consisting of a liquid blend of surface acting acids and special inhibitors.
         1) Products:
            a) ProSoCo., Inc.; Sure Klean No. 101 Lime Solvent.
            b) Diedrich Technologies; 200 Lime Solv.
            c) EaCo Chem, Inc., NMD 80 New Masonry Detergent.
      c. For brick masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic acids and special inhibitors.
         1) Products:
            a) Sure Klean Vana Trol; ProSoCo., Inc.
            b) 202 Vana-Stop; Diedrich Technologies.
            c) NMD 80 New Masonry Detergent; EaCo Chem, Inc.

D. Spray Equipment: Provide equipment for controlled spray application of water and chemical cleaners, if any, at rates indicated or recommended for pressure, measured at spray tip, and for volume. Adjust pressure and volume, as required, to ensure that damage to masonry does not result from cleaning methods.
   1. For chemical cleaner spray application, provide a low pressure tank or chemical pump suitable for the chemical cleaner indicated, equipped with a cone-shaped spray tip.
   2. For water spray application, provide a fan-shaped spray tip that disperses water at an angle of not less than 15 degrees.

2.15 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. When specifically approved by the A/E, admixtures shall meet ASTM C1384 Standard Specification for Admixtures for Masonry Mortars.
   1. Do not use calcium chloride in mortar or grout.
   2. Maintain workability of standard grey mortar by remixing or retempering. No mortar shall be used beyond 2-1/2 hours after mixing. Do not retemper colored pigmented mortar because color variations may result.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar Batching
   1. For each unit volume of cementitious materials, provide 2.25 to 3.5 volumes of aggregates.
   2. In a running mechanical paddle mixer, add 2/3 of the water and 1/2 of the aggregate (sand), then add the cementitious materials. Follow by adding the remaining water. Mix for a minimum of 5 minutes, adding water if required to produce a workable consistency.
      a. Do not hand mix mortar, unless approved in writing by A/E.

C. 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.

D. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade use Type M, where indicated only.
   2. For masonry, use Type S, unless otherwise noted.
   3. For non-load bearing interior partitions, use Type N or S, unless otherwise noted.
   4. For exterior, above-grade, masonry veneer, use Type N or S, unless otherwise noted.

E. Use natural (noncolored) mortar for the following:
   1. Concrete masonry units, unless otherwise noted.

F. Colored Pigmented Mortar: Select and proportion pigments with other ingredients to produce color indicated or, if not indicated, as selected from manufacturer's standard formulation to compliment adjacent units.
   1. Use colored pigmented mortar for the following locations:
      a. Clay face brick
   2. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color(s) required. Limit pigments to the following percentages of cement content by weight:
      a. For mineral oxide pigments and Portland cement lime mortar, not more than 10 percent.
      b. For carbon black pigment and Portland cement lime mortar, not more than 2 percent.
      c. For mineral oxide pigments and masonry cement mortar not more than 5 percent.
      d. For carbon black pigment and masonry cement mortar, not more than 1 percent.
   3. Color: Match existing.

G. Colored-Aggregate Mortar: Use colored aggregates and natural color or white cement as necessary to produce required mortar color(s).

H. Pointing mortar shall conform to ASTM C270, except that all sand shall pass a No. 16 sieve. Nonstaining and dirt resistant mortar shall be used to which ammonium stearate or calcium stearate is added to the amount equal to 3 percent of the weight of the cement used.

1. Pointing mortar shall be proportioned by volume with one part portland cement, 1/8 part Type S hydrated lime, and 2 parts graded (50 mesh or finer) sand to which ammonium stearate or calcium stearate is added in an amount equal to 2 percent of the weight of the cement used. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
2. Add colored mortar pigment to produce mortar colors required. Coordinate with CMU manufacturer to produce color(s) required to match CMU for repair of face.
3. Use pointing mortar to repair chipped CMU units.

I. Grout for Unit Masonry (by Strength): Comply with ASTM C 476. Grout mixes shall be designed by strength, unless specifically noted otherwise in the Contract Documents.
1. Conventional Grout
   a. General: Do not use admixtures, including pigment, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated. Do not lower the freezing point of grout by use of admixtures or anti-freeze agents.
      1) Admixtures containing chlorides in excess of 0.2 percent chloride ions are not permitted to be used.
      2) Antifreezes are prohibited for use in grouts.
      3) Fly ash: ASTM C618-89a, Type C or F may be substituted for up to 20 percent of the total cementitious materials in the gout mix.
   b. Grout mixes shall be plant mix or factory blended (dry mix with water added at Project site).
   c. Field mixed grout designs are not acceptable.
   d. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in TMS 402/602 for dimensions of grout spaces and pour height.
   e. Provide grout with a slump of 8 to 10 inches as measured according to ASTM C 143.
2. Self-Consolidating Grout
   a. Jobsite proportioning of self-consolidating grout is not permitted. Do not add water at jobsite except in accordance with self-consolidating grout manufacturer's instructions.
   b. Admixtures for Self-Consolidating Grout
      1) High-Range Water-Reducing Admixture
      2) Viscosity-Modifying Admixture
   c. Slump Flow: 24 to 30 inches as determined in accordance with ASTM C1611.
   d. Visual Stability Index (VSI): Less than or equal to 1 as determined in accordance with ASTM C1611, Appendix X.1.
   e. Consolidation or reconsolidation is not required for self-consolidating grout.

2.16 SOURCE QUALITY CONTROL

A. Concrete Masonry Inspection
1. Refer to Division 01 Section "Quality Requirements".
2. Materials may require testing and retesting, as directed by the A/E, during the progress of the Work. Allow free access to material stockpiles, facilities and completed construction.
3. See structural plans for special inspection requirements for masonry walls.

B. Verification of Performance: Masonry Contractor shall water test cavity to verify all water is draining to the exterior through the weeps before continuing with exterior wythe and before capping wall.

1. Contractor shall perform initial tests in the presence of A/E, flexible flashing manufacturer, and General Trades Contractor. After successful initial tests have been performed additional testing shall be performed in the presence of them so tests can be witnessed and documented. A/E,, and shall be notified when testing is to occur, in case they too wish to witness the testing, otherwise will submit documentation to A/E as work progresses.
    a. Testing shall occur at first 200 square feet of masonry wall and include a window opening and opening flashing.
2. Contractor shall hold water hose and with standard water pressure, force water into the cavity at a cell vent so water can be observed coming out adjacent weeps for a period of at least 5 minutes. Contractor shall continue down the wall to the next cell vent where a weep did not indicate water wicking out and continue this process until the entire length of flashing is tested.
3. Where water is observed inside the building or outside the building away from the weeps, masonry units shall be removed and flashing reinspected and repaired.
4. Water test shall be repeated where flashing was repaired.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work in accordance with TMS 402/602, Article 2.1.
    1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
    2. Verify that foundations are within tolerances specified.
    3. Verify that reinforcing dowels are properly placed.
    4. Verify critical steel elevations to ensure flashing will be installed at proper locations.

B. Before installation, examine rough-in and built-in construction for piping systems or conduit to verify actual locations of connections.
    1. Do not install anything in the cavity space of the exterior wall that:
        a. Diminishes the designed R-Value of the cavity-wall insulation.
        b. Encroaches on the required air gap.

C. Verify substrate and surface conditions are in accordance with flexible flashing manufacturer recommended tolerances prior to installation.
    1. Review requirements for sequencing of installation of flexible flashing assembly with installation of windows, doors, louvers and wall penetrations to provide a weathertight flashing assembly.
    2. Verify flexible flashing will be continuously supported by substrate, and not span any gaps or voids in excess of 1/2 inch.

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

3.2 PREPARATION

A. General
    1. If ice or snow has formed on masonry bed, remove by carefully applying heat until top surface is dry to the touch.
    2. Remove all masonry deemed frozen or damaged.

B. Protect existing membrane roofing system. No masonry work is to be performed over an unprotected roof.
    1. Loosely lay 1-inch minimum thick, molded expanded polystyrene (MEPS) insulation over the roofing membrane in areas indicated. Loosely lay 15/32-inch plywood or OSB panels over MEPS. Extend MEPS past edges of plywood or OSB panels a minimum of 1 inch.

a. Protection sheet or mat: Provide a sacrificial layer of matching membrane sheet extending minimum 6 inches beyond insulation in all directions or a woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

2. Limit traffic and material storage to areas of roofing that have been protected.

C. Protect concrete floor from damage where floor will remain exposed.

D. Concrete Surfaces: Where masonry is to be placed, clean concrete of laitance, dust, dirt, oil, organic matter, or other foreign materials that would inhibit bond of mortar to the surface.

3.3 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

1. Note: In lieu of double wythe foundation walls, single wythe matching nominal overall width of double wythe may be provided.

B. Build chases and recesses to accommodate items specified in this and other Sections. Provide not less than 8 inches of masonry between chases or recesses and jamb of openings, and between adjacent chases and recesses.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

1. Consult other trades and make provisions to permit installation of their work in a manner to avoid cutting and patching. Build in work specified under other Sections, as necessary, and as work progresses.

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

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

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

1. When units are above 32 deg. F, heat water above 70 deg. F.
2. When units are below 32 deg. F, heat water above 130 deg F.
3. Recommended procedure to insure that brick are nearly saturated, surface dry when laid is to place a hose on the pile of brick until the water runs from the pile. This should be done one day before brick are to be used. In extremely warm weather, place hose on pile several hours before brick are to be used.

H. Do not wet concrete masonry units.

I. Cleaning Reinforcement: Before being placed, remove loose rust, ice, or other coatings from reinforcement.

3.4 TOLERANCES

A. General: Comply with construction tolerances in TMS 402/602 and the following:

B. Dimensions and Locations of Elements:
1. For dimension 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.
4. If the above condition, cannot be meet due to previous construction, notify the A/E.

C. Lines and Levels
1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

D. Joints
1. Unless additional restrictions are indicated, horizontal mortar joints between masonry units shall be in the range of: 1/4 inch to 1/2 inch.
2. Vertical mortar joints between masonry units shall be in the range of: 1/8 inch to 3/4 inch.
3. For brick 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.
4. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
5. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
6. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

E. Reinforcing Bars: Tolerances for placing reinforcing bars are:
1. Variation from *d* for flexural elements (measured from center of reinforcement to the extreme compressive face of masonry):
   a. $d \leq 8$ inch — $\pm$ 1/2 inch
   b. 8 inch < $d \leq 24$ inch — $\pm$ 1 inch
   *c.* $d > 24$ inch — $\pm$ 1-1/4 inch
2. For vertical bars in walls — 2 inch from the location along the length of the wall indicated on the project drawings.
3. In addition, a minimum clear distance between reinforcing bars and the adjacent face of a masonry unit of 1/4 inch for fine grout or 1/2 inch for coarse grout must be maintained so that grout can flow around the bars.

## 3.5 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.
   1. Do not install cracked, broken, or chipped masonry units exceeding ASTM allowances.
   2. Clean units of surface dirt and contaminants before placing in contact with mortar.
   3. Lay-up walls plumb and true and with courses level, accurately spaced, within specified tolerances, and coordinated with other work. Do not wedge partitions tight against structural ceiling or beams, but provide an acoustical joint between masonry and the structural roof deck, structural steel framing or structural floor deck at nonrated conditions. Refer to Division 07 Section “Acoustical Joint Sealants”. At rated walls, provide firestopping. Refer to Division 07 Section “Fire-Resistive Joint Systems.”
      a. Cut masonry as required to maintain 2 inches clearance between masonry and all steel or reinforced concrete structural members that pass through or above walls, but are not to be supported by the walls.
   4. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors, unless otherwise indicated.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.
   1. One-half running bond with vertical joint in each course centered on units in courses above and below, unless otherwise noted.
   2. Provide special bonding as indicated on Drawings.
   3. Provide stack bond concrete masonry units as indicated on drawings to match interior concrete masonry units.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
   1. Align unit cells or cores that are to be grouted.

D. Stopping and Resuming Work: Stop work at vertical control joints or by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
   1. Stop off horizontal run of masonry by racking back 1/2 length of unit in each course.
   2. Toothing is not permitted, except upon written acceptance of the A/E.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
   1. Install adjustable hollow metal frame anchors, locating anchors on jambs in horizontal bed courses near the top and bottom of each frame and at intermediate points not over 24 inches apart.
   2. Unless otherwise noted or thermal break is required, contractor may grout jambs of hollow metal door and window frames in accordance with ANSI 250.8.
      a. Where grout is installed during masonry installation, frames shall be braced or fastened in such a way that will prevent the pressure of the grout from deforming the frame members. Grout shall be mixed to provide a 4 inch maximum slump consistency, hand troweled into place. Grout mixed to a thin “pumpable” consistency shall not be used.
   3. Rake joints around exterior side of exterior hollow metal door frames for sealant under Division 7.
   4. Protect inside (concealed) faces of door frames in exterior masonry walls, using fibered asphalt emulsion coating. Apply over shop primer approximately 1/8 inch thick and allow to dry before handling.

5. Where hollow metal frames do not wrap around masonry jambs and heads, rub exposed corners of block to remove sharp, irregular edges.
6. Take particular care to embed all conduits and pipes within concrete masonry without fracturing exposed shells and to fit units around switch, receptacle and other boxes set in walls. Where electric conduits, outlets, switch boxes, and similar items occur, grind and cut units before building in services. Prepare cutouts in such a manner that units can be installed plumb and flush.
7. Install anchors, reglets, and nailers for flashing and related work built into masonry work, where indicated.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a grout stop (a layer of metal lath, wire mesh, or plastic mesh) in the joint below and rod mortar or grout into core.

G. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

H. Where non-loadbearing, full-height masonry walls intersect structural framing above, provide a minimum 1/2 inch clear joint around the member. Do not build masonry solid around open-web steel joists.
1. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section “Joint Firestopping”.
2. At non-fire-rated, but acoustically rated partitions treat joint between top of partition and underside of structure above to comply with Division 07 Section “Acoustical Joint Sealants”.

3.6 MORTAR BEDDING AND JOINTING

A. Mortar Bedding; Brick and Concrete Masonry Units as follows:
1. Mix mortar ingredients for a minimum of 5 minutes in a mechanical batch mixer. Use water clear and free of deleterious materials that would impair the work. Each mortar batch is allowed only one retempering. Do not use mortar, which has begun to set after the first retempering, or if more than 2-1/2 hours has elapsed since initial mixing. Retempering will be permitted only within 1-1/2 hours of mixing, to replace moisture lost by evaporation. Discard any mortar or grout that is partially set.
2. Lay brick and other solid masonry units with completely filled bed and head joints. Do not deeply furrow bed joints. Butter ends with sufficient mortar to fill head joints and shove into place. Butter ends of brick in hand and in the wall at closures. Do not slush head joints. Rock closures into place with head joints thrown against adjacent brick in place.
   a. Do not pound corners and jambs to fit stretcher units after they are set in position. Where an adjustment must be made after mortar has started to harden, remove mortar and replace with fresh mortar.
3. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells; also bed webs in mortar in starting course on footings and foundation walls, in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
   a. Construct bed joint of the starting course of foundation with a thickness not less than 1/4 inch and not more than 3/4 inch.
4. Remove mortar protruding into cells or cavities that will be grouted. Do not permit mortar droppings to fall into cells, cavities of multi-wythe walls or to block weep holes. Maintain clear cavity width between facing and backing material and keep clear of mortar droppings by back beveling the mortar bed to prevent excess from extruding into cavity. Clean any excess that does occur by parging it to back of unit.
5. Fill holes not specified in exposed and below grade masonry with mortar.

B. Joints: Maintain joint widths shown, except for minor variations required, to maintain bond alignment. Lay walls with 3/8 inch joints. Tool joints consistently with the same type round jointer when the mortar is thumb print hard. Use a jointer that is slightly larger than the joint width so that complete contact is made along the edges of the unit. Tool joints in exposed masonry walls at uniform moisture content to avoid color variations. Perform tooling so that the mortar is compressed and the joint surface is sealed. Cut joints flush for masonry walls that are to be concealed or to be covered by other materials. For exposed masonry, provide joints as follows:
   1. Exterior Joints
      a. Concave tooled, unless otherwise noted.
      b. Provide tooled joints horizontal and vertical at scored concrete masonry units, including score joint.
   2. Interior (Room Side) Joints
      a. Concave tooled, unless otherwise noted.
   3. Cavity Wall (Exterior Side of Inner Wythe) Joints: Cut joints flush for masonry walls to receive air barrier.

3.7 MULTIWYTHE (COMPOSITE) MASONRY, GENERAL

A. Bond wythes of multiwythe masonry (non-composite) 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 24 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.
      a. Where bed joints of wythes do not align or when wythes are not laid at the same time, use adjustable (two-piece) type ties.
   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 (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.

B. Corners: Provide interlocking masonry units bond in each wythe and course at corners, unless otherwise indicated.
   1. Provide continuity with masonry-joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.

C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond wall together as follows:
   1. Provide continuity with masonry-joint reinforcement by using prefabricated T-shaped units.
      a. Where indicated, provide individual metal ties not more than 16 inches o.c.
      b. Where indicated, provide rigid metal anchors not more than 48 inches o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.8 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 24 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.

a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.

2. Masonry Joint Reinforcement: Provide unless otherwise noted. Install in horizontal mortar joints.
   a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes, if both wythes are concrete masonry and installed simultaneously. At no time shall a wythe be more than 16 inches higher than any other wythe being constructed concurrently.
   b. Where bed joints of wythes do not align, use adjustable (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 (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. Wythes may be laid up full height separate from facing wythe.
      1) Cavity width changes shall be accommodated by different sized wire ties; wire ties should not be bent or deformed to span the cavity space.
3. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

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.
1. Keep cavity clean of mortar droppings by suspending by wires a wooden strip the width of the air space. Strip shall be lifted as each course of joint reinforcement is laid in facing wythe. Install cavity mortar protection in cavity above through wall flashing and where indicated for additional protection.

C. Apply air barrier to face of backup wythe to comply with Division 07 “Air Barrier” sections.

D. Installing Cavity-Wall Insulation: Place vertical strips 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.
1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry or butter all edges of insulation board with adhesive or seal gaps with tape as recommended by insulation board manufacturer to provide a continuous weather/thermal barrier.

## 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., unless otherwise noted.
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.
   a. Reinforcement above is in addition to continuous reinforcement.
4. Provide reinforcement in every other course of concrete masonry veneer, but not in the same course as the tie.

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

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

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

E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.10 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
   1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry to structural members 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 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
   1. Fasten screw-attached 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 tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and exterior face of inner wythe or sheathing.
   3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
   5. Masonry veneer anchors shall be embedded a minimum of 1-1/2 inches into the mortar joint. Provide a minimum of 5/8 inch mortar coverage at veneer to the outside face.

B. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing or insulation.
   1. Keep air space clean of mortar droppings and other materials during construction. Bevel beds away from air space, to minimize mortar protrusions into air space. Do not attempt to trowel or remove mortar fins protruding into air space.

3.12 CONTROL AND EXPANSION JOINTS (MOVEMENT JOINTS)

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Other than bond beams do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
   1. Install an elastomeric tubing sealant backer rod at each control joint to compartmentalize masonry cavity.
   2. Reinforcing and grout for masonry bond beams are to run continuous through vertical control joints.
   3. Keep joints clean from all mortar and debris.

B. Form control joints in concrete masonry using one of the following methods:
   1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
   2. Install preformed control-joint gaskets designed to fit standard sash block.
   3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
   4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick made from clay or shale as follows:
   1. Build in compressible joint fillers, unless otherwise noted.

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
   1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

E. Control Joint Locations in Reinforced CMU: Provide vertical control joints in CMU where called for on the Drawings.

F. Control Joint Locations in Unreinforced CMU: Provide vertical control joints in reinforced CMU where called for on the Drawings. Provide vertical control joints in unreinforced CMU in accordance with NCMA TEK Bulletins 10-01A, 10-02D, 10-03, and 10-04, and at all offsets, returns, openings, and intersections with dissimilar materials and as follows to prevent cracking:
   1. At change from wall setting on foundation to wall setting on floor slab.
   2. At change from exterior wall to interior wall.
   3. At walls setting on floors that cross floor construction.
   4. At columns within masonry walls.
   5. At changes in wall thickness.
   6. Stop joint reinforcement bars on either side of control joints. Extend reinforcing bars in bond beams continuously through control joints and sleeves for bond break 18 inches each side of joint.
   7. Install control joints in concrete masonry units with prefabricated shear key.
   8. At end of lintel bearing on one end of openings less than or equal to 6'-4" and at both ends of openings greater than 6'-4".
   9. Straight runs as indicated below, with spacing related to wall height as follows:
      a. Walls less than 8 feet: Not more than 3 times wall height.
      b. Walls 8 feet or higher: Maximum 25 feet.
   10. Distance between joints should not exceed the lesser of the following:
      a. A length-to-height ratio of 3 to 2.
      b. 25 feet.

G. Expansion Joint Locations in Brick: Provide in accordance with BIA Technical Note No. 18A at vertical expansion joints in brick masonry at all offsets, returns, openings, intersections with dissimilar materials, and elsewhere as shown on Drawings and indicated hereinafter. For brick work without openings, space no more than 25 feet o.c.
   1. Place as follows:
      a. At or near corners
      b. At offsets and setbacks
      c. At wall intersections
      d. At changes in wall height
      e. Where wall backing system changes
      f. Where support of brick veneer changes
      g. Where wall function or climatic exposure changes
      h. At one jamb of openings 12 feet or wider.
   2. Form open joint of width indicated but not less than 3/8 inch for installation of preformed expansion joint filler, and sealant and backer rod specified in Division 07 Section “Joint Sealants”. Maintain joint free and clear of mortar.

H. Building Expansion Joint Through Masonry
   1. Form open joint of width indicated but not less than 3/8 inch for installation of preformed expansion joint filler, and sealant and backer rod specified in Division 07 Section “Preformed Joint Seals”. Maintain joint free and clear of mortar.
   2. For expansion joints 2 inches and greater, refer to Division 07 Section “Expansion Control”.

3.13 LINTELS

A. Install loose steel lintels furnished under Division 05.
   1. Shore steel lintels until the masonry has attained sufficient strength to carry its own weight. Limit the deflection of masonry during this period to L/600 or 0.3 inch (whichever is less). This shoring period should not be less than 24 hour. This minimum time period should be increased to three days when there are imposed loads to be supported. If the masonry is built in cold weather construction conditions, the length of cure should be increased.

B. Provide masonry lintels where shown and wherever openings of more than 8 inches for brick size units and 16 inches for block size units are shown without structural steel or other supporting lintels. Provide prefabricated or formed-in-place masonry lintels. Thoroughly cure prefabricated lintels before handling and installation. Temporarily support formed-in place lintels.
   1. For hollow masonry lintels, use specially formed "U"-shaped lintel units with solid bottom and reinforcing bars placed as shown, and filled with coarse grout. Bond beam block shall not be used to form masonry lintels.
   2. Bond pattern for masonry lintels shall match the pattern at the adjacent wall unless otherwise noted.

C. Provide minimum 8 inch solid bearing at each end, unless otherwise noted. Provide solid masonry units or hollow units filled solid.
   1. Provide a slip plane in the form of flashing or other bond breaker between the lintel and masonry in unreinforced CMU walls.

D. For steel lintels in exterior wythe, rake back mortar in preparation for sealant as specified in Division 07 Section “Joint Sealants”.

E. Where formed-in-place masonry lintels are supported by steel angles over the opening during installation, the angles shall not extend more than 2-1/2 inches into the masonry on each jamb of the opening. When the angles are removed, the void remaining shall be packed tightly with a moist mixture of Type S mortar.

F. The reinforced masonry and lintel drawings are intended to show the major lintels required for windows, doors, louvers, and other major openings. Some lintels are shown for some mechanical duct and pipe openings, but the drawings are not intended to show all of these openings. The masonry contractor shall coordinate the size and location of openings required in masonry walls by the other contractors and provide steel or masonry lintels for these openings according to the lintel schedules in the Contract Documents whether shown on the Contract Documents or not.

3.14 FLASHING, WEEPS, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep vents in first course of masonry above ground level, at shelf angles, lintels, ledges, above doors, windows and other openings and under coping and sills, other obstructions to downward flow of water in wall. Flashing shall be installed longitudinally continuous or terminated with end dams. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities. Comply with NCMA recommendations for “drainage wall system” masonry construction.
   1. Install concealed through wall flashing in accordance with SMACNA “Architectural Sheet Metal Manual” Chapter 4 Flashing and with NCMA TEK Bulletins 19-04A and 19-05A details to ensure water resistant masonry construction.
   2. Apply primer, if required by manufacturer according to manufacturer’s written instructions.
   3. Install preformed corners and end dams, cants, if required, under flexible flashing membrane, bedded in sealant in appropriate locations along wall.
   4. Starting at a corner, remove release sheet, if applicable, and apply membrane to primed, if required by manufacturer for substrate indicated.
   5. Extend membrane through wall and leave 1/4 inch minimum exposed.

6. Roll flashing into place. Ensure continuous and direct contact with substrate. Avoid trapping air and forming wrinkles.
7. Lap ends and overlap preformed corners 4 inches minimum. Seal all laps with sealant.
8. Trim exterior edge of flexible flashing membrane 3/4 inch and secure to metal drip edge per manufacturers written instructions, where drip edge is required.
    a. Embedded flashing materials shall not be used for drip edges.
9. Terminate flexible flashing membrane on vertical wall with a termination bar.
10. Apply sealant bead at each termination.
11. Protect installed flexible flashing from damage during construction.
    a. Inspect before covering and make repairs as necessary. Remove and replace damaged material. Repair holes and tears by covering with cut patch of similar product overlapping damage 2 inches minimum. Seal perimeter of patch repair with sealant/mastic.
    b. Cover flexible flashing as soon as possible after installation has been observed and tested. Do not expose longer than 60 days, unless otherwise approved by membrane manufacturer in writing.

B. Install flashing as follows, unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
    a. Install proprietary flashing/drainage system in accordance with manufacturer's installation instructions.
2. At multiwythe masonry walls, including cavity walls, where wall intersects a roof or similar horizontal element, extend flashing through outer wythe, turn up 16 inches or a minimum of 6 inches above cavity mortar protection, and terminate on exterior face of inner wythe with termination bar and sealant. Install metal reglet/receiver, extending through cavity and turned up at exterior face of inner wythe, 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 reglet/receiver.
    a. Note: Embedded flashing must terminate a minimum of 12 inches above roofing surface. Coordinate termination with roofing contractor.
3. At multiwythe masonry walls, including cavity walls, where wall intersects grade, extend flashing through outer wythe, turn up 16 inches or a minimum of 6 inches above cavity mortar protection, and terminate on exterior face of inner wythe with termination bar and sealant. Cut flexible flashing off flush at face of wall after masonry wall construction in completed.
4. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 16 inches or a minimum of 6 inches above cavity mortar protection, and terminate with a termination bar and sealant. Terminate flashing at outer wythe using the same methods used at multiwythe masonry walls as specified hereinbefore.
5. At lintels and shelf angles, extend flashing over top flange of angle across air space behind veneer and turn up a 16 inches or a minimum of 6 inches above cavity mortar protection, and terminate on exterior face of inner wythe or sheathing with termination bar and sealant. At outer wythe extend flashing at least 6 inches beyond end of lintel or shelf angle and turn up ends not less than 2 inches to form end dams. Install metal drip edges beneath flexible flashing at exterior face of wall and seal with sealant to lintel or shelf angle. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
    a. Where the lintel or shelf angle is bolt-mounted in place, cut-off excess bolt length at face of nut prior to installing the flexible flashing. After positioning the flexible flashing, cut a small "X" in the flashing to allow the flashing to fit over the nut and then apply compatible mastic to the flashing a minimum of 1 inch out from the "X" in all directions.

C. Install weep vents in head joints in exterior wythes of first course of masonry immediately above embedded flashing (not mortar) and as follows:
   1. Use specified weep/vent products to form weeps.
   2. Space weep vents 16 inches o.c., unless otherwise indicated.
   3. Keep weep holes and area above flashing free of mortar droppings.

D. Place cavity mortar protection material in cavities to comply with configuration requirements for cavity mortar protection material in Part 2 "Miscellaneous Masonry Accessories" Article.
   1. Option: Use geotextile drainage fabric as recommended by flashing manufacturer, and install to have the fabric reach the base of the flashing and covering the weep vents.
      a. Inspect flashing for holes prior to installing fabric mesh. Coordinate repair of holes with installer of flashing.
      b. Place a continuous row of fabric mesh one inch into the mortar joint of the third row of standard size exterior bricks in collar joints, cavity walls, or lintels. Drape excess material onto base of flashing. Ensure that flashing is clean of mortar droppings and debris. Adhesives and fasteners are not required; mortar need not have set.
      c. If excessive droppings are expected, use a taller height fabric mesh and taller flashing.
      d. Cut or tear to accommodate wall ties, conduit, plumbing or other materials that bridge or intrude into cavity between inner and outer walls.

E. Install vents in head joints in exterior wythes at 32 inches o.c., unless otherwise indicated. Use specified weep/vent products to form vents.
   1. Close cavities off vertically with elastomeric tube sealant back rod in manner indicated. Install through-wall flashing and weep vents above horizontal blocking.

## 3.15 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 other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 402/602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in TMS 402/602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. The low-lift grouting procedure shall be used as described in the Drawings and in NCMA-TEK 03-02A Grouting Concrete Masonry Walls.
      a. High-Lift Grouting: Do not use unless approved by A/E. If high-lift grouting is approved, limit lifts to 12’-0” and use super plasticizer in grout to reduce water content.
   3. Grout (slump 8 to 10 inches) shall be installed in the block cavities so as to completely fill each cavity with homogenous grout, extending from the lowest course to the top of the reinforced portion of the foundation or wall. Concrete or mortar shall not be used as grout for CMU.
   4. Between 5 and 20 minutes after the grout is placed, it shall be consolidated with a mechanical vibrator. The top of the grout filling shall be stopped 1-1/2 inches below the top of the concrete block to form a key, except for the top course in the wall where the grout shall be struck flush with the top.

5. Aggregate used in the grout shall be small enough not to interfere with placement and plasticity.
6. Caging devices and centering clips shall be spaced vertically such that 2 clips or devices, one near its top and one near its bottom restrain every section of vertical reinforcing bar.
7. Where grouted cores do not extend the full height of a wall, install grout stop mesh at the lower limit of the grout.
8. Where required on the plans, grouting operations shall be observed by an independent testing agency.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage qualified independent inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. Minimum qualifications for the masonry inspector shall be 5 years of reinforced masonry inspection experience or acceptance by a State, municipality, or other governmental body having a program of examining and certifying inspectors for reinforced masonry construction. The masonry inspector shall be present during sampling and placing of masonry units, placement of reinforcement, inspection of grout space immediately prior to closing of cleanouts, and during grouting operations. The masonry inspector shall assure Contractor compliance with drawings and specifications**,** including flashing. The masonry inspector shall keep a complete record of all inspections and shall submit Masonry Inspection Reports and Special Inspection requirements set forth in the structural drawings for inspection requirements and a photographic documentation of flashing.
   1. Masonry Inspection: Provide masonry construction inspection of concrete or brick masonry walls indicated as requiring inspection on the Masonry Plans to insure that masonry construction is in conformance with the Contract Documents. Masonry inspection is required for those masonry elements that must be constructed to attain high design strengths.
      a. Inspection shall use NCMA-TEK 18-03B “Concrete Masonry Inspection” as a guideline.
      b. The individual or individuals who will perform the masonry inspection shall be present for the Preliminary Masonry Meeting.
      c. The masonry inspector shall prepare a written report or reports for each day of inspection. Masonry Inspection Report, following this Section, shall be used for all inspection reports. Inspecting reports shall be submitted to the A/E within 5 days of masonry inspection.
      d. The masonry inspector shall be present and observe all masonry construction operations in walls requiring inspection. The masonry inspector shall be present at the Project site within sufficient time, in advance of grouting operations, to inspect the construction to insure its conformance to the Contract Documents and that grouting may proceed. No grouting shall be permitted unless the masonry inspector is present and has indicated that the masonry construction is properly prepared for the grouting operation.
   2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Level B special inspection according to the "TMS 402," unless otherwise noted.
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grouts 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. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140 for compressive strength.
   1. Tests of Concrete Masonry Prisms: The Masonry Contractor shall coordinate with a qualified testing laboratory to perform field quality control testing during the masonry work.
      a. When required by the Masonry Plan, construct a set of 3 masonry prisms using mortar and concrete masonry units to be used in the masonry work. Unless otherwise noted, construct prisms 8 inches by 8 inches by 16 inches high (nominal).
      b. When prism tests are required to establish the strength of masonry in lieu of Masonry Inspection, provide a minimum of one set of 3 masonry prisms for testing for each 5000 sq.ft. (gross) of masonry wall construction.
      c. Submit written reports for each prism tested. Provide the project identification name and number, date of report, name of Contractor, name of testing service, name of material suppliers, specific location where masonry represented by the prism is used, compression test strength results, and specified required strength.
      d. If the compressive strength tests fail to meet the minimum strength specified in the Plans, the masonry represented by the tests shall be considered deficient.
      e. When tests indicating deficient masonry represent masonry already constructed, such masonry shall be removed and replaced by the Contractor without additional cost to the Owner. In lieu of removal and replacement, additional cores may be grouted as required and directed by the A/E without additional cost to the Owner.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

G. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.
   1. Tests for Mortar: The Masonry Contractor shall coordinate with a qualified testing laboratory to perform field quality control testing during the masonry mortar work.
      a. For colored and noncolored mortars test for compressive strength by the methods of sampling and testing of ASTM C109 and ASTM C780.
         1) Provide a minimum of six cubes for testing per 5,000 sq.ft. of masonry wall construction and as directed by A/E. Test two cubes at 7 days, two cubes at 28 days, and reserve two cubes for future testing.
      b. Submit written reports for each material sampled and tested. Provide the project identification name and number, date of report, name of contractor, name of testing service, source of aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate material is acceptable for intended use.
      c. If the compressive strength tests fail to meet the minimum requirements specified; the mortar represented by such tests would be considered deficient in strength.
      d. Deficient mortar shall be removed and replaced by the Contractor without additional cost to the Owner.

H. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

1. Place a piece of preservative-treated wood 1-5/8 inch thick and 3 inch square on a level surface. For masonry units with permeable paper, such as absorptive paper toweling, taped to one face shell are placed around the wood block to form the mold. The resulting mold is approximately 3 inches square by 6 inches high. Measure and record the slump of the grout in accordance with Test Method C143. Pour grout into the mold in two layers. Rod each layer 15 times with a tamping rod to eliminate air bubbles. Rod the bottom layer throughout its depth. Distribute the strokes uniformly over the cross-section of the mold. For the upper layer, allow the stick to penetrate about 1/2 inch into the underlying layer. After the second lift is puddled, level the top of the specimen with a straightedge and immediately cover the specimens with wet burlap or similar material to keep it damp. Protect the specimens against disturbance and extreme changes in temperature, and after 48 hours, remove the masonry units and carefully pack the specimens for transport to the laboratory where they will be stored in a moist room until tested.
2. Cap the specimens in accordance with the applicable provisions of "Method of Capping Cylindrical Concrete Specimens," ASTM C617. The specimens shall be tested in a damp condition in accordance with the applicable provisions of ASTM C39 "Methods of Test for Compressive Strength of Molded Concrete Cylinders."
3. Four test specimens shall be made and tested for each type of grout to be used in the work.
4. As an alternate to the method of sampling described above, grout samples may be formed in grout sample boxes, when requested and approved by A/E.
5. Tests for Grout: The Masonry Contractor shall coordinate with a qualified testing laboratory to perform field quality control testing during the masonry grout work.
    a. Grout for filling reinforced or unreinforced concrete masonry cores or brick cavities: Test for compressive strength.
        1) Provide a minimum of 4 test specimens for testing per 5,000 sq.ft. of masonry wall construction or for each ready mix truckload of grout and as directed by the A/E. Test one cylinder at 7 days, two cylinders at 28 days, and reserve one cylinder for future testing.
    b. Submit written reports for each material sampled and tested. Provide the project identification name and number, date of report, name of Contractor, name of testing service, source of aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, specific location where material represented by sample is used, slump and compression test results. Indicate whether material is acceptable for intended use.

## 3.17 REPAIRING, POINTING, AND CLEANING

A. Cleaning, General

1. Know your surface. Positively identify every substrate to be cleaned. Review all manufacturers literature for cleaning recommendations.
2. Always test before overall cleaning. Always test, and always clean under the same conditions you tested under. Retest if conditions change.
3. Use the mildest cleaner and dilution that still gives effective results.
4. Clean early:
    a. Don’t give mortar smears and films a chance to become as hard as the masonry. Get if off while it’s still relatively soft. Clean masonry within 7 to 21 days of installation.
    b. Clay brick may be cleaned within 14 to 28 days.
5. Use the right cleaner for the right job. Follow the masonry manufacturer’s guidelines for cleaning each type of masonry.
6. Never clean with raw acid.
7. Cleaning basics
    a. Don’t spare the water. Pre-wetting masonry is recommended. Rise with 400 psi to remove stains and cleaner residue.
    b. Clean bottom-to-top, and always keep lower areas wet to prevent streaking.

c. Follow all safety precautions in the product literature.
d. Cold weather
1) Water-saturated masonry is vulnerable to freeze/thaw damage. Never clean if the masonry could freeze before drying.
2) Chemical cleaners and rinse water rely on chemical reactions to dissolve and rinse away construction soiling. Cold temperatures slow these chemical reactions. Compensating for the cold by using a stronger cleaning solution may cause permanent damage to the masonry, especially colored concrete.
a) Instead, extend the dwelling time of the properly diluted cleaning solution by 10-20 percent. Scrub areas of heavy soiling with a masonry washing brush. Pre-wetting and rinsing with hot water warms surface and improves results.
3) Schedule wet cleaning for when air and surface temperatures are 40 deg. F. and rising. In cold weather this means your wet-cleaning window may be only a few hours. Use the time before and after to dry-brush and scrape away heavy accumulations of excess mortar and job dirt from the next day's work area.
4) If a limited cleaning window is impractical, enclose the work area with polyethylene and use approved heaters to warm masonry.
5) Warm weather test panels won't work for cold weather cleaning. Test in cold clean in cold.

B. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
1. Provide a 100 square foot area of patched CMU for A/E's review. Do not proceed with patching until area is approved. Wall shall appear uniform from a distance of 5 feet. If masonry units are colored, coordinate blend with unit manufacturer.

C. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
1. Tuckpointing
a. Rake mortar joints to a depth of not less than 1/2 inch nor more than 3/4 inch.
b. Saturate joints with clean water.
c. Fill solidly with pointing mortar.
d. Tool joints.

D. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints. Dry brush exposed masonry with bristle brushes at end of each work day.
1. Promptly remove excess wet mortar containing integral water-repellent mortar admixture from the face of the masonry as work progresses. Do not use strong acids, over-aggressive sandblasting or high-pressure cleaning.

E. 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 or use methods used on approved mock-up. Obtain A/E's approval of sample cleaning before proceeding with cleaning of masonry.
a. Where walls are a combination of CMU and brick only the less aggressive CMU cleaners shall be used.
b. Comply with applicable environment laws and restrictions.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
   a. Remove efflorescence in accordance with brick manufacturer's recommendations. Cleaning agents may be used only with approval of masonry unit manufacturer. Cleaning agents must be same as those used on test area.
   b. If chemical cleaners are to be sprayed on, the pressure shall not exceed 50 psi.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 08-02A and 08-03A, applicable to type of stain on exposed surfaces.
   a. If additional cleaning is necessary for special CMU, consult with masonry unit manufacturer for approved method. Test method and gain A/E approval before proceeding.
   b. Water application method shall never exceed 400 psi without approval of A/E.
8. Clean stone trim to comply with stone supplier's written instructions.

## 3.18 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste and other masonry waste, and legally dispose of off Owner's property.

## 3.19 LIST OF SPECIAL INSPECTIONS

TABLE 1.19.2 (TMS 402-11)

LEVEL B QUALITY ASSURANCE

| VERIFICATION AND INSPECTION | Frequency | | Reference for Criteria | |
|---|---|---|---|---|
| | CONTINUOUS | PERIODIC | TMS 402 | TMS 602 |
| 1. Verification of slump flow and VSI as delivered to the site for self-consolidating grout. | X | -- | -- | Art. 1.5 B.1.b.3 |
| 2. Verification of $f'_m$ prior to construction except where specifically exempted by this code. | -- | X | -- | Art. 1.4 B |
| 3. Compliance with required inspection provisions of the construction documents and the approved submittals shall be verified. | --- | X | --- | Art. 1.5 |
| 4. As masonry construction begins, the following shall be verified to ensure compliance: | | | | |
| a. Proportions of site-prepared mortar. | -- | X | -- | Art. 2.1, 2.6 A |
| b. Construction of mortar joints. | -- | X | -- | Art. 3.3 B |
| c. Location of reinforcement and connectors. | -- | X | -- | Art. 3.4 |
| 5. During construction the inspection program shall verify: | | | | |
| a. Size and location of structural elements. | -- | X | -- | Art. 3.3 F |
| b. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction. | -- | X | Sec. 1.16.4.3, 1.17.1 | -- |

| | | | | |
|---|---|---|---|---|
| c. Preparation, construction and protection of masonry during cold weather (temperature below 40 deg. F) or hot weather (temperature above 90 deg F.) | -- | X | -- | Art. 1.8 C, 1.8 D |
| d. Placement of grout is in compliance | X | -- | -- | Art. 3.5 |
| 6. Prior to grouting, the following shall be verified to ensure compliance. | | | | |
| a. Grout space. | -- | X | -- | Art. 3.2 D, 3.2 F |
| b. Grade, type, and size of reinforcement and anchor bolts. | -- | X | Sec. 1.16 | Art. 2.4, 3.4 |
| c. Placement of reinforcement and connectors. | -- | X | Sec. 1.16 | Art. 3.4 |
| d. Proportions of site-prepared grout. | -- | X | -- | Art. 2.6 B |
| e. Construction of mortar joints. | -- | X | -- | Art. 3.3 B |
| 7. Preparation of any required grout specimens, mortar specimens and/or prisms shall be observed. | -- | X | -- | Art. 1.4 |

END OF SECTION 04 20 00.00

# 05 METALS

# DIVISION

# SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes structural steel framing, including, but not limited to, following:
   1. Miscellaneous angles, channels, anchor bolts, bent plates, sleeves, sag rods, leveling plates, bearing plates for structural steel and steel joists, and other incidental items of structural steel required to be built into concrete or masonry shall be provided as indicated or specified and be furnished to respective trades at proper time; including instructions and templates for their installation.
   2. Provide, where specifically called for, loose lintels, steel shelf angles, perimeter angle closure, and accessories.
   3. For openings in metal deck 12 by 12 inches and larger, provide steel reinforcing members on all sides of opening, as indicated. Openings in deck shall be cut under Division 05, Section “Steel Decking”.
   4. Shear stud connectors.
   5. Shrinkage-resistant grout.

B. Related Sections include following:
   1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
   2. Division 05 Section "Steel Decking" for field installation of shear connectors.
   3. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.
   4. Division 07 Section “Applied Fireproofing” for coordination of primers.
   5. Division 13 Section "Metal Building Systems" for structural steel.

### 1.2 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's 303 "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

### 1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination
   1. Furnish anchorage items to be embedded in or attached to other construction without delaying Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.
   2. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Pre-installation Meeting: Conduct meeting at Project site.

### 1.4 ACTION SUBMITTALS

A. Product Data:
   1. Structural-steel materials.
   2. High-strength, bolt-nut-washer assemblies.
   3. Shear stud connectors.
   4. Anchor rods.
   5. Threaded rods.
   6. Forged-steel hardware.
   7. Shop primer.
   8. Galvanized-steel primer.
   9. Etching cleaner.

10. Galvanized repair paint.
11. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemented fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed and prepared by qualified professional engineer responsible for their preparation.
6. Indicate areas to be left unprimed, surfaces primed and where members will be galvanized.
7. Structural steel shop drawings are to be submitted by complete phase or sequence including all beams and columns required for that area. Incomplete or partial shop drawings will not be reviewed. Subsequent phase or sequence submittals must be clearly delineated on erection plans from previous submittals.
8. Resubmitted shop drawings must have all revisions clearly marked. Resubmitted drawings which do not have revisions marked will not be reviewed.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1 for each welded joint qualified by testing, including following:
1. Power Source (constant current or constant voltage).
2. Electrode manufacturer and trade names, for demand-critical welds.

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

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Welding certificates.

B. Product Test Reports
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
5. Shop primers
6. Grout

C. Qualification Data: For Installer, fabricator, professional engineer, and testing agency.

D. Source quality-control test reports, when applicable.

1.6 QUALITY ASSURANCE

A. Qualifications: Structural fasteners shall be manufactured in United States. Fabricator shall furnish proof of U.S. manufacturer. If it becomes necessary to use imported fasteners, each size, type, and each large quantity package (500 pcs. or more) shall undergo a random sampling of a minimum 5 pieces for testing. Test results are to be provided to A/E. Test shall be performed by an independent testing agency, and cost shall be included in Base Bid. If inferior fasteners are discovered, all fasteners of that type shall be removed and replaced with acceptable fasteners at no cost to Owner. If possible, fasteners shall be tested prior to use in construction.

B. Fabricator Qualifications: A qualified fabricator who participates in AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspector Program for Structural Steel (Acceptance Criteria 172).
   1. Firms acceptable as fabricators for structural steel work under this Section shall be certified in category of “Standard for Steel Building Structures (BU)” by American Institute of Steel Construction or shall include in their bid amount of $3000 to cover cost of inspections by an independent testing agency to verify that fabricator is capable of performing desired level of quality in work to be performed. Fabricator shall cooperate with and make available to testing agency records and documents which focus on general management, engineering and drafting, procurement, operations and quality control and shall allow access to facilities to allow testing agency to examine actual fabrication work in shop and drafting room at time of inspection. Inspection will be performed prior to signing of a contract between Owner and Fabricator and will be basis of recommendations from A/E to Owner as to qualifications of fabricator to perform work.

C. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
   1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

E. Shop-Painting Applicators: Qualified in accordance with AISC’s Complex Coating Endorsement CCE1 and Endorsement CCE3 or to SSPC-QP3.

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

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125, Grade 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide product by manufacturers specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. “Substitution Request Form” and complete technical data for evaluation must accompany request for A/E’s approval. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of following specifications and documents:
   1. ANSI/AISC 303.
   2. ANSI/AISC 341.
   3. ANSI/AISC 360.
   4. RCSC's "Specification for Structural Joints Using High-Strength Bolts".

B. Connection Design Information
   1. Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.
      a. Use Allowable Stress Design; data are given at service-load level.

C. Moment Connections: Type FR, fully restrained.

2.3 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992 or ASTM A 572, Grade 50.

B. Channels, Angles, M, S-Shapes: ASTM A 36 or ASTM A 572, Grade 50.

C. Plate and Bar: ASTM A 36, unless otherwise noted.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53, Type E or S, Grade B.

F. Steel Castings: ASTM A 216, Grade WCB with supplementary requirement S11.

G. Steel Forgings: ASTM A 668.

H. Welding Electrodes: Comply with AWS requirements.

2.4 BOLTS AND CONNECTORS

A. High-Strength A 325 Bolts, Nuts, and Washers: ASTM F 3125, Grade A 325, Type 1, heavy hex steel structural bolts; ASTM A 563, Grade DH, heavy hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
   1. Use 3/4 inch bolts, unless otherwise noted.
   2. Finish: Plain, unless otherwise noted.
      a. Provide hot-dip zinc coating, ASTM A 153, Class C, where indicated.
   3. Direct-Tension Indicators: ASTM F 959, Type 325-1 compressible-washer type may be used as Contractor's option.
      a. Finish: Plain, unless otherwise noted.

B. High-Strength A 440 Bolt-Nut-Washer Assemblies: ASTM F 3125, Grade A 490, Type 1, heavy hex or round head steel structural bolts or Grade F 2280 tension-control, bolt-nut-washer assemblies with splined ends; with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436, Type 1 hardened carbon-steel washers.
   1. Finish: Plain, unless otherwise noted.
   2. Direct-Tension Indicators: ASTM F 959, Type 490-1 compressible-washer type and plain finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 3125, Grade F 1852, Type 1 heavy-hex or round head assemblies, consisting of steel structural bolts with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
   1. Finish: Plain, unless otherwise noted.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

E. Deformed Bar Anchors: ASTM A 496, Fy = 70 ksi.

2.5 RODS

A. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
   1. Configuration: Straight, unless otherwise noted.
   2. Nuts: ASTM A 563 hex carbon steel.
   3. Plate Washers: ASTM A 36 carbon steel.
   4. Washers: ASTM F 436, Type 1, hardened carbon steel.
      a. To be used with 3/4 inch diameter anchor rods with maximum 1-1/16 inch hole in base pate.
   5. Finish: Plain, unless otherwise noted.
      a. Provide hot-dip zinc coating, ASTM A153, Class C, where indicated.

B. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
   1. Nuts: ASTM A 563 heavy hex carbon steel.
   2. Plate Washers: ASTM A 36 carbon steel.
   3. Washers: ASTM F 436, Type 1, hardened carbon steel.
      a. To be used with 3/4 inch diameter anchor rods with maximum 1-1/16 inch hole in base pate.
   4. Finish: Plain, unless otherwise noted.

C. Threaded Rods: ASTM A 36.
   1. Nuts: ASTM A 563 hex carbon steel.
   2. Washers: ASTM A 36 carbon steel.
   3. Finish: Plain, unless otherwise noted.
      a. Provide hot-dip zinc coating, ASTM A153, Class C, where indicated.

2.6 FORGED-STEEL STRUCTURAL HARDWARE AND ACCESSORIES

A. Clevises and Turnbuckles: ASTM A 108, AISI C-1035, cold-finished carbon steel.

B. Eye Bolts and Nuts: ASTM A 108, AISI C-1030, cold-finished carbon steel.

C. Sleeve Nuts: ASTM A 108, AISI C-1018, cold-finished carbon steel.

2.7 PRIMER

A. Steel Primer:
   1. Unless otherwise noted, provide fabricator’s standard lead-and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI #79 or SSPC-Paint 23 and compatible with topcoat.

2.8 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
   1. Products:
      a. Five Star Fluid Grout 100; Five Star Products, Inc.
      b. Crystex; L&M Construction Chemicals, Inc.
      c. Sure-Grip High Performance Grout; Dayton Superior Corp.
      d. Sealtight Pac-it Grout; W. R. Meadows, Inc.
      e. Enduro 50; Conspec Marketing & Manufacturing Co., Inc.
      f. NS Grout: The Euclid Chemical Company

2.9 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's 303 and AISC's 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel 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.

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 according to SSPC-SP 2, "Hand Tool Cleaning", unless otherwise noted.

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Base-Plate 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.

H. Masonry Bearing Plates
   1. All joists shall bear on masonry bearing plates with anchor rods or headed studs embedded in masonry below. Weld joists to bearing plates in accordance with SJI Specifications. See Framing Details and Plans for bearing plate sizes.
   2. All beams shall bear on masonry bearing plates with anchor rods or headed studs embedded in masonry below. Do not weld beams to bearing plates unless otherwise noted. See Framing Details and Plans for bearing plate sizes.
   3. Set bearing plates under Work of Division 04 Section “Unit Masonry”.

2.10 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings not less than 8 inches, unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.11 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing or masonry construction. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 32 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.12 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.13 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened, unless otherwise noted.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's 303 for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances.
    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.14 SHOP PRIMING

A. Shop prime steel surfaces except following:
1. Interior members permanently concealed (enclosed) in finished construction.
    a. All interior steel not exposed to view in final structure shall be shipped with no paint and no surface prep, unless otherwise noted.
    b. All interior stock, exposed to be painted, shall receive a primer compatible with topcoats as specified in Division 09 Section “Interior Painting”.
2. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
    a. Bituminous coating shall be applied to all steel encased in concrete and/or masonry below grade.
3. Surfaces to be field welded.
4. Surfaces to be high-strength bolted with slip-critical connections.
5. Surfaces to receive sprayed fire-resistive materials.
    a. Structural steel work that will be receiving sprayed-on fireproofing or intumescent paint shall be unprimed only where fireproofing is to be applied and no surface prep.
6. Galvanized surfaces.
    a. All exterior steel that is exposed to weather shall be galvanized, unless a high performance finish system is required.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to following specifications and standards:
   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."

C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP16.

D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

## 2.15 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by hot-dip process to structural steel according to ASTM A 123.
   1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
   2. Fill vent holes and drain holes that are exposed in finished work unless they function as weep holes by plugging with zinc solder and filling off smooth.
   3. Galvanize all steel (both beams and angles, including lintels and shelf angles) located in exterior walls.
   4. Galvanize all exterior steel exposed to weather, unless otherwise noted.

## 2.16 SOURCE QUALITY CONTROL

A. Owner shall engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports when fabricator is not certified. Cost of tests and inspections shall be paid by Owner and deducted from $3000.00 allowance.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
   2. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A490 Bolts."
   3. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.
   4. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
      a. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
      b. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.
   5. Correct deficiencies in Work that test reports and inspections indicate do not comply with Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedment, with steel erector present, for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedment 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.
   1. Do not remove temporary shoring supporting composite deck construction 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 according to:
   1. AISC 303 and AISC 360
   2. OSHA Construction Industry Standards (29 CFR 1926)
   3. Specified requirements

B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
   1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of base plate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed, unless otherwise noted. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
   1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
   2. Refer to Division 03 of these Specifications for anchor bolt installation requirements in concrete, and Division 04 for masonry installation, if required.
   3. Where anchor bolts are broken after installation, engineer of record shall be contacted for an appropriate solution.
   4. Where anchor bolts are incorrectly located in concrete or masonry that encases them, engineer of record shall be contacted for an appropriate solution.

D. Lintels and Shelf Angles: Weld or bolt members together where indicated.
   1. Lintels shall have 8 inch bearing at each end, minimum, unless shown otherwise. Bearing pressures shall not exceed allowable stress for masonry.
   2. Where shelf angles are attached to concrete with bolts and adjustable inserts, provide slotted holes of proper size and spacing in vertical leg of shelf angles.

E. Maintain erection tolerances of structural steel within AISC's 303.

F. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be 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.

G. Splice members only where indicated.

H. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

I. Do not use thermal cutting during erection unless approved by A/E. If approved, finish thermally cut sections within smoothness limits in AWS D1.1.

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

K. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened, unless otherwise noted.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
   1. Comply with AISC's 303 and 360 for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs, where indicated, back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC 303 for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform 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 connection.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
   1. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   2. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
      a. In addition to visual inspection, field welds may be tested according to AWS D1.1 and following inspection procedures, at testing agency's option:
         1) Liquid Penetrant Inspection: ASTM E 165.
         2) Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
         3) Ultrasonic Inspection: ASTM E 164.
         4) Radiographic Inspection: ASTM E 94.

C. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with Contract Documents.

3.6 ERECTION ALIGNMENT

A. Framing: Framing shall be built up true, plumb, and level within a tolerance of 1:500; and temporary bracing shall be introduced, wherever necessary, to take care of loads to which structure may be subjected, including erection equipment and its operation. Such bracing shall be left in place as long as may be required for safety. Contractor as part of his equipment shall finally remove it. As erection progresses, Work shall be securely connected to take care of dead load, wind, and erection stresses.

3.7 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with 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 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
   2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 05 12 00

# SECTION 05 21 00 - STEEL JOIST FRAMING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
   1. K-series steel joists.
   2. KCS-type K-series steel joists.
   3. K-series steel joist substitutes.
   4. Joist accessories.
      a. When outriggers, angles, or other components are attached to the open web steel joists in the shop, in such a way that they actually are a component part of the joists, they are to be provided under this Section.
      b. The Work includes bridging and bridging anchors, sag rods, wall anchors, and beam anchors.

B. Related Sections include the following:
   1. Division 03 Section "Cast-in-Place Concrete" for installing bearing plates in concrete.
   2. Division 04 Section "Unit Masonry" for installing bearing plates in unit masonry.
   3. Division 05 Section "Structural Steel Framing" for bearing plates.
   4. Division 05 Section “Metal Fabrications” for adhesive anchor bolts and bearing plates.
   5. Division 07 Section “Applied Fireproofing” for priming requirements.

### 1.2 DEFINITIONS

A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. Shop Drawings:
   1. Show layout, designation, number, type, location, and spacings of joists.
   2. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.
   3. Indicate where members are to be unprimed and are to be primed

### 1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Welding certificates.

B. Manufacturer Certificates: Signed by manufacturers stating that work was performed in accordance with approved construction documents and with SJI standard specifications.

C. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.

D. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.
   1. Submit design calculations with a cover letter bearing seal and signature of the joist manufacturer's registered design professional. In addition to standard calculations under seal and signature, submittal of the following shall be included:
      a. Joists with special loading conditions.

b. Non-SJI standard bridging details (e.g., for cantilevered conditions, net uplift, etc.).
c. Connection details for
    1) Non-SJI standard connections (e.g., flush-framed or framed connections);
    2) Field splices;
    3) Joist headers.

E. Qualification Data: For manufacturer and professional engineer.

F. Steel-joist placement plans: Shall include, at a minimum, the following:
1. Listing of all applicable loads as used in the design of the steel joists and joist girders as specified in the construction documents.
2. Profiles of nonstandard joist and girder configurations.
3. Connection requirements for:
    a. Joist supports
    b. Field splices
    c. Bridging attachments
4. Deflection criteria for live and total loads for non-SJI standard joists.
5. Size, location, and connections for all bridging.
6. Joist headers.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance.
1. A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."
2. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements. This responsibility includes preparation of shop drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installation of joists that are similar to those indicated for this Project in material, storage, and extent.

C. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.7 SEQUENCING

A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Canam Steel Corporation; Canam Group, Inc.
   2. Gooder-Henrichsen Co.
   3. New Millennium Building Systems, LLC
   4. Structures of U.S.A., Inc.
   5. Valley Joist
   6. Vulcraft; Nucor Corporation.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
   1. Use basic load cases shown on drawings.
   2. Design special joists to withstand design loads with live load deflections no greater than the following:
      a. Roof Joists: Vertical deflection of 1/360 of the span.

2.3 MATERIALS, GENERAL

A. Steel: Comply with SJI, Federal Register 29 CFR 1926 and with AISC "Standard Specifications."
   1. Yield strength used as a basis for the design stresses shall be as follows:
      a. Chords = 50,000 psi
      b. Webs = 36,000 psi or 50,000 psi
   2. Evidence that the steel furnished meets or exceeds the design yield strength shall be provided, on A/E's request, in the form of certified test reports.
   3. Deduct the area of holes in chords from the area of the chord when calculating the strength of the member.

2.4 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.5 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
   1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

D. Provide holes in chord members for connecting and securing other construction to joists.

E. Top-Chord Extensions and Extended Ends: Provide cantilevered ends of joints with either Type S-top chord extensions or Type R extended ends as required for the loads indicated. Unless indicated otherwise, design cantilevered ends for the same pound-per-linear-foot capacity as the main span of the joist.

F. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

G. Camber joists according to SJI's "Specifications."

H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.6 JOIST ACCESSORIES

A. Bridging: Detail and fabricate according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

B. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface, unless otherwise indicated.

C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.Finish: Plain, uncoated, unless otherwise noted.
   a. Provide hot-dip zinc coating, ASTM A 153, Class C, where indicated.

D. High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
   1. Finish: Plain, uncoated, unless otherwise noted.
      a. Provide hot-dip zinc coating, ASTM A 153, Class C, where indicated.

E. Welding Electrodes: Comply with AWS standards.

F. Galvanizing Repair Paint: MPI #18, MPI#19, or SSPC-Paint 20 or ASTM A 780.

G. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.7 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or SSPG-SP3, unless otherwise noted or required by paint manufacturer.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
   1. Before installation, splice joists delivered to Project site in more than one piece.
   2. Space, adjust, and align joists accurately in location before permanently fastening.
   3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
   4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joist to supporting steel framework using carbon-steel bolt, where indicated.
   1. Provide high-strength structural bolts, where indicated. Comply with Research Council on Structural Connections' "Specification for Structural Joints Using ASTM F 3125, Grade A325 or A490 Bolts" for high strength structural bolt installation and tightening requirements.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

F. Anchors: Bridging shall extend to walls or beams and shall be anchored thereto before construction loads are placed on the joists.

G. Support of Other Work: Suspension wires, straps, chains, etc. used to support lights, ceiling grid, ductwork piping conduit, etc. shall be hung from top or bottom chord panel points.

## 3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

B. Field welds will be visually inspected according to AWS D1.1.
   1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following procedures, as applicable:
      a. Radiographic Testing: ASTM E 94.
      b. Magnetic Particle Inspection: ASTM E 709.
      c. Ultrasonic Testing: ASTM E 164.
      d. Liquid Penetrant Inspection: ASTM E 165.

C. Bolted connections will be visually inspected.
   1. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."

D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

E. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

## 3.4 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories.
   1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
   2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 21 00

# SECTION 05 31 00 - STEEL DECKING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes following:
   1. Roof deck.

B. Related Sections include following:
   1. Division 03 Section "Cast-in-Place Concrete" for concrete fill over steel deck.
   2. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
   3. Division 05 Section “Structural Steel Framing” for framing deck openings 12 inch square and larger with miscellaneous steel shapes.
   4. Division 09 Section "Interior Painting" for painting of deck.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated, including dimensions of individual components, profiles, and finishes.

B. Shop Drawings: Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

### 1.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Welding Certificates: If welding is used, welder certificates signed by the Contractor certifying that welder’s comply with requirements specified in Quality Assurance.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of following complies with requirements:
   1. Power-actuated mechanical fasteners.
      a. Provide calculations in accordance with IIC-ES AC43 or SDI design method verifying allowable diaphragm shear strength and stiffness.

### 1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with applicable provisions of the following specifications:
   1. AISI S100-16, North American Specification for the Design of Cold-Formed Steel Structural Members.
      a. ANSI/SDI RD, Standard for Steel Roof Deck.

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

C. Installer Qualifications:
   1. All steel roof deck welders AWS certified for welding of sheet steel.
   2. All mechanical fasteners installers certified or licensed by fastener and tool system manufacture on project site in accordance with ANSI A10.3 requirements. Certification or licensing includes all training necessary for proper tool operation, fastener selection, maintenance and troubleshooting.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
   1. Do not rack, bend or mar steel roof deck sheets.

B. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
   1. If ground storage is needed, the deck bundles must be stored off the ground, with one end elevated to provide drainage. Bundles must be protected against condensation with a ventilated waterproof covering. Bundles must be stacked so there is no danger of tipping, sliding, rolling, shifting or material damage. Bundles must be periodically checked for tightness, and retightened as necessary.
   2. Deck bundles placed on the building frame must be placed near a main supporting beam at a column or wall. In no case are the bundles to be placed on unbolted frames or an unattached and/or unbridged joists. The structural frame must be properly based to receive the bundles.

C. Store welding electrodes, mechanical fasteners and powder-actuated cartridges in original packages in a cool, dry location until final installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products of deck manufacturers certified by Steel Deck Institute will be considered, providing their products equal or exceed quality specified; and they can provide products of type, size, function, and arrangement as indicated.
   1. Units shall be capable of supporting design loads shown.

B. In other Part 2 articles where titles below introduce lists, following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide product by manufacturers specified.

C. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. “Substitution Request Form” and complete technical data for evaluation must accompany request for A/E’s approval. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Design Requirements
   1. Compute properties of metal roof deck sections on basis of effective design width as limited by provisions of SDI specifications. Provide deck section properties, including section modulus and moment of inertia per foot of width.
   2. Allowable Deflection: Design and fabricate deck for a maximum deflection of 1/360 of clear span under uniform live load.
   3. The deck shall be selected to provide the load capacities shown on drawings and as determined using the ANSI/SD RD construct loading criteria.
   4. The deck type provided shall be capable of supporting the superimposed live loads as shown on the plans.

B. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
   2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

C. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for Design of Cold-Formed Steel Structural Members."

2.3 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI RD" and with following:
   1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33 G60 zinc coating, unless otherwise noted.
      a. Do not pre-treat surface with chromates or other passivating treatments where deck is to be painted.
      b. Prime-painted deck is not acceptable.
   2. Deck Profile: Type WR, wide rib, unless otherwise noted.
   3. Profile Depth: 1-1/2 inches, unless otherwise noted.
   4. Design Uncoated-Steel Thickness: As indicated.
   5. Span Condition: Triple span or more, unless otherwise noted or approved.
   6. Side Laps: Overlapped or interlocking seam at Contractor’s option.
   7. Ridge and valley plates, flat plates at changes of deck direction, sump pans and side closures shall be the standard type provided by the deck manufacturer, unless indicated otherwise on the drawings.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
   1. Products:
      a. X-ENP-19 L15 or X-HSN-24 pins, Hilti.
      b. TEKS, ITW Builders.
      c. D100; MKT Fastening, LLC.
   2. Design Requirements: ICC-ES AC43 or SDI method for diaphragm shear strength and stiffness.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
   1. Design Requirements: ICC-ES AC43 or SDI method for diaphragm shear strength and stiffness.

D. 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.

E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Standards for overhang and slab depth.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

G. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in field.

H. Galvanizing Repair Paint: ASTM A 780 or SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

I. Epoxy Primer: Refer to finish coating sections for coordination with manufacturers recommended primer.

PART 3 - EXECUTION

3.1 EXAMINATION/PREPARATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Layout: Place steel roof deck sheets ensuring bearing on supporting steel framing. Sheets shall be true and straight with horizontal deviations less than ¼ inch in 100 feet. Minimum end laps 2 inches.

C. Marking: Mark steel roof deck at centerline of supporting steel members to prevent weld burn through or mechanical fastener punch trough. Use a chalk line or indelible marker.

D. Test Fastenings:
1. Welds: Perform project specific test welds prior to final installation per AWS D1.3. Test welds are considered examples or representative work.
2. Mechanical fasteners: gauge powder-activated tool systems to base material steel type, steel deck type and thickness prior to final installation. Confirm appropriate power regulation and powder-activated cartridge type prior to final installation.

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

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI RD, as applicable; manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks. Attach firmly to the supports immediately after placement in and or to form a safe working platform.

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.
1. Trades that subsequently cut unscheduled openings through the deck are responsible for reinforcing the openings.

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 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as indicated.
   1. Weld Diameter: 5/8 inch, minimum.
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches apart in field of roof and 6 inches apart in roof corners and perimeter, based on roof area definitions in FMG Loss Prevention Data Sheet 1-28, unless otherwise indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as indicated.
   1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Lapped 2 inches minimum, unless otherwise noted.
      a. End joints of 3 inch roof deck may be butted over center of supports.

D. Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

F. Support of Other Work: Suspension wires, straps, chains, and metal framing such as those used to support following shall not be attached to or through steel roof decks.
   1. Bulkheads.
   2. Suspended ceilings.
   3. Fire-suppression systems.
   4. Ductwork.
   5. Lighting.
   6. Similar items.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Tests and Inspections:
   1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SID QA/AC.
      a. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and A/E.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.
   1. Before placement of roof insulation and roof covering, the deck shall be inspected for tear, dents or other damage that may prevent the deck from acting as a structural roof base. The need for repair of damaged deck shall be determined by the A/E based on structural performance.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair of Blow Holes in Deck: All holes require sheet metal plate patches fastened to deck in accordance with SDI Deck Damage and Penetrations.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.
   1. Do not use deck units as a working platform or storage area until units are in position and permanently attached to the structure.
   2. Construction loads must not exceed load carrying capacity of the deck.

END OF SECTION 05 31 00

# SECTION 05 40 00 - COLD-FORMED METAL FRAMING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
   1. Non-axial load-bearing
      a. Exterior non-load-bearing wall framing.
   2. Soffit framing.

B. Related Sections include the following:
   1. Division 05 Section "Metal Fabrications".
   2. Division 06 Section “Sheathing” for sheathing.
   3. Division 09 Section "Gypsum Board Assemblies" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

### 1.2 PREINSTALLATION MEETING

A. Preinstallation Meeting: Conduct meeting at Project site.
   1. Review and Discuss: Project requirements, substrate conditions, and manufacturer’s installation instructions.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
   1. Research Reports:
      a. For cold-formed steel framing.
      b. Steel framing manufacturer to have a third-party evaluation report for its products that are reviewed to the codes indicated on drawings and AISI S100.

B. Shop Drawings:
   1. Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.
   1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   2. Shop drawings must either prepared or reviewed and approved by manufacturer before issued to A/E.

### 1.4 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of shop drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Manufacturer
   1. Product Tests: Mill certificates or data from a qualified independent testing agency or in-house testing with calibrated test equipment per ICC AC46 Acceptance Criteria for Cold-Formed Steel Framing Members indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
   2. Provide full time quality control over fabrication and erection complying with applicable codes, ordinances, rules and regulations of government agencies having jurisdiction.

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
   1. Quality welding processes and welding operations in accordance with AWS “Standard Qualification Procedure”.

E. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.
   1. Products to be certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS Accreditation Criteria for Inspection Agencies.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling, per requirements of AISI’s “Code of Standard Practice”.
   1. Store materials protected from exposure to rain, snow, and other harmful weather conditions, at temperature and humidity conditions per ASTM C955.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   1. Clark Dietrich
   2. SCAFCO Steel Stud Company
   3. MarinoWARE
   4. MBA Building Supplies
   5. Telling Industries
   6. The Steel Network
   7. All Steel and Gypsum Products, Inc.
   8. MRI Steel Framing, LLC
   9. Jaimes Industries
   10. State Building Products

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany request for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design cold-formed metal framing.

B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design steel in accordance with AISI S100, current addition, unless otherwise noted.
   2. Design Loads: As indicated.
   3. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height for walls not clad in masonry
         1) Deflection limited to 1/600 of the wall height for brick veneer backup.
      b. Soffit Framing: Vertical deflection of 1/360 of the span.
   4. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
   5. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of 1 inch.
   6. Design framing systems to accept and support lateral forces and loads from storefront, curtainwall and other punched openings within and connected to the wall system. Framing system shall work in conjunction with structural steel provided.
   7. The concrete, masonry and structural steel design and drawings indicate the additional building structure the framing system can attach to for support and anchorage. Additional components will not be provided. Framing system design must include all materials required if design analysis requires additional steel structure for compliance with performance requirements. Additional materials must be provided as part of the Work of this section. Refer to Section “Structural Steel Framing” for material requirements.

C. Cold-Formed Steel Framing, General: Design according to AISI's S100 and AISI S200 and ASTM C956, Section 8 (Screw Penetration Test).
   1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
   2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

D. Cold-Formed Steel Framing Design Standards: AISI S240.

E. Fire-Resistance Ratings: Comply with ASTME 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency acceptable to authority having jurisdiction.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.3 MATERIALS

A. Framing Members, General: Comply with AISI S200 and ASTM C955, Section 8, for conditions indicated.

B. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As required by structural performance.
   2. Coating: CP 60: G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90) minimum.
      a. CP90: G90 (Z275), AZ50 (AZM150), or GF45 (ZGF135) where framing backs up masonry, and where indicated.

C. System Components, General: With each type of metal framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer for applications indicated, as needed to provide complete metal framing system.
   1. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:
      a. Grade: As required by structural performance.
      b. Coating: CP 60: G60 (Z180), A60 (ZF180), AZ50 (AZM 150), or GF30 (ZGF90) per AISI S200 and ASTM C955, unless otherwise noted.
         1) Provide CP 90: G90 (Z275), AZ50 (AZM 150), or GF45 (ZGF135) per AISI S200 and ASTM C955, where indicated and as required to match coatings used for framing.

D. Stud Punch-Outs: Minimum 10 inches between end of member and near edge of web punch-out and 24 inches on center thereafter.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING (NON-AXIAL)

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base- Steel Thickness: 0.0428 inch (fka 18 gauge).
   2. Minimum Flange Width: 1-5/8 inches .

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base- Steel Thickness: 0.0428 inch (fka 18 gauge).
   2. Minimum Flange Width: 1-1/4 inches.

C. Deflection Track (Slotted): Manufacturer's single, deep-leg, U-shaped steel track; punched with vertical slots in both legs. Studs should be positively attached to deep-leg track using vertical slots while allowing free vertical movement. Legs designed to support horizontal and lateral loads and transfer them to the primary structure.
   1. Leg Dimension: 3 inches with 2-inch slot.

D. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

F. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, or manufacturer's proprietary shape used to form header beams and jambs, columns or posts, of web depths indicated, unpunched, with stiffened flanges, and as follows:
   1. Minimum Base- Steel Thickness: 0.0428 inch (fka 18 gauge).
   2. Minimum Flange Width: 1-5/8 inches.

2.5 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections of web depths as required to meet load requirements including uplift, with stiffened flanges, and as follows:
   1. Minimum Base- Steel Thickness: 0.0428 inch (fka 18 gauge).
   2. Minimum Flange Width: 1-5/8 inches.

B. Tie wire and Hanger Wire: ASTM A641, Class 1 zinc coating, soft temper or of a material and size having superior corrosion resistance and equivalent strength to the galvanized steel wire specified.
   1. Tie wire shall be 0.0625-inch or double strand of 0.0475 inch diameter wire.
   2. Hanger wire shall be 0.162-inch diameter wire.

C. Carrying Channels: Base metal thickness of 0.0538 inch, a minimum 1/2-inch wide flange, with ASTM A653, G60, or equivalent corrosive resistance.
   1. Depth: 1-1/2 inches, unless otherwise noted.

D. Furring Channels: ASTM A653, G60, (G60) or equivalent corrosive resistance.
   1. Cold-Rolled Channels: 0.0538 inch bare-steel thickness, with minimum 1/2 inch wide flanges, 3/4 inch deep.
   2. Hat Shaped, Rigid Furring Channels: ASTM C645-07, 7/8 inch deep.
      a. Minimum Base Metal Thickness: 0.0179 inch or equivalent thickness of members that can show independently verified test performance per ASTM C645-07 Section 9.2.
   3. Steel Studs: ASTM C645
      a. Minimum Base Metal Thickness: 0.0179 inch or equivalent thickness of members that can show independently verified test performance per ASTM C645-07 Section 9.2.
      b. Depth: 1-5/8 inch minimum, unless otherwise noted.

## 2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, structural grade, Type H, metallic coated, of same grade and coating weight used for framing members, complying with ASTM C 955 and AISI 200.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Anchor clips.
   5. End clips.
   6. Foundation clips.
   7. Gusset plates.
   8. Stud kickers, knee braces, and girts.
   9. Joist hangers and end closures.
   10. Hole reinforcing plates.
   11. Backer plates.

## 2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153, Class C.

C. Post-Installed Anchors: Refer to Division 05 Section “Metal Fabrications” for post-installed anchor requirements.

D. Power-Actuated Anchors: fastener systems with working capacity greater than of equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
   1. Powder-actuated pins are not acceptable.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, MIL-P-21035B, or ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

E. Sill Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

F. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type 1 (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

G. Minimum 20 gauge 6 inch strap to secure the flashing termination bar.

2.9 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed metal framing members by welding or screw fastening as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
   4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

E. Do not install any materials with signs of “red rust”. It is progressive and will continue to spread. White rust is okay. It is considered a wet storage stain and is not progressive. It is just the zinc coating reacting to moisture.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's S200 "Standard for Cold-Formed Steel Framing - General Provisions, AISI S202," and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
   2. Do not weld or mechanically fasten to or through steel roof deck.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

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

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION (NON-AXIAL)

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track, unless otherwise indicated. Space studs as follows:
   1. Maximum Stud Spacing: 16 inches

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Install single deep-leg deflection tracks and anchor to building structure.
   2. Connect vertical deflection clips to bypassing and infill studs and anchor to building structure.
   3. Connect drift clips to cold formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection. Provide one of the following:
   1. Channel Bridging: Cold-rolled steel channel welded or mechanically fastened to webs of punched studs.
   2. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
   3. Install solid blocking at 96-inch centers.
   4. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   5. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.
   1. Uplift Bracing: Place metal framing between the runners and the structure above at 4 foot o.c. in each direction. Design framing for a maximum deflection of 1/360 of its height under the dead load plus a wind force of 30 psf, minimum acting in either direction.
      a. Provide uplift bracing at all exterior ceilings and soffits.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
   1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
   2. Provide boxed jamb assemblies at large opening as required to comply with performance standards.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
   1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

## 3.5 INSTALLING STEEL FRAMING FOR SOFFITS

A. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free of contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Wire Hangers: Secure by looping and tying, either directly to structure or directly to fasteners that are secure and appropriate for substrate, in a manner that will not cause them to deteriorate or otherwise fail.
   3. Do not support soffits directly from permanent metal forms. Secure to fastener devices that extend through forms.
   4. Do not attach hangers to steel deck tabs.
   5. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   6. Do not connect steel framing to or suspend it from ducts, pipes, or conduit.

B. Installation Tolerances: Install steel framing components for ceilings so members are level to within 1/4 inch in 10 feet measured lengthwise on each member and transversely between parallel members.

C. Sway-brace suspended steel framing with hangers used for support.

D. Install steel framing components for ceilings in sizes and spacings indicated but not less than that required by the referenced steel framing and installation standards.
   1. Hanger Spacing: 48 inches o.c. or as indicated.
   2. Main Runner (Carrying Channel) Spacing: For suspended soffits, 36 inches o.c. or as indicated.

## 3.6 INSTALLATION TOLERANCES

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

## 3.7 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and A/E.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

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

END OF SECTION 05 40 00

# SECTION 05 50 00 - METAL FABRICATIONS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
   1. General: The extent of metal fabrications includes items fabricated from iron and steel shapes, plates, bars, strips, tubes, pipes, and castings which are not a part of structural steel systems in these Specifications.
   2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   3. Steel weld plates, bent plates and angles for casting into concrete or masonry.
      a. Overhead door jambs and head plates.
   4. Prefabricated ladders.
   5. Post-installed, torque-controlled expansion anchors.

B. Products furnished, but not installed, under this Section include the following:
   1. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
   2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections include the following:
   1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
   2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
   3. Division 05 Section "Structural Steel Framing" for lintels, shelf angles, and loose bearing and leveling plates and prefabricated building columns.
   4. Division 06 Section "Rough Carpentry" for metal framing anchors.
   5. Division 33 Section “Utility Services” for metal downspout boots.

### 1.2 COORDINATION

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

B. 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.

### 1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Adhesive anchor bolts.
   2. Post-installed, torque-controlled expansion anchors.
   3. Ladders and ship’s ladders.
   4. Prefabricated ladders.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
      a. Steel framing and supports for applications where framing and supports are not specified in other Sections.
      b. Miscellaneous steel trim including steel edgings.

c. Metal ladders, provide reaction loads for each hanger and bracket.
d. Prefabricated ladders, provide reaction loads for each hanger and bracket.

2. Provide templates for anchors and bolts specified for installation under other Sections.

1.4 QUALITY ASSURANCE

A. Prefabricated Ladders Manufacturers Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.
1. Record of successful in-service performance.
2. Sufficient production capacity to produce required units.
3. Professional engineering component in design all structural analysis to fabricate ladders in compliance with industry standards and local codes.

B. Prefabricated Ladder Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

C. Qualifications:
1. Structural fasteners shall be manufactured in the United States. Fabricator shall furnish proof of U.S. manufacturer. If it becomes necessary to use imported fasteners, each size, type, and each large quantity package (500 pcs. or more) shall undergo a random sampling of a minimum 5 pieces for testing. Test results are to be provided to A/E. Test shall be performed by an independent testing agency, and the cost shall be included in the Base Bid. If inferior fasteners are discovered, all fasteners of that type shall be removed and replaced with acceptable fasteners at no cost to the Owner. If possible, fasteners shall be tested prior to use in construction.
2. Ladders: Product design shall comply with OSHA 1910.27 minimum standards.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1 "Structural Welding Code – Steel."

E. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."

F. Post-Installed Torque-Controlled expansion Anchors and Adhesive Anchor Bolts: Installers of post-installed anchors shall undergo a manufacturer’s training program or be provided with on-site instruction for proper installation from a manufacturer’s representative.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.6 PREMANUFACTURED LADDER WARRANTY

A. Manufacturer: For extended corrective period for work of premanufactured ladders for a period of 5 years commencing on the shipment date of the product against all the conditions indicated below, and when notified in writing from Owner, manufacturer promptly and without inconvenience and cost to Owner correct said deficiencies.
1. Defects in materials and workmanship.
2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, usual abuse or neglect expected.

3. Within the warranty period, the manufacturer shall, as its option, repair, replace, or refund the purchase price of defective ladder.

B. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses or of expenses, resulting from the use of ladder products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Basis-of-Design Product: The design for each product type is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany request for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
1. Product design shall comply with OSHA 1910.27 minimum standards.

B. Structural Performance of Aluminum Ladders: Provide aluminum ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.3 METALS, GENERAL

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.

2.4 FERROUS METALS

A. W-Shapes: ASTM A 992.

B. Channels, Angles, M, S-Shapes: ASTM A 36 or ASTM A 572, Grade 50.

C. Steel Plates, Shapes, and Bars: ASTM A 36.

D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

E. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

F. Rolled-Steel Floor Plate: ASTM A 786, rolled from plate complying with ASTM A 36 or ASTM A 283, Grade C or D.

G. Steel Tubing: ASTM A 500, cold-formed steel tubing.

H. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

I. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-4.
   1. Size of Channels: 1-5/8 inch wide single and double channels as required.
   2. Material: Steel complying with ASTM A 1011, structural steel, Grade 33; 0.0528-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
   3. Fittings: Fabricate from steel that meets or exceeds the physical requirements of ASTM A1011 SS Grade 33 and conforms to one of the following ASTM specifications:
      a. A1011 SS Grade 33
      b. A575
      c. A576
      d. A36
      e. A635

J. Cast Iron: Either gray iron ASTM A 48, or malleable iron, ASTM A 47, unless other indicated or required by structural loads.

## 2.5 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632, Alloy 6061-T6.

D. Aluminum Castings: ASTM B 26, Alloy 443.0-F.

## 2.6 FASTENERS

A. General: Unless otherwise indicated, provide Type 304, Type 316 within pool/natatorium environment, 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. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
   1. Provide stainless-steel fasteners for fastening aluminum.

B. High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A 325, Type 3, heavy-hex steel structural bolts; ASTM A 563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1 and Group 2 within natatorium/pool environment.

E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
   1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

F. Eyebolts: ASTM A 489.

G. Machine Screws: ASME B18.6.3.

H. Lag Bolts: ASME B18.2.1.

I. Wood Screws: Flat head, ASME B18.6.1.

J. Plain Washers: Round, ASME B18.22.1.

K. Lock Washers: Helical, spring type, ASME B18.21.1.

L. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM F 2329.

M. Post Installed, Torque-Controlled Expansion Anchors: Anchor bolt and sleeve assembly satisfying the cracked concrete requirements of ICC-ES AC 193 with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   1. Products:
      a. Kwik Bolt TZ; Hilti, Inc.
      b. Strong Bolt II; Simpson Strong-Tie Company, Inc.
      c. Truebolt+; ITW Ramset/Red Head
   2. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5 or ASTM F 1941, Class Fc/Zn5, unless otherwise indicated. .
   3. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

N. Adhesive (Chemical) Anchor Bolts (In Concrete): Chemically grouted adhesive (chemical) anchor bolts satisfying the cracked concrete requirements of ICC-ES AC 308. Subject to compliance with requirements, provide one of the following:
   1. Products:
      a. HY 200 Safe Set system or RE 500 V3 Safe Set; Hilti, Inc.
      b. Ceramic 6 EPCON System Adhesive Anchors; ITW Ramset/Red Head.
      c. Simpson Set Epoxy-Tie Adhesive Anchors; Simpson Strong-Tie Company, Inc.
   2. Anchors to be ASTM A36 or A307, zinc plated steel threaded rods (Fy = 36 ksi) unless otherwise noted.
   3. Where noted on the drawings anchors to be ASTM F593, Condition CW stainless steel threaded rods (Fy = 65 ksi for diameters 3/8 inch through 5/8 inch and Fy = 45 ksi for diameters 3/4 inch through 1-1/4 inch).
   4. Anchors to be installed in strict conformance to manufacturer's installation instructions.
   5. Adhesive Anchors shall have the following minimum allowable load capacities: (Based on embedment in 4000 psi concrete and a minimum safety factor on ultimate load capacities of 3.5. Use proportional allowable loads for other strengths of concrete. Note: Actual anchor load capacity varies with spacing and edge distance.)

| Size | Allowable Shear | Allowable Tension | Minimum Embedment |
|---|---|---|---|
| 3/8 inch | 1000 lbs. | 2100 lbs. | 3-3/8 inch |
| 1/2 inch | 1850 lbs. | 3300 lbs. | 4-1/4 inch |

| | | | |
|---|---|---|---|
| 5/8 inch | 2900 lbs. | 5100 lbs. | 5 inches |
| 3/4 inch | 4200 lbs. | 6800 lbs. | 6-5/8 inch |
| 1 inch | 7500 lbs. | 11,000 lbs. | 8-1/4 inch |

O. Adhesive Anchor Bolts (In Masonry)

1. In hollow CMU: Chemically grouted adhesive anchor systems with nylon or stainless steel screen inserts.
   a. Products:
      1) HIT HY270 Adhesive Anchors, Hilti, Inc.
      2) Ceramic 6 EPCON System, ITW/Ramset/Red Head
      3) Simpson Set Epoxy-Tie Adhesive Anchors, Simpson Strong-Tie Company, Inc.
2. In solid grouted CMU: Chemically grouted adhesive anchor systems. If voids in grout are encountered, use adhesive anchor bolts specified above for hollow CMU.
   a. Products:
      1) HIT-ICE (Cold Weather) or HY270 (Hot Weather) Adhesive Anchors, Hilti, Inc.
      2) Ceramic 6 EPCON System, ITW/Ramset/Redhead
      3) Simpson Set Epoxy-Tie Adhesive Anchors, Simpson Strong-Tie Company, Inc.
3. Anchors to be ASTM A36 or A307 zinc plated steel threaded rods (Fy = 36 ksi) unless otherwise noted.
4. Where noted on the drawings, anchors to be ASTM F593, Condition CW stainless steel threaded rods (Fy = 65 ksi for diameters 3/8 inch through 5/8 inch and Fy = 45 ksi for diameters 3/4 inch through 1-1/4 inch).
5. Anchors to be installed in strict conformance to manufacturer's installation instructions.
6. Adhesive anchors shall have the following minimum allowable load capacities: (Based on F'm = 1500 psi , grout with f'c = 2500 psi at 28 days and a minimum safety factor on ultimate load capacities of 3.5. Note: Actual anchor load capacity varies with spacing and edge distance.)

   a. In Hollow CMU:

| Size | Allowable Shear | Allowable Tension | Minimum Embedment |
|---|---|---|---|
| 3/8 inch | 600 lbs. | 500 lbs. | 2 inch |
| 1/2 inch | 900 lbs. | 500 lbs. | 2 inch |

   b. In Solid Grouted CMU:

| Size | Allowable Shear | Allowable Tension | Minimum Embedment |
|---|---|---|---|
| 1/2 inch | 1200 lbs. | 1400 lbs. | 4-1/4 inch |
| 5/8 inch | 1600 lbs. | 1800 lbs. | 5 inch |
| 3/4 inch | 1600 lbs. | 2900 lbs. | 6-5/8 inch |

7. Adhesive anchor bolt suppliers shall submit product data, including certified test results showing the ultimate and allowable shear and tension load capacities for all anchors sizes and types to be furnished.

2.7 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Epoxy Zinc-Rich Primer: Complying with MPI #20 and compatible with topcoat.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, 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 or SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert type noncorrosive compound free of asbestos fibers, sulfur compounds, and other deleterious impurities.

G. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.8 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.9 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated but not less than recommended by partition manufacturer. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

C. 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 retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.

D. Prime miscellaneous framing and supports with where indicated.

2.10 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel stud anchors for embedding in concrete.
1. Bent plates for overhead door jambs shall be installed as concrete or masonry wall is constructed.
2. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.
3. Galvanize exterior weld plates, bent plates and angles serving as door jambs.

B. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.

C. Provide galvanized steel angles with integral welded steel strap for casting into edge of concrete slabs.

D. Provide galvanized steel plates or channels with integrally welded steel strap for casting into concrete at face of loading dock or transition at overhead door openings.

2.11 PREFABRICATED ALUMINUM LADDERS

A. Basis-of-Design Product: Subject to compliance with requriements, provide products by O'Keefee's or comparable product by one of the following:
1. ACL Industries
2. Alco-Lite Industrial Products
3. Precision Ladders, LLC
4. Thompson Fabricating, LLC
5. Halliday Products
6. Royalite Manufacturing, Inc.

B. Aluminum Ladder Construction/Type(s):
1. Type 1: Model #500/501 tubular rail straight, fixed ladder.
2. Type 3A: Model #503A tubular rail low parapet access ladder with platform with side railings at platform.
3. Construction shall be as follows: Self-locking stainless steel fasteners; full penetration inert-gas heliarc welds; clean, smooth, and burr free surfaces.
4. Heavy-duty tubular side rails shall be assembled from two interlocking aluminum extrusions no less than .125-inch wall thickness by three inches, having a minimum sectional modulus of 89.

5. Rungs shall be no less than 1-1/4 inches in section and 18-3/8 inches long, formed from tubular aluminum extrusions, alloy 6063-T5, and shall be squared and deeply serrated on sides to provide maximum grip and foot traction. Rungs shall be able to withstand a 1000-pound loading without failure.
6. Ladders shall comply with OSHA 1910.27, State, and local safety codes.
7. Support each ladder at top and bottom and not more than 10 feet o.c. with welded or bolted steel brackets.
    a. Attach ladder to parapet/wall and not to roof surface in any manner. Provide bottom support bracket.
    b. Provide extended bracket attachment to clear building overhang. Engineer bracket to support loading with extended dimension. Coordinate required attachment material with metal building contractor.
8. Apply manufacturer's standard primer and powder coat finish after forming, according to coating manufacturer's written instructions for application, thermosetting, and minimum dry film thickness.
    a. Color and Gloss: As selected by A/E from manufacturer's full range.

2.12 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153, for galvanizing steel and iron hardware.
3. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

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 indicated.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Paint items embedded in concrete with two coats of bituminous paint.
2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.14 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder-coat finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.
   1. Color and Gloss: As selected by A/E from coating manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer shall examine areas and conditions under which miscellaneous metal items shall be installed. Notify Contractor in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.2 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Coat concealed surfaces of steel embedded in concrete with two coats of bituminous paint.

G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.4 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly braced from building structure and in accordance with ASTM E 557.

## 3.5 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

## 3.6 INSTALLING LADDERS

A. Examination:
   1. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural leads for fastener resistance.
   2. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.

B. Installation, General: Install in accordance with “Performance Requirements” manufacturer’s instructions, if applicable, and in proper relationship to adjacent construction.
   1. Install in compliance with ANSI A14.3 and OSHA 1910.R7.
   2. Position ladder such that side rails end minimum 3 inches above roof and center of rungs are 7 inches from wall.
      a. Note: Where indicated at interior ladders, ladders may contact floor.
      b. Where indicated and due to building conditions, center of rung dimension to wall will exceed 7 inches.

## 3.7 INSTALLATION OF MISCELLANEOUS STEEL TRIM

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

## 3.8 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.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

# DIVISION 06

# WOODS, PLASTICS, AND COMPOSITES

# SECTION 06 10 00 - ROUGH CARPENTRY

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
   1. Wood blocking, cants, and nailers.
   2. Miscellaneous plywood.

B. Related Sections include the following:
   1. Division 05 Section “Metal Fabrications” for post-installed anchors.
   2. Division 06 Section "Sheathing" for sheathing, subflooring, and underlayment.
   3. Division 26 Section “General Electrical Panels” for plywood backing panels.

### 1.2 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. Timber: Lumber of 5 inches nominal or greater in least dimension.

D. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

E. 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.

### 1.3 QUALITY ASSURANCE

A. Environmental Conditions:
   1. Preservative treatment shall not contain hazardous materials as arsenic or chromium. Chromated copper arsenate (CCA) and ammoniacal copper zinc arsenate (ACZA) shall not be used.
   2. Composite wood products shall be labeled or show compliance with the Toxic Substances Control Act (TSCA) Title VI.

### 1.4 DELIVERY, STORAGE, AND HANDLING

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

### 1.5 FIELD CONDITIONS

A. Installer must examine the substrates and supporting structure and the conditions under which the Carpentry Work is to be installed; and notify the A/E in writing of conditions detrimental to the Work. Do not proceed with the installation until unsatisfactory conditions have been corrected.

B. Coordination: Fit Carpentry Work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow proper attachment of other work.
   1. Contractor shall confirm with roofing system manufacturer that adhesives come into contact with roof membrane are compatible and acceptable.

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. Maximum Moisture Content of Lumber: 19 percent.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER (WPTL)

A. Preservative Treatment by Pressure Process: AWPA U1, use categories as follows:
   1. UC2: Interior construction not in contract with ground, but may be subject to moisture.
   2. UC3B (Commodity Specification A): Uncoated sawn products in exterior construction not in contact with ground, exposed to all weather cycles including intermittent wetting, but with sufficient air circulation for wood to dry. Excludes sawn products not in contact with ground but with ground contact hazards.
   3. UC4A (Commodity Specification A): Non-critical sawn products in contact with ground and exposed to all weather cycles including continuous or prolonged wetting, and sawn products not in contact with ground, but with ground contact-type hazards or that are critical or hard to replace.
   4. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
      a. Unless otherwise noted: Use one of the following formulations of inorganic boron.
         1) Sodium-octaborate (SBX) or disodium-octaborate-tetrahydrate (DOT).
         2) Zinc borates (ZB) for treating engineered wood or wood composites during the manufacturing process.
      b. For sleepers sill plates and for wood that will be installed in a location where it will be in contact with the ground or will be exposed to liquid water (continuously or periodically), use one of the following copper formulations:
         1) Alkaline-copper-quat (quaternary ammonium) (ACQ)
         2) Copper azole, Type B (CA-B).
         3) Micronized Copper Azole (MCA).

B. Kiln-dry or air-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing except where specifically noted herein to be fire-retardant treated.

2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS (FRTM)

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

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat all rough carpentry, unless otherwise indicated to be preservative treated.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
2. Nailers.
3. Cants.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content of any species.
1. Provide No. 2 grade Douglas Fir or Southern Yellow Pine nailers associated with roofing and roof flashing.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
1. Mixed southern pine, No. 3 grade; SPIB.
2. Hem-fir or hem-fir (north), Standard or 3 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Standard or 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 MISCELLANEOUS PLYWOOD PANELS

A. General: Where plywood panels will be used for the following concealed types of applications, provide APA performance rated panels complying with requirements indicated for grade designation, span rating, exposure durability classification, edge detail (where applicable), and thickness.
   1. Plywood Shims, Nailers, and Blocking for Roof Insulation Stops: Shall be APA UNDERLAYMENT C-C PLUGGED EXT.
   2. Plywood at Top of Wall (Coping): Either DOC PS1 or DOC PS2, exterior type fire-retardant treated.
      a. Integrate mineral-wool board insulation for increased thermal resistance.
   3. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4 inch nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
   1. Where rough carpentry is exposed to weather, in ground contact, preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153 or of Type 304 stainless steel.
      a. Provide Class D coating for fasteners 3/8-inch diameter and less. Provide Class C coating for larger fasteners.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
   1. Exception: Powder-activated/actuated fasteners that involve a projectile propelled by a charge of carbon-dioxide or gun powder are not allowed.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Metal Framing: ASTM C 1002 or ASTM C 954, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

I. Post-Installed Anchors: Refer to Division 05 Section “Metal Fabrications”.

2.7 MISCELLANEOUS MATERIALS

A. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry 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.

C. Do not splice structural members between supports, unless otherwise indicated.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
   2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- thickness.
   3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
   4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet 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.
   1. Partial boards shall be fastened at a rate commensurate with full boards and shall have not less than two (2) fasteners per piece.

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. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. ICC-ES ESR-1539 for power-driven fasteners.

J. 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.

K. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
   1. Use finishing nails, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

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.
   1. Install additional fasteners, as required to counteract minor warpage or variances in substrate, and to hold tight and true to lines.
   2. When using multiple nailer courses, weave corners and stagger end joints a minimum of 3 feet from underlying course.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

D. Wood Nailers at low slope Roof: Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imported by project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7. Minimum thickness of nailers must be such that the top of the nailer is flush with the top of the membrane underlayment. Wood nailers are required in any situation where 1 inch or greater of insulation is added to the roof perimeter edge.
   1. Wood nailers shall be #2 FRTM treated lumber or better and shall be fastened to the deck, wall, or existing secure nailer in such a manner that they resist 300 lbs. of force per ft. of nailer in any direction. Fasteners used to attach wood nailers shall be spaced no greater than 18 inches apart and no less than 6 inches from end. Fasteners shall be staggered 1/3 nailer width. Nailer attachment shall meet hereinbefore requirements and those of Factory Mutual Loss Prevention Data Sheet 1-49.

E. Wood Nailers at low slope Flashing and Sheet Metal: Minimum thickness of the nailers must be such that the top of the nailers are flush with the top of the membrane underlayment.
   1. Wood nailers are required for securement of metal edgings, scuppers, insulated pipes.
      a. The width of the wood nailers shall be 5-1/2 inches minimum, and must exceed the width of the metal flange of edgings and insulated metal collars by 1/2 inch.
   2. Wood nailers must be #2 FRTM grade lumber or better and shall be fastened to the deck or wall in such a manner that they resist 300 pounds of force per linear foot of nailer in any direction. Fasteners used to attach wood nailers must be spaced no greater than 18 inches apart. Wood nailers are required in any situation where 1 inch or greater of insulation is added to the roof perimeter edge. Top of the nailers must be flush with the top of the roof membrane underlayment. Wood nailers are not required at a change of plane such as the intersection between a parapet wall and the decking.

F. Wood blocking, nailers, and grounds shall be provided as necessary to receive woodwork, lockers, cabinets, and other finish items.

3.3 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 sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

# SECTION 06 16 00 - SHEATHING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
   1. Wall sheathing.
   2. Sheathing joint-and-penetration treatment.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for miscellaneous plywood panels.
   2. Division 07 Section “Vapor-Permeable Fluid-Applied Membrane Air Barriers”.
   3. Division 07 Section “Thermal Insulation” for insulation within framing.
   4. Division 07 Roofing Sections for coordination of parapet insulation provided as part of roofing.

### 1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting; Convene prior to commencing work of this Section. Review installation procedures and coordination required with “Related Work” and the following:
   1. Review wall assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing work.
   2. Review continuous insulation wall panels installation methods and procedures related to application, including manufacturers, installation guidelines.
   3. Review firestopping requirements and weather resistive membrane requirements and placement locations.
   4. Review field quality control procedures.

B. Sequencing
   1. Coordinate with installation of weather and air barrier systems.
   2. Ensure that products of this Section are supplied to affected trades in time to prevent interruption of construction progress.
   3. Do not install products under environmental conditions outside manufacturer’s absolute limits.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   3. Wall Sheathing Product Test Reports: Submit evaluation reports published by independent laboratory indicating evidence of compliance with specified criteria.
      a. NFPA 285 Compliance: Submit documentation showing components in wall assembly are in compliance with NFPA 285.

### 1.4 DELIVERY, STORAGE, AND HANDLING

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

B. Store composite nail board sheathing products off the ground, in dry conditions, under cover and in manufacturer's unopened packaging until ready for installation.
   1. The manufacturer's plastic wrapping is provided for protection during shipment only. Replace any panels that become wet before installation.
   2. Insulation shall rest on firm blocking and shall be covered with tarps.

C. Install no more insulation in one day than can be covered the same day with underlayment or membrane flashing.
   1. Do not expose insulation to excessive heat, sparks, or open flame.

D. Composite wood products shall be labeled or show compliance with the Toxic Substances Control Act (TSCA) Title VI.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide product by the manufacturers specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

B. Fire Resistance: Exterior wall system and component materials part of cold-formed metal framing assembly shall comply with the following requirements:
   1. System complies with one of the following: NFPA 285, FM 4800, UL 1040, or UL 1715; Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load Bearing Wall Assemblies Containing Combustible Components using the Intermediate Scale, Multi-Story Test Apparatus.
   2. Firestopping measures, per requirements of authorities with jurisdiction, shall be included at the floor line in the cold-formed stud cavity when the wall assembly extends beyond the floor line.

C. Continuous Insulation (Wall Sheathing): Products shall meet the continuous insulation standards of ASHRAE 90.1 and applicable Building Codes for commercial exterior wall applications in accordance with requirements of authorities with jurisdiction.
   1. Code Compliance: Exterior Insulation (Sheathing): Class A (</= 25 Flame spread index and < 450 Smoke Developed Index) classified at maximum thickness per UL 723 criteria or ASTM E 84 criteria.

2.3 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.4 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC36 for exterior construction not in contact with ground, and Use Category UC4a for items in contact with the ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
      a. Unless otherwise noted: use one of the following formulations of inorganic boron.
         1) Sodium-octaborate (SBX) or disodium-octaborate-tetrahydrate (DOT).
         2) Zinc borates (ZB) for treating engineered wood or wood composites during the manufacturing process.
      b. For sleepers, sill plates and for wood that will be installed in a location where it will be in contact with the ground or will be exposed to liquid water (continuously or periodically), use one of the following copper formulations:
         1) Alkaline-copper-quat (quaternary ammonium) (ACQ)
         2) Copper acole, Type B (CA-B).

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat only items indicated on Drawings and the following:
   1. Plywood in contact with masonry or concrete.
   2. Plywood used with roofing, flashing, vapor barriers, and waterproofing.

2.5 FIRE-RETARDANT-TREATED PLYWOOD

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

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feetbeyond the centerline of the burners at any time during the test.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified.

C. Kiln-dry material after treatment to maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings, and the following:
   1. Plywood as part of wall construction assembly and top of wall construction.

## 2.6 WALL SHEATHING

A. Plywood Wall Sheathing: Exposure 1, Structural I sheathing (CDX).
   1. Span Rating: Not less than 24/0.
   2. Nominal Thickness: Not less than 1/2 inch or in thickness indicated on Drawings.

B. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed; Saint-Gobain
      b. Continental Building Products, LLC
      c. Georgia-Pacific Gypsum LLC
      d. National Gypsum Company
      e. USG Corporation
   2. Type and Thickness: Regular, 1/2 inch thick, unless otherwise noted. Provide Type X, 5/8 inch thick, where required for thermal rating.

C. Plywood Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation, Class A, with plywood fire-retardant treated laminated to one face complying with ASTM C 1289, Type V. Edge of sheathing component shall be routed back 1/8 inch (approximately) from all four sides of the insulation panel.
   1. Manufacturers:
      a. Johns Manville; Berkshire Hathaway Inc.
      b. Rmax, Inc.
      c. Hunter Panels
      d. Atlas EPs; a Division of Atlas Roofing Corp.
      e. TechBase Pro; Kurt Building Materials.
   2. Polyisocyanurate-Foam Thickness: As indicated.
   3. Plywood Fire-Retardant Treated Nominal Thickness: 5/8 inch, unless otherwise noted.
   4. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

## 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. For roof, parapet, and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153 or Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

E. Screws for Fastening Wood Structural Panels and Plywood-Surfaced, Polyisocyanurate-Foam Sheathing to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
   1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

G. Screws for Fastening Plywood-Surfaces, Polyisocyanurate-Foam Sheathing to CMU: Use steel drill screws as recommended by sheathing manufacturer for a minimum of 1-inch penetration into CMU. Hole will need to be pre-drilled. Amount of fasteners will depend on the height of the parapet and shall not exceed a maximum distance of 16 inches between fasteners in either direction.

2.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing, and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
1. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

2.9 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ADAAFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and installation conditions for compliance with requirements for installation conditions affecting performance of the work.
1. Verify that metal wall studs, opening framing, bridging, bracing, and other framing support members and anchorage have been installed within wall system alignment tolerances and requirements.
2. Verify that items required to penetrate the wall system are placed and penetration gaps and cracks can be sealed to prevent water penetration.

B. Do not proceed with wall system installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
1. ICC-ES ESR-1539 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. 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. Install fasteners without splitting wood.

E. Coordinate wall parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.3 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:
   1. Wall and Roof Sheathing:
      a. Screw to cold-formed metal framing.
      b. Space panels 1/8 inch apart at edges and ends.

3.4 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   2. Fasten gypsum sheathing to cold-formed metal framing with screws.
   3. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
   4. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

D. Seal sheathing joints according to sheathing manufacturer’s written instructions. Provide one of the following:
   1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
   2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.5 INSULATED WALL SHEATHING INSTALLATION

A. Comply with manufacturer's written instructions. Fasten to exterior face of exterior face of exterior metal stud walls using sheathing manufacturer’s recommended type and length screw fasteners with washers. Abut panels tightly together and around openings and penetrations.
   1. Install in exterior spaces without gaps or voids. Do not compress insulation.
      a. Fill voids with spray foam insulation. Refer to Division 07 Section “Thermal Insulation”.
   2. Trim sheathing/insulation neatly to fit spaces.
   3. Coordinate with the cladding or mason for the attachment requirements over sheathing/insulation.

4. Exposed insulation must be protected from open flame and kept dry at all times.
5. Install sheathing panels horizontally with aluminum facing to exterior. Use maximum lengths to minimize number of joints. Locate edge joints parallel to and on framing. Center end joints over supports and stagger in each course. Provide additional framing wherever panel joints do not bear against framing plate or sill members.
6. Fasten panels to each support with fasteners spaced 12 inches on center at perimeter of the wall and 16 inches on center in panel field. Set back perimeter fasteners 3/8 inch from edges and ends of panel units. Drive fasteners to bear tight and flush with surface of insulation. Do not overdrive fastener causing damage to the insulation board facer. Perimeter fasteners can be detailed to bridge the gap of abutting board joints due to the 2 inch diameter of the washer used to fasten the board to studs. Maximum of two board joints may be bridged per fastener.
7. Install flashing at end and edge joints in accordance with sheathing manufacturer's joint sealing recommendations.
8. Seal sheathing joints and penetrations of sheathing in accordance with sheathing manufacturer's joint and penetration sealing recommendations.

3.6 PROTECTION

A. Protect installed products until finish materials can be applied.
   1. Protect sheathing/insulation work from exposure to moisture damage and deterioration, primarily by prompt installation of the roofing, sheet metal and waterproofing work.

B. Cover the top and edges of unfinished roof panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.
   1. Do not leave panels exposed to moisture. Wet panels shall be removed prior to application of roof covering.

END OF SECTION 06 16 00

# SECTION 06 41 16 – PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
   1. Custom plastic-laminate-faced cabinets including base, wall and tall cabinets.
   2. Plastic Laminate Countertops
   3. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets, unless concealed within other construction before cabinet installation.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
   2. Division 07 Section “Joint Sealants”.

### 1.2 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

B. Exposed Portions of Casework: Include surfaces visible when doors and drawers are closed. Bottoms of casework more than 4 feet above floor and tops less than 6 feet 6 inches above floor shall be considered as exposed. Visible members in open cases or behind glass doors also shall be considered as exposed portions. Any unit exterior side surface that is visible after installation.

C. Semi-Exposed Portions of Casework: Includes those members behind opaque doors, such as shelves, divisions, interior faces of ends, case back, drawer sides, backs and bottoms, and back face of doors. Tops of casework 6 feet 6 inches or more above floor shall be considered semi-exposed.

D. Concealed Portions of Casework: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

### 1.3 SYSTEM DESCRIPTION

A. Accessibility Requirements: Millwork shall be provided to conform to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.

B. Performance Requirements
   1. Cabinet tops shall not deflect more than 1/4 inch, where indicated to receive loads.
      a. Cabinets supporting TV/monitor shall be capable of supporting a 250 pound capacity, unless otherwise noted.
   2. Countertops shall not deflect more than 1/4 inch when a load of 100 pounds per linear foot is applied.
      a. Unsupported countertop spans shall not exceed 48 inches and must be reinforced to prevent deflection in excess of 1/4 inch.

### 1.4 COORDINATION

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

1.5 ACTION SUBMITTALS

A. Product Data: For panel products high-pressure decorative laminate adhesive for bonding plastic laminate solid-surfacing material cabinet hardware and accessories and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for electrical switches and outlets plumbing fixtures faucets and other items installed in architectural woodwork.

C. Samples for Verification:
   1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.

1.6 QUALITY ASSURANCE

A. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

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

C. Physical Performance Characteristics for Solid Surface Material
   1. Flammability Test (flame spread and smoke developed)
      a. Test Procedure: ASTM E84.
      b. Rating: Class A.
   2. Food Zone Use
      a. Test Procedure: NSF 51.
      b. Rating: Pass

D. Materials shall contain less than one percent asbestos by content.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating or temporary facilities are capable of maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide product by the manufacturers specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

### 2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the “Architectural Woodwork Standards” for grades of architectural wood cabinets indicated for construction, finishes, installation, and other requirements.
   1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
   2. Grade: Custom.

### 2.3 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
   1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
   2. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
   1. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
   2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde or Grade M-2-Exterior Glue.
   3. Softwood Plywood: DOC PS 1, medium-density overlay.

C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
   1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges. Match color and pattern of thermoset decorative panels.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

2.4 COLOR AND FINISH

A. Thermoset Decorative Panel Colors, Patterns, and Finishes: As selected by A/E from casework manufacturer's full range

B. Plastic-Laminate Colors, Patterns, and Finishes: As indicated in the “List of Finishes”.

C. PVC Edgebanding Color: As selected from casework manufacturer's full range.
   1. Colors of PVC leading edges:
      a. Open Units: Match exterior plastic laminate color.
      b. Horizontal and Vertical Front Cabinet Members: Match exposed plastic laminate color or as selected by A/E.
      c. Semi-Exposed Locations: Match interior plastic laminate color.
      d. Drawer and Door Fronts: As selected from colors to match plastic laminate, or as selected by A/E.

2.5 CABINET HARDWARE AND ACCESSORIES

A. Hardware Standards: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

B. Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges made from 0.095 inch thick metal with hospital tip, and as follows:

C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

D. Catches: Magnetic catches, BHMA A156.9, B03141, roller catches, BHMA A156.9, B03071, or ball friction catches, BHMA A156.9, B03013.

E. Adjustable Shelf Supports: Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 1-inch centers. Each shelf support has 2 integral support pins, to interface pre-drilled holes, and to prevent accidental rotation of support. Support also provides non-tip feature for shelving.
   1. Structural load to support 1200 lbs. without failure.

F. Drawer Slides: BHMA A156.9, B05091.
   1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-overtravel-extension type; zinc-plated steel ball-bearing slides.
   2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
   3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.
   4. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches high and 24 inches wide.
   5. Trash Bin Slides: Grade 1HD-200, for trash bins not more than 20-inches high and 16-inches wide.

G. Drawer and Hinged Door Locks:
   1. Cylindrical (cam) or mortise type, 5-pin tumbler, brass with chrome-plated finish, and complying with BHMA A156.11, Grade 1.
   2. Cabinets to be keyed alike per room, each room keyed differently and master keyed, unless noted otherwise on drawings.
      a. Provide four keys per room and 6 master keys.
   3. Provide locks on all doors and drawers.

H. Door and Drawer Silencers: BHMA A156.16, L03011.

I. Grommets for Cable Passage through Countertops: 3-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

L. Leveling Guides: Threaded hydraulically operated glide with silicone putty.

M. Wire Management: Fabricate components as indicated on the Drawings.
   1. Contractor's Option: Provide prefabricated metal or fiberglass channel / cable tray, in lieu of plastic laminate tray, consisting of a one-piece solid bottom-channel section, complying with NEMA VE1 or NEMA FG1, and UL568. Sizes and configurations shall be no less than that indicated. Subject to compliance with requirements, provide products from one of the following manufacturers:
      a. Chalfant Cable Tray, Cleveland, Ohio
      b. GS Metals Corp., Pinckneyville, Illinois
      c. MP Huskey Corp., Greenville, South Carolina
      d. P-W Industries, Atlanta, Georgia
      e. T.J. Cope, Collegeville, Pennsylvania
      f. Wiremold Co., West Hartford, Connecticut
      g. Thomas & Butts Corp., Memphis, Tennessee

N. Other accessories as indicated on the Casework Schedule.

## 2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood 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 nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

## 2.7 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Unless indicated otherwise, ease edges as follows:
   1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch radius.
   2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch radius.

D. Complete fabrication, including assembly, finishing, 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.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
   1. Seal edges of openings in countertops with a coat of varnish.

2.8 PLASTIC-LAMINATE CABINETS

A. AWI Type of Cabinet Construction: Flush overlay.

B. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
   1. Horizontal Surfaces Other Than Tops: Grade HGS.
   2. Vertical Surfaces: Grade HGS or VGS.
   3. Edges: 0.018-inch and PVC edge banding 3mm thick, through-door in satin finish matching laminate in color and pattern, as indicated.

C. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS, High-pressure decorative laminate, Grade CLS, or Thermoset decorative panels.
      a. Edges of Plastic-Laminate Shelves:
         1) Impact resistant PVC edge-banding, 1mm thick, through-color in satin finish.
         2) Unless otherwise indicated, provide specified edge-banding on all semi-exposed edges.
      b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS or CLS.
   2. Drawer Sides and Backs: Solid-hardwood lumber or thermoset decorative panels.
   3. Drawer Bottoms: Hardwood plywood or thermoset decorative panels.

D. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

2.9 CABINET CONSTRUCTION

A. Plastic-Laminate-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:
   1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semiexposed surfaces, unless otherwise noted or as required to meet “Performance Requirements”.
   2. Shelves:
      a. Exposed Locations: 1 inch thick, vertical grade plastic laminate both sides. Color to match cabinet exterior plastic laminate or as selected by A/E.
      b. Semi-exposed locations: 1 inch thick, thermoset decorative panels both sides.
      c. Front and back leading edges shall be edged with flat 1mm thick impact-resistant PVC edging to match shelf color.
      d. Number of adjustable shelves provided, unless indicated otherwise on the Drawings or on the Schedule
         1) Tall cabinets
            3 up to 60 inches  5 up to 84 inches
            4 up to 72 inches  6 up to 96 inches
         2) Base cabinets
            1 up to 36 inches
         3) Wall hung cabinets
            1 up to 24 inches  3 up to 42 inches
            2 up to 36 inches
   3. Backs of Cabinets: 1/4-inch - 1/2-inch particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semiexposed surfaces.
   4. Drawer Fronts: 3/4-inch particleboard, plastic-laminate faced to match doors.

5. Drawer Sides, Backs, and Bottoms:
    a. Constructed of minimum 1/2-inch particleboard, plywood, hardwood lumber, or high-density fiber board; glued and doweled or dovetail jointed; surfaced with vertical grade laminate or melamine of balanced construction. Bottoms constructed of minimum 1/4-inch tempered hardboard, surfaced to match drawer sides, inset and glued to four sides. Reinforce bottoms on wide drawers with front to back inset stiffeners, 1 at 24 inch wide drawers, 2 at 36 inch and 4 at 48 inch; glue, fasten, and seal perimeter with hot melt adhesive.
        1) Drawers:
            a) Sides, back and sub front shall be particleboard, 1/2-inch thick, laminated with vertical grade laminate or melamine of balanced construction. The back and sub front shall be doweled and glued into the sides. Dowels shall be fluted, with chamfered ends and a minimum diameter of 8mm.
            b) Drawer bottom shall be particleboard, 1/2-inch thick, laminated with vertical grade laminate or melamine of balanced construction, screwed directly to the bottom edges of the drawer box. Drawer bottom less than 1/2-inch thick will not be permitted.
            c) Paper storage drawers shall be constructed similar except retaining hood shall be included at the rear of each drawer.
6. File Drawers: Construct as specified above. File drawers shall have front-to-back and side-to-side hanger file capability with hanger channel for letter size files integral with file drawer sides. 3/16 inch by 1/2-inch removable steel channel to span side-to-side for legal size hanging files.
7. Doors: 3/4-inch particleboard or MDF, plastic-laminate faced may be provided as fabricator's option to wood drawers.
8. Provide stud framing chase walls with panels at specialty fabrications, desks, and plastic-laminate clad assemblies.
    a. Panels shall be removable where indicated.

B. 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 selected by A/E.

## 2.10 COUNTERTOPS

A. Countertops, General: Provide smooth, clean exposed tops and edges in uniform plane free of defects. Provide front and end overhang of 1 inch over base cabinets.
1. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
2. Shop cut openings to maximum extent possible to receive fixtures and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.
    a. For plastic-laminate clad countertops: Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with a coat of varnish.

B. Plastic-Laminate Tops: Plastic-laminate sheet, shop bonded to both sides of 1-1/8-inch plywood or particleboard. Sand surfaces to which plastic laminate is to be bonded.
1. Plastic Laminate for Flat Tops: Grade HGS, unless otherwise noted.
2. Plastic Laminate for Backing: Grade BKL.
3. Provide 3-mm PVC edging on front edge of top, on top edges of backsplashes and end splashes, and on ends of tops and splashes.
4. Backsplashes 4-inch high scribable, square set; color matching, and mechanically attached, with endsplashes.
    a. Provide at locations where countertops abut walls and where otherwise indicated.
    b. Backsplashes shall have a moisture-resistant core.
5. Use exterior plywood or exterior glue particleboard for countertops containing sinks.

2.11 SPECIALTY ITEMS

A. Support Members: Furniture grade, epoxy powder coated steel or aluminum, of size and configuration as detailed, indicated or required by “performance standards”. Exposed welds shall be ground smooth.
   1. Countertop Support Brackets: Wall mounted, heavy duty, welded aluminum brackets for support of countertops and work surfaces.
      a. Extruded aluminum complying with ASTM B221, 6063-T5 alloy.
      b. Finish: Clear Anodized.
      c. Size: As required by countertop width to support.
      d. Product: As indicated on Drawings as manufactured by Rangine Corporation (Rakks).
   2. Countertop Support: Wall mounted, heavy duty, steel support brace.
      a. Steel, ASTM A36 or JIS G3131 SPHC Steel, 12 gauge.
      b. Provide holes in bracket for cable passage.
      c. Size: As required by countertop width to support.
      d. Finish: Manufacturer’s standard powder coat paint finish.
      e. Product: As indicated on Drawings as manufactured by Rangine Corporation (Rakks).

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas for not less than 72 hours.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install cabinets and woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble cabinets and woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Anchor cabinets and woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

D. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   2. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
   3. Maintain veneer sequence matching of cabinets with transparent finish.
   4. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

E. Countertops: Install countertops to comply with same grade as item to be installed. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
    a. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer’s written instructions to exert a constant, heavy-clamping pressure at joints.
3. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
4. Scribe tops and backsplashes to walls and other adjoining vertical surfaces.
5. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
6. Caulk space between backsplash and wall with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.
7. Where indicated, remove existing countertops and prepare surfaces to receive new countertop assembly.

F. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

## 3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets and woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 41 13

## SECTION 06 61 16 - SOLID SURFACE FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Solid Surface Fabrications (SSM) including, but not limited to the following:
   1. Wall caps/shelf.

1.2 REFERENCES

A. Applicable Standards: Standards of the following, as referenced herein:
   1. American National Standards Institute (ANSI)
   2. American Society for Testing and Materials (ASTM)
   3. National Electrical Manufacturers Association (NEMA)

1.3 ACTION SUBMITTALS

A. Product Data: Indicate product description, fabrication information and compliance with specified performance requirements. Clearly indicate manufacturer and compliance with standards.
   1. Flammability test reports.
   2. NSF/ANSI Standard 51 for food zone – all food types.

B. Shop Drawings: Indicate dimensions, component sizes, fabrication details, and attachment provision and coordination requirements with adjacent work.
   1. Show full-size details, edge details, thermoforming requirements, attachments, etc.
   2. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in solid surface.

C. Samples for Verification: Submit minimum 2 inch by 2-inch samples. Indicate full range of potential variation in color and pattern. Approved samples will be retained as standards for work.

1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project closeout documents.
   2. Warranty: Special warranty as specified in this Section.

1.5 QUALITY ASSURANCE

A. Allowable tolerance:
   1. Variation in component size: +/- 1/8 inch.
   2. Location of openings: +/- 1/8 inch from indicated location.

B. Physical Performance Characteristics
   1. Flammability Test (flame spread and smoke developed)
      a. Test Procedure: NFPA 255 or UL 723.
      b. Rating: Class A.
   2. Food Zone Use
      a. Test Procedure: NSF 51.
      b. Rating: Pass

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery no components to the project site until areas are ready for installation. Store components indoors prior to installation.

B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.7 WARRANTY

A. Provide manufacturer's warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

B. Manufacturer’s Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOLID POLYMER FABRICATIONS

A. Manufacturers: Subject to compliance with requirements, provide one of the following:
1. ABA Industries
2. Avonite, Inc.
3. E.I. du Pont de Nemours and Company.
4. Formica Corp.
5. LG Chemical, Ltd.
6. Meganite Inc.; a division of the Pyrochem Group.
7. Samsung Chemicals (USA), Inc.; Cheil Industries Inc.
8. Swan Corporation (The).
9. Transolid, Inc.
10. Wilsonart International; Div. of Premark International, Inc.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 MATERIALS

A. Material: Homogeneous solid sheets of filled acrylic resin complying with ANSI Z124.3 or ANSI Z124.6.
1. Superficial damage to a depth of 0.010 inches shall be repairable by sanding and polishing.
2. Wall Caps/Shelf: (SSF) 1/2 inch thick, adhesively joined with inconspicuous seams; edge details as indicated on the A/E’s Drawings.
a. Color: Refer to “List of Finishes”.

2.3 ACCESSORY PRODUCTS

A. Joint Adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.

B. Sealant: Manufacturer's standard mildew-resistant, NSF 51 - compliant silicone sealant in color matching or clear formulations.

2.4 FABRICATION

A. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with final shop drawings and manufacturers requirements.

B. Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 2 inch wide reinforcing strip under each joint.

C. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

D. Finish: All surfaces shall have uniform finish.
   1. Matte, with a gloss rating of 5 - 20.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which solid surfacing will be installed.

B. Coordinate with responsible entity to correct unsatisfactory conditions.

C. Commencement of work by installer is acceptance of substrate conditions.

3.2 INSTALLATION

A. Install components plumb and level, in accordance with final shop drawings and product installation details.
   1. Provide product in the largest pieces available.
   2. Form field joints using manufacturer’s recommended adhesive, with joints inconspicuous in finished work.
      a. Exposed joints/seams shall not be allowed.
   3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the scam with the strip being the same thickness as the top.
   4. Cut and finish component edges with clean, sharp returns.
   5. Route radii and contours to template.
   6. Anchor securely to base cabinets or other supports.
   7. Align adjacent tops and form seams to comply with manufacturer’s written recommendations using adhesive in color to match countertop.
   8. Carefully dress joints smooth, remove surface scratches and clean entire surface.

B. Provide backsplashes and endsplashes as indicated on the drawings.

C. Keep components and hands clean during installation. Remove adhesives, sealants and other stains.

3.3 REPAIR/CLEANING/PROTECTION

A. Repair minor imperfections and cracked seams and replace sections of severely damaged surfaces in accordance with manufacturer’s recommendations.

B. Clean surfaces in accordance with manufacturer’s instructions.

C. Cover horizontal surfaces with heavy paper or cardboard to protect from damage until date of Substantial Completion or acceptance by Owner.

END OF SECTION 06 61 16

# DIVISION 07

# THERMAL AND MOISTURE PROTECTION

**SECTION 07 21 00 - THERMAL INSULATION**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Glass-fiber blanket insulation.
2. Mineral-wool blanket insulation.
3. Miscellaneous spray polyurethane foam insulation.
4. Spray-applied insulation at underside of deck, where indicated, i.e. roof drains.

B. Related Sections:
1. Division 03 Section “Cast-in-Place Concrete” for underslab vapor barriers.
2. Division 04 Section "Unit Masonry" for insulation installed in cavity walls.
3. Division 06 Section "Sheathing" for foam-plastic board sheathing over wood or steel framing.
4. Division 07 Section(s) "Membrane Roofing" for insulation specified as part of roofing construction.
5. Division 07 Section "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.
6. Division 09 Section(s) "Gypsum Board Assemblies" for sound attenuation blanket used as acoustic insulation.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate with other thermal assemblies and air barrier assemblies to provide a complete thermal envelope.
1. Fill gaps around penetrations to prevent gaps in thermal envelope.

B. Sequence: Sequence installation of insulation so materials can be installed for optimum performance.

C. Sequence and coordinate application of sprayed-on insulation with other related Work specified in other Sections to comply with the following requirements:
1. Ensure that insulating material is installed prior to installation of enclosing or concealing work, with sufficient time allowed for observation, testing, and correction of defective insulation work.
2. Plumbing, wiring (including telephone and other low-voltage work) shall be completely roughed in stud cavities before beginning insulation work.

D. Coordinate installation of sprayed insulation with other Work in order to minimize the need for other trades to cut or remove insulation.
1. Cutting and patching after installation of sprayed-on insulation shall be in accordance with Division 01 Section “Cutting and Patching”.

E. Ducts, piping, conduit, or other suspended equipment that interfere with the uniform application of the insulation material shall be positioned after the application of the sprayed insulation.

1.3 QUALITY ASSURANCE

A. Polyurethane Foam Installer Qualifications: An authorized representative who is trained and approved by manufacturer or certified by the Spray Polyurethane Foam Alliance through the SPFA-PCP as an insulation installer or higher certification.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Materials to be delivered to the site in original labeled and unopened packages.

B. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
   1. Bonding adhesives must be kept from freezing at all times.

C. Protect foam-plastic board insulation as follows:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

1.5 FIELD CONDITIONS

A. Environmental Conditions: Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer’s absolute limits.
   1. Do not install sprayed-on insulation when ambient or substrate temperatures may fall below 40 degrees F or rise above 85 degrees during the application and drying processes.
   2. Ventilate the sprayed insulation by means of natural or forced air circulation during and after application until it dries thoroughly.
      1. In enclosed areas, ventilation shall not be less than 4 complete air changes per hour.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Plenum Rating: Provide glass or slag-wool-fiber/rock-wool-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
   1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm air velocity.
   2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

B. Reference Standards:
   1. NFPA: Foam plastics left exposed to the interior occupied space must be covered by a thermal barrier or show compliance to NFPA 286 for flame spread classifications for specific materials or assemblies.
   2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

C. Labeling of Building Envelope Insulation: The rated-R-value shall be clearly identified by an identification mark applied by the manufacturer to each piece of building envelope insulation.
   1. When insulation does not have such an identification mark, the installer of such insulation shall provide a signed and dated certification for the installed insulation listing the type of insulation, the manufacturer, the rated R-value, and where appropriate, the installed thickness and the coverage area.

D. Compliance with Manufacturer's Requirements: Insulation materials shall be installed in accordance with manufacturer's recommendations and in such a manner as to achieve rated R-value of insulation.

## 2.3 GLASS-FIBER BLANKET INSULATION

A. Design Requirements: Products that have been manufactured fabricated and installed to the following criteria:
   1. Fire Test Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing protocol required to achieve UL Classified rated per UL 723 or by testing identical products according to ASTM E84 by a qualified testing agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CertainTeed Corporation
   2. Johns Manville
   3. Knauf Insulation
   4. Owens Corning

C. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per UL 723 or ASTM E 84; passing ASTM E 136 for combustion characteristics.

D. Thermal Resistance
   1. R-value: 1.3 hr/ft2/f Btu
   2. RSI value: 2.3
   3. Thickness: As indicated.

E. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

## 2.4 MINERAL-WOOL BLANKET INSULATION

A. Design Requirements: Products that have been manufactured fabricated and installed to the following criteria:
   1. Fire Test Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing protocol required to achieve UL Classified rated per UL 723 or by testing identical products according to ASTM E84 by a qualified testing agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Thermafiber, an Owens Corning Co.
   2. Johns Manville
   3. Rockwool International

C. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
   1. Thermal Resistance: R-Value; 3.8 per inch.

D. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.5 SPRAY-APPLIED INSULATION

A. Self-Supported, Spray-Applied Cellulosic Insulation: ASTM C 1149, Type I (materials applied with liquid adhesive; suitable for either exposed or enclosed applications), chemically treated for flame-resistance, processing, and handling characteristics.
   1. Flame-spread index of 25 or less per ASTM E84.
   2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into Work include, but not limited to, following:
      1. International Cellulose Corporation
      2. Isolatek International Company
      3. Green Fiber
      4. Hamilton Manufacturing, Inc.
   3. Thermal Resistance: R-Value; 3.8 per inch per ASTM C 518.

B. Glass Fiber Insulation Spray Applied: MONOGLASS Spray-On White Fiber conforming to CAN/ULC S102-10 and ASTM E136 using MONOGLASS Liquid Bonding Adhesive manufactured by Monoglass Incorporated. Fibers shall consist of Type 902 Bio Soluble fiberglass.
   1. Insulation shall not contain asbestos, free crystalline silica or combustible fibers, and shall exhibit following properties.

| PROPERTY | TEST METHOD | RESULTS |
|---|---|---|
| Fire Hazard Classification | ASTM E84-07:<br>CAN/ULC s102-10 | Flame Spread = 0<br>Smoke Developed = 0 |
| Non-Combustibility | ASTM E-136-11, ISO 1182-90 | Non-Combustible |
| Air Erosion | ASTM E859 | No Mass Loss |
| Smolder Resistance | CGSB 51-GP-36P | Passed: 0.4% mean weight loss |
| Vibration Resistance Type 1 | CGSB 51GP-11M | Passed: 0.02% mass loss |
| Dry Density | ASTM D-1622-83 | 3.0 pounds/cubic foot |
| Thermal Conductivity | ASTM C-518 | K-Factor .25, R-Value 4.00/inch |
| Noise Reduction Coefficient | ASTM C-423<br>ISO 354 | NRC = .85, 1.4” on solid backing<br>NRC = .75@ 25mm/1”*<br>NRC = .95 @ 50mm/2”* |
| Fire Gas Toxicity | University of Pittsburgh Protocol | Max CO2 3.5%, Max CO 0.3% |
| Fungus & Bacterial Resistance | ASTM G-21 MIL STD810F | No Growth |

   2. Bonding Adhesive shall be mixed with fresh, clean water to exact properties recommended by manufacturer.

2.6 SPRAY POLYURETHANE FOAM INSULATION/THERMAL BARRIER

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Bayor Material Science: Bayseal with one of the following thermal barriers:
      1. Bayseal IC Intumescent Coating, Bayor
      2. Flame Seal TB, Flame Seal Products
      3. TPR$^2$ Fireshell BMS-TC, TPR$^2$ Corporation
      4. DC 315, International Fireproof Technology

2. Icynene Inc.: Icynene ProSeal Eco with the following thermal barrier:
    1. DC 315, International Fireproof Technology
3. Henry Company: Permax 2.0X with one of the following thermal barriers:
    1. Flame Seal TB, Flame Seal Products
    2. TPR$^2$ Fireshell BMS-TC, TPR$^2$ Corporation
    3. DC 315, International Fireproofing Technology
4. MBCC Group: Spraytite, Comfort Foam and Walltite with one of the following thermal barriers:
    1. Aldocoat 800, Aldo Products
    2. Noburn Plus, No-Burn Inc.
    3. Spraycoat 1920, MBCC Group
    4. Flame Seal TB, Specialty Products
    5. DC 315, International Fireproof Technology
5. Johns Manville: Corbond III with one of the following thermal barriers:
    1. JM TC Thermal Barrier Intumescent Coating, Johns Manville.
    2. Flame Seal TB, Flame Seal Products.
    3. TPR$^2$ Fireshell BMS-TC, TPR$^2$ Corporation.
    4. DC 315, International Fireproofing Technology.
6. NCFI Polyurethane: InsulBloc with the following thermal barrier.
    1. DC 315, International Fireproofing Technology.
7. Huntsman Building Solutions: Heatlok XT with one of the following thermal barriers.
    1. Blazelox TBX.
    2. DC-315 Fireproof Paint

B. Closed-Cell Polyurethane Foam Insulation with Thermal Barrier: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
    1. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.
    2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
    3. Thermal Barrier: Provide an intumescent coating that has been qualified as the code-mandated thermal barrier over polyurethane foam by room corner tests conducted in accordance with NFPA 286 or UL 1715 as acceptable to authorities with jurisdiction.

2.7 ACCESSORIES

A. Wire/Poultry Netting: 1 inch hexagonal, 20 gauge galvanized wire netting.

B. Welded Wire Fabric: Cold drawn 10 gauge steel wire, electrically welded at the intersection of the transverse and longitudinal wires, which are both spaced 6 inches apart. Fabric shall conform to ASTM A 185 and be identified as 6 x 6-10 WWF.

C. Sprayed Polyurethane Foam Sealant (Insulation for Miscellaneous Voids): 1 or 2 component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu.ft. density; flame spread index of 25 or less according to ASTM E162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
    1. Provide single-component polyurethane sealant low expansion pressure specifically designed for sealing perimeter of openings.
    2. Use one-component foam for cracks or openings 1/4-inch to 2-inch wide. Use two-component foam sealant for gaps over 2-inches wide and for voids in hidden cavities.

D. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, if applicable, and demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with installer present, for compliance with requirements of Sections in which substrates and related work are specified and, for other conditions affecting performance.

B. Examine sizes and conditions of voids to be sealed to establish correct thicknesses and installation of materials per manufacturer's recommendations.

C. Verify that surfaces are ready to accept the work of this Section and penetrating elements are securely fixed, properly located and with the required space allowance between penetrants and openings.

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

3.2 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

B. Clean substrate surfaces to remove moisture, dirt, dust, grease, oil, loose material, or other matter which may affect bond of foam sealant material. Ensure surfaces are dry before proceeding with installation.
   1. Remove incompatible materials that may affect bond.
   2. Install backing and damming materials for foam sealant to arrest material leakage and for support.
   3. Mask, using masking tape, where necessary to avoid spillage and over coating onto adjoining finish surfaces; remove stains on adjacent surfaces. Remove tape as soon as possible without disturbing foam sealant.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

D. Spray Polyurethane Foam Insulation Priming: Prime Substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer’s written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer’s R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

F. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

C. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions.
   1. Apply to multiple passes to not exceed maximum thicknesses recommended by manufacturer.
   2. Shield the spray polyurethane foam from interior exposure with an approved thermal barrier as indicated and by authorities with jurisdiction.
   3. Glass-Fiber (Return Air Plenums): Board tamp sprayed insulation surface and apply Monoglass adhesive to seal tamped insulation surface, in accordance with manufacturer’s written instructions.
      1. Paint as required, or apply spray insulation using manufacturer’s pre-treated adhesives, per manufacturer’s instructions.
      2. If surface protection is required, spray-apply InsulSeal protective coating to desired thickness as indicated on manufacturer’s coverage chart.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Loose-Fill Insulation (Interior Assemblies): Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
   2. Spray Polyurethane Insulation or Foam Sealant (Exterior Walls): Apply according to manufacturer's written instructions.
      1. Apply sealants within recommended application temperature ranges. Consult manufacturer when sealants cannot be applied within recommended ranges.
         1) In low humidity, mist area with water to aid cure of one-component sealant.
      2. Provide continuity of thermal barrier by sealing the following areas within the construction and construction assemblies. Note that these areas are typical in nature and do not limit the application of these products to these noted areas, but any and all details within the construction that present similar characteristics should receive similar applications.
         1) Opening head, jamb, and sill areas at cavity wall.
         2) Roof/Wall Junctions (Spray Polyurethane Insulation and Thermal Barrier): Inspect roof/wall perimeter for thermal gaps in areas such as the fluted deck itself, truss and structural beam penetrations above and below the top of the wall, open joints, and conduit and pipe penetrations.
            a) Where deck flutes run perpendicular to the wall, foam the open flutes completely out to the fascia.
            b) Where closed flutes occur, punch flutes and inject foam through holes. Locate holes as close to wall as possible so that the plane of injected and cured foam within the closed flute is level with the plane of the exposed foam in the open flutes.
            c) Where steel deck is parallel to the wall, fill the void with either one-component or two-component material, depending on gap size.

d) Roof to wall junctions at perimeter must be sealed with spray polyurethane insulation and if exposed thermal barrier. Depending on orientation of steel deck as noted above, this work may be required prior to installation of roof assembly. Coordinate with roofing contractor and construction schedule to ensure thermal envelope continuity.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

**SECTION 07 27 26.02 – VAPOR-PERMEABLE, FLUID-APPLIED MEMBRANE AIR BARRIER**

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes the following:
   1. Materials and installation methods for a vapor-permeable, fluid-applied membrane air water resistive barrier system located in the non-accessible part of the wall.
   2. Materials and installation to bridge and seal the following air leakage pathways and gaps:
      a. Connections of the walls to the roof air barrier.
      b. Connections of the walls to the foundations.
      c. Expansion joints.
      d. Openings and penetrations of window frames, storefront, curtain wall.
      e. Barrier other envelope systems.
      f. Door frames.
      g. Piping, conduit, duct and similar penetrations.
      h. Masonry ties, screws, bolts and similar penetrations.
      i. All other air leakage pathways in the building envelope.

B. Related Sections include the following:
   1. Division 03 Section “Cast-in-Place Concrete” for coordination with underslab vapor barriers.
   2. Division 04 Section "Unit Masonry" for embedded flashings (through-wall).
   3. Division 06 Section "Sheathing" for wall sheathings, wall sheathing joint-and-penetration treatments, building paper, and building wraps.
   4. Division 07 Roofing Sections for coordination with roof air and vapor barriers.
   5. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashings.
   6. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

1.2 DEFINITIONS

A. ABAA: Air Barrier Association of America.

B. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

C. Air Barrier Accessory: A transitional component of the air barrier that provides continuity.

D. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

E. ICC-ES AC 212: Acceptance criteria for water resistive coatings used as water resistive barriers over exterior sheathing, published by International Code Council Evaluation Services.

F. Vapor-Permeable, Fluid-Applied Water Resistive Barriers: Membrane exhibiting water vapor transmission properties according to Grade D of ICC-ES AC 212. Grade D membrane exhibits minimum 5 perms when tested in accordance with ASTM E 96 B (water method – unmodified).

1.3 PREINSTALLATION MEETINGS

A. Pre-Installation Meeting: Conduct meeting at Project site.
   1. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, constructionof mock-up, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and special details of construction. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.

2. Review air-barrier requirements and installation, special details, mockups, air leakage and bond testing, air barrier protection, and work scheduling that covers air barriers.

1.4 SEQUENCING

A. Coordination of Trades:
1. Applicator shall evaluate adjacent materials such as windows, doors, etc. for conformance to project details.
2. General Contractor shall make provision for installation of air seals between the primary air barrier and other wall components (penetrations, etc.) in order to maintain continuity of an air barrier system.
3. Applicator shall provide protection of rough openings before installing windows, doors, and other penetrations through the wall.

1.5 ACTION SUBMITTALS

A. Product Data: Submit manufacturer’s product data, installation instructions, and manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.
1. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.
2. Include statement that materials are compatible with adjacent materials proposed for use.
3. Submit reports indicating that field peel-adhesion test on all materials to which sealants are adhered have been performed and the changes made, if required, to other approved materials, in order to achieve successful adhesion.

1.6 QUALITY ASSURANCE

A. Manufacturer: Obtain primary materials from a single manufacturer regularly engaged in manufacturing air and vapor barrier membranes. Obtain secondary materials from a source acceptable to the primary materials manufacturer.

B. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds for the specific authority having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer. Protect stored materials from direct sunlight. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Avoid spillage. Immediately notify Owner and A/E if spillage occurs and start clean up procedures.

D. Clean spills and leave area as it was prior to spill.

1.8 FIELD CONDITIONS

A. Temperature: Install air and vapor barrier within range of ambient and substrate temperatures recommended by air and vapor barrier manufacturer.
1. Protect substrates from environmental conditions that affect air-barrier performance.

B. Field Conditions: Do not install air and vapor barrier in snow, rain, fog, or mist without temporary protection and supplemental heat as required. Do not install air and vapor barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer. Apply membrane to a surface dry substrate, or in accordance with manufacturer's recommendations.

C. Sequencing. Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.

D. Compatibility. Do not allow air barrier materials to come in contact with chemically incompatible materials.

E. Ultra-Violet Exposure. Do not expose air barrier materials to sunlight longer than as recommended by the material manufacturer.

1.9 WARRANTY

A. Material Warranty: Provide manufacturer's standard product warranty, for a minimum 2 years from date of Substantial Completion.
   1. Protect substrates from environmental conditions that affect air-barrier performance.

B. Installation Warranty: Provide air barrier subcontractor's 2-year warranty from date of Substantial Completion, including all components of the air and vapor barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Material Performance: Provide materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 in. water (1.57 psf) (0.02 L/$m^2$ at 75 Pa.) when tested according to ASTM E2178.

B. Water Vapor Transmission: The water vapor transmission water method, (Procedure B) shall be determined in accordance with ASTM E96 and shall be declared by material manufacturer as follows:
   1. Water vapor transmission shall be a minimum of 35 g/($m^2$ * 24h) (5 grains/(h*$ft^2$*in Hg) = 5 Perms) when tested in accordance with ASTM E96 B (water method – unmodified).

C. Assembly Performance: Provide a continuous air and vapor barrier assembly that has an air leakage not to exceed 0.040 cubic feet per square foot per minute under a pressure differential of 0.3 in. water (1.57 psf) (0.20 L/ $m^2$ at 75 Pa.) when tested in accordance with ASTM E2357, and a vapor permeance of 1 perm (57 mg) or less when tested in accordance with ASTM E96 using the desiccant method. Assembly shall perform as a liquid drainage plane flashed to discharge condensation or water penetration to the exterior. Assembly shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air and vapor seal materials at such locations, changes in substrate and perimeter conditions.
   1. Assembly shall be capable of withstanding combined positive and negative design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure.
   2. Assembly shall not displace adjacent materials under full load.
   3. Assembly shall be joined in an airtight and flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep, and anticipated movement.

D. Connections to Adjacent Materials: Provide connections to prevent air leakage and vapor migration at the following locations.
   1. Foundation and walls, including penetrations, ties and anchors.
   2. Walls, windows, curtain walls, storefronts, louvers or doors.
   3. Different wall assemblies, and fixed openings within those assemblies.
   4. Wall and roof connections and penetrations.
   5. Floors over unconditioned space.
   6. Walls, floor and roof across construction, control and expansion joints.
   7. Walls, floors and roof to utility, pipe and duct penetrations.
   8. Expansion joints.
   9. All other leakage pathways in the building envelope.

E. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

F. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.

G. Application Temperature: 25 deg. to 120 deg.

H. Damp Surface Tolerant: Can be applied to damp-to-touch surfaces that are free of liquid water.

2.2 MATERIALS, GENERAL

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.3 VAPOR-PERMEABLE, FLUID-APPLIED AIR BARRIER

A. Vapor-Permeable, Fluid-Applied Membrane Air Barrier: Use regular, high temperature or low-temperature formulation depending on site conditions, within temperature ranges specified by manufacturer. Subject to compliance with requirements, provide one of the following:
   1. Material: Tyvek Fluid Applied WB at 25 mils thick (wet), 25 mils thick (dry) by DuPont Building Innovations www.Weatherization.Tyvek.com:
      a. Air Barrier Material Properties:
         1) Air permeance for this material has been tested and reported as being 0.0002 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0002 cfm/$ft^2$ @ 1.57 psf), at 25 mils (dry), when tested in accordance with ASTM E2178 (unmodified).
         2) Water vapor permeance for this material has been tested and reported as being 25 grains of water vapor passing through each square foot of area per hour per inch Hg of water vapor pressure differential (25 Perms) when tested in accordance with ASTM E96 B (water method – unmodified). Corresponding water vapor transmission is 173 grams of water vapor passing through each square meter of area per day (173 g/($m^2$*24h)).
      b. Air Barrier Accessory Materials
         1) Fluid-Applied Air Barrier Membrane: DuPont™ Tyvek® Fluid Applied WB - A vapor permeable, low VOC, single-component elastomeric polymer membrane. Spray or roller applied in one coat at 25mils; low temperature, and damp surface application.
         2) Solvent Based Primer for Flashing, Transition Strip and Detail Membranes: 3M High Strength 90; Denso Butyl (used with self-adhered membranes only)
         3) Through-Wall Flashings or Shelf Angle Flashings: Refer to Division 04 Section "Unit Masonry".
         4) Sealants, Mastics, Adhesives and Tapes: DuPont™ Sealant for Tyvek®
         5) Fluid Applied System; DuPont™ Tyvek® Flashing and Joint Compound; fiberglass mesh tape
         6) Transition, Termination, and Detailing Membrane: DuPont™ StraightFlash™, or DuPont™ Tyvek® Flashing and Joint Compound (60mil)
         7) Penetrations & Termination Sealant: DuPont™ Sealant for Tyvek® Fluid Applied System

8) Window Flashing Membrane: DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound, or DuPont™ Tyvek® Fluid Applied Flashing – Brush Formulation, or DuPont™ StraightFlash™ with DuPont™ FlexWrap™
9) Joint Treatment: None(≤ 1/16" gaps); (DuPont™ Tyvek® Flashing and Joint Compound(≤ 1/4" gaps); DuPont™ Tyvek® Flashing and Joint Compound w/ fiberglass mesh tape (≤ 1/2" gaps); DuPont™ StraightFlash™ (≤ 1" gaps)

2. Material: Perm-A-Barrier VPL 50RS, 20 mils thick (wet/dry) by GCP Applied Technologies, www.GCPAT.com:
   a. Air Barrier Material Properties:
      1) Air permeance for this material has been tested and reported as being 0.0004 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0004 cfm/ft$^2$ @ 1.57 psf), at 69 mils (wet), when tested in accordance with ASTM E2178 (unmodified).
      2) Water Vapor Permeance: ASTM E96, Method B: Greater than 10 perms at 20 mil.
   b. Air Barrier Accessory Materials:
      1) Transition Membrane: GCP Applied Technologies. Product shall meet GCP most current performance standards:
         a) PERM-A-BARRIER; Detail Membrane, NPS Detail Membrane, Aluminum Flashing, Wall Flashing, and Liquid Flashing.
      2) Penetrations and Termination Sealant: Perm-a-Barrier Liquid Flashing manufactured by GCP Applied Technologies: Sealant for Details, Final Terminations.
      3) Sheathing Joint Sealant: PERM-A-BARRIER 5100.
      4) Through-Wall Flashings or Shelf Angle Flashings: Refer to Division 04 Section "Unit Masonry".
3. Material: Air Bloc All Weather STPE; Henry at 20 mils (wet/dry) www.henry.com:
   a. Air Barrier Material Properties:
      1) Air permeance for this material has been tested and reported as being 0.00024 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.00024 cfm/ft$^2$ @ 1.57 psf), at 87 mils (wet) when tested in accordance with ASTM E2178 (unmodified).
      2) Water vapor permeance for this material has been tested and reported as being 2066 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential 36.12 US perms at 44 mils (dry) when tested in accordance with ASTM E96 (water method – unmodified).
   b. Air Barrier Accessory Materials:
      1) Flashings; choose from the following:
         a) Liquid-applied flashing:
            .1 Moisture-cure one component elastomeric liquid applied flashing using an STPE (Silyl-Terminated Polyether) polymer, having the following typical properties:
               .a Basis of Design Product: Henry Air-Bloc LF® Liquid Applied Flashing.
               .b Color: Blue.
         b) Self-adhering flashing:
            .1 Vapor impermeable, self-adhered water resistive air and vapor barrier consisting of an SBS rubberized asphalt compound, integrally laminated to a blue engineered thermoplastic film, having the following typical properties:
               .a Basis of Design Product: Henry Blueskin® SA Self-Adhered Water Resistive Air Barrier.
               .b Color: Blue.
      2) Primers for Self-Adhered Flashing:
         a) Polymer emulsion-based primer for self-adhered membranes, and having the following typical properties:
            .1 Basis-of-Design Product: Henry Aquatac™ Primer.
            .2 Color: Aqua.
            .3 Water based: Maximum VOC: 50 g/l.

3) Sealants:
a) Moisture cure, medium modulus polymer modified sealant compound, having the following typical properties:
.1 Basis-of-Design Product: Henry 925 BES Sealant.
.2 Complies with Fed. Spec. TT-S-00230C, Type II, Class A.
.3 Complies with ASTM C920, Type S, Grade NS, Class 35.
4) Thru-Wall Flashing:
a) Vapor impermeable, self-adhered water resistive air and vapor barrier consisting of an SBS rubberized asphalt compound, integrally laminated to a yellow engineered thermoplastic film, having the following typical properties:
.1 Basis-of-Design Product: Henry Blueskin TWF Self-Adhered Thru-Wall Flashing.
.2 Color: Yellow.

4. Material: Spray-N-Rod; Polyguard Airlok STPE WRB
a. Air Barrier Material Properties:
1) Air permeance for this material has been tested and reported as being 0.000024 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot at 20 mils (dry) when tested in accordance with ASTM E2178 (unmodified).
2) Water vapor permeance for this material has been tested and reported as being 857 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential 15 US perms at 20 mils (dry) when tested in accordance with ASTM E96 (water method – unmodified).
b. Air Barrier Accessory Materials:
1) Flashing: Airlok® Flash-N-Roll is a single component, Silyl Terminated Polyether (STPE), 100 percent solid moisture-cured, elastomeric, roller-applied above-grade fluid flashing.
2) Flashing: Airlok® STPE WRB Gun-N-Spread is a single component, Silyl Terminated Polyether (STPE), 100 percent solid moisture-cured, elastomeric gun and trowel applied above-grade fluid flashing.
3) Flashing and Sealant Detail Sealant PW™ is a single component, Silyl Terminated Polyether (STPE), 100 percent solid moisture-cured, elastomeric tube and trowel applied joint filler, sealant and fluid flashing.
4) Flashing and Sealant Airlok® STPE WRB Detail-N-Joint is a single component, Silyl Terminated Polyether (STPE), 100 percent solid moisture-cured, elastomeric tube and trowel applied above grade fiber filled joint filler, sealant and transition fluid flashing.
5) Flashing: Polyguard® Airlok® Sheet 400 NP is a 40-mil, laminated, modified-asphalt, self-adhesive membrane bonded to a cross-laminated polyethylene sheet and is used for wall flashing, through-wall flashing (TWF), joint flashing, and non-vapor permeable sheet air barrier. Use Airlok® Sheet 400 NP for ambient and substrate surface temperatures 25 deg. and rising. Airlok® Sheet 400 NP resists sunlight up to 30 days.
6) Flashing: Polyguard® Airlok® Sheet UV 400 NP is a 40-mil, composite membrane, consisting of a foil/polyscrim, laminated to a layer of rubberized-asphalt and is used for wall flashing, through-wall flashing (TWF), and joint flashing, and non-vapor permeable sheet air barrier. Use Airlok® Sheet UV 400 NP for ambient and substrate surface temperatures 25 deg. and rising. Airlok® Sheet UV 400 NP resists sunlight up to 1 year.
7) Flashing: Polyguard® Airlok® Sheet UV 400 NP is a 40-mil, laminated, modified-asphalt, self-adhesive membrane bonded to a cross-laminated polyethylene sheet with a top protective layer of aluminum and is used for wall flashing, through-wall flashing (TWF), and joint flashing, and non-vapor permeable sheet air barrier. Use Airlok® Sheet UV Ultra 400 NP for ambient and substrate surface temperatures 40 deg. and rising. Airlok® Sheet UV Ultra 400 NP resists sunlight up to 2 years.

8) Flashing: Polyguard® Airlok® Sheet 200 BU/NP is a 28-mil, laminated, butyl compound, self-adhesive, non-permeable sheet membrane bonded to a cross-laminated polyethylene sheet and is used for wall flashing, through-wall flashing (TWF), joint flashing, and non-vapor permeable sheet air barrier. Use Airlok® Sheet 200 BU/NP for ambient and substrate surface temperatures 20 deg. and rising. Airlok® Sheet 200 BU/NP resists sunlight up to 30 days.

9) Flashing: Polyguard® Airlok® Sheet UV 200 BU/NP is a 28-mil, laminated, butyl compound, self-adhesive, non-permeable sheet membrane bonded to a cross-laminated polyethylene sheet and is used for wall flashing, through-wall flashing (TWF), and joint flashing, and non-vapor permeable sheet air barrier. Use Airlok® Sheet UV 200 BU/NP for ambient and substrate surface temperatures 20 deg. and rising. Airlok® Sheet UV 200 BU/NP resists sunlight up to 1 year.

10) Surface Primer Roller-Grade Adhesive:
    a) Polyguard® 650 LT Liquid Adhesive: A rubber-based, tacky adhesive which is specifically formulated to provide excellent adhesion.
    b) Polyguard® California Sealant: A rubber-based sealant which is specifically formulated to provide excellent adhesion. The VOC (Volatile Organic Compound) content meets the South Coast Air Quality Management District regulations established under the February 1, 1991 version of Rule 1168© (2) Adhesion and Sealant Applications, California Sealant is classified as an Architectural Sealant Primer Porous, with VOC of 527 g/L. Current SCAQMD regulations for this type sealant primer are 775 g/L.

11) Spray Adhesive
    a) Quick Grip Spray Adhesive: A Building Envelope, industrial-grade aerosolized adhesive in a portable spray system. It contains non chlorinated solvents, and offers an excellent alternative to methylene chloride-based products.

5. Material: Sopraseal LM 204 VP; Soprema:
   a. Air Barrier Material Properties:
      1) Air permeance for this material has been tested and reported as being 0.00097 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot at 40 mils (wet) when tested in accordance with ASTM E2178 (unmodified).
      2) Water vapor permeance for this material has been tested and reported as being 857 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential 15.0 US perms at 20 mils (dry) when tested in accordance with ASTM E96 (water method – unmodified).
   b. Air Barrier Accessory Materials:
      1) Soprema Sopraseal Liquid Flashing; 100 percent solids, moisture curing polyether flashing material. 10.1 oz. cartridge or 20 oz. sausages.
      2) Soprema Sopraseal Stick 1100T; tri-laminate woven polyethylene film-surfaced, SBS self-adhesive flashing and transition membrane for rough openings and penetrations. 40 mil thick, 36 inch, by 22.9 feet long rolls, or pre-cut rolls.
      3) Soprema Soprasolin HD; aluminum foil-surfaced, SBS self-adhesive flashing and transition membrane for rough openings and penetrations. 40 mil thick, 39.4 inch by 32.8 feet long rolls, or pre-cut rolls.
      4) Soprema Sopraseal Stick Primer, 500 g/L VOC, self-adhesive membrane primer for use in Soprasolin HD and Sopraseal Stick 1100T.
      5) Soprema Elastocol Stick H20 Primer, water-based, 0 g/L VOC, self-adhesive membrane primer for use with Soprasolin HD and Sopraseal Stick 1100T.
      6) Soprema Elastocol Stick Zero Primer, zero VOC polymer based primer for use with Soprasolin HD and Sopraseal Stick 1100T.

7) Sealant Soprema Sopraseal Sealant, ASTM C920, 19 g/L low VOC, moisture curing polyether sealant approved for application. 10.1 oz. or 20 oz. sausages.
8) Polyurethane Foam Sealant: Approved by manufacturer for compatibility with fluid applied air barrier.
9) Flashing (Counter) for Masonry at Through-Wall Flashings or Transition Membranes: Refer to Division 04 Section “Unit Masonry”.

6. Material: GE Elemax 2600 by Momentive Performance Materials at 17 mils (dry) www.ge.com/silicones:
   a. Air Barrier Material Properties
      1) Air permeance for this material has been tested and reported as being 0.0006 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0006 cfm/ft$^2$ @ 1.57 psf), at 17 mils (dry) when tested in accordance with ASTM E2178 (unmodified).
      2) Water vapor permeance for this material has been tested and reported as being 581 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential 10.16 US perms at 17 mils (dry) when tested in accordance with ASTM E 96 (water method – unmodified).
   b. Air Barrier Accessory Materials:
      1) Solvent-Based Primer: SS80
      2) Sealants: CSC2000, SCS9000, SCS2700
      3) Transition Membrane for details and terminations: UST2200, USM pre-formed silicone molded corner parts.
      4) Solvent-Based Primer for Flashing, Transition Strip and Detail Membrane: SS80
      5) Substrate Joint Treatment: SCS2000, SCS9000, SCS2700

2.4 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lab sealants, and other accessory materials that are specified hereinbefore or specifically recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air barrier material and adjacent construction to which they may seal.

B. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.

C. Stainless-Steel Sheet: ASTM A 240, type 304, 0.0187 inch minimum thick, and Series 300 stainless-steel fasteners.

D. Preformed Silicone Extrusion: Manufacturer’s standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. GE Construction Sealants; Momentive Performance Materials Inc.
      b. Pecora Corporation
      c. The Dow Chemical Co.
      d. Tremco Incorporated

PART 3 - EXECUTION

3.1 EXAMINATION

A. The Air Barrier Contractor shall examine substrates, areas, and conditions under which air and vapor barrier assemblies will be applied, with Installer present, for compliance with requirements.

1. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
2. Do not proceed with installation until after minimum concrete curing period recommended by air and vapor barrier manufacturer.
3. Ensure that the following conditions are met:
    a. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants
    b. Concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions.
    c. Masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.
4. Verify substrate is surface dry. Test for capillary moisture by plastic sheet method according to ASTM D4263 and take suitable measures until substrate passes moisture test. Surface dry is an acceptable substrate condition if acceptable to the manufacturer.
5. Verify sealants used in sheathing are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.
6. Notify A/E in writing of anticipated problems using air and vapor barrier over substrate prior to proceeding.

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

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air and vapor barrier application.
1. Ensure that penetrating work by other trades is in place and complete.
2. Prepare surfaces by brushing, scrubbing, scraping, grinding, or compressed air to remove loose mortar, dust, oil, grease, oxidations, mill scale and other contaminants which will affect adhesion of the fluid-applied membrane.
3. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
4. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
5. Wipe down metal surfaces to remove release agents or other non-compatible with the primary air material.

B. Prime substrate for application of sheet membrane transition strips as recommended by manufacturer and as follows:
1. Prime masonry, concrete substrates with conditioning primer.
2. Prime glass-fiber surfaced gypsum sheathing an adequate number of coats to achieve required bond, with adequate drying time between coats.
3. Prime wood, metal, and painted substrates with primer.
4. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air and vapor barrier and at protrusions.

C. Prime substrate for application of fluid-applied air and vapor barrier if recommended by manufacturer based on project conditions and as follows.

D. Protection from spray-applied materials:
1. Mask and cover adjacent areas to protect from over-spray.
2. Ensure any required foam stop or back up material are in place to prevent over-spray and achieve complete seal.

E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

F. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 ACCESSORIES INSTALLATION

A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
   1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
   2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
   3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
   4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or preformed silicone extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

3.4 INSTALLATION

A. Joint Treatment:
   1. Concrete and Masonry: Prepare, treat, route, and fill joints and cracks in substrate according to ASTM C1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D4258 before coating surfaces.
      a. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.
   2. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

B. Fluid Applied Membrane Air Barrier Installation: Install transition strip materials and fluid-applied air barrier to provide continuity throughout the building envelope. Install materials in accordance with manufacturer's recommendations and as follows, unless manufacturer recommends other procedures in writing based on project conditions or particular requirements of their recommended materials:
   1. Install veneer anchors as per air barrier manufacturer installation sequencing.
   2. Apply treatment to exterior gypsum joints and screw heads as per air barrier material manufacturer.
   3. Apply primer for transition strips at rate recommended by manufacturer. Allow primer to dry completely before transition strip application. Apply as many coats as necessary for proper adhesion.
   4. Position subsequent sheets of transition material so that membrane overlaps the membrane sheet below by a minimum of 2 inches, unless greater overlap is recommended by manufacturer. Roll into place with roller.

5. Overlap horizontally adjacent pieces of transition material a minimum of 2 inches, unless greater overlap is recommended by manufacturer. Roll seams with roller.
6. Seal around all penetrations with termination mastic, extruded silicone sealant, membrane counterflashing or other procedure in accordance with manufacturer's recommendations.
7. Connect air and vapor barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors and other intersection conditions and perform sealing of penetrations, using accessory materials and in accordance with the manufacturer's recommendations.
8. At changes in substrate plane, provide transition material (bead of sealant, mastic, extruded silicone sealant, membrane counterflashing or other material recommended by manufacturer) under membrane to eliminate all sharp 90-degree inside corners and to make a smooth transition from one plane to another.
9. Provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plane and to make a smooth transition from one plane to the other. Membrane shall be continuously supported by substrate or as recommended by the manufacturer.
10. At through-wall flashings, provide an additional 6-inch wide strip of manufacturer's recommended membrane counterflashing to seal top of through-wall flashing to membrane or as recommended by manufacturer. Seal exposed top edge of strip with bead of mastic or as recommended by manufacturer.
11. At deflection and control joints, provide backup for the membrane to accommodate anticipated movement.
12. At expansion and seismic joints provide transition to the joint assemblies.
13. Apply a bead or trowel coat of mastic along membrane seams at reverse lapped seams, rough cuts, and as recommended by the manufacturer.
14. At end of each working day, seal top edge of the self-adhered membrane to substrate with termination mastic.
15. Do not allow materials to come in contact with chemically incompatible materials.
16. Do not expose membrane to sunlight longer than as recommended by the manufacturer.
17. Inspect installation prior to enclosing assembly and repair punctures, damaged areas and inadequately lapped seams with a patch of membrane lapped as recommended by manufacturer.

## 3.5 FIELD QUALITY CONTROL

A. Owner's Inspection and Testing: Cooperate with Owner's testing agency and ABAA auditors. Allow access to work areas and staging. Notify Owner's testing agency/ABAA auditor in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Daily inspection and testing may be required. Do not cover Work of this Section until testing and inspection is accepted.

## 3.6 PROTECTING AND CLEANING

A. Protect air and vapor barrier assemblies from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Coordinate with installation of materials which cover air and vapor membrane, to ensure exposure period does not exceed that recommended by the air and vapor barrier manufacturer.
   2. Protect air barrier from contact with incompatible materials and sealants not approved by air barrier manufacturer.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

END OF SECTION 07 27 26.02

## SECTION 07 42 13.23 – METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes metal composite (fire resistive) material wall panels (MCM) with Rain Screen-Principle Installation.
   1. Attachment system components.
   2. Flashings and trim.

B. Related Sections:
   1. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal-faced composite wall panels.
   2. Division 06 Section “Sheathing” for plywood faced insulation sheathing.
   3. Division 07 Section “Vapor-Permeable, Fluid-Applied Membrane Air Barrier.
   4. Division 07 Section "Sheet Metal Flashing and Trim" for field-formed flashings and other sheet metal work not part of metal-faced composite wall panel assemblies.
   5. Division 07 Section "Joint Sealants" for:
      a. Silicone adhesive to secure retaining clip to face of composite wall panel.
      b. Joint sealant between perimeter trim and surrounding materials.

1.2 DEFINITION

A. Metal-Faced Composite Wall Panel Assembly: Metal-faced composite wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight and rainscreen-type wall system.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate metal-faced composite wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, sheathing, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

B. Preinstallation Meeting: A/E will schedule and conduct meeting at Project site.
   1. Meet with Owner, A/E, Owner's insurer if applicable, testing and inspecting agency representative, metal-faced composite wall panel Installer, metal-faced composite wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal-faced composite wall panels including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal-faced composite wall panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal-faced composite wall panels.
   6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   7. Review temporary protection requirements for metal-faced composite wall panel assembly during and after installation.
   8. Review wall panel observation and repair procedures after metal-faced composite wall panel installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal-faced composite wall panel and accessory.
   1. Qualification Data: For Installer, professional engineer, and testing agency.
   2. Manufacturer's Instructions: Manufacturer's installation instructions.
   3. Sample Warranty: Copy of manufacturer's warranty stating obligations.

B. Shop Drawings: Show fabrication and installation layouts of metal-faced composite wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.
   1. Accessories: Include details of following items, at a scale of not less than 1-1/2 inches per 12 inches:
      a. Flashing and trim.
      b. Anchorage systems.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Metal-Faced Composite Wall Panels: 8 inches by 8 inches color sample.

D. Delegated-Design Submittal: For metal-faced composite wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.
   1. Show governing MCM types, mounting system including anchorages, connections, and fasteners. Indicate location, type magnitude, and direction of loads imposed on building structural frame.
   2. Analysis/calculations shall be signed and sealed by a qualified Design Professional in project jurisdiction that MCM system shows conformance with performance requirements and design criteria identified for this project.

1.5 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Maintenance Data: For metal wall panels to include in maintenance manuals.
   2. Warranties: Samples of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
   1. Installer shall have experience with similar sized MCM system projects. MCM system installer must be capable of providing field service representation during construction.
   2. MCM System Installer must be approved installer by a MCM Certified Fabricator for installation of their MCM System and have undergone proper training for specified system thereof.

B. Regulatory Code Agencies Requirements: Provide composite fire rated panels which have been evaluated and are in compliance with local authorities with jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal-faced composite wall panels, and other manufactured items so as not to be damaged or deformed. Package metal-faced composite wall panels for protection during transportation and handling.

B. Unload, store, and erect metal-faced composite wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F.

D. Retain strippable protective covering on metal-faced composite wall panel for period of panel installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal-faced composite wall panels to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal-faced composite wall panel fabrication and indicate measurements on Shop Drawings.

C. Project Schedule: Provisions in project schedule must accommodate time interval between field measurements and fabrication/installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-faced composite wall panel assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, following:
      a. Structural failures, including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
      c. MCM Material Integrity: Five (5) plus 1 years from date of shipment.
   2. Warranty Period: Two years from date of Substantial Completion, unless otherwise noted.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal-faced composite wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Metal-faced composite wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design metal-faced composite wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Performance: Provide metal-faced composite wall panel assemblies capable of withstanding effects of following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:

1. Wind Loads: Determine loads based on following minimum design wind pressures:
   a. Uniform pressure of 30 lb/sq. ft. unless otherwise indicated on Drawings.
2. Deflection Movement: Provide installed MCM systems that have been designed to resist to wind loading, acting inward and outward, defined for project:
   a. Perimeter Framing Deflection: Deflection of panel perimeter framing member shall not exceed L/180 normal to plane of wall where “L” is unsupported span of perimeter framing member.
   b. Panel Deflection: Deflection of panel face at center of panels shall not exceed L/60 at design load where “L” is unsupported span of panel.
   c. Anchor Deflection: At connection points of framing members to anchors, anchor deflection in any direction shall not exceed 0.0625 inch.
   d. At 150 percent pressure, no permanent deformation exceeding L/1000 or failure to structural members is permitted.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): Minus 20 to plus 180 deg F ambient; 180 deg F material surfaces.
2. Fabrication, assembly and erection procedures shall take into account ambient temperature range at time of respective operation.

E. System Requirements: (System Type Dependent)
1. Dry System – (Tested to AAMA 501 Standard)
   a. ASTM E 283 – Air Leakage: Not more than 0.06 cfm per ft2 of wall area when tested at 6.24 psf.
   b. ASTM E 331 – Static Water Penetration: When tested under static pressure at 12.0 psf minimum, for a time period of 15 minutes. MCM systems must have:
      1) No uncontrolled water leakage to room side of assembly when tested as defined by process.
   c. ASTM E330 – Structural Performance – MCM system must be engineered to meet project design loads, however MCM system must meet or exceed following criteria when tested to a minimum pressure of 30.psf:
      1) Deflections do not exceed limitations defined within section on Deflection and Thermal Movement.
   d. AAMA 501.4 – Interstory Drift (where required by seismic zone). No failure or deterioration of system when laterally racked to 3/4 inch in both directions and repeated for three (3) cycles. System must pass static water test as described in Section 1.04.C.1.b., following seismic racking.
2. System Structural Performance.
   a. ASTM E330 (modified AAMA 508) – Structural Performance – MCM system must be engineered to meet project design loads, however MCM system must meet or exceed following criteria when tested to a minimum pressure of 30.0 psf. Note: ASTM E330 test shall be conducted with MCM system joinery closed (taped or sealed) producing required static loads on MCM system. AWB is not to be loaded for measurement.
      1) Deflections do not exceed limitations defined within section on Deflection and Thermal Movement.

F. Fire-Resistive Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL’s “Fire Resistance Directory” or from listings of another qualified testing agency.

G. Fire Propagation Characteristics: Metal composite material wall panel system passes NFPA 285 testing.

2.2 METAL-FACED COMPOSITE WALL PANELS

A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal-faced composite wall panels fabricated from two metal facings bonded to solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for rainscreen-type system.
   1. Fire-Retardant Core: Fire-retardant, with following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 120 or less.
      c. Flammability, Exterior, Non-Load-Bearing wall assemblies and panels, NFPA 285: Pass.
   2. Products: Subject to compliance with requirements, provide one of following:
      a. Alucobond Plus; 3A Composites USA Inc.
      b. Reynobond FR; Alcoa Inc.
      c. ALPOLIC/fr; ALPOLIC, Division of Mitsubishi Chemical America, Inc.
      d. Larson by Alucoil; Alucoil North America;
      e. Alfrex
   3. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. Requests for A/E's approval must be accompanied by “Substitution Request Form” and complete technical data for evaluation. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch thick, coil-coated aluminum sheet facings.
   1. Panel Thickness: 0.157 inch, minimum.
   2. Core: Fire retardant, unless otherwise noted.
   3. Surface: Smooth
   4. Exterior Finish: 2-coat fluoropolymer.
      a. Color: A/E to select from Manufacturer’s standard solid colors similar to Alucobond Classic Collection, minimum 25 colors. Metallic and Mica colors will not be selected.
   5. Fire Performance: (Class A Material)
      a. ASTM E 84: MCM shall have a flame spread index of not more than 25 when tested in maximum thickness intended for use.
      b. ASTM E 84: MCM shall have a smoke developed index of not more than 450 when tested in maximum thickness intended for use.
      c. Surface Flammability, modified ASTM E108: Pass.
   6. Bond Integrity: Test for resistance to delamination as follows:
      a. MCM panels with a solid core of extruded thermal plastic.
         1) Peel Strength (ASTM D 1781): 22.5 inch lb/in minimum as manufactured.
         2) No degradation in bond performance after 8 hours of submersion in water at 212 degrees F or 21 days of immersion in water at 70 degrees F.
         3) Thermally bonded to core material in a continuous process under heat, pressure, and tension.
      b. MCM panels with a high pressure injected liquid plastic core.
         1) Average Flatwise Tensile Strength (ASTM C 297): 400 psi. Individual values within a test group shall be within 154 percent of group average, or lowest test value is used.

C. Attachment System Components: Formed from extruded aluminum.
   1. Include manufacturer's standard perimeter extrusions with integral weather stripping, panel stiffeners, panel clips, and anchor channels.
   2. Fasteners as recommended by the panel manufacturer, concealed and non-corrosive.
   3. Panel joints shall be 1/2 inch wide using aluminum extrusions.

D. Attachment Assembly: Manufacturer's standard Rainscreen principle system.

2.3 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653, G90 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panels systems.

B. Subgirts: Manufacturer's standard C- or Z-shaped sections 0.064-inch nominal thickness.

C. Zee Clips: 0.079-inch nominal thickness.

D. Base or Sill Angles or Channels: 0.079-inch nominal thickness.

E. Hat-Shaped, Rigid Furring Channels:
1. Nominal Thickness: As required to meet performance requirements.
2. Depth: As indicated.

F. Cold-Rolled Furring Channels: Minimum 1/2-inch wide flange.
1. Nominal Thickness: As required to meet performance requirements.
2. Depth: As indicated.
3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch.
4. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch diameter wire.

G. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous metal framing members to substrates.

2.4 MISCELLANEOUS MATERIALS

A. Wall Panel Accessories: Provide components required for a complete metal-faced composite wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.

B. Flashing and Trim: Formed from same material as metal composite materials panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal-faced composite wall panels.
1. Utiliize metal composite material where feasible to continue panel closures and trim.

C. Fasteners/Attachment System Components: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal-faced composite wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.
1. Attachment System Components: Formed from extruded aluminum to meet specified design loads and system test performance according to each MCM System Fabricator’s design. Galvanized cold formed steel clips or staggered aluminum angles are not acceptable for panel to panel attachment.

D. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain watertight; and as recommended in writing by metal composite material panel manufacturer.

2.5 FABRICATION

A. Fabricators: Must be a Certified MCM Fabricator or listed as an approved fabricator by Metal Construction Association (MCA).
   1. Basis of Design: Sobotec LTD “SL-2000” system.
   2. Approved Fabricators
      a. Shaffner Heaney Associates, Inc.
      b. Universe Corp.
      c. Dams, Inc.
      d. Alcotex
      e. Altech Panel Systems
      f. MillerClapperton
      g. Division 7 Metals
      h. Tremco (Now Specialties)
   3. Fabricators Requirements: To be listed as an approved fabricator provide following supporting documentation ten days prior to bid.
      a. MCM System Fabricator shall demonstrate and offer within attested certification by at least one specified MCM manufacturer that they have fabricated; a minimum of 150,000 square feet of architectural walls per year, that are used as building weathering envelope, utilizing MCM of at least 4mm (0.157 inch) thickness.
      b. System components shall be shop fabricated.
      c. Fabrication of other types of panels or fabricator’s goods is not considered as meeting above requirement.
   4. Product of other fabricators will be considered for acceptance provided they comply with material requirements and functional qualities of this Section. “Substitution Request Form” and complete technical data must be received by A/E at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

B. General: Fabricate and finish metal-faced composite wall panels and accessories at factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

C. Fabricate metal-faced composite wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

D. Metal-Faced Composite Wall Panels: Factory form panels in a continuous process with no glues or adhesives between dissimilar materials. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.
   1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
   2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
   3. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
   4. Perimeter integral extrusions shall be full length around panel perimeter for panel reinforcement and alignment.
   5. Dimensional Tolerances:
      a. Length: +/-0.079 inch @ 70 degrees F.
      b. Width: +-0.079 inch @ 70 degrees F.
      c. Thickness: Plus or minus 0.008 inch.
      d. Squareness: +/-0.079 inch @ 70 degrees F.

E. System Type
   1. Pressure Equalized Rain Screen System: System must provide an open panel joint design with precise venting to allow air to quickly pass through panel joinery while preventing water infiltration from contacting air/water barrier as tested per AAMA 508. System must be properly compartmentalized to prevent internal cavity air moving between different pressure zones of building’s surfaces.

F. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
    a. Similar to Alucobond Axcent Material thickness: 0.040 inch thick, minimum.
        1) Drip Edge/Sill Flashing: Formed to profile indicated on Drawings at base of panel intersection with other finish wall materials, grade level and openings. Provide with concealed anchorage behind wall panels.
        2) Opening Sill Flashing.
        3) Panel Termination Trim.
        4) Opening trim.
        5) Panel to wall “L” trim.
        6) “L” Closure Trim.
        7) Sill Flashing/Transition covering masonry wall veneer at bottom of panels.
            a) Provide continuous hold down cleat at drip edge.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal-faced composite wall panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal-faced composite wall panel manufacturer for application, but not less than thickness of metal being secured.

## 2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

D. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal-faced composite wall panel supports, and other conditions affecting performance of Work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal-faced composite wall panel manufacturer.
      a. Unless otherwise required by panel manufacturer, in writing, substrate shall be with a tolerance of 1/4 inch in 20.0 feet, on level, plumb, and location control lines as indicated and within 1/8 inch offset of adjoining faces of alignment of matching profiles tolerances are noncumulative.
   2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal-faced composite wall panel manufacturer.
      a. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal-faced composite wall panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.

C. For record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of Work.

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

3.2 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal-faced composite wall panel manufacturer's written instructions.

3.3 METAL-FACED COMPOSITE WALL PANEL INSTALLATION

A. General: Install metal-faced composite wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of Work securely in place, with provisions for thermal and structural movement.
   1. Commence metal-faced composite wall panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
   2. Shim or otherwise plumb substrates receiving metal-faced composite wall panels.
   3. Flash metal-faced composite wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
   4. Install screw fasteners in predrilled holes.
   5. Locate and space fastenings in uniform vertical and horizontal alignment.
   6. Install flashing and trim as metal-faced composite wall panel work proceeds.
   7. Locate panel splices over, but not attached to, structural support. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   8. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
   9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
   10. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:
   1. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal-faced composite wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal-faced composite wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.
   1. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
   2. Provide sealants at horizontal plane joints.

E. Attachment System Installation, General: Install attachment system required to support metal-faced composite wall panels and to provide a complete rainscreen-type wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
   1. Include attachment to supports, panel-to-panel joinery, and panel-to-dissimilar-material joinery.
   2. Do not begin installation until weather barrier and flashings that will be concealed by composite panels are installed.

F. Rainscreen-Principle Installation: Provide manufacturer's standard pressure-equalized, rainscreen-principle system with vertical channel that provides support and complete secondary drainage system, draining at base of wall. Leave horizontal and vertical joints with open reveal.
   1. Do not apply sealants to joints unless otherwise indicated on Drawings.

G. Clip Installation: Attach panel clips to supports at each metal-faced composite wall panel joint at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-returned flanges of wall panels to panel clips with manufacturer's standard fasteners.
   1. Seal horizontal joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants."

## 3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal-faced composite wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated.
   1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with mastic sealant (concealed within joints).

## 3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal-faced composite wall panel units within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

## 3.6 FIELD QUALITY CONTROL

A. Field Quality Control: Comply with panel system fabricator's recommendations and guidelines for field forming of panels.

B. Fabricator's Field Services: Provide fabricator's field service consisting of products use recommendations and periodic site visit for inspection of product installation in accordance with fabricator's instructions.
   1. Site Visits: At minimum provide following:
      a. Pre-installation meeting.
      b. For first 10 sq.ft. installed.
      c. Final inspection of completed work.

C. Prepare test and inspection reports.

## 3.7 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal-faced composite wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal-faced composite wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.

B. After metal-faced composite wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal-faced composite wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
   1. Repair components of MCM system with minor damage such that repairs are not discernible at a distance of 10 feet from surface at a 80 degree angle per AAMA 2605.

D. Verify weep holes and drainage channels are unobstructed and free of dirt and sealants.

END OF SECTION 07 42 43

## SECTION 07 54 00 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Adhered thermoplastic membrane roofing system.
   2. Vapor retarder.
   3. Roof insulation.
   4. Cover board.
   5. Walkways.

B. Related Sections include the following:
   1. Division 05 Section "Steel Decking" for furnishing acoustical deck rib insulation.
   2. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
   3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
   4. Division 07 Section “Roof Specialties” for roof edge terminations.
   5. Division 07 Section "Joint Sealants" for sealants not directly associated with roofing.
   6. Division 22 Section "Facility Storm Drainage Piping" for roof drains.

1.2 REFERENCES

A. American Society of Civil Engineers: Document ASCE 7, Minimum Design Loads for Buildings and Other Structures.

B. American Society of Testing and Materials (ASTM)
   1. ASTM C168 – Standard Terminology Relating to Thermal Insulation.
   2. ASTM C177 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
   3. ASTM C209 – Methods of Testing Insulating Board, Structural and Decorative.
   4. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   5. ASTM C1289 – Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   6. ASTM C1303 – Standard Test Method for Estimating the Long Term Change in the Thermal Resistance of Unfaced Closed Cell Plastic Foams by Slicing and Scaling Under Controlled Laboratory Conditions.
   7. ASTM D1079 – Standard Terminology Related to Roofing and Waterproofing.
   8. ASTM D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
   9. ASTM D2126 – Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
   10. ASTM D2842 – Standard Test Method for Water Absorption for Rigid Cellular Plastics.
   11. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
   12. ASTM E96 – Standard Test Method for Water Vapor Transmission of Materials.
   13. ASTM E108 – Standard Test Methods for Fire Tests of Roof Coverings.

C. National Roofing Contractors Association (NRCA) – Roofing and Waterproofing Manual.

D. Sheet Metal and Air Conditioning Contractors National Association, Inc., (SMACNA) – Architectural Sheet Metal Manual.

E. Underwriters Laboratories (UL) – Roofing Materials and Systems Annual Directory.

F. ANSI/SPRI WD-1: Wind Design Standard Practice for Roofing Assemblies.

G. ANSI/SPRI ES-1: Wind Design Standard for Edge Systems used with Low Slope Roofing Systems.

H. National Fire Protection Association (NFPA): NFPA 241-Safeguarding Building Construction Operations.

I. Environmental Protection Agency (EPA): EPA Method 9045.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Positive Drainage: The drainage condition in which consideration has been made during design for all loading deflections of the deck, and additional roof slope has been provided to ensure drainage of the roof area within 48 hours of rainfall, during ambient drying conditions.

C. Roof System: A system of interacting roof components generally consisting of a membrane, roof insulation and air or vapor retarder (if present) (not including the roof deck) designed to weatherproof a structure and improve thermal resistance.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01 Section "Project Management and Coordination." A/E will schedule and conduct meeting. Review methods and procedures related to roofing system including, but not limited to, the following:
1. Meet with Owner; A/E; roofing Installer; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.
10. Deviations from the project specifications or the approved shop drawings are not permitted without prior written approval by roofing membrane manufacturer, the Owner, and the A/E.

B. Sequencing
1. Work shall begin only after openings and penetrations are in place and adjacent work required for a complete tie-in is in place. This includes masonry with special attention being given to roof-to-wall transitions. Work shall not begin:
   a. Before the “Preinstallation Conference” has occurred
   b. Until conditions exist necessary for successful completion of roofing.
   c. Without presence and approval of manufacturer’s representative
2. Prior to and during application, all dirt, devices and dust shall be removed from surfaces by vacuuming, sweeping, blowing with compressed air or similar methods.
3. Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the Applicator shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas.

4. After work on roof is started, no traffic will be permitted on the roof other than necessary for the roofing application and inspection. Materials shall not be piled on to the roof to the extent that design live loads are exceeded. Roofing materials shall not be transported over unfinished or finished roofing or existing roofs.
    a. Work shall begin at the furthest point from the designated spot where materials are shipped to the roof.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Submit specifications, installation instructions, and general recommendations from roofing materials manufacturer for type of roofing required. Include data substantiating that materials comply with requirements of this specification, inclusive of accelerated weathering data.
    1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing or SPRI's Directory of Roof Assemblies listing.
    2. Storage and handling requirements and recommendations.
    3. Roofing Assembly letter from Membrane Manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

B. Shop Drawings: Submit to membrane manufacturer for review and comments before issuing to A/E. Include plans, elevations, sections, details, and attachments to other Work.
    1. Layout and thickness of insulation, fastener type and length.
    2. Perimeter and penetration details, including base flashings and membrane terminations.
    3. Tapered insulation, including slopes.
    4. Insulation fastening patterns for corners, perimeter, and field-of-roof locations.
    5. Flashing Conditions: Show all roofing conditions, include location and type of all penetrations, including but not limited to drains, perimeter conditions, roof penetration conditions, expansion joints, etc. The shop drawings must be reviewed and approved by the roof system manufacturer to assure the completed installation will meet the manufacturer's warranty requirements.
    6. Wind Uplift Securement: Provide roof plan(s) marked-up to indicate extent of roof corner and roof perimeter areas, inclusive of fastener spacing/density. This drawing must be reviewed and approved by the roof system manufacturer to assure the completed installation will meet the manufacturer's warranty requirements and the "Performance Requirements" listed in this specification.
    7. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.

1.6 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system and qualifies to receive manufacturer's 20 year, no-dollar-limit warranty (even if a lesser warranty is specified).

B. Manufacturer Certificates:
    1. Submit evidence of meeting performance requirements, including uplift resistance.
    2. Submit insulation fastening patterns for corner, perimeter, and field-of-roof locations to meet performance requirements.
    3. Submit an intent to warrant, executed by authorized representative of system manufacturer, indicating that manufacturer has reviewed drawings, specifications, and conditions affecting the work and, and proposes to provide warranties as referenced herein without further stipulation.
    4. Submit a letter from the roof membrane manufacturer certifying the proposed roofing assembly, compatibility of materials and total R-value of insulation.

C. Qualification Data: For Installer and manufacturer.

D. Sample Warranty: Copy of manufacturer's warranty stating obligations, remedies, limitations, and exclusions before starting work.
    1. Contractor shall submit manufacturers approved "Pre-Installation Notice" (PIN) to A/E.

1.7 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Maintenance Data: For roofing system to include in maintenance manuals.
      a. Roofing membrane manufacturer shall submit a Roof Maintenance and Inspection Manual with warranties and project closeout submittals. (Final payment will not be made until roof maintenance manual is submitted.)
      b. Roof Maintenance and Inspection Manual shall include:
         1) Cover letter recommending to the Owner that 2 roof maintenance inspections should be conducted per year.
         2) Table of Contents.
         3) Visual observation checklist indicating specific flashings and details to be observed. Include items such as base flashing seams, reglets and counterflashings, roof edge flashings, roof penetration flashings, roof curb flashings, boot flashings, roof drain areas, parapet wall flashings, copings, roof membrane seams, skylight flashings, etc. Applicable items shall be listed per project.
         4) Copies of “Project Record” roofing details.
         5) Roof plan indicating penetrations, detail locations, roof drains, and seams.
         6) Final inspection report.
   2. Warranties: Special warranties specified in this Section. When warranties are delivered to the Owner, a cover letter shall be included directing the Owner to inform (copy) the manufacturer as well as the Contractor, when reporting roofing problems, regardless of when they occurred during the warranty period, including any ‘Punch List” items.
      a. Contractor shall submit manufacturers approved “Pre-Installation Notice” (PIN) to A/E.
   3. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.8 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer Qualifications: A qualified manufacturer that is UL listed or listed in FM Approvals’ RoofNav for roofing system identified to that used for this Project.
      a. Manufacturer must be in addition to attending Pre-Installation Conference and final inspection participants in Field Quality Control inspections to verify products are being installed as recommended. Inspections shall be schedule at critical points to verify membrane perimeter and penetrations are properly terminated per written instructions and submittal documents. Refer to “Field Quality Control” article for additional manufacturers inspections.
         1) Manufacturer’s inspector shall be a field technical inspector employed by the manufacturer not engaged in the sale of products. Inspector shall be experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and to determine installer’s compliance with the requirements for the Project and the manufacturer’s warranty certification.
         2) Manufacturer’s inspector services shall include examination of substrates and conditions prior to membrane installation including verification of fastening of substrate to structure. Inspections shall also include observation of membrane installation, detailing, flashing, in progress work, and complete portions of the work.
         3) Manufacturer’s inspector may not approve a roof installation as warrantable or acceptable if any current condition of the application of the new system does not meet the current published manufacturer’s standards or submittals without review by A/E. The warrantability issue is part of the Contract Documents and does not take precedent over all contract requirements.

4) Manufacturer’s inspector after site visit shall provide a written report to the A/E and roofing contractor. Report shall indicate existing conditions on day of inspection, work occurring, observation of work, workmanship and materials stored at the project site. A minimum of 5 pictures of roofing work shall be included in the reports. Reports shall be submitted within 7 days of the site visit.

2. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer’s product and that is eligible to install and receive a manufacturer’s 20 year (or manufacturer longest period for specified product) no-dollar-limit warranty. Installer must verify this approval with a letter from manufacturer and supply letter even if a lesser warranty is specified.
   a. The Contractor shall obtain from the roofing manufacturer copies of each roof inspection and furnish a copy to the A/E. The Contractor shall inform the roofing manufacturer, with regard to warranties, that warranties shall be issued, based upon the acceptance of the roofing work, and that deficiencies noted on inspection reports have been corrected. The manufacturer shall not refuse or restrict the provisions of its warranty, based upon deficiencies noted on inspection reports, especially any report that may not have been furnished to the A/E. Inspections shall be a minimum of 3 and scheduled randomly (no prior notification) and selection of the roofing manufacturer's inspector(s) shall not be influenced by the roofing subcontractor’s preferences. The A/E will not approve final payment of roofing work until final and interim inspection reports and warranty are in hand. The A/E's representative shall accompany the manufacturer's inspector and Roofing Installer during final inspection prior to issuing manufacturer's warranty.
   b. The roofing installer shall have on the job whenever roofing work is being done, a foreman/supervisor with a minimum 3 years experience in the type of roofing specified or the roofing manufacturer's technical field representative and provide adequate number of experienced workman regularly engaged in this type of work who are skilled in the application techniques of the materials specified.
3. Roofing and associated work shall be performed by a single firm called the "Installer" in this Section, so that there will be undivided responsibility for the specified performance of components parts including, but not limited to, the following (even through some parts may be subcontracted to others):
   a. Division 06 Section "Rough Carpentry": For wood insulation shops, wood nailers, and blocking required for installation of new roof and sheet metal.
   b. Division 07 Section "Sheet Metal Flashing and Trim."
   c. Division 07 Section "Roof Specialties."

B. Source Limitations: Obtain components, including roof insulation and fasteners, for membrane roofing system from or approved by roofing membrane manufacturer in writing.

C. There shall be no deviations made from this specification or shop drawing without prior written approval of the A/E. Any deviation from the manufacturer’s installation procedures must be supported by a written certification on the manufacturer’s letterhead and presented for the A/E’s consideration.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
   1. All materials delivered from manufacturers and suppliers should be carefully inspected at the time of delivery and examined during unloading. Manufacturers’ product labels should be intact. Any damaged or unsuitable material should be rejected. Material that has been exposed to weather in transit or storage should be examined carefully for deterioration and damage.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
2. Lids should be secured on cans of stored material.
3. Water-based materials such as asphalt emulsions, acrylic coatings and water-based adhesives should be protected from freezing.
4. Solvents, adhesives, and sealants should be stored at proper temperature. Read instructions contained on adhesive canister for specific storage instructions.
5. Store seam tapes and adhesives above 60 degrees F, unless otherwise recommended by manufacturer.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
1. When moisture-sensitive materials are stored outside, they shall be placed on pallets or platforms that are raised off the ground or roof deck (at least 4 inches). Materials sensitive to moisture should be covered with water-resistant coverings that have been properly secured. Coverings that are “breathable,” such as water resistant canvas tarpaulins are preferred. Factory applied shrouds used for shipping alone are not acceptable. Cover top and sides of materials and secure cover. Remove wet products from project site.
    a. During inclement seasons, or extended periods (two weeks) it is suggested that moisture sensitive materials be stored in vans or enclosed areas protected from moisture or elevated humidity.
    b. Materials determined by A/E to be damaged or to have been subjected to adverse conditions shall be removed and replaced at contractor’s expense.
2. Protect insulation against concentrated loads, and standing loads exerting a force in excess of 50 percent of the materials compressive strength.
3. Do not expose foam core to excessive heat, sparks, or open flame.

D. Single-ply sheet materials may be stored as shipped with rolls laying horizontally or as recommended by manufacturer.
1. When rolled materials are stored, the storage substrate should be swept to rid the surface of loose gravel, share objects and other debris that could damage the membrane material.
2. Cover with tarps so moisture does not gather in the rolls. Unvented polyethylene tarpaulins are not accepted due to the accumulation of moisture beneath the tarpaulin in certain weather conditions that may affect the ease of membrane weld ability.

E. Provide continuous protection of products during delivery, storage, handling, and application.

F. Do not store roofing materials in concentrated areas of roof deck.
1. Stored material should be raised up off the roof surface out of any standing water.

G. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
1. Average live loads on the roof during the work shall not exceed twenty pounds per square foot at any time.

H. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Closely follow precautions/instructions outlined on container or supplied by manufacturer/supplier.
1. Liquid propane (LP) gas containers shall be in an upright position at all times.
    a. Comply with NFPA 58 "Standard for the Storage and Handling of Liquified Petroleum Gases" as well as appropriate publications of the National LP Gas Association.

1.10 FIELD CONDITIONS

A. Weather Condition Limitations
   1. Proceed with roofing and associated work only when weather conditions will permit unrestricted use of materials and quality control of the Work being installed, complying with the requirements and with the recommendations of the roofing materials manufacturer.
      a. Proceed only when the Installer is willing to guarantee the work as required and without additional reservations and restrictions.
   2. Apply in dry weather on a dry deck only. Where rain or inclement weather occur during application, the Work shall stop and not resume until the weather has cleared and the deck is dry.
      a. When membrane roofing materials are applied, entrapment of moisture should be prevented. Moisture in or on materials may cause membrane problems. If precipitation occurs before completely installing the roof membrane, the membrane surface in the immediate work area and the substrate should be dried or allowed to dry before work resumes.
   3. Only as much roofing as can be made weathertight each day, including all flashing and detail work, shall be installed.
      a. Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in contact with the finished roof as the installation progresses. Contaminated membrane shall be replaced at no cost to the Owner.
   4. Cold Weather
      a. When the outside temperature is below 40 deg F, certain combinations of temperature and humidity may cause condensation on the surface of solvent-based adhesives and primers. If this condition occurs, discontinue the application. When the ambient air conditions no longer cause condensation on adhesive surfaces and the membrane is clean and dry then re-apply additional adhesive or primer and proceed.
      b. The consistency of sealants, adhesives and primers will begin to thicken as the temperature drops. To minimize this, the following is recommended:
         1) Start work with sealants, adhesives and primers that have been stored between 60 and 80 deg. F. Insulated and heated boxes may be helpful.
         2) Complete test areas to determine if conditions will cause problems such as condensation with the application of the materials.
         3) Stop the operation or change to another warm container when material becomes too thick to properly apply.
      c. When the outside temperature is below 40 deg., installation of the roofing system may require additional application procedures, consult with manufacturer:
         1) Ensure that the roof surface is dry. Moisture, even trace amounts, may cause poor adhesion, and may lead to moisture entrapment within the roofing system.

B. All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.

C. The applicator shall follow all safety regulations as required by OSHA and any other applicable authority having jurisdiction.

D. Precautions shall be taken when using adhesives at or near rooftop vents or air intakes. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odor while ventilating the building. Keep lids on unused cans at all times.

E. Membranes are slippery when wet or covered with snow, frost, or ice. Working on surfaces under these conditions is hazardous. Appropriate safety measures must be implemented prior to working on such surfaces. Always follow OSHA and other relevant fall protection standards when working on roofs.

F. Construction Traffic: Construction site traffic from all trades should be limited to designated areas and walkways. Completed roof membranes are not suitable as work platforms or staging areas for other trades. If construction traffic is anticipated or inevitable, the use of temporary roofs can act as a sacrificial traffic surface, allowing for construction traffic and abuse until the primary weatherproofing membrane is installed.

1.11 WARRANTY

A. Special Total System Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
   1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, cover boards, substrate board, vapor retarder, and other components of membrane roofing system, including metal work i.e. coping and roof edge-specialties.
   2. The warranty shall guarantee the roof membrane system at wind speeds up to 72 mph measured at 10 meters above ground.
   3. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
   4. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacturer, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2,000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746, ASTM D 4272 or the “Resistance to Foot Traffic Test” in Section 5.5 of FM 4470.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Roofing System Design: Provide a membrane roofing system that is listed on IBC ES-Reports or is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7 and also tested in accordance with FM 4474, UL 580, or UL 1897.

1. Fire/Windstorm Classification: Calculations shall not result in a roofing design less than FM Class 1A-60 requirements.

D. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1987;
   1. Low Roof Areas:
      a. Field-of-Roof Uplift Pressure (Zone 1): 37.61 lbf/sq.ft
      b. Perimeter Uplift Pressure (Zone 2): 63.2lbf/sq.ft.
      c. Corner Uplift Pressure (Zone 3): 95.0 lbf/sq.ft.

E. Polyisocyanurate Insulation
   1. Compressive Strength: 20 psi min.
   2. Dimensional Stability – maximum dimensional change after installation (inches).
      a. Length: +/- 1/8
      b. Width: +/- 1/8
      c. Thickness: +/- 1/16
      d. Squareness: 1/16
      e. Flatness: 1/16
   3. Moisture Vapor Transmission: ASTM E96, <1 perm.
   4. Water Absorption: ASTM C209, <1 percent by volume.
   5. Flame Spread: ASTM E84, <50.
   6. Service Temperature: Minus 100 degrees to 250 degrees F.
   7. Smoke Developed: ASTM E84, <450.
   8. Acidity: EPA Method 9045, 6 pH minimum, 8 pH maximum.
   9. Aged R-Value per Inch: ASTM C177 and C518, 5.6 R.

F. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency, unless otherwise noted.

## 2.3 PVC ROOFING MEMBRANE

A. PVC Sheet: ASTM D 4434, Type II, Grade 1, fabric reinforced.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. SureFlex 60 mil PVC; Carlisle SynTec Systems.
      b. JM PVC-60 MIL; Johns Manville, Inc.
      c. Sarnifil-G410 60; Sika-Sarnafil Inc.
      d. XT 50 mil PVC; FiberTite
   2. Thickness: Minimum 50 mil thick.
   3. Exposed Face Color:
      a. Provide White at all low-slope applications, unless otherwise noted.

## 2.4 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
   1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, 60 mil thick, type, reinforcement, thickness, and color as sheet membrane, unless otherwise noted.

C. Bonding Adhesive: Manufacturer's standard solvent-based bonding adhesive, water-based bonding adhesive shall be utilized unless cold conditions require the use of solvent-based adhesives and their use is approved by A/E.

D. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

E. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
   1. Use only where indicated. In areas where metal counterflashing or surface mounted reglets are used they must be sealed with a sealant to prevent moisture migration behind the flashing.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Approvals Corrosion Test, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
   1. Mixing metal types and methods of contact shall be assembled in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins. All concrete fasteners and anchors shall have a minimum embedment of 1-1/4 inch and shall be approved for such use by the fastener manufacturer. All miscellaneous wood fasteners and anchors used for flashings shall have a minimum embedment of 1 inch and shall be approved for such use by the fastener manufacturer.
   2. Pullout Value: Fastener shall provide a minimum pullout of 450 pounds.
   3. Static Backout Resistance: Fastener shall provide a minimum static backout resistance of 10 inch pounds.
   4. Where fasteners will be in contact with wood treated with preservative chemicals, provide fasteners and anchorage with hot dip zinc coating of G90 complying with ASTM A153 or of Type 304 or 316 stainless steel.

G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.
   1. Water Cut-Off Sealant: Butyl-based, non-curing, non-hardening sealant.
      a. Manufacturers:
         1) Sika Corporation; Sikalastomer – 511.
         2) Schnee-Morehead; Acryl-R SM 5430.
         3) Edge Adhesives; Rubex Non-Skinning Butyl Sealant.
   2. Sealant: 1 or 2 component polyurethane-based sealant meeting ASTM C 920, Type S, Grade NS, Class 35, Use NT, M, A, G, and I. Manufacturer-approved primers are required. Color to match adjacent material.
      a. Manufacturers
         1) BASF; MasterSeal NP 1.
         2) Schnee-Morehead; Permathane.
         3) Sika Corporation; Sikaflex-1a.
   3. Sealant Primers: Sealant primer is a quick-drying solvent-based primer for priming joints and substrates before the application of sealants.
      a. Manufacturers
         1) BASF; Sonolastic Primer 733.
         2) Sika Corporation; Sikaflex Sealant/Admixture Primer.
         3) Schnee-Morehead; Primer.
   4. High Temperature Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, A, and O with a service temperature up to 300 degrees F. For use in through-penetration firestops.

H. Splash Blocks: 16 inch square by 2 inch thick precast 5000 PSI concrete with mix added water-repellent additive and striated top finish.

I. Protection Sheet: An extra sacrificial layer of roofing membrane that extends a minimum of between 3 and 6 inches beyond the edges of the splash pans or downspouts. Thickness shall be equal to or greater than thickness of field membrane.

J. Secondary Seal/Flexible Vapor Retarder: Continuous waterproof EPDM membrane ASTM D 4637, or Neoprene membrane within joint and attached to substrate on each side.
   1. Expansion joints

K. Thermal Insulation/Compressible Insulation: Mineral-fiber blanket, ASTM C 665, to fill space above secondary seal/flexible vapor retarder.
   1. Maximum flame-spread and smoke-development indexes of 25 and 50 respectivel, per ASTM E 84.
   2. Expansion joints.

L. Flexible Foam Rod: Closed-cell support foam in configuration indicated on Drawings.
   1. Expansion joints.

2.5 VAPOR RETARDER

A. Vapor Retarder/Barrier Laminate Sheet: Polyethylene laminate, two layers, reinforced with cord grid, with maximum permeance rating of 0.06 perm.
   1. Location: Over standard metal deck areas.

B. Vapor Retarder/Barrier Laminate Sheet Manufacturers:
   1. Griffolyn Type – 65; Reef Industries.
   2. DURA-SKRIM 6WW; Raven Industries.
   3. WMP-VR; Lamtec Corporation.
   4. PE-10; Sika-Sarnafil.

C. Auxiliary Materials
   1. Tape: 4 inch wide self-adhesive pressure sensitive air barrier tape with flame spread index of 25 or less, smoke-developed index of 50 or less provided by or recommended by vapor retarder manufacturer for sealing seams and penetrations (i.e. curbs).
   2. Pipe Flashings (with deck flanges): Sized to fit typical penetrations (i.e. water lines, gas lines, drain pipes, and vent pipes).
   3. Butyl Tape: 1.5 inches to 2.0 inches wide 35 mil butyl tape used to seal the perimeter edge and penetrations through the air barrier.

2.6 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
   1. Insulation must be manufactured by or approved in writing by membrane manufacturer for system specified. Insulation must meet requirements for manufacturers total system warranty requirements and comply with FM 4450 or UL 1256.

B. Polyisocyanurate Board Insulation: ASTM C 1289-11A, Type II, Class 2 Grade 2 min., coated polymer bonded glass fiber mat facer on both major surfaces. Facers shall be non-organic biological growth resistant. Provide Grade 3 when required by manufacturer to meet Performance and Warranty requirements.
   1. (LTTR) Thermal resistance of insulation shall be calculated as 5.6 per inch.
   2. Nominal total thickness**,** 4 inches minimum, unless otherwise noted.
      a. Bottom Layer: 2 inch, maximum.
   3. Size: Restrict boards installed in adhesive to 4 foot by 4 foot.

C. Tapered Insulation (Field-of-Roof): Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.
   1. Polyisocyanurate Insulation
      a. Minimum Thickness: 1/2 inch at tapered starting point, unless otherwise noted.
      b. Average Thickness: 4 inches overall including tapered and base insulation calculated using the Volumetric Average Thickness method.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.7 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions in FM Approvals Corrosion Test, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer. The type of fastener shall be appropriate for the substrate to achieve maximum withdraw and anti-corrosion characteristics. The membrane manufacturer approved fasteners shall also meet the following requirements:
   1. FM 4470 SPRI Corrosion Test Procedure and Guidelines for Roofing Fasteners. To pass, the fasteners shall not accumulate more than 15 percent red rust after the "required number cycles" in the Kesternich cabinet.
      a. FM and SPRI recommended number, but in no case shall it be less than 15.
   2. Pullout Value: Fastener shall provide a minimum pullout of 450 lbs.
   3. Static Backout Resistance: Fastener shall provide a minimum static backout resistance of 10-inch pounds.
   4. Steel Deck
      a. Fasteners to have self-drilling tip. Fastener tip shall be capable of cutting steel deck material of 20 gauge thickness at point of steel deck segment overlap without damage to the fastener tip.
      b. Fasteners shall be installed in high flute of metal deck with a minimum of three-quarter inch (3/4 inch) penetration. Fasteners shall not extend past the bottom of the metal deck.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
   1. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
   2. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Cover Board: Provide one of the following coverboards as approved by roofing manufacturer for system specified:
   1. ASTM C 1177, glass mat, water resistant gypsum substrate (primed). Facers shall be non-organic biological growth resistant).
      a. Manufactures:
         1) DensDeck Prime with EONIC Technology; Georgia-Pacific Gypsum.
         2) DEXcell FA; National Gypsum.
         3) GlasRock Roof Board; CertainTeed Corporation.
         4) Securock UltraLight Coated Glass-Mat Roof Board; USG
      b. Thickness: 1/4-inch minimum. Provide 1/2-inch thickness where required to meet assembly and warranty requirements.
   2. Not Acceptable: Do not substitute either cellulosic fiber (ASTM C208), Oriented Strand Board, or fiber-reinforced gypsum roof board (ASTM C1278).

E. Sprayed-Polyurethane Foam Sealant: 1 or 2 component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 16/cu.ft. density; flame spread index for 25 or less according to ASTM E 162; with primer and non-corrosive substrate cleaner, if recommended by foam sealant manufacturer.
   1. Provide single-component polyurethane sealant low-expansion sealing gaps less than 1/2 inch.
   2. Provide one component foam for voids from 1/4 to 2 inches.
   3. Manufacturers
      a. Dow Chemical Company
         1) Great Stuff Pro Gaps and Cracks; gap $\leq$ 1/2 inch
         2) Froth Pak Foam Sealant; gap $\leq$ 1/2 inch
      b. Convenience Products
         1) Home Seal; gap $\leq$ 1/2 inch

c. FOMO Products
   1) Extreme; gap ≤ 1/2 inch
   2) Handi Foam; gap ≤ 1/2 inch
d. Hilti Corporation
   1) CF810; gap ≤ 1/2 inch

F. Flexible Walkways: Factory-formed, PVC membrane, heavy-duty, slip-resistant, surface-textured walkway pads, square in shape, approximately 30- to 39-inches wide by at least 0.072-inchthick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
1. Material manufacturers printed installation instructions are available for information and review.
2. Safety precautions and safety data sheets (SDS's) are available during application.
3. Specified materials and specified quantities, as verified by on-site inspection of product labels, are at the project site and are usually suitable for application (e.g., packaging not damaged, labels intact).
4. Materials are stored according to the manufacturers recommendations (e.g., proper temperature, covered, off ground, on pallets).
5. Equipment is in good working order and functioning properly.
6. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
7. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation and have been installed in areas to receive roofing.
   a. Verify existing fastening to comply with FM 1-49 requirement and enhance to secure as required.
   b. Replace deteriorated sections with new dimensional lumber of the same size.
8. Verify work required for complete tie-in is in place. This includes masonry with special attention given to roof to wall transitions.
   a. Verify that all counterflashing receivers, curbs, etc., are constructed in such a manner as to provide a minimum 8 inch base flashing height measured from the finished roof's surface to the top of the base flashing membrane.
9. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Division 05 Section "Steel Decking."
10. Drainage patterns for proper roof membrane installation have been identified.
11. Verify all surfaces are smooth and free of dirt, debris and incompatible materials and free of water, ice and snow.

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

3.2 PREPARATION

A. Review "Performance" and "Warranty" requirements with membrane manufacturer to ensure compliance before beginning roofing work.

B. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
1. Roof deck must be free of ponding water within 48 hours of rainfall. Use corrective measures to provide positive drainage.

D. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
   1. When completion of flashings and terminations is not completed by the end of each workday, provisions must be provided to temporarily close the membrane to prevent water infiltration. Phased roofing is not acceptable.
   2. Temporarily seal loose membrane edge down slope so that the membrane edge will not buck water. Caution must be exercised to ensure that membrane is not temporarily sealed near drains in such a way as to promote water migration below membrane.

E. Perform fastener-pull tests according to roof system manufacturer's written instructions.
   1. Submit test result within 24 hours of performing tests.
      a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 APPLICATION, GENERAL

A. Application of the roofing products for installation shall be in accordance with the roofing material manufacturer's written instructions, for installation procedures and requirements not addressed in manufacturer's written instructions comply additional requirements of the project specifications and drawings, including recommendations of NRCA, SMACNA, and SPRI. Material manufacturer's recommendations related to weather (temperature, moisture, and humidity), surface preparation, and shelf life must be observed.

B. Only install as much roofing as can be made weathertight each day, including all flashing work.
   1. Where possible, roof membrane panels shall be installed in such a manner as to create water-shedding seams.

C. Dry Surfaces: All surfaces to receive new insulation, membrane, or flashings shall be thoroughly dry.
   1. Metal deck surface to receive substrate board or insulation shall be thoroughly dry. Should surface moisture occur, the Contractor shall provide the necessary equipment to dry deck surface prior to application of roofing components.
      a. This is acceptable for metal roof deck only. Drying of roofing components including substrate board, insulation, and cover boards is not acceptable. If any of these products have moisture in them, or have had moisture on them they shall be removed and replaced.
      b. Roof decks shall be rigid, tight, dry, and clean of dust or debris. Now work shall start without testing of deck dryness at the beginning of each work day or period. It shall be the responsibility of the Contractor to maintain the deck in the proper and acceptable condition of application of the roof covering.
         1) Installer shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Applicator shall report any such blockages.

D. All new and temporary construction, including equipment and accessories, shall be secured in such a manner, at all times, as to preclude wind blow-off or wind damage.

E. Temporary water stops shall be installed at the end of each day's work, and shall be removed before proceeding with the next day's work. Temporary water stops shall be constructed to withstand protracted periods of inclement weather. Water stops shall be compatible with all materials and shall not emit dangerous or incompatible orders.

F. The Contractor is cautioned that the roof membrane may be incompatible with certain substances. Such materials shall not come into contact with the roof membrane at any time. If such contacts occur, the material shall be cut out and discarded. The Contractor shall consult material manufacturer with respect to material compatibility precautions, and recommendations.

G. If any unusual or concealed condition is discovered, stop the work and notify the A/E immediately in writing.

H. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified.

I. Quality Control (During Application) Checklist
   1. Weather and job conditions are suitable for the application.
   2. Substrate is sufficiently dry and suitably prepared to receive the insulation and roof membrane.
   3. Insulation and cover boards, if applicable, are butted together, as required, with joints staggered and offset if more than one layer is being used.
   4. Insulation is firmly attached with specified type and number of fasteners, or embedded in adhesive to substrate or underlying insulation as specified.
   5. Temporary water cut-offs are installed at the end of each day's work as required.
   6. Membrane sheets are installed to side laps and end laps that buck water are minimized.
   7. Perimeter membrane fastening complies with specifications and manufacturers' requirements.
   8. Membrane flashings are installed along with each day's completed roof area.
   9. In high-traffic areas, protection board is being used over newly completed membrane.
      a. Roof is not being abused by other trades.

## 3.4 VAPOR-RETARDER INSTALLATION

A. Vertical control/expansion joints through parapet walls shall be sealed with butyl tape or sealant prior to installation of the vapor retarder.

B. All surfaces to receive the vapor retarder shall be dry prior to installation.

C. Loosely lay polyethylene and/or polyethylene film vapor retarder in a single layer over entire roof deck extending to roof edges and to adjacent walls.

D. Side and end lap each sheet a minimum of 2 inches and 6 inches respectively.

E. Vapor retarder/Barrier shall be positively sealed at all edges, penetrations and walls utilizing manufacturer's vapor retarder accessories.
   1. Seal laps with continuous strip of tape recommended by the air barrier manufacturer.
   2. Penetrations
      a. Round Pipes: Seal with a pre-manufactured pipe boot or butyl tape to seal to pipe.
      b. Curbs: Seal with butyl tape to seal to the side walls of the curb.
   3. Roof Drains: Seal to exterior side of drain bowl with butyl tape.
   4. Seal vapor retarder to the steel deck of roof edges with butyl tape. At edges of the deck where there are corrugations, the flutes on the top side of the roof deck shall be filled with spray foam insulation and then trimmed flush. The spray foam insulation shall provide a continuous surface where the vapor retarder can be sealed.

## 3.5 INSULATION AND COVER BOARD INSTALLATION

A. Comply with roofing system manufacturer's written instructions for installing roof insulation, including warranty requirements for installing insulation.
   1. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
   2. Size: Restrict boards installed in adhesive to 4 foot by 4 foot.

B. Roof Insulation – General: Lay in multiple layers. Edges shall be butted to provide moderate contact but not deformed or placed in surface compression. Neatly cut and fit insulation around projections and vertical surfaces. Edges shall be mitered at ridges and elsewhere to prevent open joints or irregular surfaces. Stagger end joints (6 inches) in adjoining courses of base course. Stagger joints in succeeding layers with joints of layer below.

1. Insulation shall be installed in multiple layers except a single layer may be used for one board width, around drains, if thickness at drain is 2-1/2 inches or less.
    a. No single layer of insulation shall exceed 2 inches. Other locations shall be made up of 2 or more layers with staggered joints in both directions.

C. Install tapered insulation under area of roofing to conform to slopes indicated. Tapered insulation combined with tapered saddles and drainage crickets shall achieve positive drainage. Tapered saddles at a 1/2 inch per foot slope shall be placed between drains, and crickets shall be placed on the up slope side of mechanical, skylight, and other curbs to provided positive drainage. Mechanical units should not restrict flow of runoff water.
    1. Refer to NRCA Roofing and Waterproofing Manual – 2011, Figure 10-7, “Guide for Crickets and Saddles” and Figure, “Guide for "Crickets.”
    2. Tapered insulation shall be installed between the bottom and top layer of flat stock insulation. This will prevent stepped transitions from occurring at the edge of tapered insulation boards.
    3. Tapered insulation should originate at the valley line/low point of the roof in lieu of the center of the roof drains. The structure often causes the roof drains to be offset from the valley line/low point of the roof. Saddles/crickets shall provide positive slope towards drains and not allow ponding to occur in valley lines.
    4. Use tapered insulation to provide a square sump centered on drains. 8 by 8 foot square sump centered on drains is preferred.
        a. 8 by 8 foot sump is preferred, where sump is not limited by penetrations.
        b. Do not field taper insulation.

D. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation or low-rise urethane adhesive.
    1. Support the two opposite sides of each board on steel deck flanges, as close as practical to the center of the flange with a minimum bearing width of 1 inch. Trim board edges if they veer off the flange center.
    2. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
    3. Fill remaining gaps around projections, penetrations, and perimeter with low-rise urethane adhesive (foam), including but not limited to:
        a. Between perimeter of insulation boards and nailers.
        b. Between nailers and vertical walls.
        c. Between penetrations and insulation boards.
        d. Between voids in insulation boards, inclusive of roof system slope transition conditions.
    4. All voids to be filled to match full thickness of insulation boards.
    5. Provide urethane foam sealant produced or acceptable to the roofing system/installation system manufacturer.

E. Installation Over Metal Decking:
    1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows end joints staggered not less than 12 inches in adjacent rows and with long joints continuous at right angle to flutes of decking.
        a. Locate end joints over crests of decking.
        b. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
        c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
        d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
        e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
            1) Trim insulation so that water flow is unrestricted.
        f. Fill gaps exceeding 1/4 inch with insulation.
        g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

h. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification and SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
f. Trim insulation so that water flow is unrestricted.
g. Fill gaps exceeding 1/4 inch with insulation.
h. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
i. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
2) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

## 3.6 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.
a. Trim cover board so that water flow is unrestricted.
3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification or SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
b. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

B. If required by manufacturer or tested assembly, install slip sheet over cover board and immediately beneath roof membrane.

## 3.7 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. In addition, the corner and perimeter areas shall have enhanced fastening in accordance with FM1-29. Unroll roofing membrane and allow to relax before installing.
1. Install sheet according to ASTM D 5036.

B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel, A/E, and testing laboratory representative, if required.

C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply bonding adhesive to substrate at rate required by manufacturer and immediately install roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
   1. The membrane adhesive shall be installed per the membrane manufacturer's requirements. Note: Differing insulation facers require specific application methods and quantities of adhesives. Water-based adhesives should be utilized (unless cold conditions require the use of solvent-based adhesives); inclusive of manufacturer's required fasteners and additional fastener requirements as required to meet performance requirements.
      a. Conversion to the solvent-based adhesive shall be only with permission from the A/E.
      b. Bidder is cautioned to include the type of bonding adhesive that the membrane manufacturer will warrant based on the conditions under which the roof will be installed.

E. Fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing. The roofing membrane shall be secured to nailers.
   1. Membrane shall be secured at the perimeter of each roof level, roof section, expansion joint, curb, skylight, interior wall, penthouse, etc., at any angle change which exceeds 2 inches in one horizontal foot and at all other penetrations in accordance with manufacturer’s details.
   2. Terminate membrane under a termination bar, metal fascia or coping, unless otherwise noted or approved as part of submittal process.
   3. Provide premolded accessories and corners, unless otherwise noted or approved as part of the submittal process.

F. Apply roofing membrane with side laps shingled with slope of roof deck where possible. Determine the direction of water drainage and the low point of the deck. The orientation of both ends and side laps shall be such that the direction of water flow (slope) changes to avoid backwater laps.
   1. Allow sufficient membrane to cover parapet walls and flashing details at roof edge.

G. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

H. Install roofing membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and not to void warranty of existing roof system, if applicable.

## 3.8 HOT-AIR WELDING OF SEAM OVERLAPS

A. General:
   1. All seams shall be hot-air welded. All membrane to be welded shall be clean and dry.
      a. All mechanics interceding to use hot-air welding equipment shall have completed a training course provided by either the membrane or welding equipment manufacturer prior to welding.
   2. Hot-air welding equipment shall be allowed to warm up as directed by manufacturer prior to welding.
   3. Seam overlaps shall be minimum 3 inches wide when automatic machine-welded and 4 inches wide when hand-welding, except for certain approved details.
      a. Width of membrane seams shall not be less than 1-1/2 inches regardless of seaming technique.

B. Hand-Welding
   1. The back edge of the seam shall be welded with a narrow, but continuous weld to prevent loss of hot air during the final welding.
   2. The nozzle shall be inserted into the seam at a 45 degree angle to the edge of the membrane. Once the proper welding temperature has been reached and the membrane begins to “flow”, the hand roller is positioned perpendicular to the nozzle and rolled lightly. For straight seams, the 1-1/2 inch wide nozzle is recommended for use. For corners and compound connections, the 3/4 inch wide nozzle shall be used.

C. Machine Welding
   1. Machine welded seams are achieved by the use of approved automatic welding equipment. When using this equipment, all instructions shall be followed and local codes for electric supply, grounding and over current protection observed. Dedicated circuit house power or a dedicated portable general is recommended. No other equipment shall be operated simultaneously off the generator.
   2. Metal tracks may be used over the deck membrane and under the machine welder to minimize or eliminate wrinkles.

D. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation. Sealing of seams of overlapping adjacent roof membrane sheets, or overlap seams between flashing components and roof membrane sheets must be accomplished using hot air equipment specified by the membrane manufacturer for the specific membrane type, in strict compliance with roof membrane manufacturer's requirements and specifications. Width of membrane seams shall be not less than 1.5 inches regardless of seaming technique.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane. Following are guidelines for seam probing to identify cold welds, voids or other deficiencies:
      a. Allow seams to cool to ambient temperature before probing after approximately 30 minutes.
         1) Seams may be probed using tools such as a cotter key extractor that has been filled down, a blunted or dull awl or any round-tipped tool. Continuous probing will tend to sharpen the tip of the probe, so blunting the tip will need to be done on a regular basis.
      b. Draw the probing tool along the edge of the seam. Apply firm pressure to the seam, but not into the bottom membrane sheet. The tool will not penetrate the edge of a properly welded seam. Seams should be the specified width and free of voids.
      c. Mark deficiencies with a water-soluble marker.
      d. Probe repaired seams after they have cooled completely. If repair is acceptable, wipe off the marker.
   2. Test Cuts
      a. On-site evaluation of welded seams shall be made daily by the Contractor to ensure membrane seam weld quality. One inch wide cross-section samples of welded-seams shall be taken at least three times per day. Test cuts shall be taken at each start-up of welding equipment, midpoint, and at each completion of the welding process. Correct welds display failure from shearing of the membrane prior to separation of the weld. Weld quality is essential. Adjust equipment settings as necessary to assure quality welds. Based on test cut findings, appropriate membrane seam remedies must be instituted. All membrane test cut locations shall be documented and membrane test cut samples shall be labeled and provided with the required daily construction reports.
      b. Test cuts or seam samples may not represent the overall membrane seam construction. If test can or seam samples indicate defects, further sampling must be performed to establish the scope of corrective action.
      c. Additional test cuts of suspect membrane seams shall be taken at the direction of the A/E or manufacturer's representative.
      d. Each test cut shall be patched by Contractor at no additional cost to the Owner.
   3. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

4. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.
5. Where 3 or more membrane sheets overlap, the T-joints shall be treated with a handheld hot air seaming tool, or other methods as approved by the roof membrane manufacturer to ensure continued seam integrity at this point.
6. Caution: Where solvents are used to clean membrane seams, ensure presence of adequate safety and first aid information. Instruct welding operator as to appropriate amounts of heat to be used. Excessive solvent/heat will cause damage to roof membrane and certain types of insulation material. Minimize solvent dispersion of top of roof membrane.
    a. Voltage fluctuations and climate conditions will affect the temperature of the heat welding equipment and subsequent quality of the seam. Contractor must take all necessary precautions to ensure seal quality. Contractor shall continuously monitor seam quality.

E. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

F. Install roofing membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and not to void warranty of existing roof system, if applicable.

3.9 BASE FLASHING INSTALLATION

A. General: All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of A/E and membrane manufacturer. Approval shall only be for specific locations and dates. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Contractor/Applicator's expense. Flashing shall be adhered to compatible dry, smooth, and solvent-resistant surfaces. Use caution to ensure adhesive fumes are not drawn into the building.

B. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
1. All flashing membranes should extend a minimum of 12 inches above roof level, unless otherwise noted. If in question, submit in writing (RFI) to A/E and membrane manufacturer's technical department for signed approval.

C. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

D. Flash penetrations and field-formed inside and outside corners with sheet flashing and hot-air weld into place.

E. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

F. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars, covered by counterflashing. Do not tightly butt the termination bars or cross expansion joints with a solid bar.

G. Flashing
1. Walls, Parapets, and Curbs:
    a. Secure deck membrane at angle change before bonding the membrane to the vertical surface. Membrane must be fully adhered to vertical surfaces.
    b. Secure flashing membrane with fasteners in horizontal rows for additional securement when flashing height exceeds 30 inches or as required by the roof membrane manufacturer.
    c. All wood nailers exposed to the interior of the building shall be enclosed with 24 gauge, aluminum-zinc alloy-coated sheet steel.

2. Metal Edge Terminations: Approved by ANSI/SPRI ES-1
   a. The width of the perimeter wood nailer to which the metal edge is to be secured shall extend beyond the width of the metal edge deck flange.
   b. Secure the metal edge to the wood nailer as specified by the manufacturer.
   c. All perimeter wood nailers shall be totally concealed by extending the deck membrane to completely cover the nailers and extend past the bottom edge of the nailers a minimum of 3/4 inch.
   d. Prior to flashing, scrub the metal edge deck flange and membrane with splice cleaner to remove field contaminants.
3. Expansion Joints:
   a. Secure the deck membrane on both sides of expansion joints with reinforced universal securement strip. Refer to expansion joint details for proper securement details.
4. Roof Drains:
   a. During the flashing operation, drain openings shall be protected against debris, etc. Prior to roofing activities, A/E,, and Roofing Contractor shall jointly review the roof drainage system to ensure proper drainage.
   b. Provide a smooth transition from the roof surface to the drain-clamping ring. Prepare the substrate around each roof drain to avoid membrane bridging (Minimum 12 inch) at the sump area and possible distortion at the drain clamping ring.
   c. The mating surfaces between the clamping ring and drain base shall be clean and have a smooth finish.
   d. Located field splices at roof drains at least 6 inches outside the drain sump.
   e. Cut the membrane so it extends approximately 1 inch beyond the attachment points of the drain damping ring.
      1) Under no circumstances shall the hole in the membrane restrict water flow or be smaller than the drain tube.
   f. The seal between the membrane and the drain base shall be provided using Water Cut-Off Mastic under compression.
   g. Remove all existing flashing, cement, and lead in preparation for the membrane seal (application of Water Cut-Off Mastic).
   h. All bolts and/or clamps shall be in place to provide compression on the Water Cut-Off Mastic.
   i. Upon completion of roofing activities, check drain pipe to ensure that drain line is free of obstruction. Any obstructions shall be removed.
5. Vent Pipes: Preformed flashing sleeves.
   a. Flash pipes with Molded Pipe Flashing where their installation is possible.
      1) Use stainless steel clamps to seal at top.
   b. Molded pipe flashing shall not be cut and patched; deck flanges shall not overlap or be installed over angle changes.
   c. Where Molded Pipe Flashing cannot be installed, apply field fabricated pipe seals using flashing sheet.
      1) Never use a wrap around detail or molded pipe flashing on a hot or warm penetration.
6. Penetration (Pipes, Conduits, etc.)
   a. Flash pipes with molded pipe flashing where their installation is possible.
      1) Use stainless steel clamps to seal at top.
      2) Mold pipe flashing shall not be cut and patched; deck flanges shall not overlap or be installed over angle changes.
      3) Where molded pipe flashing cannot be installed, apply field fabricated pipe seals using uncured flashing.
      4) Never use a wrap around detail or molded pipe flashing on a hot or warm penetration.
   b. Flexible penetration (electrical and braided cable, etc.): Pre-molded and filed-fabricated must not b installed around flexible pipes or conduits. Flexible penetrations must be installed in a sheet metal gooseneck or other boxed out structure.

c. Penetration packets are required at the following locations:
   1) Rigid pipes with an outside diameter less than 1 inch.
   2) Clusters of pipes.
   3) Unusual shapes, e.g., structural beams, channels, or angles.

7. Mechanical Units and other Raised Curbs:
   a. Sheet metal counterflashing shall be installed to cover the top edge and overlap the upper portion of membrane base flashings unless the integral flange of the curb mounted with adequately covers the top of the membrane flashing.
      1) Provide a 4-inch coverage of roof flashings with counterflashings.
      2) Refer to Division 07 Section "Roof Accessories."

## 3.10 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
   1. Install walkways at all traffic concentration points such as roof hatches, access door, and roof top ladders.
   2. Install walkway one full width of flexible walkway around serviceable rooftop equipment.
   3. Refer to Drawings for additional requirements.

## 3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to inspect substrate conditions, surface penetration, membrane application, flashings, protection, and drainage components, and to furnish reports to A/E.

B. Manufacturers Roof Inspections: Roofing Contractor shall notify roof manufacturer in writing of schedule for Work of this Section to allow sufficient time for inspecting. Do not modify details shown in the contract documents or shop drawings without consent of manufacturer’s representative and A/E. Arrange for site inspections to verify conformance with written material manufacturer’s instructions, submittals, and the Contract Documents including this section of the project specifications.
   1. In addition to the pre-installation meeting and final roof inspection the manufacturer shall perform inspections at the following minimum rate:
      a. Up to 10,000 sq.ft. of roof contract requires one (1) inspection.
      b. 10,000 to 35,000 sq.ft. of roof contract requires two (2) inspections.
      c. 35,001 to 75,000 sq.ft. of roof contract requires three (3) inspections.
      d. 75,001 to 125,000 sq.ft. of roof contract requires four (4) inspections.
      e. 125,001 to 200,000 sq.ft. of roof contract requires five (5) inspections.
      f. 200,001 sq.ft. and over of roof contract requires six (6) inspections.
   2. Forward written reports to A/E within 10 working days of the inspection and any testing performed.
   3. If the inspection reveals any defects, promptly remove and replace defection work at no additional cost to Owner.

C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

## 3.12 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to A/E and Owner.

1. Protect existing membrane roofing system and new roof areas where continued construction traffic is anticipated.
    a. Lay protection sheet or mat over existing membrane then loose lay 1-inch minimum thick, polyisocyanurate insulation over sheet or mat and cover with loosely laid plywood or OSB panels.
    b. Protection sheet or mat: Provide a sacrificial layer of matching membrane sheet extending a minimum 6 inches beyond insulation in all directions or a woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

B. Limit traffic and material storage to areas of roofing that have been protected.

C. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

D. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

## 3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to inspect and maintain roofing system.

B. Demonstration and Training: Provide a minimum of two hours of instruction, including but not limited to the following items:
1. Review warranty requirements.
2. Review Maintenance data.
3. Review inspection procedures including:
    a. Where to look, e.g., roof access points, walkways, rooftop mechanical units, and litter.
    b. What to look for: cuts and punctures and compressed or crushed insulation.
    c. Remedial actions, emergency repair procedures.
    d. Preventative actions.

END OF SECTION 07 54 00

## SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sheet metal flashing and trim:
   1. Formed low-slope roof sheet metal fabrications.
   2. Formed equipment support flashing.

B. Related Sections include the following:
   1. Division 06 Section “Rough Carpentry” for wood nailers, curbs, and blocking.
   2. Division 07 Section "Thermoplastic Membrane Roofing" for:
      a. Preinstallation conference.
      b. Installing sheet metal flashing and trim integral with roofing membrane.
   3. Division 07 Section "Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
   4. Division 07 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.2 REFERENCES

A. American Society of Testing and Materials (ASTM)
   1. ASTM A 792 – Standard Specification for Steel Sheet, 55 percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

B. National Roofing Contractors Association (NRCA)
   1. NRCA Guidelines for Architectural Metal Flashings.

C. Sheet Metal and Air Conditioning Contractors National Association, Inc., (SMACNA).
   1. Architectural Sheet Metal Manual.

1.3 DEFINITIONS

A. Shop or Field Formed Sheet Metal: Include components that will be formed or fabricated in the field or at the fabricator’s shop. Fabrication of sheet metal flashing and trim roofing is predominantly by press brake forming.
   1. Shop or field formed roof membrane termination are not acceptable.

B. Prefabricated or Manufactured Roof Specialties: Items that will be plant manufactured ready for installation on a roof or parapet. Edge securement for low-slope roofs shall demonstrate compliance with ANSI/SPRI ES-1.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination
   1. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
   2. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leak-proof, secure, and noncorrosive installation.

B. Pre-installation Conference: Conduct conference at Project site in conjunction with roofing conference.
   1. Review construction schedule. Verify availability of materials, Installer’s personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review roof details, roof drainage, roof penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
   3. Review requirements for insurance and certificates, if applicable.
   4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" and NRCA's "The NRCA Roofing Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
   1. If there is a discrepancy between the references and the project specifications and drawings, the more stringent requirements shall govern as determined by the A/E.

B. 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage. Do not store sheet metal flashing and trim materials in contact with other materials that cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to 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. Complete sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
   1. Sheet metal flashing and trim used to terminate roof membrane must be provided part of Division 07 Section "Roof Specialties" and comply with roof manufacturer's "Total Warranty" requirements.
   2. If there is a discrepancy between these references and the project specification or drawings, the more stringent requirements shall govern as verified by A/E.

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.
   1. Comply with through wall flashing requirements of Brick Industry Association (BIA) "Technical Note No. 7 – Water Penetration Resistance – Design and Detail."

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

2.2 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.3 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
   1. Contractor may use the following materials only as indicated.

B. Stainless-Steel Sheet: ASTM A 240, Type 304.
   1. Finish: No. 2D (dull, cold rolled).

2.4 UNDERLAYMENT MATERIALS

A. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant, suitable for high temperatures over 220 deg. F.; and complying with physical requirements of ASTM D226 for Type II felts.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Atlas Roofing Corporation; Summit
      b. Kirsch Building Products, LLC; Sharkskin Ultra
      c. SDP Advanced Polymer Products Inc.; Palisade

2.5 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
   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.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
   2. Fasteners for Aluminum Sheet: Series 300 stainless steel.
   3. Fasteners for Stainless-Steel: Sheet Series 300 stainless steel.

C. Solder:
   1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. Elastomeric Sealant, where indicated only: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
   1. Provide where sealant is exposed or movement exceeds butyl sealant movement capability.

F. Butyl Sealant, unless otherwise noted: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

J. Laminated Metal: Roof membrane manufacturer's minimum 0.0247 inch thick (fka 25 gauge) galvanized steel with minimum 17-mil polyvinyl-chloride (PVC) coating.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" and NRCA's "The NRCA Roofing Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricated items where practicable. Obtain field measurements for accurate fit before shop fabrication.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:
   1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.
   2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
   2. Use lapped expansion joints only where indicated on drawings.

D. Sealant Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
   1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

F. Seams
   1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant, unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

G. Do not use graphite pencils to mark metal surfaces.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. General: Roof edge flashing and coping that terminate roof membranes shall be as specified in Division 07 Section "Roof Specialties" and not custom fabricated, unless otherwise noted and approved by A/E in writing.

B. Roof-Penetration Flashing: Fabricate from the following material:
   1. Stainless Steel: Minimum of 0.0187 inch thick.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:
   1. Stainless Steel: Minimum of 0.0187 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   2. Verify compliance with requirements for installation tolerances of substrates.
   3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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

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, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Torch cutting of sheet metal flashing and trim is not permitted.
   2. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
   3. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of welds, and butyl sealant.
   4. 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.
      a. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
   5. Do not use graphic pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
   1. Coat side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
      a. Exception: Bituminous coating is not required where stainless-steel sheet metal flashing is embedded in mortar.

2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of synthetic underlayment or Self-Adhered Sheet Underlayment.
    a. Exception: Underlayment is not required where sheet-metal flashing is embedded in mortar.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
1. Use lapped expansion joints only where indicated on drawings.

D. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails, not less than 3/4 inch for wood screws and not less than recommended by fastener manufacturer to achieve maximum pullout resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints with butyl sealant as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.
1. Do not solder prepainted, metallic-coated steel, and aluminum sheet.
2. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

H. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

## 3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements**,** and SMACNA's "Architectural Sheet Metal Manual" and NRCA's "The NRCA Roofing Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric or butyl sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
1. Seal with butyl sealant and clamp flashing to pipes penetrating roof except for flashing on vent piping.

## 3.4 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with butyl sealant to equipment support member.

## 3.5 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

## 3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

# SECTION 07 71 00 - ROOF SPECIALTIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following manufactured roof specialties:
   1. Copings.
   2. Expansion Joint Covers
   3. Counterflashings and reglets.

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry" for installing reglets.
   2. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
   3. Division 06 Section "Sheathing."
   4. Division 07 Section "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
   5. Division 07 Section "Joint Sealants" for field-applied sealants.

### 1.2 DEFINITIONS

A. Shop or Field Formed Sheet Metal: Includes components that will be formed or fabricated in the field or at the fabricator's shop. Fabrication of sheet metal flashing and trim roofing is predominantly by press brake forming.
   1. Shop or field formed roof membrane termination are not acceptable.

B. Prefabricated or Manufactured Roof Specialties: Items that will be plant manufactured ready for installation on a roof or parapet. Edge securement for low-slope roofs shall demonstrate compliance with ANSI/SPRI ES-1.

C. SPRI: Sheet membrane and component suppliers to the commercial roofing industry (address: 411 Waverly Oaks Road, Suite 331B, Waltham, MA 02452-8422, URL: www.spri.org, voice: 781-647-7026).

### 1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate installation of manufactured roof specialties with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.
   1. Verify that other trades and related work are complete before mounting coping covers.
      a. Ensure that information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
      b. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.
   2. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
   3. Refer to the construction documents, shop drawings and manufacturer's installation instructions.
   4. Coordinate installation with roof membrane manufacturer's installation instructions before starting.

B. Preinstallation Conference: Conduct conference at Project Site in conjunction with roofing conferences.
   1. Meet with Owner, CM, A/E,, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.
   2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
   3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include preparation instructions and recommendations, storage and handling requirements and recommendations and installation methods.
   3. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, verifying compliance of copings and roof edge flashings with performance requirements.

B. Shop Drawings: Show layouts of manufactured roof specialties, including plans and elevations. Identify factory- vs. field-assembled work. Include the following:
   1. Details for fastening, joining, supporting, and anchoring manufactured roof specialties including fasteners, clips, cleats, and attachments to adjoining work.
   2. Details for expansion and contraction, locations of expansion joints, including direction of expansion and contraction.
   3. Details of termination points and assemblies, including fixed points.
   4. Details of special conditions, including accessory locations.
   5. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.

C. Samples for Verification: Color samples approximately 8 inches by 8 inches.

1.5 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Warranty: Special warranty specified in this Section.
   2. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are SPRI ES-1 tested to specified design pressure.

B. Source Limitations: Obtain roof specialties approved by manufacturer providing roof-system warranty specified in Division 07.

C. Mockups: Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.
   1. First-in-place, approximately 10 feet long or to first expansion joint of typical roof edge, including fascia and gutter, including supporting construction, seams, attachments, underlayment, and accessories shall serve as mockup.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

D. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.8 SEQUENCING

A. Ensure that information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

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

C. Coordinate installation will roof membrane manufacturer's installation instructions.

1.9 WARRANTY

A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Division 07 Section "Thermoplastic Membrane Roofing".

B. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace manufactured roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified and approved by roof membrane manufacturer for "Total System Warranty".
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified and approved by roof membrane manufacturer for "Total System Warranty".

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting design wind pressures calculated in accordance with ASCE 7 (“Minimum Design Loads for Buildings and Other Structures”): Section 6.0 (“Wind Loads”).
   1. Basic Wind Speed: 90 mph unless otherwise noted.
   2. Horizontal Design Pressure: 20 psf, unless otherwise noted.

C. Thermal Movements: Provide manufactured roof specialties that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Water Infiltration: Provide manufactured roof specialties that do not allow water infiltration to building interior.

E. Roof Specialties: 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.
   1. If there is a discrepancy between these references and the project specifications and drawings, the more stringent requirements shall govern as verified by the A/E.

## 2.3 EXPOSED METALS

A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
   1. Surface: Smooth, flat finish.
   2. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions
      a. Two-Coat Fluoropolymer: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
      b. Concealed Surface: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
   1. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

C. Stainless-Steel Sheet: ASTM A 240 or ASTM A 666, Type 304, No. 4 (fine reflective, polished directional satin) finish.

## 2.4 CONCEALED METALS

A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for use and structural performance indicated, mill finished.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

C. Stainless-Steel Sheet: ASTM A 240 or ASTM A 666, Type 304.

D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 (Z275) coating designation; structural quality.

E. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.

2.5 UNDERLAYMENT MATERIALS

A. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D 226 for Type I and Type II felts.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Atlas Roofing Corporation; Summit
      b. Kirsch Building Products, LLC; Sharkskin Comp or Sharkskin Ultra
      c. SDP Advanced Polymer Products Inc; Palisade

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. Products: Subject to compliance with requirements, provide one of the following:
      a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT
      b. GCP Applied Technology; Grace Ice and Water Shield HT or Ultra
      c. Henry Company; Blueskin PE200 HT
      d. Metal-Fab Manufacturing, LLC; MetShield
      e. Owens Corning; WeatherLock Specialty Tile and Metal Underlayment
      f. Polyguard Products, Inc.; Deck Guard HT
      g. Protecto Wap Company; Protecto Jiffy Seal Ice & Water Guard HT
      h. SDP Advanced Polymer Products Inc; Palisade SA-HT

2.6 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
   1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
   2. Fasteners: Series 300 stainless steel, unless otherwise noted.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

D. Elastomeric Sealant where indicated only; ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
   1. Provide where sealant will be exposed or movement exceeds butyl sealant movement capacity.

E. Butyl Sealant unless otherwise noted: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt mastic, ASTM D 1187 or SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

G. Laminated Metal: Roof membrane manufacturer's minimum 0.045 inch thick aluminum with minimum 17-mil polyvinyl-chloride (PVC) coating.

H. Secondary Seal/Flexible Vapor Retarder: Continuous waterproof EPDM membrane ASTM D 4637, or Neoprene membrane within joint and attached to substrate on each side.
   1. Expansion joints

I. Thermal Insultion/Compressible Insulation: Mineral-fiber blanket, ASTM C 665, to fill space above secondary seal/flexible vapor retarder.
   1. Maximum flame-spread and smoke-development indexes of 25 and 50 respectivel, per ASTM E 84.
   2. Expansion joints.

2.7 COPINGS

A. Metal Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage, concealed splice plates with same finish as coping caps, mitered corner units, and end cap units. Splice plates shall include butyl sealant strips capable of providing a weathertight seal. Provide endwall flashing splice plates where parapet terminates into wall.
   1. Products: Provide one of the following Manufacturer's as approved by roofing system manufacturer for "Total System Warranty".
      a. Permasnap Coping; Hickman Edge Systems
      b. Perma-Tite Coping; Metal-Era
      c. Type AP Snap-Tight Coping; Architectural Products
      d. Presto-Lock; Johns Manville
      e. Snap-On Coping; National Sheet Metal Systems, Inc.
      f. Snap-On Coping Systems; Applied Fabricators, Inc.
      g. Snap-On Coping System; Division 7 Mtls. Inc.
      h. Snap-On Coping: Dimensional Metals.
      i. Rapid-Lok Coping: Atas International
   2. Coping Caps: Snap-on, fabricated from the following exposed metal:
      a. Formed Aluminum: In thickness that will satisfy calculated wind-load requirements and NRCA guidelines.
         1) Minimum thickness 0.063 inch.
   3. Coping Cap Color: Black.
   4. Corners: Continuously welded and sealed watertight.
   5. Accessories: End wall flashing, concealed splice plates, 8-inch minimum wide, finished to match finish of coping cap with factory applied butyl sealant strips.
   6. Special Fabrications: Extended interlocking face fabrications in size as indicated on Drawings.
   7. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.
      a. Snap-on Coping Anchor Plates: Concealed, galvanized steel sheet, 12 inches wide, 0.028 inch thick, with integral cleats.
   8. Fabrication: Taper coping from front to back, unless otherwise noted. Coping may be masonry attached or attached to a nailer as recommended by the roof specialty manufacturer for application indicated.

2.8 EXPANSION JOINT COVERS

A. Metal Expansion Joint Covers: Manufactured expansion joint system consisting of formed-metal cap in section lengths not exceeding 12 feet, concealed anchorage, concealed splice plates with same finish as coping caps, mitered corner units, and end cap units. Splice plates shall include butyl sealant strips capable of providing a weathertight seal. Provide endwall flashing splice plates where cover terminates into wall.
   1. Products: Provide one of the following Manufacturer's as approved by roofing system manufacturer for "Total System Warranty".
      a. Perma-Tite Expansion Joint, roof to roof; Metal-Era
      b. Hickman Edge Systems
      c. Architectural Products
      d. Johns Manville

e. National Sheet Metal Systems, Inc.
f. Applied Fabricators, Inc.
g. Division 7 Mtls. Inc.
h. Dimensional Metals.
i. Atas International

2. Expansion Joint Caps: Snap-on, fabricated from the following exposed metal:
   a. Formed Aluminum: In thickness that will satisfy calculated wind-load requirements and NRCA guidelines.
      1) Minimum thickness 0.063 inch.
3. Cap Color: Black.
4. Corners: Continuously welded and sealed watertight.
5. Accessories: End wall flashing, concealed splice plates, 8-inch minimum wide, finished to match finish of coping cap with factory applied butyl sealant strips.
6. Cap Attachment Method: Snap-on, fabricated from coping-cap material.
   a. Snap-on Coping Anchor Plates: Concealed, galvanized steel sheet, 12 inches wide, 0.028 inch thick, with integral cleats.
7. Fabrication: Taper coping from front to back, unless otherwise noted. Coping may be masonry attached or attached to a nailer as recommended by the roof specialty manufacturer for application indicated.

## 2.9 COUNTERFLASHINGS AND REGLETS

A. Manufacturers: Subject to compliance with requirements, provide one of the following:
1. Cheney Flashing Company.
2. Fry Reglet Corporation.
3. OMG Edge Systems (fka Hickman, W. P. Company).
4. Keystone Flashing Company.
5. Merchant & Evans, Inc.
6. Metal-Era, Inc.
7. Castle Metal Products.
8. Heckmann Building Products Inc.

B. Counterflashings: Manufactured units in lengths not exceeding 12 feet designed to snap into reglets or through-wall-flashing receiver and compress against base flashings or roof membrane with joints lapped, from the following exposed metal in thickness indicated:
1. Stainless Steel: 0.0187 inch thick (fka 26 gauge)
2. Provide counterflashing of sufficient length to cover the roof membrane terminations required by surrounding conditions.

C. Reglets/Receivers: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashings indicated with factory-mitered and -welded corners or mechanically clinched and sealed watertight, and junctions, from the following exposed metal in thickness indicated:
1. Stainless Steel: 0.0187 inch thick
2. Corners: Factory mitered and continuously welded or mechanically clinched and seal watertight.
3. Where indicated on Details provide extended leg for receivers as required to cover cavity and anchor to substrate.

D. Types
1. Surface-mounted with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
2. For stucco application, with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
3. For concrete application with temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
4. For masonry application, refer to Division 04 Section “Unit Masonry Assemblies”.
5. Multiuse, for embedment in cast-in-place concrete.

E. Accessories:
   1. Counterflashing wind-restraint clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing louver edge.
   2. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.

2.10 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
   1. Examine walls, roof edges, and parapets for suitable conditions for manufactured roof specialties.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Examine areas to receive ridge vents.
   4. Examine areas to receive eave and fascia system.

B. If substrate preparation is the responsibility of another installer, notify A/E of unsatisfactory preparation before proceeding.

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

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best results for the substrate under the project conditions.

C. Verify the manufacturer’s roof edge details for accuracy to fit the assembly prior to fabrication.

3.3 UNDERLAYMENT INSTALLATION

A. 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.

B. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.4 INSTALLATION, GENERAL

A. General: Install manufactured roof specialties according to manufacturer's written instructions. Anchor manufactured roof specialties securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.
   1. Install manufactured roof specialties with provisions for thermal and structural movement.
   2. Torch cutting of manufactured roof specialties is not permitted.
   3. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
   4. Provide uniform, neat seams with minimum exposure of solder and sealant.
   5. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
   6. Do not use graphite pencils to mark metal surfaces.
   7. Install water cut-offs, as recommended by membrane manufacturer, under the anchor bar.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of uncoated aluminum or stainless-steel manufactured roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing exposed-to-view components of manufactured roof specialties directly on cementitious or wood substrates, install a course of felt/synthetic underlayment and cover with a slip sheet, or install a course of self-adhering, high temperature sheet underlayment.
   3. Bed flanges in thick coat of butyl sealant where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Provide for thermal expansion of exposed manufactured roof specialties.
   1. Space movement joints at a maximum of 12 feet with no unplanned joints within 18 inches of corners or intersections.
   2. When ambient temperature at time of installation is between 40 and 70 degrees Fahrenheit, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws or as recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints with butyl sealant as required by manufacturer of roofing specialties.

F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 degrees Fahrenheit.

3.5 COPING INSTALLATION

A. Install coping to comply with coping manufacturer’s installation guide.

B. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

C. Anchor copings to resist uplift and outward forces according to performance requirements.
   1. Interlock face-leg drip edge into continuous cleat anchored to substrate at manufacturer’s required spacing that meets performance requirements. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer’s required spacing that meets performance requirements.

D. Install accessories, including but not limited to coping miters, end caps, splice plates, endwall flashing, and transitions as required for water tight installation.

3.6 COUNTERFLASHING AND REGLET INSTALLATION

A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Embedded Reglets: Installation of reglets is specified in Division 03 Section "Cast-in-Place Concrete" and Division 04 Section “Unit Masonry”.

C. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

D. Saw-Cut Reglet: Saw-cut reglet joint into installed/existing pre-cast concrete wall panels and existing brick wall surface. Install reglet into cut joint ready to receive counterflashings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

E. Counterflashings: Coordinate installation of counterflashings with installation of base flashings. Insert counterflashings in reglets or receivers and fit tightly to base flashings. Extend counterflashings 4 inches over base flashings. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric or butyl sealant.

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as manufactured roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace manufactured roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 71 00

# SECTION 07 72 00 - ROOF ACCESSORIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Roof hatches.
      a. Safety railing.
      b. Safety post.
      c. Railing gate.

B. Related Sections:
   1. Division 05 Section "Structural Steel Framing" for:
      a. Supplemental roof framing supporting equipment and pipe supports.
      b. Supplemental roof framing for openings at:
         1) Roof hatches.
   2. Division 05 Section "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
   3. Division 06 Section “Rough Carpentry” for roof sheathing, and wood nailers.
   4. Division 07 low-slope roofing Sections for roofing accessories.
   5. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
   6. Division 22 ("Plumbing") sections for coordinating pipe supports furnished and installed in this Section with plumbing piping furnished and installed by Plumbing Contractor.
   7. Division 23 ("HVAC") sections for roof curbs furnished and installed by HVAC Contractor for HVAC equipment.
      a. Coordinate roof curbs and equipment and pipe supports furnished and installed in this Section with equipment and piping furnished and installed by HVAC Contractor.

### 1.2 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   1. Include details showing mounting type, relationships to surrounding construction, hatch and vent type construction and locking features.
   2. Manufacturer’s Installation Instructions: Indicate preparation, instructions, and installation requirements and rough openings.

### 1.4 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

B. NRCA “Roofing and Waterproofing Manual” details for installation of units.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier’s freight bill of lading.

B. Storage: Store materials under cover in a dry and clean location off the ground.

C. Handling: Exercise proper care in handling of work so as not to disrupt finished surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed in other Part 2 articles.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer’s approval must be accompanied by the “Substitution Request Form” and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.3 METAL MATERIALS

A. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
   1. Mill Finish: As manufactured.

B. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.

C. Steel Tube: ASTM A 500, round tube.

D. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123.

E. Steel Pipe: ASTM A 53, galvanized.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.

C. Wood Nailers: Provide No. 2 grade Douglas Fir or Southern Yellow Pine nailers, treated wood
   1. Treatment: Use one of the following formulations of inorganic boron:
      a. Sodium-octaborate (SBX) or disodium – octaborate-tetrahydrate (DOT).
      b. Zinc borates (ZB) for treated engineered wood or wood composites during the manufacturing process.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Underlayment:
   1. 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.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) WIP 300HT; Carlisle Residential, a division of Carlisle Construction Materials.
         2) Grace Ice and Water Shield HT or Ultra; GCP, a unit of W. R. Grace & Co.-Conn.
         3) Blueskin PE200 HT; Henry Company.
         4) MetShield; Metal-Fab Manufacturing, LLC.
         5) WeatherLock Specialty Tile & Metal Underlayment; Owens Corning.
         6) Deck Guard HT; Polygaurd Products, Inc.
         7) Protecto Jiffy Seal Ice & Water Guard HT; Protecto Wrap Company.
         8) Palisdae SA-HT; SDP Advaned Polymer Products Inc.
      b. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
      c. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
   1. Fasteners for Aluminum Sheet: Series 300 stainless steel.

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

H. Elastomeric Sealant where indicated: ASTM C 920, elastomeric polyurethane or silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
   1. Provide where sealant is exposed or movement exceeds butyl sealant movement capacity.

I. Butyl Sealant unless otherwise noted: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

## 2.5 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Acudor Products, Inc.
      b. AES Industries, Inc.
      c. Architectural Specialties, Inc.
      d. Babcock-Davis

e. Custom Solution Roof and Metal Products
f. Dur-Red Products
g. Hi Pro International, Inc.
h. JL Industries, Inc.; a division of the Activar Construction Products Group
i. KCC International Inc.
j. Kingspan Light + Air, North America
k. Lexcor; a division of Luxsuco Corp.
l. Metallic Products Corp.
m. Milcor; Commercial Products Group of Hart & Cooley, Inc.
n. Nystrom, Inc.
o. O'Keeffe's Inc.
p. Pate Company (The)
q. Precision Ladders, LLC
r. Williams Bros. Corporation of America (The)

B. Type and Size:
1. Single-leaf lid, 30 by 48 inches, size shall comply with OSHA 1910.23

C. Performance Characteristics:
1. Cover shall be reinforced to support a minimum live load of 40 psf with a maximum deflection of 1/150$^{th}$ of the span or 20 psf wind uplift.
2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the cover shall not be affected by temperature.
4. Entire hatch shall be weathertight with fully welded corner joints on cover and curb.

D. Cover: 11 gauge aluminum with a 5 inch beaded flange with formed reinforcing members. Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
1. Cover Insulation: Fiberglass or polyisocyanurate of 1-inch thickness, fully covered and protected by a metal liner 18 gauge aluminum.
a. R-Value: 4.3

E. Curb: 12 inch (minimum) in height and of 11 gauge aluminum. The curb shall be formed with a 3-1/2 inch flange with 7/16 inch holes provided for securing to the roof deck. The curb shall be equipped with an integral metal cap flashing of the same gauge and material as the curb with fully welded corners.
1. Curb Insulation: Rigid, high-density fiberboard or glass-fiber board of 1 inch thickness on outside of curb.
a. R-Value: 4.3.

F. Lifting Mechanism: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe.

G. Hardware
1. Heavy pintle hinges shall be provided.
2. Cover shall be equipped with spring hatch and interior and exterior turn handles.
3. Roof hatch shall be equipped with interior and exterior padlock hasps.
4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1 inch diameter red vinyl grip handle to permit easy release for closing.
6. Compression spring tubes shall be an anti-corrosive composite material and all door hardware shall be zinc plated and chromate sealed.
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

H. Finishes: Factory finish shall be mill finished aluminum.

I. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch, meets OSHA required compliance for safe egress and ingress through roof hatch openings while hatch is in use, complies with OSHA CFR 29-1910.28 and CFR 29-1910.29 and authorities having jurisdiction.
   1. Railing system shall be designed to withstand a 200 pounds test load.
   2. Height: 42 inches above finished roof deck.
   3. Posts and Rails: Galvanized-steel pipe, 1-1/4 inchesin diameter or galvanized-steel tube, 1-5/8 inchesin diameter. or aluminum 1-1/2-inch OD schedule 40.
   4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inchesin diameter.
   5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
   6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
   7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
   8. Fabricate joints exposed to weather to be watertight and free of sharp edges and snag points.
   9. Fasteners: Manufacturer's standard, finished to match railing system.
   10. Finish: Manufacturer's standard.
      a. Color: Safety yellow powder coat.

J. Ladder-Assist Safety Post (Extendable): Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
   1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
   2. Height: 42 inches above finished roof deck.
   3. Material: Steel tube.
   4. Post: Telescoping tube.
   5. Post Finish: Safety yellow.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Verify that deck, curbs, roof membrane, base flashing, and other items effecting work of this section are in place and positioned correctly.

E. Verify tolerances and correct improper condition.

F. Identify conditions detrimental to providing proper quality and timely completions of work.

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

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.
   1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks. Separate metal from incompatible metal or corrosion substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.
   2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
   3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
   4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals. Coordinate installation of sealant with work of this section to ensure watertightness.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
   3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof-Hatch Installation:
   1. Install roof hatch so top surface of hatch curb is level, plumb, true to line and elevation, and without warping, jogs in alignment, buckling, or tool marks.
      a. Anchor roof hatches secure in place so they are capable of resisting indicated loads.
      b. Use fasteners, separating sealants and other miscellaneous items as required to complete installation of roof hatches and fit them to substrates.
      c. Install roof hatches to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
   2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
   3. Attach safety railing system to roof-hatch curb.
   4. Attach ladder-assist post according to manufacturer's written instructions.

D. Seal joints with butyl sealant as required by roof accessory manufacturer.

3.3 ADJUSTING

A. Adjust moveable parts for smooth operation.

B. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

3.4 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

B. Clean exposed surfaces according to manufacturer's written instructions.

C. Clean off excess sealants.

D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00

# SECTION 07 81 00 - APPLIED FIREPROOFING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes sprayed fire-resistive materials (SFRM):

B. Related Sections include the following:
   1. Division 05 Section "Structural Steel Framing" for:
      a. Surface conditions required for structural steel receiving SFRM.
      b. Coordination of primers, if applicable.
   2. Division 07 Section "Thermal Insulation" for fire-safing insulation.
   3. Division 07 Section "Penetration Firestopping" for fire-resistance-rated firestopping systems.

### 1.2 DEFINITIONS

A. SFRM: Sprayed fire-resistive material.

B. Concealed: Fire-resistive materials applied to surfaces that are concealed from view behind other construction when the Work is completed and have not been defined as exposed.

C. Exposed: Fire-resistive materials applied to surfaces that are exposed to view when the Work is completed and that are identified as exposed on Drawings.

### 1.3 COORDINATION

A. Sequence and coordinate application of SFRM with other related work specified in other Sections to comply with the following requirements:
   1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
   2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
   3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
   4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
   5. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
   6. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
   7. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
   8. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

### 1.4 PREINSTALLATION MEETINGS

A. Preinstallation Meeting: Conduct meeting at Project site. Review methods and procedures related to SFRM including, but not limited to, the following:
   1. Review products, exposure conditions, design ratings, restrained and unrestrained conditions, calculations, densities, thicknesses, bond strengths, and other performance requirements.

2. Review and finalize construction schedule and verify sequencing and coordination requirements.
3. Review weather predictions, ambient conditions, and proposed temporary protections for SFRM during and after installation.
4. Review surface conditions and preparations.
5. Review field quality-control testing procedures.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including U.L. Design Listings from U.L. Inc.

B. Shop Drawings: Structural framing plans, schedules, or both, indicating the following:
1. Locations and types of surface preparations required before applying SFRM.
2. Extent of SFRM for each construction and fire-resistance rating, including the following:
a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
1) For steel joist assemblies, include applicable fire-resistance design designations, with each steel joist tested with the same maximum tensile stress as each steel joist indicated on Drawings. Design designations with steel joists tested at lower maximum tensile stress than those indicated are not permitted.
b. Minimum thicknesses needed to achieve required fire-resistance ratings of each structural components and assembly.
c. Treatment of SFRM after application.

1.6 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
1. Field quality-control test and special inspection reports.
2. Warranties: Special warranties specified in this Section.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by SFRM manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its SFRM to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
2. Density: Test for density according to ASTM E605. Provide density indicate in referenced fire-resistance design, but not less than minimum specified in Part 2.
3. Verify that manufacturer, through it own laboratory testing or field experience, attests that primers or coatings are compatible with sprayed fire-resistive material.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain sprayed fire-resistive material manufacturer’s written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.

B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.

C. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not apply SFRM when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of SFRM, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

C. Relative humidity shall not exceed amount published in fireproofing manufacturer’s guidelines.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Source Limitations: Obtain fire protection for each fire-resistance design from single source.

2.2 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Steel members are to be considered unrestrained unless specifically noted otherwise.

C. Asbestos: Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, “Polarized Light Microscopy”.

## 2.3 SPRAYED FIRE-RESISTIVE MATERIALS

A. SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design on drawings, and mixed with water at Project site to form a slurry or mortar before conveyance and application.
   1. Products: Subject to compliance with requirements, provide one of the following as recommended by manufacturer for application indicated:
      a. AD Southwest Fireproofing Type 7GP, AD Southwest Fireproofing Type 7HD, Pyrocrete 40, Pyrocrete 239, Pyrocrete 240 High Yield, and Pyrocrete 241; Carboline Company, subsidiary of RPM International, Fireproofing Products Div.
      b. Monokote Z106, Monokote Z106/HY, and Retro-Guard; Grace, W. R. & Co. - Conn.; Grace Construction Products.
      c. Cafco Blaze-Shield II; Cafco 400, Fendolite M-II, and Fendolite TG. Isolatek International.
      d. Pyrok-HD and Pyrok-MD; Pyrok, Inc.
      e. Type 7GP and Type 7HD; Southwest Fireproofing Products Co.
   2. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
   3. Bond Strength: Minimum 150-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
   4. Density: Not less than density and as specified in the approved fire-resistance design, according to ASTM E 605.
   5. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch.
   6. Combustion Characteristics: ASTM E 136.
   7. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 10 or less.
      b. Smoke-Developed Index: 10 or less.
   8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
   9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
   10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
   11. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
   12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21 or rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273.
   13. Finish: Spray-textured finish.

## 2.4 AUXILIARY FIRE-RESISTIVE MATERIALS

A. General: Provide auxiliary fire-resistive materials that are compatible with SFRM and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:
   1. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory" for coating materials based on a series of bond tests per ASTM E 736.
   2. Primer is identical to those used in assemblies tested for fire-test-response characteristics of SFRM per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL’s “Fire Resistance Directory” or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive SFRM.
   1. Provide metal lath at applications over non-conforming or existing painted surfaces.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by manufacturer of SFRM.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by manufacturer of intumescent mastic coating fire-resistive material. Include pins and attachment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:
   1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
   2. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
   3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
   4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.

B. Verify that concrete work on steel deck has been completed before beginning fireproofing work.

C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work are completed before beginning fireproofing work.

D. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

E. Prepare written reports, endorsed by Installer, listing conditions detrimental to performance of the work.

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

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.
   1. Close off and seal ductwork in areas when fireproofing is being applied.

B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.
   1. Work in accordance with SSPC guidelines SSPC-SP-1, SSPC-SP-2, SSPC-SP-3, or SSPC-SP-6 as appropriate to prepare substrate.

C. Seal all penetrations or open ended fireproofing termination by chamfering at a 45 degree angle and sealing with high heat silicone sealant.

D. Prime substrates where recommended in writing by SFRM manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive SFRM.
   1. Provide primer “cut back” 3 inches for bolted connections and 12 inches for welded connections.

E. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of SFRM. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION, GENERAL

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
   1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
   2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:
   1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.
   2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

J. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

K. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

L. Cure fireproofing according to fireproofing manufacturer's written recommendations.

M. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

N. Finishes: Where indicated, apply fireproofing to produce the following finishes:
   1. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
   1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
   2. Test and inspect as required by the IBC, Subsection 1705.15, “Sprayed Fire-Resistant Materials.” Special inspections for sprayed fire-resistant materials applied to structural elements and decks shall be in accordance with the following:
      a. Structural Member Surface Conditions: The surfaces shall be prepared in accordance with the approved fire-resistance design and the approved manufacturer’s written instructions. The prepared surface of structural members to be sprayed shall be inspected before the application of the sprayed fire-resistant material.
      b. Application: The substrate shall have a minimum ambient temperature before and after application as specified in the approved manufacturer’s written instructions. The area for application shall be ventilated during and after application as required by the approved manufacturer’s written instructions.
      c. Thickness: The average thickness of the sprayed fire-resistant materials applied to structural elements shall not be less than the thickness required by the approved fire-resistant design. Individual measured thickness, which exceeds the thickness specified in a design by 1/4 inch or more, shall be recorded as the thickness specified in the design plus 1/4 inch. For design thicknesses 1 inch or greater, the minimum allowable individual thickness shall be the design thickness minus 1/4 inch. For design thicknesses less than 1 inch, the minimum allowable individual thickness shall be the design thickness minus 25 percent. Thickness shall be determined in accordance with ASTM E 605. Samples of the sprayed fire-resistant materials shall be selected in accordance with tests and inspections as noted herein.

B. Applied fire protection will be considered defective if it does not pass tests and inspections.
   1. Remove and replace applications of SFRM that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.
   2. Apply additional SFRM, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.

3.5 CLEANING, PROTECTING, AND REPAIR

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect SFRM, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.

C. Coordinate application of SFRM with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect SFRM and repair any damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07 81 00

**SECTION 07 84 13 – PENETRATION FIRESTOPPING**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Tested or engineering judgment based firestopping materials and systems to retain the integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and/or hot gases through penetrations. Section includes firestopping for the following:
   1. Through-Penetration Firestop Systems
      a. Penetrations through fire resistance rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
         1) Water tight firestop systems for penetrations in fire-resistance-rated floor assemblies.
      b. Penetrations through fire resistance rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
      c. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
      d. Penetrations through partitions that enclose incidental use areas – that are not required to be fire-resistance-rated due to the presence of automatic fire-extinguishing systems – but are still required to resist the passage of smoke.

B. Related Work: Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that relate directly to Work of this Section include, but are not limited to:
   1. Division 07 Section “Thermal Insulation” for floor-to-wall joints indicated as perimeter fire-containment systems between perimeter edge of fire-resistance-rated floor assemblies and back of non-fire-resistance-rated exterior curtain walls.
   2. Division 07 Section “Fire-Resistive Joint Systems” for joints:
      a. In or between fire-resistance-rated construction.
      b. At exterior curtain-wall/floor intersections.
      c. In or between partitions that enclose incidental use areas – that are not required to be fire-resistance-rated due to the presence of automatic fire-extinguishing systems – but are still required to resist the passage of smoke.
   3. Division 07 Section “Joint Sealants” for joint sealants used at penetrations through non-fire-resistance-rated construction that does not enclose an incidental use area.
   4. Division 09 Section "Interior Painting" for paint requirements.
   5. Division 21 Sections specifying fire-suppression piping penetrations.
   6. Division 22 and 23 Sections specifying duct and piping penetrations.
   7. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

1.2 DEFINITIONS

A. Firestopping: Material or combination of materials to retain integrity of fire rated construction by maintaining an effective barrier against the spread of flame, smoke, and gases through penetrations in fire rated wall and floor assemblies.
   1. Exception: When used in non-fire-resistance-rated partitions that enclose incidental use areas, firestopping shall be applied to the exposed face of mineral wool, glass fiber, or other approved non-rigid materials to maintain an effective resistance to the passage of smoke.

B. Through-Penetration Firestop Systems: An assemblage of specific materials or products that are designed, tested and fire-resistance-rated to resist for a prescribed period of time the spread of fire, the passage of hot gases, and the transfer of heat through penetrations.

C. Through-Penetration Firestop Devices: Factory built products designed to resist fire spread. Complete when delivered to site ready for installation.

D. Assembly: Particular arrangement of materials specific to a given type of construction described or defined in referenced documents.

E. Engineering Judgment: Evaluations that are developed by a manufacturer for a new firestop system that complies with similar UL approved designs or tests that are acceptable to the code enforcing authorities.

F. Intumescent: Materials that expand with heat to seal around objects threatened by fire.

G. Penetration: Opening or foreign material passing through a floor, wall or ceiling barrier such that the full thickness of the rated material(s) is breached either in total or in part.

H. Sleeve: Metal fabrication or pipe section that is part of a system that extends through a barrier.

I. Annular Space: The opening around the penetrating item. Since the penetrating item cannot be perfectly centered in the hole, the annular space has a minimum and maximum dimension.

J. Approved: Acceptable to the code official or authority having jurisdiction.

K. F-Rating: The time period that the through-penetration firestop system limits the spread of fire through the penetration when tested in accordance with ASTM E 814.

L. Fire Barrier: A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained.

M. Fire Partition: A vertical assembly of materials designed to restrict the spread of fire in which openings are protected. Fire partitions are used as wall assemblies to enclose corridors.

N. Fire Wall: A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall. A fire wall is commonly used to divide a structure into separate buildings – or to separate a new addition from the existing portion of a structure.

O. Fireblocking: Building materials installed to resist the free passage of flame, gases, heat, smoke, and other products of combustion to other areas of the building through concealed spaces. The term “draftstopping” is also used to define building materials installed to resist the movement of smoke, gases, and flames to other areas – but through relatively larger concealed spaces. Examples of fireblocking materials include – but are not limited to – the following:
   1. 2-inch nominal lumber.
   2. Two thicknesses of 1-inch nominal lumber with broken lap joints.
   3. One thickness of 0.75-inch particleboard with backed-up joints.
   4. Gypsum board.
   5. Cement fiber board.
   6. Batt-type or roll-type blankets of mineral wool, glass fiber, or other approved non-rigid materials installed in such a manner as to be securely retained in place. Loose-fill insulation material shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.

P. Horizontal Assembly: A fire-resistance-rated floor or roof assembly of materials designed to restrict the spread of fire in which continuity is maintained.

Q. Incidental Use Area: Rooms or areas that constitute special hazards or risks to life safety beyond the protection provided by the general building code requirements for the occupancy in which they are located. The building code requirements applicable to the main use group classification are not adequate enough in order to protect against hazards that are unique to these areas. Examples include – but are not limted to – the following:

1. Furnace rooms where any piece of equipment is over 400,000 Btu per hour input.
2. Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower.
3. Refrigerant machinery rooms.
4. Laboratories and vocational shops in schools.
5. Storage rooms over 100 square feet.
6. Waste collection rooms over 100 square feet.

R. L-Rating: The quantitative indication of a through-penetration firestop system's ability to resist the passage of smoke when tested in accordance with UL 2079.

S. Membrane-Penetration: An opening made through one side (wall, floor or ceiling membrane) of an assembly.

T. Smoke Barrier: A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly, that is designed and constructed to restrict the movement of smoke.

U. Smoke Partition: A non-fire-resistance-rated wall designed to resist the spread of fire and the unmitigated movement of smoke for an unspecified period of time. A smoke partition is not required to be continuous through ceilings and other concealed spaces.

V. T-Rating: The time period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325 degrees Fahrenheit (163 degrees Celsius) above its initial temperature through the penetration on the non-fire side when tested in accordance with ASTM E 814.

W. Through-Penetration: An opening that passes through an entire assembly.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.
1. American Society for Testing and Materials (ASTM).
   a. E 84 Test Method for Surface Burning Characteristics of Building Materials.
   b. E 119 Test Method for Fire Tests of Building Construction and Materials.
   c. E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg. F.
   d. E 814 Fire Tests of Through-Penetration Fire Stops.
   e. E 1349 Cyclic Movement and Measurement Minimum and Maximum Joint Widths.
   f. E 1966 Test Method for Resistance of Building Joint.
   g. E 2274 Standard Practice for On-Site Inspection of Installed Fire Stops.
   h. E 2307 Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate – Scale, Multi-Story Test Apparatus (ISMA).
   i. E 2393 Standard Practice for On-Site Inspection of Installed Fire Stop Joint Systems.
2. Factory Mutual (FM) Approvals: FM Approval Standard of Firestop Contractors – Class 4991.
3. Firestop Contractors International Association (FCIA): MOP – FCIA Firestop Manual of Practice.
4. International Firestop Council (IFC):
   a. Ref. 1 Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments (April 2001).
   b. Ref. 2 Inspectors Field Pocket Guide.
5. National Fire Protection Association (NFPA):
   a. NFPA 70 – National Electric Code.
   b. NFPA 80 – Standard for Fire Doors and Other Opening Protectives.
   c. NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operatives.
   d. NFPA 101 – Life Safety Code.
   e. NFPA 221 – Fire Walls and Fire Barriers.

f. NFPA 251 – Fire Tests of Building Construction and Materials.

6. Underwriters Laboratories, Inc. (UL):
   a. UL 263 Fire Tests of Building Construction and Materials.
   b. UL 723 Surface Burning Characteristics of Building Materials.
   c. UL 1479 Fire-Tests of Through-Penetration Fire Stops.
   d. UL Building Materials Directory:
      1) Through-Penetration Firestops Systems (XHEZ).
      2) Firestop Devices (XHJI).
      3) Forming Materials (XHKU).
      4) Wall Opening Protective Materials (CLIV).
      5) Fill, Void or Cavity Materials (XHHW).

1.4 SEQUENCING

A. Coordinate this Work as required with work of other trades. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
   1. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.
   2. Schedule firestopping after installation of penetrants but prior to concealing the openings.

B. Do not cover up those firestopping installations that will become concealed behind other construction until Owner's inspection agency and authorities having jurisdiction, if required, have examined each installation.

1.5 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION or INFORMATIONAL SUBMITTALS.
   1. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer’s written instructions.

1.6 QUALITY ASSURANCE

A. Qualifications
   1. Installer Qualifications: Engage an experienced Installer (including individual trades people such as: electrical, mechanical, insulators, etc.) who is qualified by having at least 3 firestop projects similar in type and size to that of this project and has the necessary experience, staff, and training to install manufacturer's products per specified requirements, plus the following:
      a. Acceptable to or licensed by state or local authority, where applicable.
      b. Establish a record of successful in-service experience with firestop systems or completion of manufacturer’s certified product installation training.
      c. A supplier’s willingness to sell its firestopping products to the Contractor or to an Installer engaged in does not in itself confer qualification on the buyer. Each individual engaged in performing the firestopping work shall have a certification card from the manufacturer acknowledging their completion of the manufacturer’s firestop installation training.
      d. Any firm that has been approved by FM according to FM 4991, “Approval of Firestopping Contractors,” or been evaluated by UL and found to comply with its “Qualified Firestop Contractors Program Requirements” shall be acceptable as well.
   2. Installation Responsibility: Assign installation of firestopping systems in project to a single sole source firestop specialty contractor.
   3. Single Source Responsibility: Obtain through-penetration firestop systems for kind of penetration and construction condition indicated from a single manufacturer.
      a. Materials of different manufacturer than allowed by the testing and listed system shall not be intermixed in the same firestop system or opening.

b. Tested and listed, classified firestop systems are to be used. If another manufacturer has a tested and listed system, then that system shall be used prior to an Engineering Judgement (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA).

4. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy" or ASTM D6620.
5. Do not use any product containing solvents that require hazardous waste disposal or which after curing dissolve in water.

B. Regulatory Requirements
1. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
2. Meet requirements of ASTM E814, UL1479, UL2079, or ASTM E2307 tested assemblies that provide a fire rating equal to that of construction being penetrated and other ASTM Standards as applicable for the installation.
a. ASTM E84 "Test Method for Surface Burning Characteristics of Building Materials."
b. ASTM E119 "Test Methods for Fire Tests of Building Construction and Materials."
3. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" article:
a. A qualified testing and inspection agency shall perform firestopping tests. A qualified testing and inspecting agency is UL or another agency performing test and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
b. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
1) Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
2) Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system listed by the following:
a) UL in "Fire Resistance Directory".
b) Intertek ETL SEMKO in its “Directory of Listed Building Products”.
c) FM Global in its “Building Materials Approved Guide”.
4. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirement set forth by the International Firestop Council (September 7, 1994, as may be amended from time to time).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping undamaged products to project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacturer; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
1. Comply with recommended procedures, precautions, or remedies described in material safety data sheets as applicable.

B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

C. Do not use damaged or expired materials.

1.8 FIELD CONDITIONS

A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

C. Existing Conditions: Verify the condition of the substrates and correct unsatisfactory conditions before installing products. Follow manufacturers' instructions.

D. Protection: Provide masking and drop cloths to prevent contamination of adjacent surfaces, if required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products from one of the manufacturers specified.
1. Hilti Inc.
2. Specified Technologies, Inc., (STI)
3. 3M Fire Protection Products
4. The Rectorseal Corporation
5. Tremco, Inc.; Tremco Fire Protection Systems Group
6. A/D Fire Protection Systems Inc.
7. Johns Manville
8. USG Corp.
9. Passive Fire Protection Partners
10. NUCO Inc.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 SYSTEM DESCRIPTION

A. General, Through-Penetration Firestop Systems: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers, and smoke barriers as indicated on "Code Drawing."
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies as indicated on "Code Drawing."
3. Install complete through penetration firestop systems that have been tested and/or listed by recognized testing agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of site conditions.
4. Provide firestop products that are flexible enough to allow for pipe vibration in a through penetration application.
5. Provide products that are compatible with each other, with the substrates forming openings, and with the items, if any, penetrating the firestopping, under the conditions represented by this Project, based on testing and field performance demonstrated by manufacturer.

6. For firestopping exposed to view, traffic, moisture, and physical damage, provide firestop systems for these conditions that meet conditions expected as communicated through construction documents.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
   1. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated as determined per ASTM E814, UL 1479 but not less than that equaling or exceeding the fire resistance rating of the constructions penetrated.
   2. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E814 and ASTM E119, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where specified by codes or where the following conditions exist:
      a. Where firestop systems protect penetrations located outside of wall cavities.
      b. Where firestop systems protect penetrations located outside fire resistive shaft enclosures.
      c. Where firestop systems protect penetrations located in construction containing doors required to have a temperature rise rating.
      d. Where firestop systems protect penetrating items larger than a 4-inch diameter nominal pipe or 16 square inch in overall cross sectional area.
   3. L-Rated Systems: Provide firestop systems with L-ratings indicated, as determined per ASTM UL1479, where systems maintain a barrier to smoke at:
      a. Penetrations.
      b. Connections with other surfaces.
      c. Separations required to permit building movement.
      d. Sound or vibration absorption.
      e. Other construction gaps.
   4. For firestopping exposed to traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions and will meet load requirements.
      a. For piping penetrations for plumbing and wet pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
      b. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
      c. For penetrations involving insulated piping, provide through-penetration firestop systems not required removal of insulation.
   5. For through-penetration firestop systems exposed to view, provide products with flame spread of less than 25 and smoke developed ratings of less than 450, as determined per ASTM E 84.
   6. W-Rated of Class 1 when tested in accordance with UL Water Leakage Test for systems tested and listed in accordance with ANSI/UL 1479, where indicated or required by authority having jurisdiction.
   7. For piping penetration for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   8. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

## 2.3 PENETRATION FIRESTOPPING, GENERAL

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
   1. Systems listed by approved testing agencies, may be used, providing they conform to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barriers, and fire partitions.
   2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
   2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
   3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
   4. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations through Smoke Barriers, Smoke Partitions, and partitions that enclose incidental use areas – that are not required to be fire-resistance-rated due to the presence of automatic fire-extinguishing systems – but are still required to resist the passage of smoke: Provide penetration firestopping with ratings determined per UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

E. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G 21.

F. Firestopping materials are either “cast-in-place” (integral with concrete placement) or “post installed”. Provide cast-in-place firestop devices prior to concrete placement.

G. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

H. Accessories: Provide components for each penetration firestopping systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-wool-fiber or rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      c. Fire-rated form board.
      d. Fillers for sealants.
   2. Temporary forming materials
   3. Substrate primers
   4. Collars
   5. Steel sleeves

## 2.4 FILL MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E 814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket. Cast-in-place devices for use with only noncombustible penetrants shall be red in color.

C. Fire Rated Cable Management Devices: Factory-assembled round metallic sleeve device for use with cable penetrations, containing an integrated smoke seal fabric membrane that can be opened and closed for repenetration.

D. Drop-In Firestop Devices: Factory-assembled devices for use with combustible or noncombustible penetrants in cored holes within concrete floors. Device shall consist of galvanized steel sleeve lined with an intumescent strip, an extended rectangular flange attached to one end of the sleeve for fastening to concrete floor, and neoprene gasket.

E. Acrylic Sealants: Acrylic (water) based firestop selant containing no halogens, solvents, asbestos or silicone compounds.

F. Acrylic Sprayable Mastic: Acrylic (water) based sprayable fire-rated mastic containing no halogens, solvents, or asbestos.

G. Firestop Collars: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

H. Intumescent Composite Board: Rigid panels consisting of a lightweight, polyurethane foam material.

I. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

J. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

K. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

L. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

M. Blocks/Plugs: Intumescent flexible block/plug suitable for reuse in repenetration of openings. Blocks shall allow up to 12 inches of unreinforced annular space.

N. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

O. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2.5 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.
   1. Verify penetrations are properly sized and in suitable condition for application of materials.
   2. Conduct tests according to firestop systems manufacturer's written recommendations to verify that substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt or other foreign substances capable of impairing bond of fire resistive materials.
   3. Verify objects penetrating firestop materials, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
   4. Verify substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire resistive materials.

B. Verify that environmental conditions are safe and suitable for installation of firestop materials.

C. Do not proceed with installation of firestop system until the Contractor in a manner acceptable to the A/E has corrected unsatisfactory conditions.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
   1. Remove all foreign materials from surfaces of openings and from penetrating items that could interfere with adhesion of firestopping.
   2. Clean openings and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form release agents from concrete.
   4. Do not apply firestopping and smoke seals to surfaces previously painted or treated with sealers, curing compounds, water repellent or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Ensure that anchoring devices, back-up materials, clips, sleeves, and supports and other related materials used in the actual fire tests are provided.

D. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop systems seal with substances.

3.3 INSTALLING THROUGH-PENETRATION FIRESTOPS

A. General: Comply with the "Performance Requirements" in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
   1. Coordinate with other trades to assure that all pipes, conduit, cable, and other items, which penetrate fire rated construction, have been permanently installed prior to installation of firestop assemblies.
   2. Schedule the Work to assure that partition and all other construction that conceals penetrations are not erected prior to the installation of firestop and smoke seals.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross sectional shapes and depths required to achieve fire ratings of designated through- penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
   1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire-resistance ratings.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
   4. Where through-penetration firestops are indicated to be watertight, they shall meet UL Water Leakage Test – Class I requirements for systems tested and listed in accordance with the criteria of ASTM E814 (UL1479) Standard Test Method for Fire Tests of Through-Penetration Fire Stops. W Rated – Class I requirements include a minimum water column exposure of 3 feet for 72 hours prior to the standard time/temperature curve for the fire test.
   5. Through Penetration Sealants with a Fungicide. Sealants must meet the requirements of ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

## 3.4 IDENTIFICATION

A. Identify penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
   1. The words "Warning – Through-Penetration Firestop System – Do Not Disturb. Notify Building Management of Any Damage".
   2. Contractor's name, address, and phone number.
   3. Through-penetration firestop system designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Through-penetration firestop system manufacturer's name.
   6. Installer's name.

B. Marking and Identification: In addition to identification of firestop systems, fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
   1. Be located in accessible concealed floor, floor-ceiling, or attic spaces at 15 feet from end of wall; and
   2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
   3. Include lettering not less than 3 inches in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS." Other wording must be pre-approved by Authorities with Jurisdiction.

## 3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials and sealants adjacent to openings as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop system complying with specified requirements.

3.6 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

D. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

E. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 07 84 13

# SECTION 07 84 43 – JOINT FIRESTOPPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Tested or engineering judgment based firestopping materials and systems to retain the integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and/or hot gases through penetrations.
   1. Joints in or between fire-resistance-rated constructions.
   2. Joints in or between smoke barriers, smoke partitions, and partitions that enclose incidental use areas – that are not required to be fire-resistance-rated due to the presence of automatic fire-extinguishing systems – but are still required to resist the passage of smoke.

B. Related Work: Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that relate directly to Work of this Section include, but are not limited to:
   1. Division 07 Section “Penetration Firestopping” for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and partitions that enclose incidental use areas – that are not required to be fire-resistance-rated due to the presence of automatic fire-extinguishing systems – but are still required to resist the passage of smoke.
   2. Division 07 Section “Joint Sealants” for joint sealants used in joints in and between non-fire-resistance-rated construction that does not enclose an incidental use area.
   3. Division 09 Section “Gypsum Board Assemblies” for firestop track seals.
   4. Division 09 Section "Interior Painting" for paint requirements.
   5. Division 21 Sections specifying fire-suppression piping penetrations.
   6. Division 22 and 23 Sections specifying duct and piping penetrations.
   7. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

### 1.2 DEFINITIONS

A. Firestopping: Material or combination of materials to retain integrity of fire rated construction by maintaining an effective barrier against the spread of flame, smoke, and gases through joints in or between fire rated wall and floor assemblies.
   1. Exception: When used in non-fire-resistance-rated partitions that enclose incidental use areas, firestopping shall be applied to the exposed face of mineral wool, glass fiber, or other approved non-rigid materials to maintain an effective resistance to the passage of smoke.

B. Assembly: Particular arrangement of materials specific to a given type of construction described or defined in referenced documents.

C. Construction Gap: Any joint or opening, whether static or dynamic, within or between adjacent sections of interior or exterior walls, floors, ceilings, or roof decks.

D. Engineering Judgment: Evaluations that are developed by a manufacturer for a new fire-resistive joint system that complies with similar UL approved designs or tests that are acceptable to the code enforcing authorities.

E. Intumescent: Materials that expand with heat to seal around objects threatened by fire.

F. Approved: Acceptable to the code official or authority having jurisdiction.

G. F-Rating: The time period that the fire-resistive joint system limits the spread of fire through the joint when tested in accordance with ASTM E 814.

H. Fire Barrier: A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained.

I. Fire Partition: A vertical assembly of materials designed to restrict the spread of fire in which openings are protected. Fire partitions are used as wall assemblies to enclose corridors.

J. Fire Wall: A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall. A fire wall is commonly used to divide a structure into separate buildings – or to separate a new addition from the existing portion of a structure.

K. Fireblocking: Building materials installed to resist the free passage of flame, gases, heat, smoke, and other products of combustion to other areas of the building through concealed spaces. The term “draftstopping” is also used to define building materials installed to resist the movement of smoke, gases, and flames to other areas – but through relatively larger concealed spaces. Examples of fireblocking materials include – but are not limited to – the following:
   1. 2-inch nominal lumber.
   2. Two thicknesses of 1-inch nominal lumber with broken lap joints.
   3. One thickness of 0.75-inch particleboard with backed-up joints.
   4. Gypsum board.
   5. Cement fiber board.
   6. Batt-type or roll-type blankets of mineral wool, glass fiber, or other approved non-rigid materials installed in such a manner as to be securely retained in place. Loose-fill insulation material shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.

L. Horizontal Assembly: A fire-resistance-rated floor or roof assembly of materials designed to restrict the spread of fire in which continuity is maintained.

M. Incidental Use Area: Rooms or areas that constitute special hazards or risks to life safety beyond the protection provided by the general building code requirements for the occupancy in which they are located. The building code requirements applicable to the main use group classification are not adequate enough in order to protect against hazards that are unique to these areas. Examples include – but are not limited to – the following:
   1. Furnace rooms where any piece of equipment is over 400,000 Btu per hour input.
   2. Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower.
   3. Refrigerant machinery rooms.
   4. Laboratories and vocational shops in schools.
   5. Storage rooms over 100 square feet.
   6. Waste collection rooms over 100 square feet.

N. Joint: The linear opening in or between adjacent fire-resistance-rated assemblies that is designed to allow independent movement of the building in any plane caused by thermal, seismic, wind, or any other loading.

O. L-Rating: The quantitative indication of a fire-resistant joint system’s ability to resist the passage of smoke when tested in accordance with UL 2079.

P. Smoke Barrier: A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly, that is designed and constructed to restrict the movement of smoke.

Q. Smoke Partition: A non-fire-resistance-rated wall designed to resist the spread of fire and the unmitigated movement of smoke for an unspecified period of time. A smoke partition is not required to be continuous through ceilings and other concealed spaces.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.
   1. American Society for Testing and Materials (ASTM).
      a. E 84 Test Method for Surface Burning Characteristics of Building Materials.

b. E 119 Test Method for Fire Tests of Building Construction and Materials.
c. E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg. F.
d. E 814 Fire Tests of Through-Penetration Fire Stops.
e. E 1349 Cyclic Movement and Measurement Minimum and Maximum Joint Widths.
f. E 1966 Test Method for Resistance of Building Joint.
g. E 2274 Standard Practice for On-Site Inspection of Installed Fire Stops.
h. E 2307 Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate – Scale, Multi-Story Test Apparatus (ISMA).
i. E 2393 Standard Practice for On-Site Inspection of Installed Fire Stop Joint Systems.

2. Factory Mutual (FM) Approvals: FM Approval Standard of Firestop Contractors – Class 4991.
3. Firestop Contractors International Association (FCIA): MOP – FCIA Firestop Manual of Practice.
4. International Firestop Council (IFC):
   a. Ref. 1 Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments (April 2001).
   b. Ref. 2 Inspectors Field Pocket Guide.
5. National Fire Protection Association (NFPA):
   a. NFPA 70 – National Electric Code.
   b. NFPA 80 – Standard for Fire Doors and Other Opening Protectives.
   c. NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operatives.
   d. NFPA 101 – Life Safety Code.
   e. NFPA 221 – Fire Walls and Fire Barriers.
   f. NFPA 251 – Fire Tests of Building Construction and Materials.
6. Underwriters Laboratories, Inc. (UL):
   a. UL 263 Fire Tests of Building Construction and Materials.
   b. UL 723 Surface Burning Characteristics of Building Materials.
   c. UL 1479 Fire-Tests of Through-Penetration Fire Stops.
   d. UL Building Materials Directory:
      1) Through-Penetration Firestops Systems (XHEZ).
      2) Firestop Devices (XHJI).
      3) Forming Materials (XHKU).
      4) Wall Opening Protective Materials (CLIV).
      5) Fill, Void or Cavity Materials (XHHW).

## 1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

## 1.5 SEQUENCING

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

## 1.6 QUALITY ASSURANCE

A. Qualifications
1. Installer Qualifications: Engage an experienced Installer (including individual trades people such as: electrical, mechanical, insulators, etc.) who is qualified by having at least 3 firestop projects similar in type and size to that of this project and has the necessary experience, staff, and training to install manufacturer's products per specified requirements, plus the following:

a. Acceptable to or licensed by state or local authority, where applicable.
b. Establish a record of successful in-service experience with firestop systems or completion of manufacturer's certified product installation training.
c. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged in does not in itself confer qualification on the buyer. Each individual engaged in performing the firestopping work shall have a certification card from the manufacturer acknowledging their completion of the manufacturer's firestop installation training.
d. Any firm that has been approved by FM according to FM 4991, "Approval of Firestopping Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements" shall be acceptable as well.

2. Installation Responsibility: Assign installation of firestopping systems in project to a single sole source firestop specialty contractor.
3. Single Source Responsibility: Obtain fire-resistive joint systems for kind of joint and construction condition indicated from a single manufacturer.
   a. Materials of different manufacturer than allowed by the testing and listed system shall not be intermixed in the same firestop system or opening.
   b. Tested and listed, classified firestop systems are to be used. If another manufacturer has a tested and listed system, then that system shall be used prior to an Engineering Judgement (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA).
4. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy" or ASTM D6620.
5. Do not use any product containing solvents that require hazardous waste disposal or which after curing dissolve in water.

B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
1. Fire-resistive joint system tests shall be performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems shall be identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
   a. Fire-resistive joint system products shall bear classification marking of qualified testing agency.
   b. Fire-resistive joint systems shall correspond to those indicated by reference to designations listed by the following:
      1) UL in its "Fire Resistance Directory."
      2) Intertek ETL SEMKO in its "Directory of Listed Building Products."

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping undamaged products to project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacturer; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
1. Comply with recommended procedures, precautions, or remedies described in material safety data sheets as applicable.

B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

C. Do not use damaged or expired materials.

## 1.8 FIELD CONDITIONS

A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

C. Existing Conditions: Verify the condition of the substrates and correct unsatisfactory conditions before installing products. Follow manufacturers' instructions.

D. Protection: Provide masking and drop cloths to prevent contamination of adjacent surfaces, if required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products from one of the manufacturers specified.
1. Hilti Inc.
2. Specified Technologies, Inc., (STI)
3. 3M Fire Protection Products
4. RectorSeal
5. Tremco, Inc.; Tremco Fire Protection Systems Group
6. A/D Fire Protection Systems
7. Thermafiber, Inc.; an Owens Coring Co.
8. NUCO Inc.
9. Passive Fire Protection Partners
10. Rockwool

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 SYSTEM DESCRIPTION

A. General, Fire-Resistive Joint Systems: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.
1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers, and smoke barriers as indicated on "Code Drawing."
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies as indicated on "Code Drawing."
3. Provide fire-resistive sealants and sprays for construction joint applications that are flexible enough to satisfy the movement criteria per the test standards ASTM E 1399, ASTM E 1966, or ANSI/UL 2079.
4. Provide products with the appropriate flame spread index and smoke developed index, when tested in accordance with ASTM E 84.
5. Where applicable provide systems that meet the intent of the L rating classification for the movement of smoke per ANSI/UL 2079 for construction joints.
6. Where fire-resistive construction gap systems not listed by any listed agency are required due to project conditions, submit a substitution proposal with evidence specified.
7. Provide products that are compatible with each other, with the substrates forming openings, and with the items, if any, penetrating the firestopping, under the conditions represented by this Project, based on testing and field performance demonstrated by manufacturer.
8. Fire-resistive materials must meet and be acceptable for use by all applicable codes cited in this Section.

B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities and L-ratings indicated as determined by UL 2079.
   1. Load-bearing capabilities as determined by evaluation during the time of test.

2.3 FIRE-RESISTIVE JOINT SYSTEMS

A. General, where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases. Provide fire-resistive systems listed for construction type, configuration, gap dimensions, and fire rating, and the following criteria:
   1. Fire-resistance rating must be equal or greater than that of the assembly in which it is installed.
   2. Movement capability must be appropriate to the potential movement of the gap, demonstrated by testing in accordance with ASTM E 1399 for minimum of 500 cycles at 10 cycles per minute.
   3. L-Rating: L-rating of 1 cfm per linear foot maximum.
   4. Determine ratings in accordance with UL 2079.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
   1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies, and roofs or roof/ceiling assemblies.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.

C. Voids at Intersection of a Fire Barrier and a Non-Fire-Resistance Rated Roof Assembly: Provide a material or system approved by authorities with jurisdiction and complying with NFPA 285 to fill void.

D. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg or ASTM E 2307.
   1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

E. Joints in or between Smoke Barriers, Smoke Partitions, and partitions that enclose incidental use areas – that are not required to be fire-resistance-rated due to the presence of automatic fire-extinguishing systems – but are still required to resist the passage of smoke: Provide fire-resistive joint systems with ratings determined per UL 2079, based on testing at a positive pressure differential of 0.30-inch wg.
   1. L-Rating: Not exceeding 5.0 cfm/ft of joint at both ambient and elevated temperatures.

F. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

G. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G 21.

H. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

D. Verify that field dimensions are as shown on the Drawings, tested and listed, classified systems, Engineering Judgments, EFRRA’s and as recommended by the manufacturer.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated, including “System Performance Requirements” article in Part 1.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
   2. Install metal framing, curtain wall insulation, mechanical attachments, safing materials, and other firestop system components as applicable within the system design.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply fill materials so they contact and adhere to substrates formed by joints.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
   4. Provide uniform, cross-sectional shapes and depths relative to joint width that optimize movement capability and meet tested and listed system requirements.
   5. Fill voids at intersection of a fire barrier and non-fire-resistance roof assembly securely for its entire length so not to dislodge, loosen, or otherwise impair its ability to accommodate expected building movements and to retard the passage of fire and hot gases.

D. Tool non-sag firestop materials immediately after their application and prior to the time skinning over begins. Form smooth, uniform beads of configuration required to:
   1. Produce fire-resistance rating.
   2. To eliminate air pockets.
   3. To ensure contact and adhesion with sides of joint.

3.4 IDENTIFICATION

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

B. Marking and Identification: In addition to identification of firestop systems, fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
   1. Be located in accessible concealed floor, floor-ceiling, or attic spaces; and
   2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
   3. Include lettering not less than 3 inches in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS". Other wording must be pre-approved by Authorities having Jurisdiction.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Inspect fire containment systems in accordance with ASTM E 2393, “Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers”.

C. Keep areas of work accessible until inspection by authorities having jurisdiction.

D. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 07 84 43

# SECTION 07 91 00 – PREFORMED JOINT SEALS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes
   1. Preformed joint sealants.
   2. Preformed fire rated joint sealants.

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
   2. Division 07 Section "Joint Firestopping" for sealing joints in fire-resistance-rated construction.
   3. Division 07 Section “Expansion Joint Cover Assemblies”.
   4. Division 09 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
   5. Division 07 Section “Joint Sealants” for liquid sealants applied over preformed seals in dual seal system.
   6. Division 32 Section "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

### 1.2 ACTION SUBMITTALS

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

### 1.3 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Warranties: Special warranties specified in this Section.

### 1.4 QUALITY ASSURANCE

A. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
   1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.
      a. Division 04 Section “Unit Masonry”.
   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.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multiple-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

B. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this section.

1.7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 2 years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

2.3 PREFORMED JOINT SEALANTS

A. General: Preformed foam sealants are to be used at exterior building expansion joints up to 2 inches where 1 inch of movement is anticipated.

B. Preformed Foam Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent; is factory produced in precompressed sizes in roll or stick form to fit joint widths indicated; is coated on one side with a pressure-sensitive adhesive and covered with protective wrapping; develops a watertight and airtight seal when compressed to the degree specified by manufacturer; and complies with the following:
   1. Products:
      a. Emseal 25V; EMSEAL Joint Systems, Ltd.
      b. Willseal 150 or 250; Willseal USA, LLC.
      c. Polytite B/Polytite Standard; Dayton Superior Specialty Chemicals.
      d. Polyseal; Sandell Manufacturing Co., Inc.
      e. Sealtite or Sealtite 50N; Schul International, Inc.
      f. EIF, EIS, or SIF; MM Systems Corp.
      g. Wake Seismic WeatherSeal; Watson Bowman Acme Corp.
      h. Iso-Flex Hydroseal; LymTal Int., Inc.
      i. Erie Metal Specialties, Inc.
   2. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.
      a. Density: Minimum density of 10 lb./cu.ft.
      b. Movement Capacity: -25 percent/+ 25 percent.
      c. Nominal Joint Width: As indicated on Drawings.
   3. Joint Seal Color: As selected by A/E from full range of industry colors.

C. Preformed Foam Sealant, Fire Rated: Manufacturer’s standard preformed, precompressed, fire-retardant impregnated foam backing. Water-repellant silicone sealing surfaces on each side.
   1. Products
      a. Emshield WFR_ System; Emseal, Sika
      b. Similar fire rated product from other Manufacturer’s listed above.
   2. Fire Rating: As indicated on Drawings code plan.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 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 all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
      c. Unglazed surfaces of ceramic tile.
      d. Exterior insulation and finish system.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.
      c. Porcelain enamel.
      d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with preformed joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
   1. Apply joint sealants prior to applying penetrating water repellents. Joint sealants need to cure 7 days prior to application of penetrating masonry sealers.

B. Installation of Preformed, Foam Joint Seals
   1. Install each length of seal immediately after removing protective wrapping.
   2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
   3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
   4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer’s written instructions.

3.4 PROTECTION

A. Protect preformed joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion.

B. Cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 91 00

# SECTION 07 92 00 – JOINT SEALANTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes joint sealants for the applications indicated in the Joint-Sealant Schedule at the end of Part 3.
   1. Joint sealants, general.
      a. Silicone joint sealants
      b. Urethane joint sealants
      c. Immersible joint sealants
      d. Silyl-terminated polyether (STPE) joint sealants
      e. Butyl joint sealants
      f. Latex joint sealants

B. Related Sections include the following:
   1. Division 03 Section “Cast-in-Place Concrete” for sealing of joints in slabs-on-grade or below grade.
   2. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
   3. Division 07 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
   4. Division 07 Section “Preformed Joint Seals” for preformed compressible foam and procured joint seals.
   5. Division 08 Section "Glazing" for glazing sealants.
   6. Division 09 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
   7. Division 09 Section "Tiling" for sealing tile joints.
   8. Division 09 Section “Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.
   9. Division 32 Section "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

### 1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.3 ACTION SUBMITTALS

A. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
   1. Provide color charts to jobsite for selections by A/E representative.
   2. Do not submit color samples to A/E office.

### 1.4 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Warranties: Special warranties specified in this Section.

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project, when required by terms of warranty.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
   1. Refer to Division 04 Section “Unit Masonry” for additional mockup requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multiple-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

B. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this section.

1.8 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 2 years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which silicone sealant manufacturer agrees to furnish silicone joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

2.3 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Liquid-Applied Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.
   1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

C. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.

D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Additional Movement Capability: Where additional movement capability is specified, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C920 for uses indicated.

F. Colors of Exposed Joint Sealants: As selected by A/E from manufacturer's full range, unless otherwise noted.
   1. Provide tintable silicones where custom silicones are indicated.

2.4 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 790 or NS Parking Structure Sealant.
      b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
      c. Pecora Corporation; 301 NS, 311 NS, 890NST, or 890FTS.
      d. Sika Corporation; Sikasil WS-290 or Sikasil 728 NS.
      e. Tremco Incorporated; Spectrem 1 or Spectrem 800.

B. Single-Component, Nonsag, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 756 SMS, 791, 795, or 995.
      b. GE Advanced Materials - Silicones; SilGlaze II SCS2800, SilPruf NB SCS9000, or SilPruf SCS2000.
      c. Pecora Corporation; PCS.
      d. Polymeric Systems, Inc., Whitford Worldwide; PSI-641.
      e. Sika Corporation; Sikasil WS-295 or Sikasil N+.
      f. Tremco Incorporated; Spectrem 2 or 3.

C. Multiple-Component, Nonsag, Silicone Joint Sealant: ASTM C920, Type M, Grade NS, Class 50, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Pecora Corporation; 890FTS-TXTR.
      b. Sika Corporation; Sikasil WS-295 FPS.
      c. Tremco Incorporated; Spectrem 4-TS.

D. Single-Component, Nonsag, Traffic-Grade, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, for Use T.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 790 or NS Parking Structure Sealant.
      b. Pecora Corporation; 301 NS or 311 NS.
      c. Tremco Incorporated; Spectrem 800.
      d. Sika Corporation; SikaSil 728 NS.

E. Single-Component, Pourable, Traffic-Grade, Silicone Joint Sealant: ASTM C920, Type S, Grade P, Class 100/50, for Use T.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 890-SL or SL Parking Structure Sealant.
      b. Pecora Corporation; 300 SL or 310 SL.
      c. Tremco Incorporated; Spectrem 900 SL.
      d. Sika Corporation; SikaSil 728 SL.

F. Mildew-Resistant, Single-Component, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 786 Mildew Resistant.
      b. GE Advanced Materials - Silicones; Sanitary SCS1700.
      c. Tremco Incorporated; Tremsil 200 Sanitary.
      d. Pecora Corporation; 898.
      e. Sherwin-Williams; White Lightning Silicone Ultra Low Odor All Purpose Sealant.
      f. Sika; Sikail-GP.

2.5 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, 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 C920, Type S, Grade NS, Class 35, Use NT.
   1. Adfast
   2. GE Construction Sealants; Momentive Performance Materials Inc.
   3. Pecora Corporation
   4. Sika Corporation – Building Components
   5. Dowsil 756 SMS; The Dow Chemical Company
   6. Tremco Incorporated

2.6 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 25 or 35, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Building Systems; Sonolastic NP1, Sonalastic TX1, or Sonolastic Ultra.
      b. Bostik, Inc.; Chem-Calk GPS1, 900, 915, or 916 Textured.
      c. Pacific Polymers Division, ITW; Elasto-Thane 230.
      d. Pecora Corporation; Dynatrol I-XL.
      e. Polymeric Systems, Inc., Whitford Worldwide; Flexiprene 1000.
      f. Sika Corporation, Construction Products Division; Sikaflex – 1A+ or Sikaflex Textured.
      g. Tremco Incorporated; Dymonic, Dymonic FC, or Vulkem 116.
      h. Henkel (fka OSI); EP-1000.
      i. Sherwin-Williams; Stampede 1 Polyurethane Sealant.

B. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C920. Type S, Grade NS, Class 25, for Use T.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Building Systems; Sonolastic NP1 or Sonolastic Ultra.
      b. Pacific Polymers Division, ITW; Elasto-Thane 230.
      c. Sika Corporation, Construction Products Division; Sikaflex – 1A+.
      d. Tremco Incorporated; Vulkem 116.
      e. Sherwin-Williams; Stampede 1 Polyurethane Sealant.

C. Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C920, Type S, Grade P, Class 25, for Use T.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Building Systems; Sonolastic SL 1.
      b. Bostik, Inc.; Chem-Calk 950.
      c. Pecora Corporation; NR-201.
      d. Polymeric Systems, Inc., Whitford Worldwide; Flexiprene PSI- 952.
      e. Sika Corporation. Construction Products Division; Sikaflex-1CSL.
      f. Tremco Incorporated; Vulkem 45.
      g. Sherwin-Williams; Stampede 1SL Polyurethane Sealant.

D. Multi-component, Nonsag, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.
   1. Products: Subject to compliance with requiremnents.
      a. Pecora Corporation; Dynatrol II
         1) For traffic-grade applications, install per guidelines in manufacturer's technical bulletin.
      b. Tremco Incorporated; Dymeric 240 or Dymeric 240 FC.

E. Multi-component, Nonsag, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Building Systems; Sonolastic NP 2.
      b. Bostik, Inc.; Chem-Calk 500.
      c. Pacific Polymers Division, ITW; Elasto-Thane 227 High Shore Type II, Elasto-Thane 227 R Type II or Elasto-Thane 227 Type II.
      d. Pecora Corporation; Dynatred.
      e. Sika Corporation, Construction Products Division; Sikaflex – 2c NS or Sikaflex – 2c NS EZ Mix.
      f. Tremco Incorporated; Vulkem 227.

F. Multi-component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Building Systems; Sonolastic NP 2.
      b. LymTal International, Inc.; Iso-Flex 885 SG.

c. Pacific Polymers Division, ITW; Elasto-Thane 227 High Shore Type II or Elasto-Thane 227 Type II.
d. Pecora Corporation; Dynatred.
e. Sika Corporation, Construction Products Division; Sikaflex – 2c NS or Sikaflex – 2c NS EZ TG.
f. Tremco Incorporated; Vulkem 227.

2.7 IMMERSIBLE JOINT SEALANT

A. Immersible, Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Uses T and I.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Building Systems; Sonolastic NP1.
b. Sika Corporation, Construction Products Division; Sikaflex – 1a or Sikaflex 1A+.
c. Tremco Incorporated; Vulkem 116.

B. Immersible Multi-component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Uses T and I.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Building Systems; Sonolastic NP 2.
b. LymTal International, Inc.; Iso-Flex 885 SG.
c. Sika Corporation; Sikaflex 2c NS.
d. Pecora Corporation; Dynatred.
e. Tremco Incorporated; Vulkem 227.

C. Immersible Multi-component Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C920, Type M, Grade P, Class 25, for Use T and I.
1. Products: Subject to compliance with requirements, provide one of the following:
a. LymTal International, Inc.; Iso-Flex 880 GB.
b. Sika Corporation; Sikaflex 2c SL.
c. Tremco Incorporated Vulkem 245.

2.8 SILYL-TERMINATED POLYETHER (STPE) JOINT SEALANTS

A. STPE, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. BASF Corporation-Construction Systems.
b. GE Construction Sealants; Momentive Performance Materials, Inc.
c. Pecora Corporation.
d. Sherwin-Williams Company.
e. Sika Corporation; Sika Hyflex 150LM.

2.9 BUTYL JOINT SEALANTS

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

2.10 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Building Systems; Sonolac.
b. Bostik, Inc.; Chem-Calk 600.
c. Pecora Corporation; AC-20+ Silicone.

d. Schnee-Morehead, Division, ITW; SM 8200.
e. Tremco Incorporated; Tremflex 834.
f. Sherwin-Williams; 950A Siliconized Acrylic Latex Caulk.
g. Franklin International; Titebond Kitchen and Bath Sealant

B. Paintable Mildew-Resistant Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Building Systems; Sonolac.
b. Pecora Corporation; AC-20+Silicone.
c. Sherwin-Williams:
1) Powerhouse 1110A Siliconized Acrylic Latex Sealant.
2) White Lightning Kitchen and Bath Latex Ultra Sealant.
d. Tremco; Tremflex 834.

2.11 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.12 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 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 all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
      c. Unglazed surfaces of ceramic tile.
      d. Exterior insulation and finish system.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.
      c. Porcelain enamel.
      d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
   1. Mix and apply multi-component sealants in accordance with manufacturer's printed instructions.
   2. Apply joint sealants prior to applying penetrating water repellents. Joint sealants need to cure 7 days prior to application of penetrating masonry sealers.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
   1. Joints or gaps that require sealant are to be filled with one of the specified sealants even though the note may read "Caulked".
   2. Joints to be filled shall be thoroughly dry and free from dust, dirt, oil, and grease at the time of application of sealants.
   3. Expansion and control joints in exterior walls shall have the joint filler material built into the wall, or between wall and slab, at the time of construction.
   4. Masking: Metal shall be masked with masking tape, as well as other surfaces where it’s required to prevent the sealant smearing the adjacent surface. Upon completion of the sealants, remove the tape.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. 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.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces. Avoid “over-tooling” or “stretching” sealant material during application.
3. Dry tool only, no wet tooling permitted.
4. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated.
5. Provide flush joint profile where indicated per Figure 8B in ASTM C1193.
6. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C1193.
    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

## 3.4 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 for joints as follows:
    a. Select joint sealants between multiple material types.
    b. Initial Testing: One test for every 100 feet until 10 successive acceptable tests are completed.
    c. Subsequent Testing: One test for every, 1000 feet with minimum one test for each building elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
    a. Whether sealants filled joint cavities and are free of voids.
    b. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer’s field-adhesion hand-pull test criteria.
4. Record test results in field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

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 comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

## 3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

## 3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

## 3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application (JS-A): Exterior joints in vertical surfaces and non-traffic horizontal surfaces.
   1. Joint locations such as, but not limited to:
      a. Construction joints in cast-in-place concrete.
      b. Joints between architectural precast concrete units.
      c. Control and expansion joints in unit masonry.
         1) Provide joint sealants slightly darker than the adjacent masonry units. Provide multiple colors as may be required for match.
         2) Provide sealant over expanding foam secondary sealant where a 2 inch building expansion joint is indicated.
      d. Joints in dimensional stone cladding, limestone, and cast stone.
      e. Joints in glass unit masonry assemblies.
      f. Perimeter joints between masonry, concrete, or stone and frames of doors, windows, storefronts, louvers, and similar openings.
      g. Lintels and shelf angles to masonry construction.
      h. Bed joints between stone and masonry.
      i. Butt joints between metal panels.
      j. Joints in exterior insulation and finish systems.
      k. Control and expansion joints in ceiling/soffit and similar overhead surfaces.
      l. Exterior joints between dissimilar materials where the joining of the two surfaces leaves a gap between the meeting materials or components as may be dictated by various methods of construction to make building watertight.
      m. Other joints as indicated on Drawings.
   2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
      a. Neutral-Curing Silicone Joint Sealant:
         1) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 100/50, for Use NT.
         2) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
         3) Multi-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
   3. Color: Custom color to match A/E's sample of adjacent materials.

B. Joint-Sealant Application (JS-B): Exterior joints in vertical surfaces that need to be non-staining.
   1. Joint locations such as, but not limited to:
      a. Joints in dimensional stone cladding, limestone, and cast stone.
      b. Bed joints between stone and masonry.

c. Perimeter joints between stone and frames of doors, windows, storefronts, louvers, and similar openings.
d. Other joints as indicated on drawings.

C. Joint-Sealant Application (JS-C): Exterior joints in horizontal traffic surfaces.
1. Joint locations such as, but not limited to:
a. Control and expansion joints in brick pavers.
b. Isolation and contraction joints in cast-in-place concrete slabs.
c. Joints between plant-precast architectural concrete paving units.
d. Joints in stone paving units.
e. Tile control and expansion joints.
f. Joints between different materials listed above.
g. Other joints as indicated on Drawings.
2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
a. Neutral-Curing Silicone Joint Sealant:
1) Single-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 100/50, for Use T.
2) Single-Component, Pourable, Traffic-Grade: ASTM C920, Type S, Grade P, Class 100/50, for Use T.
b. Urethane Sealant:
1) Single-Component, Pourable, Traffic-Grade: ASTM C920, Type S, Grade P, Class 25, for Use T.
2) Multi-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade P, Class 50, for Use T.
3) Multi-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade P, Class 25, for Use T.
3. Color: As selected by A/E from manufacturer's full range of colors.

D. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion (JS-D).
1. Joint locations:
a. Joints in pedestrian plazas.
b. Other joints as indicated.
2. Immersible Urethane Joint Sealant:
a. Single-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 25, for Use T and I.
b. Multi-Component, Nonsag, Traffic-Grade: ASTM C920, Type M, Grade NS, Class 25, for Use T and I,
c. Multi-Component, Pourable, Traffic-Grade: ASTM C920, Type M, Grade P, Class 25, for Use T and I.

E. Joint-Sealant Application (JS-E): Interior joints in horizontal traffic surfaces.
1. Joint locations such as, but not limited to:
a. Isolation joints in cast-in-place concrete slabs.
b. Perimeter of floor slabs or concrete curbs which abut vertical surfaces.
c. Areas around all piping systems that penetrate the slab or foundation walls below grade (utility trenches, electrical conduits, plumbing penetrations, etc.).
d. Control and expansion joints in tile flooring.
e. Other joints as indicated on Drawings.
2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
a. Neutral-Curing Silicone Joint Sealant: Single-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 100/50, for Use T.
b. Urethane Joint Sealant:
1) Single-Component, Pourable, Traffic-Grade: ASTM C920, Type S, Grade P, Class 25, for Use T.
2) Multi-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade P, Class 50, for Use T.
3) Multi-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade P, Class 25, for Use T.

3. Color: As selected by A/E from manufacturer's full range of colors.

F. Joint-Sealant Application (JS-F): Interior joints in vertical surfaces and horizontal non-traffic surfaces, subject to movement, unless otherwise noted.
   1. Joint locations such as, but not limited to:
      a. Control joints on exposed interior surfaces of exterior walls.
      b. Joints in precast beams and planks, including underside.
      c. Interior joints where interior partitions meet exterior walls of dissimilar materials and components.
      d. Other joints as indicated on Drawings.
   2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated.
      a. Urethane Joint Sealant:
         1) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 25 or 35, for Use NT.
         2) Multi-Component, Nonsag: ASTM C920, Type M, Grade NS, Class 25, for Use NT.
      b. Silyl-Terminated Polyester
         1) Single-Component, STPE, S, NS, 50, NT.
   3. Color: Custom to match A/E's sample.

G. Joint-Sealant Application (JS-G): Interior joints in vertical surfaces subject to abuse and movement.
   1. Joint locations such as, but not limited to:
      a. Vertical joints, including control joints and joints between masonry and structural support members, on exposed surfaces of interior unit masonry walls and partitions.
   2. Provide the following acceptable sealants as approved by manufacturer for substrates and use indicated:
      a. Urethane Joint Sealant: Single-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 25, for Use T.
   3. Color: Custom to match A/E's sample.

H. Joint-Sealant Application (JS-H): Interior joints in vertical surfaces not subject to movement.
   1. Joint locations such as, but not limited to:
      a. Interior perimeter joints of exterior openings.
      b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
      c. Interior joints between dissimilar materials where a gap is created where materials meet, unless otherwise noted.
   2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
      a. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
   3. Color: As selected by A/E from manufacturer's full range.

I. Joint-Sealant Application (JS-I): Mildew-resistant interior joints in non-painted vertical surfaces and horizontal nontraffic surfaces.
   1. Joint locations such as, but not limited to:
      a. Interior joints between plumbing fixtures and adjoining floors and counters.
      b. Joints between countertops and backsplashes.
      c. For interior joints in non-painted vertical and horizontal surfaces where incidental food contact may occur.
      d. Tile control and expansion joints where indicated.
      e. Other joints as indicated on Drawings.
   2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:

a. Mildew-Resistant, Single-Component, Acid-Curing, or Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Use NT.
   1) For potable water storage sealant shall be certified by National Sanitation Foundation as conforming to the requirements of NSF Standard 61 – Drinking Water System Components – Health Effect.
   2) For surfaces where incidental food contact may occur sealant must comply with United States Department of Agriculture (USDA) guidelines for incidental food contact with cured sealant.

3. Color: As selected by A/E from manufacturer's full range of colors.

J. Joint-Sealant Application (JS-J): Mildew-resistant interior joints in painted vertical surfaces and horizontal non-traffic surfaces.
1. Joint locations such as, but not limited to:
   a. Interior joints between plumbing fixtures and adjoining painted walls.
   b. Joints where countertops or backsplashes intersect painted walls.
   c. For interior joints in painted vertical and horizontal surfaces where incidental food contact may occur.
2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
   a. Mildew-Resistant Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
3. Color: As selected by A/E from manufacturer's full range of colors.

K. Joint-Sealant Application (JS-K): Interior or exterior joints in vertical surfaces between laps in fabrications of sheet metal.
1. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
   a. Urethane Joint Sealant:
      1) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 25 or 35, for Use NT.
      2) Single-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 25, for Use T.
2. Color: Not applicable.

L. Joint-Sealant Application (JS-L): Exterior joints under metal thresholds and saddles, sill plates, or as bedding sealant for sheet metal flashing and frames of metal or wood.
1. Provide one of the following acceptable sealants as approved by manufacturer for substrates and use indicated.
   a. Neutral-Curing Silicone Joint Sealant:
      1) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 100/50, for Use NT.
      2) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
      3) Multi-Component, Nonsag: ASTM C920, Type M, Grade NS, Class 50, for Use NT.
   b. Urethane Joint Sealant:
      1) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 25 or 35, for Use NT.
      2) Single-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 25, for Use T.
   c. Butyl-rubber based sealant.
2. Color: Not applicable.

END OF SECTION 07 92 00

# `SECTION 07 95 13.13 – INTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes interior expansion joint cover assemblies.

B. Related Sections include the following:
1. Division 04 Section "Unit Masonry" for masonry wall joint systems.
2. Division 07 Section "Fire-Resistive Joint Systems" for liquid-applied joint sealants in fire-resistive building joints.
3. Division 07 Section “Preformed Joint Seals” for performed foam joint seals typically at expansion joints.
4. Division 07 Section "Joint Sealants" for liquid-applied joint sealants and performed foam joint seals.

1.2 DEFINITIONS

A. Architectural Joint System: Any filler or cover used to span, fill, cover, or seal a joint, except expanding foam seals and poured or foamed in-place sealants.

B. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist passage of flame and hot gases through a movement joint.

C. Cyclic Movement: Periodic change between widest and narrowest joint widths in an automatically mechanically controlled system.

D. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

E. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

F. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage (plus or minus) of nominal value of joint width.

G. Nominal Joint Width: The width of the linear opening specified in practice and in which the joint system is installed.

1.3 ACTION SUBMITTALS

A. Product Data: For each manufactured product specified, product specified, including data sheets, installation instructions, and as required templates to explain construction and to provide for incorporation of the product into the Project.

1.4 QUALITY ASSURANCE

A. Accessibility Requirements: Comply with applicable provisions in ICC A117.1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Conspec Systems, Inc.
   2. Balco, Inc.
   3. MM Systems Corporation
   4. Watson Bowman Acme, BASF Corp.
   5. Nystrom Building Products
   6. Architectural Art Mfg. Division, Pittcon Architectural Metals, LLC
   7. Jointmaster by Inpro Corp.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany request for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
   1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
   2. Include factory-fabricated closure materials and transitions pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.

B. Provide factory fabricated architectural joint systems capable of withstanding the types of loads and of accommodating the kinds of movement, and the other functions for which they are designed including those specified below, without failure. Types of failure include those listed in Appendix X3 of ASTM E1399.
   1. Joints in Fire Resistance Rated Assemblies: Maintain fire resistance ratings of assemblies.
   2. Joints in Smoke Barriers: Maintain integrity of smoke barrier.
   3. Other Joints: Where indicated, provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.

C. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E 1966 by a qualified testing agency.
   1. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies shall be subjected to hose stream testing.
   2. Other Joints: Where indicated, provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.

2.3 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.
   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
   2. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

B. Elastomeric Seals: Manufacturer’s standard preformed elastomeric membranes or extrusions to be installed in metal frames.

C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

D. Non-Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, non-metallic aggregate grout, noncorrosive nonstaining, mixed with water to consistency suitable for application and a 30 minute working time.

E. Accessories:
1. Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.4 ARCHITECTURAL JOINT SYSTEMS, GENERAL

A. Design Criteria:
1. Nominal Joint Width: As indicated.

2.5 FLOOR EXPANSION JOINT COVERS

A. Metal-Plate Floor Joint Cover (Gym – Threshold/Transition)(Wood to Resilient Athletic Flooring): Metal cover plate fixed on one side of joint gap and free to slide on other.
1. Manufacturers: Subject to compliance with requirements; provide one of the following:
a. Balco; 1120
b. C/S Systems
c. MM Systems
d. Watson Bowman Acme
e. Nystrom Building Products
f. Architectural Art Mfg., Inc
g. Jointmaster/Inpro
2. Application: Floor to floor.
3. Installation: Surface mounted.
4. Load Capacity:
a. Uniform Load: 50 lb/sq. ft.
b. Concentrated Load: 300 lb.
c. Maximum Deflection: 0.0625 inch.
5. Cover-Plate Design: Plain.
6. Exposed Metal:
a. Aluminum: Clear anodic, Class I, unless otherwise noted.

2.6 WALL EXPANSION JOINT COVERS

A. Metal-Plate Wall Joint Cover: Metal cover plate fixed on one side of joint gap and free to slide on other.
1. Manufacturers: Subject to compliance with requirements; provide one of the following:
a. ASM Series; C/S Systems.
b. WD Series; Balco.
c. EX-K Systems; MM Systems.
d. Wabo Fastwall EWH; Watson Bowman Acme Corp.
e. WJ Series; Nystrom Building Products.
f. GXX-59-14; Architectural Art Manufacturing, Inc.
g. 811 Series; InPro Corporation.
2. Application: Wall to wall and wall to wall corner.

3. Fire-Resistance Rating: Not less than that indicated on Drawings.
   a. Provide manufacturer's standard fire barrier material within joint as required by assembly testing and rating.
4. Exposed Metal:
   a. Aluminum: Clear anodic, Class I.

2.7 FABRICATION

A. Provide expansion joint cover assemblies of design, basic profile, materials, and operation indicated. Select units comparable to those indicated or required to accommodate joint size, variations in adjacent surfaces, and structural movement. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials. Include closure materials and transition pieces, tee-joints, corners, cross-connections, and other accessories as required to provide continuous joint cover assemblies.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where architectural joint systems will be installed for installation tolerances and other conditions affecting performance of work.

B. Notify A/E where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

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

3.2 PREPARATION

A. Prepare substrates according to architectural joint system manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing architectural joint assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.
   1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify A/E where discrepancies occur that will affect proper joint installation and performance.
3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
4. Repair or grout blockout as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
5. Locate in continuous contact with adjacent surfaces.
   a. Standard-Duty Systems: Shim to level where required. Support underside of frames continuously to prevent vertical deflection when in service.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

E. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

F. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over joints. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION 07 95 13.13

# DIVISION 08 OPENINGS

# SECTION 08 12 13 - HOLLOW METAL FRAMES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Hollow metal frames
   2. Hollow metal fire rated frames
   3. Borrowed lites

B. Furnish materials and equipment necessary for complete installation by the following Sections:
   1. Division 04 Section “Unit Masonry”: For installing anchors in masonry construction.

C. Coordination: Refer to Division 08 Section “Glazing” to obtain glass thickness requirements. Provide properly sized stops and bead to house the specified glass according to the glass manufacturer's recommendations and as indicated.

D. Related Sections:
   1. Division 07 Section “Joint Sealants”: For caulking between metal frames and adjacent materials.
   2. Division 08 Section “Flush Wood Doors”.
   3. Division 08 Section “Door Hardware” for coordination.
   4. Division 08 Section “Glazing”.
   5. Division 09 Section Interior Painting**.**
   6. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.
      a. Exception: Low-voltage wiring for security/access control and for automatic door operator switches is pulled by the Division 28 ("Electronic Safety and Security") security/access control contractor.

### 1.2 DEFINITIONS

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

### 1.3 COORDINATION

A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

### 1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.5 ACTION SUBMITTALS

A. Product Data: For each type of frame specified, including details of construction, materials, dimensions, hardware preparation, fire-resistance ratings, label compliance, and finishes.

B. Shop Drawings:
   1. Provide schedule of frames using same reference numbers for details and openings as those on Contract Drawings and Schedules.
   2. Elevations of each door frame type.

3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on drawings. Coordinate with door hardware schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver frames cardboard wrapped or crated to provide protection during transit and job storage.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store frames at building site under cover. Place units on minimum 4 inch high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. Provide minimum 1/4 inch space between each stacked door to permit air circulation.

1.7 FIELD CONDITIONS

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

B. Door Size Field-Verification: Contractor/Frame Supplier shall note that the door sizes as listed on the door schedule, for new frames in existing openings, are approximate and are for bidding purposes only. The Contractor/Frame Supplier MUST field verify door size, frame preps, and other frame conditions prior to submission of Shop Drawings and fabrication of frames. It will be assumed, by the A/E, that the door size as indicated on the Shop Drawings has been field-verified by the Contractor/Frame Supplier. Frames shipped to the Project site that are incorrect size for the existing opening shall be the responsibility of the Contractor/Frame Supplier to replace at no additional cost to the Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
a. Ceco Door Products; Div. of Assa-Abloy Group Company
b. Steelcraft; Div. of Ingersoll-Rand
c. Curries; Div. of Assa-Abloy Group Company
d. Mesker Door Inc.
e. The MPI Group, LLC
f. Deansteel Manufacturing Company
g. Security Metal Products.
h. Door Components, Inc.
i. Pioneer Industries
j. Republic Doors and Frames.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the “Substitution Request Form” and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Openings shall be provided to conform with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. Where openings, in the opinion of the supplier/manufacturer, do not conform, the A/E shall be notified.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire protection ratings indicated, based on testing according to NFPA 252 or UL 10c.
   1. Test Pressure: “Positive Pressure Tested,” after 5 minutes into the test, the neutral pressure level in the furnace shall be established at 40 inches or less above the sill.

C. Fire Rated Borrowed Light Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257 or UL9.

D. Smoke Control Door Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL1784 and installed in compliance with NFPA 105.

2.3 MATERIALS

A. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A1008, Drawing Steel, Type B; stretcher-leveled standard of flatness.

B. Frame Anchors: ASTM A879, Commercial Steel (CS), 40z (12G) coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel complying with ASTM A 1008A or ASTM A 1011, hot-dip galvanized according to ASTM A 153, Class B.

C. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot dip zinc coated items to be built into exterior walls, complying with ASTM A153, Class C or D as applicable.

D. Shop Applied Paint: For steel surfaces, use rust-inhibitive enamel or paint, either air drying or baking, suitable as a base for specified finish paints.
   1. Comply with ANSI A250.10 for acceptance criteria.

E. Glazing: Comply with requirements in Division 08 Section “Glazing.”

F. Mineral Fiber Insulation: ASTM C 665, Type 1 (blankets without membrane facing); consisting of fibers manufactured from slag or rock wood with a 6 to 16 pounds per cubic foot density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

G. Corrosion-Resistant Coating: Spray-applied rubber- or asphalt-based automotive undercoating.

2.4 FRAME TYPES

A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Frames for interior door openings and borrowed lights shall be fabricated with 2 inch face at jambs, heads and mullions, unless otherwise indicated.
   1. 0.053 inch thick (fka 16 gauge) steel, cold rolled, factory applied baked on primer, for Level 2 and Level 3 steel doors and wood doors.
   2. 0.067 inch thick (fka 14 gauge) steel, cold rolled factory applied baked on primer, for Level 4 doors (provide at steel-framed partitions).
   3. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
   4. Construction: Full profile welded, unless otherwise noted.
   5. Exposed Finish: Prime.

C. Full Profile Welded Frames: Frames for masonry and steel stud and drywall construction shall be mitered or butted and set-up and welded, "SUW", with welds on exposed surfaces, dressed smooth and flush. Provide a temporary spreader bar securely fastened to the bottom of each frame. Butt welded frames without back bend at head and jamb joint will not be acceptable.

2.5 FRAME ASSEMBLIES

A. Stops and Beads: Furnish minimum 0.032 inch thick (fka 20 gauge) sheet steel glazing beads with the hollow metal frames at transoms, side lights, interior glazed panels, and other locations where beads are indicated in pressed steel frames. Glazing beads for exterior frames shall be on the interior side of transoms and sidelights. Glazing beads for interior frames shall be located on the secure side of opening.

B. Mortar/Plaster Guards: Provide minimum 0.016 inch thick (fka 26 gauge) steel plaster guards or mortar boxes, welded to the frame, at back of door hardware cutouts where mortar or other materials might obstruct hardware operation.

C. Provide minimum 0.1495 inch thick (fka 9 MSG) hinge reinforcement, including all doors with continuous-type hinges.

D. Provide minimum 0.1046 inch thick (fka 12 MSG) frame head reinforcement for closers, surface, and concealed overhead stop and holders, removable mullions, flush bolts, and top latch of vertical rod exit devices.

E. Door Silencers: Drill stops and install 3 silencers on strike jambs of single swing frames and 2 silencers on heads of double swing frames.

F. Hollow metal frames requiring continuous gear hinges or pin-and-barrel hinges shall have a continuous mortar guard of foam or cardboard by the frame height, applied with construction adhesive or a minimum 0.016-inch thick (fka 26 gauge) steel, welded to frame, the full height of the door. Mortar guards shall be shop applied by frame supplier.

G. Frames installed in masonry shall be furnished with a field-or-shop applied corrosion-resistant coating the full depth of the frame.

2.6 BORROWED LITES

A. Fabricate of minimum thickness of 0.053 inch of the following:
   1. Interior: Uncoated steel sheet.

B. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles and each joints, fabricated of metal of same or greater thickness as metal as frames.

C. Provide countersunk, flat-or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.7 FRAME ANCHORAGE

A. Wall, Floor, and Head Anchors
   1. Frames Set in New Masonry: Provide metal anchors of shapes and sizes required for the adjoining wall construction. Provide a minimum of 3 wall anchors per jamb. Frames over 7’-6” shall be provided with one additional anchor for each 24 inch or fraction thereof.
      a. Provide adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inches thick (fka 18 gauge), with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch in diameter (fka 7 WMG).
   2. Frames Set Against Previously Placed Masonry or Concrete: Punch each frame jamb and dimple countersink for not less than four 3/8 inch diameter flat head screws. For doors over 7’-6” high, punch for one additional anchor for each 24 inches or fraction thereof. Provide pipe sleeves with spacers welded into each jamb at each fastening location. Provide 3/8 inch diameter galvanized steel flat head screws with approved expansion anchors or toggles as required. After installing flat head screws, fill head of countersink screw with body filler, then sand flush with frame.
   3. Frames Set in Metal Stud Partitions: Provide a minimum of three 0.042 inch thick (fka 18 gauge) metallic coated "Z" shaped sheet metal jamb anchor clips welded in each jamb. For doors over 7’-6” high weld one additional anchor for each 24 inches or fraction thereof.
   4. Provide head anchors at door or window heads over 5 feet wide at minimum 3 feet o.c.
   5. Provide 0.067 inch thick (fka 14 gauge) minimum angle shaped floor clips welded to jambs and punched for two 3/8 inch diameter bolts each.
   6. Provide adjustable length clip angles as required.

2.8 FIRE DOOR FRAMES

A. Provide approved and labeled hollow metal fire door frames at locations indicated in Door Schedule. Approved doors, frames, and hardware shall be constructed and installed in accordance with requirements of NFPA 80 and tested by UL (Underwriters' Laboratories, Inc.) or WH (Warnock Hersey) for the class of door opening indicated in schedules.

B. Provide 3/4 inch stops for sidelights and transoms where the individual glass areas for fire rated openings exceed the allowable area for 5/8 inch stops.

C. Label Materials and Attachment: Labels shall be steel, brass, aluminum, or non-metallic. Metal labels shall be attached by welding, riveting, pop riveting, or with drive screws. Embossed labels stamped directly into the steel will not be acceptable. Labels shall be provided for doors, door frames, and borrowed lites. Labels shall be protected during painting. Label protection shall be removed after final coat of paint has been completed and approved.

D. Labeled metal frames are required for labeled wood doors.

2.9 FABRICATION

A. Fabricate steel door frame units to comply with ANSI A250.8 and be rigid, neat in appearance, and free from defects, warp, or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at the Project site.

B. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold rolled or hot rolled steel (at fabricator's option).

C. Clearances for Non-Fire Rated Doors: Not to exceed 1/8 inch at jambs and heads, 3/32 inch between pairs of doors, and 3/4 inch at bottom.

D. Clearances for Fire Rated Doors: As required by NFPA 80.

E. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

F. Exposed fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.

G. Door Hardware Preparation: Factory prepare hollow-metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
   1. Prepare hollow metal units to receive mortised and concealed door hardware, including cutouts, steel reinforcing, drilling, and tapping in accordance with final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A250.6 and ANSI/BHMA A156.115 for preparation of hollow-metal work for hardware.
   2. Reinforce hollow metal units to receive nontemplated, mortised, and surface mounted hardware. Hardware installer shall drill and tap for surface applied hardware.

H. Stops and Moldings: Manufacturer's standard, formed from minimum 0.032 inch thick (fka 20 gauge) steel sheet stops and moldings around glazed lites and louvers. Form corners of stops and moldings with butted or mitered hairline joints.
   1. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
   2. Provide fixed frame moldings on outside of exterior and on secure side of interior frames. Provide loose stops and moldings on inside of hollow-metal frames.
   3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
   4. Provide stops for installation with countersunk flat- or oval-headed machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.10 STEEL FINISHES

A. General: Comply with recommendations in "Metal Finishes Manual" by Architectural and Metal Products Division of National Association of Architectural Metal Manufacturers (NAAMM) for applying and designating finishes.
   1. Finish standard steel frames after assembly.

B. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning".

C. Factory Priming for Field Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.
   1. Shop Primer: Manufacturer's standard, fast curing, lead and chromate free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field applied finish paint system indicated; and providing a sound foundation for field applied topcoats despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel frames.
   1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.

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

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory prior to setting frames. Restore exposed finish by grinding, fitting, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Prior to installation and with Contractor-installed installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured on jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install steel frames and accessories according to shop drawings, manufacturer's data, and as specified.

B. Standard Steel Frames: Install standard steel frames for doors, sidelights, transoms, borrowed lights, and other openings, of size and profile indicated. Comply with ANSI A250.11 or NAAMM HMMA 840 as required by standards specified.
1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. At fire protection rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections due to shipping or handling limitations, field-splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   c. Install frames with removable glazing stops located on secure side of opening.
   d. Install door silencers in frames before grouting.
   e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   f. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   g. Field-apply corrosion-resistant coating to backs of frames that are installed in masonry or concrete walls, where coating has not been shop applied. coverage rate, or in the case of automotive undercoating, to a minimum 1/8-inch thickness.
2. Floor Anchors: Provide floor anchors for each jamb and mullions that extends to floor and secure with postinstalled expansion anchors.
   a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on shop drawings.
3. Metal Stud Partitions: Solidly pack mineral fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout as specified in Division 04 Section "Unit Masonry."
   a. Where grout is installed during masonry installation, frames shall be braced or fastened in such a way that will prevent the pressure of the grout from deforming the frame members. Grout shall be mixed to provide a 4 inch maximum slump consistency, hand troweled into place. Grout mixed to a thin "pumpable" consistency shall not be used.
      1) Refer to ANSI A 250.8 for additional information.

5. Existing Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Existing Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Glazing: Comply with installation requirements in Division 08 Section “Glazing” and with standard steel frame manufacturer’s written instructions.
1. Secure stops with countersunk flat or oval head machine screws spaced uniformly not more than 9 inches on center, and not more than 2 inches on center from each corner.

## 3.4 FIELD QUALITY CONTROL

A. Frames
1. Install plumb, level and true to line, secured in openings.
2. Install frames in accordance with accepted shop drawings, manufacturer's printed instructions.

B. Final Adjustment: Doors and hardware shall receive final adjustment as follows:
1. Door Contact with Silencers: Single doors shall strike a minimum of two silencers without binding lock or latch bolts in the strike plate.
2. Head, Strike and Hinge Jamb Margin: 1/8 inch.
3. Meeting Edge Clearance, Pairs of Doors: . 1/8 inch plus-or-minus 1/16 inch
4. Bolts and Screws: Leave tight and firmly seated.
5. Fire-Resistance Rated Doors: Install with clearances per NFPA 80.
6. Smoke-Control Doors: Install with clearances per NFPA 105.

C. Warped, bowed, or damaged work will be rejected and shall be replaced with new work.

D. Check and readjust operating hardware items immediately before final inspection.

E. Leave work in a complete and proper operating condition.

## 3.5 CLEANING

A. Clean grout and other bonding material off standard steel frames immediately after installation.

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

## 3.6 PROTECTION

A. After installation, protect frames from damage during subsequent construction activities.

END OF SECTION 08 12 13

# SECTION 08 13 16.16 - FLUSH ALUMINUM DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Flush aluminum doors.
   1. Hardware for flush aluminum doors will be furnished under Division 08 Section “Door Hardware”.

B. Related Sections:
   1. Division 07 Section “Joint Sealants”: For sealant between aluminum frames and adjacent materials.
   2. Division 08 Section “Aluminum-Framed Entrance and Storefront Framing”.
   3. Division 08 Section “Door Hardware” for coordination.

1.2 DEFINITIONS

A. Definitions: For fenestration industry standard terminology and definition refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA-AG).

1.3 PRE-INSTALLATION MEETING:

A. A general orientation meeting shall be attended by the following:
   1. Storefront framing contractor
   2. Hardware supplier
   3. Hardware installer
   4. Electrical contractor
   5. Security contractor
   6. Automatic door operator installer
   7. General trades contractor
   8. Construction Manager
   9. A/E’s and Owner’s representative

B. Agenda
   1. Review of installation procedures related to the schedules of hardware, doors, and frames. Review the wiring diagrams for related electronic hardware and connection to the security access system and intended function.
   2. Agenda
      a. Review and finalize construction schedule.
      b. Review code and project performance compliance documentation and testing requirements including product certification for energy (U-value, SHGC), ADA, etc.
      c. Review means and methods related to installation, including manufacturer’s written instructions.
      d. Examine support conditions for compliance with requirements including alignment and attachment to structural members.
      e. Review flashings, openings, and conditions of other construction affecting this work.
      f. Review temporary protection requirements for during and after installation of this work.

1.4 ACTION SUBMITTALS

A. Product Data: For each product specified, including details of construction relative to materials, dimensions of individual components, profiles, finishes, anchorage and fasteners, glazing, and internal drainage.
   1. Energy Performance Certificates: For aluminum doors from manufacturer.
      a. Basis for Certification: NFRC-certified energy performance values for each aluminum door type.

B. Shop Drawings: Show elevations of each door type, door construction details and methods of assembling sections, hardware locations and installation methods, dimensions, and shapes of materials, anchorage and fastening methods, weatherstripping, and finish requirements. Drawings must show actual wall conditions.
   1. Provide schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings and Schedules.

C. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.5 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
   2. Warranties: Special warranties specified in this Section.

1.6 MAINTENANCE

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

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer and supervisor who has specialized in installing flush aluminum door similar to those required for this Project and who is acceptable to manufacturers.

B. Regulatory Requirements: Doors shall be provided to conform with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. Where openings, in the opinion of the supplier/manufacturer, do not conform the A/E shall be notified.

C. 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, alignments, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not change intended aesthetic effects, as judged solely by A/E, except with A/E's approval. If changes are proposed, submit comprehensive explanatory data to A/E for review.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Materials to be packed, loaded, shipped, unloaded, stored and protected in accordance with AAMA C101-10.

B. Do not used adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of this Work to be performed according to manufacturer's installation instructions and warranty requirements.
   1. Install sealant according to sealant manufacturer guidelines.

B. Field Measurements: Check openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the work.

1.10 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of metals, metal finishes unless special finish warranty is required, and other materials beyond normal weathering.
      d. Water leakage through fixed glazing and framing areas.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to where to bare metal.
   2. Warranty Period: 10 years from date of Substantial Completion.
   3. Warranty covers factory-applied finishes on exposed extruded aluminum surfaces without standing water accumulation, against peeling, checking, cracking, checking and change of color, per applicable AAMA specifications.

1.11 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
      a. Tubelite Inc. (Tubelite) a subsidiary of Apogee Framing Systems
      b. Cross Aluminum Products (Cross)
      c. EFCO Corporation (EFCO) a subsidiary of Apogee Framing Systems
      d. Kawneer Company, Inc. (Kawneer)
      e. Manko Window Systems Inc. (Manko)
      f. Special-Lite, Inc.
      g. U.S. Aluminum Division, CR Laurence Co. (CRL).
      h. YKK AP America Inc. (YKK)
      i. Oldcastle Building Envelope

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

1.12 PERFORMANCE REQUIREMENTS

A. Refer to Division 08 Section "Aluminum-Framed Entrances and Storefront Framing" for additional "Opening" requirements.

B. General: Provide flush aluminum doors capable of withstanding loads and thermal and structural movement requirements without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

C. Design Wind Loads
   1. Wind Loads: As indicated on Drawings.
   2. The design wind pressure for the project will be:
      a. 20 psf positive and negative, unless otherwise noted.
         1) Provide a minimum 25 psf negative at corner zones.
      b. Per local building codes.

D. Structural: Test according to ASTM E330 as follows:
   1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites of glass to 3/4 inch whichever is smaller.
   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.

E. Performance Requirements: Exterior entrance doors
   1. Air Infiltration Test: With door sash closed and locked, test unit in accordance with ASTM E283 or NFRC 400 at a static air pressure difference of 1.57 psf.
      a. Air infiltration shall not exceed .50 cfm/SF of unit, for a single door.
      b. Air infiltration shall not exceed 1.0 cfm/SF of unit, for a pair of doors.
   2. Water Penetration under Static Pressure: Test according to ASTM E331 and as follows:
      a. 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.

F. Energy Performance: Certify and label energy performance according to NFRC as follows:
   1. Thermal Transmittance (U-factor): Thermally-improved doors shall have U-factor at not more than 0.70 Btu/sq.ft. x h x deg F.
   2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
   3. Condensation Resistance: Fixed glazing and framing areas shall have an NRFC certified condensation resistance rating at no less than 45 as determined according to NFRC 500.

## 1.13 FLUSH ALUMINUM DOORS

A. Doors: Manufacturer's standard flush aluminum doors, for manual swing operation.
   1. Provide minimum 1-3/4-inch-thick doors constructed from the following materials:
      a. Framing and Hardware Backup: Extruded aluminum tubing, 0.125 inch minimum thickness.
      b. Facing; provide one of the following:
         1) Seamless aluminum sheet 0.062 inch thick ribbed texture, laminated to 0.125-inch tempered hardboard.
         2) Seamless aluminum sheet 0.090 inch thick ribbed texture.
   2. Core: Rigid insulating material of not less than 2.0 lb./cu.ft. density.
   3. Exterior stops shall be an integral part of the door construction with a minimum wall thickness of .132 inch and a minimum height of 3/4 inch. Glazing tape shall be applied to stop prior to installation of glass or panel. Doors shall be interior glazed with 3/4-inch-high extruded aluminum snap-in glass stops with a minimum wall thickness of 0.060 inch with a roll-in gasket.
   4. Reinforce doors as required for installing hardware.
      a. At pair of exterior doors, provide sliding weather retained in adjustable strip mortised into door edge.
      b. At exterior doors, provide weather sweeps applied to door bottoms.
   5. Where aluminum doors are scheduled to receive a concealed overhead stop, the jamb bracket shall be mortised into the frame and the channel mortised into the top of the door. The cut for the arm on the stop side of the door shall not be cut below the stop strip of the frame.

B. Where ADA compliant threshold is scheduled, provide door with door bottom sweeps and undercut door as required for weathertight seal. Verify type threshold with door hardware schedule.

C. Weatherstripping: Manufacturer's replaceable components used as tested for air infiltration, water penetration, and thermal "performance requirements".

1.14 DOOR AND WINDOW FRAMING MATERIALS AND CONSTRUCTION

A. Refer to Division 08 Section "Aluminum-Framed Entrance and Storefront Framing".

1.15 HARDWARE

A. For balance of hardware furnished by others, refer to Division 08 Section "Door Hardware".

1.16 FINISH

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604and with coating and resin manufacturer's written instructions.
   1. Color and Gloss: Black.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

2.2 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
   1. Aluminum Surface Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

2.3 INSTALLATION

A. Flush aluminum doors shall be securely installed according to the manufacturer's recommendations, and operating hardware shall be checked for proper function and adjustment.
   1. Adjust weatherstripping contact and hardware movement to produce proper operation.

B. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturer's written instructions.
   1. Field-Installed Entrance Door Hardware: Install surface mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.
   2. Exterior Doors: Install to produce weathertight enclosure and tight fit at weatherstriping.

C. Refer to Division 08 Section "Aluminum-Framed Entrances and Storefronts".

D. Do not cut aluminum frame stop strip when mounting exit devices and closers.

E. Where aluminum doors are scheduled to receive a concealed overhead stop, the jamb bracket shall be mortised into the frame and the channel mortised into the top of the door. The cut for the arm on the stop side of the door shall not be cut below the stop strip of the frame.

2.4 ADJUSTING AND CLEANING

A. Adjust doors and hardware to provide tight fit at contact points and weatherstripping, smooth operation, and weathertight closure.
   1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70 degree open position to 3 inches from the latch measured to the leading door edge.

B. Cleaning: Comply with AAMA 609 and 610 for methods, equipment, and materials to clean finished aluminum after installation.

C. Remove excess sealant and glazing compounds, and dirt from surfaces.

2.5 PROTECTION

A. Protect the flush aluminum doors and their finish against damage from construction activities and harmful substances. Clean the aluminum surfaces as recommended for the type of finish applied.

END OF SECTION 08 13 16.16

# SECTION 08 14 16 - FLUSH WOOD DOORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Factory-preparation of wood doors for hardware specified in Division 08 Section “Door Hardware”.
3. Doors shall be factory-finished, unless otherwise noted.
4. Factory-fitting flush wood doors to frames.
5. Factory-glazing.
6. Full-glass full-warranty doors.

B. Related Sections:
1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Door Hardware” for coordination.
3. Division 08 Section “Glazing”.

### 1.2 ACTION SUBMITTALS

A. Product Data: Submit door manufacturer's product data, specifications, and installation instructions for each type of wood door, including door construction description and WDMA I.S.1-A and AWS classifications.
1. Include details of core and stile construction, trim for openings and louvers (if any), and similar components.
2. Include factory-finishing specifications.

B. Shop Drawings: Indicate locations, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension, and locations of hardware, lite and louver cutouts, and glazing thickness.
3. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
4. Dimensions and locations of blocking for hardware attachment.
5. Dimensions and locations of mortises and holes for hardware.
6. Undercuts and clearances.
7. Requirements for veneer matching.
8. Doors to be factory finished and finish requirements.
9. Include details of sound control seals.

C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
1. Faces of Factory-Finished Doors: Show the full range of colors available for stained and opaque finishes.

### 1.3 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
1. Cleaning Instructions: Submit manufacturer’s cleaning instructions for doors.
2. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Comply with the applicable requirements of the following standards unless otherwise indicated:
   1. ANSI/WDMA I.S. 1, "Industry Standard for Wood Flush Doors," published by Window and Door Manufacturers Association (WDMA), formerly the National Wood Window and Door Association (NWWDA).

B. Openings shall be provided to conform to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. Where, in the opinion of the supplier/manufacturer, openings do not conform, notify the A/E.

C. Composite wood products shall be labeled or show compliance with the Toxic Substances Control Act (TSCA) Title VI.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect wood doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced ANSI standard and recommendations of WDMA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors," as well as with manufacturer's instructions.

B. Identify each door with individual opening numbers that correlate with designation system used on shop drawings for door, frames, and hardware, and STC or fire rating where applicable, using temporary, removable, or concealed markings.

C. Polybag protect each door for shipment and handling.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location.

1.7 WARRANTY

A. Special Warranty: Manufacturer’s standard form, signed by manufacturer, installer, and contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42 by 84 inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3 inch span.
   1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   2. Warranty shall be in effect during the following period of time from date of Substantial Completion.
      a. Interior Solid-Core Interior Doors: Full Life of Original Installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
      a. Masonite Architectural
      b. Lambton Doors
      c. Oregon Door
      d. Oshkosh Door Company
      e. VT Industries, Inc.
      f. Wilsonart LLC

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Manufacturer: Obtain doors from a single manufacturer to ensure uniformity in quality of appearance and construction.

2.2 DOOR CONSTRUCTION, GENERAL

A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors".
   1. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing a positive pressure according to NFPA 252 or UL 10C.
   1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of test assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
   2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F. above ambient after 30 minutes of standard fire-test exposure.
   3. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
   4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
   5. Pairs: Provide formed-steel edges and astragals with intumescent seals.
      a. Finish steel edges and astragals to match door hardware (locksets or exit devices).

D. Smoke-and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

E. Particleboard-Core Doors:
   1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde resin.
   2. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices, light openings, or louvers.

F. Structural-Composite-Lumber-Core Doors:
   1. Structural Composite Lumber: WDMA I.S.10.
      a. Screw Withdrawal, Face: 700 lbf (3100 N).
      b. Screw Withdrawal, Edge: 400 lbf (1780 N).

G. Mineral-Core Doors:
   1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
   2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
      a. Two 4-1/2-by-10-inch lock blocks or 5-inch mid-rail blocking, in doors indicated to have exit devices.
   3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split-resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors, General:
1. Grade: Custom (Grade A faces).
2. Species: Red oak.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Slip match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Exposed Vertical Edges: Applied wood (veneered or solid) edges of same species as faces and covering edges of crossbands-edge Type B or D.
8. Core:
   a. Doors without Exit Devices, Light Openings, or Louvers: Provide particle board core (PC), unless otherwise noted.
   b. Doors with Exit Devices, Doors with Light Openings and Doors with Louvers (and where otherwise noted): Provide structural composite lumber core (SCLC).
      1) Lock-to-lite-cutout shall not be less than 1 1/2 inches.
9. Construction: Five plies. Stiles and rails are bonded to core, then abrasive-plane entire unit before veneering. Faces are bonded to core using a hot press.
   a. Seven plies will not be acceptable.

B. Fire-Rated Solid Core Doors, General:
1. Provide faces and grade to match nonrated doors.
2. Core Construction: Manufacturer's standard core construction as required to provide fire-resistance rating indicated.
3. Stile Construction: Manufacturer shall provide stiles that will provide the maximum screw withdrawal rate for use with full mortise hinges. Withdrawal rate shall be not less than 740 lbs. Stiles shall be manufacturer's standard. Test results for screw withdrawal shall be submitted to the A/E upon request.
   a. Preps for mortise butt hinges and continuous hinges shall have factory-predrilled pilot holes per hinge manufacturer’s template.
4. Door Thickness: 1-3/4 inch.
5. Edges: Provide Category “A” edge construction.
6. Blocking: Manufacturer shall provide lock blocks for mortise and bored locks, minimum 5 inches by 10 inches, and 2 lock blocks for rim-, mortise-, and vertical-rod-type exit devices. Provide 5 inch top rail for attachment of closers and bottom rail (heights as required) for attachment of vertical rod exit device bottom latch and automatic flush bolts. Both blocking and through-bolt attachment of hardware items, shall be required as specified.
7. Pairs of wood doors with a 20-, 30-, 45-, 60-, and 90-minute fire rating with 3 point latching (lockset and flush bolts), shall be supplied with manufacturer's standard steel edges and steel astragal, factory-applied and factory-prepared for hardware as scheduled.
   a. Right Hand Reverse (RHR) and Left Hand Reverse (LHR) Doors: Mount astragal on the ACTIVE leaf and overlap the inactive leaf on the key side for latch bolt security. Notch astragal for strike lip.
   b. Right Hand (RH) and Left Hand (LH) Doors: Mount astragal on the INACTIVE leaf to overlap the active door leaf on the key side for latch bolt security.
   c. For special beveling requirements for pairs of doors, see first Paragraph of Part 2 Article "Pre-Fitting and Preparation for Hardware."
8. Where pairs of labeled doors are used in a means of egress with 2 vertical rod exit devices, whether top and bottom rods or less bottom rods (“LBR”), the doors shall be provided with manufacturer's standard meeting edges (metal edges, veneered treated edges, or Category “A” edge construction with intumescent material concealed by outer stile matching face veneer).
   a. Labeled doors scheduled with 2 vertical rod exit devices less bottom rods (“LBR”) shall be furnished with a door-to-door thermal bolt. Door-to-floor thermal bolts or pins are not acceptable. Verify with door manufacturer their labeling requirements for this application prior to bid.

b. Where labeled doors are scheduled to receive protection plates over 16 inches high, furnish doors with blocking as required by door manufacturer for attachment of plates with screws. Verify with door manufacturer their labeling requirements for this application prior to bid. Indicate blocking in door schedule submittals.

C. Provide approved and labeled wood fire doors at locations indicated in Door Schedule. Approved doors, frames, and hardware shall be constructed and installed in accordance with requirements of NFPA 80 and tested by Underwriters' Laboratories, Inc. (UL) or Warnock Hersey (WH) for the class of door opening indicated in schedules.

D. Nonrated and 20 Minute Rated Full-Glass Full-Warranty Doors:
1. Provide faces and grade to match doors as specified first paragraph of this Article.
2. Core Construction: Engineered Hardwood Composite Lumber (LSL) Core.
3. Door Thickness: 1-3/4 inch.
4. Core/Edge Innerface: Bonded.
5. Top rail and vertical stiles shall be a minimum 6 inches wide and bottom rail shall be a minimum of 10 inches wide.
6. Lock-to-Lite Cutout (minimum): 1-1/2 inch.
7. Stile and Rail Edges:
a. Top and Bottom Rails: Mill-option hardwood.
b. Vertical Stiles: Provide veneered edges to conceal crossband edges.

2.4 GLAZING

A. Factory Glazing:
1. Nonrated doors shall be glazed with 1/4 inch thick clear tempered safety glass, unless otherwise noted.
a. Provide fire-rated, sound-rated and security glass, where indicated.
2. Door supplier shall provide wood stops for nonrated and 20-minute doors. Stop shall be flush with face veneer; recessed stops will not be acceptable.
3. For labeled wood doors to receive glass, door supplier shall provide manufacturer’s standard frame formed of 0.0478inch (fka 18 gauge) cold-rolled steel, low-profile (maximum 3/32-inches high), veneer wrapped with same species as door face veneer, and approved for use in door of fire rating indicated.

2.5 LOUVERS AND LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.6 PREFITTING AND PREPARATION FOR HARDWARE

A. Prefit and pre-machine wood doors at factory, including beveling both edges 1/8 inch in 2 inches. Where pairs of doors are scheduled, prefit and pre-machine as pairs. Where pairs of doors are scheduled with 3 point latching (lockset and flush bolts), the strike edge of the inactive leaf shall be square equal to WDMA meeting edge option E1.

B. Rated and nonrated doors shall comply with tolerance requirements of NFPA 80 for pre-fitting. Machine doors for hardware requiring cutting of doors. Comply with final hardware schedules and door frame shop drawings and with hardware templates and other essential information required to ensure proper fit of doors and hardware.

1. Top and hinge edges: 1/8 inch maximum.
2. Single door, lock edge: 1/8 inch maximum.
3. Pair meeting edge: 1/16 inch per leaf maximum.
4. Bottom (rated or nonrated):
    a. 1/2 inch from decorative floor covering.
    b. 3/4 inch maximum from top of noncombustible floor.
    c. 3/8 inch maximum from top of noncombustible sill or threshold.
    d. Doors with vertical rod exit devices, manual or automatic flush bolts shall be undercut for latching of bolts to a flush floor strike or threshold.
    e. See Division 09 Section “Room Finish Schedule”, for floor finish materials.

C. Coordinate with the metal frame supplier the locations of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining in factory.

D. Factory-machine doors for hardware that is not surface-applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame, shop drawings, DHI A115-W series standards, and hardware templates.

2.7 FABRICATION

A. General:
1. The utility or structural strength of the doors must not be impaired in fitting to the opening in applying hardware, in preparing for lights, louvers, plant-ons or other detailing.
2. Pilot holes must be drilled for all screws that act as hardware attachments. Threaded-to-the-head screws are preferable for fastening hardware to nonrated doors and are required on fire-rated doors.
3. In fitting for height, do not trim top or bottom edge by more than 3/4 inch, unless accommodated by additional blocking. Do not trim top edge of fire doors.

B. Factory-fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
1. Comply with clearance requirements of referenced quality standard for fitting, unless otherwise indicated.
2. Comply with requirements in NFPA 80 for fire-rated doors.

C. Factory-machine doors for hardware that is not surface-applied.
1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
3. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory-machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
5. Metal Astragals: Factory-machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

D. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory-install glazing in doors indicated to be factory-finished. Comply with applicable requirements in Division 08 Section "Glazing."

2.8 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory-finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface-applied, before finishing.
1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory, unless specifically noted otherwise.

C. Transparent Finish:
   1. Grade: Premium.
   2. Finish: WDMA TR-6 catalyzed polyurethane or TR-8 UV cured acrylated.
   3. Staining: As selected by A/E from manufacturer's full range.
   4. Effect: Open-grain finish.
   5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
   1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

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

C. Ensure frames are solidly anchored, allowing no deflection when doors are installed.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section “Door Hardware”.

B. Manufacturer’s Written Instructions: Install doors to comply with manufacturer’s written instructions, referenced quality standard, and as indicated.
   1. Install fire-rated doors according to NFPA 80.
   2. Install smoke-and draft-control doors according to NFPA 105.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
   1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 3/8 inch from bottom of door to top of threshold.
      a. Comply with NFPA 80 for fire-rated doors.
   2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

3.4 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer’s instructions.

B. Do not use harsh cleaning materials or methods that could damage finish.

3.5 PROTECTION

A. Protect installed doors from damage during construction.

END OF SECTION 08 14 16

**SECTION 08 31 13 - ACCESS DOORS AND FRAMES**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Access doors and frames for walls and ceilings.

B. Related Sections include the following:
1. Division 03 Section "Cast-in-Place Concrete" for blocking out openings for access doors and frames in concrete.
2. Division 04 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
3. Division 07 Section "Roof Accessories" for roof hatches.
4. Division 09 Section "Gypsum Board Assemblies" for anchoring access door frames set in gypsum board construction.
5. Division 09 Section “Interior Painting” for field painting of access doors and frames.
6. Division 23 Section “Air Duct Accessories” for heating and air-conditioning duct access doors.

1.2 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical data for each type of access door and panel assembly, including setting drawings, templates, finish requirements, and details of anchorage devices.
1. Include complete schedule, type, locations, construction details, finishes, latching or locking provisions, and other pertinent data.

1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
1. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

B. Size Variations: Obtain A/E's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Acudor Products, Inc.
2. Babcock-Davis.
3. Cendrex Inc.
4. Elmdor/Stoneman Manufacturing Co.; Div. of Acorn Engineering Co.
5. J. L. Industries, Inc.; Div. of Activar Construction Products Group.

6. Karp Associates, Inc.
7. Lane-Aire Manufacturing Corp.
8. Larsen's Manufacturing Company.
9. Maxam Metal Products Limited.
10. Metropolitan Door Industries Corp.
11. MIFAB, Inc.
12. Milcor Inc.
13. Nystrom, Inc.
14. Williams Bros. Corporation of America (The).

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Flush Access Doors with Exposed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Wall.
3. Door Size: 24 inches by 24 inches, unless otherwise noted.
4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gauge.
   a. Finish: Factory prime.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gauge.
   a. Finish: Factory prime.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Manufacturer's standard.
8. Hardware: Latch.

D. Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
2. Locations: Wall and ceiling.
3. Door Size: 24 inches by 24 inches, unless otherwise noted.
4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gauge.
   a. Finish: Factory prime.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gauge.
   a. Finish: Factory prime.
6. Frame Material: Same material and thickness as door.
7. Hinges: Manufacturer's standard.
8. Hardware: Latch.

E. Hardware:
1. Latch: Cam latch operated by screwdriver or by flush key.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879, with cold-rolled steel sheet substrate complying with ASTM A 1008, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: Same type as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
   2. Provide mounting holes in frames for attachment of units to metal or wood framing.
   3. Provide mounting holes in frame for attachment of masonry anchors.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:
   1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Verify that rough openings for door and frame are correctly sized and located.
   2. Verify mechanical and electrical requirements for ceiling or wall access panels.

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

3.2 PREPARATION

A. Advise installers of other work about specific requirements relating to access door installation, including size of openings to receive access door and frame, as well as locations of supports, insert, and anchoring devices. Furnish inserts and anchoring devices for access doors that mut be built into other construction. Coordinate delivery with other work to avoid delay.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.
   1. Install frames plumb and level in opening. Secure rigidly in place.
   2. Position units to provide convenient access to concealed work requiring access.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.4 ADJUSTING

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

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13

## SECTION 08 33 23 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Insulated service doors.

B. Related Sections:
   1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.
   2. Division 26 Sections for electrical service and connections for powered operators and accessories, disconnect switches, and installation of control station and wiring.

C. Products That May Be Supplied, But Are Not Installed Under This Section
   1. Control station.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
   1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Manufacturer’s installation instructions.
   3. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
   1. Include plans, elevations, sections, details, and attachments to other work. Drawings must show actual wall conditions.
   2. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
   5. Show locations of controls, detectors, replaceable fusible links and other accessories.
   6. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
   1. Include similar Samples of accessories involving color selection.

1.3 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Maintenance Data: For overhead coiling doors to include in maintenance manuals.
      a. Operation and Maintenance Manuals: Operating instructions outlining the step-by-step procedures required for motorized door operation for the overhead rolling door unit shall be provided. The instructions shall include the manufacturer’s name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, and simplified diagrams for the equipment as installed shall be provided. A complete list of parts and supplies, source of supply, and a list of the high mortality maintenance parts shall be provided.

2. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.
3. Special warranty

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project and has demonstrated experience on projects of similar size and complexity.

1.5 WARRANTY

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Manufacturer: Products subject to compliance with requirements, provide one of the following projects listed.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
1. Obtain operators and controls from overhead coiling door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

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

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

C. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

D. Insulated Door Slat Material Requirements:
1. Flame Spread Index of 0. and a Smoke Developed Index of 10 as tested per ASTM E84.
2. Minimum R-value of 8.0 as calculated using the ASHRAE Handbook of Fundamentals.
3. Insulation to be CFC Free with an Ozone Depletion Potential rating of zero.

2.3 DOOR ASSEMBLY

A. Insulated Service Door
1. Insulated Service Door, Motorized, Interior Face Mounted
a. Steel
1) ESD30; Cornell Iron Works
2) 625 Series; Overhead Door Corp.
3) 800-C Series, SDF7PS; Wayne-Dalton Corp.

4) ESD30; Cookson Co.
5) DuraCoil Standard; Raynor Garage Door
6) 6000 Series; C.H.I. Overhead Doors

B. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

C. Operation Cycles: Not less than 50,000.

D. Curtain R-Value: 8.0 deg F x h x sq. ft./Btu calculated using the ASHRAE Handbook of Fundamentals.

E. Door Curtain Material: Galvanized steel.

F. Door Curtain Slats: Flat profile slats from 1-7/8-inch to 3-1/4-inch center-to-center height.
1. Insulated-Slat Interior Facing: Galvanized steel.

G. Endlock: Alternate slat each secured with two 1/4 inch rivets. Fabricate interlocking sections with high strength nylon or galvanized cast iron.

H. Bottom Bar: Two angles, each not less than 1-1/2 by 1/8 inch; fabricated from hot-dip galvanized steel and finished to match door.

I. Hood: Match curtain material and finish.
1. Shape: Square.
2. Mounting: Face of wall.

J. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
1. Each guide assembly shall be fabricated of structural steel support angles and guide retaining angles of a sufficient depth to retain curtain in the guides under the design wind pressure and impact forces specified. Provide neoprene weather seals extending the full height of both guides.
2. Finish: Powder coat to match door as specified herein.

K. Electric Door Operator:
1. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day.
2. Operator Location: As recommended by manufacturer for application indicated and surrounding conditions or as specifically indicated.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
a. Moving parts of operator must be enclosed or guarded if exposed and mounted at 8 feet or lower.
4. Motor Exposure: Interior.
5. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.
a. Sensor Edge Bulb Color: Black.
6. Emergency Manual Operation: Push-up or chain type.
a. Chain must be concealed above ceiling on top of motor or hood.
7. Control Station: Interior.

L. Curtain Accessories: Equip door with weatherseals and astragal.

M. Door Finish:
1. Powder-Coated Finish: Color as selected by A/E from manufacturer’s full range.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

## 2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653, with G90 zinc coating; nominal sheet thickness (coated) as follows and as required to meet performance requirements.
   a. 0.0299 inch (fka 22 gauge).
2. Insulation: Fill slats for insulated doors with 7/8 inch foamed-in-place, closed cell urethane complying with maximum flame-spread and smoke-developed indexes of 0 and 10, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
   a. R-value: 8.0.
3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.

B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement. Provide windlocks as required to meet specified wind load.
   1. Provide only malleable iron casings on doors over 20 feet wide.

C. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from manufacturer's standard galvanized steel extrusions to match curtain slats and finish.

D. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

E. Curtain Jamb Guides: Manufacturer's standard angles, or extruded aluminum sections as indicated of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.
   1. Provide thermal break at insulated doors.

## 2.5 HOOD

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head and a weather seal. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods. Equip hood with intermediate support brackets as required to prevent sagging.
   1. Galvanized Steel: Nominal 0.028-inch- thick (fka 24 gauge), hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653.

## 2.6 CURTAIN ACCESSORIES

A. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
   1. At door head, use 1/8-inch thick, replaceable, continuous sheet secured to inside of hood or a neoprene/rayon baffle to impede air flow above coil.
   2. Lintel Seal: Provide a brush lintel seal to seal gap between lintel and outside face of coiling door.
   3. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch thick seals of flexible vinyl, rubber, or neoprene as required meeting performance standards.
   4. Bottom Bar: Provide a replaceable, bulb-style, compressible EPDM gasket extending to guides.

B. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

2.7 COUNTERBALANCING MECHANISM

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

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.8 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
   1. Comply with NFPA 70 and UL 325 standard.
   2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): As recommended by door supplier for application indicated and surrounding conditions unless specifically noted. Doors may require multiple mounting locations based on conditions.
   1. Top-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
   2. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.
   3. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements.
   1. Electrical Characteristics:
      a. Phase:
         1) Single phase, capacitor-start type for motors 1/2 hp or less.
      b. Volts: 115/120 V. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
      c. Hertz: 60.
   2. Motor Type and Controller: Reversible motor with controller (disconnect switch) for motor exposure indicated.
   3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.

4. Operating Controls, Controllers Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction Detection Device: Equip indicated motorized doors with indicated external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
1. Continuously monitored, wireless sensing/weather edge seal extending full width of door bottom bar. Contact before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position.
2. Provide wireless sensing edge kit with transmitter and receiver for field mounting.

G. Control Station:
1. Interior units, full-guarded, flush-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 B enclosure “open/close” key switch.
a. Make key switch ready for installation of interchangeable core and house by Owner.

H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf unless door size requires 30 lbf and chain or crank.
1. Gather or bag chain and store on top of motor or hood concealed above adjacent ceiling and out of view of public.

I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

J. Operator Cover: Provide a sheet metal cover matching hood to enclose moving operating components lower than 8 feet above floor at coil area of unit. Finish to match door hood.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 GALVANIZED STEEL FINISHES

A. Powder-Coat Finish: AAMA 2604. Comply with coating manufacturer’s written instructions for cleaning, conversion coating, application, and baking.
1. Powder-Coat Finish shall be equal to “Spectrashield Powder Coating” by Cornell with over 200 color options available for selection. Limited color selections are not acceptable.
a. The color selected for door finish shall be utilized on interior of door, jamb guides and hood as specified.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
1. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

B. Examine locations of electrical connections.

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

## 3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install according to UL 325.

## 3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Perform installation and startup checks according to manufacturer's written instructions.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

## 3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
   1. Adjust exterior door and components to be weather-resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide weathertight fit around entire perimeter.

## 3.5 DEMONSTRATION

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

END OF SECTION 08 33 23

**SECTION 08 36 13 - SECTIONAL DOORS**

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes sectional doors assemblies.
   1. Interior, electric.

B. Related Sections:
   1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory. Include the following:
   1. Construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
   2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
   1. Include plans, elevations, sections, details, and attachments to other work. Drawings must show actual wall conditions.
   2. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Maintenance Data: For sectional doors to include in maintenance manuals.
   2. Special manufacturer’s warranty.
   3. Special finish warranty.

1.4 QUALITY ASSURANCE

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

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Faulty operation of hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.

d. Delamination of exterior or interior facing materials.
e. Failure of components or operators before reaching required number of operation cycles.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

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

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products from one of the manufacturers specified.

1. C.H.I. Overhead Doors
2. Clopay Building Products, Inc., a Griffon Company
3. Raynor
4. Wayne-Dalton Corp.
5. Overhead Door Corp.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Source Limitations: Obtain sectional doors from a single source from a single manufacturer.

1. Obtain operators and controls from the sectional door manufacturer or approved in writing by the sectional door manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Sectional doors shall meet performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

B. Delegated Design: Design sectional doors and anchorage including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Operation Cycles: Provide sectional door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

### 2.3 ALUMINUM DOOR ASSEMBLIES

A. Aluminum Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.

B. Operation Cycles: Door components and operators capable of operating for not less than 25,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

C. Aluminum Sections: Construct door sections with stiles and rails formed from extruded-aluminum shapes, complying with ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated, with wall thickness not less than 0.065 inch for door section 1-3/4 inches deep. Fabricate sections with stile and rail dimensions and profiles shown on Drawings. Join stiles and rails by welding or with concealed, 1/4-inch minimum diameter, aluminum or nonmagnetic stainless-steel through bolts, full height of door section. Form meeting rails to provide a weathertight-seal joint.
   1. Provide reinforcement for hardware attachment.

D. Aluminum Sections: Full vision.
   1. End stiles: 4 inch face.
   2. Center stiles: 2 inch face.
   3. Bottom rail: 4 inch face.
   4. Intermediate rails: 2 inch face.
   5. Top Rail: 4 inch face.

E. Full-Vision Sections: Manufacturer's standard, tubular, aluminum-framed section glazing set in vinyl, rubber, or neoprene glazing channel and with removable extruded-vinyl or aluminum stops.
   1. 6mm thick, clear acrylic or polycarbonate.

F. Weatherseals: Fitted to bottom and top and around entire perimeter of door.
   1. Provide bottom weatherseal.

G. Roller-Tire Material: Manufacturer's standard.

2.4 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Manufacturer's standard, galvanized-steel vertical-lift track system, sized for door size and weight, designed for lift type indicated and clearances shown on Drawings, and complying with ASTM A 653 for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slope tracks at proper angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.

B. Track Reinforcement and Supports: Galvanized-steel track reinforcement and support members, complying with ASTM A 36 and ASTM A 123. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.
   1. Vertical Track Assembly: Track with continuous reinforcing angle attached to track and attached to wall with jamb brackets.

C. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

2.5 HARDWARE/SAFETY DEVICES

A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges where required, for doors over 16 feet wide unless otherwise recommended by door manufacturer.

C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch diameter roller tires for 3-inch wide track and 2-inch diameter roller tires for 2-inch wide track.

D. Push/Pull Handles: For push-up or emergency-operated doors, provide galvanized-steel lifting handles on each side of door.

E. Safety Devices (Interior)
1. Provide roller shields, to help to prevent fingers from getting caught by roller in track.
2. Provide tapered reverse angle mounted tracks, in lieu of standard reverse angle mounted, to keep fingers from reaching in from the outside.
3. Provide center back-hang and rear back-hanging device in case one would ever fail.

2.6 COUNTERBALANCE MECHANISM

A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.

B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.

C. Cables: Galvanized-steel lifting cables with cable safety factor of at least 7 to 1.

D. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.

E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.

F. Bumper: Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.7 ELECTRIC DOOR OPERATORS, COMMERCIAL

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
1. Comply with NFPA 70.
2. Provide control equipment complying with NEMA ICS 1B, unless otherwise noted, NEMA ICS 2, and NEMA ICS 6 at exterior and high-humidity locations, where indicated; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
3. Safety: Listed in accordance with UL325 by a qualified testing agency for commercial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
4. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day.

B. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.
1. Manufacturer’s standard for door requirements.

2. Jackshaft, Center Mounted: Jackshaft operator mounted on the inside front wall above door and connected to torsion shaft with an adjustable coupling or drive chain.
3. Jackshaft, Side Mounted: Jackshaft operator mounted on the inside front wall on right or left side of door and connected to torsion shaft with an adjustable coupling or drive chain.

C. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements.
1. Electrical Characteristics:
a. Phase
1) Single phase, provide where capacitor-start type motor is 1/2 hp or less.
2) Volts: 208V. Coordinate wiring requirements with building electrical system.
b. Hertz: 60.
2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
6. Use adjustable motor-mounting bases for belt-driven operators.

D. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

E. Control Station: Door may open with momentary-contact, but must close with sustained or constant pressure, unless otherwise noted.
1. Interior units, full-guarded, flush-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1B enclosure, “open/close” key switch.

F. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
1. If operating chain required, chain shall be bagged and placed on top of operator or concealed to side of assembly.

G. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

H. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

## 2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's/NOMMA’s "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

A. Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.
   1. Powder-Coat Finish shall be equal to C.H.I. Overhead Door standard color offering of 188 available door options. Limited color selections are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

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

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Tracks:
   1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
   2. Repair galvanized coating on tracks according to ASTM A 780.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weathertight fit around entire perimeter.

D. Align and adjust motors, pulleys, belts, sprockets, chains, and controls according to manufacturer's written instructions.

E. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780.

3.5 DEMONSTRATION

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

END OF SECTION 08 36 13

## SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aluminum-framed storefront systems.
      a. Provide framing for Aluminum-framed entrance doors and Flush Aluminum Doors systems.
   2. Aluminum-framed entrance door system.

B. Related Sections:
   1. Division 07 Section “Joint Sealants”: For sealant between aluminum frames and adjacent materials.
   2. Division 08 Section “Door Hardware”.
   3. Division 08 Section “Glazing”: For glazing requirements.

1.2 PREINSTALLATION MEETINGS

A. A general orientation meeting shall be attended by the following:
   1. Storefront framing contractor
   2. Hardware supplier
   3. Hardware installer
   4. Electrical contractor
   5. Security contractor
   6. Automatic door operator installer
   7. General contractor
   8. Construction Manager
   9. A/E’s and Owner’s representative

B. Review of installation procedures related to the schedules of hardware, doors, and frames. Review the wiring diagrams for related electronic hardware and connection to the security access system and intended function.

1.3 ACTION SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.
   1. Energy Performance Certificates: For aluminum-framed entrances and storefront framings accessories and components, from manufacturer.
      a. Provide an NFRC Component Modeling Approach (CMA) generated label certificate shall be provided by the manufacturer. The label certificate shall be project specific and will contain the thermal performance ratings of the manufacturer’s framing combined with specified glass and glass spacer used in the fabrication of the glass, at NFRC standard test size as defined in table 4-3 in NFRC 100-2010.
   2. Glazing: Submit manufacturer’s technical data for each glass type and glazing material required to comply with Energy Performance criteria. Refer to Division 08 Section “Glazing” for specific glazing requirements.
      a. Performance charts indicating performance values required to comply with total opening energy performance.
      b. Documentation for solar-control low-e coated glass demonstrating that glazing manufacturer of coated glass is certified by coating manufacturer.
   3. Qualification Data: For installers and engineers.
      a. For professional engineer’s experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located

B. Shop Drawings: For entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, and details of components, provisions for expansion and contraction, and attachments to other work. Drawings must show actual wall conditions.
   1. Indicate member sizes and reinforcement necessary to meet performance requirements and support hardware.
   2. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   3. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
   4. Transition Details: Include three-dimensional isometric drawings of the frame illustrating how the frame will interface with the transition strip associated with the air barrier in the masonry cavity. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
   5. Include point-to-point wiring diagrams showing the following:
      a. Power requirements for each electrically operated door hardware.
      b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

C. Samples for Verification: Color samples approximately 8 inches by 8 inches on aluminum.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

B. Warranties: Special warranties specified in this Section.

1.5 MAINTENANCE

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

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer and supervisor who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass and Metal (AG and M) contractors.

B. Regulatory Requirements
   1. Accessible Entrances: Conform to the U.S. Architectural & Transportation Barriers Compliance Board's, "Americans with Disabilities Act Accessibility Guidelines" (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
      a. Opening-Force Requirements:
         1) Egress Doors: Not more than 30 lbf required to set door in motion and not more than 15 lbf required to open door to minimum required width.
         2) Accessible Interior Doors: Not more than 5 lbf.

C. Product Options: Information on all Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignments, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjacent construction.
   1. Do not change intended aesthetic, effects, as judged solely by A/E, except with A/E's approval. If changes are proposed, submit comprehensive explanatory data to A/E for review.

D. Mockups: Building mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. First installation of aluminum-framed entrances and storefronts, including glazing may serve as mockup. Coordinate location with A/E.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless A/E specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Field Measurements: Check openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the work.

1.8 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of metals, metal finishes (unless special finish warranty is required), and other materials beyond normal weathering.
      d. Water leakage through fixed glazing and framing areas.
      e. Failure of operating components.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to where to bare metal.
   2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing, spandrel panels, venting windows, and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "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 manufacturer, fabrication, installation, or other defects in construction.
   1. Aluminum-framed entrances 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. Glazing: Physically and thermally isolate glazing from framing members.

D. Wind Design Loads
   1. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," "6.5, Method 2 - Analytical Procedure," whichever are more stringent.
      a. Refer to Structural Drawings.
   2. Per local building codes, but never less than 20 psf positive and negative or 25 psf negative in corner zones.

E. Deflection of Framing Members: At design wind pressure, as follows:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
   2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing tile to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
   3. Cantilever Deflection: Limited to 2L/175 at unsupported cantilevers:

F. Structural: Test according to ASTM E330 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.

G. Air Infiltration: Test according to ASTM E283 or NFRC 400 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. Pair of Doors: Maximum air leakage of 1.0 cfm/sq.ft. at a static-air-pressure differential of 1.57 lbf/sq.ft.
      b. Single Doors: Maximum air leakage of 0.5 cfm/sq.ft. at a static-air-pressure differential of 1.57 lbf/sq.ft.

H. Water Penetration under Static Pressure: Test according to ASTM E331 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.

I. Energy Performance: Certify and label energy performance according to NFRC as follows:
   1. Thermal Transmittance (U-factor):
      a. Type III (Thermally Broken): 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:
      a. Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
      b. Entrance Doors: SHGC of not more than0.40 as determined in accordance with NFRC 200.
   3. Condensation Resistance:
      a. Fixed glazing and framing areas shall have a NRFC-certified condensation resistance rating of no less than 56 as determined according to NFRC 500.
      b. Entrance Doors: CRF of not less than 68 as determined in accordance with AAMA 1503.

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.

K. Dimensional Tolerances: Provide window and storefront systems that accommodate dimensional tolerances of building frame and other work.

2.3 MATERIAL

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below:
   1. Sheet and Plate: ASTM B209.
   2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B221.
   3. Extruded Structural Pipe and Tubes: ASTM B429.
   4. Bars, Rods, and Wire: ASTM B211.
   5. Welding Rods and Bare Electrodes: AWS A5.10.
   6. Structural Profiles: ASTM B308.

B. Steel Reinforcement: With manufacturer's standard 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.
   1. Structural Shapes, Plates, and Bars: ASTM A 36.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011.

C. Steel Reinforcement Primer: Manufacturers 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 in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

D. Glazing as specified in Division 08 Section “Glazing”.

E. Glazing Gaskets: Manufacturer’s standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

F. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer’s standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

G. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

H. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 07 Section “Joint Sealants”.
   1. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other system components with which it comes in contact; and recommended by sealant and aluminum-framed system manufacturer for this use.

I. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30 mil thickness per coat.

2.4 FRAMING SYSTEM

A. Framing members, transition members, mullions, adapters, and mountings (including sill anchors, frame receptors at jambs, and other frame trim and accessories shown on Drawings), shall be extruded aluminum with alloy and temper consistent with the method of manufacturer.
   1. Framing members shall be of thickness required and reinforced as required to support imposed loads.
   2. Construction: Where indicated, members shall incorporate a thermal-barrier by one of the following methods:
      a. Framing members shall be composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.
   3. Fabrication Method: Field-fabricated stick system or unitized as recommended by fabricator for application indicated.
   4. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   5. Steel Reinforcement: As required by manufacturer to meet Performance Requirements.
      a. Required for spans exceeding structural performance requirements. Increase in depth dimension is also acceptable to comply with span and loading requirements.

B. Type I – 1-3/4 by 4-1/2 inch. Framing members shall provide for flush center glazing of 1/4 inch glass, by use of elastomeric gaskets on both sides of the glass, with no projecting stops. Vertical and horizontal framing members shall have a nominal face dimension of 1-3/4 inches with an overall depth of 4-1/2 inches. Entrance framing members shall be compatible with glass framing in appearance. Single acting entrance frames shall include weatherstripping.
   1. Manufacturers: Subject to compliance with requirements, provide one of the manufacturers specified:
      a. System 400 (NT); EFCO Corporation
      b. Trifab VG 450; Kawneer Co.

c. 450 Series; Manko Window Systems, Inc.
d. SL-450; Special-Lite, Inc.
e. YES 45; YKK AP America
f. 450 Series; U.S. Aluminum Div. of CRL
g. Oldcastle Building Envelope
h. Tubelite
i. Cross Aluminum Products

2. Application for framing type
   a. Interior vestibule doors.
   b. Interior storefront system (no doors).
   c. Interior storefront system with doors, sidelights and transoms.

C. Type III – 2 by 4-1/2 inch with thermal barrier. Framing members shall provide for flush center glazing of one inch insulating glass, by use of elastomeric gaskets on both sides of the glass, with no projecting stops. Framing members shall incorporate a thermal barrier. Vertical and horizontal framing members shall have a nominal face dimension of 2 inches with an overall depth of 4-1/2 inches. Door entrance frames shall include weatherstripping.

1. Manufacturers: Subject to compliance with requirements, provide one of the manufacturers specified:
   a. System 403 Thermal; EFCO Corporation
   b. Trifab VG 451T; Kawneer Co.
   c. 2450 Series; Manko Window Systems, Inc.
   d. T 14000; Tubelite
   e. YES 45TU; YKK AP America
   f. IT451 Series; U.S. Aluminum Div. of CRL
   g. Series 3000 Thermal MultiPlane; Oldcastle Building Envelope (OBE)
   h. Cross Aluminum Products
   i. Special-Lite, Inc.
2. Application for framing type
   a. Entries with multiple sidelights or transoms.
   b. Exterior doors without sidelights or transoms.
   c. Exterior storefront system (punched openings).

D. Where indicated on Drawings, provide deeper frame profile. Face width shall remain the same.

E. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

F. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

G. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.
   a. Provide a backup reinforcement, at door frame head, of steel or 1/4 inch aluminum for attachment of closer arm.
   b. All members less than 0.125 inch thick to receive threaded fasteners shall receive backup reinforcement.

H. Anchors: Three way adjustable anchors with minimum adjacent of 1 inch that accommodate fabrication and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.
2. Select anchors and connections based on existing opening conditions. Conditions may vary throughout building. Anchors shall remain concealed or covered by additional aluminum trim components.

I. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

J. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.
   1. Sills: Provide formed or extruded sills as indicated on Drawings, 0.125 inch thick aluminum in same finish as the framing members.
   2. Exterior closure flashings, closure angle, and closure trim shall be 0.063 inch thick aluminum in same finish as the framing members.
      a. This includes but is not limited to corner closures, aluminum closure trim and closures adjacent to existing construction.
   3. Interior Trim, Closures and Angles: As detailed, of extruded or formed shapes no less than 0.063 inch nominal wall thickness.

K. Vertical mullions between doors shall have steel reinforcement and be attached to the floor with concealed fasteners.

L. Subsills: Thermally broken, extruded-aluminum subsills.
   1. Provide at all locations where other extended sills are not indicated.

2.5 ENTRANCE DOOR SYSTEMS

A. Stile and Rail Design: Wide stile, nominally 5–inch wide vertical stiles, 6-1/2–inch high top rail, intermediate rail, and nominally 10–inch high bottom rail.
   1. Series 550 (modified top and bottom rail and door muntin): U.S. Aluminum Division of CRL.
   2. WS-500-HD (modified top and bottom rail and intermediate rail): Cross.
   3. Series D500 (modified top and bottom rail) and mid-rail: EFCO.
   4. 500 (modified top and bottom rail) and intermediate rail: Kawneer.
   5. Series 150 (modified top and bottom rail and mid-rail): Manko.
   6. Series SL-15 (modified top and bottom rail and intermediate rail): Special-Lite, Inc.
   7. Wide Stile (modified top and bottom rail and intermediate rail): Tubelite.
   8. 50D Wide Stile (modified top and bottom rail and intermediate rail): YKK.
   9. WS-500 Wide Stile: Oldcastle Building Envelope.

B. Sections shall be extruded from 6063-T5 aluminum alloy (ASTM B221 Alloy GS 10A T5).

C. Major portions of the door stiles shall be 0.125 inch in thickness, and glazing molding shall be 0.050 inch thick.
   1. Mullions shall be as detailed on Drawings and as required for type of door being furnished.
   2. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
   3. Glazing Stops and Gaskets: Square, snap-on, extruded aluminum stops and preformed gaskets of neoprene bulb type.
      a. Provide lock-in tamperproof type glazing stops on outside of door.
      b. No exposed screws shall be required to secure stops.

D. Screws, miscellaneous fastening devices, and internal components shall be of stainless steel, plated, or corrosion-resistant materials of sufficient strength to perform the functions for which they are used.

E. Wide Stile: Corner construction shall consist of both sigma deep penetration and sigma fillet welds and mechanical fastening. Inside joints between the top rail and vertical stiles shall have a continuous bead of sealant. Interior glazing stops shall be square snap-in type with neoprene bulb type glazing. Square stops on exterior side shall be lock-in tamperproof type. No exposed screws shall be required to secure stops.

F. Weathering: Manufacturer's replaceable components used as tested for air-infiltration, water penetration and thermal "Performance Requirements".

G. Where ADA-compliant threshold is scheduled, provide door with door bottom sweeps and undercut door as required for weathertight seal. Verify type threshold with door hardware schedule.

H. Doors shall have the lockstile portion of the top rail closed for mounting security door contacts.

I. Where aluminum doors are scheduled to receive a concealed overhead stop, the jamb bracket shall be mortised into the frame and the channel mortised into the top of the door. The cut for the arm on the stop side of the door shall not be cut below the stop strip of the frame.

2.6 HARDWARE

A. Refer to Division Section "Door Hardware", unless otherwise noted.

B. Weather Stripping: Manufacturer's standard replaceable components.
1. Compression Type: Mode of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.

C. Weather Sweeps: Manufacturer's standard exterior door bottom sweep with concealed fasteners on mounting strip.

D. Silencers: BHMA A156.16, Grade 1.

2.7 FABRICATION

A. Framing Members, General: 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. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   a. Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual".
6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or panels.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
8. Where aluminum will contact dissimilar metals, protect against galvanic action.
9. Provide manufacturer's standard profiles for special conditions:

B. Form or extrude aluminum shapes before finishing.

C. 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.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

E. Storefront Framing: Fabricate components for assembly using screw-spline system or head and sill receptor system with shear blocks at intermediate horizontal members.
   1. Factory assemble components to greatest extent possible. Dissemble components only as necessary for shipment and installation.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.
   1. At exterior and interior doors, provide compression weather stripping at fixed stops.
   2. Provide subframes and reinforcing of types indicated or, if not indicated, as required for complete system.
   3. Where aluminum doors are scheduled to receive a concealed overhead stop, the jamb bracket shall be mortised into the frame and the channel mortised into the top of the door. The cut for the arm on the stop side of the door shall not be cut below the stop strip of the frame.
   4. Provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.

2.8 FINISH

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604and with coating and resin manufacturer's written instructions.
   1. Color and Gloss: Black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

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

## 3.2 PREPARATION

A. Openings for aluminum entrances and storefronts shall be prepared to the proper size, plumb, square, level, and in the proper location and alignment as shown on the Drawings and the final shop drawings.
   1. Coordinate with masonry tolerances. Refer to Division 04 Section “Unit Masonry”.

## 3.3 INSTALLATION

A. General: Comply with manufacturer’s written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
   1. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   2. Shim and brace aluminum system before anchoring to structure.
   3. Provide sill flashing at exterior storefront systems. Extend extruded flashing continuous with splice joints; set in continuous beads of sealant.
   4. Verify storefront system allows water entering system to be collected in gutters and wept to exterior.
   5. Locate expansion mullions where indicated on reviewed shop drawings.
   6. Seal perimeter and other joints watertight, unless otherwise indicated.
      a. Do not seal weeps.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
   1. Provide end dams at all sill terminations.

D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 07 Section “Joint Sealants”.
   1. To minimize the potential for water leakage attributed to the subsill, fastener penetrations through the horizontal leg of the subsill should be avoided. Instead, brackets that engage the subsill without penetrating the wet zone should be mechanically attached to the subsill extrusion and fully sealed to ensure a watertight interface.

E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers’ written instructions.
   1. Install surface-mounted hardware according to manufacturer’s written instructions using concealed fasteners to greatest extent possible.

G. Install glazing to comply with requirements of Division 08 Section “Glazing”, unless otherwise indicated.
   1. Prepare surfaces that will contact structural sealant according to sealant manufacturer’s written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

H. Install perimeter sealant to comply with requirements of Division 07 Section “Joint Sealants”, unless otherwise indicated.

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

J. Do not cut aluminum frame stop strip when mounting exit devices and closers.

K. Coordinate with Division 08, Division 26, and security access contractor for location and installation of conduit/wiring required for electrified hardware items mounted to doors and frames, including, but not limited to, cutting/drilling any access holes required for pulling wires through frame head/jambs to the electrified hardware items.

## 3.4 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit of weatherstripping.

## 3.5 ADJUSTING AND CLEANING

A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.
   1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

B. Remove excess sealant and glazing compounds, and dirt from surfaces.

## 3.6 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 41 13

# SECTION 08 71 00 - DOOR HARDWARE

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section "Alternates" for alternates affecting this section.
2. Division 06 Section "Rough Carpentry"
3. Division 06 Section "Finish Carpentry"
4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
   a. "Metal Doors and Frames"
   b. "Flush Wood Doors"
   c. "Stainless Steel Doors and Frames"
6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

### 1.02 REFERENCES

A. UL - 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. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
2. NFPA 101 – Life Safety Code
3. NFPA 105 – Smoke and Draft Control Door Assemblies
4. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
   a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
   a. Wiring Diagrams: For power, signal, and control wiring and including:
      1) Details of interface of electrified door hardware and building safety and security systems.
      2) Schematic diagram of systems that interface with electrified door hardware.
      3) Point-to-point wiring.
      4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
   a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:
   a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.

b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
c. Indicate complete designations of each item required for each opening, include:
    1) Door Index: door number, heading number, and Architect's hardware set number.
    2) Quantity, type, style, function, size, and finish of each hardware item.
    3) Name and manufacturer of each item.
    4) Fastenings and other pertinent information.
    5) Location of each hardware set cross-referenced to indications on Drawings.
    6) Explanation of all abbreviations, symbols, and codes contained in schedule.
    7) Mounting locations for hardware.
    8) Door and frame sizes and materials.
    9) Degree of door swing and handing.
    10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:
    a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
    b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
    c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
    d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
    e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
    f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

6. 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. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:
    a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
    b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
    a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    b. Catalog pages for each product.
    c. Final approved hardware schedule edited to reflect conditions as installed.
    d. Final keying schedule
    e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
   a. fire door assemblies, in compliance with NFPA 80.
   b. required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
   a. For door hardware: DHI certified AHC or DHC.
   b. Can provide installation and technical data to Architect and other related subcontractors.
   c. Can inspect and verify components are in working order upon completion of installation.
   d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:
   a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
   b. Provide only items of door hardware that are listed products tested by 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.

2. Smoke and Draft Control Door Assemblies:
   a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
   b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware
    a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:
    a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference
    a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
        1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
        2) Preliminary key system schematic diagram.
        3) Requirements for key control system.
        4) Requirements for access control.
        5) Address for delivery of keys.

2. Pre-installation Conference
    a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Inspect and discuss preparatory work performed by other trades.
    c. Inspect and discuss electrical roughing-in for electrified door hardware.
    d. Review sequence of operation for each type of electrified door hardware.
    e. Review required testing, inspecting, and certifying procedures.
    f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:
    a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

## 1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

## 1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

## 1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
    a. Mechanical Warranty
        1) Locks: 3 Years
        2) Exit Devices: 3 Years
        3) Closers: 30 Years
        4) Continuous Hinges: Lifetime
    b. Electrical Warranty
        1) Electric Locks: 1 year

## 1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."

1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.

B. 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.

C. 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.

D. 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:
   a. Ives 5BB series

2. Acceptable Manufacturers and Products:
    a. Hager BB series
    b. McKinney TA/T4A series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. Hinge Height:
    a. 1-3/4 inch (44 mm) thick doors up to 36 inches (914 mm) wide: 4-1/2 inches (114 mm) high
    b. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide: 4-1/2 inches (114 mm) high
    c. 2 inches or thicker doors: 5 inches (127 mm) high, regardless of door width
4. Hinge width: 4-1/2 inches (114 mm) wide typical. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
5. Hinge quantity: 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

## 2.04 CONTINUOUS HINGES, ALUMINUM, GEARED

A. Manufacturers:

1. Scheduled Manufacturer:
    a. Ives

2. Acceptable Manufacturers:
    a. Select
    b. Hager

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

## 2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:
   a. Von Duprin EPT-10

2. Acceptable Manufacturers and Products:
   a. No Substitute

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

## 2.06 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Rockwood
   b. Trimco

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide flush bolts designed, tested, and warrantied for door material and door manufacturer. Provide dust-proof strikes at each bottom flush bolt.

## 2.07 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Rockwood
   b. Trimco

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.

2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers, surface vertical rod exit device strikes, or other stop mounted hardware. Factory-prepared coordinators for vertical rod devices as specified.

## 2.08 MORTISE LOCKS AND DEADBOLTS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Schlage L series

2. Acceptable Manufacturers and Products:
   a. No Substitute

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Verify lock functions with owner prior to ordering.
8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
   a. Lever Design: SCHLAGE 03A.

## 2.09 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Von Duprin 99 series

2. Acceptable Manufacturers and Products:
   a. No Substitute

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 grooved touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.

4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer's approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Verify exit device functions with owner prior to ordering.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

## 2.10 CYLINDER HOUSINGS

A. Manufacturers:

1. Scheduled Manufacturer and Product:
   a. Schlage

2. Acceptable Manufacturers and Products:
   a. Best

B. Requirements:

1. Provide cylinder housings from same manufacturer of locksets, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer’s series as indicated. Refer to “KEYING” article, herein.
2. Provide cylinder housings in the below-listed configuration(s), distributed throughout the Project as indicated.
   a. Cylinder/Core Type: Small Format Interchangeable Core (SFIC)

3. 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.

4. Verify with Owner where permanent cores are to be shipped to.

## 2.11 PERMANENT CORES, KEYING, KEYS

A. Manufacturers:

1. Scheduled Manufacturer: Best

B. Acceptable Manufacturers:

1. No Substitute

C. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

D. Permanent Core Requirements:

1. Provide permanent cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cores in the below-listed configuration(s), distributed throughout the Project as indicated.
   a. Match Owner's existing system.
   b. Cylinder/Core Type: Small Format Interchangeable Core (SFIC).
   c. Nickel silver bottom pins.

E. Keying Requirements:

1. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
2. Provide keying system capable of multiplex masterkeying.
3. Permanent cores keyed by the manufacturer according to the following key system.
   a. Keying system as directed by the Owner.
   b. Match Owner's existing system.
   c. (Great)Grand Master Key System: Cylinders/cores operated by change (day) keys and subsequent masters (including grand/great grand) keys.

4. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
5. Provide keys with the following features:
   a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm).

6. Identification:
   a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
   b. Identification stamping provisions must be approved by the Architect and Owner.
   c. Stamp keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE".
   d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.

7. Quantity: Furnish in the following quantities.
   a. Change (Day) Keys: 3 per cylinder/core.
   b. Permanent Control Keys: 3 (if required).
   c. Master Keys: 6 per master.
   d. Unused balance of key blanks shall be furnished to Owner with the cut keys.

8. Verify with owner where permanent cores and keys are to be shipped to.

## 2.12 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. LCN 4040XP series

2. Acceptable Manufacturers and Products:
   a. No Substitute

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 5/8-inch (16 mm) diameter double 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. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

## 2.13 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. LCN 4600 series

2. Acceptable Manufacturers and Products:
   a. No Substitute

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door

4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide drop plates, brackets, and adapters for arms as required for details.
6. Provide actuator switches and receivers for operation as specified.
7. Provide weather-resistant actuators at exterior applications.
8. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.
9. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
10. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

## 2.14 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Trimco
   b. Rockwood

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

## 2.15 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Trimco
   b. Rockwood

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with countersunk sheet metal screws, finished to match plates.
2. Height of protection plates as shown in the sets. Adjust height as required for bottom rail of door or to avoid conflicts with other hardware.
3. Width of plates as shown in the sets. Adjust width as required to avoid conflicts with other hardware.
4. At fire rated doors, provide protection plates over 16 inches high with UL label.

## 2.16 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Trimco
   b. Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

## 2.17 GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Zero International

2. Acceptable Manufacturers:
   a. National Guard
   b. Reese
   c. Pemko

B. Requirements:

1. Provide gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

## 2.18 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Rockwood
   b. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.

2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

## 2.19 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Schlage

2. Acceptable Manufacturers:
   a. George Risk Industries, Inc.

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

## 2.20 FINISHES

A. Provide finish for each item as indicated in the sets.

# PART 3 - EXECUTION

## 3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install 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.

H. Lock Cylinders:

1. Install construction cores to secure building and areas during construction period.
2. Replace construction cores with permanent cores as indicated in keying section.

I. Wiring: Coordinate with Division 26 ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to panel interface modules, controllers, and gateways.
4. Testing and labeling wires with Architect's opening number.

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. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

L. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

M. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

N. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

P. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

Q. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

## 3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

   1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

## 3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer's instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

## 3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

111043 OPT0371993 Version 2

HARDWARE GROUP NO. 01

For use on Door #(s):
A102C

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 2 | EA | CONT. HINGE | 112XY | 628 | IVE |
| 2 | EA | DUMMY PUSH BAR X PULL TRIM | 330 X 990DT | 626 | VON |
| 1 | EA | OH STOP | 100S | 630 | GLY |
| 2 | EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 1 | EA | SURF. AUTO OPERATOR | 4642 WMS 120 VAC | 689 | LCN |
| 1 | EA | MOUNTING PLATE | 4040XP-18PA | 689 | LCN |
| 1 | EA | BLADE STOP SPACER | 4040XP-61 | 689 | LCN |
| 2 | EA | ACTUATOR | 8310-853T | 630 | LCN |
| 2 | EA | MOUNT BOX | 8310-867S | | LCN |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |

BOTH AUTO OPERATOR ACTUATORS ENABLED AT ALL TIMES. PUSHING EITHER ACTUATOR SIGNALS AUTO OPERATOR TO OPEN DOOR. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 02

For use on Door #(s):
A102D

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 2 | EA | CONT. HINGE | 112XY | 628 | IVE |
| 2 | EA | DUMMY PUSH BAR X PULL TRIM | 330 X 990DT | 626 | VON |
| 1 | EA | OH STOP | 100S | 630 | GLY |
| 2 | EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 2 | EA | MOUNTING PLATE | 4040XP-18PA | 689 | LCN |
| 2 | EA | BLADE STOP SPACER | 4040XP-61 | 689 | LCN |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |

HARDWARE GROUP NO. 03

For use on Door #(s):
A103 A104 A105 A106

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 (NRP AS REQ'D) | 652 | IVE |
| 1 | EA | DEADLOCK, CYL X C/R TT | L463BDC XB11-720 | 626 | SCH |
| 1 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | PUSH PLATE | 8200 4" X 16" | 630 | IVE |
| 1 | EA | PULL PLATE | 8303 10" 4" X 16" | 630 | IVE |
| 1 | EA | SURFACE CLOSER | 4040XP REG | 689 | LCN |
| 1 | EA | MOP PLATE | 8400 4" X 1" LDW B-CS | BLK | IVE |
| 1 | EA | KICK PLATE | 8400 8" X 1 1/2" LDW B-CS (VERIFY/MATCH HEIGHT AND MATERIAL WITH EXISTING) | BLK | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

HARDWARE GROUP NO. 04

For use on Door #(s):
A108 A109

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 (NRP AS REQ'D) | 652 | IVE |
| 1 | EA | PRIVACY LOCK W/ OUTSIDE INDICATOR | L9040 03A L583-363 OS-OCC | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4040XP REG | 689 | LCN |
| 1 | EA | MOP PLATE | 8400 4" X 1" LDW B-CS | BLK | IVE |
| 1 | EA | KICK PLATE | 8400 8" X 1 1/2" LDW B-CS (VERIFY/MATCH HEIGHT AND MATERIAL WITH EXISTING) | BLK | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

HARDWARE GROUP NO. 05

For use on Door #(s):
A111

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 (NRP AS REQ'D) | 652 | IVE |
| 1 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | EU MORTISE LOCK | L9092BDCEU 03A 12/24 VDC | 626 | SCH |
| 1 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | SURFACE CLOSER (W/ DEAD STOP) | 4040XP CUSH | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 8" X 1 1/2" LDW B-CS (VERIFY/MATCH HEIGHT AND MATERIAL WITH EXISTING) | BLK | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |
| 1 | EA | POWER SUPPLY | BY ACCESS CONTROL INTEGRATOR | | B/O |
| 1 | EA | CREDENTIAL READER | BY ACCESS CONTROL INTEGRATOR | | B/O |

DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER WILL UNLOCK OUTSIDE LEVER, ALLOWING ACCESS. DOOR REMAINS LOCKED WITH LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 06

For use on Door #(s):
A101

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 (NRP AS REQ'D) | 652 | IVE |
| 1 | EA | STOREROOM LOCK | L9080BDC 03A | 626 | SCH |
| 1 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | SURFACE CLOSER | 4040XP REG | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 8" X 1 1/2" LDW B-CS (VERIFY/MATCH HEIGHT AND MATERIAL WITH EXISTING) | BLK | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

HARDWARE GROUP NO. 07

For use on Door #(s):
A107

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 6 | EA | HINGE | 5BB1HW 4.5 X 4.5 (NRP AS REQ'D) | 652 | IVE |
| 1 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | AUTO FLUSH BOLT | FB31T/FB41T (AS REQ'D) | 630 | IVE |
| 1 | EA | EU MORTISE LOCK | L9092BDCEU 03A 12/24 VDC | 626 | SCH |
| 1 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | COORDINATOR | COR X FL (MB AS REQ'D) | 628 | IVE |
| 2 | EA | SURFACE CLOSER | 4040XP REG | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 8" X 1" LDW B-CS (VERIFY/MATCH HEIGHT AND MATERIAL WITH EXISTING) | BLK | IVE |
| 2 | EA | WALL STOP/HOLDER | WS20/WS20X | 626 | IVE |
| 2 | EA | SILENCER | SR64 | GRY | IVE |
| 1 | EA | POWER SUPPLY | BY ACCESS CONTROL INTEGRATOR | | B/O |
| 1 | EA | CREDENTIAL READER | BY ACCESS CONTROL INTEGRATOR | | B/O |

DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER WILL UNLOCK OUTSIDE LEVER, ALLOWING ACCESS. DOOR REMAINS LOCKED WITH LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 08

For use on Door #(s):
A110 A110A

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 1 | EA | CONT. HINGE | 224XY | 628 | IVE |
| 1 | EA | CONT. HINGE | 224XY EPT | 628 | IVE |
| 1 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | AUTO FLUSH BOLT | FB31T/FB41T (AS REQ'D) | 630 | IVE |
| 1 | EA | EU MORTISE LOCK | L9092BDCEU 03A 12/24 VDC | 626 | SCH |
| 1 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | COORDINATOR | COR X FL (MB AS REQ'D) | 628 | IVE |
| 2 | EA | SURFACE CLOSER (W/ DEAD STOP & HO) | 4040XP HCUSH | 689 | LCN |
| 2 | EA | ARMOR PLATE | 8400 35" X 1" LDW B-CS | 630 | IVE |
| 2 | EA | SILENCER | SR64 | GRY | IVE |
| 1 | EA | POWER SUPPLY | BY ACCESS CONTROL INTEGRATOR | | B/O |
| 1 | EA | CREDENTIAL READER | BY ACCESS CONTROL INTEGRATOR | | B/O |

DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER WILL UNLOCK OUTSIDE LEVER, ALLOWING ACCESS. DOOR REMAINS LOCKED WITH LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 09

For use on Door #(s):
A100

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 1 | EA | CONT. HINGE | 112XY | 628 | IVE |
| 1 | EA | PANIC HARDWARE | CD-99-NL | 628 | VON |
| 2 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | MORTISE CYL HOUSING (SFIC) | 80-110 XQ11-948 (W/ DISP CONST CORE) | 626 | SCH |
| 1 | EA | RIM CYL HOUSING (SFIC) | 80-116 (W/ DISP CONST CORE) | 626 | SCH |
| 1 | EA | SURFACE CLOSER (W/ DEAD STOP & HO) | 4040XP HCUSH SRI | 689 | LCN |

HARDWARE GROUP NO. 10

For use on Door #(s):
A112A

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 (NRP AS REQ'D) | 652 | IVE |
| 1 | EA | PANIC HARDWARE | LD-99-L-NL-03 | 626 | VON |
| 1 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | RIM CYL HOUSING (SFIC) | 80-116 (W/ DISP CONST CORE) | 626 | SCH |
| 1 | EA | SURFACE CLOSER (W/ DEAD STOP) | 4040XP CUSH | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 8" X 1 1/2" LDW B-CS (VERIFY/MATCH HEIGHT AND MATERIAL WITH EXISTING) | BLK | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

HARDWARE GROUP NO. 11

For use on Door #(s):
B114A B115C

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 (NRP AS REQ'D) | 652 | IVE |
| 1 | EA | PANIC HARDWARE | LD-99-EO | 626 | VON |
| 1 | EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 8" X 1 1/2" LDW B-CS (VERIFY/MATCH HEIGHT AND MATERIAL WITH EXISTING) | BLK | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

HARDWARE GROUP NO. 12

For use on Door #(s):
B114B B115A

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 6 | EA | HINGE | 5BB1HW 4.5 X 4.5 (NRP AS REQ'D) | 652 | IVE |
| 1 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | REMOVABLE MULLION | KR4954 STAB | 689 | VON |
| 1 | EA | PANIC HARDWARE | LD-99-DT | 626 | VON |
| 1 | EA | ELEC PANIC HARDWARE | QEL-99-NL 24 VDC | 626 | VON |
| 2 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | MORTISE CYL HOUSING (SFIC) | 80-110 (W/ DISP CONST CORE) | 626 | SCH |
| 1 | EA | RIM CYL HOUSING (SFIC) | 80-116 (W/ DISP CONST CORE) | 626 | SCH |
| 2 | EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 8" X 1" LDW B-CS (VERIFY/MATCH HEIGHT AND MATERIAL WITH EXISTING) | BLK | IVE |
| 2 | EA | WALL STOP/HOLDER | WS45/WS45X | 626 | IVE |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |
| 2 | EA | SILENCER | SR64 | GRY | IVE |
| 1 | EA | POWER SUPPLY | BY ACCESS CONTROL INTEGRATOR | | B/O |
| 1 | EA | CREDENTIAL READER | BY ACCESS CONTROL INTEGRATOR | | B/O |

HARDWARE GROUP NO. 13

For use on Door #(s):
A102A

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 2 | EA | CONT. HINGE | 112XY EPT (OR 027XY EPT AS REQ'D FOR DR THK) | 628 | IVE |
| 2 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | REMOVABLE MULLION | KR4954 STAB | 689 | VON |
| 1 | EA | ELEC PANIC HARDWARE | LX-RX-QEL-99-NL 24 VDC | 626 | VON |
| 1 | EA | ELEC PANIC HARDWARE | RX-QEL-99-DT 24 VDC | 626 | VON |
| 2 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | MORTISE CYL HOUSING (SFIC) | 80-110 (W/ DISP CONST CORE) | 626 | SCH |
| 1 | EA | RIM CYL HOUSING (SFIC) | 80-159 (W/ KEYED CONST CORE) | 626 | SCH |
| 2 | EA | OH STOP | 100S | 630 | GLY |
| 1 | EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 1 | EA | SURF. AUTO OPERATOR | 4642 WMS 120 VAC | 689 | LCN |
| 1 | EA | MOUNTING PLATE | 4040XP-18PA | 689 | LCN |
| 1 | EA | BLADE STOP SPACER | 4040XP-61 | 689 | LCN |
| 1 | EA | WEATHER RING | 8310-801 | | LCN |
| 2 | EA | ACTUATOR | 8310-853T | 630 | LCN |
| 2 | EA | MOUNT BOX | 8310-867S | | LCN |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |
| 1 | EA | WEATHERSTRIPPING | BY DOOR/FRAME MANUFACTURER | | B/O |
| 2 | EA | DOOR SWEEP, BRUSH W/ DRIP | 8198AA | AA | ZER |
| 1 | EA | THRESHOLD, 1/2" | 655A | A | ZER |
| 1 | EA | POWER SUPPLY | BY ACCESS CONTROL INTEGRATOR | | B/O |
| 1 | EA | CREDENTIAL READER | BY ACCESS CONTROL INTEGRATOR | | B/O |
| 2 | EA | DOOR CONTACT | 679 SERIES | BLK | SCE |

DOOR(S) NORMALLY CLOSED AND LOCKED AND EXTERIOR ACTUATOR DISABLED. PRESENTING VALID CREDENTIAL TO READER RETRACTS EXIT DEVICE LATCH AND ENABLES EXTERIOR ACTUATOR. PUSHING ENABLED EXTERIOR ACTUATOR SIGNALS AUTOMATIC OPERATOR TO OPEN DOOR. INTERIOR ACTUATOR ENABLED AT ALL TIMES. PUSHING INTERIOR ACTUATOR RETRACTS LATCH AND SIGNALS AUTOMATIC OPERATOR TO OPEN DOOR. EXIT DEVICE LATCH ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN (I.E. PUSH/PULL MODE) AS DESIGNATED BY ACCESS CONTROL SYSTEM SCHEDULE. EXIT DEVICE LATCHES AND LOCKS WITH LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 14

For use on Door #(s):
A102B

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 2 | EA | CONT. HINGE | 112XY EPT (OR 027XY EPT AS REQ'D FOR DR THK) | 628 | IVE |
| 2 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | REMOVABLE MULLION | KR4954 STAB | 689 | VON |
| 2 | EA | ELEC PANIC HARDWARE | RX-QEL-99-DT 24 VDC | 626 | VON |
| 1 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | MORTISE CYL HOUSING (SFIC) | 80-110 (W/ DISP CONST CORE) | 626 | SCH |
| 2 | EA | OH STOP | 100S | 630 | GLY |
| 2 | EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 2 | EA | MOUNTING PLATE | 4040XP-18PA | 689 | LCN |
| 2 | EA | BLADE STOP SPACER | 4040XP-61 | 689 | LCN |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |
| 1 | EA | WEATHERSTRIPPING | BY DOOR/FRAME MANUFACTURER | | B/O |
| 2 | EA | DOOR SWEEP, BRUSH W/ DRIP | 8198AA | AA | ZER |
| 1 | EA | THRESHOLD, 1/2" | 655A | A | ZER |
| 2 | EA | DOOR CONTACT | 679 SERIES | BLK | SCE |

EXIT DEVICE LATCH CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN (I.E. PUSH/PULL MODE) AS DESIGNATED BY ACCESS CONTROL SYSTEM SCHEDULE. EXIT DEVICE LATCHES AND LOCKS WITH LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 15

For use on Door #(s):

A112 A113A A113B A113C

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 2 | EA | CONT. HINGE | 224XY EPT | 628 | IVE |
| 2 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | REMOVABLE MULLION | KR4954 STAB | 689 | VON |
| 1 | EA | ELEC PANIC HARDWARE | LD-RX-99-DT | 626 | VON |
| 1 | EA | ELEC PANIC HARDWARE | RX-QEL-99-NL 24 VDC | 626 | VON |
| 2 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | MORTISE CYL HOUSING (SFIC) | 80-110 (W/ DISP CONST CORE) | 626 | SCH |
| 1 | EA | RIM CYL HOUSING (SFIC) | 80-159 (W/ KEYED CONST CORE) | 626 | SCH |
| 2 | EA | SURFACE CLOSER (W/ SPRING STOP) | 4040XP SCUSH | 696 | LCN |
| 2 | EA | KICK PLATE | 8400 8" X 1" LDW B-CS (VERIFY/MATCH HEIGHT AND MATERIAL WITH EXISTING) | BLK | IVE |
| 1 | SET | WEATHERSTRIPPING | 429AA-S | AA | ZER |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |
| 2 | EA | ASTRAGAL, MEETING STILE (2PC) | 8195AA | AA | ZER |
| 2 | EA | DOOR SWEEP, BRUSH W/ DRIP | 8198AA | AA | ZER |
| 1 | EA | THRESHOLD, 1/2" | 655A | A | ZER |
| 1 | EA | POWER SUPPLY | BY ACCESS CONTROL INTEGRATOR | | B/O |
| 1 | EA | CREDENTIAL READER | BY ACCESS CONTROL INTEGRATOR | | B/O |
| 2 | EA | DOOR CONTACT | 679 SERIES | BLK | SCE |

DOOR(S) NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER RETRACTS EXIT DEVICE LATCH, ALLOWING ACCESS. EXIT DEVICE LATCH ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN (I.E. PUSH/PULL MODE) AS DESIGNATED BY ACCESS CONTROL SYSTEM SCHEDULE. EXIT DEVICE LATCHES AND LOCKS WITH LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 16

For use on Door #(s):
A001

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 2 | EA | CONT. HINGE | 224XY EPT | 628 | IVE |
| 2 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | ELEC FIRE EXIT HARDWARE | RX-QEL-9947WDC-DT-F-LBR-SNB 24 VDC | 626 | VON |
| 1 | EA | ELEC FIRE EXIT HARDWARE | RX-QEL-9947WDC-NL-F-LBR-SNB 24 VDC | 626 | VON |
| 1 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | RIM CYL HOUSING (SFIC) | 80-116 (W/ DISP CONST CORE) | 626 | SCH |
| 2 | EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 8" X 1" LDW B-CS (VERIFY/MATCH HEIGHT AND MATERIAL WITH EXISTING) | BLK | IVE |
| 2 | EA | ELEC WALL MAG HOLDER | SEM7850 AS REQ (3 5/8" PROJECTION, 12/24/120V AC/DC TRI-VOLT) | 689 | LCN |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |
| 1 | EA | GASKETING, MEETING STILE | 5070 | CL | NGP |
| 1 | EA | POWER SUPPLY | BY ACCESS CONTROL INTEGRATOR | | B/O |
| 1 | EA | CREDENTIAL READER | BY ACCESS CONTROL INTEGRATOR | | B/O |
| 2 | EA | DOOR CONTACT | 679 SERIES | BLK | SCE |

DOORS CAPABLE OF BEING HELD OPEN BY ELEC HOLDERS. DOORS CLOSE AND LATCH WITH ACTIVATION OF FIRE ALARM OR LOSS OF POWER. DOORS CAN ALSO BE MANUALLY RELEASED FROM ELEC HOLDERS.

WHEN DOOR ARE CLOSED AND LOCKED, PRESENTING VALID CREDENTIAL TO READER RETRACTS EXIT DEVICE LATCH, ALLOWING ACCESS. EXIT DEVICE LATCH ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN (I.E. PUSH/PULL MODE) AS DESIGNATED BY ACCESS CONTROL SYSTEM SCHEDULE. EXIT DEVICE LATCHES AND LOCKS WITH LOSS OF POWER AND WITH FIRE ALARM ACTIVATION. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 17

For use on Door #(s):
A113D B115B

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 1 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | MORTISE CYL HOUSING (SFIC) | 80-110 (W/ DISP CONST CORE) | 626 | SCH |

VERIFY EXACT CYLINDER TYPE REQUIRED. BALANCE OF HARDWARE BY DOOR MANUFACTURER.

HARDWARE GROUP NO. 18

For use on Door #(s):
GATE1

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 1 | EA | PANIC HARDWARE, WEATHERIZED | LD-WR9952-EO-WH | 626 | VON |
| 1 | EA | PANIC DEVICE PULL TRIM | 990-NL-RV | 626 | VON |
| 1 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |
| 1 | EA | RIM CYL HOUSING (SFIC) | 80-116 (W/ DISP CONST CORE) | 626 | SCH |
| 1 | | ELECTRIC STRIKE | EN400RP x EN400-GATEBOX | 630 | TRN |
| 1 | EA | POWER SUPPLY | BY ACCESS CONTROL INTEGRATOR | | B/O |
| 1 | EA | CREDENTIAL READER | BY ACCESS CONTROL INTEGRATOR | | B/O |

BALANCE OF HARDWARE BY DOOR MANUFACTURER/SUPPLIER.

DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER MOMENTARILY RELEASES ELECTRIC STRIKE, ALLOWING ACCESS. DOOR TO REMAIN LOCKED UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 19

For use on Door #(s):
GATE2

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 1 | EA | CREDENTIAL READER | BY ACCESS CONTROL INTEGRATOR | | B/O |

ALL HARDWARE BY DOOR MANUFACTURER/SUPPLIER.

DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER MOMENTARILY RELEASES ELECTRIC STRIKE, ALLOWING ACCESS. DOOR TO REMAIN LOCKED UPON LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 20

For use on Door #(s):
PH-1

Provide each OPENING with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 1 | EA | STOREROOM LOCK | L9080HD 03A | 626 | SCH |
| 1 | EA | PERMANENT CORE | 1C7*2 | 626 | BES |

VERIFY EXACT CYLINDER TYPE REQUIRED. BALANCE OF HARDWARE BY DOOR MANUFACTURER/SUPPLIER.

**END OF SECTION**

**SECTION 08 80 00 – GLAZING**

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Doors.
   2. Storefront framing.
   3. Fire-rated glazing.

B. Related Sections include the following:
   1. Division 08 Section “Aluminum-Framed Entrances and Storefront” for thermal performance requirements.
   2. Division 12 casework sections for glazing built into manufactured casework.

C. Refer to “Code Plans” and Door and Frame Schedule for fire-protection-rated and fire-resistive-rated glazing.

1.2 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters (mm) according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Solar Heat Gain Coefficient (SHGC): The ratio of the solar heat gain through the glass relative to the incident solar radiation. Solar heat gain includes both direct and indirect gain. The direct gain is the solar energy directly transmitted through the glazing. The indirect gain is the solar energy absorbed by the glazing and subsequently convected and thermally radiated inward.

E. Low-Emissivity (“Low-E”): Having the demonstrated ability to reduce heat gain or loss by reflecting long-wave infra-red (IR) energy (heat), thereby decreasing the U-value and improving energy efficiency.
   1. “Solar-Control” Low-E Glazing: Glazing that has a SHGC equal to or less than 0.40. Solar-control low-e coatings maximize the amount of daylight transmitted through the glass while minimizing both the amount of solar heat transmitted into the building and the amount of heat loss from the long-wave infrared portion of the heat spectrum.

F. Sealed Insulating Glass Unit Surface Designations:
   1. Surface 1 – Exterior surface of the outer glass lite.
   2. Surface 2 – Interspace surface of the outer glass lite.
   3. Surface 3 – Interspace surface of the inner glass lite.
   4. Surface 4 – Interior surface of the inner glass lite.

G. Fire-Rated Glazing: Fire-rated glazing can be of two types – fire-resistance rated or fire protection rated. Fire-resistance-rating glazing is tested to ASTM E 119 or UL 263 and may be used in walls and is not considered as an opening. Fire-protection-rated glazing is tested to NFPA 257 or UL 9 and is usually in doors or limited size window openings in fire barriers and fire partitions.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances.

1.4 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each glass type and glazing material required, including installation and maintenance instructions.
   a. Interior glass and fire rated glazing only required submittal.
   b. Exterior glazing product data shall be included in the opening submittals, refer to other Division 08 Sections.
   c. **Do Not** provide exterior glazing product information under this Section.

B. Glass Materials Samples:
   1. Spandrel glass color selections.
   2. Translucent film material for laminated glass interlayer.

C. Samples for Verification: For translucent laminated glass assemblies in color selected, 12 by 12 inch size.

1.5 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Qualifications
   1. Fabricator Qualifications for Insulating-Glass Units: Fabricator must be capable of producing certified sealed insulating-glass products equivalent to “CBA” level. Fabricators must be listed in the IGCC directory or submit evidence of quality-assurance program. The quality-assurance program, as a minimum, must have the following elements:
      a. A quality manual.
      b. Operating procedures documenting how insulating-glass units are fabricated.
      c. A designated person responsible for quality assurance.
      d. Routine product or component checks.
   2. Installer Qualifications: An experienced installer who has completed glazing similar in material design and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.
      a. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass and Metal (AG&M) contractors.
   3. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC’s CAP 1 Certification Agency Program.
   4. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

B. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of Insulating Glass Certification Council (IGCC).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's and fabricators written instructions. Prevent damage to glass and glazing materials from:
   1. Condensation.
   2. Temperature changes.
   3. Direct exposure to sun.

4. Other causes.
    a. Primary seal protection: Follow manufacturer/fabricator protocols to minimize the risk for damage to, or failure of, the primary IG unit seal caused by shearing stresses during handling and storage.
    b. Avoid glass-to-glass contact: Guard against latent damage to large IG units caused by glass-to-glass contact when subject to changes in temperature and/or barometric pressure.
5. Protect from contact with corrosive chemicals.
6. Avoid placement of glass edge on concrete, metal, or other hard objects.

B. For insulating-glass units that might be exposed to substantial altitude changes, comply with insulating-glass fabricator's written recommendations for venting and sealing units to avoid hermetic seal ruptures.

C. Deliver glass to site in suitable containers that will protect glass from the weather and from breakage. Carefully store material, as directed, in a safe place where breakage can be reduced to a minimum. Deliver sufficient glass to allow for normal breakage. Glazing compounds shall arrive at the project site in labeled containers that have not been opened.
1. Exercise exceptional care to prevent edge damage to glass, and damage/deterioration to coating on glass.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. Laminated Glass: Fabricator’s standard form in which laminated-glass fabricator agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributable to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer’s written instructions.
1. Defects include:
    a. Edge separation.
    b. Delamination materially obstructing vision through glass.
    c. Blemishes exceeding those allowed by referenced laminated-glass standard.
2. Warranty Period: Ten years from date of Fabrication.

C. Insulating Glass: Fabricator’s standard form in which insulating-glass fabricator 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 attributable to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer’s written instructions.
1. Evidence of failure is the obstruction of vision by:
    a. Dust.
    b. Moisture.
    c. Film on interior surfaces of glass.
2. Glass breakage due to thermal stress will be replaced by the Contractor at no additional cost to the Owner during the guarantee period.
3. Warranty Period: Manufacturer's/fabricators standard but not less than 10 years after date of Fabrication.

D. Ceramic Frit and Silkscreened Glass: Provide a written 5-year warranty from date of fabrication for ceramic frit and silkscreened glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers of Non-Fire-Protection-Rated Glass: Subject to compliance with requirements, provide products from the following.
   1. AGC Primary Division and AGC Coatings Division, AGC Flat Glass North America, Inc. (fka AFG), Asahi Glass America, Inc., Asahi Glass Co. Ltd.
   2. Cardinal IG Co., Cardinal Glass Industries.
   3. Guardian/Sunguard Industries Corp.
   4. Pilkington North America Inc. (fka LOF), Nippon Sheet Glass (NSG) Co. Ltd.
   5. Vitro Glass (fka PPG Flat Glass).

B. Manufacturers of Fire-Protection-Rated Glass: Subject to compliance with requirements, provide products by one of the following.
   1. Pilkington Group Ltd., NSG Group Flat Glass Business, Nippon Sheet Glass (NSG) Co. Ltd., Merseyside UK in partnership in North America with Technical Glass Products (TGP).
   2. SAFTI*FIRST* Division, O'Keefe's Inc.
   3. SCHOTT North America, Inc., SCHOTT Group.
   4. Vetrotech Saint-Gobain North America, Inc.

C. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least ten days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

D. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
   1. Obtain tinted glass from single soured from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following:
   1. Defective manufacture, fabrication, or installation.
   2. Failure of sealants or gaskets to remain watertight and airtight.
   3. Deterioration of glazing materials.
   4. Other defects in construction.

B. Delegated Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat-treated) required to meet or exceed the following criteria:
   1. Glass Thicknesses: Select minimum glass thickness to comply with ASTM E 1300, according to the following requirements:
      a. Design Wind Loads: Determine design wind loads applicable to the Project according to ASCE 7, Minimum Design Loads for Buildings and Other Structures: Section 6.5, Method 2 – Analytical Procedure, based on mean roof heights above grade indicated on drawings.
         1) Refer to Structural Drawings for loading information.

2. Design Snow Loads: As indicated on Drawings, but not less than snow loads applicable to Project as required by ASCE 7, “Minimum Design Loads for Buildings and other Structures”; Section 7.0, “Snow Loads”.
3. Probability of Breakage for Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load. Minimum thickness of annealed or heat-treated glass products to be selected so the worst case probability of failure does not exceed 8 breaks per 1,000 for glass under wind action.
4. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
5. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 3/4 inch, whichever is less.
6. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
1. Change in Ambient Temperature: 120 degrees Fahrenheit
2. Change in Temperature of Material Surfaces: 180 degrees Fahrenheit

D. Regulatory Requirements:
1. Safety Glazing: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
   a. Subject to compliance with requirements, permanently mark safety glazing with certification label of Safety Glazing Certification Council (SGCC) or another certification agency acceptable to authorities having jurisdiction.
      1) Identification on tempered glass shall include the words “Tempered Safety Glass”.
   b. Where glazing units, including Kind-FT (fully tempered) glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 square feet in exposed surface area of one side, provide glazing products that comply with Category II materials. For lites 9 square feet or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials.
      1) Exception for hazardous locations: Where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
2. Fire-Protection-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection-ratings indicated, based on testing according to NFPA 252.
   a. Each lite shall bear a permanent, non-removable label of UL and/or WHI certifying it for use in tested and in fire-resistance-rated protective assemblies.
3. Fire-Protection-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection-ratings indicated, based on testing according to NFPA 257.
   a. Each lite shall bear a permanent, non-removable label of UL and/or WHI certifying it for use in tested and in fire-resistance-rated protective assemblies.

E. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer’s name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg. F., and the fire-resistance rating in minutes.
1. Marking fire-rated glazing assemblies.

| Fire Test Standard | Marking | Definitions of Marking |
|---|---|---|
| ASTM E 119 or UL 263 | W | Meets wall assembly criteria |
| NFPA 257 or UL 9 | OH | Meets fire window assembly criteria including the hose stream test |
| NFPA 252 or UL 10B | D | Meets fire door assembly criteria |
| or UL 10C | H | Meets fire door assembly hose stream test |
| | T | Meets 450 deg. F temperature rise criteria |

for 30 minutes

XXX The time in minutes of the fire resistance or fire-protection rating of the glazing assembly

F. Thermal and Optical Performance Properties: Provide glass with performance properties specified and required by Opening Manufacturer to meet requirements, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6mm thick.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBNL's WINDOW 6.3 computer program, expressed as Btu/sq.ft. x h x deg F.
   5. Solar Height-Gain Coefficient and Visible Transmittance: Center of glazing values, according to NFRC 200 methodology and based on LBNL's Window 6.3 computer program.
      a. Solar Heat Gain Coefficient: Shall not be greater than the following:
         1) 0.40
   6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 FABRICATORS

A. Fabricators of Non-Fire-Protection-Rated Glass: Subject to compliance with requirements, provide products by one of the fabricators listed as certified with IGCC or meeting "Quality Assurance" requirements.

2.4 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass manufacturers, glass product fabricators, and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. Glass Association of North America (GANA):
      a. Glazing Manual (2009).
      b. Sealant Manual (2008).
   2. Laminating Division of GANA: Laminated Glass Design Guide (2000).
   3. American Architectural Manufacturers Association (AAMA):
      a. Glass Design for Sloped Glazing (AAMA GDSG-1-87).
   4. Insulating Glass Manufacturers Alliance (IGMA):
      a. SIGMA TM-3000 "Glazing Guidelines for Sealed Insulating Glass Units".
      b. IGMA Guidelines for Sloped Glazing (IGMA TB-3001-01).

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 lites in thicknesses as needed to comply with requirements indicated.

E. Strength: Where float glass is indicated, provide annealed float glass, Kind-HS heat-treated float glass, or Kind-FT heat-treated float glass as needed to comply with Performance Requirements article. Where heat-strengthened glass is indicated, provide Kind-HS heat-treated float glass or Kind-FT heat-treated float glass as needed to comply with Performance Requirements article. Where fully tempered glass is indicated, provide Kind-FT heat-treated float glass.
   1. Insulated Glass
      a. Unless glass in noted as tempered all clear insulated glass greater than 35 sq.ft. shall be heat-strengthened.

2.5 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality q3 (glazing select), Class 1 (clear).

B. Heat-Strengthened Float Glass: ASTM C 1048, Type I (transparent flat glass), Quality q3 (glazing select), of class, kind, and condition indicated.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated. Performance requirements:
      a. Distortion Tolerance: Roll wave peak-to-valley (PV) not to exceed 0.003 center/0.008 edges.
      b. Millidiopter: 90 percent of surface not to exceed +/- 120 millidiopters.
      c. Monitoring: Every lite measured with an on-line distortion measurement system.
      d. Bow/Warp Tolerance: Maximum tolerance for bow/warp is 1/2 of ASTM C 1048.
      e. All documentation recorded and may be available upon request.
   2. Provide Kind-HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
      a. Minimum requirements
         1) All clear insulated glass greater than 35 sq.ft. shall be heat-strengthened or tempered.
   3. For uncoated glass, comply with requirements for Condition A.
   4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
   5. Provide Kind-FT (fully tempered) float glass in place of annealed or Kind-HS (heat-strengthened) float glass where safety glass is indicated.

C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated. Performance requirements:
      a. Distortion Tolerance: Roll wave peak-to-valley (PV) not to exceed 0.003 center/0.008 edges.
      b. Millidiopter: 90 percent of surface not to exceed +/- 120 millidiopters.
      c. Monitoring: Every lite measured with an on-line distortion measurement system.
      d. Bow/Warp Tolerance: Maximum tolerance for bow/warp is 1/2 of ASTM C 1048.
      e. All documentation recorded and may be available upon request.

D. Tinted Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality q3 (glazing select), Class 2 (tinted heat-absorbing and light-reducing).

E. Wired Glass: Not acceptable.

F. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum-deposition process after manufacture and heat-treatment (if any), and complying with other requirements specified.
   1. Kind: Kind CV (coated vision glass).
      a. Exception where the lower edge of the glass is more than 6 feet above the adjacent floor level or cannot be approached closer than 10 feet: Kind CO (coated overhead glass).

G. Silicone-Coated Spandrel Glass: ASTM C 1048, Condition C (other uncoated glass), Type I (transparent flat glass), Quality q3 and complying with other requirements specified.

## 2.6 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172 and complying with testing requirements in 16 CFR 1201 for Category II materials and with other requirements specified. Use materials that have a proven track record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Use same interlayer material throughout project.
   1. Construction: Laminate glass with polyvinyl-butyral interlayer to comply with interlayer manufacturer's written recommendations.
      a. Do not use a cast-in-place and cured-transparent-resin interlayer.
   2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
   3. Interlayer Color: Clear unless otherwise indicated.
   4. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.
      a. Laminate lites in autoclave with heat plus pressure.

## 2.7 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, and complying with other requirements specified.
   1. Provide Kind-HS (heat-strengthened or fully tempered) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
      a. All clear insulated glass greater than 35 sq.ft. shall be heat-strengthened or tempered.
   2. Provide Kind-FT (fully tempered) glass lites where safety glass is indicated.
   3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

B. Sealing System: Dual-seal, with manufacturer's standard primary and secondary.

C. Spacer: Manufacturer's recommended spacer material and construction, required to meet thermal performance requirements of opening.

D. Desiccant: Molecular sieve or silica gel, or blend of both.

## 2.8 FIRE-PROTECTION-RATED GLAZING

A. General: Products incorporating either wired glass or applied films are not acceptable.

B. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing accordance with NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.
   1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream tests.

C. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 degree F. temperature-rise limitation; and the fire-resistance rating in minutes.

D. Laminated Ceramic Glazing Material: Proprietary Category II safety glazing product in the form of 2 lites of clear ceramic glazing material laminated together to produce a laminated lite of 8-mm nominal thickness, polished on both surfaces, weighing 4 pounds per square foot, and as follows:

1. Fire-Protection Rating: As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
2. Polished on both surfaces, transparent.

E. Specialty Fire Protective Glass: Proprietary Category I or II safety glazing product in the form of 3/4 inch thick monolithic lite as follows:
1. Fire-Protection Rating: Up to 90 minutes and permanently labeled by a testing and inspection agency acceptable to authorities having jurisdiction.
2. Usable in a maximum of 100 square inch daylight openings in doors.

F. Fire-Protection-Rated Tempered Monolithic Glass: Proprietary Category II safety glazing product in the form of a specially tempered 6.0-mm (minimum) thick monolithic lite, and as follows:
1. Fire-Protection Rating: 20 minutes only and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

G. Laminated Glass with Intumescent Interlayer(s): Proprietary Category II safety glazing product in the form of multiple lites of Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Kind-FT (fully tempered) float glass laminated with intumescent interlayer(s), and as follows:
1. Fire-Protection Rating: As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

H. Gel-Filled, Dual-Glazed Units: Proprietary Category II safety glazing product in the form of two lites of Condition-A (uncoated surfaces), Type-I (transparent flat glass), Class-1 (clear), Kind-FT (fully tempered) float glass, with a perimeter metal spacer separating lites and dual-edge seal enclosing a cavity completely filled with clear, fully transparent, heat-absorbing polymer.
1. Fire-Protection Rating: As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

2.9 GLASS USAGE

A. General: Hereinafter are the minimum glazing requirements. Adjust sealed space, spacer, and coating as required to meet opening performance requirements. Glass shall be as required by opening manufacturer to meet thermal requirements as documented in manufacturer's published test data or verified with testing prescribed.

B. Exterior:
1. Basis of Design: Select glazing type in combination with opening assembly performance requirements outlined in other Division 08 Sections.
a. Minimum performance requirements shall equal or exceed Vitro, Solarban 60. Utilize other glass products as required to comply with opening assembly performance requirements specified.
1) Thermal Transmittance: U-factor not more than 0.29 Btu/sq.ft. x h x deg F.
2) Solar Heat Gain Coefficient: No greater than 0.39.
2. Glass for Exterior Doors:
a. 25-mm thick fully tempered insulating glass consisting of 6.0-mm thick, minimum, grey tint outer panel, a 13-mm wide hermetically sealed air or gas as required to meet opening "Performance Requirements". space, and 6.0-mm thick, minimum, clear inner panel and shall be factory-installed.
1) Provide low-e coating on second or third surface as required to meet opening "Performance Requirements".
3. Storefront: 25-mm thick insulating glass consisting of 6.0-mm thick, minimum, grey tint, outer panel, a 13-mm wide hermetically sealed air or argon space, as required to meet opening "Performance Requirements" and 6.0-mm thick clear glass inner panel.
a. Provide heat-strengthened glass when lite is tinted and tempered glass where indicated or required by "Performance Requirements" and "Regulatory Requirements" and glass manufacturer.

b. Provide solar-control low-e coating on second or third surface as required to meet opening “Performance Requirements”.

4. Glass for Storefront and Doors (Insulated Security Glazing):
   a. Type 2: 25-mm thick insulating glass consisting of 6.0-mm thick, minimum, grey tint outer panel, a 11-mm wide hermetically sealed air or argon space, as required to meet opening “Performance Requirements” and 8.0-mm thick clear laminated glass inner panel.
      1) Provide heat-strengthened glass when lite is tinted and tempered glass where indicated or required by “Performance Requirements” and “Regulatory Requirements” and glass manufacturer.
      2) Provide solar-control low-e coating on second or third surface as required to meet opening “Performance Requirements”.
      3) Laminate glass, type LT consisting of two lites of 1/8 inch thick heat strengthened glass with 0.090 clear plastic interlayer. Within insulated unit adjust thickness of air space as required to install into Aluminum Door, Aluminum Storefront or Aluminum Curtain Wall systems. Minimum thickness shall be 1 inch, 25mm.
5. Glass for Storefront: 25-mm thick insulating glass consisting of 6-mm thick clear outer panel, 11-mm wide hermetically sealed air space, and 8-mm thick laminated glass inner panel.
   a. Provide tempered glass where indicated or required by “Performance Requirements” and “Regulatory Requirements” and glass manufacturer.
   b. Laminated Glass:
      1) Laminated Glass: Kind LT, consisting of two lites of fully tempered float glass.
         a) Inner and Outer Light: Type I (transparent glass, flat) float glass.
            .1 Class I (clear).
            .2 Kind FT (fully tempered).
            .3 Thickness: 3.0 mm.
         b) Plastic Interlayer: 0.030-inch thick.
            .1 Color: White translucent.
      2) Low-E Coating: On second surfaces.
   c. Location: Window openings in gymnasium/fieldhouse.
6. Ceramic-Coated or Silicone Spandrel Insulating Glass:
   a. Construction: Provide units that comply with requirements specified for insulating-glass units except for indoor lite.
      1) Kind FT (fully tempered).
      2) Ceramic Coating Location: Third surface.
         a) Color: As selected by A/E from manufacturer’s full range. Color shall compliment glass tint.

C. Interior:
1. Glass for Vestibule Doors, Sidelights, and Transoms: 6-mm thick clear tempered safety glass, unless otherwise noted.
2. Glass for Interior Non-Fire-Protection-Rated Doors, Storefront, and Windows: 6-mm thick clear tempered glass.
3. Glass for Interior Fire-Protection-Rated Doors, Storefront, and Windows:
   a. Provide fire-protection-rated glazing products, per Schedule at end of Section, where indicated.
4. Doors: Provide 12 mm thick tempered safety glass where glass is subject to projectile impact in door and window openings toward gymnasium/fieldhouse and where indicated.

## 2.10 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
1. EPDM, ASTM C 864.
2. Silicone, ASTM C 1115.
3. Thermoplastic polyolefin rubber, ASTM C 1115.

B. Soft Compression Gaskets:
   1. Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below, complying with ASTM C 509, Type II, black, and of profile and hardness required to maintain watertight seal:
      a. EPDM.
      b. Silicone.
      c. Thermoplastic polyolefin rubber.
   2. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.11 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:
   1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Colors of Exposed Glazing Sealants: As selected by A/E from manufacturer's full range.
   4. Glazing materials brought on site shall contain less than one percent asbestos by content.

B. Elastomeric Glazing Sealant Standard (Weatherseal): Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
   1. Low-Modulus Neutral-Curing Silicone Glazing Sealant (ASTM C 920, Type S, Grade NS, Class 100/50, Use NT):
      a. 790 by Dow Corning Corp.
      b. Bondaflex Sil 290 by May National Associates, Inc.; a subsidiary of Sika Corporation.
      c. Silpruf LM SCS2700 by Momentive Performance Materials Inc., Apollo Management, LP (fka GE Sealants and Adhesives).
      d. 890 by Pecora Corp.
      e. PSI-641 by Polymeric Systems, Inc., Whitford Worldwide.
      f. Spectrem 1 by Tremco Sealant/Weatherproofing Division, RPM International Inc.
   2. Medium-Modulus Neutral-Curing Silicone Glazing Sealant (ASTM C 920, Type S, Grade NS, Class 50, Use NT):
      a. Omniseal 50 by BASF Building Systems (fka DeGussa, fka ChemRex, fka Sonneborn), BASF Construction Chemicals Americas, BASF Aktiengesellschaft.
      b. 756-SMS, 791, 795, or 995 by Dow Corning Corp.
      c. Bondaflex Sil 295 by May National Associates, Inc.
      d. SilGlaze II SCS2800, Silpruf NB SCS9000, Silpruf SCS2000, or UltraPruf II SCS2900 by Momentive Performance Materials Inc., Apollo Management, LP (fka GE Sealants and Adhesives).
      e. 864, 895, 895NST, or 898 by Pecora Corp.
      f. PSI-641 by Polymeric Systems, Inc., Whitford Worldwide.
      g. SikaSil-C995 by Sika Corp. (USA).
      h. Spectrem 2 or Spectrem 3 by Tremco Sealant/Weatherproofing Division, RPM International Inc.
   3. High-Modulus Neutral-Curing Silicone Glazing Sealant (ASTM C 920, Type S, Grade NS, Class 25, Use NT):
      a. 799 by Dow Corning Corp.
      b. Bondaflex Sil 200 GPN and Bondaflex Sil 201 FC by May National Associates, Inc.
      c. UltraGlaze SSG4000 or UltraGlaze SSG4000AC by Momentive Performance Materials Inc., Apollo Management, LP (fka GE Sealants and Adhesives).

d. PSI-631 by Polymeric Systems, Inc., Whitford Worldwide.
e. PolyGlaze Plus (SM5731) by Schnee-Moorehead (S-M) Division, Illinois Tool Works (ITW) Inc.
f. Proglaze SSG or Tremsil 600 by Tremco Sealant/Weatherproofing Division, RPM International Inc.

4. High-Modulus Acid-Curing Silicone Glazing Sealant (ASCTM C 920, Type S, Grade NS, Class 25, Use NT):
a. OmniPlus by BASF Building Systems (fka DeGussa, fka ChemRex, fka Sonneborn), BASF Construction Chemicals Americas, BASF Aktiengesellschaft.
b. Chem-Calk 1200 by Bostik Construction Products Division, Bostik Findley Unit of TotalFinaElf.
c. 999-A by Dow Corning Corp.
d. Sil 100 GC, Sil 100 GP, or Sil 100 WF by May National Associates, Inc.
e. Contractors SCS1000 or SCS1200 by Momentive Performance Materials Inc., Apollo Management, LP (fka GE Sealants and Adhesives).
f. 860 by Pecora Corp.
g. PSI-601 by Polymeric Systems, Inc., Whitford Worldwide.
h. PolyGlaze (SM5732) by Schnee-Moorehead (S-M) Division, Illinois Tool Works (ITW) Inc.
i. Proglaze or Tremsil 200 by Tremco Sealant/Weatherproofing Division, RPM International Inc.

## 2.12 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent, non-staining and non-migrating in contact with non-porous surfaces, with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, polyvinyl-chloride (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.

## 2.13 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus-or-minus 5.
1. Type recommended by sealant or glass manufacturer.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
   1. Type recommended by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise optimum glazing sealant performance.

2.14 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

D. Heat-Strengthened/Tempered Glass: Cut float glass materials to indicated sizes and provide cut-outs and holes, if indicated, before heat strengthening.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine glass framing, channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass framing members.

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

3.2 PREPARATION FOR GLAZING

A. Clean the glazing channel or other framing members to receive glass, immediately before glazing. Remove coatings that are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.
   1. Seal porous glazing channels and recesses with primer or sealer compatible with substrate.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

1. All glazing exposed to exterior shall be wet/wet or wet/dry in accordance with GANA Glazing Manual for window type.

C. Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and air tight, deterioration of glazing materials, and other defects in the Work.

D. Adjust glazing channel dimensions as required by project conditions during installation to provide:
1. Necessary bite on glass.
2. Minimum edge and face clearances.
3. Adequate sealant thicknesses, with reasonable tolerances.

E. The glazier is responsible for correct glass size for each opening within the tolerances and necessary dimensions established.

F. Protect glass from edge damage at all times during handling, installation, and operation of the building. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
1. Inspect each piece of glass immediately before installation and eliminate those that have observable edge damage or face imperfections.

G. Apply primers or sealers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant substrate testing and as recommended by sealant manufacturer.

H. 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.

I. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

J. Provide spacers inside and out and of proper size and spacing for glass lites where length plus width is larger than 50 united inches, except where gaskets are used for glazing.
1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width.
    a. Exception for Glazing Tape: Use thickness slightly less than final compressed thickness of tape.

K. 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.
1. Coordinate glazing with wood door stops so stop is flush with outside of face veneer.

L. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in the channel at the heel of jambs and head (do not leave voids in the sill channels) except as otherwise indicated, depending on light size, thickness and type of glass, and complying with manufacturer's recommendations.

M. Do not attempt to cut, seam, nip, or abrade glass that is tempered, heat-strengthened, or coated.

N. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

O. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

P. Set glass lites with proper orientation so that coatings face fire side or protected of exterior or interior as specified.

Q. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel, so as to eliminate dirt and moisture pockets.

R. Clean and trim excess glazing materials from the glass and stops or frames promptly after installation and eliminate stains and discoloration.

S. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket does not "walk" out when subjected to dynamic movement.

T. Square-cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away. Seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tape to heads and sills first and then to jambs. Cover horizontal framing joints by applying tape to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. 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 joint 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.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer’s written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.8 CURING

A. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength, and surface durability.

3.9 PROTECTION, AND CLEANING

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect exterior glass from breakage and other damage immediately upon installation by attaching crossed streamers to framing held away from glass. Do not apply markers to surfaces of glass. Remove non-permanent labels and clean surfaces.

C. Protect glass from contact with contaminating substances resulting from construction operations. If despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
   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.

D. Examine glass surfaces adjacent to or below exterior concrete and masonry surfaces at frequent intervals during construction – but not less than once a month – for buildup of dirt, scum, alkaline deposits, or stains. Remove as recommended in writing by glass manufacturer.

E. Remove and replace glass that is broken, chipped, cracked, or abraded, or that is otherwise damaged due to natural causes, accidents, or vandalism, during the construction period.

F. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass according to:
   1. Written recommendations of glass manufacturer.

G. Do not use scrapers or other metal tools to clean glass.

| FIRE-PROTECTION-RATED GLASS SCHEDULE | | | | | |
|---|---|---|---|---|---|
| | DOORS (NFPA 80) (in square inches) | | | | |
| **MANUFACTURER/ PRODUCT** | **20 MIN.** | **45 MIN.** | **60 MIN.** | **90 MIN.** | **3 HR.** |
| TGP/FIREGLASS 20<br>(without Hose Stream Test) | 3,204<br>(36 by 89) | | | | |
| TGP/FIRELITE PLUS | 3,204<br>(36 by 89) | 3,204<br>(36 by 89) | 100 | 100 | 100 |
| TGP/PYROSTOP | | 3,724<br>(41 by 89) | 100 | 100 | |
| VETROTECH/ PYROSWISS<br>(without Hose Stream Test) | 2,372<br>(34 by 70) | | | | |
| VETROTECH/ KERALITE FR-L | 490<br>(33 by 33) | 490<br>(33 by 33) | 100 | 100 | |
| VETROTECH/ SWISSFLAM 45-N2 | | 2,635<br>(36 by 77) | | | |
| VETROTECH/ SWISSFLAM 60-N2 | | | 100 | | |
| VETROTECH/<br>SWISSFLAM 90 AND 120 | | | | 100 | |
| SAFTI/SUPERLITE I<br>(without Hose Stream Test) | 3,436<br>(36 by 96) | | | | |
| SAFTI/SUPERLITE X-90 | | 100 | 100 | 100 | |
| SAFTI/SUPERLITE II-XL | | 4,952<br>(60 by 124) | 100 | 100 | |
| INTEREDGE/PYROEDGE 20<br>(without Hose Stream Test) | 2,868<br>(87 by 87) | | | | |
| INTEREDGE/PYROBEL-45 | 2,747 | 2,747<br>(58 by 58) | | | |
| INTEREDGE/PYROBEL-60 | | | 100 | | |
| INTEREDGE/PYROBEL-90 | | | | 100 | |
| SCHOTT/<br>PYRAN PLATINUM-L | 2,376<br>(36 by 76) | 2,376<br>(36 by 76) | 100 | 100 | |
| OLDCASTLE/<br>PYROGUARD | 1,288<br>(28 by 46) | | | | |

END OF SECTION 08 80 00

# SECTION 08 83 00 - MIRRORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following types of silvered flat glass mirrors.
   1. Film-backed glass mirrors qualifying as safety glazing.

B. Related Sections include the following:
   1. Division 08 Section "Glazing" for glass with reflective coatings used for vision and spandrel lites.
   2. Division 10 Section "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

### 1.2 DEFINITIONS

A. Deterioration of Mirrors: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning mirrors contrary to mirror manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

### 1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
   2. Mirror mastic.
   3. Mirror hardware.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

### 1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Warranty: Special warranty specified in this Section.

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed mirror glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in mirror installations with a record of successful in-service performance.

B. Source Limitations for Mirrors: Obtain mirrors from one source for each type of mirror indicated.

C. Source Limitations for Mirror Glazing Accessories: Obtain mirror glazing accessories from one source for each type of accessory indicated.

D. Glazing Publications: Comply with the following published recommendations:
   1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
   2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

E. Safety Glazing Products: For film-backed mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.8 WARRANTY

A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Manufacturer's standard form, made out to Owner and signed by mirror manufacturer agreeing to replace mirrors that deteriorate as defined in "Definitions" Article within specified warranty period indicated below:
   1. Warranty Period: Five years from date of manufacture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
      a. Walker Glass Co., Ltd.
      b. Guardian Glass
      c. Lenoir Mirror Company
      d. Virginia Mirror Company, Inc.
      e. National Glass Industries
      f. Gardner Glass Products.
      g. Avalon Glass and Mirror Co.
      h. Gilded Mirrors, Inc.
      i. Binswanger Mirror Products

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Provide mirrors that will not fail under normal usage. Failure includes glass breakage and deterioration attributable to defective manufacture, fabrication, and installation.

2.3 GLASS MIRROR MATERIALS

A. Annealed Monolithic Glass Mirrors: Mirror Glazing Quality, clear.
   1. Nominal Thickness: 6.0 mm.

B. Safety Glazing Products: For film-backing mirrors, provide products that comply with 16 CFR 1201, Category II.

2.4 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
   1. Manufacturers:
      a. Franklin International; Titebond Division
      b. Laurence, C.R. Co., Inc.
      c. Macco Adhesives; Liquid Nails Division
      d. OSI Sealants, Inc.
      e. Palmer Products Corporation
      f. Pecora Corp.
      g. Royal Adhesives & Sealants; Gunther Mirror Mastics Division
      h. Sommer & Maca Industries, Inc.

2.5 MIRROR HARDWARE

A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
   1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.
      a. Products:
         1) Laurence, C.R. Co., Inc.; CRL Standard “J” Channel.
         2) Andscot; Aluminum Shallow Nose “J” Moulding Lower Bar.
         3) Stylmark; Heavy Gauge Aluminum Shallow Nose “J”.
   2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.04 inch.
      a. Products:
         1) Laurence, C.R. Co., Inc.; CRL Deep “J” Channel.
         2) Andscot; Aluminum Deep Nose “J” Moulding Upper Bar.
         3) Stylmark;Heavy Gauge Aluminum Deep Nose “J”.
   3. Finish: Clear bright anodized.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching if in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.6 FABRICATION

A. Mirror Sizes: To suit Project conditions, cut mirrors to final sizes and shapes.
   1. Mirror thickness shall be 6.0 mm, unless indicated otherwise.

B. Cutouts: Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished edge.
   1. Seal edges of mirrors after edge treatment to prevent chemical or atmospheric penetration of glass coating.
   2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

D. Film-Backed Safety Mirrors: Apply film backing with pressure-sensitive adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections. Use adhesives and film backing compatible with mirror backing paint as certified by mirror manufacturer.
   1. Tapeback: Provide annealed float glass mirrors with manufacturer applied safety tape applied to the back surface and complying with FS DD-G-1403, ANSI Z97.1-1984 CPSC 16 CFR 1201 Category II.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance.
   1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
   2. Proceed with mirror installation only after unsatisfactory conditions have been corrected and surfaces are dry.

### 3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating surfaces with mastic manufacturer's special bond coating where applicable.

### 3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
   1. NGA Publications: “Laminated Glazing Reference Manual,” Glazing Manual” and “Installation Techniques Designed to Prolong the Life of Flat Glass Mirrors”.

B. Provide a minimum air space of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. For wall-mounted mirrors, install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
   1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, 2 slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
   2. For mirror hardware in the form of a continuous J-channel at bottom and continuous top trim at top, fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
   3. Install mirror hardware in the form of J-channels that are fabricated in single lengths to fit and cover top and bottom edges of mirrors.
   4. Install mastic as follows:
      a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.

b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Clean mirrors as recommended in writing by mirror manufacturer and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION 08 83 00

# DIVISION 9 FINISHES

**SECTION 09 01 91 - MOISTURE RESISTANT/WATER-PROOF FLOORING ADHESIVE FOR CONCRETE SLABS**

PART 1 - GENERAL

1.1 SUMMARY

A. Water-proof adhesives for interior concrete slabs scheduled for floor finish of resilient tile flooring, rubber flooring, resilient sheet flooring, and other approved flooring materials.

B. Related Sections
1. Division 03 Section “Cast-In Place Concrete”: Installation and curing requirements according to ACI 302.
2. Division 09 Section “Existing Substrate Preparation for Floor Finishes”.
3. Division 09 Section “Resilient Tile Flooring”: Rubber sheet and vinyl tile installation requirements.

1.2 REFERENCES

A. American Society of Testing and Materials (ASTM):
1. C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
2. C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
3. F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
4. F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

B. International Concrete Repair Institute (ICRI) Guideline No. 310.2-1997 (formerly 03732): Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

1.3 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
1. Warranty: Warranty documents specified herein.

1.4 QUALITY ASSURANCE

A. The Waterproof Adhesive shall be specifically formulated and marketed for water vapor resistance and alkalinity control. System design shall provide warranted adhesive bond suitable to 95.0% in situ relative humidity per ASTM F2170 or to the maximum of allowed testing equipment.

B. Installer Qualifications: Applicator shall be approved by the manufacturer, experienced in surface preparation and application of the material and shall be subject to inspection and control by the manufacturer.

C. Mock-up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Do not proceed with remaining work until workmanship, color, and sheen are approved by A/E.
2. Refinish mock-up area as required to produce acceptable work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the job site in their original unopened containers, clearly labeled with the manufacturer's name and brand designation.

B. Store products in an approved ventilated dry area; protect from dampness, freezing, and direct sun light. Product should not be stored in areas with temperatures in excess of 90 degrees F or below 50 degrees F.

C. Handle product in a manner that will prevent breakage of containers and damage products.

1.6 FIELD CONDITIONS

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

B. Do not apply Waterproof Adhesive to surfaces when water is accumulated on the surface of the concrete.

C. Do not apply moisture resistant or water-proof adhesives when temperature is lower than 50 degrees F or expected to fall below this temperature within 24 hours from time of application.

D. Allow continuous ventilation and indirect air movement at all times during application and curing process of the moisture resistant or water-proof adhesive.

1.7 SCHEDULING

A. Before installation of VCT, sheet vinyl, rubber flooring, or other over the interior concrete slabs, in situ relative humidity testing shall be performed per ASTM F2170 to determine the level of relative humidity in the slab.

B. Coordinate the scheduling of the Waterproof Installation System Mock- up, allowing adequate time to apply and review results.

1.8 WARRANTY

A. Manufacturer shall provide a system warranty including adhesives and surface preparation products for a period of no less than ten (10) years at no additional cost.

B. Installer of moisture resistant or water-proof adhesives shall provide standard installation warranty for workmanship.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Moisture resistant or water-proof flooring adhesive having the performance profile to withstand elevated alkaline moisture identified per ASTM F2170.

B. Product: Suitable for application to prepared concrete exhibiting in situ relative humidity reading OF 95%RH.

C. Basis-of-Design Product: Formulators' Aquaflex Waterproof Installation System comparable system recommend by flooring manufacturer for full system warranty or one of the following.
1. Flexera (HT) Premium Universal Adhesive: TEC.
2. TrowelFast Vinyl Flooring Adhesive: TEC.
3. 5092 HT: Parabond.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared per ASTM F710.

B. If substrate preparation is the responsibility of another installer, notify A/E of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Inspect surfaces with manufacturer's representative to determine its suitability to receive the moisture resistant or water-proof flooring adhesive. Provide an uncontaminated, sound surface.

B. Clean surfaces to receive moisture resistant or water-proof flooring adhesive. Remove defective materials, and foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, etc. Mechanically prepare concrete to ASTM F710 standards.

C. Repair cracks, expansion joint, control Joints, and open surface honeycombs by filling with epoxy-based crack repair material.

D. Use Patch Mix to repair surface defects with requirements listed in manufacturer's technical data information. No exceptions. Consult with manufacturer.

E. Do not acid etch surface.

F. Verify that the substrate surface does not deteriorate due to the presence of sulphurous compounds, fly ash or alkaline aggregate/silica reaction encountered in certain areas.

G. Consult with system manufacturer prior to application.

H. The surface substrate shall remain uncontaminated, absorptive, smooth and sound prior to receiving moisture resistant or water-proof flooring adhesive per ASTM F-710. Comply with all requirements as listed in manufacturer's technical data information. No exceptions.

3.3 APPLICATION

A. Adhesive Application:
   1. The coverage rates for the moisture resistant or water-proof flooring adhesive are dependent on the surface texture and porosity of the substrate.

B. Product selection and required application rate relative to existing levels of moisture per ASTM F2170.

3.4 TESTING

A. Initial Tests:
   1. ASTM F2170, insitu relative humidity testing shall be performed by the installer.
   2. Provide initial results of ASTM F2170 to A/E. Tests shall be performed on properly prepared concrete.
   3. Conduct ASTM F2170 tests at the same temperature and humidity as designed normal occupancy. If this is not possible, test conditions shall be 75 degrees F +/-10 degrees (24 degree C +/- 5 degrees) and 50 percent +/-10 percent relative humidity. Maintain these conditions 48 hours prior to and during tests.
   4. Installer shall provide test results with a marked up floor finish plan showing test placement.

B. Post-Treatment / Pre-Flooring Tests:
   1. Before installation of VCT, sheet vinyl, rubber flooring, and/or other flooring, and after mechanical preparation of concrete surface, conduct a porosity test. This test will involve placing a single droplet of water on the concrete surface and spreading to the size of a quarter dollar. Water should absorb within 30 seconds.
   2. The installer shall provide test results of the level of in situ relative humidity (%RH) and absorption test of the concrete slab to all parties involved. The flooring manufacturer and installer shall accept the floor condition and certify that the flooring application materials and methods are compatible with the test results and floor condition.

C. Adhesion
   1. The flooring installer shall verify the usage of cementitious materials prior to the installation of any concrete repair materials.
   2. The flooring installer will consult manufacturers 72 hours prior to adhesive application concerning installation strategy and technique.

3.5 CLEANING

A. Remove all debris resulting from installation from project site.

3.6 PROTECTION

A. Protect applied adhesive during specified cure period from any kind of traffic, topical water and contaminants.

END OF SECTION 09 01 91

## SECTION 09 05 16 – EXISTING SUBSTRATE PREPARATION FOR FLOOR FINISHES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes substrate preparation requirements for existing areas to receive installation of new flooring materials. This Section includes:
   1. Removal of existing floor coverings.
   2. Floor leveling and repair.

B. Related Sections:
   1. Division 02 Section “Selective Demolition” for additional demolition requirements.
   2. Division 09 for finish flooring sections.

1.2 REFERENCES

A. Publications listed below form a part of this Specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Society for Testing and Materials (ASTM):
   1. C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
   2. C191 – Standard Test Method for Time of Setting of Hydraulic-Cement.
   3. C348 – Standard Test Method for Flexural Strength of Hydraulic Cement Mortars.
   4. D4259 – Standard Practice for Abrading Concrete to alter surface profile of concrete and to remove foreign materials and weak surface laitance.
   5. D7234 – Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
   6. E96 – Standard Test Methods for Water Vapor Transmission of Materials.
   7. F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
   8. F1869 – Standard Test Method for Measuring Moisture Vapor Emissions Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
   9. F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-stu Probes.
   10. F3010 – Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Flooring Coverings.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate both products and installation requirements with warranty holding manufacturers technical representative.

B. Preinstallation Conference: Conduct conference at Project site. A/E will schedule and conduct meeting. Review methods and procedures related to flooring system installation including, but not limited to, following:
   1. Meet with Owner, A/E, testing and inspecting agency representative, floor system installers, including installed of moisture mitigation and cementitious underlayment, floor system manufacturers representatives, including those of moisture mitigation, cementitious underlayment, and adhesive and installers work interfaces or affects flooring.
   2. Review methods and procedures related to flooring installation, including manufacturer’s written instructions.
   3. Review and finalize construction schedule and verify availability of materials, Installer’s personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Example substrate conditions, including flatness and any testing results pertaining to substrate i.e., core samples, moisture readings.
   5. Review warranty obligations.
   6. Review temporary protection requirement for each sequence of work.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection and approving application method.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for warranty work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in combination with label legible and intact and grade-seals unbroken.

B. Store material to prevent damage or contamination.

PART 2 - PRODUCTS

2.1 CEMENTITIOUS SELF-LEVELING UNDERLAYMENT

A. System Description: High performance self-leveling underlayment resurfacer. Single component, self-leveling, cementitious material designed for easy application as an underlayment for all types of flooring materials. It is used for substrate repair and leveling.

B. Products: Subject to compliance with system warranty, applicable fire, health, environmental, and safety requirements for storage, handling, installation, and clean up. Gypsum-based products are unacceptable.
   1. Custom Building Products, Custom Tech, TechLevel 150.
   2. Mapei, Novoplan SP.

C. System Characteristics:
   1. Wearing Surface: Smooth.
   2. Thickness: Ranging from feathered edge to 1 inch, per application. Applications greater than 1 inch require additional 3/8 inch aggregate to mix or as recommended by manufacturer.

D. Underlayment shall be calcium aluminate cement-based, containing Portland cement.

E. Compressive Strength: Minimum 4100 psi in 28 days in accordance with ASTM C109.

F. Flexural Strength: Minimum 1000 psi in 28 days in accordance with ASTM C348.

G. Primer: Compatible and as recommended by manufacturer for use over intended substrate.

H. System Components: Manufacturer's standard components that are compatible with each other and as follows:
   1. Primer:
      a. Resin: Copolymer
      b. Formulation Description: Single component ready to use.
      c. Application Method: Squeegee and medium nap roller. All puddles shall be removed, and material shall be allowed to dry, 1-2 hours at 70 degrees F.
      d. Number of Coats: One.
   2. Grout Resurfacing Base:
      a. Formulation Description: Single component, cementitious self-leveling high-early and high-ultimate strength grout.
      b. Application Method: Colloidal mix pump, cam rake, spike roll.
         1) Thickness of Coats: Per architectural scope, 1 inch lifts.
         2) Number of Coats: More than one if needed.
      c. Aggregates: For applications greater than 1 inch, require additional 3/8 inch aggregate to mix.

| Property | Test | Value |
|---|---|---|
| Compressive Strength | ASTM C109 | 2,200 psi @ 24 hours<br>3,000 psi @ 7 days |
| Initial Set Time<br>Final Set Time | ASTM C191 | 30 to 45 minute<br>1 to 1-1/2 hours |
| Bond Strength | ASTM D7234 | 100 percent bond to concrete failure |

2.2 CEMENTITIOUS TROWEL-APPLIED UNDERLAYMENT

A. Underlayment shall be calcium aluminate cement-based, containing Portland cement. Gypsum-based products are unacceptable.
   1. Custom Building Products, Silk Patching & Finishing Compound
   2. Mapei, Planipatch.

B. Compressive Strength: Minimum 4000 psi in 28 days.

C. Trowel-applied underlayment shall not contain silica quartz (sand).

D. Dry Time: Underlayment shall receive application of floor covering in 15 to 20 minutes.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature of work area at not less than 60 degrees F., without interruption, for not less than 24 hours before testing and not less than 3 days after testing.

B. Maintain higher temperature for a longer period of time where required by manufacturer's recommendation.

C. Do not install materials when temperatures of substrate or materials are not within 60 to 85 degrees F.

3.2 SURFACE PREPARATION

A. General: Prepare and clean substrates according to flooring manufacturer's written instructions for substrate indicated.
   1. Concrete shall meet requirements of ASTM F 710
   2. Substrate should be clean and free of dust, dirt, oil, grease, wax, soap, paint, concrete color stains, curing compounds, concrete sealers, clear coats, loosely bonded toppings, old adhesive residues and any other substance that may prevent or reduce adhesion.
   3. Contaminants should be mechanically removed.
   4. No chemicals or solvents shall be used.

B. Existing concrete slabs with existing floor coverings.
   1. Conduct visual observation of existing floor coverage for adhesion, water damage, alkaline deposits, and other defects.
   2. Remove existing floor covering and adhesives. Comply with local, state, and federal regulations and RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
      a. Removal includes removal of all adhesive material, flooring backing and residual debris to the concrete substrate.

1) Wet-scrape adhesive residue to the finished surface of the concrete

b. Removal may require special processes and specialty equipment.

C. Prepare concrete substrates per ASTM D4249 to an ICRI concrete surface profile between 1 and 3 CSP as follows: Do not use water blast method.
1. Dry abrasive blasting or mechanical abrading operation.
2. Vacuum-assisted abrasive blasting.
3. Concrete slabs should have a broomed or brushed finish to enhance bond. Existing or new concrete slabs with a smooth finish must be abraded to ensure a good bond.

D. Existing terrazzo: Comply with new finish flooring manufacturers written instructions for preparation and adhesive products.
1. Clean surface of all dirt and debris.
2. At a minimum mechanically strip existing polish or sealer from existing terrazzo flooring.
3. Roughen or abrade surface of existing terrazzo as required to achieve a mechanical bond with new flooring adhesive.
4. If required by flooring manufacturer for the substrate, provide a primer over the existing terrazzo.

E. Repair damaged and deteriorated concrete according to flooring manufacturers written recommendations.

F. Prepare joints in accordance with material manufacturer's instructions.

G. Tolerances: Subsurface shall meet flatness and levelness tolerance as recommended by floor finish manufacturer. Install underlayment to achieve required tolerance.

H. Other Subsurface: For all other subsurface conditions, such as wood or metal, contact floor finish or underlayment manufacturer, as appropriate, for proper preparation practice.

## 3.3 CEMENTITIOUS SELF-LEVELING UNDERLAYMENT

A. Install cementitious self-leveling underlayment as required to correct surface defects, floor flatness or levelness corrections to meet floor manufacturer's tolerance requirements.
1. Address non-moving cracks or joints.
2. Provide a smooth surface for installation of flooring covering.

B. Mix and apply in accordance with manufacturer's instructions.

## 3.4 CEMENTITIOUS TROWEL-APPLIED UNDERLAYMENT

A. Install cementitious trowel-applied underlayment per manufacturers written installation instructions to correct surface defects and skim coating of surface to meet floor manufacturer's tolerance requirements.
1. Dampen surfaces, force material into all cracks and voids up the 1/2 inch thicknessusing broad knife or trowel and finish flush with surface.
2. For skim coating, use a smooth-edged trowel to level the surface area. Skim coating must produce a smooth and level surface without trowel marks when used as preparation for resilient flooring products.

## 3.5 FLOORING, GENERAL

A. Flooring shall be installed in accordance with manufacturers writing recommendations with adhesive that meets requirements of warranty holder.

## 3.6 PROTECTION

A. Prior to installation of finish flooring, surface of underlayment should be protected from abuse by other trades by use of plywood, tempered hardwood, or other suitable protection course.

END OF SECTION 09 05 16

# SECTION 09 21 16.00 - GYPSUM BOARD ASSEMBLIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Gypsum board, metal support systems, metal accessories, fasteners, and related items necessary as indicated and as follows:
   1. Interior gypsum board products types, sizes, and thickness indicated.
      a. Gypsum boards shall have fire-resistance ratings and be moisture and mold resistant.
         1) Joint treatment shall be moisture and mold resistant.
   2. Non-Structural Steel Framing, including firestop top track seals.
      a. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
      b. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).
      c. Grid suspension systems for gypsum board ceilings.
   3. Acoustical insulation unless specifically excluded.
   4. Reinforcement, both metal and wood, within framing systems to support wall and ceiling-mounted furnishings or equipment provided by other trades.

B. Related Sections include the following:
   1. Division 05 Section “Cold-Formed Metal Framing”: For exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists.
   2. Division 06 Section “Rough Carpentry”: For wood blocking.
   3. Division 06 Section “Sheathing”: For gypsum sheathing (exterior).
   4. Division 07 Section “Thermal Insulation”: For thermal insulation and vapor barriers.
   5. Division 07 Section “Penetration Firestopping”: For firestopping systems.
   6. Division 07 Section “Joint Firestopping” for fire-resistance-rated joint sealants.
   7. Division 09 Section “Interior Finish System” for interior sheathing as part of system.
   8. Division 09 Section “Interior Painting”: For primers applied to gypsum board surfaces and for coordination of repair work.

### 1.2 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C11 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

B. Wet Walls: Walls with plumbing fixtures mounted on them and walls in restrooms, shower or similar areas that will be intermittent wet.

### 1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination
   1. Coordinate blocking and furring work with installers of related work including, but not limited casework, acoustical ceilings, thermal insulation, gypsum board, light fixtures, mechanical system, electrical systems, and sprinklers.
   2. All work above ceiling line should be completed, prior to installing the gypsum board. There should be no materials resting against or wrapped around the suspension system, hanger wires or ties.

B. Pre-Installation Meeting: Conduct a pre-installation meeting to verify project requirements, substrate conditions, and manufacturer’s installation instruction.
   1. Review blocking requirements.

1.4 ACTION SUBMITTALS

A. Product Data: Include manufacturer's product data and installation instructions for each type of product indicated, including other data as might be required to show compliance with these Specifications, including firestop top track seal manufacturer's printed installation instructions.
   1. Submit data indicating compliance with "fire-test-response characteristics".

1.5 QUALITY ASSURANCE

A. Materials or operations specified by reference to the published specifications of a manufacturer or other published standards shall comply with the requirements of the standards listed.
   1. Standards include ASTM C840 and GA216, except more stringent requirements of manufacturer shall govern.
   2. Materials brought on-site shall contain less than 1 percent asbestos by polarized light microscopy (PLM) analysis.
   3. Applicable requirements of ASTM C754 for installation of steel framing.
   4. Apply acoustical sealant in accordance with applicable requirements of ASTM C919.

B. Refer to "Recommended Specification on Levels of Gypsum Board Finish" as published by the Gypsum Association (and AWCI/CISCA/PDCA) for finish levels required herein.

C. Mold-Resistant: Gypsum board assemblies designed to provide extra protection against mold and mildew compared to standard paper-faced wallboard products. When tested by an independent lab per ASTM D3273 ("Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber") gypsum board shall achieve an average board score of 8 or greater out of a possible high score of 10.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected from weather, condensation, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum boards flat to prevent sagging.
   1. Protect joint compounds from freezing.

C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

D. Protect metal framing from corrosion, deformation and other damage during delivery, storage, and handling per requirements of AISI's S202, "Code of Standard Practice" for Cold-Formed Steel Structural Framing".

1.7 FIELD CONDITIONS

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C840 and with gypsum board manufacturer's recommendations. Do not install gypsum board when ambient temperature is below 40 deg. F.
   1. Do not install paper-faced gypsum boards until installation areas are enclosed and conditioned.
      a. Only interior extended exposure gypsum boards maybe installed.
   2. Maintain dry bulb temperatures between 55 and 80 degrees F. and relative humidity at less than 50 percent during taping and curing of joint compound.

B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 degrees F. For adhesive attachment and finishing of gypsum board, maintain not less than 55 degrees F. for 48 hours prior to application and continuously after until dry. Do not exceed 80 degrees F. when using temporary heat sources.

C. Ventilation: Ventilate building spaces, as required, for dry joint-treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

D. Do not install boards that are wet, those that are moisture-damaged, and those that are mold-damaged.
   1. Indications that boards are wet or moisture-damaged include, but are not limited to discoloration, sagging, or irregular shape.
   2. Indications that boards are mold-damaged include, but are not limited to fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Moisture and Mold Resistant Gypsum Boards
      a. EcoSmart Mold Tough (Firecode); United States Gypsum Company
      b. XP Fireshield Wallboard; National Gypsum Co.
      c. M2Tech Gypsum Wallboard or Air Renew (Type X); CertainTeed Gypsum, Inc.
      d. M-Bloc (Type X); American Gypsum
      e. Mold-Guard Gypsum Board or Dens Armour Plus (Interior) (Type X); Georgia Pacific
      f. Mold Defense (Type X); Continental Building Products, LLC (fka Lafarge)
   2. Impact-ResistantMold-Resistant Gypsum Boards
      a. Mold Tough VHI; United States Gypsum Company
      b. Hi-Impact XP Wallboard; National Gypsum Company
      c. Extreme Impact-Resistant with M2Tech; CertainTeed Gypsum, Inc.
      d. Protecta HIR 300 with Mold Defense; Continental Building Products, LLC (fka Lafarge)
      e. Dens Armour Plus (Impact-Resistant); Georgia Pacific
   3. Direct Suspension Systems Drywall Ceilings
      a. Drywall Furring 640; Chicago Metallic Corp.
      b. Drywall Suspension System; USG Interiors, Inc.
      c. Worthington Steel Company
      d. Drywall Grid Systems; Armstrong World Industries

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other board products or from a manufacturer acceptable to the gypsum board manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. System Requirements: Fabricate and install systems as indicated, but not less than that required to comply with ASTM C754 under the following conditions:
   1. Gypsum board partitions:
      a. Standard systems: Maximum deflection of L/240 of partition height.
      b. Systems to receive tile: Maximum deflection of L/360 of partition height.
   2. Interior Suspended Ceilings and Soffits: Maximum deflection of L/360 of distance between supports.

3. Design framing system to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of 1 inch, unless otherwise noted.
4. Design framing systems in accordance with ASTM C645, unless otherwise indicated.

B. Fire-Resistance-Rated Assemblies: Where fire-resistance-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction or other methods acceptable to authorities with jurisdiction.
1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory" or GA-600, "Fire Resistance Design Manual" where accepted by local authorities.

C. STC-Rated Assemblies: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by a qualified independent testing agency.
1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."
2. Plenum Rating: Provide glass or slag-wool-fiber/rock-wool-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
a. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm air velocity.
b. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

## 2.3 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C645 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C645 requirements for metal, unless otherwise indicated.
2. Protective Coating: ASTM C645 and ASTM A653, G40, or equivalent corrosion resistance, unless otherwise indicated.
a. Coatings shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
b. Provide a protective coating, ASTM A653, G60, hot-dip galvanized at wet walls and where indicated.
c. Galvannealed products are not acceptable.

## 2.4 SUSPENSION SYSTEM COMPONENTS

A. Hanger Attachments to Concrete; as follows:
1. Anchors: Fabricated from corrosion resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E488 by a qualified independent testing agency.
a. Type: Post installed, chemical anchor or post installed, expansion anchor.
b. Powder-Actuated Fasteners: Not acceptable.

B. Tie Wire: ASTM A641, Class 1 zinc coating, soft temper or of a material and size having superior corrosion-resistance and equivalent strength to the galvanized steel wire specified.
1. Tie wire shall be 0.0625-inch or double strand of 0.0475 inch diameter wire.

C. Hangers: As follows:
   1. Wire Hangers: ASTM A641, Class 1 zinc coating, soft temper, 0.162 inch diameter.
      a. In high-humidity areas, provide one of the following:
         1) Stainless-Steel Wire: ASTM A580, Type 304, nonmagnetic.
         2) Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
   2. Rod Hangers: ASTM A510, mild carbon steel.
      a. Diameter: 1/4 inch, unless otherwise indicated or required by load.
      b. Protective Coating: ASTM A 153, hot-dip galvanized or rust-inhibitive paint.
   3. Flat Hangers: Commercial-steel sheet, ASTM A653, G40, hot-dip galvanized, unless otherwise noted.
      a. At high-humidity areas, provide ASTM A 653, G60, hot-dip galvanized material.
      b. Size: 1 by 3/16 inch by length indicated, unless otherwise noted or required by loads.
   4. Angle Hangers: ASTM A 653, G60, hot-dip galvanized commercial-steel sheet.
      a. Minimum Base Steel Thickness: 0.0312, unless otherwise noted.
      b. Size: 1-5/8 by 1-5/8 inches.

D. Carrying Channels: Base steel thickness of 0.0538 inch (fka 16 gauge), a minimum 1/2-inch wide flange, with ASTM A653, G40, or equivalent corrosive resistance.
   1. Depth: 1-1/2 inches, unless otherwise noted.

E. Furring Channels: ASTM A653, G40, or equivalent corrosive resistance.
   1. Cold-Rolled Channels: 0.0538 inch bare-steel thickness (fka 16 gauge), with minimum 1/2 inch wide flanges, 3/4 inch deep.
   2. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.
      a. Minimum Base Steel Thickness: 0.0179 inch (fka 25 gauge).
   3. Steel Studs and Runners: ASTM C645.
      a. Minimum Base Steel Thickness: 0.0179 inch (fka 25 gauge) or equivalent thickness 0.0150 inch (fka 25EQ gauge).
      b. Depth: 1-5/8 inch minimum, unless otherwise noted.

F. (Contractor's Option) Grid Suspension System of Interior Ceilings: ASTM C645-07, manufacturer's standard direct-hung grid suspension system composed of the main beams and cross furring members that interlock to form a modular supporting network.
   1. Structural Classification:
      a. Main beam shall be heavy duty per ASTM C635.
      b. Classification can require wires to be closer together for additional loading when used to support double layer gypsum panels, verticals, slopes, circles, soffits, canopies, and stop conditions which call for loading or unusual designs and shapes in gypsum board construction.
      c. Deflection of fastening suspension system supporting light fixtures, ceiling grilles, access doors, verticals and horizontal loads shall have a maximum deflection of 1/360 of the span.

## 2.5 STEEL FRAMING FOR PARTITIONS AND SOFFITS

A. Steel Studs and Runners: ASTM C645 with flange edges of studs bent back 90 degrees and doubled over to form 3/16 inch wide minimum lip (return), and complying with the following requirements:
   1. Thickness and spacing of studs shall be as indicated, but not less than that required complying with AISI S220 with maximum deflection L/240 at 5 lbf. per sq.ft., unless otherwise noted.
   2. Unless indicated otherwise, metal stud framing shall be formed from 0.0296-inch minimum sheet base metal (fka 20 gauge-non-structural) or equivalent thickness 0.0181 inch (fka 20EQ gauge non-structural).
      a. Framing shall not exceed an unbraced length of 16’-0” when framing is 16 inches on center.

b. Provide 0.0538 inch (fka 16 gauge) thick metal framing around overhead coiling door openings, and where openings exceed 48 inches in accordance with door manufacturer's requirements or equivalent thickness.
c. Provide a minimum base-steel thickness or 0.018 inch (fka 25 gauge) above finished ceilings, where indicated to extend CMU partitions to deck and for soffits.
1) Framing at the above locations shall be no greater than 24 inch on center.

3. Depth: As indicated.

B. Slip-Type Head Joints: Provide one of the following:
1. Single Long-Leg Runner System: ASTM C645 top runner with 2 inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs of provide lateral bracing.
2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
a. Products: Subject to compliance with requirements, provide one of the following:
1) The Steel Network, Inc.; VertiClip SLD Series or VertiTrack VTD Series.
2) ClarkDietrich; MaxTrak or Slotted Deflection Track.
3) Metal-Lite, Inc.; Slotted Track.
3. Firestop Top Track Seal: One-piece, preformed, polyurethane foam based, firestop seal for use with standard head-joint top tracks and bottom-joint tracks, and slip-type head joints in fire-rated construction at top or bottom of partition to maintain continuity of the fire-resistance-rated assembly indicated. Provide in width and configuration required to accommodate depth and installation of studs and designed to saddle-over the top track or under the bottom-track.
a. Use only firestop track seal product that has been UL2079 tested for specific fire-rated construction conditions conforming to construction assembly type, space requirements and fire-rating required for each application.
b. Performance Requirements
1) Movement: +/- 50 percent.
2) Surface Burning Characteristics (UL 723) ASTM E 84: Flame Spread: 20; Smoke Developed: 20.
3) Mold-Mildew Performance (ASTM G21-96): Class 0.
c. Acceptable Product: Subject to compliance with requirements, provide the following or compatible product by one of the other framing manufacturer's listed.
1) Model CFS-TTS "Firestop Top Track Seal"; Hilti, Inc.

C. Firestop Deflection Track (Contractor's Option): Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. The Steel Network, Inc.
b. Fire Trak Corp
c. Metal-Lite, Inc./Perfect Wall, Inc.
d. CEMCO; California Expanded Metal Products Co.
e. ClarkDietrich Building Systems
f. Marino/Ware.
g. SCAFCO Steel Stud Company
h. Steel Network, Inc.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing.
1. Flat Strap: Minimum Base Steel Thickness: 0.0296 inch (fka 20 gauge).
2. Backing Plate: Steel galvanized, 6 inches wide by 0.0538 inch (fka 16 gauge) thick minimum by lengths to suit size of items to be attached; fastened to studs for attachment of surface mounted fittings and accessories.
a. Provide either backing plates or wood blocking. Direct attachment of accessories or equipment to studs is strongly discouraged, unless loads have been analyzed.

E. Cold-Rolled Channel Bridging: 0.0538-inch base steel thickness (fka 16 gauge), with minimum 1/2 inch wide flange.
   1. Depth: 1-1/2 inches, unless otherwise noted.
   2. Clip Angle: 1-1/2 by 1-1/2 inch, 0.053 inch thick (fka 16 gauge), galvanized steel.
   3. Proprietary bridging may also be provided as contractor's option.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645 or AISI S220.
   1. Minimum Base Steel Thickness 0.0179 inch (fka 25 gauge).
   2. Depth: 7/8 inch, unless otherwise noted.

G. Soffit Framing System (Option): Prefabricated soffit framing system that clicks into shape and installs quickly.
   1. Aligns with construction industry dynamics:
      a. Enhanced safety.
      b. Reduced need for skilled labor.
      c. Transition from stick-build to pre-fab/off-site construction.
   2. Minimum G40 hot-dipped, galvanized coating (per ASETM C645); provides superior corrosion resistance.
   3. Basis-of-Design: SIMPLESOFFIT; Armstrong Ceiling and Wall Solutions.

2.6 GYPSUM BOARD PRODUCTS

A. General Requirements: Comply with ASTM C 1396. Provide in maximum lengths and widths available that will minimize joints in each area, that will minimize joints in each area, and that correspond with support system indicated.
   1. Unless otherwise noted all gypsum board shall be fire-resistance-rated. Refer to Code Plan in Construction Drawings for specific locations and requirements of fire-resistance-rated assemblies indicated.
   2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
   3. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
   4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B. Moisture-and Mold-Resistant Gypsum Boards: ASTM C 1396 with moisture and mold resistant core and surfaces.
   1. Core: 5/8 inch, Type X.
   2. Long Edges: Tapered.
   3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

C. Impact-Resistant/Mold-Resistant Gypsum Boards: Boards shall be 5/8 inch thick, complying with Type X fire-resistance in accordance with ASTM C1396 and C1629, and for NFPA Class I Flame Spread, Smoke Development and Fuel Contribution under ASTM E84.
   1. Surface Abrasion: ASTM C 1629, meets or exceeds Level 2 requirements.
   2. Indentation: ASTM C 1629, meets or exceeds Level 1 requirements.
   3. Soft-Body Impact: ASTM C 1629, meets or exceeds Level 3 requirements.
   4. Hard-Body Impact: ASTM C 1629, meets or exceeds Level 2 requirements.

2.7 ACOUSTICAL INSULATION MATERIALS

A. Sound-Attenuation Blankets: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without facing membrane), unless noted otherwise.
   1. Mineral-Fiber Type: Fibers manufactured from glass, slag wool, or rock wool.
      a. Where used in fire-resistance rated assemblies, mineral fiber types shall correspond with requirements of tested assemblies.

B. Acoustical Joint 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.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. BOSS 826 Acoustical Sound Sealant; Accumetric LLC.
   b. RCS 20 Acoustical; GE Construction Sealants.
   c. Acoustical Sealant GSC; Grabber Construction Products.
   d. OSI Pro-Series SC-175 Acoustical Sound Sealant; Henkel Corp.
   e. AC-20 FTR or AIS-919; Pecora Corp.
   f. Smoke-N-Sound Acoustical Sealant; Specified Technologies, Inc.
   g. Quiet Seal Pro; Serious Energy, Inc.
   h. SHEETROCK Acoustical Sealant; USG Corp.
   i. CP 506 Smoke and Acoustical Sealant; Hilti.
   j. Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: Franklin International.

## 2.8 MISCELLANEOUS MATERIALS

A. General: Comply with ASTM C475 and C1396. Provide auxiliary materials that comply with referenced installation standards.

B. Joint Tape: Tape shall be mold resistant and achieve a 10 rating when tested per ASTM D 3273.

1. Interior Gypsum Board (Temperature/Humidity controlled): Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats. Pre-mixed compounds shall be free of antifreeze, biocides, and other slow releasing compound. All-purpose type compound will not be acceptable for prefilling, embedding and first coat.

1. Prefilling: At open joints and damaged surface areas, use setting-type compound.
   a. ProForm Brand Quick Set Lite Setting Joint Compound, by National Gypsum Company.
   b. Sheetrock Brand Easy Sand Setting Type Joint Compound, by USG.
   c. Comparable product approved by one of the gypsum board manufacturers listed.
2. Level 2: Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type compound.
   a. ProForm Brand Quick Set Lite Setting Joint Compound, by National Gypsum Company.
   b. Sheetrock Brand Easy Sand Setting Type Joint Compound, by USG
   c. Comparable product approved by one of the gypsum board manufacturers listed.
3. Level 3: Fill coat, Second and Third Coat: For third coat, use all –purpose, midweight, topping, or lightweight compounds.
   a. ProForm Brand Lite Blue Ready Mix Joint Compound, by National Gypsum Company.
   b. Sheetrock Brand Plus 3 Lightweight or Ultra Lightweight All Purpose Joint Compound, by USG
   c. Comparable product approved by one of the gypsum board manufacturers listed.
5. Level 4: Finish Coat: For fourth coat, use all-purpose, midweight, topping, or lightweight compounds.
   a. ProForm Brand Lite Blue Ready Mix Joint Compound, by National Gypsum Company.
   d. Sheetrock Brand Plus 3 Lightweight or Ultra Lightweight All Purpose Joint Compound, by USG
   e. Comparable product approved by one of the gypsum board manufacturers listed.
6. Level 5: Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound, or a high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
   a. Primer and its application to surfaces are specified in Division 09 Section "Interior Painting."

D. Steel Screws for Gypsum Board: ASTM C1002, unless otherwise noted.
   1. Use screws complying with ASTM C954 for fastening boards 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 board manufacturer.

E. Fasteners for Metal Framing: Of type, material, size, corrosion-resistance, holding power, and other properties required to fasten steel members to substrates.

F. Accessories for Interior Installation: Corner bead, edge trim, and control joints complying with ASTM C1047 and requirements indicated below:
   1. Material: Formed metal with metal complying with the following requirements:
      a. Steel sheet zinc-coated by hot-dip or electrolytic process, or steel sheet coated with aluminum or rolled zinc, unless otherwise noted.
         1) Do not use plastic accessories, unless otherwise noted or approved by A/E in writing.
         2) Provide paper-faced galvanized steel sheet at abuse-resistant gypsum boards, where recommended by manufacturer.
   2. Shapes indicated below by reference to Figure 1 designations in ASTM C1047:
      a. Corner Bead: Use at outside corners, unless otherwise indicated.
         1) For corner bead, a high strength tapered copolymer core, preformed, uniform, 90 degree angle trim may be used. Surface shall be tight fibered, formulated paperboard. Back shall be joint tape paper for uniform surface bonding.
            a) Basis-of-Design: No-Coat; Ultratrim Outside 90.
            b) Comparable Product: Clark Dietrich Straitflex OS-300 or Big Stick.
      b. L-bead with face flange only; face flange formed to receive joint compound. Use for edge trim (perimeter relief).
         1) For L-bead, a high strength tapered copolymer core trim may be used. Surface shall be tight fibered, formulated paperboard. Back shall be joint tape paper for uniform surface bonding.
            a) Basis-of-Design: No-Coat; Ultratrim – 1/2 L-Trim.
            b) Comparable Product: Clark Dietrich Straitflex L-Bead.
      c. LC-bead (J-shaped): Exposed long flange receives joint compound; use at exposed board edges.
      d. One-piece control joint formed with V-shaped slot and removable strip covering slot opening.

G. Reveal Drywall (Aluminum) Trim
   1. Basis-of-Design: Subject to compliance with requirements, provide products as manufactured by Fry Reglet Corp. or comparable products by one of the following:
      a. Gordon, Inc.
      b. MM Systems Corp.
      c. Pittcon Industries
      d. Flannery, Inc.
      e. Tamlyn
   2. Type:
      a. Type “Z”; “Z Reveal Molding”: 5/8-inch, DRMZ-625-625.
      b. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
      c. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
   3. Extruded accessories of profiles and dimensions indicated.
      a. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
      b. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

H. Isolation Strip at Exterior Walls: Provide one of the following:
   1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
   2. Foam Gaskets: Closed-cell vinyl foam adhesive-backed strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit metal stud size indicated.

I. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum boards to continuous substrate.
   1. Do not adhere gypsum board directly to CMU on an exterior wall.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section.

B. Examine boards before installation. Reject boards that are wet, moisture damaged, and mold damaged.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLING STEEL FRAMING, GENERAL

A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation, except comply with framing sizes and spacing indicated.
   1. Do not bridge building expansion and control joints with steel framing [**or furring**] members. Independently frame both sides.
   2. Install bracing at terminations in assemblies.
   3. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, (shelving) or similar construction.
      a. Install backer plates or wood blocking accurately positioned and firmly secured to metal studs to support transferred loads.

B. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Intertek Laboratories.

3.4 INSTALLING SUSPENSION SYSTEMS, CEILINGS/SOFFITS

A. Install suspension system components in sizes and spacing indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling, plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
   3. Secure wire hangers by looping and wire tying, either directly to structures or to fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
   4. Secure rod, flat, or angle hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Locate and suspend carrying channel runners 48 inches o.c. with hangers to structure above.
      a. Follow manufacturer's recommendation for hanger spacing. If structure above forces the hanger to exceed 48 inches, substitute steel studs for the carrying channel runners.
      b. Extend runners to within 6 inches of walls.
      c. Do not permit furring or runners to contact masonry or concrete walls.
   6. Install furring channels 24 inches o.c., perpendicular to channel runners above. Assemble components in accordance with manufacturer's instructions.
      a. Stagger butt connect furring tees for gypsum board board end support.
      b. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports; do not clip.
      c. Provide 1 inch clearance between furring or runners and abutting walls and partitions.
   7. Do not support ceilings/soffits directly from permanent metal forms.
   8. Do not attach hangers/metal stud framing to steel deck tabs.
   9. Do not attach hangers/metal stud framing to steel roof deck. Attach hangers to structural members.
   10. Do not connect or suspend steel framing from ducts, pipes or conduit.
   11. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
      a. Flat Ceilings: Main tees shall be spaced a maximum of 48 inches on center and supported by hanger wires spaced a maximum 48 inches on center and as specified by UL Fire Resistance Directory attaching hanger wires directly to structure above. Do not attach to metal deck.
         1) Cross tees shall be spaced per manufacturers' recommendations and as specified by UL Fire Resistance Directory.
      b. Transitions (changes in elevation in soffit and fascia ceiling applications): When constructing stepped soffits, bracing of the gypsum board suspension system and/or additional hanger wires might be necessary to ensure stability and structural performance during and after gypsum board attachment.
         1) The maximum vertical soffit height shall be 48 inches. (Maximum unsupported gypsum area shall not exceed 48 inches by 24 inches).
         2) Intermediate cross tees are not necessary when bulkhead dimensions do not exceed 24 inches.
         3) Cross tee spacing in horizontal soffit plane shall not exceed 24 inches.
         4) Intermediate cross tees might be necessary to maintain visually acceptable drywall planes and drywall corners.

D. Installation Tolerances: Install suspension systems that are level to within 1/8-inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

A. Framing systems shall be set to the dimensions indicated on the Drawings.
   1. Where framing is installed directly against exterior walls, install felt strips or foam gaskets between studs and wall.
   2. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
      a. For STC-rated and fire-resistance-rated partitions that extend to underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing and structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.
   3. Install steel studs and furring in sizes and at spacing indicated with flanges within framing system pointing in same direction, but not greater than spacings required by referenced installation standards for assembly types.
      a. Space framing 16 inches o.c., unless otherwise indicated.
         1) Framing above ceilings, e.g., partition enclosures may be installed 24 inches o.c.
   4. Cover both faces of steel stud partition framing with gypsum boards in concealed spaces (above ceilings, etc.), except in chases that are internally braced.
      a. Fit gypsum boards around ducts, pipes, and conduits.
      b. Where partitions intersect members projecting below underside of floor/roof slabs and decks, cut gypsum boards to fit profile formed by members - allow for deflection and sealant.

B. Align base and cap channel runner track accurately to the partition layout. Secure to concrete floor slabs and roof or floor decks above, with 1/2-inch concrete stud nails or other suitable fasteners, not over 24 inches o.c.

C. Assembly connections may be welded instead of screwed.

D. Install horizontal bridging not more than 48 inches apart in walls, where gypsum wallboard is not full height on both sides of partition or “composite” construction. Note: bridging is not needed for an interior, non-axial load bearing wall with gypsum board attached to both stud flanges for the entire height of the wall, unless otherwise noted..
   1. Wall stud bridging shall be attached in a manner to secure stud spacing at top and to prevent stud rotation.
   2. For walls taller than 30’-0”, horizontal lateral bracing is recommended every 10’-0” o.c
   3. For an interior, non-axial load bearing wall with partial height gypsum board, continuous lateral bracing/bridging is requires at a 5 ft. maximum vertical spacing above the elevation at which the board is terminated.
   4. For an interior, non-axial load bearing wall with gypsum board on one side only, bridging is required a 5-ft. maximum vertical spacing..

E. Isolate steel framing a minimum of 1 inch from building structure whenever wall extends to underside of floor or roof structure to prevent transfer of loading imposed by structural movement. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
   1. Use deep-leg or deflection track, unless otherwise noted or required for fire-resistance-rated conditions.
   2. Install one row of horizontal bridging parallel to and within 8 inches of head track.
   3. Do not attach studs to head track.
   4. Do not attach top track in a manner that would penetrate top flute of metal roof deck.

F. Install flat strap diagonal bracing at corners and wherever recommended by stud manufacturer.

G. Frame door openings to comply with GA-600, and with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated. Install two studs at each jamb, unless otherwise indicated. Attach vertical studs at jambs with screws to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
   1. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joints.

H. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.

I. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated, to support closures, and to make partitions continuous from floor to underside of solid structure.
   1. Firestop Deflection Track (Contractor's Option): Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
   2. Firestop Top Track Seal: Install to maintain continuity of fire-resistance-rated assembly indicated. Install in accordance with the firestop manufacturer's printed installation instructions.

J. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated. If not indicated provide to meet "Performance Requirements".

K. Install reinforcement within framing system including additional studs, bracing members, plates, channels, and angles to support furnishings or equipment furnished by other trades. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co. These items include, but are not limited to, the following:
   1. Recessed Items: access boards, fire extinguisher cabinets, electrical boxes, openings for ducts and pipes, miscellaneous electrical, mechanical, or structural penetrations.
   2. Surface-Mounted Items: handrails, grab bars, toilet accessories, curtain tracks, drapery hardware, wall-mounted cabinets, corner guards, door stop, and other finish hardware.
   3. Items Anchored to Walls: casework, shelving, furnishings, toilet partitions, plumbing fixtures, and lockers.

L. Do not bridge building expansion joints and control joints with steel framing [**or furring**] members. Independently frame both sides of joints with framing [**or furring**] members as indicated.
   1. Provide a maximum 1/2-inch gap at control joints and fill gap with mineral fiber safing.

M. Direct Furring:
   1. Attach to concrete or masonry with stub nails, or screws designed for masonry attachment, spaced 24 inches o.c.

N. Installation Tolerances: Install each framing member so fastening surface varies not more than 1/8 inch from the plane formed by faces of adjacent framing.

## 3.6 SOUND-RATED CONSTRUCTION

A. General: Install sound attenuation blankets in sound-rated partitions and ceilings.

B. Interior-Partition Soundproofing
   1. Acoustical sealant shall be used to seal the entire perimeter of partitions having acoustical insulation as indicated on the Drawings, to seal cutouts in these partitions, and to seal under control joints. Sealant shall be installed in strict accordance with the manufacturer's written instructions. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
      a. Cutouts include electrical boxes, recessed cabinets, heating ducts, and cold air returns. (Apply sealant on sides and backs of electrical boxes.)
   2. Acoustical insulation shall be inserted between studs and extend the full height of the soundproof partition.
      a. Fit carefully behind electrical outlets and other work penetrating sound-rated construction.

C. Acoustical Sealant:
   1. At partition walls, provide continuous beads of acoustic sealant at juncture of both faces of runners with floor and ceiling construction, and wherever gypsum board abuts dissimilar materials, prior to installation of gypsum board.
   2. At ceilings, provide continuous beads of sealant whenever gypsum board abuts dissimilar materials.
   3. Provide continuous bead of sealant behind faces of control joints prior to installation of control joint accessories.
   4. After installation of gypsum board base layers, cut face layer sheets 1/2 inch less than floor-to-ceiling height and position with 1/4 inch open space between gypsum board and floor, ceiling and dissimilar vertical construction. Fill 1/4 inch open space with continuous sealant beads after installation of face layer.
   5. At openings and cutouts, fill open spaces between gypsum board and fixtures, cabinets, ducts and other flush or penetrating items, with continuous bead of sealant.

D. Sound Flanking Paths:
   1. Where sound-rated partitions intersect non-rated gypsum board partition walls, extend sound-rated construction to completely close sound flanking paths through non-rated construction.
   2. Seal joints between face layers at vertical interior angles of intersecting partitions.

## 3.7 APPLYING AND FINISHING BOARDS, GENERAL

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum boards to comply with ASTM C840.

B. Work shall be provided in accordance with the manufacturer's printed instructions and as specified herein. Where fire-rating requirements for systems are indicated on the Drawings or in the schedules, install components in accordance with manufacturer's instructions to comply with indicated fire rating requirements.
   1. Tolerances
      a. Do not exceed 1/8 inch in 8 feet 0 inches variation from plumb or level in exposed lines of surface, except at joints between gypsum board units.
      b. Do not exceed 1/16 inch variation between planes of abutting edges or ends.
      c. Shim as required to comply with specified tolerances.

C. Wallboard joints shall be butted tightly together.
   1. Install ceiling boards in direction, either parallel or perpendicular to framing members, which results in the least number of joints. Install in maximum practical lengths to span with minimum number of end (butt) joints. Stagger end joints of adjoining boards not less than one framing member.
   2. Form control and expansion joints with space between edges of adjoining gypsum boards.
   3. Attachment to Steel Framing: Attach boards so leading edge or end of each board is attached to open (unsupported) edges of stud flanges first.

4. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide a minimum of 1/4-inch perimeter relief where board abuts different materials, including floors. Trim edges with U-bead edge trim, where edges of gypsum boards are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
5. Install gypsum boards with face-side out. Butt boards together for a light contact at edges and ends with not more than 1/16 inch of open space between boards. Do not force into place.
6. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
7. Cover both faces of steel-stud partition framing with gypsum boards in concealed spaces (above ceilings, etc.) except in chases braced internally or where gypsum board is specifically noted as being installed on only one side of steel-stud partition framing.
    a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq.ft in area.
    b. Fit gypsum boards around ducts, pipes, and conduits.
    c. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum boards to fit profile formed by joists, and other structural members; allow 1/4 to 3/8 inch wide joints to install sealant.

D. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

E. Install sound attenuation blankets before installing gypsum boards unless blankets are readily installed after boards have been installed on one side.

## 3.8 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:
1. On ceilings, apply gypsum boards before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum boards vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    a. Stagger abutting end joints not less than one framing member in alternate courses of boards.
    b. Use maximum length boards to minimize end joints.
3. Fastening Methods: Apply gypsum boards to supports with steel drill screws.

B. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

C. Openings cut in gypsum board to fit electrical outlets, plumbing, and piping shall fit snugly and shall be small enough to be covered by plates and escutcheons. Both face and back paper shall be cut for cutouts that are not made by use of a saw.
   1. Make necessary cut-outs and seal cut or exposed board edges as recommended by gypsum board manufacturer.

D. Fasteners: Install fasteners no closer than 3/8 inch to end or edge. Space fasteners approximately 7 inches o.c., opposite each other on adjacent ends or edges. Begin fastening from center of wallboard and proceed toward outer end or edges.

E. Apply pressure on gypsum board, adjacent to fasteners being driven, to insure that gypsum board will be secured tightly to framing member. Check for looseness at fasteners. Drive fastener with shank reasonably perpendicular to face of board.

F. Drive screws with power screwdriver as recommended by gypsum board manufacturer. Surface of head shall be below surface of paper without cutting paper.

G. Direct Bonding (laminating) to Substrate: Where gypsum boards are indicated as directly adhered to a substrate, comply with gypsum board manufacturer's recommendations, and temporarily brace or fasten gypsum boards until fastening adhesive has set.

3.9 INSTALLING TRIM ACCESSORIES

A. General: For trim with backflanges intended for fasteners, attach to framing with same fasteners used for boards. Otherwise, attach trim according to manufacturer's written instructions.

B. Joint and corner treatment shall be in accordance with the manufacturer's printed instructions to provide a finished surface, ready for painting. Surface shall be free of dimples, excess finishing compound, ridges, or untrue corners.
   1. Install edge trim where edge of gypsum boards would otherwise be exposed or semi-exposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.

C. Provide control joints in gypsum board partitions, bulkheads, ceilings, and soffits according to ASTM C840 and as follows:
   1. Partition, furring abuts a structural element (except floor) or dissimilar wall or ceiling.
   2. Ceiling or soffit abuts a structural element, dissimilar wall or partition or other vertical penetration.
   3. Construction changes within plane of partition or ceiling.
   4. Partition or furring run exceeds 30 feet, unless noted otherwise.
   5. Ceiling dimensions exceed 40 feet in either direction.
   6. Wings of "L", "U", and "T"-shaped ceiling areas are joined.
   7. Expansion or control joints occur in the exterior wall.
   8. Less-than-ceiling-height frames should have control joints extending to the ceiling from both corners. Ceiling height door frames may be used as control joints. Treat window openings in same manner as doors.
   9. Control Joint: Apply over face of gypsum board where specified. Cut to length with a fine-toothed hacksaw (32 teeth per inch). Cut end joints square, butt together, and align to provide neat fit. Attach control joint to gypsum board with fasteners spaced 6 inches o.c. maximum along each flange. Remove plastic tape after finishing with joint compound or veneer finish.
      a. Leave a 1/2-inch continuous opening between gypsum boards for insertion of surface-mounted joint.
      b. Do not attach gypsum board to steel studs on one side of control joint.
      c. Provide separate supports for each control joint flange.
      d. Provide an adequate seal behind control joint where sound or fire ratings are prime considerations.

D. Aluminum Trim: Install in locations indicated on drawings.

## 3.10 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
   1. Prefill open joints and damaged surface areas.
   2. Apply joint tape over gypsum-board joints, except those with trim having flanges not intended for tape.
   3. Joint tape and setting compounds shall not reduce moisture and mold resistance of gypsum wallboard assembly.
   4. Coats of non-setting type components shall be thoroughly dry before sanding of the application of additional coats.

B. Levels of Finish: The following levels of finish are established as a guide for specific final finishes in accordance with GA-214 and ASTM C840, for locations as indicated.
   1. Level 0: No taping, finishing, or accessories required.
      a. This level of finish shall be used in temporary construction only.
   2. Level 1: Joints and interior angles shall have tape embedded in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
      a. This finish level shall be used in plenum areas above ceilings, in attics, and in areas where the assembly is concealed.
      b. Where a fire-resistance rating is required for the gypsum board assembly, details of construction shall be in accordance with reports of fire tests of assemblies that have met the fire-rating requirement. Tape and fastener heads need not be covered with joint compound.
   3. Level 2: All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
      a. This level may be used as a substrate for tile.
   4. Level 3: All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. One additional coat of joint compound shall be applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Surface shall be covered with primer prior to the application of the final decoration.
      a. This level may be used at areas to receive heavy- or medium-texture (spray or hand applied) finishes before final painting, or where a heavy-grade wall covering is to be applied as final decoration.
   5. Level 4: All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener head and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges.
      a. This level is to be used at areas to receive flat/eggshell paints, light textures, or wall coverings are to be applied.

6. Level 5: All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.
    a. This level is to be used at areas to receive semi-gloss and gloss paint and areas subject to severe lighting, where indicated.
    b. Provide level 5 finish on exposed gypsum board assemblies within the lobby area adjacent to storefront.

## 3.11 REPAIR

A. General: Finishing of gypsum wallboard assemblies often requires patches and repairs of existing walls or corrections to errors made in erecting new work.
1. Coordinate patching and repair work with work of Division 09 Section “Interior Painting” and “High Performance Painting”.
2. Repair and patch as recommended by gypsum wallboard manufacturer.
    a. Small holes use a patching or setting compound as recommended by manufacturer.
    b. For larger holes up to 12 inches reinforce patch with fiberglass tape.
    c. For even larger opening gypsum repair clips may be incorporated.
3. Where ceilings and walls are badly disfigured, a fresh surface maybe desirable. The wall can be resurfaced with a layer of 1/4 inch or 3/8 inch gypsum boards.
    a. Preparation: Remove all loose surfacing material and trim if necessary to create a smooth surface. Fill small holes with joint compound or patching compound. Patch large holes to the surrounding level with single or multiple layers of gypsum board attached to framing and shimmed out as required.
        1) Where large irregularities of surface exist, apply furring strips not over 16 inch o.c. using wood shims to shim out to a true even plane.
        2) Electrical outlet boxes for switches, wall receptacles and fixtures should be extended outward to compensate for the added gypsum board thickness.
    b. Install boards as recommended by gypsum manufacturer and as noted hereinbefore.

## 3.12 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction and other causes during remainder of the construction period.

C. Remove and replace boards that are wet, moisture-damaged, and mold-damaged.
1. Indications that boards are wet or moisture-damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that boards are mold-damaged include, but are not limited to fuzzy or splotchy surface contamination and discoloration.

## 3.13 FIELD QUALITY CONTROL

A. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

B. Above Ceiling Observation: Before Contractor installs gypsum board ceilings, A/E will conduct an above ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify A/E 7 days in advance of date and time when project, or part of project, will be ready for above-ceiling observation.
2. Before notifying A/E, complete the following in areas to receive gypsum board ceilings:
   a. Installation of 80 percent of lighting fixtures, powered for operation.
   b. Installation, insulation, and leak and pressure testing of water piping systems.
   c. Installation of air duct systems.
   d. Installation of ceiling support framing.

END OF SECTION 09 21 16.00

# SECTION 09 24 23.13 - THIN COAT STUCCO SYSTEM

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Thin coat stucco system, including flashings and accessories.

B. Related Sections
   1. Division 05 Section “Cold-Formed Metal Framing”.
   2. Division 07 Section “Flashing and Sheet Metal”.
   3. Division 07 Section “Joint Sealants”.

### 1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.3 COORDINATION/SCHEDULING

A. Provide minimum 28 day cure of concrete masonry units before the installation of stucco.

B. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall and provide sill flashing. Coordinate installation of moisture barrier with window and door installation to provide weather proofing of the structure and to prevent moisture infiltration and excess air infiltration.

C. Install window and door head flashing immediately after windows and doors are installed.

D. Install diverter flashings wherever water can enter the wall assembly to direct water to the exterior.

E. Install copings and sealant immediately after installation of the stucco and when finish coatings are dry.

F. Attach penetrations through stucco to structural support and provide water tight seal at penetrations.

### 1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications, installation instructions, and warranty for each material and include other data as may be required to show compliance with these Specifications.

B. Samples for Verification: At least 12 inches square of each type of finish indicated, in sets for each color, texture, and pattern specified, showing full range of variations expected in these characteristics.

### 1.5 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: For stucco to include in maintenance manuals.
   2. Warranties: Special warranties specified in this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufactured materials in the original sealed packages, containers, or bundles and bearing the name of the manufacturer and the brand. Except as otherwise specified herein, the mixing, installation, and application of manufactured material shall be in strict accordance with the printed directions of the manufacturer.

B. Protect materials against dampness until used. Store materials off the ground, under cover, and away from sweating walls and other damp surfaces. Protect metal accessories in a manner to prevent rusting. Do not install rusted metal accessories in the Work.

1.7 FIELD CONDITIONS

A. Install product when wall will not be subject to damaging effect of rain, cold, or windblown dust and debris before stucco has cured.
   1. Comply with ASTM C 926 requirements.

B. Protection
   1. Protect fresh material from freezing, direct rain, wind, dust, or other physical harm or contamination.
   2. Protect adjacent areas and surfaces from spillage and splattering of material during application.

C. Stucco
   1. Temperature Requirements: Do not apply plaster when ambient air or substrate temperature is less than 40 degrees F. or more than 100 degrees F.
      a. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.
   2. Warm Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural or artificial. Apply and cure plaster as required by climatic and job conditions to prevent rapid dryout. Provide suitable coverings, moist curing, or barriers to deflect sunlight and wind, or combinations of these, as required.
   3. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of stucco system materials that fail within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.

B. Special Project Warranty: Submit Installer's warranty covering work of this Section, including all components of stucco system against defects in workmanship for the following warranty period:
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Diamondwall; Omega Products International
   2. Fastwall; El Rey Stucco Company
   3. STO-Stucco System, #OCS 501
   4. Thoro Stucco; ChemRex, Inc.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Water-/Weather-Resistive-Barrier Coating: With physical properties that comply with the following when tested on substrate per methods referenced:
   1. Tensile Adhesion: No failure in bond when 5 samples of water-/weather-resistive coating are applied to substrate and tested at a minimum 15 psi flatwise tensile strength per ASTM C 297.
   2. Water Penetration: 3 samples each sized not less than 4 by 8 feet; consisting of coating applied to substrate including a minimum of 2 vertical joints and 1 horizontal joint within sheathing substrate, each joint not less than 0.125 inch wide; and tested sequentially as follows:
      a. Passing 10 cycles at 80 percent positive design load (design load is defined as ultimate load with a safety factor of 3.0 imposed) as the maximum test load when tested in accordance with ASTM E 1233, Procedure A.
      b. No water penetration on the plane of the exterior-facing side of substrate after 75 minutes at 6.24 lbf/sq.ft. of air-pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per ASTM E 331.
   3. Water Resistance: 3 samples, each sized not less than 4 by 6 inches and consisting of coating applied to substrate, showing no crackling, checking, crazing, erosion, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.
   4. Water Vapor Transmission: Three samples prepared by applying the coating, at recommended thickness, to a nonadhesive surface and removing cured coating film. Average thickness is determined from material density, area, and weight and samples are tested per ASTM E 96 after conditioning at 75 plus or minus 5 degrees F and 50 percent relative humidity for 40 hours before testing.

2.3 WEATHER RESISTIVE BARRIER

A. Gypsum Sheathing Substrate: Provide one of the following:
   1. Building Wrap: Air retarder complying with ASTM E1677; made from polyolefins; either cross laminated films, woven strands, or spunbonded fibers; coated or uncoated; with or without perforations to transmit water vapor but not liquid water; and as follows:
      a. Air Penetration: TAPPI T-460>1500.
      b. Minimum Water Vapor Transmission: 20 perms when tested according to ASTM E96, Method B.
      c. Water Penetration Resistance: AATCC-127 not less than 250.
      d. Maximum Flame Spread: 25 per ASTM E84.
      e. Minimum Allowable Exposure Time: 3 months.
      f. Building Wrap Tape: Pressure sensitive plastic tape recommended by building wrap manufacturer for sealing joints and penetrations in building wrap.
   2. Water-/Weather-Resistive-Barrier Coating: Manufacturer's standard formulation and accessories designed for indicated use, compatible with substrate, and complying with performance requirements indicated.

2.4 SHEATHING

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Sheathing:
1. Exterior Cement Board: Not less than 7/16 inch, fiber cement board complying with ASTM C1186, Type A, for exterior applications.
a. Fasteners: Wafer head or hard-roc steel drill screws complying with ASTM C954, with an organic polymer coating or other corrosion protective coating having a salt-spray resistance of more than 500 hours per ASTM B117.
1) Size and Length: As recommended by sheathing manufacturer for type and thickness of sheathing board to be attached.

2.5 LATH

A. Expanded Metal Lath: Comply with ASTM C 847 for material, type, configuration, and other characteristics indicated below.
1. Material: Fabricate expanded metal lath from sheet metal conforming to the following:
a. Galvanized Steel: Structural quality, zinc coated (galvanized) steel sheet complying with ASTM A 653, G60 minimum coating designation, unless otherwise indicated.
2. Diamond Mesh Lath: Comply with the following requirements:
a. Configuration: Self furring.
1) Weight: 3.4 pound/sq.yd.
3. Rib Lath: Comply with the following requirements:
a. Configuration: Flat, rib depth of not over 1/8 inch.
1) Weight: 3.4 pound/sq.yd.

2.6 ACCESSORIES

A. General: Comply with material provisions of ASTM C 1063 and the requirements indicated below; coordinate depth of accessories with thicknesses and number of plaster coats required.
1. Galvanized Steel Components: Fabricated from zinc coated (galvanized) steel sheet complying with ASTM A 653, G60 minimum coating designation.

B. Corner Beads: Small nose corner beads fabricated from the following metal, with expanded flanges of large mesh diamond metal lath allowing full plaster encasement.
1. Galvanized Steel: Minimum 0.0172 inch thick.

C. Casing Beads: Square edged style, with expanded flanges of the following material:
1. Galvanized Steel: Minimum 0.0172 inch thick.

D. Control Joints and Expansion: Prefabricated, of material and type indicated below:
1. Galvanized Steel: Minimum 0.0172 inch thick.
2. One Piece Type: Folded pair of nonperforated screeds in M-shaped configuration, with expanded flanges.

E. Venting Screen: Fabricated from perforated stainless steel formed to attach to the metal framing and sheathing. Match existing component.

2.7 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting stucco set or of damaging stucco, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.

C. Bonding Compound: ASTM C 932.

D. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.

2.8 BASE COAT

A. Manufacturer's standard, fiber reinforced, Portland cement based base coat.
   1. Manufacturers approved liquid acrylic admixture is acceptable.

2.9 FINISH COAT

A. Manufacturer's standard elastomeric finish coat.
   1. Texture: Match existing**.**
   2. Color: Match existing.

2.10 STUCCO MIXES

A. General: Comply with ASTM C 926 for applications indicated.
   1. Fiber Content: Add fiber to base coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb. of fiber/cu.ft. of cementitious materials. Reduce aggregate quantities accordingly to maintain workability.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before stucco is applied, the surfaces shall be carefully examined. The Architect shall be notified of unsatisfactory surfaces or conditions. Application of stucco shall not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare and clean substrates as required to comply with manufacturer's requirements.
   1. Protect adjacent work from soiling, splattering, moisture deterioration, and other harmful effects caused by plastering.

B. Weather Resistive Barrier: Install over substrates for secondary projection from air/vapor penetration. Seal at openings, penetrations, and terminations.

3.3 INSTALLATION OF LATH, GENERAL

A. Standards: Comply with ML/SFA 920, "Guide Specifications for Metal Lathing and Furring", and with requirements of ASTM C 1063.
   1. Wall Framing and Vertical Furring: Install flat diamond-mesh, flat rib or woven-wire lath.
   2. On Solid Surfaces, Not Otherwise Furred: Install self-furring diamond-mesh or woven-wire lath.

B. Install supplementary framing, blocking, and bracing at terminations in work and for support of fixtures, and similar work to comply with details indicated or, if not otherwise indicated, to comply with applicable written instructions of lath manufacturer.

C. Install additional framing, furring, runners, lath, and beads, as required to form openings and frames for other work as indicated. Coordinate support system for proper support of framed work that is not indicated to be supported independently of metal furring and lathing system.

3.4 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Reinforcement for Exterior Corners: Install cornerbead.

C. Control Joints: Install control joints as indicated on Drawings, but no less than the following:
   1. As required to delineate stucco into areas (panels) of the following maximum sizes:
      a. Vertical Surfaces: 144 sq.ft.
      b. Horizontal and other Nonvertical Surfaces: 100 sq.ft.
   2. At distances between control joints of not greater than 18 feet o.c.
   3. As required to delineate stucco work into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
   4. Where control joints occur in surface of construction directly behind stucco.
   5. Where stucco areas change dimensions to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.5 INSTALLATION OF THIN COAT STUCCO

A. Under no circumstances shall any of the ready mixed products be altered by adding any additives, except for small amounts of clean water as directed on label. Antifreeze, accelerators, rapid binders, etc., are not allowed.

B. The surface to receive the stucco system shall be structurally sound, clean, dry and free of warpage, residual moisture or damage from moisture. Surfaces shall be inspected for compliance with the following requirements prior to installation of the stucco system components:

C. After satisfactory inspection of surfaces and correction of any deviations from specification requirements, the stucco installation may begin.

D. Where wire lath is used it shall be attached through sheathing to structural framing or to the structural concrete or masonry substrate with appropriate fasteners. Seams shall be overlapped a minimum of 2 inches. Typically, fasteners are spaced 6 to 8 inches on center vertically and 16 inches on center horizontally (except where stud spacing is 24 inches on center). The type fastener selected, its layout and pullout or withdrawal values from the substrate must be verified and approved by the Architect/Engineer with respect to design wind load and local code requirements.

E. All areas where the stucco system meets dissimilar materials or terminates shall have appropriate accessories and sealant installed. Expansion joints are required every 144 sq.ft. maximum, at dissimilar construction, and at floor lines on multilevel construction. Length to width ratio of expansion joint layout shall not exceed 2:1. Supplementary control joints are required at penetrations through the system, for example, above and below doors or windows. Accessories shall be fastened securely to the structural substrate or wire tied to lath in accordance with locations indicated on Architectural Drawings and the requirements of this specification. Accessory manufacturer's sealant instructions shall be followed for accessory butt joints to maintain watertightness.

F. Apply stucco with proper spray equipment or a stainless steel trowel to a minimum thickness of 3/8 inch. Apply second coat, if necessary, to match the height of the trim accessories as soon as the first coat is firm enough to receive the second coat without physical damage. Alternatively, if allowed by the Manufacturer, damp cure the first coat for 48 hours, then apply the second coat. Level the stucco surface with a darby or stainless steel trowel to achieve a smooth, plumb surface. Damp cure by lightly fogging the installed area for at least 48 hours after the stucco takes initial set (usually within the first 1 to 4 hours after installation). Do not install stucco during extremely hot, dry or windy conditions. Do not install stucco onto hot accessories. Allow final stucco application to completely dry before applying primer and/or finish.
   1. The use of liquid acrylic admixture in basecoat may allow a shorter cure period. Follow manufacturer’s instructions.

G. If a primer is used, apply with brush, roller or proper spray equipment over clean, dry stucco and allow to dry thoroughly before applying finish.

H. Apply finish directly over the stucco (or primed stucco) only after the stucco/primer has thoroughly dried. The finish shall be applied by spraying, rolling or troweling with a stainless steel trowel, depending on finish specified. General rules for application of finishes are as follows:

1. Use a clean, rust free, high speed mixer to thoroughly stir the finish to a uniform consistency.
2. Avoid application in direct sunlight.
3. Apply finish in a continuous application, always working to a wet edge.
4. Weather conditions affect application and drying time. Hot or dry conditions limit working and accelerate drying and may require adjustments in the scheduling of work to achieve desired results; cool or damp conditions extend working time and retard drying and may require added measures of protection against wind, dust, dirt, rain, and freezing.
5. Avoid installing finish on accessories.
6. Textured finishes must be floated with a plastic trowel to achieve their rilled texture.
7. Avoid installing separate batches of finish side by side.

3.6 PLASTER REPAIRS

A. Cut, patch, replace, and repair stucco as necessary to accommodate other work and to restore cracks, dents, and imperfections. Repair or replace work to eliminate blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.7 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove stucco from doorframes, windows, and other surfaces not indicated to be stuccoed. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during stuccoing.

END OF SECTION 09 24 23.13

**SECTION 09 30 00 - TILING**

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes following:
   1. Ceramic mosaic tile.
   2. Porcelain wall tile.
   3. Metal edge strips installed as part of tile installations.

B. Related Sections include following:
   1. Division 03 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates, admixtures, and topping that may affect performance of installed tile.
   2. Division 04 Section “Concrete Unit Masonry for masonry wall substrates.
   3. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.2 DEFINITIONS

A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in “American National Standard Specifications for Installation of Ceramic Tile.”

C. ISO 13007 Standards for ceramic tiles, grouts and adhesives.

D. Module Size: Actual tile size plus joint width indicated.

E. Face Size: Actual tile size, excluding spacer lugs.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Conference: Conduct conference at Project site. A/E will schedule and conduct meeting.
   1. Review mockup.
   2. Review requirements in ANSI 108.01 for substrates and for preparation by other trades.
   3. Flooring product manufacturer will have a technical installation representative available at job site at inception of installation to insure there are no conditions which will compromise installation of material and that material is being installed according to industry standards, practices and manufacturers guidelines. Manufacturer’s technical representative will document and confirm that substrate, material, and installation are in compliance with manufacturer’s guidelines and accepted industry standards and practices.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Qualification Data: For Installer.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.

1.5 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: Include cleaning methods, cleaning solutions recommended, stain removal methods, and polishes and waxes recommended.
   2. Receipt for verification of extra stock.

1.6 MAINTENANCE MATERIALS

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 1 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.7 QUALITY ASSURANCE

A. Installers Qualifications: Work done under this Section of Specifications shall be performed by mechanics skilled and experienced in class of work involved. Workmanship shall be in accordance with best trade practices, and surface shall be true to line and free from waves and other imperfections. Joints between tiles shall be maintained uniform and even and properly grouted.
   1. Installers shall be experienced in ANSI A108 standards and Tile Council of North America (TCNA) recommendations. A copy of these standards shall be present at jobsite.
   2. Install shall meet one or more of following qualifications:
      a. Installer is a five-star member of National Tile Contractors Association or a Travel of Excellence member of Tile Contractors' Association of America.
      b. Installer's supervisor for Project holds International Masonry Institute's Foreman Certification.
      c. Installer employs Ceramic Tile Education Foundation Certified Installers.
      d. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of large format tile.

B. Regulatory Requirements:
   1. TCNA Handbook for Ceramic Tile Installation by Tile Council or North America, latest edition.
   2. American National Standard Specifications for Installation of Ceramic Tile.

C. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
   1. Build mockup of restroom wall tile installation.
   2. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.
      a. Do not proceed with remaining work until workmanship, color, and sheen are approved by A/E. Obtain A/E's acceptance of mockups before start at final unit of work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at levels indicated in referenced standards and manufacturer's written instructions.

B. Protection: Protect adjacent work surfaces during tile work. Close rooms or spaces to traffic, of all types, until mortar and grout have set.

C. Safety: Observe manufacturer’s safety instructions including those pertaining to ventilation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
   3. Basis-of-Design Product: Design for each tile type is based on product named. Subject to compliance with requirements, provide either named product or a comparable product by one of other manufacturers specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. Requests for Architect/Engineer’s approval must be accompanied by “Substitution Request Form” and complete technical data for evaluation. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
   1. Where products are indicated on List of Finishes with color selected, provide sample or color chart to verify color match with substitution request.

C. Source Limitation for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
   1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregates, from single manufacturer.
   2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1/.2, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
   2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with following requirements:
   1. Refer to “List of Finishes”.

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
   1. Where tile is indicated for installation in swimming pools, on exteriors, or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

A. Unglazed Ceramic Mosaic Tile (CMT): Factory-mounted flat tile as follows:
   1. Composition: Vitreous or impervious natural clay or porcelain.
   2. Surface: Smooth, without abrasive admixture, unless otherwise noted
   3. Module Size: As indicated.
   4. Nominal Thickness: 1/4 inch.
   5. Face: Plain with cushion edges, unless otherwise noted.
   6. Dynamic Coefficient of Friction: Not less than 0.42.
   7. Basis-of-Design Product/Color: Refer to “List of Finishes.”

B. Porcelain Tile, Wall (PWT): Flat tile as follows:
   1. Composition: Impervious natural clay or porcelain.
   2. Facial Dimensions: As indicated.
   3. Face Size Variation: Rectified.
   4. Thickness: As indicated**.**
   5. Face: Plain with cushion edges, unless otherwise noted.
   6. Dynamic Coefficient of Friction: Not less than 0.42.
   7. For latex-portland cement-mortared and -grouted paver tile, precoat with temporary protective coating.
   8. Basis-of-Design Product: Refer to “List of Finishes”

C. Glazed Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
   1. Base for Thin-Set Mortar Installations: Straight.
   2. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose.
   3. External Corners for Thin-Set Mortar Installations: Surface bullnose.
   4. Internal Corners: Field-butted square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.

D. Ceramic Mosaic Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
   1. Base Cove: Cove.
   2. Base Cap for Thin-Set Mortar Installations: Surface bullnose,
   3. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose.
   4. External Corners for Thin-Set Mortar Installations: Surface bullnose.
   5. Internal Corners: Cove.
   6. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

2.4 SETTING AND GROUTING MATERIALS

A. Products: Subject to compliance with requirements, provide one of following:
   1. Standard Dry Set Mortars: ANSI A118.1
      a. Bostik; Tile-Mate Floor & Wall (712/762)
      b. C-Cure; 911 Thinset
      c. Laticrete; Laticrete 272
      d. Mapei; Kerabond
      e. HB Fuller; TEC TA Full Set Plus
      f. Custom Building Products; CustomBlend – Standard Thin-Set
      g. DAP; Durabond Thin-Set Mortar
      h. Southern Grouts & Mortars; Thin Set Mortar 726/727
      i. Summitville Tiles; Thin Set Mortar
   2. Nonsagging Dry-Set Mortars: ANSI A118.4
      a. ARDEX Engineered Cements; X77 Microtec Fiber Reinforced Mortar
      b. C-Cure; Perma Bond Non-Sag 903
      c. Custom Building Products, ProLite Tile and Stone Mortar
      d. MAPEI; Keraflex Plus
      e. HB Fuller; TEC Ultimate 6 Plus
      f. Modified Dry-Set Mortar (Thinset): ANSI A118.4 (Large and Heavy Tile Mortar)
      g. ARDEX Engineered Cements; X77 Microtec Fiber Reinforced or X32 Microtec Rapid Setting Thin-to-Thick Bed Mortar
      h. Bostik; Hydroment
      i. C-Cure; 911 Thinset/939 Cure Crylic Premium
      j. Laticrete; Laticrete 272 Premium/3701/333
      k. MAPEI; Keraflex Plus
      l. HB Fuller; TEC Ultimate 6 Plus
      m. Custom Building Products; Complete Contact Fortified Thin-Set
      n. Boiardi Products; Elastiment/102/753
      o. DAP; Durabond/DBL16/DBL36
      p. Southern Grouts and Mortars; Thinset Mortar 726/727/Southcrete 25/28
      q. Summitville Tiles; SB777 Thin Set Mortar/SB800/SB810
   3. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15
      a. HB Fuller; TEC Super Flex or 3N1 Large and Heavy Tile Mortar
      b. Bonsal American, an Oldcastle Co.; PermaFlex 600
      c. Custom Building Products; Flexbond-LFT Premium Crack Prevention Large Format Tile Mortar
      d. LATICRETE SUPERCAP, LLC; 4-XLT
      e. MAPEI Corporation; Keraflex Plus
   4. Polymer-Modified, Unsanded Tile Grout: ANSI A118.7
      a. ARDEX Engineered Cements; FG-C Microtec Unsanded Floor and Wall Grout
      b. Bostik; Hydroment (Unsanded)/425
      c. C-Cure; Supreme 925/MP 923/CureCylic 938/Color Cure 945
      d. DAP; Durabond C150/Durabond DBL26
      e. Laticrete; 600 Series/LATICRETE 1776
      f. MAPEI; Keracolor U
      g. Southern Grouts & Mortars; Dry-Set Grout Unsanded Polymer Modified Tile Grout/Southcrete 20 Acrylic Admix
      h. Summitville Tiles; SB687/SB775

i. HB Fuller; TEC Unsanded AccuColor/TA Acrylic Grout Additive
j. Custom Building Products: Polyblend Non-Sanded Tile Grout

5. Polymer-Modified, Sanded Tile Grouts: ANSI A118.7
   a. Bostik; Vivid
   b. C-Cure
      1) AR Sanded Grout 922/MP Sanded 924
      2) CureCrylic 938
   c. Laticrete: Permacolor Select
   d. MAPEI, Keracolor S
   e. HB Fuller:
      1) Power Grout
      2) AccuColor Plus
   f. Custom Building Products: Polyblend Plus Sanded Grout
   g. DAP; Durabond ARB20/Durabond DBL26
   h. Southern Grouts & Mortars; Saltillo Grout Mix/Southcrete 20 Acrylic Admix
   i. Summitville Tiles; SB700/SB775 or SB776
   j. ARDEX Americas: FL Rapid Set, Flexible, Sanded Grout

B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
   1. For wall applications, provide nonsagging mortar that complies with Paragraph C-4.6.1 in addition to other requirements in ANSI A118.1.

C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of following:
   1. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.

D. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.
   1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added to Project site.
   2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.15.

E. Organic Adhesive: Not acceptable.

F. Polymer-Modified, High-Performance, Tile Grout: ANSI A118.7, color as indicated.
   1. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
      a. Unsanded grout mixture for joints 1/8 inch and narrower.
      b. Sanded grout mixture for joints 1/8 inch and wider.

## 2.5 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 07 Section "Joint Sealants."
   1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
   1. Products:
      a. Dow Corning Corporation; Dow Corning 786.
      b. GE Silicones; Sanitary 1700.
      c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
      d. Tremco, Inc.; Tremsil 600 White.

e. Laticrete International, Inc., Latasil Tile and Stone Sealant.
f. MAPEI, Mapesil
g. ARDEX Engineered Cements; SX 100% Silicone Sealant.
h. Custom Building Products: Commercial 100% Silicone Caulk.
i. HB Fuller; TEC AccuColor TA 155 100% Silicone Sealant.

D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
1. Products:
a. Bostik; Chem-Calk 550.
b. Degussa Building Systems; Sonneborn Sonolastic SL-2.
c. Pecora Corporation; NR-200 Urexpan/Dynatrol II-SG.
d. Tremco, Inc.; THC-900/THC-901.
e. Sika Corporation; Sikaflex – 2cSL.
f. Mapei; Planipatch.

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, white zinc alloy or stainless steel; ASTM A 666, 300 Series exposed-edge material.
1. Manufacturers: Subject to compliance with requirements, provide products by one of following:
a. Blanke Corporation
b. Ceramic Tool Company, Inc.
c. Schluter Systems L.P.
d. Custom Building Products: PROFLOOR Series.
2. Where indicated, provide other metal shaped profile at floor and wall transitions, corners and tile terminations.

C. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Grout Sealer: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.
1. Products:
a. Bonsal, American, an Oldcastle company.
b. Bostik; CeramaSeal Grout Sealer.
c. C-Cure; Penetrating Sealer 978.
d. Custom Building Products; Grout Sealer/Surfaceguard Sealer/Aqua Mix Grout Sealer.
e. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
f. HB Fuller; TEC Grout Guard Penetrating Grout Sealer.
g. Summitville Tiles, Inc.; SL-15; Invisible Seal.

2.7 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

2.8 SOURCE QUALITY CONTROL

A. Manufacturer Services: Manufacturer assures product submitted is appropriate for application and environment in which it is to be installed and that product is merchantable for service, free of visible and latent defects and will perform for purpose for which it is intended without compromise.

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 installed tile.
   1. Verify substrate mix design for additives i.e. hardeners, moisture vapor reduction admixture, and other ingredients that might affect performance of installed tile.
   2. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films or silicones, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
   3. Verify that concrete surfaces for tile floors installed with bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.1 for installations indicated.
      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
      b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
   4. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
   5. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials, using mechanical methods recommended by manufacturer. Do not use solvents.

B. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
   1. For tiles with all edges shorter than 15 inches, maximum allowable variation in tile substrate is 1/4 inch in 10 feet from required plane, with no more than 1/15 inch variation in 1 foot when measured from high points of surface.
   2. For tiles with at least one edge 15 inches in length or longer, maximum allowable variation in tile substrate is 1/8 inch in 10 feet from required plane, with no more than 1/16 inch variation in 2 feet when measured from high points of surface.

3. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
4. Remove protrusions, bumps, and ridges by sanding or grinding.
5. All concrete substrates at least 28 days old, completely cured and free of hydrostatic conditions.

C. 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.

D. Wall and Ceiling Preparation: Comply with ANSI A108.01, Section 2.5.
1. Gypsum board shall be installed per guidelines of ANSI A108.01, Section 3.5.

E. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, 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.

F. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules, and apply to types of setting and grouting materials used.

B. TCNA Installation Guidelines: TCNA's "Handbook for Ceramic Tile Installation." Comply with TCNA installation methods indicated in ceramic tile installation schedules.
1. Lay out tilework so as to minimize cuts less than one-half tile in size. Do not interrupt pattern through openings, unless otherwise noted. No staggered joints will be permitted.
2. Locate cuts in both walls and floors so as to be least conspicuous.
3. Align floor joints to give straight uniform grout lines parallel with walls. Align joints between floor and base tile. Align joints in both directions. Create transitions to other material or colors under door, unless otherwise noted.

C. 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.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
1. Form internal angles square and external angles bullnosed, unless otherwise noted.

E. Provide manufacturer’s standard trim shapes where necessary to eliminate tile edges, unless otherwise noted.

F. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

G. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where tiles are specified or indicated to be whole integer multiple of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
3. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.

H. Lay out tile wainscots to next full tile beyond dimensions indicated.

I. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
3. Control joints and other sealant usage
    a. Install control joints where tile abuts retaining surfaces such as perimeter walls, curbs, columns, wall corners, and directly over cold joints and control joints in structural surfaces conforming to architectural details.
    b. Install control joint in floors at spacings as indicated in TCNA Installation Handbook, unless noted otherwise.
    c. Rake or cut control joints through setting bed to supporting slab or structure. Keep joints free of mortar.
    d. Install in accordance with TCNA Installation Handbook.
    e. Fill joints with self leveling polyurethane sealant and backing material specified in Division 07 Section “Joint Sealants”.
    f. Fill joints around toilet fixtures with white silicone sanitary sealant. Refer to Division 07 Section “Joint Sealants”.
4. Expansion Joints
    a. Keep expansion joints free of mortar and grout.
    b. Use manufacturer’s expansion joint flashing when covering expansion joints with waterproofing or crack-suppression membranes.
    c. Provide expansion joints directly over changes in material, over control and expansion joints in substrate, at juncture of floors and walls, at other restraining surfaces such as curbs, columns, bases, and wall corners, and where recommended by TCNA EJ171 Expansion Joint requirements.
    d. Install sealant in expansion joints.
    e. Provide sealant material at items penetrating tile work, unless otherwise indicated.
    f. Provide sealants and related materials in accordance with cited ANSI and TCNA requirements.

J. Grout tile to comply with requirements of following tile installation standards:
1. For ceramic tile grouts (polymer-modified tile grouts), comply with ANSI A108.10.

## 3.4 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in Floor Tile Installation Schedule, including those referencing TCNA installation methods and ANSI A108 Series of tile installation standards.
1. Thin set method, floors and walls, general
    a. Apply mortar with notched trowel using scraping motion to work material into good contact with surface to be covered. Maintain 90 percent coverage on back of tile and fully bed all corners, unless otherwise noted.
        1) For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
            a) Tile floors in wet areas, i.e., showers, drying areas.
            b) Tile floors consisting of tiles 8 by 8 inches or larger.
            c) Tile floors composed of rib-backed tiles.
    b. Apply only as much mortar as can be covered within allowable windows as recommended by mortar manufacturer or while surface is still tacky.

c. When installing large tiles, ceramics or mosaics, trowel small quantity of mortar onto back of each tile or sheet of tiles.
d. Set tiles in place and rub or beat with small beating block.
e. Beat or rap tile to ensure proper bond and also to level surface of tile.
f. Align tile to show uniform joints and allow to set until firm.
g. Clean excess mortar from surface of tile with wet cheese cloth (not a sponge) while mortar is fresh.
h. Allow face mounted tile to set until firm before removing paper and before grouting.
i. Sound tile after setting. Replace hollow sounding tiles.

B. Joint Widths: Install tile on floors with following joint widths:
1. Ceramic Mosaic Tile: 1/16 inch.

C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
1. Locate transition under doors, unless otherwise noted.

D. Floor/Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.5 WALL (BASE) TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in Wall Tile Installation Schedule, including those referencing TCNA installation methods and ANSI setting-bed standards.
1. Bonding large format tile for coverage and support
a. Following installation techniques are required to ensure 95 percent coverage of bonding surface of larger tiles and provide full support of edges and corners, in accordance with procedures in ANSI A108 Series tile installation standards. Large tiles are generally considered to be 8 by 8 inch and greater.
1) Select a notched trowel sized to facilitate proper coverage.
2) Key mortar into substrate with flat side of trowel.
3) Comb with notched side of trowel in one direction.
4) Firmly press tiles into mortar and move them perpendicularly across ridges, forward and back approximately 1/8 to 1/4 inch to flatten ridges and fill valleys.
5) This method can produce maximum coverage, with corners and edges fully supported, without backbuttering or beat in.
6) Periodically remove and check a tile to assure proper coverage is being attained.
7) Sound tile after setting. Replace hollow sounding tile.
2. Re-install salvaged tile base where indicated.

B. Joint Widths: Install tile on walls with following joint widths:
1. Ceramic Mosaic Tile: 1/16 inch.
2. Porcelain Wall Tile: 1/8 inch.

3.6 ADJUSTING/CLEANING AND PROTECTING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove latex-portland cement grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

C. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

D. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

E. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.7 INTERIOR, FLOOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor
1. Tile Installation (FTI-C): Interior floor installation on concrete; thin-set mortar; TCNA F113 and ANSI A108.5.
a. Tile Type: Unglazed ceramic mosaic tile.
b. Thin-Set Mortar: Improved modified dry-set mortar as recommended by manufacturer for application indicated.
c. Grout: Polymer-modified, high-performance sanded grout.

3.8 INTERIOR, WALL (BASE) TILE INSTALLATION SCHEDULE

A. Interior Wall Installations, Masonry or Concrete
1. Tile Installation (WTI-A): Interior wall installation over sound, dimensionally stable masonry or concrete; thin-set mortar; TCNA W202I and ANSI A108.5.
a. Tile Type: Unglazed ceramic mosaic, Porcelain wall tile.
b. Thin-Set Mortar: Improved modified dry-set mortar as recommended by manufacturer for application indicated.
c. Grout: Polymer-modified, high-performance, unsanded grout.

END OF SECTION 09 30 00

# SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings and acoustical ceiling clouds.

### 1.2 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

### 1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Preinstallation Conference: Conduct conference at Project site.
   1. Agenda shall include project conditions, coordination with work of other trades, layout of items which penetrate ceilings.

C. Sequencing
   1. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generated activities and wet work have terminated, and overhead work is completed, tested, and approved.
   2. Install acoustic units after interior wet work is dry.
   3. Ensure that products of this Section are supplied to affected trades in time to prevent interruption of construction progress.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including:
   1. Preparation instructions and recommendations.
   2. Dimensions, load carrying capacity, and performance standards compliance.
   3. Storage and handling requirements and recommendations.
   4. Installation and maintenance instructions.

B. Tile Samples: Do not submit.

### 1.5 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: For finishes to include in maintenance manuals.
   2. Receipt of extra materials.

1.6 EXTRA (MAINTENANCE) MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
   2. Hold-Down Clips: Equal to 2 percent of quantity installed.

B. Replacement Stock: In addition to the maintenance stock specified above, provide extra replacement stock of acoustical materials, consisting of a minimum of one percent of area of each size, type, and thickness installed on the job. This extra stock is for replacement of damaged materials during the 60-day period following Substantial Completion, when the Owner's agent cannot ascertain the party responsible for the damage. Replacement stock that is not used shall be furnished to the Owner as extra materials.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain acoustical panel ceiling and suspension system from one source from a single manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: Refer to “List of Finishes” on drawings.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   1. Acoustical Tile Products
      a. Armstrong World Industries
      b. USG Interior Systems
      c. CertainTeed Ceilings
   2. Suspension System Products
      a. Armstrong World Industries
      b. USG Interior Systems
      c. CertainTeed Ceilings
   3. Trim and Accessories
      a. Armstrong World Industries
      b. USG Interior Systems
      c. Gordon, Inc.

d. Fry Reglet Corporation
e. MM Systems, Inc.

C. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Panels shall meet the following minimum performance criteria:
1. ASTM E1264, Class A materials.
2. Moisture Resistant: No visible sag at of 90-percent relative humidity and 104 degrees F.

B. Kitchens and associated rooms (storage, locker, and toilet) excluding classrooms and halls require aluminum, aluminum faced galvanized steel or stainless steel grid and lay-in panels with smooth, unperforated vinyl, polyester film (Mylar), or similar surface.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
a. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance’s, unless otherwise indicated.
1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by A/E from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

C. Panel Characteristics: Comply with requirements indicated on “List of Finishes”.

D. Humidity Resistance: Where indicated in “Acoustical Panel Ceiling Product Schedule,” panels shall be dimensionally stable at up to 100 percent relative humidity at temperatures ranging from 32 to 104 deg F. without having to acclimatize tiles.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. 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 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
      a. Type: Cast-in-place, postinstalled expansion, or postinstalled bonded anchors.
      b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition, unless otherwise noted.
   2. Power-Actuated Fasteners in Concrete: Not allowed.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper, unless otherwise noted.
   2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch diameter wire.
   3. At clouds provide the following installation hardware items to conceal/minimize hangers (installation kit):
      a. Strong Backs: Hot dipped galvanized cold rolled steel, caring channel, cut length to accommodate installation of cable 24 inches from edge of cloud.
      b. Cable Hardware: 2-1/16 inches by 1 inch by 3/8 inch quick loop where clamp for 1/16 inch diameter cable.
         1) Hardware shall be capable of supporting 200 lbs.
      c. Cable: 7 by 7 aircraft cable, 1/16 inch by 120 inch galvanized with loop at one end.

E. Hanger Rods or Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch thick, galvanized steel sheet complying with ASTM A 653, G90 coating designation; with bolted connections and 5/16-inch diameter bolts.

G. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

## 2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653, not less than G30 coating designation, with prefinished 15/16-inch wide metal caps on flanges.
   1. Structural Classification: Intermediate duty system.
   2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
   3. Face Design: Flat, flush.
   4. Cap Material: Steel or aluminum cold-rolled sheet.
   5. Cap Finish: Painted white, unless otherwise noted.
   6. Provide this suspension system unless otherwise noted.

B. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G60, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653, G60 coating designation, with prefinished, cold-rolled, 15/16-inch wide, aluminum caps on flanges.
   1. Structural Classification: Intermediate duty system.
   2. Face Design: Flat, flush.
   3. Cap Material: Aluminum.
   4. Face Finish: Painted white, unless otherwise noted.
   5. Provide this suspension system in locker rooms.

## 2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
   2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
   4. Provide radiused corner edge molding trim at bullnose block.

B. Suspension (Perimeter) Trim: 4 inch wide face, 9/16-inch horizontal legs with hems formed for attachment to the mounting clip; commercial quality cold-rolled 24-gauge steel, factory finished in based enamel paint finish, on all exposed surfaces.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
      a. Axiom Trims and Transitions; Armstrong World Industries.
      b. Compasso Standard; USG Interior Systems.
      c. Cloud Perimeter Trim; CertainTeed Ceilings.
      d. Infinity; Rockfon.
   2. Splice Plate: Steel in finish to match trim pans; formed for snap-fit into pan ends.
   3. Attachment Clips: Hot-dipped galvanized steel in finish to match pans formed for snap-fit into pan and attached to suspension system members.
   4. Corner Trim Pieces: To match trim.
   5. Trim shall be straight and/or curved as indicated.
   6. Color: Match adjacent suspension system.

## 2.7 ACOUSTICAL SEALANT

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, non-staining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
      b. Grabber Construction Products; Acoustical Sealant GSC.
      c. Pecora Corporation; AC-20 FTR or AIS-919.
      d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
      e. USG Corporation; SHEETROCK Acoustical Sealant.
      f. GE Construction Sealants; RCS20 Acoustical
      g. Henkel Corp.; OSI Pro-Series SC-175 Acoustical Sound Sealant.
      h. Serious Energy Inc.,: Quiet Seal Pro.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. General: Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the Project Conditions.

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

C. Refer to Room Finish Schedule, Legend and Reflected Ceiling Plan for spaces to receive acoustical ceiling tile. Grid shall be laid out and coordinated for lighting fixtures and mechanical system items. Furnish layouts for anchors, clips, and other ceiling anchors whose installation is specified in other Sections.

D. The installation of the ceiling shall be done prior to the installation of shelving, built-in counters, and finished floors; but after the other work in the room has been completed, including painting, unless otherwise approved by the A/E.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and design requirements indicated, 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 suspension wires 4 foot on center, maximum in both directions. For lighting fixtures install hanger wires to runners at all 4 corners of fixtures.
   2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   4. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   5. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
   6. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structures.
   7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, that extend through forms into concrete.
      a. Powder-actuated fasteners are not allowed.
   8. 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.
   9. Do not attach hangers to steel deck tabs.
   10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   11. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
   12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications and so deflection does not exceed 1/360 of the span.

C. Install clouds in accordance with the manufacturer's instructions and in compliance with authorities with jurisdiction.
   1. Review the location of the "strongback" carrying channels. Locate 2 foot from longest side of the cloud and 4 foot on center.
   2. Hanging cables shall be plumb, located along the length of the "strongback" carrying channel starting 1 foot from the end (2 foot from the edges of the cloud) and then 4 foot on centers (note that in some instances this pattern will result in two hanging cables being positioned 2 foot from one another at the center of the cloud).
      a. Install supplemental suspension members and hangers in the form of trapeze or equivalent devices as required so as not to splay hangers. Hangers shall be plumb.
      b. Cables shall be fitted with a loop at one end that is cinched to mounting hardware appropriated for the surface to which it is attached. Select hardware that will be capable of supporting a minimum of 200 lbs.
   3. Install mains and tees in accordance with manufacturer's requirements.
   4. Install trim as indicated and in accordance with manufacturer's requirements.
      a. Suspension (perimeter) trim shall be braced 24 inches on center.
   5. Provide supplemental steel framing in form of studs, channels, angles, or slotted metal channel framing in size required to span between structural main frames and purlins where structure is beyond 10 feet above cloud level and spaced wider than hanger spacing requirements.

D. Secure bracing wires, if required by authorities, with jurisdiction, to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   2. Screw attach moldings to substrate at intervals not more than 16 inches 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.

F. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

G. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
   1. Arrange directionally patterned acoustical panels as follows:
      a. As indicated on reflected ceiling plans.
   2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
   3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer, if edges are not concealed by suspension system flanges.

## 3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

# SECTION 09 64 66.00 - WOOD ATHLETIC FLOORING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes wood sports-floor assemblies.

B. Related Sections include the following:
   1. Division 03 Section “Cast-in-Place Concrete” for moisture barrier and slab requirements, including coordination with potential admixtures and toppings that may affect performance of installed flooring.
      a. Provide a concrete slab, troweled smooth and level to a tolerance of +/- 1/8 inch in a 10 foot radius.
      b. Slab depressions per flooring manufacturer’s specifications.
      c. Concrete shall be free of washed river gravel, pea gravel, flint or hardener additives.
   2. Division 07 Section “Interior Expansion Joint Cover Assemblies” for thresholds.
   3. Division 11 Section “Athletic Equipment” for inserts.

### 1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination
   1. Coordinate layout and installation of slab depressions to accommodate layout and height of wood athletic flooring assembly.
   2. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

B. Preinstallation Meeting: Conduct meeting at Project site. Come to full agreement on suitable expansion spaces at regular intervals across flooring surface. Review construction schedule, installation schedule, conditions within the building during installation and after installation. Review finish requirements based on installation and completion schedule. Attendees shall include:
   1. A/E and Construction Manager.
   2. Flooring installer
   3. Flooring system manufacturer's representative.

### 1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wood sports-floor assemblies. Include instructions for handling, storage, maintenance, and installation.

B. Shop Drawings: Show installation details including location and layout of each type of floor assembly and accessory. Include the following:
   1. Plans, sections, and attachment details.
   2. Details of concrete slab depressions.
   3. Locations of different grades of wood flooring.
   4. Expansion provisions and trim details.
   5. Layout, colors, widths, and dimensions of graphics, game lines and markers.
   6. Locations of floor inserts for athletic equipment installed through flooring assembly.
   7. Blocking (stop) requirements at telescoping bleachers, portable backstops, and other areas subject to high loads as shown on drawing, as required by flooring manufacturer.

C. Samples for Initial Selection: Manufacturer's color charts showing colors and glosses available for the following:
   1. Floor finish.
   2. Game-line and marker paint.

1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: For wood sports-floor assemblies and finish systems to include in maintenance manuals.
      a. Data shall include manufacturer's recommendations for continued maintenance requirements and precautions against cleaning materials and methods detrimental to finishes and performance.
      b. Data shall also include NFMA's "Taking Care of Your NFMA Maple Sports Floor (Wall Chart)".
   2. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Flooring product manufacturer will have a technical installation representative available at the job site at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer's technical representative will document and confirm that the substrate, material, and installation are in compliance with manufacturer's guidelines and accepted industry standards and practices.
   1. Any noticed defect with the product or installation system will require the response of the manufacturer's technical field service personnel on site to determine cause, correction or replacement.

B. Installer Qualifications: An experienced installer who has completed wood sports-floor assembly installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in installations with a record of successful in-service performance and a firm or individual that has been approved by MFMA as an accredited Installer according to the MFMA Accreditation Program.
   1. Installer responsibilities include installation and field finishing of sports-floor assembly components and accessories, and application of game lines and markers.
   2. MFMA Accredited Installer shall be on-site for duration of the wood floor installation.

C. Wood flooring shall be MFMA-RL, MFMA-FJ or MFMA-PQ Maple.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver assembly materials in unopened cartons or bundles.

B. Protect wood flooring from exposure to moisture in shipment, storage, and handling. Deliver in unopened cartons or bundles and store in a dry place with adequate air circulation. Do not deliver material to building until concrete, plaster, masonry, ceramic tile, and other wet work is complete and cured to a condition of equilibrium and temperature and humidity are maintained at or near occupancy levels. The building must be enclosed and watertight.
   1. Flooring shall be delivered to the premises a minimum of 7 days before installation commences or as required for acclimation.
   2. All flooring bundles should be broken and loosely piled to acclimate the flooring to environmental conditions in the building.
   3. Materials shall not be stored at the installation location if the moisture content of the slab vapor transmissions exceeds 4.5 pounds per 1000 square feet.

C. Store wood components in a dry, warm, well-ventilated, weathertight location and in a horizontal position.

1.7 FIELD CONDITIONS

A. Conditioning period begins not less than seven days before sports-floor assembly installation, is continuous through installation, and continues not less than seven days after sports-floor installation.
   1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants, but not less than 35 percent or more than 50 percent, in spaces to receive sports-floor assemblies during the conditioning period.
   2. Wood Conditioning: Move wood components into spaces where they will be installed, no later than beginning of the conditioning period.
      a. Do not install sports-floor assemblies until wood components adjust to relative humidity of, and are at same temperature as, spaces where they are to be installed.
      b. Open sealed packages to allow wood components to acclimatize immediately on moving wood components into spaces in which they will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Site Evaluation: Prior to installation of the wood athletic flooring the following items shall occur.
   1. All roof work should be completed, including flashing, guttering and exterior drainage.
   2. The building must be permanently enclosed and weathertight.
   3. All concrete unit masonry, brick, tile, marble and/or terrazzo work must be complete, cured and dried.
   4. Concrete flatness and moisture content must meet the requirements detailed in MFMA Position Statements “Concrete Slab Moisture Content” and “Concrete Slab Flatness”.
   5. All interior painting must be completed and dry.
   6. The permanent light, heating, electrical and ventilation systems must be operating.
   7. All overhead work must be complete, and the floor area must be free of obstructions.
   8. All backstops and sports accessory fixtures must be installed.

1.8 WARRANTY

A. Provide a written warranty executed by Manufacturer, Installer, and Contractor agreeing to repair or replace wood flooring that fails in materials or workmanship within the specified warranty period. Failures include but are not limited to:
   1. Buckling, warping, squeaking, and loosening.
   2. Excessive open joints or cracks.
   3. Deterioration of finishes beyond normal wearing.

B. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Athletic Flooring
      a. Maple, strip flooring on fixed sectional channel system (WAF)
         1) Bio Channel Star; Robbins Sport Surfaces
         2) RezilBase; Connor
         3) Aacer Channel; Aacer Flooring
         4) Channel Flex Ultra F; Action Floor Systems.
         5) CRP, Horner Flooring Co.
         6) Performance Anchor Steel Channel; Tarkett Sports

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 SYSTEM DESCRIPTION

A. Design Requirements
1. Floor surfaces shall be provided to conform to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
2. Volatile organic compound (VOC) emission standards shall not exceed either of the following
a. The National Volatile Organic Compound Emission Standards for Architectural Coatings published by the Environmental Protection Agency, September 11, 1998.
b. The current standards for architectural and industrial maintenance (AIM) coatings in the state where the Project is located.
3. Provide game lines and markers complying with requirements in the National Federation of State High School Associations’ “Court and Field Design Guide.”

B. Surface Appearance
1. Expansion spaces will not exceed 1/64 inch at time of installation and will be spread evenly across the floor with each row of flooring.
2. Expansion spacing will be installed to allow for normal expected increases in Equilibrium Wood Moisture Content.

2.3 WOOD FLOORING

A. Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.
1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.

B. Random-Length Strip Flooring: Northern hard maple (Acer saccharum), kiln dried, random length, tongue and groove, and end matched.
1. Grade: MFMA-RL Thirds and better.
2. Cut: Flat, unless otherwise noted.
a. Provide edge grade where indicated.
3. Thickness: 25/32 inch.
4. Face Width: 2-1/4 inches.
5. Backs: Channeled (kerfed) for stress relief.

2.4 SUBFLOOR SYSTEM

A. General: Subfloor shall be manufactured by and supplied by an MFMA flooring manufacturer or approved by manufacturer in writing.

B. Plywood Underlayment: APA rated, C-D Plugged, exterior glue, tongue and groove, 11/32 - 15/32 inch thick. No OSB can be substituted.
1. Manufacturer’s factory fabricated subfloor system with components sized specifically for the system shall be provided.

C. Channels: Manufacturer's standard as indicated by product designation above.
1. Channel Anchors: Manufacturer's standard but not less than modified steel drive pins recommended by anchor manufacturer to achieve minimum 900-lbf pullout strength.
2. Clips: Manufacturer's standard as indicated by product designation above.

D. Resilient Pads: With air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated above.
1. Thickness: 9/16 inch lineal strip resilient shock pad.

2.5 ACCESSORIES

A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6 mils thick.

B. Vented Resilient Wall Base (VRB): Molded, vented, rubber or vinyl cove base; 4 by 3 by 48 inches; with premolded outside corners.
   1. Color: Black, unless otherwise noted.

C. Thresholds: As specified in Division 07 Section "Interior Expansion Joint Cover Assemblies."

D. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.
   1. Flooring fasteners shall be barbed cleats or coated staples, unless otherwise specified by MFMA flooring manufacturer.
   2. Exception: Powder-activated/actuated fasteners that involve a projectile propelled by a charge of carbon-dioxide or gun powder are not allowed.

E. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by sports-floor manufacturer and coordinated with concrete schedule.

F. Adhesives: Manufacturer's standard for application indicated.
   1. Concrete Primers: Manufacturer's standard for application indicated.

2.6 FINISHES

A. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer and MFMA approved.
   1. Floor-Sealer Formulation: Pliable, penetrating type.
      a. Type: MFMA Group 1: Urethane Oil Type Sealers. Subject to requirements provide sanding sealers with a VOC content of less than 350 grams per liter.
         1) Coliseum 100 by Buckeye International Inc.
         2) EZ-ON by Ecolab Inc.
         3) WP-4.1 Fast Dry 350 Poly Sealer by Sika Corp.
         4) PoloPlaz Low VOC Sealer.
   2. Stain: Penetrating and nonfading type compatible with other finish coats.
      a. Color: As selected by Owner and A/E.
   3. Finish-Coat Formulation: Formulated for gloss finish and multi-coat application.
      a. Type: MFMA Group 3, Gymnasium Type (Surface) Finishes; urethane-oil type.
   4. Game-Line and Marker Paint/Stain: Industrial enamel compatible with finish coats and recommended in writing by manufacturers of finish coats, and paint and stain for this use.
      a. Court staining and painted graphics will be required as indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of sports-floor assemblies.
   1. Verify substrate mix design for additives, i.e. hardeners, moisture vapor reduction admixture and other ingredients that might affect performance of installed flooring.
   2. Moisture testing shall be performed at least 60 days in advance of flooring installation to allow sufficient drying time if levels are found to be excessive.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Concrete Slabs: Verify that concrete slabs comply with requirements specified in Division 03 Section "Cast-in-Place Concrete."
   1. Moisture Testing: Perform tests so that test area does not exceed 1000 sq.ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Relative Humidity Testing: Perform relative humidity test using in situ probes according to most recent ASTM F2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement, unless otherwise noted.
1) For glued down systems, concrete slab relative humidity level shall be 85 percent or lower before installation.

2. Perform additional moisture tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

B. Remove coatings including curing compounds and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone; use mechanical methods recommended by manufacturer. Do not use solvents.

C. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION, GENERAL

A. General: Comply with sports-floor assembly manufacturer's written instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.
1. If required by the following system manufacturer, install solid blocking under bleachers in the stacked position and where portable backstops or other areas subjected to high loads as shown on drawings. If required by the floor system manufacturer, install recommended blocking below bleachers in the extended position.

B. Pattern: Lay flooring parallel with long dimension of space to be floored, unless otherwise indicated.

C. Expansion Spaces: Provide 2 inch expansion voids at perimeter, at all vertical obstruction and, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.
1. Cover expansion spaces with base molding, trim, and saddles, as indicated on Drawings.
2. If gym floor is to be installed in winter installer shall take moisture content of flooring into account. Winter installations require the installer to take extra precautions to compensate for decrease in moisture content of the flooring during heating season. In the summer, the moisture in the air can cause the floor to cup. Artificial expansion gaps should be left between the boards to accommodate for swelling in the summer months due to increased humidity. Consult the USDA map of expected moisture content by region prior to installation.
3. Expansion rows will be evenly distributed with each row of flooring, with each space not exceeding 1/64 inch.

D. Install vapor retarder directly over concrete slab, lap and seal seams to provide a continuous membrane according to flooring manufacturer’s written instructions. Take care not to puncture or damage vapor retarder membrane. Lap joints minimum 6 inches.
1. Run membrane up sides of floor depression and seal at the top edge with continuous bead of high grade mildew resistant silicone sealant.

E. Installation Tolerances: 1/8 inch in 10 feet variance from level.

## 3.4 ATHLETIC FLOORING

A. Maple, Strip Flooring, on Fixed Resilient Channel System
   1. Fasten channels to concrete perpendicular to finish flooring with steel anchors driven approximately 14 inches on center along base of channels and within 3 inches of the ends.
   2. Install subfloor in accordance with wood system manufacturer's directions.
   3. Install maple flooring by mechanically fastening approximately 12 inches on center with end joints properly driven up.
   4. Provide 1-1/2 inch minimum expansion voids at perimeter and at all vertical obstructions.

## 3.5 SANDING AND FINISHING

A. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors."

B. Allow installed flooring to acclimate to ambient conditions for at least 10 days before sanding.

C. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups. Remove sanding dust by tack or vacuum.

D. Finish: Apply seal and finish coats of finish system according to finish manufacturer's written instructions. Provide not less than four coats total and not less than two finish coats.
   1. Game Lines and Markers: Apply game-line and marker paint between final seal coat and first finish coat according to paint manufacturer's written instructions.
      a. Mask flooring at game lines and markers, and apply paint to produce lines and markers with sharp edges.
      b. Where game lines cross, break minor game line at intersection; do not overlap lines.
      c. Apply game lines and markers in widths and colors according to referenced standard.
      d. Apply finish coats after game-line and marker paint/stain is fully cured.

## 3.6 WALL BASE INSTALLATION

A. Install vented cove base by anchoring to walls with base cement. Miter inside corners and use premolded outside corners.

## 3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to review maintenance manual and cleaning methods, including products recommended for continued maintenance program to maintain wood athletic flooring.
   1. Review MFMA recommendations for daily care and annual maintenance.

## 3.8 PROTECTION

A. Protect sports floors during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.
   1. Do not cover sports floors after finishing until finish reaches full cure, and not before seven days after applying last finish coat.
   2. Do not move heavy and sharp objects directly over sports floors. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over sports floors.

END OF SECTION 09 64 66

# SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Resilient base.
   2. Resilient molding accessories.

B. Related Sections:
   1. Division 09 Section "Resilient Tile Flooring" for resilient floor tile.

### 1.2 ACTION SUBMITTALS

A. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 1-1/2 inches long, of each resilient product color, texture, and pattern required.

### 1.3 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Receipt for extra materials.

### 1.4 MAINTENANCE MATERIALS

A. Leave, at Project where directed, any remaining full size pieces of each type, color, pattern, and size for Owner’s maintenance.

### 1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Include at least one inside and one outside corner.
   2. Coordinate mockups in this Section with markups specified in adjacent flooring in other Sections.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless A/E specifically approves such deviations in writing.
   4. 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. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

### 1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F, in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Maintain the ambient relative humidity between 40 percent and 60 percent during installation.

C. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 85 deg F.

D. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by a qualified testing agency by testing identical products.
   1. Critical Radiant Flux Classification (ASTM E 648 or NFPA 253): Class I (not less than 0.45 watts per $cm^2$.
   2. Smoke Generation (ASTM E 662 or NFPA 258): Maximum specific optical density of 450 or less.

B. Accessibility: Transitions and adaptors shall comply with accessibility requirements of the U.S. Architectural and Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 as required by local authorities with jurisdiction.

2.3 RESILIENT BASE (RB)

A. Resilient Base:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armstrong World Industries, Inc.
      b. Mannington Mills, Inc.
      c. Burke Mercer Flooring; Division of Burke Industries, Inc.
      d. Flexco, Inc.
      e. Johnsonite; a Tarkett company.
      f. Musson, R. C. Rubber Co.
      g. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
      h. PRF USA, Inc.
      i. Roppe Corporation, USA.
      j. VPI, LLC; Floor Products Division.
      k. Allstate Rubber Corp.

B. Resilient Base Standard: ASTM F 1861.
   1. Material Requirement: Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic).
   2. Manufacturing Method: Group I (solid, homogeneous) or Group II (layered).
   3. Style and Location: Style B, Cove: Provide unless otherwise noted or required by governing authority.

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches, unless otherwise noted.

E. Lengths: Cut lengths, 48 inches long.

F. Outside Corners: Factory preformed or factory precut. Corners must be a minimum of 4 inches in length each way.

G. Inside Corners: Factory preformed or job formed.

H. Finish: Satin.

I. Colors and Patterns: Refer to “List of Finishes”.

2.4 RESILIENT MOLDING ACCESSORY (RMA)

A. Resilient Molding Accessory:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong World Industries, Inc.
   b. Flexco, Inc.
   c. Johnsonite; a Tarkett company.
   d. R.C.A. Rubber Company (The).
   e. Roppe Corporation, USA.
   f. Burke Mercer Flooring Products; a division of Burke Industries Inc.
   g. VPI, LLC; Floor Products Division.
   h. Musson Rubber Co.

B. Description: Carpet edge for glue-down applications; Nosing for carpet; Nosing for resilient floor covering; Reducer strip for resilient floor covering; Joiner for tile and carpet; Transition strips.

C. Material: Vinyl or rubber, unless otherwise noted.
1. Where indicated, provide extruded aluminum with mill finish of width shown, of height required to protect exposed edges of floor coverings, and in maximum available lengths to minimize running joints.

D. Profile and Dimensions: As indicated.
1. General, provide where meeting unfinished floor or flooring of different material transitions.
   a. Comply with accessibility requirements for change in level and slope requirement for ramps.

E. Colors and Patterns: Refer to “List of Finishes”.

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 manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Metal Edge Strips, where indicated: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: 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 manufacturer. Do not use solvents.
   3. Mechanically remove contamination on the substrate that may cause damage to the resilient material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the material or used to work the substrate as they could bleed through and stain the material.
   4. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
      a. At pH test for alkalinity must be conducted. Results should range between 7 and 9. If the test results are not within the acceptable range of 7 to 9, the installation must not proceed until the problem has been corrected.
   5. Moisture Testing: Perform tests recommended by manufacturer at least 60 days in advance of flooring installation to allow sufficient drying time of levels are found to be excessive.
      a. If moisture levels in concrete slabs are too high, temporary climate control will be used to remove excess moisture to levels acceptable to floor manufacturer. Refer to Division 01 Section “Temporary Facilities and Controls”.
   6. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 85 percent relative humidity level measurement.
   7. Proceed with installation only after unsatisfactory conditions have been corrected.
      a. Installation of flooring products indicates acceptance of surfaces and conditions.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Floor covering shall not be installed over expansion joints.

E. Do not install resilient products until they are same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 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.
   1. Exception: Resilient base shall not wrap 1 inch thick worksurface supports between workstations.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:
   1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 4 inches in length.
      a. Butt one piece to corner then cope/scribe next piece to fit.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION 09 65 13

# SECTION 09 65 19 - RESILIENT TILE FLOORING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Rubber floor tile (RFT).

B. Related Sections:
   1. Division 03 Section “Cast-In-Place Concrete” for moisture barrier and slab requirements, including coordination with potential admixtures or toppings that may affect performance of installed floors.
   2. Division 09 Section “Moisture Resistant/Tolerant Flooring Adhesive for Concrete Slabs”.
   3. Division 03 Section “Cast-in-Place Concrete” for vapor retarder.
   4. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

### 1.2 ADMINISTRATIVE REQUIREMENTS

A. Preliminary Meeting: Conduct meeting at Project site a minimum of 60 days before scheduled date of “Resilient Tile Flooring” installation.
   1. Review Article “FIELD CONDITIONS”.
   2. Review Article “EXAMINIATION”.

B. Preinstallation Meeting: Before resilient tile installation, conduct a meeting at Project site to review mock-ups, joint locations, transitions, installation methods, and pattern layouts. A/E will schedule and conduct meeting.
   1. Flooring manufacturer shall have a representative at the Preinstallation meeting.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including fire-test-response.

B. Shop Drawings: For each type of flooring. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns and logos.

C. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern of floor covering required.

### 1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: For each type of floor tile to include in maintenance manuals.
   2. Receipt for extra materials.

### 1.5 MAINTENANCE MATERIALS

A. Leave where directed at Project site, any remaining full size pieces of each type, color, pattern, and size for Owner’s maintenance.

1.6 QUALITY ASSURANCE

A. Manufacturers Qualifications: Flooring product manufacturer will have a technical installation representative available at the job site at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer's technical representative will document and confirm that the substrate, material, and installation are in compliance with manufacturer's guidelines and accepted industry standards and practices.
   1. Any noticed defect with the product or installation system will require the response of the manufacturer's technical field service personnel on site to determine cause, correction or replacement.

B. Installer's Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation method.

C. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for floor tile including accessories.
      a. Size: First-in-place 100 sq. ft. for each type, color, and pattern shall serve as mockup.
         1) Perform bond testing on mockup.
   2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockups, unless A/E specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work, if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
   1. 48 hours (minimum) before installation.
   2. During installation.
   3. 48 hours after installation.

B. Maintain the ambient relative humidity between 40 and 60 percent during installation.

C. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

D. Close spaces to traffic during floor tile installation.

E. Close spaces to traffic for 48 hours after floor tile installation.

F. Install floor tile after other finishing operations, including painting, have been completed.

1.9 WARRANTY

A. Manufacturer Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide product by the manufacturers specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
   1. Where products are indicated on List of Finishes with colors selected, provide sample to verify color match with substitution request.

C. Source Limitations: Obtain resilient tile flooring of same standard, class and type from one manufacturing plant to minimize size variations. Flooring from one manufacturer but separate plants is not acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by a qualified testing agency by testing identical products.
   1. Critical Radiant Flux Classification (ASTM E 648 or NFPA 253): Class I (not less than 0.45 watts per $cm^2$).
   2. Smoke Generation (ASTM E 662 or NFPA 258): Maximum specific optical density of 450 or less.

B. Accessibility: Flooring shall comply with accessibility requirements of the U.S. Architectural and Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 as required by local authorities with jurisdiction.
   1. Comply with ASTM D 2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring: Exceeds Federal Standards and ADA requirements for slip-resistance.

2.3 RUBBER FLOOR TILE (RFT)

A. Products: Subject to compliance with requirements, provide products by one of the manufacturers specified in "List of Finishes":

B. Tile Standard: ASTM F 1344, Class I-A, homogeneous rubber tile, solid color, unless otherwise indicated by product designations in "List of Finishes".

C. Hardness: Not less than 85 as required by ASTM F 1344, measured using Shore, Type A durometer per ASTM D 2240.

D. Wearing Surface: Hammered**.**

E. Thickness: 0.137 inch, minimum.

F. Size: As indicated in “List of Finishes”.

G. Colors and Patterns: Refer to “List of Finishes.”

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated and coordinate with substrate. Note: A primer may be required.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
1. Adhesives shall be approved by manufacturer for use over concrete substrates with RH of less than 95 percent (ASTM F2170) and maximum pH of 10.
2. If Resilient Tile Flooring manufacturer does not have moisture/water resistant adhesive for the relative humidity values, provide adhesives as specified in Division 09 Section “Moisture Resistant/Water-Proof Flooring Adhesive for Concrete Slabs”.

2.5 QUALITY CONTROL

A. Manufacturer Services: Manufacturer assures the product submitted is appropriate for the application and environment in which it is to be installed and that the product is merchantable for service, free of visible and latent defects and will perform for the purpose for which it is intended without compromise.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
1. Verify substrate mix design for additives, i.e. hardeners, moisture vapor reduction admixture and other ingredients that might affect performance of installed flooring.
a. Vinyl is particularly sensitive to the influence of abatement chemicals. Verify substrate is free of all chemical, residue, if abatement of previous flooring with hazardous materials has occurred.
2. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, curing compounds, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
1. Bond Test: An adhesive bond test must be performed using the actual flooring materials and adhesive to be installed. The tests area must be a minimum of 36 by 36 inches and remain in place for at least 72 hours and then evaluated for bond strength to the substrate.

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 manufacturer. Do not use solvents.
    a. Mechanically remove contamination of the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
    a. A pH test for alkalinity must be conducted. Results should range between 7 and 10. If the test results are not within the acceptable range of 7 to 10, the installation must not proceed until the problem has been corrected.
    b. If concrete additives, i.e., hardeners, moisture vapor reduction admixtures or other ingredients have been included in the mix or suspected to be in the mix that might affect the performance of the flooring installation, test the bond.
        1) Perform bond and any additional tests as recommended by the flooring manufacturer. If tests do not produce satisfactory results, coordinate with both concrete additive manufacturer and flooring manufacturer for potential solutions. Retest until a satisfactory result can be obtained.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
    a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 95 percent relative humidity level measurement.
    b. Moisture testing shall be performed at least 60 days in advance of flooring installation to allow sufficient drying time for levels acceptable to floor manufacturer. Refer to Division 01 Section “Temporary Facilities and Controls.”

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
    1. Underlayment shall be steel troweled smooth and trowel marks showing through installed tile shall be reason to remove the tile and sand out trowel marks.

D. Floor covering shall not be installed over expansion joints.

E. Do not install floor tiles until they are same temperature as space where they are to be installed.
    1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

## 3.3 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 in pattern indicated.

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.

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, nonstaining marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using manufacturer recommended method for materials and substrate indicated. Produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
   1. Tiles should be lightly butted together when placing the flooring into adhesive.
   2. Do not force tiles together creating a ledge condition at the seams and corners. Sliding tiles will result in forcing the adhesive out between the seams.
   3. Periodically, lift the corner of an installed tile to ensure proper transfer of adhesive.
   4. Roll floor in both directions with a 100 pound three-section roller. Use a small hand roller in areas that cannot be reached with a large roller.
   5. Roll the flooring in both directions using a 100 pound three-section roller.
   6. Inspect the floor surface, especially seams, and remove any adhesive on the surface.
   7. Install adhesive as recommended for the site conditions and follow adhesive label for proper use.
   8. Custom logo components shall be fitted together and fully adhered to edge of material and to substrate.

## 3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.
   4. Provide manufacturer’s recommended initial wet wash of installed flooring. Utilize floor scrubber, pads and materials as recommended by tile manufacturer.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
   1. No traffic for 24 hours after installation.
   2. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.

D. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

**SECTION 09 65 66.01 – WEIGHT ROOM FLOORING**

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Rubber weight room flooring, sheet (MLRSAF-1, 2, and 3).
   2. Indoor Turf (IT-)

B. Related Sections include the following:
   1. Division 03 Section “Cast-In-Place Concrete” for moisture barrier and slab requirements, including coordination with potential admixtures or toppings that may affect performance of installed floors.
   2. Division 09 Section "Resilient Base and Accessories" for wall base and accessories installed with floor coverings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

B. Pre-Installation Conference: Before resilient athletic flooring installation, conduct a conference at Project site to review mockups, joint locations, transitions, installation methods, and pattern layouts. A/E will schedule and conduct meeting.
   1. Flooring product manufacturer will have a technical installation representative available at the jobsite at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer’s technical representative will document and confirm that the substrate, material and installation are in compliance with manufacturer’s guidelines and accepted industry standards and practices.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Show installation details and locations of the following:
   1. Border tiles.
   2. Floor patterns.
   3. Layout, colors, widths, and dimensions of game lines.
   4. Locations of floor inserts for athletic equipment.

C. Samples for Initial Selection: For each type of floor covering indicated.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Sheet Floor Coverings: Furnish full-width rolls of not less than 10 linear feet for each 500 linear feet or fraction thereof, of each type, color, and pattern of floor covering installed.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed rubber floor covering installations using methods indicated for this Project and similar in material, design, and extent to that indicated for this Project, who is acceptable to manufacturer, and whose work has resulted in installations with a record of successful in-service performance.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for resilient sheet flooring including accessories.
      a. Size: First-in-place 100 sq.ft. for each type, color and pattern shall serve as mockup.
         1) Perform bond tests on mockups, if product is adhered.
   2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.

B. Store materials to prevent deterioration. Store tiles on flat surfaces and rolls upright.

1.7 FIELD CONDITIONS

A. Adhesively Applied Products:
   1. Maintain temperatures within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor coverings during the following time periods:
      a. 48 hours before installation, unless longer period is recommended in writing by manufacturer.
      b. During installation.
      c. 48 hours after installation, unless longer period is recommended in writing by manufacturer.
   2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
   3. Close spaces to traffic during floor covering installation.
   4. Close spaces to traffic for 48 hours after floor covering installation, unless manufacturer recommends longer period in writing.

B. Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide products listed in other Part 2 articles.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 SYSTEM DESCRIPTION

A. Design Requirements
1. Floor surfaces shall be provided to conform to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.

2.3 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by a qualified testing agency by testing identical products.
1. Critical Radiant Flux Classification (ASTM E 648 or NFPA 253): Class I (not less than 0.45 watts per $cm^2$.
2. Smoke Generation (ASTM E 662 or NFPA 258): Maximum specific optical density of 450 or less.

B. Accessibility: Flooring shall comply with accessibility requirements of the U.S. Architectural and Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 as required by local authorities with jurisdiction.

2.4 MULTIPLE-LAYER RUBBER SHEET WEIGHT ROOM FLOORING (MLRSAF)

A. Subject to compliance with requirements (MLRSAF-1, 2 and 3):
1. Acceptable Manufacturers:
a. "Achieve" by PLAE.
b. "Mondo Armor" by Mondo USA
c. "DynaFit SP" by Dynamic Sports Construction, Inc.
2. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
3. Description: Rubber weight room flooring provided as rolled goods for adhered installation.
4. Material: Recycled SBR rubber and EPDM rubber granules bound by polyurethane, factory fused.
5. Installation Method: Adhered.
6. Traffic-Surface Texture: Smooth.
7. Roll Size: Not less than 48 inches wide by longest length that is practical to minimize splicing during installation.
8. Thickness: 18.0 mm minimum with 3mm wear layer.
9. Color and Pattern: As selected from Manufacturer's standard color offerings.
a. Multiple Colors will be selected as indicated on Drawings.

2.5 INDOOR TURF (IT- )

A. Non-rubber infilled turf blend of nylon and polyethylene.
1. Tufted construction.
2. Dual layer polypropylene backing with 5mm polyurethane foam with fleece.
3. Pile Height: 7/8 inch.
4. Face Weight: minimum of 48 - 55 oz/yd.
5. Total Fabrick Weight: 140 oz/yd with foam backing.
6. Colors: As indicated on List of Finishes.
7. Lines: Provide accent color lines in layout indicated on Drawings
8. Products:
a. TurfZone Ultra 55 by Kiefer USA
b. Attack by PLAE.

2.6 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by floor covering contractor and coordinate with substrate.

B. Adhesives: Water-resistant type recommended in writing by manufacturer to suit resilient athletic flooring for high-moisture substrate conditions indicated.
   1. Adhesives shall be approved by manufacturer for use over concrete substrates with maximum RH of 95 percent (ASTM F 2170) and maximum pH of 9.

C. Subfloor Leveler Strip: Resilient subfloor leveler strip PVC composition with ramp transition configuration to align differing material thicknesses.
   1. Subfloor Leveler System by Tarkett.
   2. Color: Black.
   3. Profile and dimensions as required to transition between weight room flooring and turf materials.
   4. Size: 4 foot long sections, approximately 12 inches wide.
   5. Installation and Location: Adhered to substrate below other flooring materials.

2.7 SOURCE QUALITY CONTROL

A. Manufacturer Services: Manufacturer assures the product submitted is appropriate for the application and environment in which it is to be installed and that the product is merchantable for service, free of visible and latent defects and will perform for the purpose for which it is intended without compromise.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, curing compound, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of floor coverings.
   1. Bond Test: An adhesive bond test must be performed using the actual flooring materials and adhesive to be installed. The tests area must be a minimum of 36 by 36 inches and remain in place for at least 72 hours and then evaluated for bond strength to the substrate.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Alkalinity and Adhesion Testing: Perform tests recommended in writing by manufacturer. Proceed with installation only after substrates pass testing.
      a. A pH test for alkalinity must be conducted. Results should range between 7 and 9.
   3. Moisture Testing:
      a. Perform 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.

1) Perform tests so that each test area does not exceed 200 sq. ft. and perform not less than 2 tests in each installation area and with test areas evenly spaced in installation areas.

b. Perform tests recommended in writing by manufacturer. Proceed with installation only after substrates pass testing.

c. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement.

d. Moisture testing shall be performed at lest 60 days in advance of flooring installation to allow sufficient drying time for levels acceptable to floor manufacturer. Refer to Division 01 Section “Temporary Facilities and Controls.”

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.

1. Mechanically remove contamination of the substrate that may cause damage to the resilient floor material. Permanent and nonpermanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation, unless manufacturer recommends a longer period in writing.

1. Do not install floor coverings until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

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

3.3 FLOOR COVERING INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Scribe, cut, and fit floor coverings to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

C. Extend floor coverings into toe spaces, door reveals, closets, and similar openings, unless otherwise indicated.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on floor coverings. Use nonpermanent, nonstaining marking device.

E. Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and floor covering manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 SHEET FLOOR COVERING INSTALLATION

A. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting.

B. Lay out sheet floor coverings as follows:
   1. Maintain uniformity of floor covering direction.
   2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
   3. Match edges of floor coverings for color shading at seams.
   4. Avoid cross seams.

C. Seams: Prepare and finish seams to produce surfaces flush with adjoining floor covering surfaces.
   1. Chemically Bonded Seams: Comply with ASTM F 693. Seal seams to prevent openings from forming between cut edges and to prevent penetration of dirt, liquids, and other substances into seams.

3.5 CLEANING AND PROTECTING

A. Perform the following operations immediately after completing floor covering installation:
   1. Remove adhesive and other blemishes from floor covering surfaces.
   2. Sweep and vacuum floor coverings thoroughly.
   3. Damp-mop floor coverings to remove marks and soil.
      a. Do not wash floor coverings until after time period recommended in writing by manufacturer.

B. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
   1. Do not move heavy and sharp objects directly over floor coverings. Protect floor coverings with plywood or hardboard panels to prevent damage from storing or moving objects over floor coverings.

END OF SECTION 09 65 66

# SECTION 09 66 16.13 - TERRAZZO FLOOR TILE

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes: Terrazo tile (TERRT) work, including accessories as indicated.

B. Related Sections:
   1. Division 03 Section “Cast-in-Place Concrete” for concrete substrate including levelness tolerances.

### 1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct meeting at Project site.
   1. Flooring product manufacturer will have a technical installation representative available at the jobsite at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer’s technical representative will document and confirm that the substrate, material and installation are in compliance with manufacturer’s guidelines and accepted industry standards and practices.

### 1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer’s specifications and technical data for terrazzo floor tile and accessories, including manufacturer’s printed installation instructions.

B. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory requested showing the full range of color, texture, and pattern variations expected. Due to variations in samples, A/E may request multiple samples. Label each terrazzo sample to identify matrix color and aggregate types, sizes, and proportions. Prepare samples of same thickness and from same material to be used for the work in size indicated below:
   1. Terrazzo: Samples to be at least 6 inches square.

### 1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: Include cleaning methods and cleaning solutions recommended.
   2. Receipt of extra materials.

### 1.5 MAINTENANCE

A. Leave where directed at Project site, any remaining full size pieces of each type, color, pattern, and size for Owner’s maintenance.

### 1.6 QUALITY ASSURANCE

A. Work done under this Section of the Specifications shall be performed by mechanics skilled and experienced in the class of work involved. Workmanship shall be in accordance with best trade practices, and surface shall be true-to-line and free from waves and other imperfections. Joints between tiles shall be maintained uniform and even.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver to jobsite in unopened containers with manufacturer's product name, pattern, and color clearly printed thereon.

B. Store materials in a protected area. Storage area shall be kept dry and temperature of storage area shall not be lower than 40 deg F or higher than 100 deg F.

1.8 FIELD CONDITIONS

A. Tiles shall not be installed until all other work that could cause damage to the finished flooring has been completed. Maintain a temperature of not less than 70 deg F in spaces where tiles are to be installed for at least 48 hours before, during, and after the laying of tiles. Bring tiles into such spaces and allow it to condition at not less than 70 deg F at least 48 hours before installing.

1.9 WARRANTY

A. Manufacturer’s standard limited warranty against wear-through on material only.
   1. Warranty Period: 20 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Terrazzo tile shall be "Nurazzo” Terrazzo Tile, Dalton, Georgia.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer’s approval must be accompanied by the “Substitution Request Form” and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: Floor surfaces shall be provided to conform with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.

2.3 MATERIALS

A. Terrazzo Tile:
   1. Tile shall be manufactured of natural stone, recycled glass, and epoxy resing binding matrix.
   2. Thickness: 1/4 inch.
   3. Size: As indicated in the List of Finishes.
   4. Color: As indicated in the List of Finishes.
   5. Abrasive Resistance: ASTM D-04060 – 35 mg.
   6. Impact Resistance: MIL-D3134F – withstands 16 ft/lbs without cracking, delamination or chipping.
   7. Slip Resistance: ASTM D-2047 – Wet 0.62, Dry 0.85.
   8. Compressive Strength: ASTM C-579 – 10,000 psi minimum after 7 days.
   9. Flexural Strength: ASTM C-580 – 3,000 psi.
   10. Factory Finish: Provide manufacturer’s standard factory polished finish via 3,000 grit hi-luster polishing.
   11. Where indicated, provide custom logo/lettering via factory waterjet cut operations.

2.4 TILE ACCESSORIES

A. Thinset Mortar Materials: As recommended by manufacturer for concrete substrate.
   1. Laticrete 254 Platinum.
   2. Mapei Ultraflex, Kerabond Keralastic
   3. TEC Super Flex or Isolight

B. Expansion Joint Control Strips: As recommended by tile manufacturer.

C. Sealer: Manufacturer's recommended sealer impregnator for factory polished tile.

2.5 SOURCE QUALITY CONTROL

A. Manufacturer Services: Manufacturer assures the product submitted is appropriate for the application and environment in which it is to be installed and that the product is merchantable for service, free of visible and latent defects and will perform for the purpose for which it is intended without compromise.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to installing tile, the tile subcontractor shall inspect surfaces which are to receive tile covering. He shall notify the Architect in writing of serious defects or conditions that will interfere with or prevent a satisfactory tile installation. Do not proceed with installation until such defects or conditions have been corrected.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the tile manufacturer.
   2. Finishes of subfloors complying with tolerances and other requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving tile.
   3. Subfloors are to be free of cracks, ridges, depressions, scale, and foreign deposits of any kind.

C. The starting of installation work in an area or space shall imply acceptance of the surfaces to receive the tile in that space and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

A. Apply latex underlayment where required to correct subfloor. Underlayment shall be steel troweled smooth.

B. Tile shall only be installed at a temperature (tile, floor, and air) of 70 deg F and above, and room temperature shall be maintained at 70 deg F or above for at least 48 hours

3.3 INSTALLATION

A. General: Tile shall be installed in accordance with tile manufacturers approved tile installation instructions. Lay design symmetrical about center lines of rooms. Provide grout joints minimum of 1/8 inch but not greater than 1/4 inch in true alignment. Cut tile to fit snugly at pipes and other vertical surfaces. Remove spots or smears of adhesive immediately. (Use water only). Make entire surfaces of finished tile floors smooth, straight, and free from bleeding adhesive, buckles, waves, or projecting tile edges upon completion. Prior to applying base adhesive, remove any surface film on back of base due to mold release agents as recommended by base manufacturer.

1. Control Joints: Provide in accordance with manufacturers recommendations.

B. Provide thinset mortar installation procedures in accordance with Manufacturer's written installation instructions.

C. Place tile carefully and firmly in position, butting it clearly, evenly, and snugly against adjacent tile.

D. Floors shall not be subjected to traffic until adhesive is dry and hard (approximately 24 hours).

E. Sealing:
1. Clean and residue from surface using a neutral cleaner.
2. Clean and rinse surface and allow to dry.
3. Apply two applications of the manufacturer's sealer/impregnator according to manufacturer's written installation instructions.
4. Buff the surface using a 175 rpm buffing machine and manufacturer's recommended polishing pad.

F. Protection:
1. Remove any excess adhesive or grout immediately after installation.
2. Provide protective cover of traffic areas until completion of project.

END OF SECTION 09 66 16.13

# SECTION 09 67 23 – DECORATIVE RESINOUS FLOORING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes decorative resinous flooring systems with epoxy body coat(s).
   1. Application Method: Self-leveling slurry with broadcast aggregates (DRF).

B. Related Sections include the following:
   1. Division 07 Section "Joint Sealants" for sealants installed at joints in resinous flooring systems.

C. Flooring System Description: System shall be 1/8 textured epoxy surfacing with broadcast colored quartz to form a decorative skid-resistant surface. Surface finish shall be a clear two component UV light resistant epoxy sealer.

### 1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct meeting at Project site.
   1. Review mockup.
   2. Review manufacturer’s written instructions for substrate preparation and environmental conditions affecting resinous flooring installation.
   3. Review details of integral cove bases.
   4. Review manufacturer’s written instructions for installing resinous flooring systems.
   5. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, curbs, base details, and so forth.
   6. Flooring product manufacturer will have a technical installation representative available at the jobsite at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer’s technical representative will document and confirm that the substrate, material and installation are in compliance with manufacturer’s guidelines and accepted industry standards and practices.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
   1. Provide details for flexible joints required for flooring in area of installation.
   2. Provide details of cove base, if indicated, and termination details at floor material transitions and where adjoining equipment.

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

### 1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Maintenance Data: For resinous flooring to include in maintenance manuals.

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
   1. Engage an installer who employs only persons trained and approved by resinous flooring manufacturer for applying resinous flooring systems indicated.

B. Manufacturer Field Technical Service Representative: Resinous flooring manufacturer shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on this project.
   1. Field Technical Services Representatives shall be employed by the system manufacturer to assist in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.
   2. Flooring product manufacturer will have a technical service representative available at the jobsite at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer's technical representative will document and conform that the substrate, material, and installation are in compliance with manufacturer's guidelines and accepted industry standards and practices.
   3. Any noticed defect with the product or installation system will require the response of the manufacturer's technical field service personnel on site to determine cause, correction or replacement.

C. Mockups: Prior to starting application of flooring:
   1. Purposes:
      a. To verify color selections made under Sample submittals.
      b. To determine texture (cleanability versus slip-resistance).
      c. To demonstrate aesthetic affects, chemical-resistance, thickness, and other features of the resinous flooring.
      d. To set quality standards for materials and execution.
   2. Provide full scale mock-up of not less than 4 square feet of each flooring system.
      a. Include 48 inch length of integral cove base with inside corner, if applicable.
   3. Simulate finished lighting conditions for A/E's review of Mock-Ups.
   4. If judged unacceptable, make adjustments to comply with requirements and apply another similar sample until acceptable.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Decorative Resinous Flooring with aggregates. Subject to compliance with requirements, provide one of the products specified.
   1. Basis of Design: Resuflor Deco Quartz BC23; Sherwin-Williams Company.
   2. Dex-O-Tex Decor Flor; Crossfield Products Corp.
   3. Dur-A-Quartz; Dur-A-Flex Inc.

4. Stonshield SLT; Stonhard, Inc.
5. Eco-DQF; Tennant Company
6. BASF Construction Systems
7. Terrazzo & Marble Supply Co.
8. Action Floor Systems
9. Tnemec
10. PPG Flooring

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
   1. Where products are indicated on List of Finishes with colors selected, provide sample to verify color match with substitution request.

C. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

2.2 PERFORMANCE REQUIREMENTS

A. Flammability: Self-extinguishing according to ASTM D 635.

2.3 DECORATIVE RESINOUS FLOORING

A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, decorative-aggregate-filled, epoxy-resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base.

B. System Characteristics:
   1. Color and Pattern: As selected by A/E from manufacturer's full range.
   2. Wearing Surface: Textured for slip resistance.
   3. Thickness: 1/8 inch minimum, thickness does not include waterproofing or reinforcing membrane.

C. System Components: Manufacturer's standard components that are compatible with each other and as follows:
   1. Body Coat(s):
      a. Resin: Epoxy.
      b. Formulation Description: 100 percent solids.
      c. Type: Pigmented.
      d. Application Method: Self-leveling slurry with broadcast aggregates.
         1) Thickness of Coats: 1/8 inch.
         2) Number of Coats: One.
      e. Aggregates, DRF: Colored quartz (ceramic-coated silica).
   2. Moisture Resistant Primer: Manufacturer's two-component epoxy resin that is tolerant of residual moisture in concrete, product similar to Resuprime MVT by Sherwin Williams.
   3. Waterproofing Membrane: Type recommended by manufacturer for substrate and primer and body coat(s) indicated.
      a. Formulation Description: 100 percent solids.
   4. Reinforcing Membrane: Flexible resin formulation that is recommended by manufacturer for substrate and primer and body coat(s) indicated and that prevents substrate cracks from reflecting through resinous flooring.
      a. Formulation Description: 100 percent solids.
         1) Provide fiberglass scrim embedded in reinforcing membrane as recommended by manufacturer.

5. Topcoat: UV-resistant sealing or finish coat(s).
    a. Resin: Epoxy.
    b. Formulation Description: 100 percent solids.
    c. Type: Clear.
    d. Finish: Gloss.
    e. Number of Coats: Two coats for final sealer.

2.4 ACCESSORY MATERIALS

A. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated. Material must be compatible and coordinated with concrete slab mix.

B. Metal Edge Strips: Angle or L-shape, height to match resinous flooring thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, white zinc alloy or stainless steel; ASTM A 666, 300 Series exposed-edge material.
    1. Refer to Division 09 Section “Resilient Base and Accessories” for specialty trims integral to this floor system such as stair nosings and edge trims.

2.5 SOURCE QUALITY CONTROL

A. Manufacturer Services: Manufacturer assures the product submitted is appropriate for the application and environment in which it is to be installed and that the product is merchantable for service, free of visible and latent defects and will perform for the purpose for which it is intended without compromise.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate and areas, with the Installer present, for compliance with the requirements for installation tolerances and other unsatisfactory conditions affecting performance of the Work.
    1. Verify substrate mix design for additives, i.e. hardeners, moisture vapor reduction admixture and other ingredients that might affect performance of installed flooring.

B. Proceed with the installation only after unsatisfactory conditions, including levelness tolerances have been corrected and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
    1. Roughen concrete substrates as follows:
        a. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
    2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
        a. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab in 24 hours.
    3. Perform relative humidity test using in situ Verify that concrete substrates are dry and moisture-type emissions are within acceptable levels according to manufacturer’s written instructions.

a. Perform anhydrous calcium chloride test, ASTM F 1869. probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
b. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.
c. Moisture testing shall be performed at least 60 days in advance of flooring installation to allow sufficient drying time if levels are found to be excessive.
1) If moisture levels in concrete slabs are too high, temporary climate control may be used to remove excess moisture to levels acceptable to floor manufacturer. Refer to Division 01 Section “Temporary Facilities and Control.”

4. Relative Humidity Test: Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.3 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.

B. Moisture Resistant Primer: Apply moisture resistant primer over prepared substrate at 16-20 mils DFT. Coordinate applying primer with topping mix to ensure optimum adhesion between resinous flooring and substrate.

C. Waterproofing Membrane: Apply waterproofing membrane, where indicated, in manufacturer's recommended thickness.
1. Apply waterproofing membrane at all shower locations.

D. Apply reinforcing membrane to substrate cracks.

E. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
1. Integral Cove Base: 4-inches high, unless otherwise noted.

F. Apply self-leveling slurry body coat(s) in thickness indicated for flooring system.
1. Broadcast aggregates and flakes, after resin is cured, remove excess aggregates to provide surface texture indicated.

G. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

H. Metal Edge Strips: Install at locations indicated or where exposed edge of resinous flooring meets carpet, wood, resilient tile or other flooring that finishes flush or below top of resinous flooring.
1. Locate transition under doors, unless otherwise noted.

## 3.4 TERMINATIONS

A. Chase edges to “lock” the flooring system into the concrete substrate along lines of termination.

B. Penetration Treatment: Lap and seal the flooring system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

C. Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

D. Treat floor drains by chasing the flooring system to lock in place at point of termination.

## 3.5 FIELD QUALITY CONTROL

A. Material Sampling: Owner may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements.
   1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
   3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

## 3.6 PROTECTING

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 23

# SECTION 09 67 66 - FLUID-APPLIED ATHLETIC FLOORING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes polyurethane flooring that is fluid applied.
   1. Polyurethane flooring over resilient, base mat. (PFS)

B. Related Sections include the following:
   1. Division 03 Section “Cast-in-Place Concrete”, for moisture barrier and slab requirements, including coordination with potential admixtures and toppings that may affect performance of installed flooring.
   2. Division 09 Section "Resilient Base and Accessories" for wall base and accessories installed with fluid-applied sports flooring.
   3. Division 09 Section “Resilient Athletic Flooring” for roll and tile resilient athletic flooring.
   4. Division 11 Section “Athletic Equipment” for coordination of floor insert installation and type.

### 1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination
   1. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.
   2. Coordinate location of telescoping stands wheel loads with pad installation.

B. Preinstallation Conference: Conduct conference at Project site.
   1. Flooring product manufacturer will have a technical installation representative available at the jobsite at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer’s technical representative will document and confirm that the substrate, material and installation are in compliance with manufacturer’s guidelines and accepted industry standards and practices.

### 1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Show installation details for flooring including layout, colors, widths, and dimensions of game lines and markers and locations of athletic equipment floor inserts.

C. Samples for Initial Selection: Manufacturer's color charts showing colors and glosses available for flooring and game-line and marker paints.

### 1.4 CLOSEOUT SUBMITTALS

A. Submittals:
   1. Maintenance Data: For fluid-applied sports flooring to include in maintenance manuals.

### 1.5 QUALITY ASSURANCE

A. Floor Manufacturer: Supplier shall be an established firm experienced in athletic flooring and have been in business as a Manufacturer for a minimum of 10 years.

B. Installer Qualifications: An installer (applicator) who is approved, trained, or certified by fluid-applied sports flooring manufacturer.

C. Industry Approvals:

| | | |
|---|---|---|
| 1. | Shock Absorption per EN 14808 | 20% |
| 2. | Vertical Deformation per EN 14809 | 1.0 mm |
| 3. | Ball Bounce per EN 12235 | 98% |
| 4. | Elongation at break per DIN 53455 | 150% |
| 5. | Tensile Strength per DIN 53515 | 8 N/mm2 (1,160 psi) |

D. Floor System shall be approved for use by the International Volleyball Federation (FIVB), International Basketball Federation (FIBA) and International Handball Federation (IHF).

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials
1. Material shall not be delivered or installed until all masonry, painting, plastering, tile work are completed and all overhead mechanical work, lighting, backstops, scoreboards are installed.
2. Room temperature shall be at least 55 degrees F, and ambient relative humidity shall be 75 percent or less. In-slab relative humidity shall be 80 percent or less.
3. Area where materials are to be stored should be maintained at least 55 degrees F and under 75 percent relative humidity.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Comply with flooring manufacturer's written instructions for substrate temperature, ambient temperature, humidity, ventilation, and other conditions affecting flooring application.
1. Do not apply flooring until spaces are enclosed and weatherproof; wet work in spaces is complete and dry; and overhead work, including installing mechanical systems, lighting, and athletic equipment, is complete.

B. Conditioning Period: Begins not less than seven days before flooring application, is continuous through application, and continues not less than three days after application.
1. During conditioning period, maintain an ambient temperature between 65 and 75 deg F and not more than 50 percent relative humidity in spaces to receive flooring.
2. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Close spaces to traffic during flooring application and for period after application recommended by manufacturer, but not less than that required for the flooring system, including game-line and marker paint to cure.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:
1. Base Bid: Polyurethane Flooring over Resilient, Base Mat (PFS):
a. Pulastic Classic 90 Robbins Sports Surfaces
b. Herculan MF 800; Action Floors
2. Alternate Bid: Polyurethane Flooring over Resilient, Base Mat (PFS):
a. ElastiPlus; Sport Court, Subsidiary of Conner Sport Court Inter.
b. Strata Sport; Robbins Sports Surfaces.
c. MP Sport; Aacer
d. Cushion Court; Horner Flooring Company
e. Dynaforce; Dynamic Sport Construction, Inc.
f. Synchro; Action Floors
g. Duraflex Elite, Kiefer USA
h. PolyTurfPlus Pad and Pour; Beynon Sports Surfaces (a Tarkett Company)

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
   1. Where products are indicated on List of Finishes with colors selected, provide sample to verify color match with substitution request.

2.2 POLYURETHANE FLOORING OVER RESILIENT BASE MAT

A. Polyurethane Flooring and Resilient, Base Mat System (PFS):
   1. Resilient Base Mat: Manufacturer's standard base mats of granulated recycled rubber in polyurethane binder.
   2. Base-Mat Adhesive: Manufacturer's standard two-component polyurethane.
   3. Base-Mat Sealer: Manufacturer's standard two-component polyurethane compound formulated for sealing base mat.
   4. Body Coat(s): Two-component, self-leveling, pigmented, polyurethane containing no rubber fillers and no mercury.
      a. Pigment of body coat must match the topcoat.
   5. Topcoat (Finish Coat): Manufacturer's standard two-component pigmented polyurethane.
      a. Color: As selected by A/E from manufacturer's full range to match color offering from Robbins, Pulastic.
         1) Multiple colors will be selected.
      b. Surface Texture: Smooth.
   6. Overall System Thickness: 11 mm (9 + 2)

B. VOC Emission Requirements: Comply with requirements of CA 01350.

2.3 ACCESSORIES

A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer and compatible and coordinated with concrete substrate.

B. Game-Line and Marker Paint: Manufacturer's standard two-component polyurethane.
   1. Colors: As required to comply with game-line and marker requirements of sports association indicated.

2.4 SOURCE QUALITY CONTROL

A. Manufacturer Services: Manufacturer assures the product submitted is appropriate for the application and environment in which it is to be installed and that the product is merchantable for service, free of visible and latent defects and will perform for the purpose for which it is intended without compromise.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer (Applicator) present, for conditions affecting performance of flooring including substrate moisture content. Begin flooring application only after unsatisfactory conditions have been corrected.
   1. Verify substrate mix design for additives, i.e. hardeners, moisture vapor reduction admixture and other ingredients that might affect performance of installed flooring.
   2. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, curing compounds, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

A. Concrete Slabs: Verify that concrete slabs are flat, level, and dry.
   1. Flatness Tolerance: Maximum 1/8 inch in 10 feet when measured with a straight edge.
   2. Moisture Testing: Perform the following tests and any tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test per ASTM F 1869, as follows:
         1) Perform tests so that each test area does not exceed 200 sq. ft. and perform not less than 2 tests in each installation area and with test areas evenly spaced in installation areas.
         2) Proceed with application only after substrates do not exceed the maximum moisture-vapor-emission rate recommended by manufacturer, but not more than 3 lb of water/1000 sq. ft. in 24 hours.
      b. Determine relative humidity of concrete slabs using in situ probes per ASTM F 2170.
         1) Proceed with application only after substrates have maximum relative humidity recommended in writing by manufacturer, but not more than 75 percent.
      c. Moisture testing shall be performed at least 60 days in advance of flooring installation to allow sufficient drying time if levels are found to be excessive.
         1) If moisture levels in concrete slabs are too high, temporary climate control may be used to remove excess moisture to levels acceptable to floor manufacturer. Refer to Division 01 Section “Temporary Facilities and Controls.”

B. Concrete Substrates: Prepare and clean substrates according to manufacturer's written instructions.
   1. Remove laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair flooring bond. Remove contaminants using mechanical means.
   2. Treat nonmoving substrate cracks and control joints to prevent cracks from telegraphing (reflecting) through flooring according to manufacturer's written recommendations.
   3. Protect substrate voids and joints to prevent flooring resins from flowing into or leaking through them.
   4. If concrete additives, i.e., hardeners, moisture vapor reduction admixtures or other ingredients have been included in the mix or suspected to be in the mix that might affect the performance of the flooring installation, test the bond.
      a. Perform bond and any additional tests as recommended by the flooring manufacturer. If tests do not produce satisfactory results, coordinate with both concrete additive manufacturer and flooring manufacturer for potential solutions. Retest until a satisfactory result can be obtained.

C. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.

D. Protect walls, floor openings, athletic equipment inserts, electrical openings, door frames, and other obstructions during installation. Cover floor and wall areas at mixing stations.

3.3 APPLICATION

A. General: Mix and apply flooring components according to manufacturer's written instructions.
   1. At substrate expansion, isolation, and other moving joints, install continuous joint of same width through flooring.

B. Polyurethane Flooring and Resilient, Base Mat:
   1. Adhesively apply resilient base mats to substrate according to manufacturer's written instructions.
      a. Base mats must not be in compression. Leave gap of width recommended in writing by manufacturer at butted base-mat sheets, walls, floor openings, athletic equipment inserts, electrical openings, door frames, and other obstructions.
      b. Roll base mats to set them into adhesive and eliminate air pockets.
      c. Repair ridges at seams, loose areas, and air pockets according to manufacturer's written instructions.
   2. Apply seal coat to base mats before applying body coat(s).
      a. Do not seal base mat under areas where telescoping stand loads will be applied. Allow resin to harden the pad of these locations.
   3. Smooth ridges and high spots in seal coat before applying elastomeric resin.
   4. Apply elastomeric resin and topcoat to produce a uniform surface and finish.

## 3.4 GAME LINES AND MARKERS

A. Mask flooring surfaces at game lines and markers, and apply paint to produce sharp edges.
   1. Where game lines cross, break minor game line at intersection; do not overlap lines.
   2. Apply game lines and markers in widths and colors according to sports association indicated.

B. Lay out game lines and markers to comply with rules and diagrams published by National Federation of State High School Associations for athletic activities indicated.

## 3.5 PROTECTION

A. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.

B. Protect fluid-applied sports flooring during remainder of construction period to allow it to cure and to ensure that flooring and finish are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09 67 66

## SECTION 09 84 33.13 - ABUSE-RESISTANT SOUND-ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Abuse-resistant acoustical wall treatment (AR-AWT) as indicated.

B. Related Sections:
   1. Division 06 Section “Rough Carpentry”.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for each material, and include other data as may be required to show compliance with these specifications. Indicate by transmittal form that a copy of each installation instruction has been distributed to the installer.
   1. Recommended procedures for normal cleaning and removal of stains including precautions in use of cleaning materials that may be detrimental to surfaces.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical wall treatment from excessive moisture in shipment, storage, and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until wet work, such as concrete and plaster, has been completed and cured to a condition of equilibrium.

B. Before installing acoustical wall units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical wall units carefully to avoid chipping edges or damaged units in any way.

1.4 FIELD CONDITIONS

A. Environmental Conditions: Do not begin installation until spaces for acoustical wall treatment have been enclosed and maintained at approximately the same humidity and temperature conditions as planned for occupancy. Maintain temperature and humidity as recommended by panel manufacturer.
   1. Locate materials onsite at least 24 hours before beginning installation to allow materials reach temperature and moisture content equilibrium.

B. Field Measurements: Check actual wall surfaces by accurate field measurements before fabrication and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   1. Tectum® by Armstrong World Industries, Inc.
   2. Knauf/Heraklith
   3. Troy Acoustics
   4. Cardinal Acoustics

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Provide acoustical wall panel assembly designed and tested to provide surface-burning characteristics (ASTM E84) as follows:
   1. Flame spread:
      a. Fabric covered: 25
      b. Natural: 0

B. Provide acoustical wall panel system that has been manufactured, fabricated, and installed to provide Noise Reduction Coefficient (NRC) rating as indicated.

2.3 ACOUSTICAL WALL TREATMENT (AR-AWT)

A. Abuse-Resistant Acoustical Panels, General:
   1. Flame spread of panels shall be 25 or less under the ASTM E 84.
   2. Panels are Class A.
   3. Panels shall consist of wood fibers and a hydraulic-cement binder formed under controlled conditions of heat and pressure.
   4. Humidity/Sag Resistance: Manufactures standard treatment, similar to Armstrong HumiGuard.
   5. Anti-Mold/Mildew: Manufacturers standard treatment, similar to Armstrong BioBlock.

B. Interior Wall Panels
   1. Basis of Design: Tectum DesignArt
   2. Material:
      a. Material: Aspen wood fibers bonded with inorganic hydraulic cement.
   3. Thickness
      a. Thickness 2 inches (Walls)
         1) Mounting Method:
            a) Type C-20; NRC .90
      b. Edges: S and painted.
   4. Size and shape shall be as indicated on Drawings.
   5. Finish: Factory applied latex paint on abuse resistant silicate surface coating.
   6. Color: Refer to “List of Finishes”

2.4 ACCESSORIES

A. Panel Edge Spline: Furnish vinyl splines that are continuous. Insert splines into kerfed edges of panel and fasten to the wall or other structures.
   1. Utilize when panels abut each other or are arranged continuously.

B. Supplemental Acoustical Insulation:
   1. Mounting Method C-20: Thermal insulation board (between furring) combing glass fibers with thermosetting resin binders to comply with ASTM C612, Type 1A or Type 1B.
      a. Nominal Density: 3 pounds per cubic foot.
      b. Thermal Conductivity: k-value of 0.23 at a mean temperature of 75 degrees Fahrenheit.

C. Furring Strips: Fire retardant treated framing lumber or boards as required by installation method, per requirements of Division 06 Section “Rough Carpentry”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of acoustical wall treatment.

B. Do not proceed with installation until all work such as concrete, and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer’s printed recommendations.

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

3.2 PREPARATION

A. Measure each wall area and establish layout of wall units. Coordinate panel layout with mechanical and electrical fixtures.

3.3 INSTALLATION

A. General: Install acoustical wall panels in locations indicated with vertical surfaces and edge plumb, top edges level and in alignment with other panels, scribed to fit adjoining work accurately at borders and at penetrations. Comply with panel manufacturer's printed instructions for installation of panels using type of mounting accessories indicated or, if none indicated, as recommended by manufacturer for substrate.

B. Painted Panels: Install panels using the following method, unless otherwise noted.
   1. Type C-20: Laid on 3/4 inch furring strips, 24 inches o.c. or less, cavities to be filled with glass-fiber board insulation. Furring is required at panel ends, top and bottom. Sound-absorbing insulation shall not be left exposed. Furring at outside edge shall be recessed back 1 inch from panel edge and exposed surface of furring painted. Mechanically attach panels with screws as recommended by the manufacturer.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel, trim, moldings, and suspension members to comply with manufacturer’s instructions for cleaning.

B. Touch up any minor finish damage.

C. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.5 PROTECTION

A. Protect installed work from damage due to subsequent construction activity, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION 09 84 33.13

# SECTION 09 91 23.00 - INTERIOR PAINTING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes surface preparation and application of paint systems on the following interior substrates:
   1. Concrete masonry units.
   2. Steel and iron.
   3. Galvanized metal.
   4. Gypsum board.
   5. Cotton or canvas insulation covering.
   6. ASJ insulation covering.

B. Work under this contract shall also include, but not necessarily be limited to following:
   1. Surface preparation of substrates as required for acceptance of painting, including cleaning, small crack repair, patching, caulking, and making good surfaces and areas to limits defined under Master Painters Institute (MPI) preparation requirements.
      a. Preparation and testing of existing painted surfaces, indicated to be repainted to accommodate new work, shall be performed as work of this Section.
      b. Specific pre-treatments noted herein or specified in MPI Repainting Manual.
      c. Sealing/priming surfaces for repainting in accordance with MPI Repainting Manual requirements.
         1) When re-painting existing surfaces, “making good surfaces” includes removal of adhesive tape, hanging devices, nails, screws, and similar items, and repair of associated surface defects to match adjoining surface.
      d. Provide for safe and adequate ventilation as required over and above temporary ventilation supplied by others, where toxic and/or volatile/flammable materials are being used.
   2. Surface preparation and prime painting surfaces for wall coverings prior to installation in accordance with MPI and wall covering manufacturer’s requirements.
   3. Priming (except where pre-primed with an approved primer under other sections of work) and painting of structural steel, miscellaneous metal, ornamental metal and primed steel equipment.
   4. Priming and back-priming of wood materials as noted herein or specified in MPI Architectural Painting Specification Manual.
   5. Painting of all semi-concealed areas (e.g. inside of light troughs and valances, behind grilles, and projecting edges above and below sight lines).
   6. Painting of exposed-to-view fire suppression, plumbing, HVAC, electrical, communication, and electronic safety and security.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Prefinished items include following factory finished components:
   2. Concealed surfaces including walls or ceilings in following generally inaccessible spaces:
      a. Foundation spaces
      b. Furred areas
      c. Ceiling plenums
      d. Utility tunnels
      e. Pipe spaces
      f. Duct shafts, unless otherwise noted
      g. Elevator shafts
   3. Finished metal surfaces include following:
      a. Anodized aluminum
      b. Stainless steel
      c. Chromium plate
      d. Copper and copper alloys
      e. Bronze and brass

4. Operating parts include moving parts of operating equipment.
    a. Valve and damper operators (including valve stems).
    b. Linkages
    c. Sensing devices
    d. Motor and fan shafts
5. Labels: Do not paint over UL, FMG, or other code required labels or equipment name, identification, performance rating, or nomenclature plates.
6. Communication Cable: Do not paint cable and protect communications cabling from overspray. Paint voids warranty of cable and if painted shall be replaced at painting contractors expense.
    a. Communications plenum cable.
    b. Communications riser cable.
    c. Communications general purpose cable.
    d. Communications cable, limited use.
    e. Under carpet communications wire and cable.

D. Related Sections include following:
1. Division 05 Sections for shop priming of metal substrates.
2. Division 09 Section “Vinyl-Coated Fabric Wall Coverings” for primer.
3. Division 09 Section "Gypsum Board Assemblies" for texture finishes and repairs.
4. Division 09 Section “High Performance Coatings” for special finishes.

1.2 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a glass range below 15 when measured at an 85-degree meter. (MPI values similar to G1 and G2).
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter. (MPI values similar to G3 and G4).
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter. (MPI values similar to G5).
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter. (MPI values similar to G6 and G7).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for application and use.
1. Provide paint system summary prepared by Manufacturer listing paint systems for each applicable material to be painted.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
1. Receipt of extra materials. Properly package materials and obtain a signed receipt.
2. At Project completion provide an itemized list complete with manufacturer, paint type and color coding of all paints used for Owner’s later use in maintenance.

1.5 QUALITY ASSURANCE

A. MPI Standards:
   1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List," unless otherwise noted.
   2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
      a. All surface requiring repainting shall be inspected by painting subcontractor who shall notify A/E, CM, and General Contractor in writing of any defects or problems, prior to commencing repainting or after preparation work.
      b. Where “special” coatings or decorative systems (i.e. textured coatings or non-MPI listed products or systems) are to be used, paint manufacturer shall provide as part of this Work, certification of all surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Owner.

B. Regulatory Requirements
   1. Conform to work place safety regulations for storage, mixing, application and disposal of all paint related materials to requirements of those authorities having jurisdiction.
   2. To reduce amount of contaminants entering waterways, sanitary/storm drain systems or into ground following procedures shall be strictly adhered to:
      a. Retain cleaning water for water-based materials to allow sediments.
      b. Retain cleaners, thinners, solvents, and excess paint and place in designated containers and ensure proper disposal.
      c. Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
      d. Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
      e. Empty paint cans are to be dry prior to disposal or recycling.
      f. Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

C. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Surface-Preparation Mockups: On existing surfaces using applicable methods recommended in MPI’s Maintenance Repainting Manual and paint manufacturer demonstrate methods of cleaning and other surface preparation, where indicated by A/E. Provide mockup sample of at least 100 sq.ft. for each type of wall substrate.
   2. A/E will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Wall and ceiling surfaces, unless otherwise noted, first-in-place 100 sq.ft. of each product and surface may serve as mockup.
         1) Provide a test patch where deep colors are indicated.
      b. Other Items: A/E will designate items or areas required.
   3. Apply benchmark samples after permanent lighting and other environmental services have been activated.
   4. Final approval of color selections will be based on benchmark samples.
      a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by A/E at no added cost to Owner.
   5. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.
   6. Subject to compliance with requirements, approved mockups may become part of completed work if undisturbed at time of Substantial Completion.

D. Preinstallation Meeting: Conduct meeting at Project site.
   1. Review methods and procedures related to painting, but not limited to, following:
      a. Construction Schedule. Verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
      b. Materials, material application, colors, patterns, and sequencing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to job site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store Materials
   1. Store only approved materials at jobsite and store only in a suitable and designated area restricted to storage of paint materials and related equipment.
      a. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
      b. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.
      c. Remove rags and waste from storage areas daily.
   2. Use means necessary to ensure safe storage and use of paint materials and prompt and safe disposal of waste.
   3. Use means necessary to protect paint materials before, during, and after application and to protect installed work and materials of other trades.
   4. Where toxic and/or volatile/explosive/flammable materials are being used, provide adequate fireproof storage lockers and take all necessary precautions and post adequate warnings as required.
   5. Take all necessary precautionary and safety measures to prevent fire hazards and spontaneous combustion and to protect environment from hazard spills. Materials that constitute a fire hazard (paints, solvents, drop clothes, etc.) shall be stored in suitable closed and rated containers and removed from site on a daily basis.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
   1. Apply solvent thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F. and 95 degrees F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above dew point; or to damp or wet surfaces.

C. Perform no interior painting or decorating work unless adequate continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above minimum requirements for 24 hours before, during, and after paint application. Provide supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

D. Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect quality of finished surfaces.

E. Perform no painting or decorating work unless a minimum lighting level of 30 foot candles is provided on surfaces to be painted.

1.8 SCHEDULING

A. Schedule painting operations to prevent disruption of and by other trades.

B. Schedule painting operations in occupied facilities to prevent disruption of occupants in and about building. Paint shall be carried out after facility working hours or on weekends in accordance with Owner's operating requirements. Schedule work such that painted surfaces will have dried before occupants are affected. Obtain written authorization from CM or Owner for changes in work schedule.

1.9 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied in unopened cans and that are packaged for storage and identified with labels describing contents for Owner's later use in maintenance. Store where directed.
   1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers on current "MPI Approved Products List".

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

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: Paint materials selected for coating systems for each type of surface shall be product of a single manufacturer.
   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. Paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with surface to be coated; tools and equipment shall be compatible with coating to be applied.
   1. Review other Sections in which primers are provided to ensure compatibility of total system for various substrates. On request, furnish information on characteristic of finish materials to ensure use of compatible primers.

D. Thinners, when used, shall be only those thinners recommended for that purpose by manufacturer of material to be thinned.

E. All materials used shall be lead- and mercury-free and VOC-compliant with local authorities with jurisdiction.

F. Colors: As indicated in “List of Finishes.”

G. By submitting a proposal, Contractor has reviewed bidding documents with painting subcontractor and accepts Specifications as sufficient to produce approved painting results. If painting subcontractor contends that materials or number of coats specified will not produce satisfactory results, he shall so notify A/E directly or indirectly through a Bidding Contractor 10 days prior to receipt of bids for proper action.

2.3 MIXING AND TINTING

A. Unless otherwise specified or pre-approved, all paints shall be ready mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity.

B. Paste, powder, or catalyzed paint mixes shall be mixed in strict accordance with manufacturer’s written instructions.

C. Where thinner is used, addition shall not exceed paint manufacturer’s recommendations.

D. If required, thin paint for spraying in strict accordance with paint manufacturer’s instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to A/E.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Test suspect surfaces (concrete, masonry, plaster and wood surfaces) for moisture and alkalinity as required by paint manufacturer. Conduct all moisture tests using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a “cover patch test, unless otherwise required by paint manufacturer. Maximum moisture shall not exceed:
1. Gypsum Board: 12 percent

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
1. Test galvanized surfaces for chromates or other passivating treatments.

E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
1. Proper product selection, surface preparation and application affect coating performance. Coating integrity and service life will be reduced because of improperly prepared surfaces. Selection and implementation of proper surface preparation ensures coating adhesion to substrate and prolongs service life of coating system.

B. Remove and securely store all miscellaneous hardware and surface fittings/fastenings (e.g. electrical plates, mechanical louvers, door and window hardware) (e.g. hinges, knobs, locks, trim frame stops), removable rating/hazard/instruction labels, washroom accessories, light fixture trim, etc. from wall and ceiling surfaces, door and frames, prior to repainting and replace upon completion. Carefully clean and replace all such items upon completion of repainting work in each area. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes (e.g. lacquer finishes). Doors shall be removed before repainting to paint bottom and top edges and then re-hung. 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 trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Protect all adjacent interior surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, etc., from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.
   1. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, nomenclature plates, or communicating cabling.

D. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Schedule cleaning and painting application so dust and other contaminates from cleaning process will not fall on wet, newly coated surfaces.
   2. Remove incompatible primers and reprime substrate with compatible primers or provide barrier coats as required to produce paint systems indicated. Notify A/E in writing about anticipated problems using specified finish coats materials with substrates primed by others.

E. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than following:
   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
   1. Surface preparation should start with SSPC SP-1 Solvent Cleaning to remove oil/grease contamination. If galvanized surface is shinney, surface must be de-glossed and roughened in one of two ways:
      a. In mild building environments, wash with a chemical etching solution such as MPI #25.
   2. Galvanized metals are very smooth and have virtually no profile for coating to adhere to. It is important to abrade surface of galvanized metal through Brush of Blast (SSPC SP7), or an etching primer before coatings application, as recommended by paint manufacturer.
   3. Galvanized surfaces must use a primer before applying a topcoat. Topcoats will not adhere to zinc layer of galvanized surface and requires a primer to form a bond between two. Manufacturer’s water-based bonding primers as an alternative to previously used cementitious primers. An epoxy primer may also be used, however, it should be noted that epoxy primers typically require an abrasive blast-cleaned surface.

I. Gypsum Wallboard: Must be clean and dry. Fill nail heads must be set and spackled. Joints must be taped and covered with joint compound. Spackled nail heads and taped joints must be sanded smooth and all dust removed prior to painting.
   1. Vacuum wall with brush attachment.
      a. As wall is vacuumed, wipe if down with microfiber cloth. Piles of dust may accumulate near base. Be sure to vacuum this dust before you begin to paint; otherwise, it could become airborne and ruin your smoothly painted wall.
   2. Wipe down wall with microfiber cloth.
   3. Gently wash walls.
      a. Apply water sparingly. Let wall dry thoroughly before painting.
   4. Repeat steps until all traces of dust are removed.

J. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. General: Do not commence painting unless substrates are acceptable and until all environmental conditions (heating, ventilation, lighting and completion of other substrate work, if applicable) are acceptable for applications of products.

B. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual.".
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
   5. Omit first coat (primer) on metal surfaces that have been shop primed and touch-up painted, unless otherwise indicated.
   6. Where a level 5 drywall finish is specified or required in critical lighting conditions or when using non-flat finish, comply with following to optimize results:
      a. Even if initial finish was sprayed, back roll surface: Stipple pattern of roller can help hide underlying texture variations. A 1/2 inch/15 mm nap roller may offer best and most efficient results.
      b. When finish occurs in phases (stops one batch and finishes with another) painter shall “blend back” finish of each new section by shading new topcoat back over previous section with a spray gun; with a flat finish, this can effectively prevent a noticeable difference between sections finished at different dates with material from different batches.

C. Scheduling Painting: Apply first coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
   1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of undercoat, unless manufacturer’s directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.
   2. Slightly vary color of succeeding coats.

D. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate.
   1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
   2. Sand and dust between each coat to provide an anchor for next coat and to remove defects in preview coat (runs, sags, etc.) visible from a distance up to 39 inches.
   3. Deep and accent clear base colors may require 1 or 2 more coats to achieve proper hide.

E. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

F. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
   1. To avoid air entrapment in applied coats, apply material in strict accordance with manufacturer's spread rates and application requirements.

G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication and Electronic Safety and Security Work:
   1. Paint following work where exposed in equipment rooms:
      a. Mechanical, electrical, and other equipment:
         1) Exceptions:
            a) Do not paint electrical switchgear, transformers or substation equipment.
            b) Do not paint new electrical panelboards.
            c) Do not paint communication cabling.
            d) Do not paint sprinkler heads.
         2) Touch up scratches and marks and repaint such mechanical and electrical equipment and components with color, and sheen finish to match existing, unless otherwise noted or scheduled.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Tanks that do not have factory-applied final finishes.
      h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   2. Paint following work where exposed in occupied spaces:
      a. Mechanical, electrical, and other equipment:
         1) Exceptions:
            a) Do not paint electrical switchgear, transformers or substation equipment.
            b) Do not paint new electrical panelboards.
            c) Do not paint communication cabling.
            d) Do not paint sprinkler heads.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   3. Paint portions of internal surfaces of metal ducts, without liner behind air inlets and outlets that are visible from occupied spaces.

## 3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves right to invoke following procedure at any time and as often as Owner deems necessary during period when paints are being applied:
   1. Owner will engage services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will perform tests for compliance with product requirements, including dry film thicknesses.

a. Contractor shall touch up and restore painted surfaces damaged by testing.
b. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, two paints are incompatible.

B. Standard of Acceptance

1. All surfaces, preparation and paint applications shall be inspected by A/E.
2. Painted interior surfaces shall be considered to lack uniformity and soundness if any of following defects are apparent to A/E:
   a. Brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
   b. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
   c. Damage due to touching before paint is sufficiently dry or any other contributory cause.
   d. Damage due to application on moist surfaces or caused by inadequate protection from weather.
   e. Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
3. Painted surfaces shall be considered unacceptable if any of following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
   a. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
   b. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
   c. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
   d. When final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
4. Painted surfaces rejected by A/E shall be made good at expense of Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

## 3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.
2. Clean equipment and dispose of wash water/solvents as well as all other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with safety requirements of authorities having jurisdiction.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by A/E, and leave in an undamaged condition.
   1. Erect barriers or screens and post signs to warn, limit or direct traffic away or around work area as required.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE (P-CODE)

A. CMU Substrates:
   1. Institutional Low-Odor/VOC Latex System: (Code #4.14)
      a. Prime Coat: Interior/exterior latex block filler.
         1) Sherwin Williams; PreRite Block Filler.
         2) PPG; 6-15XI Speedhide Hi-Fill Latex Block Filler
         3) Benjamin Moore: Ultra Spec HP Masonry Int/Ext High Build Block Filler 571
      b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
      c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).
         1) Sherwin Williams; Pro Mar 200 Zero VOC
         2) PPG: Speedhide Zero, 0 VOC
         3) Benjamin Moore: Ultra Spec 500 Zero VOC – T537 (Low Sheen Eggshell) T546 (Semi-Gloss)
         4) Application includes, but is not limited to:
            a) Typical concrete block walls not subject to high-humidity or abuse.

B. Steel (Ferrous) Substrates:
   1. Water-Based Dry-Fall System (over shop-applied primer): (Code #5.11).
      a. Prime Coat: Not applicable.
      b. Topcoat: Waterborne dry fall, flat or eggshell.
         1) Sherwin Williams; Pro Industrial Waterborne Acrylic DryFall
         2) PPG; 6-725XI Speedhide Super Tech Interior Dry Fog.
         3) Benjamin Moore: Super Spec Sweep Up Latex, 153.
         4) Application includes, but is not limited to:
            a) Beams and joists.
            b) Supplemental roof framing components
   2. Institutional Low-Odor/VOC Latex System: (Code #5.12)
      a. Prime Coat: Rust-inhibitive primer (water based).
         1) Sherwin Williams; Pro Industrial Pro-Cryl Universal Primer
         2) PPG: 4020 Pitt-Tech Plus DTM Primer
         3) Benjamin Moore: Super Spec Metal Primer, P04.
         4) Verify compatibility with primer, if shop-applied primer is used.
      b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
      c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).
         1) Sherwin Williams; B66-600 Pro Industrial Acrylic or Pro Industrial Waterbased Alykd Urethane, B53-1150
         2) PPG: 4216HP Pitt-Tech Plus DTM.
         3) Benjamin Moore: Super Spec HP P28
         4) Application includes, but is not limited to:
            a) Columns, main frame columns, beams, girts, purlins and joists.
            b) Supplemental wall framing, opening framing, and bracing.
            c) Hollow metal doors, including vision lite kits, frames, door mullions and astragals.
            d) Access doors**.**
            e) Exposed to view, in public areas, fire suppression, plumbing, HVAC, electrical communication, and electronic safety and security unfinished items.

C. Galvanized-Metal Substrates:
   1. Water-Based Dry-Fall System: (Code #5.31)
      a. Prime Coat: Waterborne dry fall.
      b. Topcoat: Waterborne dry fall, flat or eggshell.
         1) Sherwin Williams; Pro Industrial Waterborne Acrylic DryFall
         2) PPG; 6-725XI Speedhide Super Tech Interior Dry Fog.
         3) Benjamin Moore: Super Spec Sweep Up Latex, 153.
         4) Application includes, but is not limited to:
            a) Overhead decking, pipes, ducts, etc.
   2. Institutional Low-Odor/VOC Latex System: MPI INT 5.3N. (Code #5.32).
      a. Prime Coat: Waterborne galvanized-metal bonding primer. MPI #134.
         1) Sherwin Williams: Pro Industrial Pro-Cryl Universal Primer
         2) PPG: 4020 Pitt-Tech Plus DTM Primer
         3) Benjamin Moore: Super Spec Metal Primer, P04.
         4) Note: Primer may be omitted, if not required by paint manufacturer.
      b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
      c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).
         1) Sherwin Williams: B66-600 Pro Industrial Acrylic or Pro Industrial Waterbased Alkyd Urethane B53-1150
         2) PPG; 4216HP Pitt-Tech Plus DTM
         3) Benjamin Moore: Super Spec HP P28
         4) Application includes, but is not limited to:
            a) Other non-ferrous surfaces.

D. Gypsum Board Substrates:
   1. Institutional Low-Odor/VOC Latex System: (Code #9.21)
      a. Prime Coat: Interior latex primer/sealer. .
         1) Sherwin Williams; Pro Mar 200 Zero VOC Latex Primer
         2) PPG; 6-2 Speedhide Quick Drying Latex Sealer
         3) Benjamin Moore: Super Spec, 253.
      b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
      c. Topcoat: Institutional low-odor/VOC interior latex flat.
         1) Sherwin Williams; Pro Mar 200 Zero VOC
         2) PPG; Speedhide Zero, 0 VOC
         3) Benjamin Moore: Ultra Spec 500, N539
         4) Application includes, but is not limited to:
            a) Horizontal gypsum surfaces.
   2. Institutional Low-Odor/VOC Latex System: (Code #9.23)
      a. Prime Coat: Interior latex primer/sealer.
         1) Sherwin Williams; Pro Mar 200 Zero VOC Latex Primer
         2) PPG; 6-2 Speedhide Quick Drying Latex Sealer
         3) Benjamin Moore: Ultra Spec 500 Interior Zero VOC Latex Primer N534
      b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
      c. Topcoat: Institutional low-odor/VOC interior latex semigloss.
         1) Sherwin Williams; Pro Mar 200 Zero VOC
         2) PPG; Speedhide Zero, 0 VOC
         3) Benjamin Moore: Ultra Spec 500 Interior Zero VOC Semi-Gloss T546
         4) Application includes, but is not limited to:
            a) Vertical gypsum surfaces where cleaning is likely to occur

E. Cotton or Canvas and ASJ Insulation-Covering Substrates:
   1. Institutional Low-Odor/VOC Latex System: (Code #10.11)
      a. Prime Coat: Interior latex primer/sealer.
         1) Sherwin Williams; Pro Mar 200 Zero VOC Latex Primer
         2) PPG; 6-2 Speedhide Quick Drying Latex Sealer
         3) Benjamin Moore: Super Spec, 253.
      b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.

c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).
   1) Sherwin Williams; Pro Mar 200 Zero VOC
   2) PPG; Speedhide Zero, 0 VOC
   3) Benjamin Moore: Ultra Spec 500, N539
   4) Application includes, but is not limited to:
      a) Pipe and duct coverings.

END OF SECTION 09 91 23.00

## SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and application of high-performance coating systems (HPC) on the following substrates:
   1. Exterior Substrates:
      a. Galvanized metal.
   2. Interior Substrates:
      a. Steel and Galvanized steel
      b. Concrete masonry units.
      c. Gypsum board.

B. Related Sections include the following:
   1. Division 05 Sections for shop priming of metal substrates.
   2. Division 09 painting Sections for special-use coatings and general field painting.

1.2 DEFINITIONS

A. Standard coating terms defined in ASTM D 16 apply to this Section.

B. Gloss ranges used in this Section include the following:
   1. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter. (MPI value similar to G5).
   2. High gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter. (MPI values similar to G6 and G7).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Provide paint system summary prepared by Manufacturer listing paint systems for each applicable material to be painted.

B. Samples for Verification: For each type of coating system and in each color and gloss of finish coat indicated.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Receipt of extra materials.

1.5 QUALITY ASSURANCE

A. Master Painters Institute (MPI) Standards:
   1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
   2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and coating systems indicated.

B. Mockups: Apply benchmark samples of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. A/E will select one surface to represent surfaces and conditions for application of each type of coating and substrate.
      a. Wall and Ceiling Surfaces: Unless otherwise noted, first-in-place 100 sq.ft. of each product and surface may serve as mockup.
      b. Other Items: A/E will designate items or areas required.
   2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
   3. Final approval of color selections will be based on benchmark samples.
      a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by A/E at no added cost to Owner.
   4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.
   5. 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. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:
   1. Name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. Handling instructions and precautions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers on the current “MPI Approved Product List”.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL (HPC)

A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."

B. Material Compatibility:
   1. Provide materials for use within each coating 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 coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
   3. Provide products of same manufacturer for each coat in a coating system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
   1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
      a. Concrete: 12 percent.
      b. Gypsum Board: 12 percent.
      c. Masonry (Clay and CMU): 12 percent.

B. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

C. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Coating application indicates acceptance of surfaces and conditions.

E. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.
   1. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
      a. Confirmation of primer's suitability for expected service conditions.
      b. Confirmation of primer's ability to be top coated with materials specified.
   2. Notify A/E about anticipated problems before using the coatings specified over substrates primed by others.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
   1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

C. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Schedule cleaning and coating application so dust and other contaminates from cleaning process will not fall on wet, newly coated surfaces.
2. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
1. Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
2. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

E. CMU Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust and loose mill scale.
1. Clean using methods recommended in writing by coating manufacturer, but not less than the following:
a. SSPC-SP6/NACE No. 3, "Commercial Blast Cleaning."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

I. Gypsum Wallboard: Must be clean and dry. Fill nail heads must be set and spackled. Joints must be taped and covered with joint compound. Spackled nail heads and taped joints must be sanded smooth and all dust removed prior to painting.
1. Vacuum wall with brush attachment.
a. As wall is vacuumed, wipe if down with microfiber cloth. Piles of dust may accumulate near base. Be sure to vacuum this dust before you begin to paint; otherwise, it could become airborne and ruin your smoothly painted wall.
2. Wipe down wall with microfiber cloth.
3. Gently wash walls.
a. Apply water sparingly. Let wall dry thoroughly before painting.
4. Repeat steps until all traces of dust are removed.

## 3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions.
1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

## 3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:
   1. Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will perform tests for compliance with specified requirements.
   3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

B. Dry Film Thickness Testing: Owner reserves the right to engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
   1. Contractor shall touch up and restore coated surfaces damaged by testing.
   2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

## 3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by A/E, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

## 3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Galvanized-Metal Substrates:
   1. W.B. Light Industrial Coating System: (Code #5.311).
      a. Prime Coat:
         1) Sherwin Williams:
         2) PPG: 90-712, Pitt-Tech Int/Ext Primer Finish DTM
      b. Intermediate Coat: W.B. Light Industrial Coating, matching topcoat (semi-gloss).
      c. Topcoat: W.B. Light Industrial Coating, (semi-gloss).
         1) Sherwin Williams:
         2) PPG: 4216HP, Pitt-Tech Plus Int/Ext DTM Industrial Enamel.
      d. Application includes, but is not limited to:
         1) Exposed lintels.

2. Pigmented Polyurethane and Epoxy Primer System: (Code #5.321).
    a. Prime Coat: Primer.
        1) Sherwin Williams; Macropoxy 641.
        2) PPG; Amerlock 2 VOC
    b. Intermediate Coat: Same as Topcoat.
    c. Topcoat: Polyurethane, two-component, pigmented gloss (Gloss Level 6).
        1) Sherwin Williams; Pro-Industrial WB Acrolon 100 Polyurethane
        2) PPG; 95-3300 Durethane DTM Urethane Mastic
    d. Application includes, but is not limited to:
        1) Steel plate door jambs
        2) Steel bollards
        3) Downspout boot assemblies
        4) Hollow metal doors and frames.

## 3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:
1. W.B. Light Industrial Coating System: (Code #5.223).
    a. Prime Coat:
        1) Sherwin Williams: Pro-Cryl Universal Primer
        2) PPG: 90-712 Pitt-Tech DTM Primer
    b. Intermediate Coat: W.B. Light Industrial Coating, gloss.
    c. Topcoat: W.B. Light Industrial Coating, gloss.
        1) Sherwin Williams: Pro Industrial WB Urethane Alykd.
        2) PPG: Aquacron 870 Series WB Polyurethane.
    d. Application includes, but is not limited to:
        1) Exposed columns and main frame columns from 10’-0” to finish floor.

B. Galvanized-Metal Substrates:
1. W.B. Light Industrial Coating System: (Code #5.322)
    a. Prime Coat: primer.
        1) Note: Primer maybe omitted on recommendations by manufacturer.
        2) Sherwin Williams; Pro-Cryl Universal Primer
        3) PPG; 90-712 Pitt-Tech DTM Primer
    b. Intermediate Coat: W.B. Light Industrial Coating, semi-gloss.
    c. Topcoat: W.B. Light Industrial Coating, semi-gloss.
        1) Sherwin Williams: Pro Industrial Waterborne Urethane
        2) PPG: Aquacron 870 Series WB Polyurethane.
    d. Application includes, but is not limited to:
        1) High contact traffic areas (doors, frames, railings, pipes, etc.).

C. CMU Substrates:
1. Water-Based Epoxy Coating System: (Code #4.224).
    a. Prime Coat: Interior/exterior latex block filler.
        1) Sherwin Williams; Pro Industrial Heavy Duty Block Filler
        2) PPG; 6-15XI Speedhide Hi-Fill Block Filler
    b. Intermediate Coat: Water-based epoxy (interior), semi-gloss.
    c. Topcoat: Water-based epoxy (interior), semi-gloss.
        1) Sherwin Williams; Pro Industrial Pre-Catalyzed Epoxy
        2) PPG; 16-510 Pitt-Glaze WB1 Pre-Catalyzed Epoxy
    d. Application includes, but is not limited to:
        1) Dry environments additional abrasion-resistance is required (for example, toilet rooms, locker rooms).

D. Gypsum Board Substrates:
   1. Water-Based Epoxy Coating System: (Code 9.211).
      a. Prime Coat: Interior latex primer/sealer.
         1) Sherwin Williams; ProMar 200 Zero VOC Interior Latex Primer
         2) PPG; 6-2 Speedhide Quick Drying Latex Sealer
         3) Benjamin Moore; Ultra Spec 500 Interior Latex Primer N534
      b. Intermediate Coat: Water-based epoxy (interior and exterior).
      c. Topcoat: Water-based epoxy, semi-gloss (interior and exterior), semi-gloss.
         1) Sherwin Williams; Pro Industrial Pre-Catalyzed Epoxy
         2) PPG; 16-1510 Pitt-Glaze WB1 Pre-Catalyzed Epoxy
         3) Benjamin Moore; Corotech Pre-Catalyzed Waterborne Epoxy V341
      d. Application includes, but is not limited to:
         1) High traffic areas where frequent cleaning with detergent and industrial cleaners is likely to occur e.g. toilet room.

END OF SECTION 09 96 00

**SECTION 09 96 63 - INTERIOR FINISH SYSTEM**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation and interior finish system (IFS) as indicated.
   1. Ceiling installation.

B. Work of This Section; But Specified Elsewhere
   1. Division 07 Section “Joint Sealants”.

C. Related Sections:
   1. Division 09 Section “Gypsum Board Assemblies”: For metal framing.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical information for each component of systems specified.
   1. Include technical information, basic materials analysis and instructions for handling, storage, and application.
   2. List each coating material and cross reference the specific coating application. Identify each material by manufacturer's catalog number and general classification.

B. Samples for Initial Color Selection: Manufacturer's color charts.

1.3 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: Methods for maintaining coating and precautions for using cleaning materials and methods that could be detrimental to the finish and performance.
   2. Warranty: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Interior Finish System Applicator Qualifications: Applicator shall be approved or certified by the material manufacturer.
   1. Installation workmen shall be thoroughly trained and experienced in skills required and shall be completely familiar with manufacturer's current methods of installation as well as requirements of this Work.

B. Mock-Up: Apply 10 square feet of interior finish system on specified substrate at location on Project as directed by the A/E. Upon approval by A/E, mock-up will demonstrate minimum standard for the Work.
   1. Provide mock-up of ceiling installation. Mock-up may become part of completed work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in original unopened packaging with legible manufacturer's identification.
   1. Upon arrival, materials shall be inspected for physical damage, freezing or overheating. Questionable materials shall not be used.

B. Store products in a cool dry place out of direct sunlight, protected from the elements and from damage.
   1. Store at a temperature of not less than 50 degrees F.

1.6 FIELD CONDITIONS

A. Environmental Requirements
   1. Application of the system shall be in ambient temperatures above 50 degrees F. Substrate system shall also be above 50 degrees F.
      a. For installation in temperatures less than 50 degrees F, supplementary heat shall be provided.
   2. A minimum ambient temperature of 50 degrees F shall be maintained for at least 24 hours after the system installation.
   3. Adequate fresh air and ventilation during application shall be provided.

B. Protection
   1. Protect surrounding areas and surfaces to preclude damage during application of the system.
   2. Protect finished Work when stopping for the day or when completing an area in order that water will not penetrate behind the system.

C. Coordination
   1. The Work of this Section requires close coordination between related sections.
   2. Joints to be caulked shall be done immediately after the installation of the system as recommended by manufacturer.

D. Scheduling: Sufficient manpower and equipment shall be employed to ensure a continuous operation, free of cold joints, scaffold lines, texture variations, etc.

1.7 WARRANTY

A. Interior Finish System: The complete installation of the system shall be jointly warranted by the installer and the manufacturer against defects in material and workmanship for a period of 5 years following installation and acceptance by the Owner. The warranty shall be submitted in writing through the A/E to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: StoQuick Finish for Pool Rooms; STO Industries, Inc. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
   1. Firestone, Simplex Products Div.
   2. Parex
   3. Senergy, Inc.
   4. Dryvit Systems, Inc. (Dryvit Architectural Finishes for Indoor Pool Areas)
   5. Omega Products International, Inc.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Source Limitations: Option interior finish system from single source from single IFS manufacturer and from sources approved by IFS manufacturer as compatible with IFS components.

2.2 SHEATHING

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Sheathing: Provide one of the following, per manufacturers recommendations and system requirements:
   1. Glass Mat Gypsum Backing Board: ASTM C 1178.
      a. Core: 5/8 inch, Type X.
   2. Exterior Cement Board: Not less than 7/16 inch, fiber cement board complying with ASTM C1186, Type A, for exterior applications.
      a. Fasteners: Wafer head or hard-roc steel drill screws complying with ASTM C954, with an organic polymer coating or other corrosion protective coating having a salt-spray resistance of more than 500 hours per ASTM B117.
         1) Size and Length: As recommended by sheathing manufacturer for type and thickness of sheathing board to be attached.
   3. Tile Backer: ASTM C1179, Type X.
      a. Core: 5/8 inch, ASTM C36, Type X.

2.3 INTERIOR FINISH SYSTEM - MATERIALS

A. Job Mix Ingredients
   1. Water: Shall be clear, clean and potable, without any foreign matter in solution which might affect the color or setting qualities of the cement, adhesive, or finish coat; mixed in at factory.
   2. Portland Cement: ASTM C150, Type I.

B. Reinforcing Mesh: Nominal 4.5 oz./sq. yd., symmetrical, interlaced open weave glass fiber fabric made with minimum 25 percent by weight alkaline resistant coating for compatibility with IFS system manufacturers.

C. Base Coat: Acrylic based, fiber reinforced, flexible waterproofer.
   1. Basis of Design: Sto Flexyl or Sto Watertight Coat.

D. Primer: A synthetic resin, pigmented, copolymer based primer. Tint to same shade as finish.

E. Finish Coat Materials: IFS manufacturer's siliconized acrylic based coating complying with the following requirements for material composition and method of combined materials:
   1. Factory mixed formulation of polymer emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
   2. Texture: Fine sand finish**.**
   3. Color: As selected by A/E from manufacturer's standards unless otherwise noted in "List of Finishes".
      a. Multiple colors may be selected.

2.4 ACCESSORIES

A. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with IFS manufacturer's written requirements; manufactured from UV stabilized PVC; and complying with ASTM D1784, manufacturer's standard Cell Class for use intended, and ASTM C1063.
   1. Casing Bead: Prefabricated one piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
   2. Expansion/Control Joint: Prefabricated one piece V profile; designed to relieve stress of movement.

B. Elastomeric Sealant Products: Provide IFS manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials, and complies with requirements for products and testing indicated in EIMA's "EIMA Guide for Use of Sealants with Exterior Insulation and Finish Systems, Class PB" and with requirements in Division 07 Section "Joint Sealants" for products corresponding to description indicated below:
   1. Low modulus, nonacid curing silicone sealant.

2.5 INTERIOR FINISH SYSTEM – MIXING

A. Materials shall be mixed in clean plastic containers, free of foreign substance. Do not use container which has been used for or cleaned with a petroleum product.

B. Finish
   1. Thoroughly mix the factory prepared finish material with the high speed mixer, until a uniform workable consistency is attained.
      a. A small amount of clean potable water may be added to adjust workability.

C. Mix components in strict accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.1 SUBSTRATE INSTALLATION METHODS

A. Gypsum Board Application and Finish Standards: ASTM C 840.

B. Apply sheathing panels perpendicular to supports, with end joints staggered and located over supports.
   1. Install with 1/4 inch open space where panels abut other construction or structural penetrations.
   2. Fasten with corrosion resistant screws.

3.2 INTERIOR FINISH SYSTEM - INSTALLATION

A. Installation, General: Materials shall be mixed and applied in accordance with manufacturer’s published product data sheets for the individual products specified.
   1. Under no circumstances shall products be altered by adding any additives, except for small amounts of clean water as directed on the label. Antifreeze, accelerators, rapid binders, etc., are forbidden.

B. The surface to receive the interior finish system shall be clean and dry. Substrate joints shall be taped and sanded smooth.

C. Base Coat: Apply to exposed surfaces of insulation in minimum thickness recommended in writing by IFS manufacturer, but not less than 1/16 inch dry coat thickness.

D. Trim Accessories: Mechanically fasten accessories to framing members, masonry, or concrete at perimeter and control joints.

E. Reinforcing Mesh: Embed type indicated below in wet base coat to produce wrinkle free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer’s written requirements. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base coat material if necessary, so reinforcing mesh color and pattern are not visible.
   1. Standard impact reinforcing mesh.

F. Primer: Apply over dry base coat according to IFS manufacturer’s written instructions.

G. Finish Coat: Apply over dry primer, maintaining a wet edge at all times for uniform appearance in thickness required by IFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

H. Provide expansion/control joints at locations specifically recommended by manufacturer and in general conformance with the following:
   1. Control joints shall be installed for a maximum of 900 square foot area, or every 30 LF.
   2. At expansion or control joints in the substrate.
   3. Where IFS system is applied to dissimilar substrates.

3.3 INSTALLATION OF JOINT SEALANTS

A. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements in Division 07 Section “Joint Sealants” and in EIMA’s “EIMA Guide for Use of Sealants with Exterior Insulation and Finish System, Class PB.”
   1. Clean surfaces to receive sealants to comply with indicated requirements and IFS manufacturer’s written instructions.
   2. Apply primer recommended in writing by sealant manufacturer for surfaces to be sealed.
   3. Install sealant backing to control depth and configuration of sealant joint and to prevent sealant from adhering to back of joint.
   4. Apply masking tape to protect areas adjacent to sealant joints. Remove tape immediately after tooling joints, without disturbing joint seal.

3.4 CLEAN-UP AND PROTECTION

A. Clean-Up: During progress of Work remove from site discarded coatings materials, rubbish, cans, and rags at end of each work day.

B. Protection: Protect work of other trades, whether to be coated or not, against damage by coating and finishing work. Correct any damage by cleaning, repairing, or replacing and repainting, as acceptable to A/E.

C. Provide: "WET PAINT" signs as required to protect newly coated surfaces. Remove temporary protective wrappings and completion of coating operations.

D. After completion of Work of other trades, touch-up and restore damaged or defaced coated surfaces.

END OF SECTION 09 96 63

# DIVISION 10 SPECIALTIES

# SECTION 10 11 00 - VISUAL DISPLAY UNITS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
   1. Visual display board assemblies
      a. Markerboards (MB).

### 1.2 DEFINITIONS

A. Tackboard: Framed or unframed, tackable, visual display board assembly.

B. Visual Display Board Assembly: Visual display surface that is factory-fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.

C. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

### 1.3 PREINSTALLATION MEETINGS

A. Preinstall Meeting: Conduct meeting at Project site.
   1. Review blocking requirements.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show location of joints, between units. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
   2. Show location of special-purpose graphics for visual display surfaces.
   3. Include sections of typical trim members.

### 1.5 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: For visual display surfaces to include in maintenance manuals.
   2. Warranties: Special warranties specified in this Section.

### 1.6 QUALITY ASSURANCE

A. Units shall be factory-assembled, unless otherwise noted.

B. Fire-Test-Response Characteristics: Provide fabrics with the surface-burning characteristics indicated (Class A per applicable building code), as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Flame Spread: 25 or less.
   2. Smoke Developed: 50 or less.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display boards, including factory-applied trim, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured board size, provide two or more pieces of equal length as acceptable to A/E. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display units vertically with packing materials between each unit.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating visual display surfaces without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to established dimensions.
   2. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.9 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Surfaces lose original writing and erasing qualities.
      b. Surfaces become slick or shiny.
      c. Surfaces exhibit crazing, cracking, or flaking.
   2. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Product: Subject to compliance with requirements, provide product specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: PEI-1002, with manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; 1.7 to 2.5 mil thick ground coat, and color cover coat; and concealed face coated with primer and 1.7 to 2.5 mil thick ground coat.
   1. Gloss Finish: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser.

B. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.

C. Fiberboard:
   1. Cellulosic or Wood Fiberboard: ASTM C208 and ASTM C209.
   2. Mineral Fiberboard: ASTM C612.
   3. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.

D. Hardboard: ANSI/AHA A135.4, Class 1, tempered.

E. Natural Cork Sheet: Seamless, single layer, compressed fine-grain cork sheet, bulletin board quality; face sanded for natural finish, with surface-burning characteristics indicated.

F. Plastic-Impregnated Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto burlap backing; with washable vinyl finish and integral color throughout, with surface-burning characteristics indicated.

G. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.3 MARKERBOARD ASSEMBLIES (MB)

A. Porcelain-Enamel Markerboard Assembly (MB): Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and minimum 0.0209-inch- thick (fka 25 gauge), porcelain-enamel face sheet with high-gloss finish.
   1. Manufacturers:
      a. AARCO Products, Inc.
      b. ADP/Lemco, Inc.
      c. Best-Rite Manufacturing by MooreCo, Inc.
      d. Claridge Products & Equipment, Inc.
      e. Ghent Manufacturing Inc.
      f. Marsh Industries, Inc.
      g. Platinum Visual Systems; a division of ABC School Equipment, Inc.
      h. Cig Jan Products Ltd.
      i. K-Pro Specialty Products.
      j. Nelson Adams Naco
   2. Core: Particleboard (3/8 inch thick, minimum); with 0.005-inch- thick, aluminum foil backing, minimum.
      a. Manufacturer’s Option: Medium-density fiberboard (3/8-inch thick, minimum) may be substituted for particleboard.
   3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.
   4. Edges: Mitered extruded aluminum J-shaped channels. No exposed fasteners permitted.
   5. Color: As selected by A/E from full range of industry colors.

B. Melamine and high-pressure laminate markerboard assemblies are not acceptable.

2.4 MARKERBOARD AND TACKBOARD ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; of size and shape indicated.

1. Factory-Applied Trim: Manufacturer's standard, unless otherwise noted.
    a. Where boards exceed maximum manufactured lengths, provide snap-on trims with no visible screws or exposed joints for field-application.
    b. Limit projection of frame from board surface to 3/8 inch or less.

B. Chalktray: Manufacturer's standard, continuous.
1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
2. Solid Type: Not acceptable.

C. Display/Map Rail: Manufacturer’s standard, extruded-aluminum display rail designed to hold the following accessories:
1. Display Rail: Continuous and integral with rail; fabricated from plastic-impregnated cork approximately 1 to 2 inches high, unless otherwise noted.
    a. Color: As selected by Architect from full range of industry colors.
2. End Stops: Located at each end of map rail.
3. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of map rail or fraction thereof.
4. Flag Holder: One for each room.
5. Paper Holder: Extruded aluminum; designed to hold paper by clamping action, provide two per map rail.

## 2.5 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
1. Height of visual display assemblies shall be four feet, unless otherwise noted.

B. Visual Display Boards: Factory-assemble visual display boards, unless otherwise indicated.
1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
2. Provide manufacturer's standard vertical-joint hidden spline system between abutting sections of chalkboards or markerboards.
    a. H-trim is not acceptable.
3. Provide manufacturer's standard mullion trim at joints between chalkboards, markerboards, and tackboards of combination units.
4. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by A/E from manufacturer's standard structural support accessories to suit conditions indicated.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.
1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

## 2.6 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine walls and partitions for proper backing for visual display surfaces.

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

### 3.2 PREPARATION

A. Comply with manufacturer’s written instructions for surface preparation. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.

### 3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Field-Assembled Visual Display Units: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.
   1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
   2. Provide manufacturer's standard vertical-joint spline system between abutting sections of chalkboards or markerboards.
      a. H-trim will not be acceptable.
   3. Provide manufacturer's standard mullion trim at joints between chalkboards or markerboards and tackboards of combination units.

### 3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY UNITS

A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.
   1. Install end stops at each end of map rail.

### 3.5 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 10 11 00

## SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cast dimensional characters.

B. Related Sections
   1. Division 10 Section “Interior Panel Signage”, including molded-plastic dimensional letters.

1.2 COORDINATION

A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.3 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 Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
   1. Include representative Samples of available typestyles and graphic symbols.

1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: For signs to include in maintenance manuals.
   2. Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Deterioration of finishes beyond normal weathering.
    b. Separation or delamination of sheet materials and components.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturers: Subject to compliance with requirements, provide signage by one of the manufacturers specified herein.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” Sample sign, and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 DIMENSIONAL CHARACTERS

A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
    1. Manufacturers: Subject to compliance with requirements, provide signage by one of the manufacturers specified.
        a. A.R.K. Ramos
        b. ASI – Sign Systems, Inc.
        c. Innerface Sign Systems, Inc.
        d. Metal Arts; Div. of L & H Mfg.
        e. Metallic Arts
        f. Mohawk Sign Systems
        g. Southwell Co.
        h. Gemini Incorp.
        i. ACE Sign Systems
        j. Jarob
        k. Mathews International
        l. Interior Graphic Systems
        m. Ellet Sign Company
        n. Cosco
        o. Essential Architectural Signs
        p. Landmark Sign
    2. Character Material: Cast aluminum.
    3. Character Height: As indicated on Drawings.
    4. Thickness: Manufacturer's standard for size of character.
    5. Finishes:
        a. Powder-Coat Finish: Custom color to match “school color” as supplied by A/E and Owner.
        b. Overcoat: Manufacturer's standard baked-on clear coating.
    6. Mounting: Concealed studs.
    7. Typeface: As indicated on Drawings.
    8. Location: Exterior.

2.3 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Castings: ASTM B 26, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

## 2.4 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. 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. Adhesive: As recommended by sign manufacturer. Do not use double faced tape without adhesive.

## 2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
   4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   5. Internally brace signs for stability and for securing fasteners.
   6. 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.
   7. 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.

## 2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

## 2.7 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that electrical service is correctly sized and located to accommodate signs.

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

3.2 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.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 19

## SECTION 10 14 33 – EXTERIOR ILLUMINATED PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Internally Illuminated panel logo signage, wall mounted.

B. Related Sections include the following:
   1. Division 10 Section “Dimensional Letter Signage”.
   2. Division 10 Section “Interior Panel Signage”.

1.2 DEFINITIONS

A. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

1.3 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details for signs.
   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   3. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
   4. Show locations of electrically powered.
   5. Include diagrams for power signal and control wiring.

C. Closeout Submittals:
   1. Maintenance Data: For signs to include in maintenance manuals.
   2. Warranty: Special warranty specified in this Section.

1.5 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Deterioration of embedded graphic image, colors, and sign lamination.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturers: Subject to compliance with requirements, provide signage by one of the manufacturers specified.

1. Panel Signs
    a. A1 Signs
    b. Archetype
    c. Architectural Design & Signs
    d. MS Signs, Inc.
    e. Poblocki Sign Co.
    f. Stewart Signs
    g. Essential Architectural Signs, Inc.
    h. Landmark Sign
    i. ISF Signs
    j. FastSigns

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" Sample sign, and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
    1. Uniform Wind Load: As indicated on Drawings.

2.3 MATERIALS

A. Polycarbonate Sheet: ASTM C 1349, Appendix XI, Type II (coated, mar-resistant, UV-stabilized polycarbonate), with coatings on both sides.

2.4 PANEL SIGNS (EXTERIOR)

A. Illuminated Panel Logo Signs: Facelighted construction with LED lighting including transformers, insulation, and other accessories for operability, with provision for serving 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 sign surfaces as needed to illuminate evenly.
    1. Power: 277V, 1 phase, 20 amp, or with an MVOLT LED driver (120-277 Volts).
        a. Lighting shall be a pre-wired assembly with all components and pigtails for ease of connection to building power source.
        b. Provide ballast brackets as required along with enclosed electrical raceway covers.
    2. Lighting shall be minimum 7100K bright white LED.
    3. Aluminum body shall be sheet or plate material in thickness as required for size of logo, minimum 0.090 inch thick.
        a. Body assembly shall be fully welded watertight construction with gaskets to seal connections and overlap of other materials.
            1) Weeps: Provide weep holes to drain water from lowest parts of logo configuration where water potentially could collect.
        b. Frame: Exposed and painted extruded or formed aluminum.
        c. Provide concealed hinges or frame/cover retainers to allow access to interior of signage and servicing of lighting assembly.
        d. Provide internal aluminum flange supports for rigidity of the body and face sheet.
        e. Provide supplemental aluminum framing or construction for attachment of concealed mounting hardware.
        f. Finish: Exposed surfaces shall be painted in color as selected by A/E.
    4. Translucent Face Sheet: Provide the following as recommended by manufacturer for application indicated.
        a. Laminate Polycarbonate-Sheet Sign: Acrylic or Polycarbonate face sheet laminate to a base sheet, minimum of 0.125 inch thick.
            1) Graphic: Screen printing or vinyl graphic decal in multiple colors.

5. Frame: Entire perimeter.
   a. Material: Aluminum.
   b. Depth: 4 - 5 inches.
6. Mounting: Manufacturer’s standard concealed fastening method for substrates indicated.
7. Surface Finish and Applied Graphics:
   a. Integral Aluminum Finish: Powder-Coat Finish: Manufacturer's standard, in color as selected by A/E from manufacturer's full range.
8. Fasteners: Provide screws, bolts, and other fastening devices made from same material as items being fastened, except provide hot-dip galvanized, stainless-steel, or aluminum fasteners for exterior applications. Provide types, sizes, and lengths to suit installation conditions. Use security fasteners where exposed to view.

## 2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer’s standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, complying with the following:
   1. Use concealed fasteners and anchors, unless indicated to be exposed.

## 2.6 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.
   1. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
   2. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
   3. Conceal fasteners if possible; otherwise, locate fasteners where they will be 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.

## 2.7 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces, unless otherwise indicated.

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

## 3.2 INSTALLATION

A. General: Install signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.

2. Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
3. Install signs so they do not protrude or obstruct according to the accessibility standard.
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 sign. Remove loose debris from hole and substrate surface.

C. Wall-Mounted Panel Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
1. Mounting Brackets: Aluminum or galvanized steel mounting brackets shall be concealed behind sign assembly. Sign assembly shall be secured to mounting brackets and have ability to be removed or sections removed for service.
a. Provide aluminum shims as required by profile of metal panels to mount panel sign on level and plumb.
2. Provide fasteners appropriate substrate, profiled metal wall panels.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 00

## SECTION 10 21 13.19 – SOLID POLYMER TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes solid-polymer units as follows:
   1. Toilet Enclosures: Overhead braced.
   2. Urinal Screens: Wall hung.

B. Related Sections include the following:
   1. Division 06 Section “Rough Carpentry” for blocking.
   2. Division 10 Section "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.
   5. Product Certificates: For each type of toilet compartment, from manufacturer verifying flammability characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of floor drains.
   3. Details including anchoring components (bolt layouts) and methods for project conditions; indicate components required for installation, but not supplied by toilet compartment manufacturer.

C. Samples for Verification: Of each type of color/pattern, texture, and finish required for units, prepared on 6-inch- square Samples of same thickness and material indicated for Work.

1.3 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Warranty: Special warranties specified in this Section.
   2. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.5 WARRANTY

A. Toilet compartment manufacturer shall warrant plastic panels for 5 years against warping and defect.
   1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOLID-POLYMER UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   1. Toilet Compartments: Solid High Density Polyethylene (HDPE).
      a. Accurate Partitions Corp., ASI Group.
      b. General Partitions Mfg. Corp.
      c. Global Steel Products Corp., ASI Group.
      d. Scranton Products (Hiny Hiders fka Santana/Comtec/Capitol).
      e. Partition System International of South Carolina (PSISC); Columbia Systems International of South Carolina LLC
      f. Rockville Partitions Incorporated
      g. Metpar Corp.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural and Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities," ICC/ANSI A117.1 and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
   1. Where dressing and fitting rooms are provided for use by the general public or employees, 5 percent, but never less than one, of the dressing for each type of use in each cluster of dressing rooms shall be accessible.

B. Flammability Characteristics: High-density polyethylene or polypropylene shall be tested in accordance with the NFPA 286 Standard Methods of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth” and meet the “Pass-Fail” criteria contained in the local codes and required by authorities with jurisdiction.

2.3 COMPARTMENTS AND SCREENS

A. Toilet-Enclosure Style: Overhead braced.

B. Urinal-Screen Style: Wall hung.

C. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE)panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
   1. Heat-Sink Strip: Manuafcturer’s standard continuous, stainless steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
   2. Color and Pattern and Texture: One color and pattern in each room as selected by A/E from manufacturer’s full range of colors and patterns.

D. Urinal-Screen Construction: Matching panel construction.

E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; polymer.
   1. Polymer Color and Pattern: Matching pilaster.

F. Brackets (Fittings):
   1. Full-Height (Continuous) Type, unless otherwise noted: Manufacturer's standard design; stainless steel.
   2. Provide stirrup type, ear or U-brackets, clear-anodized aluminum or stainless steel at ambulatory accessible toilet compartments as required to accommodate a clear width opening of 32 inches minimum with the door open 90 degrees.

2.4 COMPONENTS

A. Doors and Dividing Panels: Privacy stile, no sightlines, where full height units are not indicated.
   1. 55 to 58 inches high, mounted 14 inches above finished floor.
   2. Doors: 60 degree angle on two opposite edges for enhanced privacy.
      a. Manufacturer’s standard no-sightline fabrication acceptable.

B. Sightlines: Provide brackets and components to provide no minimum sightlines where full height units are not indicated.

2.5 HARDWARE AND ACCESSORIES

A. Hardware and Accessories, Heavy Duty: Manufacturer's heavy-duty operating hardware and accessories.
   1. Hinges: Manufacturer's minimum 0.062-inch- (1.59-mm-) thick stainless steel continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door. Mount with through bolts.
   2. Latch and Keeper: Manufacturer's heavy-duty, surface-mounted, cast-stainless steel latch unit, designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through bolts.
   3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless steel hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories. Mount with through bolts.
   4. Door Bumper: Manufacturer's heavy-duty, rubber-tipped, cast-stainless steel bumper at outswinging doors. Mount with through bolts.
   5. Door Pull: Manufacturer's heavy-duty, cast-stainless steel pull at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through bolts.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.6 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221 (ASTM B221M).

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

D. Stainless Steel Castings: ASTM A743/A743M.

2.7 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, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Doors: 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 indicated to be accessible to people with disabilities.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
   1. Confirm location and adequacy of blocking and supports required for installation.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch.
      b. Panels and Walls: 1 inch.
   2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets, unless otherwise noted.
      a. Where required to provide a 32-inch clear opening, install panel-to-pilaster with no fewer than three brackets attached at midpoint and near top and bottom of panel.
         1) Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
         2) Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer’s written instructions. Secure continuous head rail to each pilaster with not less than two fasteners. Hang doors to align tops of doors with tops of panels and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Wall-Hung Urinal Screens: Attach with full height continuous brackets with anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to 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 10 21 13.19

# SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes following:
   1. Public-use washroom accessories.
   2. Public-use shower room accessories.
   3. Childcare/special needs accessories.
   4. Custodial accessories.

B. Owner-Furnished and Contractor Installed Material: Soap dispenser and toilet paper dispensers.

### 1.2 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying Work.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include following:
   1. Construction detail, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Electrical characteristics.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

### 1.4 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: For toilet and bath accessories to include in maintenance manuals; including replacement parts information.
   2. Warranty: Special warranties specified in this Section.

### 1.5 QUALITY ASSURANCE

A. Accessibility Requirements: Comply with requirements applicable in jurisdiction of project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.
   1. Where bottoms of units are between 27 and 80 inches above finished floor, accessories mounted on or in wall cannot protrude more than 4 inches into a clear access aisle.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer’s instructions and recommendations.

1.7 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: Comply with requirements applicable in jurisdiction of project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.
   1. Where bottoms of units are between 27 and 80 inches above finished floor, accessories mounted on or in wall cannot protrude more than 4 inches into a clear access aisle.

B. Structural Performance: Accessories and fasteners to comply with the following requirements:
   1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
   2. Shower Seats: Installed units are able to resist 250 lbf applied in any direction and at any point.

2.2 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
   2. Products: Subject to compliance with requirements, provide one of specified products.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. Requests for A/E's approval and complete technical data for evaluation must be received at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.3 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Steel Sheet: ASTM A 1008, Designation CS (cold-rolled, commercial steel), 0.0359-inch minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A 653, with G60 hot-dip zinc coating.

D. Galvanized-Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0-mm thick.
   1. Provide mirror furnished with a uniform plastic film 8 mils nominal thickness with acrylic adhesive which is moisture resistant and non-corrosive, meeting 16 CFR 1201-11 and ANSI 297.1 requirements category II tape back.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.4 PUBLIC-USE WASHROOM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
   1. AJW Architectural Products
   2. American Specialties, Inc.
   3. Bobrick Washroom Equipment, Inc.
   4. Bradley Corporation.
   5. GAMCO Commercial Restroom Accessories Division, Bobrick Washroom Equipment, Inc.

B. Grab Bar:
   1. Stainless Steel Type: Provide grab bars with wall thickness not less than 0.05 inch and as follows:
      a. Mounting: Concealed, manufacturer's standard flanges and anchorages.
      b. Clearance: 1-1/2-inch clearance between wall surface and inside face of bar.
      c. Gripping Surfaces
         1) Smooth, satin finish, unless noted otherwise.
         2) Manufacturer's standard nonslip texture in wet areas (showers).
      d. Heavy-Duty Size: Outside diameter of 1-1/4 inches minimum.
   2. Grab bar shall be constructed of Type 304 stainless steel with satin finish. Concealed mounting flanges shall be 1/8-inch thick stainless-steel plate, 3-1/8 inch diameter, and each shall have 2 screw holes for attachment to wall. Flange covers shall be 0.03125-inch thick (fka 22-gauge), 3-1/4-inch diameter by 1/2-inch deep, and shall snap over mounting flange to conceal mounting screws. Ends of grab bars shall pass through concealed mounting flanges and be heliarc-welded to form one structural unit. Grab bars shall comply with ADA Accessibility Guidelines for structural strength. Provide concealed anchor device or backing as specified or required in accordance with local building codes before wall is finished.
      a. Products:
         1) Bobrick: B-5806 Series
         2) Bradley: 832-001 Series
         3) AJW Architectural Products: UG2 Series
         4) American Specialties: 3700 Series
         5) Gamco: 125S-Series

C. Sanitary-Napkin/Tampon Accessories:
   1. Surface-Mounted Partition Mounted Sanitary-Napkin/Tampon Disposal (ND-1): Surface-mounted sanitary-napkin disposal shall be Type 304 stainless steel with all-welded construction; exposed surfaces shall have satin finish. Self-closing door shall be secured to cabinet with a spring-loaded, full-length, stainless-steel piano hinge and equipped with international graphic symbol identified sanitary-napkin disposal. Unit shall be furnished with a removable stainless-steel receptacle that is equipped with a tumbler lock. Receptacle shall have a capacity of 1.2 gallons.
      a. Products:
         1) Bobrick: B-254
         2) Bradley: 4722-150000
         3) AJW Architectural Products: U582/IGS
         4) American Specialties: 0473-1A
         5) Gamco: ND-5

D. Mirrors
1. Stainless-Steel Framed Mirror (M-1, M-2): Mirror shall have a one-piece, Type 304 stainless-steel angle frame, 3/4 inch by 3/4 inch with continuous integral stiffener on all sides and beveled front to hold frame tightly against mirror; corners shall be heliarc-welded, ground, and polished smooth; all exposed surfaces shall have satin finish with vertical grain. Float/plate glass mirror shall be guaranteed for 15 years against silver spoilage. All edges shall be protected by plastic filler strips and back shall be protected by full-size, shock-absorbing, water-resistant, nonabrasive, 1/8-inch thick polyethylene padding. Corrugated cardboard is not an acceptable filler material. Galvanized-steel back shall have integral hanging brackets for mounting on concealed rectangular wall hanger(s). Mirror shall be secured to hanger(s) with concealed Phillips-head locking screws located in bottom of frame.
a. Products:
1) Bobrick: B-290
2) Bradley: MIR780
3) AJW Architectural Products: U700
4) American Specialties: 0600
5) Gamco: A-Series

2.5 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of following:
1. AJW Architectural Products.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. GAMCO Commercial Restroom Accessories Division, Bobrick Washroom Equipment, Inc.

B. Shower Curtain Rod:
1. Shower Rods (SR): Shower curtain rod shall be 1-1/4-inch outside diameter and constructed of 0.0500-inch thick (fka 18-gauge), Type 304, stainless steel with satin finish. Flanges shall be 0.0375-inch thick (fka 20-gauge), Type 304, stainless steel with satin finish. Flanges shall be 0.0375-inch thick (fka 20-gauge), one-piece, die-formed, Type 304 stainless steel with satin finish.
a. Products:
1) Bobrick: B-6047 by length as indicated
2) Bradley: 9531
3) AJW Architectural Products: UX2-B
4) American Specialties: 1204
5) Gamco: 125SR by length as indicated

C. Shower Curtain:
1. Shower curtains, shall be opaque, matte vinyl 0.006-inch thickness with hemmed edges and corrosion-resistant grommets. Color shall white. Curtains shall be fabricated as follows:
a. Curtains to be at least 10-percent wider than rod from which they hang and shall extend to within 2 to 3 inches of floor.
b. Shower Curtain Hooks: Stainless-steel, spring-wire curtain hooks with snap fasteners sized to accommodate specified curtain rod. Provide one hook per curtain grommet.
c. Products:
1) Bobrick: 204-2/204-1.
2) Bradley: 9533/9536.
3) AJW Architectural Products: UX250P/UX169.
4) American Specialties: 1200V/1200-SHU (hook).
5) Gamco: 125SQ by length as indicated.

D. Folding Shower Seat:
1. Folding Shower Seat (SS1): Folding shower seat shall have a frame constructed of Type 304, satin-finish stainless steel that consists of 0.0625-inch thick (fka 16-gauge) 1-1/4-inch square tubing and 0.0500-inch thick (fka 18-gauge), 1-inch diameter seamless tubing. Seat shall consist of 6 slats constructed of 5/16-inch thick, solidly fused plastic laminate with matte finish melamine surfaces, ivory-colored face sheets, and black phenolic resin core; secured to frame with stainless-steel carriage bolts and acorn nuts. Shower seat shall be equipped with two 3-inch diameter mounting flanges constructed of Type 304, 3/16-inch thick satin-finish stainless steel; a guide bracket constructed of Type 304, 0.0625-inch thick (fka 16-gauge), satin-finish stainless steel; and a spring constructed of Type 304, 0.0250-inch thick (fka 24-gauge) stainless steel that is spot-welded to base plate of Type 304, heavy-gauge stainless steel. Seat shall be able to lock in upright position when not in use. Shower seat shall comply with ADA Accessibility Guidelines for structural strength.
a. Products:
1) Bobrick: B-5181
2) Bradley: 9569
3) AJW Architectural Products: U929
4) American Specialties: 8206-R/8206-L
5) Gamco: 5181

E. Towel Hooks (TH):
1. Surface-mounted stainless-steel towel pin shall be constructed entirely of Type 304 stainless steel with bright polished finish. Flange shall be equipped with 0.0625-inch thick (fka 16-gauge) mounting bracket which locks to concealed 0.0625-inch thick (fka 16-gauge) wall plate with stainless-steel lock screw. Cap shall be 0.1406-inch thick (fka 10-gauge) stainless steel, welded to post.
a. Products:
1) Bobrick: B-7671
2) Bradley: 9115
3) AJW Architectural Products: UX110BF
4) American Specialties: 7340-B
5) Gamco: 7671

F. Recessed Soap Dish Tray (ST-):
1. Recessed heavy-duty stainless-steel combination soap dish shall be constructed entirely of 18-8, Type 304, stainless steel with stain finish. Soap dish and flange shall be drawn and beveled, one-piece seamless construction.
a. Rough Wall Opening: 6-1/4-inch wide by 4-1/4-inch high by 2-3/4-inch minimum recessed depth.
1) Products:
a) Bobrick: B-4380
b) Bradley
c) AJW Architectural Products
d) American Specialties
e) Gamco

## 2.6 WARM-AIR DRYERS

A. High Speed Air Hand Dryers (HD): Surface Mounted
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
c. EXtremeAir GXT9-; American Dryer.
d. TURBO-Dri 0197; American Specialties.
a. ThinAir Hand Dryer; Excel Dryer, Inc.
f. EXtremeAir G-XT6-; Gamco.
g. Airforce ; World Dryer.
h. SMARTdri; World Dryer.
i. Machflow**;** Saniflow Corporation
j. Dyson Airblade V, Model H402; Dyson

2. Description: High-speed warm-air hand dryer for rapid hand drying.
3. Mounting: Surface-mounted
   a. Protrusion Limit: Installed unit protrudes maximum 4 inches from wall surface.
4. Operation: Infrared-sensor activated with timed power cutoff switch.
   a. Average Dry Time: Less than 15 seconds.
   b. Automatic Shutoff: At 60 seconds.
5. Cover Material and Finish: Satin Chrome or Stainless steel, ASTM A480 No. 4 finish (satin).
6. Electrical Requirements: 115V, 15A, 1725W.

## 2.7 CHILDCARE/SPECIAL NEEDS ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of following:
1. AJW Architectural Products.
2. American Infant Care Products Inc.
3. American Specialties, Inc.
4. Foundations Worldwide Inc.
5. Koala Corporation; KB 200.
6. Safe-Strap Company, Inc.

B. Diaper-Changing Station (DCS):
1. Horizontal, Surface-Mounted Unit: Diaper-changing station with surface-mounted, mildew-resistant, molded-polyethylene body that folds horizontally against wall when not in use; projects not more than 4 inches from wall when closed; and is engineered to support a minimum of 250-pound static weight when opened. Provide unit with pneumatic shock-absorbing operating mechanism and built-in dispenser for sanitary liners.
   a. Color shall be selected by A/E from manufacturer's standards.

## 2.8 CUSTODIAL ACCESSORIES

A. Manufacturers:
1. AJW Architectural Products.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. GAMCO Commercial Restroom Division, Bobrick Washroom Equipment, Inc.

B. Mop and Broom Holder:
1. Mop and Broom Holders (MH): Surface-mounted mop and broom holder shall be Type 304 stainless steel with satin finish. Unit shall be 36-inches long with 4 spring-loaded, rubber cam holders.
   a. Products:
      1) Bobrick: B-223-XX
      2) Bradley: 995X
      3) AJW Architectural Products: UJ13B
      4) American Specialties: 8215
      5) Gamco: MS

## 2.9 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:

C. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Coordinate requirements for blocking and construction of wall openings for recessed units.

B. Provide templates and rough-in measurements as required.

### 3.2 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
1. Verify blocking, if required, has been installed properly.
2. Verify location does not interfere with door swings or use of fixtures.
3. Comply with manufacturer’s recommendations for backing and proper support.
4. Use vandal-resistant fasteners and anchors suitable for substrate and project conditions.
5. Conceal evidence of drilling, cutting, and fitting to room finish.
6. Test for proper operation.

B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.

C. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

D. Changing Stations: Install in accordance with manufactured instructions.
1. Changing stations and other accessories shall be installed to comply with requirements for accessible mounting heights, protrusions into accessible routes, and other requirements of ICC/ANSI A117.1.
2. Install units so they are level, plumb, and secure.
3. After installation, open and close units a minimum of 3 times. Verify units operate smoothly and properly latch. Adjust as required for proper safe use.
4. Wash exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean cloths. Do not use abrasives.

### 3.3 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

# SECTION 10 41 16 – LOCK BOX

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Furnishing and installing fire department lock boxes for building master key(s) as indicated.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Basis-of-Design: Heavy-duty key vault, recessed mounted. Subject to compliance with requirements (including approval by the local fire department), provide a product manufactured by one of the following:
   1. ABLOY Security, Inc.; an ASSA ABLOY Group Company.
   2. Knox Box
   3. Supra Products.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least ten days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

### 2.2 FABRICATION

A. Provide boxes with the following components and properties:
   1. Rough-in Dimensions: 6-inches high by 6-inches wide by 4-inches deep.
   2. Provide lock box with 1/4-inch thick plate steel housing and 1/2-inch thick solid steel door.
   3. Door gasket seal for weather protection and 1/8-inch thick stainless steel dust cover with tamper seal mounting capability.
   4. Steel Finish: Pre-treatment zinc phosphate, F.S. TT-C-490, Type II.
   5. Boxes and lock shall be UL-listed.
   6. Lock shall have double action rotating tumblers and hardened steel pins, accessed by a bias-cut key.
   7. Provide recessed mounting kit.
   8. Finish Color: As selected by A/E from manufacturer's standard colors and finishes.

B. Order form for lock boxes and padlock shall be obtained and signed by an authorized officer of the local fire department.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install lock boxes and accessories as recommended by manufacturer at location indicated.
   1. Set-in-place during masonry wall construction.

END OF SECTION 10 41 16

# SECTION 10 43 13 – DEFIBRILLATOR CABINETS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes furnishing and installation of:
   1. Steel cabinets for automatic external defibrillators (AEDs).
   2. Automatic external defibrillators.

B. Related Requirements:
   1. Division 10 Section “Fire Extinguisher Cabinets.”

### 1.2 REFERENCES

A. Reference Standards: The publications listed below form a part of this Section to the extent referenced. The publications are referred to within the text by the basic designation only.
   1. American Heart Association (AHA): 2005 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.

### 1.3 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:
   1. Comply with defibrillator cabinet manufacturer’s written recommendations for sequencing construction operations.
   2. Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

B. Coordination
   1. Coordinate size of automated external defibrillator cabinets to ensure that type and capacity of automated external defibrillators indicated are accommodated.
   2. Coordinate sizes and locations of automated external defibrillator cabinets with wall depths.

### 1.4 ACTION SUBMITTALS

A. Product Data: For specified products:
   1. Cabinets: Materials description for defibrillator cabinets include roughing-in dimensions, details showing mounting methods, relationships to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, door style and materials.
   2. Installation instructions for each product specified.

### 1.5 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Operation and Maintenance Data: For installed products. Include manufacturer’s instructions covering maintenance requirements.

### 1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.
   2. Installer: Experienced in performing work of this Section who has specialized in assembly and installation of work similar to that required for this Project.

B. Single-Source Responsibility: Provide both defibrillator cabinet and alarm mechanism from a single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials in manufacturer's original packaging with identification labels intact.

B. Storage and Handling Requirements: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Cabinet Products: Subject to compliance with requirements, select from one of the following.
1. Lifestart 1400 Series by JL Industries Division, Activar Construction Products Group.
2. 180 Series by Modern Metal Products Division of Technico Inc.
3. PFE7023D by Philips Healthcare Division of Royal Philips Electronics N.V.

B. Defibrillators: Select from one of the following:
1. Powerheart AED G3 Plus by Cardiac Science, Opto Cardiac Care Ltd.
2. HeartStart OnSite (HS1) AED by Philips Healthcare Div'n of Royal Philips Electronics N.V.
3. Medtronic LifePak CR Plus AED by Physio-Control Inc.
4. AED Plus by ZOLL Medical Div'n of Asahi Kasei Corp.

C. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least ten days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 CABINETS FOR AUTOMATIC EXTERNAL DEFIBRILLATORS (AEDs)

A. Cabinet with Steel Trim and Door:
1. Cabinet Style: Semi-recessed.
2. Components:
a. Tub: Cold-rolled steel.
1) Finish: Factory-applied powder coat paint finish.
a) Standard Color: White.
b. Door and Trim Construction: Cold-rolled steel; flush doors with 5/8 inch door stop attached by continuous hinge and equipped with zinc-plated with roller catch.
1) Finish: Factory-applied powder coat paint finish.
a) Standard Color: White.
2) Door Style:
a) Full Tempered Glazing; Pull & AED Decal
c. Trim Style and Depth:
2) Semi-Recessed Cabinet:
a) Rolled Edge: 3 inch.
3) 4)Trim Dimensions: 1-3/4 inch face trim on door and frame.
4. Alarms: Standard: 85 db Commander (audible) cabinet-mounted alarm standard (battery operated) to protect against theft or tampering. Alarm deactivated when door is closed.
a. Alarm with 85 dB (audible) Alarm (battery operated). Alarm stays on for 2 minutes after door is closed.
5. Wall Signs and Cabinet Lettering:
a. AED wall signs.

2.3 AUTOMATED EXTERNAL DEFIBRILLATOR (AED)

A. Automated External Defibrillator: Portable automated external defibrillator capable of automatically diagnosing life-threatening cardiac arrhythmias, suitable for use on adult or pediatric patients. Lid release on/off button operation. Type, size, and capacity for each cabinet indicated.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Activar Construction Products Group, Inc. – JL Industries; LIFEPAK CR2 Defibrillator or comparable product.
   2. Battery Capacity: 13 hours.
   3. Standby Life: 6 years.
   4. Accessories: Pediatric Pad-Pak.

2.4 ACCESSORIES

A. Cabinet seals or pull seals (to monitor if AED has been accessed or handled).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:
   1. Prior to installation of defibrillator cabinets, verify that substrates previously installed under other sections or contracts are acceptable for product installation in accordance with manufacturer's instructions.
   2. Examine conditions affecting performance of work, with Installer present, for compliance with requirements and other conditions.
   3. Inform A/E of unacceptable conditions immediately upon discovery.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's Product Data and written installation instructions applicable to products and applications indicated, including product technical bulletins, product catalog installation instructions, and product carton installation instructions to comply with applicable regulations.

B. Automated External Defibrillator Cabinets: 48 inches above finished floor to top of defibrillator.

C. Automated External Defibrillator Cabinets: Fasten cabinets to structure, square and plumb.
   1. Fasten mounting brackets to inside surface of automated external defibrillator cabinets, square and plumb.

D. Identification
   1. Apply decals or vinyl lettering at locations indicated.

3.3 ADJUSTING

A. Adjust defibrillator cabinet doors to achieve smooth operation.

3.4 CLEANING

A. Upon completing installation, remove surplus and excess materials, rubbish, tools, and equipment.

## 3.5 CLOSEOUT ACTIVITIES

A. Demonstration:
   1. Instruct Owner’s designated maintenance personnel in care, adjustment, and operation of defibrillator cabinets.
   2. Forward statement to A/E countersigned by maintenance personnel confirming that these instructions have been provided.

## 3.6 PROTECTION

A. Protect installed products from damage during construction.

END OF SECTION 10 43 13

# SECTION 10 44 13 - FIRE EXTINGUISHER CABINETS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Fire protection cabinets for the following:
      a. Portable fire extinguishers.

B. Related Sections:
   1. Division 10 Section "Fire Extinguishers."

### 1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination
   1. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
      a. Field Measurement: Verify dimensions of existing recessed wall openings by field measurements before fabrication and indicate measurements on Shop Drawings.
   2. Coordinate sizes and locations of fire protection cabinets with wall depths.

### 1.3 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of specified product. Requests for A/E's approval must be accompanied by the “Substitution Request Form” and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

A. U.S. Architectural and Transportation Barriers Compliance Board, Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG), Adopted in 1991; Continual revisions as published in Federal Register.
   1. These regulations shall supersede Technical Specifications of this Section.

### 2.3 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B.

B. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).
   1. Note: Wire glass and acrylic sheets are not acceptable.

2.4 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Fire End & Croker Corporation.
      b. J. L. Industries, Inc., a division of Activar Construction Products Group.
      c. Larsen's Manufacturing Company.
      d. Modern Metal Products, Division of Technico Inc.
      e. Guardian Fire Equipment, Inc.
      f. Potter Roemer LLC; Alta Series.
      g. Moon American.
      h. Nystrom, Inc.
      i. Strike First Corp. of America.
      j. Babcock-Davis.

B. Cabinet Material: Steel sheet.

C. Semirecessed Cabinet (SR-): Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
   1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

D. Cabinet Trim Material: Same material and finish as door.

E. Door Material: Steel sheet.

F. Door Style:
   1. Vertical duo panel with frame, unless otherwise noted.
   2. Solid opaque panel with frame, in gymnasium or similar multi-purpose spaces and where noted.

G. Door Glazing: Tempered float glass (clear).

H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide recessed door pull and friction latch.
   2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

I. Accessories:
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
   2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
      a. Identify fire extinguisher in fire protection cabinet with the words "**FIRE EXTINGUISHER**."
         1) Location: Applied to cabinet door.
         2) Application Process: Silk-screened, engraved, etched, or die cut.
            a) Pressure-sensitive vinyl letters or decals are not acceptable.
         3) Lettering Color: Red.
         4) Orientation: Vertical.

J. Finishes:
   1. Manufacturer's standard baked-enamel paint for the following:
      a. Exterior of cabinet door and trim except for those surfaces indicated to receive another finish.
      b. Interior of cabinet and door.
   2. Steel: Baked enamel or powder coat.

2.5 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.
   1. Weld joints and grind smooth.
   2. Provide factory-drilled mounting holes.
   3. Miter corners and grind smooth.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
   1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick, unless otherwise noted.
   2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 STEEL FINISHES

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
   1. Color and Gloss: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where fully recessed and semi-recessed cabinets will be installed.

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

## 3.2 PREPARATION

A. Prepare recesses for fully recessed and semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

## 3.3 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide semi-recessed fire protection cabinets.
   2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
   3. Seal any through penetration with firestopping sealant as specified in Division 07 Section “Penetration Firestopping”.

C. Identification: Apply decals or vinyl lettering at locations indicated.

## 3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturers written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

## SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Sections:
1. Division 10 Section "Fire Extinguisher Cabinets."

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination
1. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.3 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
1. Warranty: Sample of special warranty.
2. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 QUALITY ASSURANCE

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.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fails in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, following:
a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within warranty period.
b. Faulty operation of valves or release levers.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
1. Portable Fire Extinguishers
a. Amerex Corp.
b. Ansul Inc.
c. Bobcock-Davis
d. Badger Fire Protection
e. Buckeye Fire Equipment Company
f. Fire End and Croker Corp.
g. Guardian Fire Equipment, Inc.
h. J.L. Industries; a division of Activar Construction Products Group

i. Kidde, Residential and Commercial Div., UTC Fire and Security Co., United Technologies Corp.
j. Larsen's Manufacturing Company
k. Moon America
l. Nystron Building Products
m. Potter-Roemer
n. Pem All Fire Extinguisher Company, A Division of PEM System
o. Pyro-Chem, Tyco Safety Products
p. Strike First Corp. of America

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Source Limitations: Obtain fire extinguisher, fire-protection cabinets, and accessories, from a single source from a single manufacturer.

2.2 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.

2.3 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
1. Valves: Manufacturer's standard, unless otherwise noted.
2. Handles and Levers: Manufacturer's standard, unless otherwise noted.
a. Gauge face cover and horn cone parts shall be metal. No plastic or nylon valves, trigger/handle, casing, or gauge will be acceptable.
3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel or Aluminum Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled container.
1. Provide this type throughout facility, unless otherwise noted.

2.4 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
a. Orientation: Vertical or horizontal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

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

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
   1. Mounting Brackets: 48 inches above finished floor to handle of fire extinguisher, unless required by authorities with jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

## SECTION 10 51 26.00 - SOLID PLASTIC LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Solid plastic lockers.
   1. Wardrobe lockers.
   2. Solid Plastic Bench top panels and hardware.

1.2 ACTION SUBMITTALS

A. Product Data: Submit product data indicating construction details, material descriptions, dimensions of individual components and profiles and finishes for each type of locker, including locks.

B. Shop Drawings: Submit shop drawings prior to fabrication. Shop drawings shall indicate type of material, reinforcement, filler, finishing strips, and other details of construction. They shall show methods and details of attachment, layout of the lockers, and devices to be furnished by others.
   1. When a numbering system is indicated, shop drawings shall identify the locations where each series is to be installed.

C. Samples for Initial Selection: For each type of plastic components.

1.3 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: For adjusting, repairing, and replacing locker doors, locks, and latching mechanisms to include in maintenance manuals, includes ADA locks.
   2. Warranties: Special warranties specified in this Section.
   3. Receipt for extra materials.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below, before construction begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Full-size units of the following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than 5 units:
      a. Locks, including, but not limited to ADA locks and accessories.
      b. Identification plates.
      c. Hooks

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Where lockers and benches are indicated to comply with accessibility, requirements, comply with applicable requirements of the U.S. Architectural and Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1.
   1. Provide not less than one shelf located within reach ranges.
   2. Provide hardware that does not require tight grasping, pinching, or twisting of the wrist, and that operates with a force of not more than 5 lbf.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver lockers until spaces to receive them are clean, dry, and ready for locker installation.

B. Protect lockers from damage during delivery, handling, storage, and installation.

1.7 WARRANTY

A. Locker manufacturer shall warranty the lockers against rust, delamination or breakage of any of the plastic components under normal use.
   1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
   1. Scranton Products, TuffTec Lockers
   2. Columbia Lockers, a division of Partition Systems Inc. of South Carolina, Polylife
   3. ASI Storage Solutions Inc., Traditional Collection
   4. Bradley Corporation, Lenox Lockers
   5. Summit Lockers, HDPE Lockers

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the “Substitution Request Form” and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. Five percent of lockers provided shall be lockers for the physically challenged complying with Americans with Disabilities Act Accessibility Guidelines.
   1. Where locker rooms are provided at least 5 percent, but not less than one, of each type of use in each cluster provided shall be accessible.

B. ADA Compliant Locks: Locks designed to meet the ADA requirements cited in the current edition of the Department of Justice ADA Standards for Accessible Design or ICC/ANSI A117.1 – Accessible and Usable Buildings and Facilities.

2.3 MATERIALS

A. Provide High Density Polyethylene (HDPE) resin plastic components to resist deterioration and discoloration when exposed to the following chemicals:
   1. Acetic Acid (80%), Ammonium Phosphate, Acetone, Bleach (12%), Ammonia Liquid, Brine, Borax, Citric Acid, Caustic Soda, Copper Chloride, Chlorine Water, Core Oils, Hydrochloric Acid (40%), Hydrogen Peroxide (30%), Isopropyl Alcohol, Lactic Acid (25%), Nicotine, Lime Sulphur, Soaps, Potassium Bromide, Trisodium Phosphate, Sodium Bicarbonate, Urea and Urine, and Vinegar.

B. Materials for exposed fasteners and any exposed metal components.
   1. Stainless Steel: ASTM A 666, Type 304.

2.4 COMPONENTS

A. Sides, Shelves, Tops and Bottoms: Constructed from polymer resin formed under high pressure to solid plastic components 3/8 inch thick with a homogeneous color.

B. Doors: Constructed from polymer resin formed under high pressure to solid plastic components 1/2 inch thick with a homogeneous color.
   1. Provide manufacturer's standard ventilation slots at top and bottom of door.

C. Door Frames: Constructed from polymer resin formed under high pressure to solid plastic components 1/2 inch thick with a homogeneous color.

D. Locker Top: Slope top constructed of same material, minimum 3/8 inch thick.

E. Continuous Latch: Made from high-impact HDPE plastic, 1/2 inch thick, capable of accepting various locking mechanisms. Finger slide latching mechanism capable of accepting a padlock and securely fastened to door. Attach continuous latch mechanism entire length of door.

F. Door Hinge: Continuous and integrate into full length of door and main locker body.
   1. Material: Stainless steel.

G. Locker Shelves: 3/8 inch thick solid plastic components with homogeneous color.

H. Coat Hooks: Construct from solid plastic with two prongs. Hooks shall be mounted to bottom of the shelf or divider.

I. Filler/Trim Pieces: Provide as required to close spaces between lockers and adjacent walls. Attach filler/trim pieces with concealed fasteners.

J. Number plates: Provided by manufacturer to match Owner's numbering system. Plates may be field or factory mounted.

## 2.5 DOOR LOCKS

A. General: Fabricate lockers to receive locking devices. Provide one locking device for each locker door, unless otherwise indicated.
   1. Provide standard stainless steel hasp where indicated for Owner provided padlocks.

B. ADA Compliant Locks:
   1. ADA Combination Locks for lift handle lockers.
      a. Type: Built-in, ADA, combination lock with steel body for mounting on gravity lift handle lockers.
      b. Mounting: Concealed in recessed pocket or flush mount to locker door.
      c. Operation: Vertical travel locking bolt engages lift handle locker mechanism. Locks automatically on door closure.
      d. Combination: 3 digit dial type. Provide 5 preset combinations to be selected by pressing button. Locks shall have random combination change pattern with no sequentially adjacent locks having same pattern.
      e. Provide 5 pin tumbler cylinder for supervisory access. Master key enabled. Includes 2 student keys with 1 ADA keyhead.
      f. Basis-of-Design: Model 1636MKADA Series: Master Lock.

## 2.6 BENCHES

A. Bench Tops: High Density Polyethylene (HDPE) resin plastic that resists marks from writing instruments and homogenous color throughout.
   1. Plastic: High density polyethylene.
   2. Thickness: 1-1/4 – 1-1/2 inch, with edges rounded to 1/4 inch radius.
   3. Width: As Detailed
   4. Length: As indicated on drawings; units under 96 inches long in one piece.
   5. Color: One color to be selected from manufacturer's full line.
   6. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications.

2.7 FABRICATION

A. Fabricate locker components, square and rigid, finish free of scratches and chips.
   1. Configuration: Single full height and double height locker units as indicated on Drawings.

B. Dovetail solid plastic locker components to provide a solid and secure joint that slides together easily for assembly.

C. Slope top shall be fabricated of a single sheet of plastic. Material shall be grooved in order to bend to form a backing strip for attachment to the wall and a slope top surface to cover the locker tops.

2.8 FINISH

A. Tops, Bottoms, Sidewalls, Shelves, benches and Frames.
   1. Commercial grade smooth.
   2. Refer to “List of Finishes” for color selections.

B. Doors and Filler/Trim Pieces
   1. Color
      a. Refer to “List of Finishes” for color selections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and concrete bases for suitable conditions where metal lockers are to be installed.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. The Installer for the Work under this Section shall install the equipment level, plumb, true, and flush in strict accordance with the manufacturer's specifications, instructions, and recommendations.
   1. This shall include the proper assembly of lockers and their installation in accurate position and alignment. Assembly devices shall be properly installed and tightly drawn.
   2. Install end panels and filler plates to complete each section of the assembly.
   3. Install finishing strips required to bring the completed assembly into proper finished condition.

B. Anchor lockers to floors, base construction, and walls at intervals recommended by manufacturer, but not more than 36 inches on center. Install anchors through backup reinforcing plates where necessary to avoid surface distortion, using concealed fasteners.
   1. Lockers shall be leveled with cedar shims, where necessary, to provide for irregularities in the base.

C. Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

D. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical.

E. Attach sloping top units to lockers, with end panels covering exposed ends without visible fasteners.

F. Number Plates: Install plates after lockers are in place.
   1. Attach number plate on each locker door, near top, centered, with at least 2 screws with finish matching number plate.

G. Locks: Attach door locks on doors using security-type fasteners.
   1. ADA compliant locks shall be installed on lockers that meet the Department of Justice ADA Standards for Accessible Design and ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities for space allowance and reach ranges for physically impaired.
   2. After installation operate each lock to ensure proper operation. Correct deficiencies and adjust for smooth operation. Verify combination and locker numbers are as scheduled and recorded. Verify functional operation.

H. Install bench tops and hardware in location indicated on Drawings. Coordinate fasteners with surrounding construction materials.

3.3 ADJUSTING AND PROTECTION

A. The Installer of the Work under this Section is responsible for the protection of the new lockers installed against scratches or other imperfections or defects up until the time of final acceptance of the building.

B. Defective work of material occurring prior to that time shall be promptly replaced, when requested by the Architect, without additional cost to the Owner.

3.4 DEMONSTRATION

A. Demonstrate to Owner's Representative: Use of preset lock combinations, supervisory access, and other maintenance activities.

END OF SECTION 10 51 26

# DIVISION 11 EQUIPMENT

# SECTION 11 66 00.00 – ATHLETIC EQUIPMENT

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Athletic Equipment, accessories and necessary mounting, and installation hardware as indicated.
   1. Basketball equipment
   2. Gymnasium divider curtains
   3. Specialty suspended cages.
   4. Wall safety padding
   5. Volleyball Equipment floor inserts.
   6. Electronic control system for gymnasium equipment.

B. Related Sections include the following:
   1. Division 03 Section “Cast-In-Place Concrete”: For installation of floor insert sleeves to be cast-in-concrete subfloors and footings.
   2. Division 26 Sections for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized gymnasium equipment.

C. Products furnished, but not installed under this Section, include floor inserts to be cast in concrete subfloors and footings.

### 1.2 DEFINITIONS

A. NFHS: National Federation of State High School Associations.

B. NCAA: The National Collegiate Athletic Associations.

C. USAV: USA Volleyball.

### 1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.
   2. Coordinate layout and installation of overhead-supported gymnasium equipment, including gymnasium dividers, and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
   3. Electrically Operated Devices: Coordinate electrical requirements for type and location of power supply, conduit, wiring, and control boxes.

B. Preinstallation Conference: Conduct conference at Project site.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of equipment specified. Include construction details, material descriptions dimensions of individual components and profiles, features, and finishes. Include details of anchors, hardware, and fastenings. If applicable, include assembly, disassembly, and storage instructions.
   1. Gymnasium Equipment Operators: Include operating instructions.
   2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements and wiring diagrams to power source and controls.
   3. Ceiling Suspended Equipment:
      a. Submit manufacturer’s design data, including static loads and point reactions.
      b. Submit calculations complete, showing hanger and hoist pulley points.

B. Shop Drawings: Indicate the model number, type of material, gauges or thickness of metal, finishes and details of construction, and attachment. Provide layout of gymnasium showing location dimensions for each piece of equipment. Show method of field assembly, connections, installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work. Include transport and storage accessories for removable equipment.
   1. Shop drawings shall be coordinated with Athletic Equipment Schedule listing equipment in numerical order with item numbers in Schedule. Each item number listed in Athletic Equipment Schedule shall be indicated under each appropriate piece of equipment indicated on shop drawings.
   2. Design Calculations: Calculate requirements for supporting gymnasium equipment. Verify capacity of members and connections to support loads and verify loads, point reactions, and locations for attachment of gymnasium equipment to structure with those indicated on Drawings.
   3. Wiring Diagrams: Power, signal, and control wiring.
   4. Setting Drawings: For cast-in-floor insert sleeves for post standards.
   5. Gymnasium Dividers
      a. Include plans showing alignment of curtains in relation to court layout.
      b. Include elevations, sections, details, and attachments to other work.
      c. Include system clearances, stacking requirements, and limits for fitting into adjacent construction.
      d. Include loads, point reactions, and locations for attachment of gymnasium dividers to structure.

C. Samples for Initial Selection: For each type of gymnasium equipment indicated, including divider curtain and wall padding.

1.5 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Operating and Maintenance Data: For Athletic Equipment including gymnasium dividers, to include in the Operation and Maintenance Manuals specified in Division 1.
      a. Include operation, maintenance, adjustment, and cleaning instructions; trouble shooting guide; parts list; and electrical wiring diagrams.
      b. Include safety recommendations.
   2. Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Regulatory Requirements
   1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   2. Standards: Provide gymnasium equipment complying with or exceeding requirements of the National Federation of State High School Associations.
   3. All welding to be performed by personnel having passed Welder Qualification testing in accordance with American Welding Society (AWS) code D1.1 or higher. Manufacturer to provide certification and test results upon request.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer’s instructions. Keep temporary protective coverings in place.

C. Handling: Protect materials and finish from damage during handling and installation.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements:
1. Verify position and elevation of floor inserts and layout for gymnasium equipment. Verify dimensions by field measurements.
2. Verify size of space, available clearances, obstructions, and position for gymnasium dividers.

C. Loose items of equipment shall be turned over to the Owner after unpackaging or uncrating, and checking for proper type, material, size, and fit of each accessory. Obtain receipt from Owner for items turned over. No claim may be made for items turned over to the Owner without obtaining a receipt.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium equipment and gymnasium dividers that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Basketball backboard failures including glass breakage
b. Faulty operation of basketball backstops
c. Faulty operation of gymnasium dividers
d. Tearing or deterioration of fabric, seams, or other materials beyond normal use
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products from one of the manufacturers specified.
1. Athletic Equipment
a. Porter Athletic Equipment Company (Porter), a Div. of Gill Athletics
b. Draper, Inc. (Draper)
c. Performance Sports Systems, Inc. (PSS)
d. Jaypro Sports, Inc. (Jaypro)

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Refer to Athletic Equipment Schedule for additional information and detailed requirements.

D. Source Limitations: Obtain each type of gymnasium equipment from a single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Attachment of ceiling suspended equipment to building structure to be with clamps capable of supporting a minimum of 7,000 lbs. each. Superstructure shall be designed with a minimum of four attachment clamps to produce a combined minimum attachment point safety factor of not less than 40 to 1.

B. Backstop winches shall be UL listed as a complete assembly – not just the components.

2.3 MATERIALS, GENERAL

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; mill finish or decorative, baked-enamel, powder-coat finish.
   1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
   2. Cast Aluminum: ASTM B 179.
   3. Flat Sheet: ASTM B 209.

B. Steel: Comply with the following:
   1. Steel Plates, Shapes, and Bars: ASTM A 36, hot-dip galvanized.
   2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53.
   3. Cold-Formed Steel Tubing: ASTM A 500, Grade A, unless another grade is required by structural loads.
   4. Steel Sheet: ASTM A 1011.
   5. Steel Mechanical Tubing: Cold-rolled, electric-resistance, welded carbon or alloy steel tubing complying with ASTM A 513 or steel tubing fabricated from steel complying with ASTM A 569 and complying with the dimensional tolerances in ASTM A 500.
   6. Malleable-Iron Castings: ASTM A 47, grade required by structural loads.

C. Support Cable: 1/4 inch diameter, 7 by 19 galvanized steel aircraft cable with a breaking strength of 7000 lb. Provide fittings complying with cable manufacturer's written recommendations for size, number, and method of installation.

D. Support Chain and Fittings: Grade 80 hardened alloy steel chain rated for overhead lifting, ASTM A 391, with commercial-quality, hot-dip galvanized steel connectors and hangers. Provide fittings complying with chain manufacturer's written recommendations for size, number, and method of installation.

E. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, complying with ASTM A 413, Grade 30 proof coil chain or other grade recommended by gymnasium equipment manufacturer. Provide coating type, chain size, number, and installation method complying with manufacturer's written instructions.

F. Castings and Hangers: Malleable iron, complying with ASTM A 47; grade required for structural loading.

G. Medium-Density Fiberboard: ANSI A208.2, made with binder containing no urea formaldehyde.

H. Softwood Plywood: DOC PS 1, exterior.

I. Equipment Mounting Pads: Wood, transparent finish, size, and quantity as required to mount gymnasium equipment according to manufacturer's written recommendations.

J. Anchors, Fasteners, Fittings and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed tamperproof, vandal and theft resistant. Provide as required for gymnasium equipment assembly, mounting, and secure attachment.

K. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.

## 2.4 BASKETBALL EQUIPMENT

A. General: Provide equipment complying with requirements in “NFHS Basketball Rules Book.
   1. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.
   2. Provide manufacturer’s recommended connections complying with Division 05 Section “Metal Fabrications” for size and type required to transfer loads to building structure.

B. Overhead-Supported Backstop: Complete assembly spanning height indicated on Drawings, including primary and secondary superstructure support framing to building structure, pipe and cable bracing, adjustable hangers, clamps, cables, chains, pulleys, fittings, hardware, and fasteners.
   1. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.
      a. Center Mast: Welded, welded and bolted or clamped construction with sway bracing of pipe.
      b. Finish: Manufacturer’s factory-applied, color, baked powder-coating finish complying with finish manufacturer’s written instruction for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
         1) Color as selected by A/E from minimum 50 colors.
   2. Provide support cradles for span between structural framing members as required by roof structure components.
   3. Refer to Athletic Equipment Schedule for types, folding, accessories and additional requirements.

## 2.5 GYMNASIUM DIVIDER CURTAINS

A. Divider Curtain Materials, General
   1. Upper Curtain, Mesh: Woven mesh of polyester yarn coated with vinyl, weighing not less than 9 oz/sq.yd.
      a. Mesh Color: As selected by A/E from full range of industry colors and color densitites.
   2. Lower Curtain, Solid: Woven polyester fabric coated with vinyl, 18 oz./sq.yd., 8 foot height above floor, unless otherwise noted.
      a. Fabric Color: One color, unless otherwise noted, As selected by A/E from full range of industry colors and color densities.
   3. Hems: Folded and electronically welded.
   4. Seams: Electronically welded.
   5. Overall Curtain Height: Floor to ceiling, with installation clearances required.
   6. Bottom of Curtain: Approximately 2 inches above finished floor.
   7. Divider Curtain Flame-Resistance Ratings: Passes NFPA 701, Test 2.

B. Fold-Up Gymnasium Divider Curtain: Electrically operated, upward folding, cable suspended, and as follows:
   1. Top curtain to be fabricated with solid vinyl pocket to conceal continuous steel tube extending the full length of the curtain to insure proper support. Tube shall be supported from roller assembly supports on adjustable chains.
   2. Curtain shall be hoisted by cable. Bottom end of cables to terminate around tube in bottom pocket, secured with concealed clamps. Cables shall be routed thru cable guides to fold the curtain in a compact accordion fold arrangement, which lays across bottom support tube as curtain is hoisted. D-ring hoist systems shall not be approved as equal.
      a. Outer Edge Items: Triple turned and welded.
      b. Bottom Curtain Pocket: 6 inches with manufacturer’s standard pipe batten with padding.

3. Upper ends of hoist cables shall terminate into individual hoist drums positioned on continuous tube line shaft arrangement. Line shaft shall turn in special support assemblies equipped with four steel ball bearing wheel rollers. Each support assembly shall be positioned adjacent to a cable hoist drum. Support assemblies shall be secured to structural roof framing supports by means of threaded rods and support chains to provide structural integrity and accommodate all slopes or building camber.
4. All metal parts shall be painted one coat of flat black enamel.

C. Divider Accessories
1. Safety Lock: Locks drive system when speed exceeds 1-1/2 fps or manufacturer's recommended speed.
a. Safety lock shall be designed to work regardless of direction of rotation to insure that unit cannot be installed incorrectly. The locking mechanism must be fail-safe, so that any sticking, jamming or breakage of any of the components of the arresting mechanism results in immediate, positive locking of the drive shaft. The locking mechanism to be self-checking and shall actively and positively conform, six times per revolution, that the reel is traveling at a safe speed. The unit shall incorporate a fully automatic reset when equipment is repaired and load removed and requiring no poles, ropes, levels, or buttons to be used.

D. Electric Operation
1. General: Factory-assembled electric operation system of size and capacity recommended and provided by gymnasium divider manufacturer for gymnasium dividers specified, with electric motors, thermal-overload protection, factory-prewired motor controls, control devices, and accessories required for proper operation. Include wiring from control stations to motors. Coordinate operator wiring requirements and electrical characters with building electrical system.
2. Electrical Component, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended locations and application.
3. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop dividers at fully extended and fully retracted positions.
4. Control System:
a. Touch-screen programmable operating system.

E. Support Materials and Fasteners
1. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80, heat-treated alloy-steel chains, according to ASTM A 391, with commercial-quality, hot-dip galvanized steel connectors and hangers.
2. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, according to ASTM A 413, Grade 30 proof coil chain or higher grade recommended by gymnasium divider manufacturer. Provide coating type, chain size, number, and installation method according to manufacturer's written instructions.
3. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof vandal-resistant design.
4. Supplementary support for suspension from building structure may be required for divider curtains based on locations, configuration and structural framing of pre-engineered building.

## 2.6 CEILING SUSPENDED CAGES

A. Ceiling Suspended Batting/Golf Cage
1. Size of cage to be 10'-0" high by 12'-0" wide by 70'-0" in length.
a. Cages shall be at least 24 inches away from any solid surface.
2. The four sides and top of cage shall be 3/4" square, knotless nylon mesh netting. With 70 foot side open, as many as seven individuals may use the cage for golf at the same time. Netting shall be of sufficient size to allow approximately one foot of material to lay on floor to stop balls from being driven under netting.

a. Corners on each end of one long side should be zippered, tied, or have hook-and-loop so it can be separated from other sides. This side can fold up on top of the frame, and multiple users could hit golf balls into the other long side, increasing the usefulness of the cages by allowing safe use by multiple people.

3. For compact storage, the supporting frame may be lowered to the floor while placing the four sides of netting on top of the frame, requiring a minimum of space in the raised and stored position.
4. Supporting frame (12'-0" x 70'-6") of cage to be constructed of heavy wall tubing with cross spreaders. Hoist cables vandal proof galvanized cable (2,100 lb. breaking strength each cable). Bottom end of each cable shall terminate in a sling arrangement for proper support of frame assembly.
5. Operator: Provide factory-assembled electric operator designed for rolling flat and compacting in to position the divider curtain. Provide operator system, of size and capacity and with features, characteristics, and accessories suitable for Project conditions, recommended by gymnasium equipment manufacturer; complete with electric motor and factory prewired motor controls with limit controls, remote-control stations, remote-control devices, power disconnect switch, enclosures protecting controls and all operating parts, and accessories required for proper operation. Include wiring from motor controls to motor, unless otherwise noted. Coordinate with operator wiring requirements and electrical characteristics with the building electrical system.
   a. Comply with NFPA 70.
   b. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6.
   c. Electric Motor: UL approved or –recognized, totally enclosed insulated, capacitor-start motor, complying with NEMA MG 1, with thermal-overload protection, brake, and permanently lubricated bearings.
      1) Service Factor: According to NEMA MG 1, unless otherwise indicated.
      2) Motor Characteristics: Single phase, sized by gymnasium equipment manufacturer, 115 V, 60 Hz.
   d. Control System:
      1) Touch-screen programmable operating system.
6. Cage Safety Accessories
   a. Safety Lock: Lock drives system when speed exceeds 1-1/2 fps or manufacturer's recommended speed.

B. Supplementary support for suspension from building structure may be required for cages based on locations, configuration and structural framing of pre-engineered building.

## 2.7 VOLLEYBALL EQUIPMENT

A. Floor Insert: Solid-brass or Chrome-plated brass floor plate; and steel pipe sleeve, concealed by floor plate, with capped bottom end, sized with ID to fit post standards, not less than 9 inches long to securely anchor pipe sleeve in structural floor or below finished floor in concrete footing as indicated on Drawings; with anchors designed for securing floor insert to floor substrate indicated; quantity as indicated on Drawings.
   1. Wood Floor, Floor Plate: Lockable swivel access cover, designed for use with floating wood floors, unless otherwise noted, and to be flush with adjacent flooring. Provide two tools for unlocking access covers.
   2. Products: Subject to compliance with requirements, provide either the scheduled product or a comparable product by one of the following:
      a. Porter: 00870-200
      b. Spalding: 0408420
      c. Draper: 501031/501006
      d. PSS: 6405/6429

## 2.8 WALL-MOUNTED AND POST COLUMN SAFETY PADS

A. Wall Pads, General: All pads shall meet or exceed requirements of ASTM F2440-11.

B. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric cover, free from sag and wrinkles and firmly attached to back of backer board.
   1. Backer Board: Not less than 3/8 inch thick plywood, mat-formed, or composite panel, or fire-retardant-treated plywood per AWPA C27, Interior Type A.
   2. Fill: Multiple-impact-resistant foam not less than 2 inch thick bonded polyurethane, 6 lb. density.
   3. Size: Each panel section 24 inches wide by not less than 72 inches long, unless otherwise indicated on Drawings.
   4. Number of Panel Sections: As indicated on Drawings, modular panel sections.
   5. Installation Method: Concealed mounting Z-clips.
   6. Fabric Cover Colors: As selected by A/E from manufacturer's full range – not just one "standard".

C. Column Safety Pads: Pads covering exposed flange of 6 to 8 inch wide flange columns to height indicated, consisting of not less than 1-1/4 inch thick, multiple-impact-resistant, closed-cell polyethylene foam filler, covered both sides and all edges of pad by fabric cover with self-adhesive hook-and-loop attachment to exposed face of column.
   1. Length: Each pad not less than 72 inches, unless otherwise noted.
   2. Fabric Cover Color: Match color of wall safety pads.
   3. At main frame structure tapered columns, provide blocking/sheathing and metal studs as required to provide continuous surface for padding and flush condition along front of column. Provide a solid cap between webs of structure. Padding shall be vertical for the height of the padding at the front face and extend to the perimeter wall on each side.

D. Cut-Out Trim: Provide manufacturer's standard flanged cut-out trim kits for fitting pads around switches, receptacles, and other obstructions.
   1. Color: Gray.

## 2.9 ELECTRONIC GROUP CONTROL SYSTEM FOR GYMNASIUM EQUIPMENT

A. Fully programmable control processor.
   1. Programmable to operate single devices or groups of up to eight devices simultaneously.

B. Relay panels
   1. Relay panels shall be capable of being mounted at remote locations.
   2. Each relay panel shall include eight relays.
      a. Devices that operate in an up/down or in/out cycle shall require two relays.
      b. Devices that operate in an on/off cycle shall require one relay.
   3. Multiple relay panels may be required.
      a. Interconnect relay panels for complete operation.
   4. Power Characteristics: 120-volt alternating current, connected to a 30-amp circuit that is shared by all athletic equipment connected to that relay.

C. Communication between Processor and Relay Panel(s): 24-volt direct current power and two communications wires.

D. Connect athletic equipment to relay panels per project-specific instructions provided by control system supplier.

E. Graphical User Interfaces: Color touch-screen with custom-programmed 7 inch control screen, backlit WVGA full color LCD display, minimum 800x400 resolution.
   1. Security Code: A user-programmable four-digit code shall be required to be entered prior to accessing control screens.
   2. Power Characteristics: 12-volt direct current.

3. Provide matching enclosure for touch-screen for wall mounted int electrical box.
4. Flush-mount in full view of equipment being operated.

F. System. Subject to compliance with requirements, provide the specified system or a similar system from one of the following:
1. Powr-Touch 4 Control System by Porter.
2. TotalGym Controller by Spalding.
3. TSC2000XL Total System Control Keypad; Performance Sport Systems.
4. Draper: Smart Gym

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearance, accurate locations of connections to building electrical system, and other conditions affecting performance.
1. Verify critical dimensions.
2. Examine supporting structure and below finished floor for subfloor and footings.
3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements have been clearly marked for installers. Locate reinforcements and mark locations if not already done.

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

3.2 PREPARATION

A. Coordinate support of basketball backstop and gymnasium divider curtains with roof structure to ensure proper distribution of loads and adequacy of attachment points. Ensure that building structure has been designed for loads of specific gymnasium divider to be provided. Provide additional structural members as required in accordance with Division 05 Section “Metal Fabrications”.

B. Coordinate configuration, size, and installation of basketball backstops and gymnasium divider curtains with height, slope, and type of building structure and lighting fixtures, mechanical equipment, ductwork, fire-suppression systems, bleachers, athletic equipment, and other potential obstructions.

C. Field verify dimensions prior to fabrication.

D. Coordinate electrical requirements for motorized operating mechanism to ensure proper power source, conduit, wiring, and boxes for keyed switches. Prior to installation, verify type and location of power supply.

E. Coordinate delivery of volleyball floor sleeves and covers with subcontractors responsible for installation.

F. For any installations made after wood gymnasium flooring is installed, provide protection and exercise care not to damage flooring.

3.3 INSTALLATION, GENERAL

A. General: Comply with manufacturer’s written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly, where required.
1. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, have been completed.

B. Permanently Placed Gymnasium Equipment and Components: Rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction; and aligned with court layout.
   1. Floor Insert Location: Coordinate location with application of game lines and markers.
   2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and type of floor plate.
   3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.
   4. All components of the support system for overhead supported basketball backstops must be coordinated with structure, mechanical and electrical equipment or locate below the bottom of the roof joists, where still able to maintain minimum height restrictions.

C. Floor Insert Setting: Grout sleeve for post standards in oversized, recessed voids in concrete slabs and footings. Clean holes of debris. Position sleeve and fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor and footing from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.

D. Wall, Corner, and Column Safety Pads: Mount with bottom edge at 4 inches above finished floor.
   1. Fabricate cutouts in the field per manufacturer's recommendations to accommodate electrical outlets, key switches, fire-alarm stations, and the like.
   2. Limit cuts in face of padding from trim units' corner-to-corner outside dimensions. Install with ends of cuts concealed behind trim flange.

E. Anchoring to In-Place Construction: Use anchors and fasteners where necessary for securing built-in and permanently placed gymnasium equipment to structural support and for properly transferring load to in-place construction.

F. Connections: Coordinate with Electrical Contractor for final connections to building power supply and wiring required for control system components.

3.4 ADJUSTING

A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

B. Limit Switch Adjustment: Set and adjust upper and lower limit controls.

3.5 CLEANING/PROTECTION

A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

B. Provide final protection and maintain conditions acceptable to manufacturer and Installer that ensure gymnasium equipment is without damage or deterioration at time of Substantial Completion.

C. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by A/E, before time of Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment. Refer to Division 01 Section "Operation and Maintenance Data".
   1. Perform tests and inspections with the assistance of a factory-authorized service representative in presence of Owner.
      a. Perform visual inspections and operational tests as recommended by referenced standard rules of each sport.
   2. Operate basketball backstops to ensure proper lifting and lowering. Adjust as required to ensure smooth operation and accurate positioning.

END OF SECTION 11 66 00.00

# SECTION 11 66 43 - INTERIOR SCOREBOARDS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Interior, electronic, multi-sport multi-purpose basketball, volleyball, wrestling scoreboards including control center, and other accessories for complete functional installation.

B. Related Sections include the following:
   1. Division 11 Section "Gymnasium Equipment."
   2. Division 26 Electrical.

### 1.2 REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:
   1. ASTM B221 – Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

B. National Electric Code.

C. Federal Communications Commission, Part 15 Rules and Regulations.

D. Underwriters Laboratories (UL) Incorporated:
   1. Standard for Electric Signs, Fourteenth Edition (UL 48).
   2. Standard for Control Centers for Changing Message Type Electric Signs, Fourth Edition (UL 1433).

### 1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer’s product illustrations, data and literature that fully describes the scoreboards and accessories proposed for installation.

B. Shop Drawings: Submit shop drawing depicting scoreboard and accessories as configured for project.
   1. Submit wiring diagrams indicating pre-wired versus field wired items.
   2. Indicate weight and mounting method to structure.

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

### 1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: Submit manufacturer’s installation, operation, and maintenance manuals.
   2. Warranties: Special warranties specified in this Section.

### 1.5 QUALITY ASSURANCE

A. Source Limitation: All components including scoreboard, control center, control cable, and other accessories and installation hardware shall be products of a single manufacturer or approved by manufacturers in writing.

B. Scoreboards and other electrical components shall be certified for use in United States by Underwriters Laboratories (UL), Inc. or ETL listed to UL Standards 48 and 1433.

C. Scoreboards and other electrical components shall be electrically grounded in accordance with National Electrical Code (NEC), Article 600.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Scoreboard and equipment to be housed in clean, dry, secure environment.

B. Special precautions for scoreboard face
   1. Each scoreboard section should be protected during shipment. Avoid removing this protection until the installation begins.
   2. Never lay a scoreboard face down or stack other objects on a scoreboard lying on its back.
   3. Avoid sliding objects (like another scoreboard) along the plane of the scoreboard face.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install interior scoring equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for project when occupied for its intended use.

B. Field Measurements: Coordinate scoreboard, controls and accessories, location, including height with Owner. Verify dimensions by field measurements.

1.8 WARRANTY

A. Warranty to cover defects in materials and workmanship.
   1. Five years parts and factory labor guarantee for scoreboards and accessories from invoice date.
   2. Two years parts and factory labor guarantee for wireless controls and receivers from date of invoice.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: The design is based on Nevco Scoreboard Company. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
   1. Daktronics, Inc.
   2. Fair Play

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 SYSTEM DESCRIPTION

A. Design Requirements
   1. Basketball, volleyball, wrestling scoreboard, UL listed/CSA Certified, remotely operated from one control station. Display(s) minutes, seconds, 1/10$^{th}$ seconds (when time is less than one minute), team scores, period, bonus, jump ball, "next possession", and "changeable" captions from basketball, volleyball, wrestling on multi-purpose lower section, using low-voltage 100-percent solid-state 2-wire cable multiplex system, quartz-crystal-controlled.

2.3 MATERIALS

A. Aluminum face and perimeter frame: Fabricated from 0.050-inch minimum thickness, ASTM B221 aluminum sheet.

B. Finish: Acrylic polyurethane paint. Color as selected by A/E from manufacturer's standard range..

C. Electronics: Low voltage, solid state, 2-wire cable, multiplex system, quartz crystal controlled.

D. Provide fiber optic communication interface to reduce threat of damage from electrical storms.

E. LED (light emitting diode) units: Seven-bar, segmented digits in protective aluminum cover, rated typical life 100,000 hours, and designed to provide excellent visibility from all angles and sides.

F. Provide location specific universal power cord with plugs for world-wide installation.

G. Control cable where required shall be UL listed, 2-wire, type RG-58/U, coaxial cable, 1/4-inch diameter.

H. Junction boxes where required: Sheet metal box and cover, 4-1/2 x 2-1/8 x 2-1/8 inches minimum complying with NEMA standards.

2.4 SCOREBOARDS

A. Interior, multi-purpose basketball/volleyball/wrestling electronic scoreboard with two integral horns, changeable captions, LED displays for time, scores, period, number of player fouling with personal fouls, team fouls, bonus and double bonus indicators, and next possession arrows:
   1. Basis-of-Design: Model 2750 as manufactured by Nevco. No captions shall be applied directly to the face of the scoreboard. All caption plates will be changeable and made of polyvinyl chloride with vinyl lettering applied.
   2. Size: 8 feet long x 6 feet high and 8 inches deep.
   3. Approximate hanging weight: 107 pounds.
   4. Wireless operation.
   5. Captions: Rear-Lit
      a. 6 inches high:
         1) Basic: "Home," "Guests," and "period."
         2) Basketball: "fouls" and "player."
         3) Volleyball: "won" and "game."
         4) Wrestling: "match" and "weight."
   6. LED displays:
      a. Timing: Super Bright Red 13 inches high digits with lit colon.
      b. Team scores: Super Bright Amber 13 inches high digits.
      c. Period: Super Bright Amber 9 inches high digits.
      d. Player number with personal fouls, game, and weight: Super Bright Red 9 inches high digits.
      e. Team fouls, games won, and match: Super Bright Amber 9 inches high digits.
      f. Next possession: Super Bright Amber arrow for each team.
      g. Include bonus and double bonus in the form of a 4 inch Super Bright Red LED "B".
   7. Horn: Two located in scoreboard
   8. Power requirement: 120 VAC, .80 amps, 50/60 Hz
   9. Lightning Protection: Built-in optical isolation circuitry.
   10. Wall or wall framing mounting.

2.5 ACCESSORIES

A. Provide each scoreboard with electrical junction boxes, mounting hardware, and other accessories as required for installation are to be provided by others.

2.6 CONTROL CENTER

A. General:
   1. Transmitter shall be built into controller.
   2. Controller must be universal and able to operate all sports.
   3. Controller must be able to turn off the scoreboard.

B. Type: Wireless, microprocessor based, operator's control center with receiver unit mounted at scoreboard and designed to operate different models of scoreboard by interchange of keyboard overlay; Model MPCW as manufactured by Nevco.
   1. Unit shall comply with Part 15 of FCC Rules regarding interference.
   2. Console: High impact, break-resistant gray plastic 11 inches x 9-1/2 inches x 4-1/8 inches.
      a. Provide a control center for each scoreboard.
      b. Control center shall be able to operate each scoreboard individually or 1 control center operate both scoreboards together.
   3. Features:
      a. Control can be used to operate both wireless and wired scoreboards.
      b. Power on-off switch.
      c. Split and raised 40 key keyboards, internal beeper acknowledging each entry, and bookmark capabilities.
      d. Keyboard overlays for scoreboard or accessory.
      e. Remote hand-held main time switch with integral horn button.
      f. Provide with LED displays, lithium cell battery backup to maintain scoreboard memory and time of day, self test mode, power on-off switch, alternate time control, and multiple scoreboard operation.
      g. Timer features: Time of day display, multiple timeout timers with warning, interval horn, upcount auto stop with horn, and 1/10th second display during last minute.
      h. Dimmer control for scoreboard.
   4. Receiver: Aluminum construction, 6-1/8 inches x 3 inches x 1-3/8 inches with 4 inch antenna and mounted at scoreboard.
   5. Maximum range: 1,000 feet from control center to receiver.
   6. Receiver shall require no additional source of power or separate control cable.
   7. Power adapters: Provide for each control center and receiver.
      a. Input: 120 volts, 0.4 amps, 50/60 Hz.
      b. Output: 9 volts, 1.67 amps, 15 watts.
   8. Provide option of battery supply for control operation if utility power not available.
   9. Provide carrying case for control center and hand-held switch: Model CC-3 as manufactured by Nevco.
      a. Size: 18-1/2 inches x 14-1/2 inches x 6 inches.
      b. Construction: Double wall, high density black polyethylene plastic exterior with padded interior, mechanical latches, and hinges.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify exact scoreboard and control center quantities and junction box locations with A/E.

B. Coordinate requirements for electrical power, wall blocking, auxiliary framing and supports, suspension cables, and other components to be provided under other Specification Sections to ensure adequate provisions are made for complete, functional installation of scoreboards.

C. Coordinate scoreboard electrical requirements to ensure proper power source, conduit, wiring, and boxes are provided. Prior to installation, verify type and location of power supply.

3.2 INSTALLATION

A. Install scoreboards and accessories in accordance with manufacturer's instructions.

B. Before installation, field test scoreboards and accessories for operating functions. Ensure that scoreboards accurately perform all operations. Correct deficiencies.

C. Rigidly mount scoreboards and accessories level and plumb with brackets and fasteners.

D. Clean exposed surfaces.

E. Protect scoreboards and finishes from other construction operations.

3.3 DEMONSTRATING AND TRAINING

A. Provide demonstration and training session for Owner's representative covering operation and maintenance of electronic scoreboard.
   1. The most common source of damage to scoreboards and accessories are electrical surges running through power or data connections. The usual causes are lightning, power equipment problems (floating neutrals, bad transformers, etc.) and improper connections. To minimize these problems:
      a. Unplug control console from power outlet and from data cable when not in use.
      b. Turn off the breaker to disconnect scoreboard from power when not in use.
      c. Label scoreboard data cable junction box and all connectors near junction box, scoreboard, and accessories so that public address systems and other devices with similar connections are not accidentally plugged into the scoreboard.
      d. Avoid loss or damage of control console, extension cable, and other accessories by storing when not in use.

END OF SECTION 11 66 43

# DIVISION 12

# FURNISHINGS

**SECTION 12 48 26.01 – ENTRANCE CARPET TILE**

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Entrance carpet tile (ECT).

B. Related Sections include the following:
   1. Division 09 Section “Tile Carpeting” for modular carpet tiles.

1.2 ACTION SUBMITTALS

A. Samples for Verification: For each type of product indicated.
   1. Size: 8-1/2 by 11 inch square, assembled sections.

1.3 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: For floor mats to include in maintenance manuals.
   2. Extra Materials: Receipt for extra materials.

1.4 MAINTENANCE 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. Entrance Carpet Tiles: Full-size units equal to 2 percent of amount installed for each size, color, and pattern indicated, but no fewer than 10 units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   3. Basis-of-Design Product: The design for entrance floor mats and frames is based on products named. Subject to compliance with requirements, provide either the name product or a comparable product by one of the other manufacturers specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of specified product. Requests for A/E's approval must be accompanied by the “Substitution Request Form” and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 ENTRANCE CARPET TILE

A. General: Refer to “List of Finishes.”

B. Entrance Tile; carpet tiles shall be specifically designed for use in entries to reduce the amount of contaminates tracked into occupied space.
   1. Indoor Air Quality (IAQ): CRI IAQ Certification “Green Label Plus”.
   2. Flammability – Radiant Panel Test: Class I, ASTM E648.
   3. NBS Smoke: <450 Flaming Mode, ASTM E662.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, and other conditions affecting installation of floor mats and frames.

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

3.2 INSTALLATION, ENTRANCE CARPET TILE

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

END OF SECTION 12 48 26.01

# DIVISION 13

# SPECIAL CONSTRUCTION

# SECTION 13 34 19 - METAL BUILDING SYSTEMS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes metal building systems that consist of integrated sets of mutually dependent components including:
   1. Structural-steel framing
   2. Metal roof panels
   3. Metal wall panels
   4. Thermal insulation
   5. Accessories.
   6. Anchor Bolts

### 1.2 DEFINITIONS

A. Bay: Dimension between main frames measured normal to frame (at centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured normal to end wall (outside face of end-wall girt) for end bays.

B. Building Length: Dimension of the building measured perpendicular to main framing from end wall to end wall (outside face of girt to outside face of girt).

C. Building Width: Dimension of the building measured parallel to main framing from sidewall to sidewall (outside face of girt to outside face of girt).

D. Clear Span: Distance between supports of beams, girders, or trusses (measured from lowest level of connecting area of a column and a rafter frame or knee).

E. Eave Height: Vertical dimension from finished floor to eave (the line along the sidewall formed by intersection of the planes of the roof and wall).

F. Clear Height under Structure: Vertical dimension from finished floor to lowest point of any part of primary or secondary structure, not including crane supports, located within clear span.

G. Terminology Standard: Refer to MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

### 1.3 COORDINATION

A. Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

### 1.4 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of the following metal building system components:
   1. Structural-framing system.
   2. Metal roof panels.
   3. Metal wall panels and metal liner panels.
   4. Insulation and vapor retarders.
   5. Flashing and trim.

B. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other Work.
   1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   2. Anchor-Bolt Plans: Submit anchor-bolt plans before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
   3. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
   4. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
      a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, snow guards, and items mounted on roof curbs.
      b. Show wall-mounted items including doors, windows, louvers, and lighting fixtures.
      c. Show translucent panels.
   5. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:8):
      a. Flashing and trim.
      b. Gutters.
      c. Downspouts.

C. Samples for Initial Selection: For each type of building component with factory-applied color finish.

D. Delegated-Design Submittal: For metal building systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Product Certificates: For each type of metal building system, signed by product manufacturer.
   1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
      a. Name and location of Project.
      b. Order number.
      c. Name of manufacturer.
      d. Name of Contractor.
      e. Building dimensions including width, length, height, and roof slope.
      f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
      g. Governing building code and year of edition.
      h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
      i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
      j. Building-Use Category: Indicate category of building use and its effect on load importance factors.
      k. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.

B. Welding certificates.

C. Erector Certificate: Signed by manufacturer certifying that erector complies with requirements.

D. Manufacturer Certificate: Signed by manufacturer certifying that products comply with requirements.

E. Qualification Data: For Erector, manufacturer, and professional engineer.

1.6 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: For metal panel finishes to include in maintenance manuals.
   2. Warranties: Special warranties specified in this Section.

1.7 QUALITY ASSURANCE

A. Erector Qualifications: An experienced erector who has specialized in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

B. Manufacturer Qualifications: A qualified manufacturer.
   1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems".
   2. Engineering Responsibility: Preparation of comprehensive engineering analysis and shop drawings by a professional engineer who is legally qualified to practice in jurisdiction where project is located.

C. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing surveying services of the kind indicated.

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

E. Structural Steel: Comply with AISC's 360, "Specification for Structural Steel Buildings--Allowable Stress Design, Plastic Design," or AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings," for design requirements and allowable stresses.

F. Cold-Formed Steel: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members," or AISI's "Load and Resistance Factor Design Specification for Steel Structural Members," for design requirements and allowable stresses.

G. Surface-Burning Characteristics: Provide field-insulated metal panels having thermal insulation and vapor-retarder-facing materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. Flame-Spread Index: 25 or less, unless otherwise indicated.
   2. Smoke-Developed Index: 450 or less, unless otherwise indicated.

H. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to metal building systems including, but not limited to, the following:
   1. Review methods and procedures related to metal building systems including, but not limited to, the following:
      a. Inspect and discuss condition of foundations and other preparatory work performed by other trades.
      b. Review structural load limitations.
      c. Review and finalize construction schedule and verify availability of materials, Erector's personnel, equipment, and facilities needed to make progress and avoid delays.

d. Review required testing, inspecting, and certifying procedures.
e. Review weather and forecasted weather conditions and procedures for unfavorable conditions.

2. Review methods and procedures related to metal roof panel assemblies including, but not limited to the following:
   a. Examine purlin and rafter conditions for compliance with requirements, including flatness and attachment to structural members.
   b. Review structural limitations of purlins and rafters during and after roofing.
   c. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
   d. Review temporary protection requirements for metal roof panel assembly during and after installation.
   e. Review roof observation and repair procedures after metal roof panel installation.
3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
   a. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   b. Review structural limitations of girts and columns during and after wall panel installation.
   c. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
   d. Review temporary protection requirements for metal wall panel assembly during and after installation.
   e. Review wall observation and repair procedures after metal wall panel installation.

I. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. First-in-place 20 panels roof and wall panels shall serve as a mock-up for A/E's approval of appearance, including extent and intensity of "oil-canning" appearing in panels. Sample area, when approved by A/E and Owner, shall become project standard for appearance including extent and intensity of oil-canning and set quality standards for fabrication and installation.
2. Mockup accessories as shown on drawings, including but not limited to eave, fascia and soffit. Metal roof and wall areas not meeting project standard shall be removed and new panels installed including necessary corrective work to substrate to achieve acceptable project appearance standard at no additional cost to Owner.
3. Approval of mock-ups does not constitute approval at deviations from Contract Documents contained in mock-ups unless A/E specifically approves such deviations in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness and with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements:
   1. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
   2. Established Dimensions for Metal Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements, or allow for field trimming metal panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.10 WARRANTY

A. Special Warranty on Metal 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. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: 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 MANUFACTURERS

A. Basis-of-Design Product: The design for metal building systems is based on Nucor Building Systems. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. A & S Building Systems, Inc.; Division of NCI Building Systems, LLP.
   2. American Buildings Company
   3. Butler Manufacturing Company.
   4. Ceco Building Systems; Division of Robertson-Ceco Corporation.
   5. Chief Buildings.
   6. Star Building Systems; Division of Robertson-Ceco Corporation.
   7. VP Buildings, Inc.; a United Dominion Company.
   8. Crown Metal Buildings, Inc.
   9. Kirby Building Systems

2.2 SYSTEM DESCRIPTION

A. General: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior. Include primary and secondary framing, metal roof panels, metal wall panels, and accessories complying with requirements indicated.
   1. Provide metal building system of size and with spacings, slopes, and spans indicated.

B. Primary Frame Type:
   1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.

D. Secondary Frame Type: Manufacturer's standard purlins and joists and exterior-framed (bypass) girts.

E. Eave Height: As indicated by nominal height on Drawings.

F. Bay Spacing: As indicated on Drawings**.**

G. Roof Slope: 2:12.

H. Roof System: Manufacturer's standard vertical-rib, standing-seam metal roof panels.

I. Exterior Wall System: Manufacturer's standard exposed-fastener, tapered-rib, metal wall panels.
   1. Interior Liner Panels: Manufacturer’s standard.

2.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified licensed professional engineer, using performance requirements and design criteria.

B. Structural Performance: Provide metal building system capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA’s “Metal Building Systems Manual”.
   1. Design Loads: Reduction of load due to tributary loaded area is not permitted in the design of this building. The basic design loads shall include live loads, wind loads, and earthquake (if applicable), in addition to dead load. Other design loads, whether they be of static, dynamic, or kinetic nature, shall be considered as auxiliary loads.
      a. Furnish anchor bolt diameters, calculated on the basis of stress in the steel bolt, to resist the column reactions induced by the design loads on that structure. Anchor bolts and embedment requirements are furnished by others.
      b. Design shall include loads indicated on drawings for roof. Coordinate connection design and fabrication with structural steel supplier.
   2. The controlling loads, combining of normal loads and auxiliary loads, and design procedures from the following reference standards, shall be used where applicable in the structural design of the metal building covered by this Section.
      a. "Recommended Design Practices Manual," Metal Building Manufacturers Association.
      b. "Steel Construction Manual," American Institute of Steel Construction.
      c. "Cold Formed Steel Design Manual," American Iron and Steel Institute.
      d. "Aluminum Construction Manual," The Aluminum Association.
      e. "Code for Welding in Building Construction," American Welding Society.
      f. State building code having jurisdiction over the area in which the site is located.
   3. In no case shall the design loads be less than those indicated on Drawings and as required by ASCE 7, “Minimum Design Loads for Buildings and other Structures.”
   4. Auxiliary loads for roof framing, including purlins:
      a. Increased live loads from drifting snow adjacent to taller structures.
      b. Vertical hanging loads of 5 pounds per square foot.
      c. Hanging point load on structural frame and a lateral impact load per A.I.S.C. code perpendicular to structural frame as indicated.
      d. See drawings for magnitude and location of other auxiliary loads.
   5. Deflection and Drift Limits: Engineer assemblies to withstand design loads with deflection no greater than the following:
      a. Purlins and Rafters:
         1) Vertical deflection of 1/180 of the span for areas not supporting ceilings, unless otherwise noted.

2) Vertical deflection of 1/240 of the span for areas supporting non-plaster ceilings.

b. Girts: Horizontal deflection of 1/180 of the span, unless otherwise noted.
1) Deflection where wall supports masonry shall be limited to 1/600.
2) Deflection where the wall supports glass shall be limited to 1/175 or 3/4 inch.

c. Metal Roof Panels: Vertical deflection of 1/180 of the span.

d. Metal Wall Panels: Horizontal deflection of 1/180 of the span.

6. Design secondary framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.

7. Lateral Drift: Maximum of 1/300 of the building height.

8. Refer to Structural and Architectural Drawings for additional static loads from hanging equipment that must be accounted for in the design and layout of metal building system main structural members and secondary framing members.
a. Provide secondary framing members as required between main building frames.
1) Basketball backstops require minimum 3 beams per backstop for attachment.
2) Divider Curtains provide beam(s) in line with curtain if not on a main frame.
3) Batting cage provide beam(s) along length of each unit.
4) Large Ceiling Fans, provide two support beams per fan. Support from roof purlins is not sufficient for ceiling fans.
5) Structure mounted scoreboard, provide two support beams between main frame columns.
6) Ceiling Clouds support beams between main frames.

C. Thermal Movements: Provide metal panel systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Thermal Performance: Provide insulated metal panel assemblies with the following maximum U-factors and minimum R-values for opaque elements when tested according to ASTM C 1363 or ASTM C 518:
1. Metal Roof Panel Assemblies:
a. R-Value: R-32
1) 8 inch batt insulation between purlins.
2) Batt insulation over the purlins with thermal break as required to achieve R-32 total.
2. Metal Wall Panel Assemblies:
a. U-Factor: 0.113
b. R-Value: R-13.0

E. Air Infiltration for Metal Roof Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at negative test-pressure difference of 1.57 lbf/sq. ft.**.**

F. Air Infiltration for Metal Wall Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at static-air-pressure difference of 1.57 lfb/sq.ft.

G. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 2.86 lbf/sq. ft..

H. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at a minimum differential pressure of 2.86 lbf/sq. ft. and not more than 12 lbf/sq. ft.

I. Fire Propagation Characteristics: Exterior wall assemblies containing foam plates pacs NFPA 285 fire test.

J. Structural Performance for Metal Roof Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
   1. Wind Loads: As indicated on Drawings.

2.4 STRUCTURAL-FRAMING MATERIALS

A. W-Shapes: ASTM A 992; ASTM A 572, Grade 50 or 55 (345 or 380); or ASTM A 529, Grade 50 or 55 (345 or 380).

B. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36; ASTM A 572, Grade 50 or 55 (345 or 380); or ASTM A 529, Grade 50 or 55 (345 or 380).

C. Plate and Bar: ASTM A 36; ASTM A 572, Grade 50 or 55 (345 or 380); or ASTM A 529, Grade 50 or 55 (345 or 380).

D. Steel Pipe: ASTM A 53, Type E or S, Grade B.

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.

F. Structural-Steel Sheet: Hot-rolled, ASTM A 1011, Structural Steel (SS), Grades 30 through 55 (205 through 380), or High-Strength Low Alloy Steel (HSLAS), Grades 45 through 70 (310 through 480); or cold-rolled, ASTM A 1008, Structural Steel (SS), Grades 25 through 80 (170 through 550), or High-Strength Low Alloy Steel (HSLAS), Grades 45 through 70 (310 through 480).

G. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, Structural Steel (SS), Grades 33 through 80 (230 through 550) or High-Strength Low Alloy Steel (HSLAS), Grades 50 through 80 (340 through 550); with G90 (Z275) coating designation.
   2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Structural Steel (SS), Grade 50 or 80 (340 or 550); with Class AZ50 (AZM150) coating.

H. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, Property Class 4.6), carbon-steel, hex-head bolts; ASTM A 563) carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.
   1. Finish: Hot-dip zinc coating, ASTM A 153, Class C, unless otherwise noted.

I. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
   1. Finish: Hot-dip zinc coating, ASTM A 153, Class C, unless otherwise noted.
   2. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with splined ends.
   3. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50, unless otherwise noted.

J. Provide all anchor bolts for anchoring structure to concrete footings. Furnish anchor bolts to Contractor placing concrete footings and coordinate installation requirements.

K. High-Strength Bolts, Nuts, and Washers: ASTM A 490), Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.

L. Unheaded Anchor Rods: ASTM F 1554, Grade 36, Unless otherwise noted on the drawings.
   1. Configuration: Straight.
   2. Nuts: ASTM A 563 heavy hex carbon steel.
   3. Plate Washers: ASTM A 36 carbon steel.
   4. Washers: ASTM F 436, Type 1, hardened carbon steel.
   5. Finish: Hot-dip zinc coating, ASTM A 153, Class C, unless otherwise noted.

M. Headed Anchor Rods: ASTM F 1554, Grade 36, Unless otherwise noted on the drawings.
   1. Nuts: ASTM A 563 heavy hex carbon steel.
   2. Plate Washers: ASTM A 36 carbon steel.
   3. Washers: ASTM F 436, Type 1, hardened carbon steel.
   4. Finish: Hot-dip zinc coating, ASTM A 153, Class C, unless otherwise noted.

N. Threaded Rods: ASTM A 36.
   1. Nuts: ASTM A 563 heavy hex carbon steel.
   2. Washers: ASTM F 436, Type 1, hardened carbon steel.
   3. Finish: Hot-dip zinc coating, ASTM A 153, Class C, unless otherwise noted.

O. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
   1. Clean and prepare in accordance with SSPC-SP2.
   2. Coat with manufacturer's standard red primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.
      a. Prime secondary framing formed from uncoated steel to a minimum dry film thickness of 0.5 mil on each side.

## 2.5 MATERIALS FOR FIELD-ASSEMBLED METAL PANELS

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, Structural Steel (SS), Grades 33 through 80 (230 through 550), with G90 (Z275) coating designation.
   2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Structural Steel (SS), Grade 50 or 80 (340 or 550); with Class AZ50 (AZM150) coating designation.
   3. Surface: Smooth, flat finish.
   4. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings:
      a. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
      b. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored backer finish, consisting of prime coat and wash coat with a total minimum dry film thickness of 0.5 mil.

## 2.6 THERMAL INSULATION FOR FIELD-ASSEMBLED METAL PANELS

A. Unfaced Metal Building Insulation: ASTM C 991, Type I or NAIMA 202, glass-fiber-blanket insulation, 0.5-lb./cu.ft. density; 2 inch wide, continuous vapor-tight edge tabs; with a flame-spread index of 25 or less.
   1. Roof and wall insulation.

B. Roof Liner Insulation Retaining System: Liner system that permanently supports insulation and allows full depth and insulation width between and above purlins as indicated herein.
   1. Roof liner system shall provide an OSHA compliant fall arrest system and protection from falling objects.
   2. Manufacturer's standard polyethylene vapor retarder liner fabric, white.
      a. Fabric liner composed of woven high-density polyethylene coated on both sides with polyethylene.
      b. ASTM C1136, Types I through Type VI.
      c. Perm Rating: Maximum of 0.02 per ASTM E96.
      d. Surface Burning: Flame Spread Index of 0 and Smoke Development Indiex of less than 50, per ASTM E84.
      e. Manufacturer's standard double sided tape and patch tape as required.

3. Galvanized metal support straps (bands).
    a. Coated steel, width 1.0 inch, structural steel Grade 50 per ASTM C 653, exposed color, white.
    b. Provide gridwork of steel retainer straps engineered for compliance with fall arrest system and insulation loading.
4. Metal Building Insulation, two layers.
    a. Batt Insulation, ASTM C991, Type 1.
    b. Surface Burning: Flame Spread Index less than 25 and Smoke Development Index less than 50 per ASTM E84.
    c. Unfaced.
    d. Thermal Resistance, total: R-32.
    e. Thickness over purlins As required to achieve total R value listed with 8 inch full depth insulation between purlins.
    f. Thermal Breaks: Extruded or expanded polystyrene thermal spacer blocks.
    g. Insulation hangers: Manufacturer's standard as required.
5. Fasteners: Manufacturer's standard, color matched to liner system with sealing washers.
6. Manufacturers:
    a. "Simple Save System" by Thermal Design.
    b. "ProLiner Branded Liner System by Therm-All.
    c. "Glide FP" by Silvercote Envelope Solutions."

## 2.7 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
1. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
2. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with nylon or polypropylene washer.
3. Fasteners for Metal Roof and Wall Panels: Self-drilling Type 410 stainless-steel or self-tapping Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal panels.
4. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
5. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

D. Metal Panel Sealants:
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
2. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane, polysulfide, or silicone-rubber sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.8 FABRICATION, GENERAL

A. General: Design components and field connections required for erection to permit easy assembly.
   1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
   2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual": Chapter IV, Section 9, "Fabrication and Erection Tolerances."

C. Primary Framing: Shop fabricate framing components to indicated size and section with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
   1. Make shop connections by welding or by using high-strength bolts.
   2. Join flanges to webs of built-up members by a continuous submerged arc-welding process.
   3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
   4. Weld clips to frames for attaching secondary framing members.
   5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary structural members with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
   1. Make shop connections by welding or by using non-high-strength bolts.
   2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary structural members with specified primer after fabrication.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
   1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.9 STRUCTURAL FRAMING

A. Structural Steel: Comply with AISC 360, “Specification for Structural Steel Buildings.”

B. Bolted Connections: Comply with RCSC’s “Specification for Structural Joints Using High-Strength Bolts.”

C. Cold-Formed Steel: Comply with AISI’s “North American Specification for the Design of Cold-Formed Steel Structural Members” for design requirements and allowable stresses.

D. Primary Framing: Manufacturer's standard structural primary framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
   1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
      a. Slight variations in span and spacing may be acceptable if necessary to meet manufacturer's standard, as approved by Architect.

2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
3. Long-Bay Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
4. Frame Configuration: Single gable.
5. Exterior Column Type: Tapered on main frames.
6. Rafter Type: Tapered.

E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0598 inch.
2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0598 inch; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

F. Secondary Framing: Manufacturer's standard secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Fabricate framing from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet prepainted with coil coating, unless otherwise indicated, to comply with the following:
1. Purlins: C- or Z-shaped sections; fabricated from minimum 0.0598-inch thick steel sheet, built-up steel plates, or structural-steel shapes; minimum 2-1/2-inch wide flanges.
   a. Depth: As required to comply with system performance requirements.
   b. Where required provide other shapes to adequately support loads hanging from roof structure or provide additional framing members to support hanging loads.
2. Girts: C- or Z-shaped sections; fabricated from minimum 0.0598-inch thick steel sheet, built-up steel plates, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees to flange and with minimum 2-1/2-inch wide flanges.
   a. Depth: 8 inches.
3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from 0.0598-inch thick steel sheet, built-up steel plates, or structural-steel shapes; to provide adequate backup for metal panels.
4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch diameter, cold-formed structural tubing to stiffen primary frame flanges.
5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
6. Base or Sill Angles: Minimum 3-by-2-by-0.0598-inch zinc-coated (galvanized) steel sheet.
7. Purlin and Girt Clips: Minimum 0.0598-inch thick, steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
8. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from minimum 0.0598-inch thick, zinc-coated (galvanized) steel sheet.
9. Framing for Openings: Channel shapes; fabricated from minimum 0.0598-inch thick, cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings, and head, jamb, and sill of other openings.
10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

G. Bracing: Provide adjustable wind bracing as follows:
1. Rods: ASTM A 36; ASTM A 572, Grade 50 (345); or ASTM A 529, Grade 50 (345); minimum 1/2-inch diameter steel; threaded full length or threaded a minimum of 6 inches at each end.
2. Cable: ASTM A 475, 1/4-inch diameter, extra-high-strength grade, Class B zinc-coated, 7-strand steel; with threaded end anchors.
3. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.

4. Rigid Portal Frames: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
5. Fixed-Base Columns: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
6. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
7. Bracing: Provide wind bracing using any method specified above, at manufacturer's option.
8. Refer to Drawings for limitations on areas where bracing can be provided due to open wall areas.
9. Provide rafter brace clips for connection to bottom plane of purlins at roof.

H. Bolts: Provide plain finish bolts for structural-framing components that are primed or finish painted. Provide hot-dipped galvanized bolts for structural-framing components that are galvanized.

I. Factory-Primed Finish: Apply specified primer immediately after cleaning and pretreating.
1. Prime primary, secondary, and end-wall structural-framing members to a minimum dry film thickness of 1 mil.
a. Prime secondary steel framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.
2. Prime galvanized members with specified primer, after phosphoric acid pretreatment.

## 2.10 METAL ROOF PANELS

A. Vertical-Rib, 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 and engaging opposite edge of adjacent panels.
1. Material: Aluminum-zinc alloy-coated steel sheet, 24 gauge thick.
a. Exterior Finish: 2-Coat Fluoropolymer.
b. Color: As selected by A/E from manufacturer's full range.
2. Clips: Manufacturer's standard, floating type to accommodate thermal movement; fabricated from aluminum-zinc alloy-coated steel sheet.
3. Joint Type: Mechanically seamed, folded as standard with manufacturer.
4. Panel Coverage: 24 inches.
5. Panel Height: 3 inches.
6. Basis of Design: “CFR Standing Seam roof Panel” by Nucor Buildings Group.

B. Finishes
1. Exposed Coil-Coated Finish:
a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer’s written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer’s standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

## 2.11 FIELD-ASSEMBLED METAL WALL PANELS

A. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and flat pan between major ribs; designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
1. Material: Aluminum-zinc alloy-coated steel sheet, 24 gauge.
a. Exterior Finish: 2-Coat Fluoropolymer.
b. Color: As selected by A/E from manufacturer's full range.
2. Major-Rib Spacing: 12 inches o.c.
3. Panel Coverage: 36 inches.

4. Panel Height: 1.5 inches.
5. Basis of Design: “Group R-Panel” by Nucor Buildings Group.

B. Tapered-Rib-Profile, Metal Liner Panels: Formed with raised, trapezoidal major ribs and flat pan between major ribs; designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
1. Material: Aluminum-zinc alloy-coated steel sheet, 26 gauge thick.
   a. Exterior Finish: Siliconized polyester or acrylic enamel.
   b. Color: As selected by A/E from manufacturer's full range.
2. Major-Rib Spacing: 12 inches o.c.
3. Panel Coverage: 36 inches.
4. Panel Height: 1.5 inches.
5. Basis of Design: “Group R-Panel” by Nucor Buildings Group.

2.12 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match profile and material of metal wall panels.
1. Finish: Match finish and color of metal wall panels.

2.13 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.
1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
2. Gable Trim: Manufacturer’s standard profile at gable end to close roof and wall intersection.
3. Clips: Manufacturer's standard, formed from steel sheet or stainless-steel sheet, designed to withstand negative-load requirements.
4. Cleats: Manufacturer's standard, mechanically seamed cleats formed from steel sheet or stainless-steel sheet or nylon-coated aluminum sheet.
5. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
6. 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 roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
7. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1 inch standoff; fabricated from extruded polystyrene.

C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall 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 wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

D. Flashing and Trim: Formed from minimum 0.018-inch thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.
1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
a. Additional flashing and trim for a complete project includes but is not limited to:
1) Wall panel closures, base and top.
2) Base flashings.
2. Opening Trim (Windows and Louvers): Minimum 0.0269-inch thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
3. Metal Sill Flashing: Formed from minimum 20 gauge, metallic-coated steel sheet prepainted with same finish to match adjacent panels. Formed into configuration as indicated on Drawings.
a. Provide continuous hold down cleat at drip edge.
b. Location: Transition between metal wall panel and masonry wall and transition between openings in metal wall panel and masonry wall.

E. Gutters: Formed from minimum 0.0159-inch thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
1. Gutter Supports: Fabricated from same material and finish as gutters; spaced 36 inches o.c.
2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
3. Color: Black

F. Downspouts: Formed from 0.0159-inch thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot long sections, complete with formed elbows and offsets. Size according to SMACNA's "Architectural Sheet Metal Manual."
1. Mounting Straps: Fabricated from same material and finish as gutters; spaced 10 feet o.c.
2. Color: Black

G. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

H. Snow Guards: Prefabricated, noncorrosive units designed to be installed without penetrating roof panel, with predrilled holes and clamps or hooks for anchoring.
1. Metal-Type Guard: Consisting of aluminum or stainless-steel rods or bars held in place by supports clamped to vertical ribs of standing-seam roof.
a. Products: Subject to compliance with requirements, provide one of the following:
1) LMCurbs; S-5! SnoFence.
2) Riddell & Company, Inc.; Snobar.
3) Snow Management Systems; Vermont Snowguard.

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. For the record, prepare written report, endorsed by Erector, listing conditions detrimental to performance of work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with Erector present, for compliance with requirements and metal building system manufacturer's tolerances.
   1. Engage land surveyor to perform surveying.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

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

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing true to line, level, plumb, rigid, and secure. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist cure grout for not less than seven days after placement.
   1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
      a. Joint Type: Snug tightened or pretensioned.

G. Secondary Framing: Erect framing true to line, level, plumb, rigid, and secure. Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts.
   1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
   2. Locate and space wall girts to suit openings such as doors and windows.
   3. Provide supplemental framing at entire perimeter of openings, including doors, overhead doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Steel Framing: Install framing and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders," joist manufacturer's written recommendations, and requirements in this Section.
   1. Before installation, splice joists delivered to Project site in more than one piece.
   2. Space, adjust, and align joists accurately in location before permanently fastening.
   3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
   4. Bolt joists to supporting steel framework using high-strength structural bolts, unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
   5. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
   1. Tighten rod and cable bracing to avoid sag.
   2. Locate interior end-bay bracing only where indicated.

J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.4 METAL PANEL INSTALLATION, GENERAL

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer’s standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Examination: Examine primary and secondary framing to verify that structural panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
   1. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before metal panel installation.

C. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
      a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
   2. Install metal panels perpendicular to structural supports, unless otherwise indicated.
   3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

D. Lap-Seam Metal Panels: Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or metal panels. Install screws in predrilled holes.
   1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

E. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

F. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal panel manufacturer.
   1. Seal metal panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal panel manufacturer.
   2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

## 3.5 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations.
   1. Install ridge caps as metal roof panel work proceeds.
   2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint at location and spacing recommended by manufacturer.
   1. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal roof panels.
   2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
   3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels; on side laps of ribbed or fluted metal panels; and elsewhere as needed to make metal panels weatherproof to driving rains.

4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

C. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

## 3.6 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When two rows of metal panels are required, lap panels 4 inches minimum.
4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners in predrilled holes.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated, or if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
1. Field-Insulated Assemblies: Install thermal insulation as specified. Install metal liner panels over insulation on interior side of girts at locations indicated. Fasten with exposed fasteners as recommended by manufacturer.

C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

## 3.7 THERMAL INSULATION INSTALLATION

A. General: Install insulation concurrently with metal wall panel installation, in thickness indicated to cover entire wall, according to manufacturer's written instructions.
1. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths with both sets of facing tabs sealed to provide a complete vapor retarder.
4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:
1. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
2. Install blanket insulation into roof liner insulation retaining systems between structural members.

C. Blanket Wall Insulation: Extend insulation over and perpendicular to top flange of secondary framing members. Hold in place by metal wall panels fastened to secondary framing.

## 3.8 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   2. Install components for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   3. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
   1. Tie downspouts to underground drainage system indicated.

E. Snow Guards: Install as recommended by manufacturer.

## 3.9 FIELD QUALITY CONTROL

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

B. Tests and Inspections:
   1. High-Strength, Field-Bolted Connections: Connections shall be inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1 and the following inspection procedures, at inspector's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

C. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

3.10 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or SSPC-SP 3, "Power Tool Cleaning."
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 13 34 19

# GUARANTEE FORM
(Metal Building Systems)

Whereas, _____

Of _____

Herein called "the Contractor," has completed application of the following roof:

Owner: _____

Address of Owner: _____

Type and Name of Building: _____

Location: _____

Type of Roof: _____

Date of Initiation of Warranty: _____

Date Warranty Expires: _____

Whereas, at the inception of such work, the Contractor agreed to guarantee the aforesaid pre-engineered building components against faulty materials or workmanship for a limited period and subject to the conditions herein set forth:

Now, Therefore, the Contractor hereby guarantees, subject to the conditions herein set forth, that during a period of 5 years from the date of Substantial Completion of said pre-engineered building he will, at his own cost and expense, make or cause to be made such repairs to said roof resulting solely from faults or defects in material or workmanship applied by or through the Contractor as may be necessary to maintain said pre-engineered building in weathertight condition. Guarantee shall include, but not be limited to, metal roof, roof insulation, sheet metal fascia and soffits, sheet metal closures, trim and flashings, curbs at roof openings, gutters and downspouts, coping caps, and counterflashings.

This Guarantee is made subject to the following conditions:

1. Specifically excluded from this Guarantee is damage caused by lightning, windstorm, hailstorm, or other unusual phenomena of the elements; foundation settlement; failure or cracking of the roof deck; defects or faulty constructions and leakage due to failure of vents, supports, or other parts of the building or damaged caused by fire. The gutters and valleys must be kept clear and free of dirt and debris. The roof is not to be used as a promenade deck or work deck, unless specifically agreed upon or specified at time of application of roofing. If the pre-engineered building is damaged by reason of the foregoing, this Guarantee shall thereupon become null and void for the balance of the guarantee period unless such damage is repaired by the Contractor at the expense of the party requesting such repairs.

2. Nothing in this instrument shall render the Contractor liable for consequential damages to the building or contents resulting from defects in said roof.

3. No work shall be done on said pre-engineered building including, but without limitation, openings made for flues, vents, drains, sign braces, or other equipment fastened to or set on the roof unless the Contractor shall be first notified, shall be given the opportunity to make the necessary application recommendations with respect thereto, and such recommendations are complied with. Failure to observe this condition shall render this Guarantee null and void. The Contractor shall be paid for time and material expended in making recommendations or repairs occasioned by the work of others on said pre-engineered building.

4. Repairs required, either permanent or temporary, to pre-engineered building or flashings under this guarantee to keep the pre-engineered building weather-tight shall be made within 3 days after notice of the need for repairs. Should the Contractor fail to make such repairs within the time period, the Owner may have such repairs made and charge the cost to the Pre-Engineered Building Contractor.

5. Guarantee period shall begin on the date of Substantial Completion for the Project or such date that the roof is accepted by the Architect and Owner.

6. Additional conditions or exclusions:

In Witness Whereof, this instrument has been duly executed this _____ day of _____, 20_____.

_____ Notary

_____ Authorized Signature

My commission expires _____

Title _____