

SECTION 011199 – SUMMARY OF WORK

PART 1 - GENERAL

1.01 *SUMMARY*

A. Section Includes

1. Project Information
2. Work covered by Contract Documents
3. Owner-furnished, Contractor-installed (OFICI) products
4. Contractor's use of site and premises
5. Coordination with occupants
6. Work restrictions
7. Specifications and Drawing conventions

1.02 *PROJECT INFORMATION*

A. Project: Federal Way High School CTE Storage

1. 30611 16th Avenue S.
2. Federal Way, WA 98003

B. Owner: Federal Way Public Schools

1. 1211 S. 332nd St.
2. Federal way, WA 98003

C. Architect: Bassetti Architects

1. 71 Columbia Street, Suite 500
2. Seattle, WA 98104

1.03 *WORK COVERED BY CONTRACT DOCUMENTS*

A. CTE Storage

1. The project will create a storage space for the existing CTE classroom, as part of the Federal Way High School (FWHS) Career and Technical Education (CTE) curriculum. This space is an extension of the existing vocational/woodshop area at the Federal Way High School. The project (CTE Storage Canopy) is located directly adjacent to the existing Federal Way High School building, immediately west of the Woodshop classroom. The CTE storage canopy consists of a fenced enclosure and a canopy for class materials. It will require demolition of existing concrete slab within

extent of work and a new concrete slab and column foundations. The canopy will be enclosed by a 12' high chain-link fence 3 sides and abutting the existing building on the fourth side. The fence will be 1" mesh, black chain-link. The canopy structure will be a steel moment frame structure, with a 14'x30' footprint, approximately 13' high, with a low-slope metal roof, sloping in one direction. Sidewall fire sprinkler heads will be routed off the existing fire sprinkler system inside the building to the canopy area. New conduit will be routed from existing interior lighting circuit to new exterior lighting.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.04 *OWNER-FURNISHED, CONTRACTOR-INSTALLED (OFICI) PRODUCTS*

- A. Not in Use

1.05 *CONTRACTOR'S USE OF SITE AND PREMISES*

- A. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- B. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.06 *COORDINATION WITH OCCUPANTS*

- A. Partial Owner Occupancy: Owner will occupy premises during entire construction period, with exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.07 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
1. Weekend Hours: 9:00 a.m. to 7:00 p.m.
 2. Early Morning Hours: High Impact Equipment restricted to 8:00 a.m. to 5:00 p.m.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
1. Notify Owner not less than 2 days in advance of proposed utility interruptions.
 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify Owner not less than 2 days in advance of proposed disruptive operations.
 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Project site or within existing building is not permitted.
- F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.08 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: Specifications use certain conventions for style of language and intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in Specifications. The words "shall," "shall be," or "shall comply with," depending on context, are implied where a colon (:) is used within a sentence or phrase.
 2. Specification requirements shall be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to Work of all Sections in Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in Specifications. One or more of the following are used on Drawings to identify materials and products:
1. **Terminology**: Materials and products are identified by typical generic terms used in individual Specifications Sections.
 2. **Abbreviations**: Materials and products are identified by abbreviations scheduled on Drawings.
 3. **Keynoting**: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 011199

SECTION 024119 - SELECTIVE AND STRUCTURE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Demolition and removal of selected building elements and site elements as indicated on Drawings.

1.02 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- C. 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.

1.03 MATERIALS OWNERSHIP

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

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination Meetings: Conduct coordination meetings specifically for alteration Work at weekly intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation meetings.
 1. Attendees: In addition to representatives of Owner, Architect, and Contractor, each specialist, supplier, Installer, and other entity concerned with progress or involved in planning, coordination, or performance of alteration Work activities shall be represented at these meetings. Participants at meeting shall be familiar with Project and authorized to conclude matters relating to alteration Work.
 2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration Work. Include topics for discussion as appropriate to status of Project.

- a. Alteration Work Subschedule: Review progress since last coordination meeting. Determine whether each schedule item is on time, ahead of schedule, or behind schedule. Determine how construction behind schedule will be expedited with retention of quality; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within Contract Time.
 - b. Schedule Updating: Revise Contractor's Alteration Work Subschedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each entity present, including review items listed in "Preliminary Conference for Alteration Work" Paragraph in this article and the following:
 - 1) Interface requirements of alteration Work with other Project Work.
 - 2) Status of submittals for alteration Work.
 - 3) Access to alteration Work locations.
 - 4) Effectiveness of fire-prevention plan.
 - 5) Quality and work standards of alteration Work.
 - 6) Change Orders for alteration Work.
 3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
 4. Arrange selective demolition schedule so as not to interfere with Owner's operations.
- B. Preinstallation conference and Field Walk: Prior to start of Work conduct conference and field walk of area to be demolished with all team members including involved trades.
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 Fire-Protection Plan. Include the following:
 - a. Heat-generating equipment.
 - b. Fire-watch.
 - c. Fire-control devices, location and type.
 - d. Sprinkler systems.
 6. Review and finalize protection requirements.
 7. Review procedures for noise control and dust control.
 8. Review procedures for protection of adjacent buildings.
 9. Review Drawings and scope/extent of demolition.

1.05 INFORMATIONAL SUBMITTALS

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

- B. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.
- C. Schedule of Selective Demolition Activities: Indicate following:
 - 1. Detailed sequence of selective demolition and removal Work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Temporary interruption of utility services and extend of limited utility use.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - 5. Shoring.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Submit before Work begins.
- E. Fire Protection Plan: Develop plan that addresses use of heat-generating equipment and combustible materials and complies with authorities having jurisdiction and local codes.
 - 1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled "Owner's Responsibility for Fire Protection."
 - 2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for immediate Work.
 - a. If combustible material cannot be removed, provide fire blankets to cover such materials.

1.06 CLOSEOUT SUBMITTALS

- A. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.07 QUALITY ASSURANCE

- A. Contractor Qualifications: Work shall be performed by skilled contractors having successful experience in comparable protection, salvage and removal operations including work on at least 3 projects similar in scope and scale to this Project in the last 5 years. Submit references with name of contact person and telephone number for the 3 submitted similar projects. Work to be performed by individuals whose qualifications have been submitted and approved.

1.08 FIELD CONDITIONS

- A. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
 - 1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
 - 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

- a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective or structure demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- 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.

1.09 COORDINATION

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.
- B. Alteration Work Subschedule: A construction schedule coordinating sequencing and scheduling of alteration Work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration Work.
 1. Schedule construction operations in sequence required to obtain best Work results.
 2. Coordinate sequence of alteration Work activities to accommodate the following:
 - a. Owner's continuing occupancy of portions of existing building.
 - b. Owner's partial occupancy of completed Work.
 - c. Other known Work in progress.
 - d. Tests and inspections.
 3. Detail sequence of alteration Work, with start and end dates.
 4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
 5. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support imposed loadings without damage.

PART 2 - PRODUCTS

2.01 PERFORMANCE CRITERIA

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Contractor and subcontractors performing demolition activities are to comply with lead paint regulations in OAR 437 Division 3, 1926.62.
- C. Standards: Comply with ASSE A10.6 and NFPA 241.

2.02 REPAIR MATERIALS

- A. Use repair materials identical to existing materials and as specified in Section as indicated on Drawings:
 - 1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to fullest extent possible.
 - 2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Determine whether removing any element might result in structural deficiency or unplanned operations
- D. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as Work progresses to detect hazards resulting from selective demolition activities.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
 - 1. Inventory and record the condition of items to be removed. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.02 PREPARATION

- A. Temporary Protection: 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.
- B. Temporary Protection of Materials to Remain:
 - 1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
 - 2. Do not attach temporary protection to existing surfaces except as indicated as part of alteration Work program.
- C. Temporary Shoring: Design, 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.
- D. Remove temporary barricades and protections where hazards no longer exist.
- E. Existing Facilities: Protect adjacent walkways, building entries, and other building facilities during demolition operations.
- F. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
 - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
 - 2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
 - a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- G. Existing Drains: Prior to start of Work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin Work in an area until drainage system is functioning properly.
 - 1. Prevent solids such as adhesive or mortar residue or other debris from entering drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration Work.
 - 2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

3.03 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete 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 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. Temporarily cover openings to remain.
 3. Cut or drill from exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until Work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain fire watch at Project site during and until 60 minutes after conclusion of day's Work.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly.
- B. 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.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, 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.

3.04 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- B. Anchorages:
1. Remove anchorages associated with removed items.
 2. Dismantle anchorages associated with dismantled items.
 3. Patch holes created by anchorage removal or dismantling according to the requirements for new Work.

3.05 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 312000 "Earth Moving."
- C. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.06 REPAIRS

- A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 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. Do not burn demolished materials.

3.08 CLEANING

- 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.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including formwork, concrete materials, mixture design, placement procedures, and finishes.
2. Penetrating Liquid Floor Treatment
3. Vapor retarder.
4. Install products from other sections that require casting into concrete including:
 - a. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts.
 - b. Steel weld plates and angles.

1.02 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: Fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. Concrete Surface Profile (CSP): Measure of the average distance from the peaks of the surface to the valleys as seen through a cross-sectional view of the concrete surface.
- C. Design Reference Sample: Sample designated by Architect in Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural concrete.
- D. Reveal: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.
- E. W/C Ratio: Ratio by weight of water to cementitious materials.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Conference: Conduct meeting at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor.
 - b. Contractor's superintendent.
 - c. Owner.
 - d. Architect.
 - e. Independent testing agency responsible for concrete design mixtures.
 - f. Party responsible for concrete design mixtures.

- g. Ready-mix concrete manufacturer.
- h. Concrete Subcontractor.

2. Review the following:

- a. Project schedule.
- b. Special inspection, testing and inspecting agency procedures for field quality control.
- c. Installer's Quality Control Plan.
- d. Construction joints, control joints, isolation joints, and joint-filler strips.
- e. Concrete finishes and finishing.
- f. Cold and hot-weather concreting procedures.
- g. Curing procedures.
- h. Coordination with vapor-barrier installation.
- i. Mix design and strategy for carbon footprint reduction.
- j. Vapor retarder installation.
 - 1) Review Concrete Surface Profile (CSP) required by vapor retarder installer and plan for compliance.
- k. Anchor rod and anchorage device installation.
- l. Tolerances, steel reinforcement installation.
- m. Methods for achieving specified floor and slab flatness, levelness and CSP rating.
- n. Floor and slab flatness and levelness measurement.
- o. Concrete repair procedures.
- p. Concrete protection.
- q. Initial curing and field curing of field test cylinders (ASTM C31).
- r. Protection of field cured field test cylinders.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product. Portland cement.

- 1. Portland Cement.
- 2. Pozzolans (fly ash, slag cement and others).
- 3. Blended hydraulic cement.
- 4. Silica fume.
- 5. Performance-based hydraulic cement
- 6. Aggregates.
- 7. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
- 8. Curing materials.
- 9. Joint fillers.
- 10. Repair materials.

B. Design Mixtures: For each concrete mixture. Include the following

1. Mixture identification.
2. Minimum 28 day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Slump limit.
6. Air content.
7. Nominal maximum aggregate size.
8. Steel-fiber reinforcement content.
9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.

C. Steel Reinforcement Shop Drawings: Comply with ACI SP-066.

1. Shop Drawings shall contain sufficient detail and information to allow complete fabrication, bending, and placement of steel reinforcement without reference to the Drawings. Generate Shop Drawing fabrication and installation details from the Drawings and Specifications. Do not reproduce or photocopy Drawings. If CAD or REVIT files are provided, detailers responsibility to remove non-relevant information.
 - a. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical and welded connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Bar arrangement to identify size, shape, grade, and location of steel reinforcement.
 - b. Provide details of fabrication, bending, and placement, prepared according to ACI Detailing Manual SP-66. Include special reinforcement required for openings through concrete structures.
 - c. Shop drawings shall include elevations for concrete beams, walls, and columns and plans for slabs to show bar arrangement. Plans and elevations to include special reinforcement required for openings through concrete structures
 - d. Shop drawing re-submittals shall clearly identify revisions to previous submittals.
 - e. Heavy ink clouded outlines (revision clouds) shall be drawn around revised areas of individual sheets.
 - f. Architect/Engineer will not review information outside of revision clouds on resubmitted drawings.

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

1. Coordination location of construction joints with Architect's jointing pattern. Locations are subject to approval by Architect.

E. Placement Schedule: Submit concrete placement schedule before start of placement operations. Include locations of joints, including construction joints.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data for the following:

1. Installer: Include copies of applicable ACI certificates.
 - a. Include installer's project references with name of project and project architect.
 - b. Include photos of finishes and documentation of floor finish tolerances achieved.

2. Manufacturer: Ready mixed concrete manufacturer.
3. Testing Agency: Include copies of applicable ACI certificates.

B. Welding certificates.

1. Reinforcement to be Welded: Welding procedure specification in accordance with AWS D1.4

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

1. Steel Reinforcement:
 - a. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

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

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Floor and slab treatments.
5. Bonding agents.
6. Release agents.
7. Adhesives.
8. Joint filler.
9. Joint-filler strips.
10. Repair materials.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances in accordance with ASTM E1155.

F. Manufacturer's installation and product data for fiber reinforcing.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer with a minimum 5 years of experience who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

1. Quality Control Plan: Develop plan that outlines activities and procedures to minimize problems on Project.

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

1. Manufacturer member of NRMCA and certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
2. Quality Control personnel with responsibility for concrete mixtures certified as an NRMCA Concrete Technologist Level 2 or equivalent. Include criteria or equivalent certification in submittal.

- C. Testing Agency Qualifications: Independent testing agency shall meet ASTM C1077.
 - 1. Personnel conducting field test for acceptance shall be certified as ACI Concrete Field Testing Technician Grade I or equal.
 - 2. Test results for the purpose of acceptance shall be certified by registered design professional employed with the Testing Agency.

- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4.

- E. Moisture Content and Alkalinity Testing for Concrete Slab:
 - 1. Take measures to control concrete mix design water content, placement, curing, and other procedures as necessary to achieve acceptable moisture and alkalinity content within time period scheduled for installation of finish flooring systems specified under other Sections.
 - 2. Conduct testing as specified under PART 3 of this Section under Field Quality Control testing for concrete slabs. Do not begin testing until after building envelope is fully enclosed and ambient temperature and humidity approximate final interior conditions.

- F. Geotechnical Report:
 - 1. Available for information only and is not a Contract Document.
 - 2. Where Geotechnical Report recommendations differ from Contract Document, verify with Architect prior to proceeding.

- G. Capillary Break:
 - 1. Do not install sand layer or other granular fill over vapor retarder prior to placement of concrete slab-on-grade.
 - 2. Rounded pea gravel as a subbase is not acceptable. Subbase gravel must be crushed or angular.

1.07 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
 - 1. The following will be included in the test report:
 - a. Admixture dosage rates.
 - b. Slump.
 - c. Air content.
 - d. Unit weight of concrete.
 - e. 7-day compressive strength.
 - f. 28-day compressive strength.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94 and ACI 301.

- B. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- C. Store reinforcement to avoid contact with earth.

1.09 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301, structural general notes on drawings, and as follows:
 - 1. Protect concrete Work from physical damage by low temperatures.
 - 2. When average low temperature is expected to fall below 40 degree F. for 3 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 on frozen subgrade or on subgrade containing frozen materials.
 - 4. Do not use calcium chloride in concrete with steel reinforcement. Do not use chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301, and ACI 305.1, structural general notes on drawings, and as follows:
 - 1. Maintain concrete temperature below 90 degree 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 standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.01 PERFORMANCE CRITERIA

- A. Environmental Product Declaration (EPD): Provide current certification for each concrete mix design.
 - 1. Provide an EPD conforming to one of the following:
 - a. Product specific declaration conforming to ISO 14044.
 - b. Product specific Type III EPD conforming to ISO 14071, ISO 14025, and EN 15804 or ISO 21930.

2.02 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in Contract Documents:
 - 1. ACI 301, Specification for Structural Concrete, Sections 1 through 5.

2. ACI 117, Specifications for Tolerances for Concrete Construction and Materials.

2.03 FORM-FACING DESIGN CRITERIA

- A. Formwork Design, Structural Stability, and Sufficiency: Conform to ACI 318 Chapter 6, and ACI 347R.
 1. Design, and construct formwork, shoring and bracing to withstand construction loads, continuous loads, and lateral pressure as required to accomplish cast-in-place concrete work.
 2. Design and construct formwork to withstand pressure resulting from placement and vibration, while maintaining specified tolerances.
 3. Design for special vertical and horizontal loads conforming to ACI 347R Section 2.2.
 4. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, dimensions and appearance.
 5. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.
- B. Concrete Finish Standards:
 1. Public/ Prominently Displayed Concrete: Provide smooth concrete surface levels meeting or exceeding CSC3 from ACI 347.3R-13 for Architectural Concrete.
- C. Form facing material should be of consistent type, grade and source resulting in color uniformity complying with ACI 347.3R-13.

2.04 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Class A or B, Construction Surface Category (CSC) 4.
 1. Form-facing panels that provide continuous, true, and smooth concrete surfaces, matched, tight fitting, and stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete. Furnish in largest practicable sizes to minimize number of joints.
 - a. Plywood, metal, glass-fiber-reinforced plastic, or other accepted panel materials.
 - b. Use for concrete that will be exposed in finished Work.
- B. Rough-Formed Finished Concrete: Class C or D, Construction Surface Category (CSC) 2.
 1. Plywood, lumber, metal, or another accepted material. Provide lumber dressed on at least 2 edges and 1 side for tight fit.
 2. Use for concrete that will be concealed in finished Work.
- C. Form Ties, Exposed Concrete Locations:
 1. Fiberglass Ties: Glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 2. Color: Gray.
- D. Form Ties, Concealed Concrete Locations:

1. Snap Ties:
 - a. Basis of Design: Provide Loop Tie by Meadow Burke or accepted substitution:
 - 1) Dayton Superior.
 - b. 1 inch diameter by 1 inch deep snap-tie with flattened break-offs and plastic cone.
 - c. High strength, non-corrosive, non-staining finish.
 - d. One inch minimum break-back below concrete surface.
 - e. Wire snap-ties strength and length as required for conditions of installation.
 - f. Water seals to inhibit flow of water along tie shaft and to block against leakage.
- E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- F. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 051200 - Structural Steel Framing.

2.05 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed.

2.06 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. 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:
- C. Steel Tie Wire: ASTM A1064, annealed steel, not less than 0.0508 inch in diameter.
 1. Finish: Galvanized.

2.07 CONCRETE MATERIALS

- A. Source Limitations:
 1. Obtain concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
 2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
 3. Obtain aggregate from single source.
 4. Obtain admixtures from single source from single manufacturer. If admixtures from different manufacturers are used, concrete supplier to demonstrate compatibility.
- B. Cementitious Materials: Portland Cement; ASTM C150, ASTM C595, ASTM C595 or ASTM C1157; as follows:

1. Exterior Locations: Type I and Type IL with specified air entrainment admixture, preferred to Type IA and Type IIA air-entrained concrete. Type IIIA acceptable for cold weather construction.
2. Fly Ash: ASTM C618, Class F or Class C.
3. Slag Cement: ASTM C989, Grade 120.
4. Recycled Ground-Glass Pozzolan: ASTM C1866.

C. Aggregates: ASTM C33.

1. Fine and Course: Class 3M.
2. Maximum Coarse Aggregate Size: 1 inch.
 - a. Do not exceed guidelines set forth by ACI for distance between reinforcing steel and thickness of concrete slabs and toppings.
3. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, and less than 8 percent may be retained on sieves finer than No. 50.

D. Water-Reducing and -Retarding Admixture: ASTM C494, Type D.

E. Air-Entraining Admixture: ASTM C260; for use at exterior concrete unless indicated otherwise.

1. Achieve percent entrained air per ACI 318 Table 19.3.3.1, Exposure F2, plus or minus 1 1/2 percent to batch plant concrete mix, for exterior concrete exposed to earth, weather, or freezing temperatures after curing.

2.08 VAPOR RETARDER

A. Underslab Sheet Vapor Retarder: ASTM E1745 Class A and ASTM E1643. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Manufacturers: Provide products by one of the following:
 - a. Fortifiber Building Systems Group.
 - b. Raven Industries, Inc.
 - c. Reef Industries, LLC.
 - d. Stego Industries, LLC.
 - e. W.R. Meadows, Inc.
2. Water Absorption: Maximum 0.01 percent weight-gain maximum after 48-hour immersion at 70 degree F; ASTM D570.
3. Vapor Permeance: ASTM F1249, 0.0086 perms.
4. Thickness: Minimum 15 mil.

2.09 VAPOR RETARDER ACCESSORIES

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

- B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.
- D. Vapor Barrier Seam Tape: Type as recommended by vapor barrier manufacturer.
- E. Pipe Boot: Type as recommended by vapor barrier manufacturer.
- F. Vapor Proofing Mastic: Type as recommended by vapor barrier manufacturer.

2.10 SLAB TREATMENTS

- A. Integral Hardening Admixture: Increased abrasion, durability and erosion resistance to extend life of concrete. Admixture not to affect slump, setting time, entrained air content and stability. Integral admixture to be used in horizontal, vertical surfaces as indicated on Drawings.
 - 1. Performance Standards:
 - a. Particle Size: 50 percent less than 100 microns.
 - b. Specified Gravity: 3.55.
 - c. Bulk Density: 103 pounds per ft³.
 - d. Abrasion Resistance: At least a 66 percent reduction in mass loss per ASTM C627.
- B. Non-Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
 - 1. Products: Provide one of the following:
 - a. Master Builders Solutions: MasterTop 100.
 - b. Dayton Superior Corporation: Quartz Tuff.
 - c. Euclid Chemical Company (The): Surfex Light Reflective.
 - d. L. M. Scofield Company: Lithochrome Color Hardener.
 - e. Laticrete International, Inc.: Quartz Plate FF.
 - f. Metalcrete Industries: Floor Quartz.
 - g. US Mix Co: Dense Top LR.

2.11 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, USDA approved, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, seals, and densifiers concrete surfaces.
 - 1. Products: Provide one of the following:
 - a. Master Builders Solutions: MasterKure HD 200WB.
 - b. ChemMasters, Inc.: Chemisil Plus.
 - c. Curecrete Distribution Inc.: Ashford Formula.
 - d. Dayton Superior Corporation: Sure Hard Densifier J17.
 - e. Euclid Chemical Company (The): Euco Diamond Hard.

- f. Laticrete International, Inc.: Seal Hard.
 - g. SprayLock Concrete Protection: SCP 327.
 - h. SpecChem, LLC: SpecHard.
 - i. W.R. Meadows, Inc.: LIQUI-HARD.
2. Products shall comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Location: Non-public spaces and back of house areas.

2.12 CURING MATERIALS

- A. Contractor's choice between the following:
 1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with water or continuous water-fog spray.
 2. Moisture-Retaining Cover: Provide one of the following that complies with ASTM C171:
 - a. Impervious paper consisting of 2 sheets of kraft paper cemented together by a bituminous adhesive with fiber reinforcement.
 - b. Polyethylene film, clear, minimum nominal thickness of 0.0040 inch.
 - c. White-burlap-polyethylene sheet, 40 inches wide, weighing not less than 10 ounces per linear yard.

2.13 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
 1. Products: Provide one of the following:
 - a. Masco Masons Supply Company: Reflex Rubber Joint.
 - b. Right Pointe Company: Right-Joint Fibre Expansion Joint.
 - c. SpecChem: SpecFlex Fiber Expansion Joint.
 - d. W. R. Meadows: FIBRE Expansion Joint.
 - e. Western Louisville Fiberboard: WLF Expansion Joint.
 2. Thickness: 1/2 inch unless indicated otherwise.
 3. Colors: Standard Gray.
 4. Provide for isolation joints at slab and foundation conditions, and where indicated on Drawings.
- B. Semi-Rigid Joint Filler: 2-component, semi rigid, 100 percent solids, aromatic polyurea.
 1. Products: Provide one of the following that complies with the Shore A Hardness test ranging from 85 to 95 according to ASTM D2240:
 - a. Adhesives Technology Corp.: Crackbond JF-82 Fast.
 - b. Master Builders Solutions: MasterSeal CR 100.
 - c. Euclid Chemical Company (The): Euco Qwikjoint 200.
 - d. MAPEI Corporation: Planiseal RapidJoint 15.
 - e. Metzger/McGuire: Spal-Pro RS 88.

- f. Prime Resins, Inc.: Joint Shield 5500 Polyurea 95A.
 - g. Sika Corporation: Sika Loadflex-524 EZ.
- 2. Colors: Standard Gray.
 - 3. Tensile Strength: Minimum of 800 psi according to ASTM D412.
 - 4. Elongation: Minimum 200 percent per ASTM D412.
- C. Bonding Agent: ASTM C1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
 - D. Epoxy Bonding Adhesive: ASTM C881, 2-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 I and II, non-load bearing and Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.14 REPAIR MATERIALS

- A. Repair Overlayment for Exterior Exposed Conditions: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C150, portland cement as defined in ASTM C219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5,000 psi at 28 days when tested according to ASTM C109.

2.15 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.

2.16 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings:
 - 1. As indicated on Structural Drawings.
- B. Exterior Concrete: Normal-weight concrete. Stoop slabs, exterior sidewalks, mechanical equipment pads, and other similar conditions.
 - 1. As indicated on Structural Drawings.

2.17 FABRICATING REINFORCEMENT

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

2.18 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94 and ASTM C1116, and furnish batch ticket information.
1. When air temperature is between 85 and 90 degree F., reduce mixing and delivery time from 1 1/2 hours to 75 minutes.
 2. When air temperature is above 90 degree F., reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cubic yard or smaller, continue mixing at least 1 1/2 minutes, but not more than 5 minutes, after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than 1 cubic yard., increase mixing time by 15 seconds for each additional 1 cubic yard.
 3. Provide batch ticket for each batch discharged and used in Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.01 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- 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 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
 2. Class B, 1/4 inch for rough-formed finished surfaces unless indicated otherwise.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
1. Install reglets, recesses, and the like, for easy removal.
 2. 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. Form openings, chases, offsets, sinkages, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- H. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- I. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- J. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 VAPOR RETARDER INSTALLATION

- A. Install per manufacturer's recommendations.
- B. Install vapor retarder in accordance ASTM E1643.
 - 1. Verify Concrete Surface Reading (CSP) value complies with manufacturer's required value for vapor retarder bonding.
 - 2. Unroll vapor barrier with the longest dimension parallel with the direction of concrete placement and face laps away from expected direction of the placement.
 - 3. Extend vapor barrier to the perimeter of the slab; terminate at top of slab, or at point acceptable to Structural engineer or where obstructed by impediments, such as dowels, waterstops, or other site condition requiring early termination of the vapor barrier.
 - 4. Seal vapor barrier using method recommended by manufacturer.
 - 5. Overlap joints 6 inches and seal with seam tape.
- C. Repair damages from installation and lap seams and terminations.

3.03 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete. Use setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.04 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 degree F. for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28 day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless accepted by Architect.

3.05 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. 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/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least 1 mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.06 JOINTS

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

- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as accepted by Architect.
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 a bonding agent at locations where fresh concrete is placed against non-structural hardened or partially hardened concrete surfaces.
 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against structural or load-bearing hardened or partially hardened concrete surfaces, and where curing in humid conditions exist.
- C. Control Joints in Slabs-on-Grade: Form weakened-plane control joints, sectioning concrete into areas as indicated on Drawings and accepted Shop Drawings. Verify locations with Architect before proceeding. Construct control joints for a depth equal to at least 1/4 of concrete thickness modified as follows:
1. Early-Entry Sawed Joints: Form contraction joints on both interior and exterior slabs using early-entry dry-cut saws and methods in accordance with ACI 302.1R, Chapter 8.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, , 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 Section 079200 - Joint Sealants, are indicated.
 3. Install joint-filler strips in full-length. Where more than 1 length is required, lace or clip sections together.

3.07 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of vapor retarder, formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Measure, batch, mix, deliver, and provide delivery ticket for each batch of concrete in accordance with ASTM C94.
1. Water is permitted to be added to a batch of concrete at the project site before placement provided that the amount of water added does not exceed the allowed amount indicated on the delivery ticket. Water addition shall only be permitted before any portion of the load is discharged. Samples for quality assurance tests shall be obtained after water addition and additional mixing in accordance with ASTM C94.

2. It is permitted to add water to the concrete mixture during transportation to the jobsite when concrete is transported in truck mixers equipped with automated water measurement and slump or slump flow monitoring equipment in accordance with ASTM C94.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in 1 layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 1. If a section cannot be placed continuously, provide construction joints as indicated.
 2. Deposit concrete to avoid segregation.
- E. Deposit and consolidate concrete for slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Do not place concrete 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. Do not exceed 2% cross slope.
 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 8. Do not further disturb slab surfaces before starting finishing operations.

3.08 FINISHING FORMED SURFACES

- A. As-Cast Surface Finishes:
 1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than 1 1/2 inches wide or 1/2 inch deep.
 - b. Remove projections larger than 1 inch.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 Class D.
 - e. Apply to concrete surfaces not exposed to public view.

3.09 FINISHING FLOORS AND SLABS

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

- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 AS-CAST FORMED FINISHES

- A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections exceeding specified limits on formed-surface irregularities. Repair and patch tie holes and defects.

3.11 TOLERANCES FOR FLOOR FLATNESS

- A. Finish concrete surfaces to the following tolerances, according to ASTM E1155, for locations indicated below. Measure flatness within 48 hours after slab installation:
 - 1. Conventional: Specified overall values of flatness, F(F) 20; with minimum local values of flatness, F(F) 17.
 - a. Locations: Mechanical, electrical, janitorial, and utility rooms.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

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

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/square feet by height 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. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with water or continuous water-fog spray.

3.14 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 1 month for semi-rigid joint fillers, and 6 months for joint sealants specified in Section 079200. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when accepted by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2 1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing 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 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.
 5. 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 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.
 6. 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.
- D. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verify use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least 1 composite sample for each 150 cubic yard or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
 2. Slump: ASTM C143; 1 test at point of placement for each composite sample, but not less than 1 test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C231, pressure method, for normal-weight concrete; 1 test for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064; 1 test hourly when air temperature is 40 degree F. and below or 80 degree F. and above, and 1 test for each composite sample.
 5. Compression Test Specimens: ASTM C31.
 - a. Cast and laboratory cure 3 sets of standard cylinder specimens for each composite sample.
 - b. Cast and field cure 3 sets of standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C39; test 1 set of 2 laboratory-cured specimens at 7 days and 1 set of 2 specimens at 28 days.
 - a. Test 1 set of 3 field-cured specimens at 7 days and 1 set of 3 specimens at 28 days.
 7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 8. Strength of each concrete mixture will be satisfactory if every average of any 3 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.
 9. Test results shall be reported in writing to Architect, 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.
 10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but may not be used as sole basis for approval or rejection of concrete.
 11. 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 Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Architect.
 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional Work with specified requirements.
 13. Correct deficiencies in Work that test reports and inspections indicate do not comply with Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E1155 within 48 hours of finishing and promptly report test results to Architect.

3.17 CONCRETE FINISH SCHEDULE

- A. Types and Finishes:
1. CONC-1: Penetrating Liquid Floor Treatment, CSC3, Medium Broom Finish.
 - a. Application: Exterior spaces including, but not limited to, courtyards, outdoor classrooms, entrances and exits.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Standard structural steel.
 2. Exposed aesthetic structural steel.
 3. Shrinkage-resistant grout.

1.02 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.
- B. Seismic-Load-Resisting System: As noted in Structural Drawings
- C. Exposed Structural Steel: Members and connections exposed to view as indicated in the Contract Documents, or in Specification.
- D. Demand-Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the seismic-load-resisting system and which are indicated as "demand critical" or "seismic critical" on Drawings.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Erection Conference: Meeting to include Owner, Architect, manufacturer, and the steel erector's personnel supervising installation of structural steel to review installation procedures including handling, fit-up and fastening.
1. Time: At least 3 weeks from commencement of Work.
 2. Review sequencing of structural steel and installation of anchorage items to be embedded in or attached to other construction without delaying the Work.
 - a. Review setting diagrams, sheet metal templates, instructions, and directions for installation.

1.04 ACTION SUBMITTALS

- A. Product Data:
1. Structural-steel materials.
 2. High-strength, bolt-nut-washer assemblies.
 3. Anchor rods.
 4. Threaded rods.

5. Forged-steel hardware.
 6. Shop primer.
 7. Etching cleaner.
 8. Galvanized repair paint.
 9. Shrinkage-resistant grout.
 10. Filler.
 11. Thermal Break Material.
- B. Shop Drawings: Show fabrication of structural-steel components.
1. Structural steel Shop Drawings shall contain sufficient detail and information to allow complete fabrication and erection of structure without reference to Contract Drawings either on fabrication shop floor or Project site. Steel detailer shall generate shop Drawings fabrication and installation details from Structural and Architectural Drawings and Specifications. Do not reproduce or use photocopies of Contract Drawings. When CAD or REVIT files are provided, it is detailer's responsibility to remove information not directly relevant information or references to outside sources in creation of Drawings:
 - a. Identify exposed aesthetic structural steel for each steel member and connection, including transitions between exposed aesthetic structural steel categories and between exposed aesthetic structural steel and standard structural steel.
 - b. Indicate orientation of mill marks and HSS seams on exposed aesthetic structural steel members.
 - c. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - d. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - e. Indicate grinding, finish, and profile of welds on exposed aesthetic structural steel members.
 - f. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads on exposed aesthetic structural steel members.
 - g. Indicate exposed surfaces and edges and surface preparation being used on exposed aesthetic structural steel members.
 - h. Indicate special tolerances and erection requirements on exposed aesthetic structural steel members.
 - i. Indicate weep holes for HSS and vent holes for galvanized HSS.
 - j. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections on exposed aesthetic structural steel members.
 - k. Identify members and connections of the seismic-load-resisting system.
 - l. Identify demand-critical welds.
 - m. Identify members not to be shop primed.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1 for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
 2. Electrode manufacturer and trade name, for demand-critical welds.
- D. Samples: Submit Samples to set quality standards for exposed aesthetic structural steel.

E. Material Test Reports:

1. Surface Dust Tests.
2. Surface Roughness Tests.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1. Provide project list to show compliance with requirements

B. Welding certificates.

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

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

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Shop primers.
4. Nonshrink grout.

F. Survey of existing conditions.

G. Source quality-control reports.

H. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

1. Minimum of 5 years experience in structural steel fabrication, including involvement in not less than 3 projects of similar or greater size and complexity. Fabricator shall have own fabrication plant that has operated for at least 5 years.
2. Notify Owner and Architect if Work subcontracted to other fabricators. Subcontracted fabricators to provide qualification verification.

B. Installer Qualifications: Installer shall have minimum of 5 years experience in structural steel installation., including involvement in at least 3 projects of similar, or greater, size and complexity.

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

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
2. Shop and field welders to be WABO certified or accepted equivalent as accepted by Architect and Building Official.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.
- C. Use special care in handling to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep exposed aesthetic structural steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect exposed aesthetic structural steel members and packaged materials from corrosion and deterioration.

PART 2 - PRODUCTS

2.01 STRUCTURAL-STEEL MATERIAL

- A. Structural Steel Shapes, Plates, Angles, Bars, and Rods: As specified in General Structural Notes.
- B. W-Shapes: ASTM A992.
- C. Channels, Angles: ASTM A36.
- D. Plate and Bar: ASTM A572, Grade 50.
- E. Cold-Formed Hollow Structural Sections: ASTM A500, Grade C structural tubing.
- F. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy hex steel structural bolts; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers.
 - 1. Finish: Plain, Hot-dip zinc coating, ASTM A153, Class C.
- B. High-Strength A490 Bolts, Nuts, and Washers: ASTM A490, Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers, plain.
- C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip or mechanically deposited zinc coating.
 - 2. Direct-Tension Indicators: ASTM F959, Type 325-1, compressible-washer type with mechanically deposited zinc coating finish.
- D. Threaded Rods: ASTM A36.
 - 1. Nuts: ASTM A563 heavy hex carbon steel.
 - 2. Washers: ASTM A36 carbon steel.
 - 3. Finish: Plain.

2.03 FILLER

- A. Polyester filler intended for use in repairing dents in automobile bodies.

2.04 SHRINKAGE-RESISTANT GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Compressive Strength: Per General Structural Notes.

2.05 FABRICATION, STANDARD STRUCTURAL STEEL

- A. Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel in accordance with ASTM A6 and maintain markings until structural-steel framing has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

- B. Re-Entrant Corners: Provide 1/2 inch radius at re-entrant corners, unless noted otherwise.
- C. 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.
- D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- E. Cleaning: Clean and prepare galvanized and ungalvanized steel surfaces to remain unpainted in accordance with SSPC-SP 2.
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning. Thermal cutting of holes is permitted with a surface roughness profile not exceeding 1,000 micro-inches as defined in ASME B46.1
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.06 FABRICATION, EXPOSED AESTHETIC STRUCTURAL STEEL

- A. Shop fabricate and assemble exposed aesthetic structural steel to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.
 - 1. Use special care handling and fabricating exposed aesthetic structural steel before and after shop painting to minimize damage to shop finish.
- B. Category 1:
 - 1. Comply with overall profile dimensions of AWS D1.1 for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
 - 2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
 - 3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
 - 4. Make intermittent welds appear continuous, using filler or additional welding.
 - 5. Seal weld open ends of hollow structural sections with 3/8 inch closure plates.
 - 6. Limit butt and plug weld projections to 1/16 inch.
 - 7. Install bolt heads on same side of each connection and maintain orientation consistently from one connection to another.
 - 8. Remove weld spatter, slivers, and similar surface discontinuities.
 - 9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
 - 10. Grind tack welds smooth unless incorporated into final welds.
 - 11. Remove backing and runoff tabs, and grind welds smooth.
 - 12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.

13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.

2.07 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. For demand critical welds, comply with AWS D1.8, seismic supplement including the following requirements:
 2. Continuously seal joined members exposed to weather by continuous welds.
 3. Tack welds incorporated into the final weld and weld repairs of demand critical welds shall be of the same quality as the final welds, including preheat requirements. The filler metals shall be identical.
- C. Erection Connections, etc: Place holes, plates, or other attachments required by the Erector so as not to interfere with or cause other detrimental effect to structural members or their connections. Holes and attachments not permitted in the 'protected zone' as described in the Drawings.

2.08 FINISHING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to uncoated structural steel, nuts, bolts, and fasteners in accordance with ASTM A123.
 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
 2. Weep holes shall be provided at exterior closed sections where moisture may accumulate. Sizes shall be in accordance with ASTM A123.
 3. Galvanize lintels, shelf angles, and welded door frames attached to structural-steel frame and located in exterior walls.
 4. Materials for galvanizing shall be geometrically suitable for galvanizing as specified in ASTM A384 and A385. For built-up members, assemblies shall be fabricated as required to limit warping and distortion.
- B. Steel that will be finished by hot dip galvanizing shall have controlled silicon and phosphorus contents. The silicon content shall be in either of the ranges 0 to 0.04 percent or 0.15 percent to 0.25 percent, the phosphorus content shall be below 0.04 percent. Before galvanizing, submit mill test certificates verifying silicon and phosphorus contents to the Architect and galvanizer.
- C. Where welding required, weld to fullest possible extent prior to galvanizing.

- D. Bolts, nuts and washers, and iron and steel hardware components shall be galvanized by the hot-dip process in accordance with ASTM A153.
- E. Surface Preparation: Steel shall be free of visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter: Clean steel in accordance with Steel Structures Painting Council SSPC-SP-6 Commercial Blast Cleaning. □
- F. Intermediate and Top Coat: High-Performance Coating as specified in Section 099000 - Painting and Coating.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Examine exposed aesthetic structural steel for twists, kinks, warping, gouges, and other imperfections before erecting.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.
 - 1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.

3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated on Structural Drawings.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Exposed Aesthetic Structural Steel Requirements: Comply with the following in addition to requirements specified above.
1. Avoid marking or distorting exposed aesthetic structural steel to minimize damage to shop painting/priming.
 2. Set exposed aesthetic structural steel accurately in locations; to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.
 3. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in completed Work. Take care to avoid blemishes, holes, or unsightly surfaces resulting from use or removal of temporary elements.
 4. Grind tack welds smooth.
 5. Remove backing and runoff tabs, and grind welds smooth.
 6. Conceal fabrication and erection markings from view in completed structure.
- I. In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.
1. Erection of Category 1:
 - a. Erect exposed aesthetic structural steel to standard frame tolerances specified in ANSI/AISC 303 for standard structural steel.
 - 1) Exception: Erect canopies to not exceed one-half the tolerances specified in ANSI/AISC 303.
 - b. Comply with AWS D1.1. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.

- c. Remove weld spatter, slivers, and similar surface discontinuities.
 - d. Grind off butt and plug weld projections larger than 1/16 inch.
 - e. Make continuous welds of uniform size and profile.
 - f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
 - g. Splice members only where indicated on Drawings.
 - h. No torch cutting or field fabrication is permitted.
- J. Reaming: Light drifting will be permitted to draw the parts together, but drifting to match unfair holes will not be permitted. Any enlargement of holes necessary to make connections in the field shall be done by reaming with twist drills, care being taken not to weaken the adjoining metal. If, in the judgement of the Engineer/Architect, the extent of the reaming is such that holes cannot be properly filled or accurately adjusted after reaming, the faulty member shall be discarded and replaced with a new one, and costs and expenses resulting therefrom shall be paid by the Contractor.
- K. Cutting and Fitting: No cutting of sections, either flanges, webs, stems or angles shall be done by the Contractor without the consent of the Engineer/Architect, unless this cutting is particularly specified or shown on the Drawings
- L. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors.

3.04 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
- 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
- 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.05 REPAIR

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780 Molten Zinc Repair.
- B. Field-Touchup Painting:
- 1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

- a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Cleaning and touchup painting are specified in Section 099000 - Painting and Coating.

3.06 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
 1. Verify structural-steel materials and inspect steel frame joint details.
 2. Verify weld materials and inspect welds.
 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. This will include inspection of exposed aesthetic structural steel.
 1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1.
 - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1 and the following inspection procedures, at testing agency's option:
 - 1) Liquid Penetrant Inspection: ASTM E165.
 - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3) Ultrasonic Inspection: ASTM E164.
 - 4) Radiographic Inspection: ASTM E94.
- C. Architect will observe exposed aesthetic structural steel in place to determine acceptability relating to aesthetic effect.

3.07 STRUCTURAL STEEL FINISH SCHEDULE

- A. Finishes: Structural steel level attributes and zinc-coating as indicated; hidden from view structural steel not to receive high-performance coating.
 1. STL-1:
 - a. Zinc Application: Hot-dipped galvanized.
 - b. Edges: Ground smooth.
 - c. Tolerance: One-half of standard fabrication tolerances.
 - d. Visible Marks: Mill marks removed, no visible mill marks.
 - e. Connections: Bolted, unless indicated otherwise on Drawings.
 - 1) Weld Appearance: Continuous, splatters removed.
 - f. Finish Category: Category 1.
 - g. Finish: As galvanized, quenching acceptable.

- h. Intermediate and Top Coat: High-Performance Coating as specified in Section 099000 - Painting and Coating.

END OF SECTION

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Steel structural roof deck.

1.02 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Roof deck.
- B. Shop Drawings:
 - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.03 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Research Reports: For steel deck, from ICC-ES.
- D. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.02 ROOF DECK

- A. Manufacturers: As indicated on Structural Drawings. Provide products by one of the following:
 - 1. ASC Profiles, Inc., DGB-36
 - 2. Verco Decking, Inc., a Nucor company, PLB-36
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A653, Structural Steel (SS), Minimum steel yield strength as specified in the Structural Notes and Drawings. G60 zinc coating.
 - 2. Deck Profile: As indicated on Structural Drawings .
 - 3. Profile Depth: As indicated on the Structural Drawings.
 - 4. Design Uncoated-Steel Thickness: As indicated on the Structural Drawings.
 - 5. Span Condition: As indicated on the Structural Drawings.
 - 6. Side Laps: As indicated on the Structural Drawings and in accordance with manufacturer's written recommendations.

2.03 ACCESSORIES

- A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359 inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

- F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated. Refer to Section 076200 - Sheet Metal Flashing and Trim.
- G. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- H. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- I. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.
- J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.03 INSTALLATION OF ROOF DECK

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1 1/2 inches long, and as follows:
 - 1. Weld Diameter: As indicated on Structural Drawings. (19 mm)
 - 2. Weld Spacing: As indicated on Structural Drawings. (457 mm).
 - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: As indicated on Structural Drawings.
- 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.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld.
- E. Miscellaneous Roof-Deck Accessories: Install finish strips, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

3.04 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.
- B. Repair Painting:
 - 1. Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair primer.
 - 2. Apply repair paint, of same color, to bottom surfaces of deck exposed to view.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- 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.

END OF SECTION

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Steel framing and supports for:
 - a. Applications where framing and supports are not specified in other Sections.
2. Miscellaneous steel trim
3. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products Furnished But Not Installed Under This Section:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, 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.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. 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.
2. Coordinate installation of metal fabrications that are anchored to or that receive other Work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.03 ACTION SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for mechanical and electrical equipment.

2. Steel framing and supports for applications where framing and supports are not specified in other Sections.

1.04 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- C. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.06 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.01 PERFORMANCE CRITERIA

- A. Recycled Content: Specified steel shall have recycled content with a minimum of 50 percent recycled content.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 1. Temperature Change: 120 degree F., ambient; 180 degree F., material surfaces.

2.02 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36.
- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A240 or ASTM A666, Type 304.

- D. Stainless-Steel Bars and Shapes: ASTM A276, Type 304.
- E. Steel Tubing: ASTM A500, cold-formed steel tubing.
- F. Steel Pipe: ASTM A53, Standard Weight unless otherwise indicated.
- G. Cast Iron: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.
- H. Aluminum Plate and Sheet: ASTM B209, Alloy 5005-H34 or 6061-T6.
- I. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- J. Aluminum Castings: ASTM B26, Alloy 443.0-F.
- K. Aluminum: Provide alloy and temper recommended by aluminum producer for type of use indicated, and with not less than strength and durability properties of alloy and temper designated below for each aluminum form required.
 - 1. Extruded Bars and Shapes: ASTM B221
- L. Nickel Silver Extrusions: ASTM B151, Alloy UNS No. C74500.
- M. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.03 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.
- E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

- F. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing per ASTM E488, conducted by a qualified independent testing agency.
 - 1. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F593 and nuts complying with ASTM F594.
 - a. Acceptable Product: Kwik Bolt by Hilti or approved substitution.
- G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.04 MISCELLANEOUS MATERIALS

- A. Cold-Applied Zinc Primers: As specified in Section 051200 - Structural Steel Framing.
- B. Cold Galvanizing Compound: High-zinc-dust-content paint complying with SSPC-Paint 20 or ASTM A780, and is compatible with paints specified to be used over it.
 - 1. Products: Provide one of the following:
 - a. Alvin Products; a div. of Dampney Co., Inc.: Galvax.
 - b. Rust-Oleum: 7000 System Cold Galvanizing Compound.
 - c. ITW Professional Brands; LPS: Cold Galvanize Corrosion INHIBITOR.
 - d. ZRC Worldwide: Galvilite.
 - e. Accepted substitution.
 - 2. Zinc Content: Minimum 93 percent by weight.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.
- D. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior and exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.05 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

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

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Furnish inserts for units installed after concrete is placed.
- C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 0.018 inch.

- D. Galvanize miscellaneous framing and supports, unless noted otherwise.

2.07 MISCELLANEOUS STEEL TRIM

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

2.08 LOOSE BEARING AND LEVELING PLATES

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

2.09 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 Work. Provide each unit with no fewer than 2 integrally welded steel strap anchors for embedding in concrete.

2.10 FINISHES, GENERAL

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

2.11 STEEL FINISHES

- A. Cold-Applied Zinc: As specified in Section 051200 - Structural Steel Framing.
 - 1. 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 indicate.
 - 2. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 3. Cold-apply zinc to elements scheduled to be painted.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153 for steel hardware and with ASTM A123 for other steel products.

1. Galvanize elements scheduled not to be painted.

2.12 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 1. Cast Aluminum: Heavy coat of bituminous paint.
 2. Extruded Aluminum: 2 coats of clear lacquer.

3.02 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.

3.03 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete 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 nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with zinc-rich primer/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 A780.
- C. Damaged Shop Primed Ferrous Metal Surfaces: Reapply specified shop primer to make free of scratches and stains.
- D. Damaged Galvanized Surfaces to Receive Finish Coating: Touch up with specified inorganic, zinc rich, urethane primer.
- E. Damaged Galvanized Surfaces to remain Unfinished: Touch up with specified cold galvanizing compound.
- F. Site Welding: Clean and strip primed steel to bare metal where site welding is required and apply touch-up primer or cold galvanizing compound.

END OF SECTION

SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Cold-applied, emulsified-asphalt dampproofing.

1.02 ACTION SUBMITTALS

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

1.03 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide protection course auxiliary materials recommended in writing by manufacturer of primary materials.

2.02 PERFORMANCE CRITERIA

- A. VOC Content: Less than 500 g/L or authorities having jurisdiction; whichever is lower.
- B. Coat Thickness: Not exceeding ASTM D1227.

2.03 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Manufacturers: Provide one of the following specified products:
 - 1. BASF Corporation: MasterSeal 615.
 - 2. Euclid Chemical Company (The); an RPM company: Dehydratine 75.
 - 3. Henry Company: HE307 - Fibered Asphalt Emulsion.
 - 4. Karnak Corp.: 220AF Fibered Emulsion Dampproofing.
 - 5. W. R. Meadows, Inc.: Sealmastic Type II.

- B. Trowel Coats: ASTM D 1227, Type II, Class 1.
- C. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
- D. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.04 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- C. Asphalt-Coated Glass Fabric: ASTM D1668, Type I.
- D. Patching Compound: Asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer.
- E. Protection Course: Provide the following:
 - 1. Semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, ASTM D6506, pressure laminated between two asphalt-saturated fibrous liners; 1/4 inch thick.
 - 2. Manufacturers:
 - a. Provide product from approved dampproofing manufacturer, or accepted substitution.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for surface smoothness, maximum surface moisture content, and other conditions affecting performance of Work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for dampproofing application.
- B. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

- C. Clean substrates of projections and substances detrimental to dampproofing Work; fill voids, seal joints, and remove bond breakers if any.
- D. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections.

3.03 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless otherwise indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
 - 1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8 inch-wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

3.04 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Concrete Foundations: Apply 2 brush or spray coats at not less than 1.5 gallon/100 square foot for first coat and 1 gallon/100 square foot for second coat.

3.05 PROTECTION COURSE INSTALLATION

- A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.
 - 1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
 - 2. Install protection course on same day of dampproofing installation (while coating is tacky) to ensure adhesion.

3.06 PROTECTION

- A. Correct dampproofing that does not comply with requirements; repair substrates, and reapply dampproofing.

END OF SECTION

SECTION 071416 - COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Cold-fluid applied waterproofing

1.02 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review waterproofing requirements including, but not limited to, the following:
 - a. Surface preparation specified in other Sections.
 - b. Minimum curing period.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings:
 - 1. Indicate locations and extent of waterproofing.
 - 2. Include details for substrate joints and cracks, and termination conditions.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.06 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
 2. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.

1.07 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

- A. Obtain waterproofing materials and protection course, from single source and from single manufacturer.

2.02 COLD-FLUID APPLIED WATERPROOFING

- A. Single-Coat System: Unreinforced, Liquid Waterproofing Membrane. Water-based, polymer-modified, liquid, complying with ASTM C836. Coal-tar free.
1. Basis of Design: Subject to compliance with requirements, provide one of the following:
 - a. Henry Co.: CM100
 - b. Carlisle: Miraseal
 - c. Soprema: Colphene LM Barr
 - d. W.R. Medows, Inc.: Hydralastic 836
 2. Cured Film Thickness: 0.060 inch.
 3. Solids Content: 97-100%
 4. Tensile Strength: 100- 250 psi.
 5. Flexibility: Comply with ASTM D1644.
 6. Peel Adhesion to Concrete: 5 pounds per inch minimum.
 7. Hydrostatic-Head/Pressure Resistance: 65 feet/100 psi average; ASTM D5385.
 8. Elongation at Break: 360% ; ASTM D412.
 9. Water Vapor Permeance (Dry Cup): 0.05 perm maximum, ASTM E96.

2.03 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
 - B. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated.
 - C. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.
 - D. Joint Sealant: Multicomponent polyurethane sealant, compatible with waterproofing; ASTM C920, Type M, Class 25 or greater; Grade NS for sloping and vertical applications and Grade P for deck applications; Use NT exposure as specified in Section 079200 "Joint Sealants" Insert requirement; and as recommended by manufacturer for substrate and joint conditions.
1. Backer Rod: Closed-cell polyethylene foam.

2.04 PROTECTION COURSE

- A. Protection Course, Semirigid Sheets of Fiberglass or Mineral-Reinforced Asphaltic Core: ASTM D6506, pressure laminated between two asphalt-saturated fibrous liners and as follows:
 1. Manufacturers:
 - a. Provide product from approved waterproofing manufacturer, or accepted substitution.
 2. Thickness:
 - a. 1/4 inch
 3. Adhesive: Rubber-based solvent type recommended in writing by waterproofing manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean, prepare, and treat substrates in accordance with manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other contaminants from substrate.

3.03 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

- A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners in accordance with waterproofing manufacturer's written instructions and to recommendations in ASTM C898 and ASTM C1471.
- B. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

3.04 INSTALLATION OF FLUID-APPLIED WATERPROOFING

- A. Refer to manufacturer's literature for recommendations on installation, including but not limited to, the following:
 - 1. Apply minimum 0.060 inch in all areas to be waterproofed.
 - a. Apply minimum 0.120 inch in detail areas.
 - 2. Apply protection course and related materials in accordance with manufacturer's written recommendations.

3.05 PROTECTION

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

END OF SECTION

SECTION 074113 - METAL ROOF PANELS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Standing-seam metal roof panels.
2. Underlayment.
3. Substrate board.
4. Accessories, flashing and trim.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and locations of roof penetrations with actual equipment provided.
2. Coordinate metal panel installation with rain drainage Work, flashing, trim, construction of soffits, and other adjoining Work to provide a leakproof, secure, and noncorrosive installation.

B. Preinstallation Conference: Conduct meeting at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose Work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal panel systems during and after installation.
8. Review procedures for repair of metal panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
2. Include type of coating system, dry film thickness (DTF) of each coat, product physical properties, accelerated test data and pretreatment data.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1 1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Sample Warranties: For manufacturer's special warranties.
- D. Coating Applicator Qualification: Provide coating applicator certification.
- E. Installation Instructions: For roof assembly and underlayment.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.
- B. Manufacturer's Warranty and Installers Special Guarantee: Submit signed copies. Refer to Attachment at end of this section.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm that specializes in manufacturing of specified metal roofing systems with a minimum of 10 years of documented experience.
- B. Coating Applicator Qualifications:
 1. Applicator regularly engaged in application of shop-applied coating systems of similar type to that specified.
 2. Employ persons trained for application of shop-applied coating systems.
 3. Approved by manufacturer.

4. Equipped, trained, and approved for application of shop-applied coating systems required for this Project.
 5. Approved to provide warranty specified in this Section.
- C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer with a minimum of 5 years of documented experience for roofing and underlayment.
- D. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of Work.
- E. Partial Mockups: Build in-place Partial Mockups to demonstrate aesthetic effects, and to set quality standards for materials, execution and verification of testing requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.
- B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.
- E. Cover underlayment materials and store in dry condition between temperatures of 40 and 90 degrees F. Use within one year of date of manufacture. Do not store at elevated temperatures as that will reduce the shelf life of the product.

1.08 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.09 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace metal roof panel assemblies that fail in materials or workmanship within specified warranty period.
 1. Failures include the following:
 - a. Structural failures including rupturing, cracking, or puncturing.

- b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: 2 years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Exposed Panel Finish: Deterioration includes the following:
 - a. Color fading more than Delta E of 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 adhere to bare metal.
 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace 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.
 2. Warranty coverage shall include flashings, penetrations, underlayment, field applied gutter liner material, and edge details as part of weathertightness warranty.
 3. Clearly indicate design wind speed in warranty.
 4. Wind Speed Warranty: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail at wind speeds less than design speeds specified, within specified warranty period.

PART 2 - PRODUCTS

2.01 PERFORMANCE CRITERIA

- A. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:
 1. 3-year, aged solar reflectance of not less than 0.55 and emissivity of not less than 0.75.
 2. 3-year, aged Solar Reflectance Index of not less than 64 when calculated according to ASTM E1980.
- B. Structural Performance: Provide metal panel assemblies capable of withstanding effects of the following loads, based on testing according to ASTM E1592:
 1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
 3. Deflection Limits: For wind loads, no greater than L/360 of span.
 4. Safety Factor for Panel and Clip Ultimate Loads: 1.65 with no increase for wind or per manufacturer's recommendation; which ever is more restrictive.

5. Safety Factor for Fasteners: 3.0 for single fastener in each connection and 2.25 for 2 or more fasteners in each connection or per manufacturer's recommendation; which ever is more restrictive.
- C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/square feet of roof area when tested according to ASTM E1680 at the following test-pressure difference:
 1. Test-Pressure Difference: 6.24 lbf/ square feet.
- D. Water Penetration: No water penetration when tested according to ASTM E1646 at the following test-pressure difference:
 1. Test-Pressure Difference: 6.24 lbf/square feet.
- E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 1. Uplift Rating: UL 90.
 2. Field-of-Roof Uplift Pressures for Field of Roof, Perimeter, and Corner: As indicated on structural Drawings.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 degree F, ambient; 180 degree F, material surfaces.
- G. Code and Standards Compliance:
 1. Underwriters Laboratories Inc. Class A fire classification under fiber-glass shingles and Class C under organic felt shingles (per ASTM E108/UL 790).
 2. Underwriters Laboratories Inc. Classified Sheathing Material Fire Resistance Classification with Roof Designs: P225, P227, P230, P237, P259, P508, P510, P512, P514, P701, P711, P717, P722, P723, P732, P734, P736, P742, P803, P814, P818, P824
 3. ICC ESR-1677 approval according to AC-48 Acceptance Criteria for Self-Adhered underlayments used as Ice Barriers.

2.02 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.

- B. Low-Pitch Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under 1 side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
1. Basis of Design: Provide SpanSeam by AEP Span, a Division of ASC Profiles, Inc, or accepted equal by one of the following:
 - a. Berridge Manufacturing Company.
 - b. ATAS International.
 - c. Metal Sales Manufacturing Corporation.
 - d. Morin; a Kingspan Group Company.
 - e. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755.
 - a. Nominal Thickness: 22 Gauge 0.034 inch (22 gauge) .
 - b. Exterior Finish: High-Performance Liquid Fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 3. Clips: Floating to accommodate thermal movement.
 - a. Material: Nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet. type and thickness as required to meet performance requirements. Provide clips to comply with metal roofing manufacturer's written installation guidelines for clip types.
 4. Joint Type: Single folded.
 5. Panel Coverage: 16 inch panel width, with 2 pencil ribs spaced 6 inches on center.
 6. Panel/Seam Height: 2.0 inches.
 7. Seam Type: SpanSeam

2.03 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet Underlayment: 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 and flashing; suitable for high temperatures over 240 degrees F. Provide primer in accordance with underlayment manufacturer's written instructions.
1. Products: Provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.: WIP 300HT.
 - b. GCP Applied Technologies Inc.: Grace Ice and Water Shield HT.
 - c. Henry Company: Blueskin PE200 HT.
 - d. InterWrap Inc.: Titanium PSU30.
 - e. MFM Building Products Corp.: Wind & Water Seal.
 - f. Polyguard Products, Inc.: Deckguard HT.
 - g. Protecto Wrap Company: Protecto Jiffy Seal Ice & Water Guard HT.

2. Thickness: Minimum of 40 mils.
3. Allowable UV Exposure Time: Not less than 60 days.
4. Thermal Stability: ASTM D1970, stable after testing at 240 degrees F.
5. Low-Temperature Flexibility: ASTM D1970; passes after testing at minus 20 degrees F.
6. Location: Provide under metal roof panels.

2.04 SUBSTRATE BOARD

- A. Substrate Board: ASTM C1177, glass-mat, water-resistant gypsum substrate, Type X, 1/2 inch thick, with unprimed surface finish.
 1. Products: Provide the following:
 - a. Georgia-Pacific Gypsum LLC: DensDeck Prime.
 - b. National Gypsum Company: DEXcell FA Glass Mat Roof Board.
 - c. United States Gypsum Company: Securock Glass-Mat Roof Board.
 - d. Approved substitutions.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance, designed for fastening substrate board to roof deck.

2.05 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 2. 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.
 3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- B. Panel Fasteners: Self-tapping screws designed to withstand design loads.
 1. Steel Panels: Use carbon steel fasteners with triple seal coating.
 2. Aluminum Panels: Use aluminum or metal recommended by manufacturer.
- C. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
 2. Joint Sealant: ASTM C920; as recommended in writing by metal roof panel manufacturer and complying with Section 079200.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

- D. Bearing Plate: Manufacturer's standard for mounting clips over rigid insulation. ASTM A792 G60 hot-dipped aluminum-zinc alloy or ASTM A653 G60 hot-dipped zinc galvanized to provisions of ASTM A924.

2.06 FABRICATION

- A. Fabricate and finish metal roof panels and accessories at factory, by manufacturer's standard procedures and processes, and as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with metal roof panel manufacturer's recommendations, recommendations in SMACNA's "Architectural Sheet Metal Manual," and Section 076200- Sheet Metal Flashing and Trim that apply to design, dimensions, metal, and other characteristics of items indicated.
- E. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

2.07 FINISHES

- A. Appearance of Finished Work:
 - 1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 of range of approved Samples. Noticeable variations in same piece are unacceptable.
 - 2. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.
- B. Finish designations prefixed by AA comply with system established by Aluminum Association for designating aluminum finishes.
- C. High-Performance Liquid Fluoropolymer Paint (PVDF):
 - 1. Exterior Surface: AAMA 2605-17; at least 70 percent PVDF resin by weight in color coat; 2-coat system.
 - 2. Color: Selected by Architect from manufacturer's full range.
- D. Concealed Conditions: 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; AAMA 2503-17.

- E. Liquid Strippable Coating: Apply in shop to prefinished surfaces to protect finish during fabrication, shipping, and field-handling.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of Work.
 - 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 - 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Miscellaneous Supports: Install subpurlins, eave angles, furring, and other miscellaneous panel support members and anchorage according to ASTM C754 and metal roof panel manufacturer's written instructions.

Substrate Tolerances: Deviations from flat plane shall not exceed the following:

- 1/4 inch in 20 feet.
- 1/2 inch across building elevation.
- 1/8 inch in 5 feet.

3.03 UNDERLAYMENT INSTALLATION

- A. Self-Adhering High-Temperature Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below and indicated on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3 1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply over the entire canopy roof surface.

3.04 SUBSTRATE BOARD INSTALLATION

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
- B. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof per roofing system manufacturers' written instructions.

3.05 METAL ROOF PANEL INSTALLATION

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel Work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a 4-panel lap splice condition.
 - 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 - 1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to exterior.
- C. Anchor Clips: Anchor metal roof panels and other components of Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal panel manufacturer.
 - 1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.
- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
 - 1. Install clips to supports with self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 - 4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

5. Watertight Installation:
- a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum 6 inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that 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 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).
- H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches on center using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- I. Downspouts: Join sections with 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 on center in between.
1. Provide elbows at base of downspouts to direct water away from building.
 2. Connect downspouts to underground drainage system.
- 3.06 ERECTION TOLERANCES
- A. Installation Tolerances: Shim and align metal roof panel units 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.

3.07 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.08 CLEANING AND PROTECTION

- A. Protect underlayment from damage during construction operations and installation of roofing materials. Promptly repair any damaged or deteriorated surfaces.
- B. Repair minor damage to underlayment to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired in the opinion of the Architect.
- C. Provide temporary protection of underlayment to ensure work being without damage or deterioration at time of final acceptance. Remove protective film and reclean as necessary immediately before final acceptance.
- D. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.
- E. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.09 ATTACHMENTS

- A. Roofing Installer's Guarantee.

ATTACHMENT

ROOFING INSTALLER'S GUARANTEE

- B. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: Federal Way Public Schools
 2. Address: 30611 16th Ave S, Federal Way, WA 98003.
 3. Building Name/Type: Federal Way High School CTE Storage.
 4. Area of Work: New CTE Storage Canopy Roofing.
 5. Acceptance Date: _____.
 6. Warranty Period: 3 years from date of Substantial Completion.
 7. Expiration Date: _____.
- C. AND WHEREAS Roofing Installer has contracted to warrant said work against leaks and faulty or defective materials and workmanship for designated Guarantee Period,
- D. NOW THEREFORE Roofing Installer hereby guaranties, subject to terms and conditions herein set forth, that during Guarantee Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- E. This Guarantee is made subject to the following terms and conditions:
1. Specifically excluded from this Guarantee are damages to work and other parts of the building, and to building contents, caused by:
 - a. Lightning;
 - b. Fire;
 - c. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - d. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - e. Vapor condensation on bottom of roofing; and
 - f. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Guarantee shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Guarantee but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Guarantee Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Guarantee.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Guarantee is recognized to be the only guarantee of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

F. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of

_____, _____.

1. Authorized Signature: _____
2. Name: _____
3. Title: _____

END OF ATTACHMENT

END OF SECTION

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sheet metal fabrications and formed systems.
2. Reglets with counterflashing.
3. Factory prefinished coating systems.
4. Accessories

1.02 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 leakproof, secure, and noncorrosive installation.

B. Preinstallation Conference: Conduct meeting at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special 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.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

C. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, attachment and installation details.
2. Describe general construction, configuration, profile, dimensions of individual components, jointing pattern, jointing details, expansion-joint locations, and keyed details.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Detail formed flashing and trim at a scale of not less than 1 1/2 inches per 12 inches.

- D. Samples: Submit samples of each color and gloss specified for each coating systems specified for verification, indicating compliance with matching requirements.

1.04 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing, trim, and accessories, to include in maintenance manuals.
- B. Special warranty.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance with a minimum 5 years documented experience installing commercial work.
- B. Coating Applicator Qualifications:
 - 1. Applicator regularly engaged in application of shop-applied coating systems of similar type to that specified.
 - 2. Employ persons trained for application of shop-applied coating systems.
 - 3. Approved by manufacturer.
 - 4. Equipped, trained, and approved for application of shop-applied coating systems required for this Project.
 - 5. Approved to provide warranty specified in this Section.
- C. Refer to SMACNA recommendations for configuration and installation.
- D. Exposed sharp corners are not allowed.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with dissimilar materials that might cause staining, denting, or other surface damage.
 - 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 - 2. Protect stored sheet metal flashing and trim from contact with water, excessive moisture.
 - 3. Protect with breathable material.
 - 4. Store materials off of ground.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.08 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes the following:
 - a. Color fading more than 5 Delta E (Hunter Lab) when tested per ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested per ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 10 years from date of Substantial Completion.
- B. Weathertightness: Contractor to provide 2 year material and labor weathertightness Warranty for work of this Section subject to conditions of ordinary wear and usage.

PART 2 - PRODUCTS

2.01 PERFORMANCE CRITERIA

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install roof edge flashing tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting design pressure as indicated on Drawings.
 - 1. Design Pressure: As indicated on Structural Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 degree F., ambient; 180 degree F., material surfaces.

2.02 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

- B. Metallic-Coated Steel Sheet: Provide aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A755.
1. Nominal Thickness: 18 gauge (0.0478 inches).
 2. Color: Match Roof Panel. As selected by Architect from manufacturer's full range.
 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.03 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- B. Self-Adhering, High-Temperature Sheet Underlayment: 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, flashing; suitable for high temperatures over 240 degrees F. Provide primer in accordance with underlayment manufacturer's written instructions.
1. Products: Provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.: WIP 300HT.
 - b. GCP Applied Technologies Inc.: Grace Ice and Water Shield HT.
 - c. Henry Company: Blueskin PE200 HT.
 - d. InterWrap Inc.: Titanium PSU30.
 - e. MFM Building Products Corp.: Wind & Water Seal.
 - f. Polyguard Products, Inc.: Deckguard HT.
 - g. Protecto Wrap Company: Protecto Jiffy Seal Ice & Water Guard HT.
 2. Thickness: Minimum of 40 mils.
 3. Allowable UV Exposure Time: Not less than 60 days.
 4. Thermal Stability: ASTM D1970, stable after testing at 240 degrees F.
 5. Low-Temperature Flexibility: ASTM D1970; passes after testing at minus 20 degrees F.
 6. Location: Provide under metal roof panels.

2.04 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
1. General: Blind fasteners-drilling screws, gasketed, with hex-washer head.
 - a. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

- b. Concealed Sheet Metal Fasteners: No. 12 to 14, panhead, self-drilling, self-tapping, non-corrosive fasteners, and as instructed by manufacturer.
- 2. Fasteners for Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.
- C. Solder:
 - 1. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Sealant: As specified in Section 079200 - Joint Sealants.
- F. Electrolytic Protection: Bituminous Coating; Cold-applied asphalt emulsion complying with ASTM D1187 not less than 15 mils dry film thickness.
- G. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.
- H. Rivets: Close-ended watertight of corrosion-resistant material compatible with material being secured.
- I. Reglets and Counterflashings: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.
 - 1. Source Limitations: Obtain reglets for single source from single manufacturer.
 - 2. Color: Match existing.
 - 3. Accessories:
 - a. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.

2.05 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Shop-fabricate sheet metal flashing and trim to greatest extent possible.
 - 2. 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.
 - 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 - 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
 - B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.
 - C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
 - D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant per cited sheet metal standard. Install laps with 3 continuous beads of non-shrinking, non-skinning silicone sealant as specified in Section 079200 - Joint Sealants.
 - E. Continuous Cleats and Starter Strips: Fabricate cleats and attachment devices of one gauge heavier than sheet material, in widths required by SMACNA to interlock with sheet, but not less than thickness of metal being secured. Metal to be noncorrosive and compatible with material being anchored to.
 - F. Drip edges to be minimum 3/4 inch long with 1/2 inch seams. Cleats to have minimum 1/2 inch engagement.
 - G. Seams:
 1. Coated Coils: Fabricate nonmoving seams with standing seams. Form seams and seal with 3-beads of non-skin forming silicone sealant as specified in Section 079200 - Joint Sealants unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
 - H. Do not use graphite pencils to mark metal surfaces.
- 2.06 MISCELLANEOUS ACCESSORIES
- A. Adhesives, Primers, and Seam Tapes for Flexible Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- 2.07 MISCELLANEOUS SHEET METAL FABRICATIONS
- A. Equipment Support Flashing: Fabricate from 0.028 inch thick galvanized steel.
 - B. Sheet metal flashing stretch-out dimensions of 11 inches or larger shall be fabricated from 0.028 inch thick minimum, pre-finished sheet metal.

2.08 FINISHES

A. Aluminum Sheet and Coil High-Performance Liquid Fluoropolymer Paint (PVDF) Finish:

1. Exterior Surface: AAMA 2605-17; at least 70 percent PVDF resin by weight in color coat; 2-coat system.
 - a. Basis of Design: Provide Fluoron Pure by Sherwin Williams or accepted equal:
 - 1) Color Retention: Less than 5 Delta E in 10 years.
 - 2) Pre-Treat: Minimum 40 mg/ square foot chrome.
 - 3) Prohesion: ASTM G85 Annex A5, at least 2,000 hours.
 - 4) Humidity Testing: ASTM D2247, at least 4,000 hours.
2. Concealed Conditions: 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; AAMA 2503-17.
3. Include strippable protective film for protection of prefinished steel finish.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of Work.
 1. Verify compliance with requirements for installation tolerances of substrates.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 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.

3.02 INSTALLATION, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated on Drawings and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
 1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 3. Anchor sheet metal flashing and trim and other components of Work securely in place, with provisions for thermal and structural movement.
 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 5. Install continuous cleats with fasteners spaced not more than 12 inches on center.

6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least 2 fasteners. Bend tabs over fasteners.
 7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 8. Do not field cut sheet metal flashing and trim by torch or electric saw.
 - a. Prime cut edges and coat to protect against corrosion.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing metal flashing and trim directly on cementitious or wood substrates, install a course of high heat-resistant self-adhered membrane roofing underlayment under flashing.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed Work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 d F, set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 degree F.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 - Joint Sealants.
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pre-tin edges of sheets to be soldered to a width of 1 1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
2. Do not solder metallic-coated steel sheet.
3. Do not use torches for soldering.
4. Heat surfaces to receive solder and flow solder into joint.
 - a. Fill joint completely.
 - b. Completely remove flux and spatter from exposed surfaces.

3.03 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system per cited sheet metal standard unless otherwise indicated.

3.04 ROOF FLASHING INSTALLATION

- A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, set units true to line, levels, and slopes.
2. Install Work with laps, joints, and seams that will be permanently watertight and weather resistant.

- B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3 inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches over base flashing.
3. Lap counterflashing joints a minimum of 4 inches.
4. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant, or interlocking folded seam or blind rivets and sealant unless indicated otherwise.

3.05 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.06 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

3.07 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.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- E. 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

SECTION 079200 - JOINT SEAL AND SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Joint Seals
 - a. Mixed Penetration Seals.
 - 2. Joint Sealants
 - a. Elastomeric joint sealants.
 - b. Mildew-resistant joint sealants.
 - c. Precompressed foam sealants.
 - d. Joint sealant backing.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2 inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Sealant Schedule: Submit schedule of sealant applications listing joint sealants proposed for this Work and materials to which joint sealants are specified to be applied. Obtain Architect's written approval of this sealant schedule before starting Work of this Section.
 - 1. Joint-Sealant Schedule: Include the following information:
 - a. Joint-sealant application, joint location, and designation.
 - b. Joint-sealant manufacturer and product name.
 - c. Joint-sealant formulation.
 - d. Joint-sealant color.
 - e. Joint-sealant VOC.

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency and installer.
 - 1. Submit list of qualifying projects of similar scope.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

- C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
 - 1. Joint-sealant location and designation.
 - 2. Manufacturer and product name.
 - 3. Type of substrate material.
 - 4. Proposed test.
 - 5. Number of samples required.
- D. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
- E. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- F. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- G. Sample Warranties: For special warranties.
- H. Product Installation Instructions: Submit for each product, accessory and component. Include surface preparation, cleaning, priming, joint size ratios, adhesion testing and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

- A. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified per ASTM C1021 to conduct testing indicated.
 - 2. Test per SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
- B. Installer Qualifications: Minimum of 5 years experience installing specified products and materials.
- C. Stain Testing: Conduct stain tests in accordance with ASTM C 1248 on substrate materials with orientation and exposure that replicates finished joint conditions.
- D. Compatibility Testing: Include sealant and sealers or coatings that may come into contact with sealant following sealant application.

1.05 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
 3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with masonry substrates.
 4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint sealant backings, and miscellaneous materials.
 5. Schedule sufficient time for testing and analyzing results to prevent delaying Work.
 6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
 7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 2. Conduct field tests for each kind of sealant and joint substrate.
 3. Notify Architect 7 days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants per Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately: extend cut along 1 side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in a dry, ventilated location out of direct sunlight and weather in accordance with manufacturer's written instructions.
- B. Deliver in original, unopened container and packing bearing name of manufacturer and product identification.

1.07 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 degrees F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.08 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: 2 years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: 20 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 structure caused by stresses on sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 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

2.01 JOINT SEALS AND SEALANTS, GENERAL

- A. Low Emitting Material: Sealants shall comply with requirements of California Department of Public Health's South Coast Air Quality Management District Rule 1168.
- 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 joint-sealant manufacturer, based on testing and field experience.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

1. Match adjacent substrates or match existing, provide either manufacturer's standard color if matching color is available, or, if not available, provide field-tintable custom color.

D. Install joint sealant systems with a pressure gun.

2.02 EXTERIOR JOINT SEALANTS, VERTICAL

A. Moving Joints: Joints and cracks receiving painted coating over sealant, use between dissimilar materials and EIFS. Contractor's choice between one of the following.

1. Elastomeric Hybrid: High movement, ASTM C920 Type S, Grade NS, Class 50 Use NT, M, A and O.

a. Products: Provide one of the following:

- 1) Sika: MasterSeal NP 150.

2. Polyurethane: ASTM C719, Type S, Grade NS, Class 100/50, Use NT, O, M, and A.

a. Products: Provide one of the following:

- 1) Sika Corporation: Sikaflex 15 LM. Tremco Incorporated: Vulkem 921.
- 3) Accepted substitution.

2.03 EXTERIOR HORIZONTAL/SKY FACING JOINTS

A. Exterior Paving Joints: Gunable.

1. Silicone: Neutral-curing, ASTM C920, Type S, Grade NS, Class 100/50, Use T.

a. Products: Provide one of the following:

- 1) Dow Chemical Company: Dowsil 888 Silicone Joint Sealant.
- 2) Pecora Corporation: 311 NS Silicone Parking Deck Sealant.
- 3) Sika Corporation: Sikasil 728 SL.
- 4) Tremco Incorporated: Spectrem 800.
- 5) Accepted substitution.

B. Exterior Paving Joints, Vehicular Traffic Pavement:

1. Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade P, Class 100/50, Use T.

a. Products: Provide one of the following:

- 1) Dow Chemical Company: Dowsil 890-SL Sealant.
- 2) Pecora Corporation: 300 SL.
- 3) Tremco Incorporated: Spectrem 900 SL.
- 4) Accepted substitution.

C. Exterior Paving Joints, Vehicular Traffic Pavement: Quick cure.

1. Neutral-curing, silicon sealant, ASTM C920, Type M, Grade P, Class 100/50, Uses T and NT.

a. Products: Provide one of the following:

- 1) Dow Chemical Company: Dowsil FC Parking Structure Sealant.
- 2) Sika Corporation: Sikasil 728 RCS.
- 3) Accepted substitution.

2.04 JOINT-SEALANT BACKING

A. Joint Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; as approved in writing by joint-sealant manufacturer, for joint applications indicated based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (bi-cell or closed-cell material with a surface skin), of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Products: Provide one of the following:

- a. Backer Rod Manufacturing Inc.: Mile High Foam.
- b. Sika: MasterSeal 920.
- c. Nomaco Engineered Foam Solutions: SOF rod.
- d. W. R. Meadows, Inc.: Kool-Rod.

2. Accessory: Backer rod insertion tool with adjustable depth.

C. Precompressed Foam Seals: Self-expanding, polyurethane foam tape joint seal, size as appropriate for plus and minus 50 percent elongation and compression of joint.

1. Products: Provide one of the following:

- a. Emseal Joint System: Backerseal.
- b. Schul International Company: Sealtite B.
- c. Tremco Inc.: Illmod 600.

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. Provide self-adhesive tape where applicable.

2.05 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated and as determined from mockups.

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.
- D. Concrete Joint Backer: Closed cell neoprene sponge
 - 1. Basis of Design: Provide Closed Cell Neoprene Sponge with Tear Strip by Hohmann and Barnard or accepted equal:
 - a. Tensile Strength: ASTM D3575, minimum 65 psi.
 - b. Density: 2 to 5 pcf.
 - c. Elongation: ASTM Method 3575, 305.
 - d. Compression Set: ASTM 3575/1056, maximum 12 to 25 percent.

PART 3 - EXECUTION

3.01 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.

3.02 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 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), existing joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, 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 systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion 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 by joint-sealant manufacturer or as indicated by mockup. 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 or primer 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.
- D. Deteriorated/Damaged Substrates: Prepare substrate surfaces according to sealant manufacturer's written instructions.
- E. Field Adhesion Test: Perform at least 3 sealant field adhesion tests for the first 1000 feet of installed sealant for each exterior sealant joint type.
- 1. Subsequently perform 1 test for every 1000 feet or one test per floor, per elevation.
 - 2. Remove additional sealant and prepare substrate as required to provide neat repair joint to match the original, like-new condition.
 - 3. Performing 3 additional tests after a test fail.
 - 4. Coordinate Field Adhesion Test and Partial Mockup installations.
 - 5. Locations to be selected by Architect.

3.03 INSTALLATION

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Seal interior joints to make smoke and acoustically tight and exterior joints to make watertight and weathertight. Refer to requirements of individual Sections. Include:
- 1. Exterior double weather seal consisting of pre-compressed foam sealant, backer rod and sealant around windows, doors, wall louvers, and other openings in walls.
 - 2. Exterior furring penetrations.
 - 3. Joints between dissimilar materials.
 - 4. Horizontal joints, including exterior paving joints over joint filler.
 - 5. At joints in sheet metal, flashing, and trim.
 - 6. At joints in concrete, precast concrete, and cast stone.
 - 7. Expansion joints and control joints at masonry and concrete. Moving cracks and joints subject to movement, except where firestopping is required as specified Section 078400 - Firestopping.
- D. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
 4. Use backer rod insertion tool to achieve proper and consistent depth.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. Install sealants using proven techniques that comply with the following and at 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.
- G. Install 3 beads of sealants to make watertight joints at flashing and other metal overlaps.
- H. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated.
 4. Provide flush joint profile where indicated per Figure 8B in ASTM C1193.
 5. 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.

3.04 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Conduct joint-sealant field-adhesion tests as required to meet manufacturer's extended warranty requirements and as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 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 sealant dimensions and configurations comply with specified requirements.
 - c. 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 a 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.
1. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.
- C. Quality of Work Corrections: Correct deficiencies and present remediation plan to address deficiencies if Architect, Building Envelope Consultant, Consultant's Monitor, Owner's Project Manager or Manufacturer determine that the quality of Work does not align with Specifications, Drawings, and/or Manufacturer's published requirements, industry standards.
- 3.05 CLEANING
- A. Clean off excess sealant or sealant smears adjacent to joints as Work progresses.
 1. Clean per manufacturers instructions.
 - B. Clean entire facade where sealants show dirt.
 1. If joint sealants show dirt 10 months after Final Completion, clean joint sealants over entire facade.
- 3.06 PROTECTION
- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other cause.
 1. If damage/deterioration occurs, cut out and remove damaged/deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original Work.

END OF SECTION

SECTION 099000 - PAINTING AND COATING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Surface preparation and application of paint and coating systems on exterior substrates as indicated.

1.02 ACTION SUBMITTALS

A. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches by 8 inches square.

1.03 INFORMATIONAL SUBMITTALS

A. Product List: For each product indicated, include the following:

1. Color designations.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gallon of each material and color applied.

1.05 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 50 degrees F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.07 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 degrees and 95 degrees F. unless data page indicates otherwise.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F. above dew point; or to damp or wet surfaces.

1.08 WARRANTY

- A. Installer Guarantee: Installer agrees to repair failing adhesion and evidence of deterioration within 3 years of Final Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Provide products by the following:
 - 1. Tnemec Company Inc.
 - 2. Carboline.
 - 3. Cloverdale Paint.
 - 4. Benjamin Moore & Co.
 - 5. PPG Paints Finishes, Inc.
 - 6. Rodda Paint Co.
 - 7. Rust-Oleum Corporation.
 - 8. Sherwin Williams Company (The).
 - 9. Other manufacturers where specifically indicated.

2.02 PAINT AND COATINGS, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 - 3. If a manufacturer provides more than one product within an MPI category, provide highest quality product within that category.
- C. Material Quality: Paint material containers not displaying paint manufacturer's product identification will not be accepted.
- D. Product line to meet or exceed the basis of design products' composition, physical properties, and dry film thickness (DFT) requirements and Manufacturer's warranty duration.

2.03 EXTERIOR PRIMERS, SEALERS, PREP PRODUCTS

- A. Exposed Concrete Foundation Walls: Waterborne modified polyamine epoxy. Sealing cementitious and other porous substrates and tie-coat
1. Product:
 - a. Tnemec Series 151.
 - b. Rodda, 512301 pHlexcite XL Flat
- B. Non-Ferrous metals aluminum or galvanized metals: Wash Primer. A two component, vinyl butyral/phosphoric acid wash primer used over cleaned metal surfaces, as a tie coat for subsequent priming with anti-corrosive primers or finish coatings. Primer, Vinyl Wash; MPI #80.
1. Products, provide one of the following:
 - a. PPG Architectural: Truefinish, Spectracron 701/702.
 - b. Sherwin-Williams: Industrial Wash Primer.
- C. Ferrous Metals: Anti-corrosive primer including Spot Repair/Touch-Up: Alkyd anti-corrosive primer; MPI #79.
1. Products, provide one of the following:
 - a. Tnemec: Series AK01 Tnemec Shop Primer.
 - b. Benjamin Moore: Super Spec HP, DTM Alkyd Low Luster.
 - c. Cloverdale Paint: Universal Shop Primer, Rustex .
 - d. PPG Paints: Protective and Marine Coatings, Multiprime 4160/Devguard 4160, 4160.
 - e. Rodda Paint: Barrier III HS Rust Inhibitive Metal Primer.
 - f. Rust-Oleum: High Performance 7400 System Quick Dry.
 - g. Sherwin-Williams: Kem Bond HS.
 2. Surface preparation: SSPC SP 6 commercial blast or power tool cleaning to SSPC SP 11.

2.04 EXTERIOR INTERMEDIATE AND TOPCOATS

- A. Concrete: Latex, Exterior, High Performance Architectural, Low Sheen (MPI Gloss Level 3-4): MPI #315.
1. Products: Provide one of the following:
 - a. Benjamin Moore: Regal Select, Exterior High Build Low Lustre Finish.
 - b. PPG Paints: Sun Proof Exterior Satin 100% Acrylic Latex Paint.
 - c. Rodda Paint: Covercoat XL Acrylic Exterior Low Sheen.
 - d. Sherwin Williams: SuperPaint, Exterior Acrylic Latex Satin.
- B. Primed Metals: Alkyd, Quick Dry, Semi-Gloss; MPI #81.
1. Products, provide one of the following:

- a. Benjamin Moore: D.T.M. Alkyd Semi-Gloss.
- b. PPG Architectural: HPC Urethane Alkyd 4336 / Devguard 4336.
- c. Rodda Paint Co.: Renaissance WB Urethane Alkyd Enamel Semi Gloss..
- d. Rust-Oleum: V7400 System DTM Alkyd Enamel.
- e. Sherwin-Williams: Protective & Marine Direct-To-Metal.

2.05 EXTERIOR POLYURETHANE-BASED PAINTS

- A. Metals: Polyurethane, Two-Component, Pigmented, Gloss (MPI Gloss Level 6-7): MPI #72.
 1. Basis of Design: Provide Endura-Shield Series 73 or Series 1095 by Tnemec or accepted substitution from one of the following:
 - a. Benjamin Moore: Corotech, Aliphatic Acrylic Urethane Gloss, V500.
 - b. Carboline: Carbothane 134 MC
 - c. Cloverdale Paint: ArmourShield 847 High Gloss
 - d. PPG Architectural: Protective and Marine Coatings, Pitthane Ultra Gloss Series.
 - e. Sherwin-Williams: Protective & Marine, Acrolon 218 HS.
- B. Concrete, Metal Surfaces: Polyurethane, Two-Component, Pigmented, Semi-Gloss (Gloss Level 5); MPI #174.
 1. Abrasion, weathering, chemical and solvent resistance.
 2. Products, provide one of the following:
 - a. Benjamin Moore: Corotech, Aliphatic Acrylic Urethane Semi-Gloss.
 - b. Carboline: Carbothane 133 MC.
 - c. Carboline: Carbozinc 134 HG
 - d. Cloverdale: ArmourShield 8475 Semi Gloss.
 - e. PPG Paints: Amercoat 450 HSG.
 - f. Sherwin Williams: Protective & Marine, Acrolon 218 HS Polyurethane Semi-Gloss.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of Work.
- B. Maximum Moisture Content of Substrates: Measure at least 5 opposing points on substrate. When measured with an electronic moisture meter averages should equal the following:
 1. Concrete: 12 percent.
 2. Masonry/ Concrete Masonry Units: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat to produce paint systems indicated.
- C. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- D. 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.
- E. 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. Provide a 1.0 mil profile on galvanized surface to be finished.
 1. Painting Galvanized Steel: Clean using methods recommended in writing by paint manufacturer but not less than SSPC-SP 1, "Solvent Cleaning".

3.03 APPLICATION

- A. Materials to be finished:
 1. Prepare and finish all surfaces of materials, except as specifically excluded or otherwise specified.
- B. Apply paints and coatings per manufacturer's written instructions and to recommendations in "MPI Manual."
- C. 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.
- D. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- E. Apply paints and coatings 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.
- F. Mix aluminum oxide into concrete floor opaque finish at a rate of 8 ounces per gallon of paint.

- G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following Work where exposed in spaces listed on the drawings to receive paint:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Ducts, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.04 MATERIALS NOT TO RECEIVE PAINT OR COATING

- A. Metals: Brass, bronze, copper, stainless steel, pre-finished metal, plated metals other than galvanized metal.
- B. Plastic laminate, melamine, and other finished plastic surfacing.
- C. Roofing, masonry, stone, and concrete.
- D. Glass and clear plastic.
- E. Substrates with specified factory-applied colored finishes:
 1. Includes: Door hardware, electrical switch plates, fabrics, tackboards, porcelain enameled metal fabrications, and lighting fixtures.
 2. Exception: Wire mold and other normally prefinished items mounted on surfaces receiving paints or coatings. Paint to match field surface.
- F. Inaccessible materials permanently enclosed behind building construction and structural components.

3.05 FIELD QUALITY CONTROL

- A. Contractor shall keep a daily record of wet film gage readings.
- B. Dry Film Thickness Testing: Owner may engage services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Touch up and restore painted surfaces damaged by testing.

2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, pay for testing and apply additional coats to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.06 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Touch up shall include refinishing the surface from edge to edge.

3.07 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Vertical, Opaque: EXT 3.1.
 1. Application: Vertical surfaces concrete and masonry surfaces.
 - a. Prime Coat: Primer Alkali-Resistant Primer, Water Based MPI #3.
 - b. Intermediate Coat: Match topcoat.
 - c. Topcoat: Latex, Exterior, High Performance Architectural, Eggshell MPI #315.
- B. Galvanized Steel Substrates, Opaque: Water-Based Light Industrial Coating System EXT 5.3L
 1. Application: Exterior miscellaneous galvanized metals, prepared to receive opaque colored finish.
 - a. Pretreatment: Cleaner, etching for galvanized metal, MPI #25.
 - b. Pre-primer Coat: Primer, Rust-inhibitive, water-based MPI #134.
 - c. Primer: Epoxy, Anti-Corrosive, for Metal: MPI #101.
 - d. Intermediate Coat: Match topcoat.
 - e. Topcoat: Polyurethane, Two-Component, Pigmented, (Gloss Level 6-7): MPI #72.

3.08 EXTERIOR HIGH PERFORMANCE COATINGS

- A. Galvanized and Shop-Primed Steel Substrates including Spot Repair/Touch-Up:
 1. Application: .
 - a. Primer: Tnemec Series 394; PerimePrime at 2.5-3.5 mils DFT minimum 62 percent solids by volume. (Aromatic Polyurethane, Mio-Zinc Filled Primer)
 - b. Intermediate Coat: Tnemec Series 27 FC Typoxy at 2-4 mils DFT.
 - c. Topcoat: Tnemec Series 1072V at 2-3 mils DFT.
- B. Exposed Concrete Foundation walls:

1. Application: .
 - a. Primer: Tnemec Series 151 at 1-2 mils DFT. (Waterborne Modified Polyamine Epoxy)
 - b. Intermediate Coat: Tnemec 156 at 6-8 mils DFT. (Modified Waterborne Acrylate)
 - c. Finish Coat: Tnemec 156 at 6-8 mils DFT. (Modified Waterborne Acrylate)

3.09 GLOSS AND COLOR SCHEDULES

A. Gloss Levels: As scheduled in this Section.

1. Concrete:
 - a. Vertical/Walls: MPI Level 3 (Eggshell).
2. Metal:
 - a. Exterior
 - 1) Metal Doors: MPI Level 5 (Semi-Gloss)
 - 2) Metal Frames: MPI Level 5 (Semi-Gloss)
 - 3) Overhead Metal Decking: MPI Level 5 (Semi-Gloss)
 - 4) Gutters/ Downspouts: MPI Level 5 (Semi-Gloss)
 - 5) Metal Railings: MPI Level 6 (Gloss)

END OF SECTION

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Chain-link fences.
 - 2. Swing gates.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete and post footings.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Inspect and discuss equipment bases, and other preparatory work specified elsewhere.
 - 2. Review required testing, inspecting, and certifying procedures.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Gates and hardware.
- B. Shop Drawings: For each type of fence and gate assembly.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include accessories, hardware, gate operation, and operational clearances.
- C. Samples for Initial Selection: For each type of factory-applied finish.
- D. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:

1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For factory-authorized service representative.
- B. Product Certificates: For each type of chain-link fence, and gate.
- C. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.06 FIELD CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.07 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Failure to comply with performance requirements.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.
 1. Design Wind Load: As indicated on Drawings.
 - a. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified.

- B. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.02 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:
 - 1. Fabric Height: As indicated on Drawings.
 - 2. Steel Wire for Fabric: Wire diameter of 0.148 inch (9 gauge).
 - a. Mesh Size: 1 inch.
 - b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied before, or after weaving.
 - c. Polymer-Coated Fabric: ASTM F 668, Class 2a over zinc -coated steel wire.
 - 1) Color: Black, according to ASTM F 934.
 - d. Coat selvage ends of metallic-coated fabric before or after the weaving process with manufacturer's standard clear protective coating.
 - 3. Selvage: Knuckled at both selvages.

2.03 FENCE FRAMEWORK

- A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
 - 1. Fence Height: As indicated on Drawings.
 - 2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.
 - a. Line Post: 2.875 inches in diameter.
 - b. End, Corner, and Pull Posts: 2.875 inches in diameter.
 - 3. Horizontal Framework Members: Intermediate top and bottom rails according to ASTM F 1043.
 - a. Top Rail: 1.66 inches in diameter.
 - b. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a black, verifiable polymer film.
 - 4. Polymer coating over metallic coating.
 - a. Color: Match chain-link fabric. Black, according to ASTM F 934.

2.04 SWING GATES

- A. General: ASTM F900 for gate posts and double swing gate types.
 - 1. Gate Leaf Width: As indicated.
 - 2. Framework Member Sizes and Strength: Based on gate fabric height as indicated.
- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: ASTM F1043 and ASTM F1083; protective coating and finish to match fence framework.
 - 2. Gate Posts: Round tubular steel .
 - 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded or assembled with corner fittings.
- D. Hardware:
 - 1. Hinges: 180-degree outward swing.
 - 2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
 - 3. Lock: Manufacturer's standard internal device.

2.05 FITTINGS

- A. Provide fittings according to ASTM F626.
- B. Post Caps: Provide for each post.
 - 1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 - 1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
 - 2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- H. Tie Wires, Clips, and Fasteners: According to ASTM F626.
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:

- a. Hot-Dip Galvanized Steel: 0.148-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Finish:

- 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.
 - a. Polymer coating over metallic coating.

2.06 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

2.07 GROUNDING MATERIALS

- A. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.
 - 1. Connectors for Below-Grade Use: Exothermic welded type.
 - 2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for earthwork, pavement work, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.03 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.

- B. Post Setting: Set posts in concrete at indicated spacing.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect above ground portion of posts from concrete splatter.
 - a. Posts Set into Holes in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
- C. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings.
- D. Line Posts: Space line posts uniformly as indicated on Drawings.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 - 1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- G. Intermediate and Bottom Rails: Secure to posts with fittings.
- H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1-inch to 2-inch bottom clearance between finish slab surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.
- J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- K. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side.

3.04 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.05 GROUNDING AND BONDING

- A. Fence and Gate Grounding:
 - 1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
 - 2. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
 - 3. Ground fence on each side of gates and other fence openings.
 - a. Bond metal gates to gate posts.
 - b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.
- B. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
- C. Connections:
 - 1. Make connections with clean, bare metal at points of contact.
 - 2. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 3. Make above-grade ground connections with mechanical fasteners.
 - 4. Make below-grade ground connections with exothermic welds.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- D. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

3.06 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests.
- B. Prepare test reports.

3.07 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

END OF SECTION