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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the protection and trimming of trees that interfere with, or are affected by, execution of the Work, whether temporary or new construction.
- B. Related Sections include the following:
 - 1. Division 01 Summary of Work for limits placed on Contractor's use of the site.
 - 2. Division 01 Temporary Facilities and Controls for temporary tree protection.
 - 3. Division 02 Selective Demolition for removal limits of trees, shrubs, and other plantings affected by new construction.
 - 4. Division 31 Earthwork for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials.
 - 5. Division 32 Landscaping Planting for tree and shrub planting and transplanting, tree support systems, and soil materials.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Certification: From a qualified arborist that trees indicated to remain have been protected during all phases of construction according to recognized standards and those trees were promptly and properly treated and repaired when damaged.
- D. Maintenance Recommendations: From a qualified arborist for care and protection of trees affected by construction during and after completing the Work.

1.4 QUALITY ASSURANCE

- A. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
- B. Arborist Qualifications: An arborist certified by the International Society of Arboriculture or licensed in the jurisdiction where Project is located.
- C. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless more stringent requirements are indicated.
- D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
 - 1. Before starting tree protection and trimming, meet with representatives of authorities having jurisdiction, Owner, Architect, consultants, and other concerned entities. Review tree protection and trimming procedures and responsibilities. Notify

participants at least three working days before convening conference. Record discussions and agreements and furnish a copy to each participant.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.
- B. Topsoil: Fertile, friable, surface soil, containing natural loam and complying University of Utah Topsoil Standards.
- C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.
- D. Chain Link Fence: Metallic-coated steel chain link fence fabric, 0.120-inch-diameter wire size; 48 inches high, minimum; line posts, 1.9 inches in diameter; terminal and corner posts, 2-3/8 inches in diameter; top rail, 1-5/8 inches in diameter; bottom tension wire, 0.177 inch in diameter; with tie wires, hog ring ties, and other accessories for a complete fence system.
- E. Bark Mulch: Bark Mulch (Shredded bark, natural and non-dyed): Placed around trees as indicated on the Drawings placed to a depth of 6 inches.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Temporary Fencing: Install temporary fencing located as indicated or outside the drip line of trees to protect remaining vegetation from construction damage. As indicated on the Drawings. Contractor to meet with the Landscape Architect and Arborist to define specific fencing locations for this project during phases of construction.
 - 1. Install chain link fence according to ASTM F 567 and manufacturer's written instructions.
- B. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.
- C. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line; prevent soil compaction over root systems.
- D. Do not allow fires under or adjacent to remaining trees or other plants.
- E. Install 6 inches of temporary bark mulch around trees as indicated on the Drawings.

3.2 EXCAVATION

- A. Install shoring or other protective support systems to minimize sloping or benching of excavations.
- B. Do not excavate within drip line of trees, unless otherwise indicated.
- C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.
 - 1. Relocate roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and relocate them without breaking. If encountered immediately adjacent to location of new

construction and relocation is not practical, cut roots approximately 3 inches back from new construction.

2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
- D. Where utility trenches are required within drip line of trees, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

3.3 RE-GRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond drip line of trees. Maintain existing grades within drip line of trees.
- B. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by qualified arborist, unless otherwise indicated.
1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.
- C. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.
- D. Moderate Fill: Where existing grade is more than 6 inches but less than 12 inches, below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of finish grade and extend not less than 18 inches from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches below elevation of grade.
 2. Place filter fabric with edges overlapping 6 inches minimum.
 3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.4 TREE PRUNING

- A. Prune remaining trees affected by temporary and new construction.
- B. Prune remaining trees to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by qualified arborist.
- C. Pruning Standards: Prune trees according to ANSI A300 as follows:
1. Type of Pruning: Crown cleaning.
 2. Type of Pruning: Crown thinning.
 3. Type of Pruning: Crown raising.
 4. Type of Pruning: Crown reduction.
 5. Type of Pruning: Vista pruning.
 6. Type of Pruning: Crown restoration.
- D. Cut branches with sharp pruning instruments; do not break or chop.
- E. Chip branches removed from trees. Spread chips where indicated or as directed by the Landscape Architect.

3.5 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the qualified arborist.

- B. Remove and replace dead and damaged trees that the qualified arborist determines to be incapable of restoring to a normal growth pattern.
 - 1. Provide new trees of the same size and species as those being replaced; plant and maintain as specified in Division 2 Section "Landscaping."
 - 2. Provide new trees of 6-inch caliper size and of a species selected by Owner's Representative when trees more than 6 inches in caliper size, measured 12 inches above grade, are required to be replaced.
- C. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch-diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augured soil and sand.

3.6 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted.
- B. Disposal: Remove excess excavated material, displaced trees, and excess chips from Owner's property.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Retaining walls.
 - 4. Slabs-on-grade at children education center.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
 - 2. Division 32 Section "Cement Concrete Pavement" for concrete pavement and walks.
 - 3. Division 03 Section "Architectural Concrete" for general building applications of specially finished formed concrete.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
- E. Construction and Contraction Joint Layout Drawings for where concrete slabs will be exposed: Indicate control points that will be used to locate joints in the field.
 1. Location of joints shall align with aesthetic joint locations shown in the drawings.
- F. Samples: For waterstops, integral colored concrete.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 1. Cementitious materials.
 2. Admixtures.
 3. Form materials and form-release agents.
 4. Steel reinforcement and accessories.
 5. Waterstops.
 6. Curing compounds.
 7. Floor and slab treatments.
 8. Bonding agents.
 9. Adhesives.
 10. Vapor retarders.
 11. Semirigid joint filler.
 12. Joint-filler strips.
 13. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 1. Aggregates.
- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- F. Field quality-control reports.
- G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

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1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- H. Preinstallation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging steel reinforcement.
 - B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, to match profile indicated on drawings.
- F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal, to match profile indicate on drawings.
- G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- D. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, assembled with clips.
- E. Plain-Steel Wire: ASTM A 82/A 82M, as drawn].
- F. Deformed-Steel Wire: ASTM A 496/A 496M.
- G. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.
- H. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- I. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from galvanized-steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), 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:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type II gray Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source. Retain coarse-aggregate size from three options in first subparagraph below; insert gradation requirements if preferred. Aggregate size limits relate to spacing of steel reinforcement, depth of slab, or thickness of concrete member.
 - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
 - 1. Products: Subject to compliance with requirements, provide one of the following:[
 - a. Axim Italcementi Group, Inc.; CATEXOL CN-CI.
 - b. BASF Construction Chemicals - Building Systems; Rheocrete CNI.
 - c. Euclid Chemical Company (The), an RPM company; Grace Construction Products, W. R. Grace & Co.; DCI.
 - d. Sika Corporation; Sika CNI.
- D. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ChemMasters.
 - b. Davis Colors.
 - c. Dayton Superior Corporation.
 - d. Hoover Color Corporation.
 - e. Lambert Corporation.
 - f. QC Construction Products.
 - g. Rockwood Pigments NA, Inc.
 - h. Scofield, L. M. Company.
 - i. Solomon Colors, Inc.
 - 2. Color: Provide concrete mix additives to obtain an integrally colored concrete in Black as approved by the Architect or Owner.

2.6 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Greenstreak.
 - b. Williams Products, Inc.
2. Profile: Flat, dumbbell without center bulb.
3. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick) nontapered.

2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Insulation Solutions Inc.; Viper II 15 mil
 - b. Reef Industries, Inc.; Griffolyn T-65.
 - c. From Bank:
 - d. Fortifiber Building Systems Group; Moistop Ultra 15.
 - e. Raven Industries Inc.; Vapor Block 15.
 - f. Reef Industries, Inc.; Griffolyn Type-65G.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
- C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ChemMasters; Chemisil Plus.
 - b. ChemTec Int'l; ChemTec One.
 - c. Conspec by Dayton Superior; Intraseal.
 - d. Curecrete Distribution Inc.; Ashford Formula.
 - e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
 - f. Edoco by Dayton Superior; Titan Hard.
 - g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
 - h. Kaufman Products, Inc.; SureHard.
 - i. L&M Construction Chemicals, Inc.; Seal Hard.
 - j. Meadows, W. R., Inc.; LIQUI-HARD.
 - k. Metalcrete Industries; Floorsaver.
 - l. Nox-Crete Products Group; Duro-Nox.
 - m. Symons by Dayton Superior; Buff Hard.

- n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
- o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Coordinate application of curing materials with concrete polishing contractor.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
 - b. BASF Construction Chemicals - Building Systems; Confilm.
 - c. ChemMasters; SprayFilm.
 - d. Conspec by Dayton Superior; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film (J-74).
 - f. Edoco by Dayton Superior; BurkeFilm.
 - g. Euclid Chemical Company (The), an RPM company; Eucobar.
 - h. Kaufman Products, Inc.; Vapor-Aid.
 - i. Lambert Corporation; LAMBCO Skin.
 - j. L&M Construction Chemicals, Inc.; E-CON.
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 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group; MONOFILM.
 - n. Sika Corporation; SikaFilm.
 - o. SpecChem, LLC; Spec Film.
 - p. Symons by Dayton Superior; Finishing Aid.
 - q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
 - r. Unitex; PRO-FILM.
 - s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. FIBER REINFORCEMENT

Use fiber reinforcement as indicated in the structural notes.

Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

Products:

Monofilament Fibers:

- a. Axim Concrete Technologies; Fibrasol IIP.
- b. Euclid Chemical Company (The); Fiberstrand 100.
- c. FORTA Corporation; Forta Mono.
- d. Grace, W. R. & Co.--Conn.; Grace MicroFiber.
- e. Metalcrete Industries; Polystrand 1000.
- f. SI Concrete Systems; Fibermix Stealth.

Fibrillated Fibers:

- a. Axim Concrete Technologies; Fibrasol F.
- b. FORTA Corporation; Forta.
- c. Euclid Chemical Company (The); Fiberstrand F.
- d. Grace, W. R. & Co.--Conn.; Grace Fibers.
- e. SI Concrete Systems; Fibermesh.

Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. where specified and approved in mix submittal.

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 1. Types I and II, non-load bearing; Types IV and V, load bearing; for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used:
 1. Limit combination of cementitious materials containing silica fume as follows:
 - a. Silica Fume: 10 percent.
 - b. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 - c. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 2. For exterior concrete paving exposed to deicing chemicals limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - a. Combined Fly Ash and Pozzolan: 25 percent.
 - b. Ground Granulated Blast-Furnace Slag: 50 percent.
 - c. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 1. Use water-reducing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. General: Comply with Section 033300 "Architectural Concrete" for concrete mixtures for architectural concrete building elements.
- B. Proportion normal-weight concrete mixture for all building elements (except architectural concrete) as follows:
 - 1. Minimum Compressive Strength: 3000 psi to 5000 psi at 28 days. See structural drawings for more information.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45 for 4500 psi and 5000 psi concrete, 0.5 for 3000 psi concrete.
 - 3. Slump Limit: 4 inches (100 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 - 4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 - 5. Air Content: Do not allow air content of trowel finished floors to exceed 3 percent.

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- 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 (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.

- E. Fabricate 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 keyways, 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. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Do not chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

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

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) 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 supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be 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 approved by Architect.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation, and removal of shoring and reshoring.
 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
- B. Granular Course: Place granular fill below vapor retarder, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).
 1. Prior to placing fine graded granular material (sand) over vapor barrier under slabs scheduled to receive resilient floor coverings or resinous floor coverings notify Owner's Special Inspector to inspect vapor barrier and verify its integrity and continuity prior to covering.
 2. Carefully place and compact a 2-inch- (50-mm-) thick layer of fine-graded granular material over the vapor retarder. Do not distribute with heavy equipment. Level and spread by hand.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing 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 would 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 one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.
- G. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.7 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 approved 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 (38 mm) into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the 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 the 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 hardened or partially hardened concrete surfaces.
 - 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows: At exposed concrete floor slabs joints shall correspond to location of aesthetic joints indicated on the drawings. Prior to pouring concrete carefully review joint locations on approved control joint shop drawings and establish control points so joints can be precisely located within the appropriate time frame for establishing weakened plane joint before random cracking begins to form.
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 07920 "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- 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 one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) 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.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

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

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

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

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces. Coordinate slab finishing with concrete polishing contractor where polished concrete slabs are indicated.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
 - 1. Apply scratch finish to surfaces to receive concrete floor toppings, or to receive mortar setting beds for bonded cementitious floor finishes.
- C. 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 restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
 - b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
 - 3. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm).
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and 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.
- G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m) unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.12 MISCELLANEOUS CONCRETE ITEMS

- 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 the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

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 301 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/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. 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 the remainder of the 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 seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
 - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than 14 days' old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved 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 one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) 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 (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of 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 C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 7. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
 11. 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.
 12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 033300 - ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes cast-in-place architectural concrete including form facings, reinforcement accessories, concrete materials, concrete mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Division 03 Section "Cast-In-Place Concrete" for general building applications of cast-in-place concrete.
 - 2. Division 07 Section "Water and Graffiti Repellents" for water and graffiti repellents applied to the surfaces of cast-in-place architectural concrete.
 - 3. Division 07 Section "Joint Sealants" for elastomeric joint sealants in contraction and other joints in cast-in-place architectural concrete.

1.3 DEFINITIONS

- A. Cast-in-Place Architectural Concrete: Formed concrete that is exposed to view on surfaces of completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.
- B. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
- C. Reveal: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place architectural concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Cast-in-place architectural concrete subcontractor.

2. Review concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction joints, forms and form-removal limitations, reinforcement accessory installation, concrete repair procedures, and protection of cast-in-place architectural concrete.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Formwork Shop Drawings: Show formwork construction including form-facing joints, rustications, construction and contraction joints, form joint-sealant details, form tie locations and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect cast-in-place architectural concrete.
- D. Placement Schedule: Submit concrete placement schedule before start of placement operations. Include locations of all joints including construction joints.
- E. Samples: For each of the following materials:
 1. Form-facing panel.
 2. Form ties.
 3. Form liners.
 4. Coarse- and fine-aggregate gradations.
 5. Chamfers and rustications.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Material Certificates: For each of the following:
 1. Cementitious materials.
 2. Admixtures.
 3. Form materials and form-release agents.
 4. Repair materials.
- C. Material Test Reports: For the following, by a qualified testing agency:
 1. Aggregates.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "NRMCA Quality Control Manual - Section 3, Certification of Ready Mixed Concrete Production Facilities."
- B. Source Limitations for Cast-in-Place Architectural Concrete: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide cast-in-place architectural concrete of consistent quality in appearance and physical properties.
- C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 1. ACI 301, "Specification for Structural Concrete Sections 1 through 5 and Section 6, "Architectural Concrete."
 2. ACI 303.1, "Specification for Cast-in-Place Architectural Concrete."
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Mockups: Before casting architectural concrete, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
 1. Provide 8-inch thick architectural finish concrete wall, 4-foot high by 4-foot wide, using products specified herein. Finish top of wall and outside corners at specified. Mock-up to include (1) panel-to-panel seam.
 2. Demonstrate curing, cleaning, and protecting of cast-in-place architectural concrete, finishes, and contraction joints, as applicable.
 3. In presence of Architect, damage part of the exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces.
 4. Obtain Architect's approval of mockups before casting architectural concrete.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. General: Comply with Section 03300 "Cast-in-Place Concrete" for formwork and other form-facing material requirements.
- B. Form-Facing Panels for As-Cast Finishes: New or Second Use only, exterior-grade plywood panels, nonabsorptive, that will provide continuous, true, and smooth architectural concrete surfaces, high-density overlay, Class 1, or better, complying with DOC PS 1.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will provide surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

- E. Form Liners: Units of face design, texture, arrangement, and configuration indicated . Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent surface treatments of concrete.
- F. Rustication Strips: Metal, rigid plastic, or dressed wood; nonstaining; in longest practicable lengths, to match profile indicated on drawings.
- G. Chamfer Strips: Metal, rigid plastic, elastomeric rubber, or dressed wood; nonstaining; in longest practicable lengths, to match profile indicated on drawings.
- H. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800, "Specification 810.1, Expanded Cellular Glazing Tape"; minimum 1/4 inch (6 mm) thick.
- I. Form Joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or Type S, Grade NS, that adheres to form joint substrates.
- J. Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood.
- K. Form-Release Agent: Commercially formulated, colorless form-release agent that will not bond with, stain, or adversely affect architectural concrete surfaces and will not impair subsequent treatments of those surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- L. Surface Retarder: Chemical liquid set retarder, for application on form-facing materials, capable of temporarily delaying final hardening of newly placed concrete surface to depth of reveal specified.
- M. Form Ties: Factory-fabricated, glass-fiber-reinforced plastic ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish glass-fiber-reinforced plastic ties, not greater than 1/2 inch (13 mm) in diameter, of color selected by Architect from manufacturer's full range.
 - 2. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT AND ACCESSORIES

- A. General: Comply with Section 033000 "Cast-in-Place Concrete" for steel reinforcement and other requirements for reinforcement accessories.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufacture according to CRSI's "Manual of Standard Practice."
 - 1. Where legs of wire bar supports contact forms, use CRSI Class 1, gray, plastic-protected bar supports.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type II, gray. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F.
 - b. Silica Fume: ASTM C 1240, amorphous silica.
- B. Normal-Weight Aggregates: ASTM C 33, Class 5S coarse aggregate or better, graded. Provide aggregates from single source.
 1. Maximum Coarse-Aggregate Size: 1 inch (25 mm).
 2. Gradation: Uniformly graded.
- C. Normal-Weight Fine Aggregate: ASTM C 33, manufactured or natural sand, from same source for entire Project.
- D. Water: Potable, complying with ASTM C 94/C 94M except free of wash water from mixer washout operations.

2.4 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
 1. For integrally colored concrete, curing compound shall be approved by color pigment manufacturer.
 2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

2.6 REPAIR MATERIALS

- A. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- B. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements.

1. Types I and II, non-load bearing; Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.7 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of cast-in-place architectural 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 design mixtures based on laboratory trial mixtures.
- B. Proportion conventional architectural concrete mixtures as follows:
 1. Compressive Strength (28 Days): 5000 psi
 2. Maximum Water-Cementitious Materials Ratio: 0.40.
 3. Slump Limit: 5 inches, plus or minus 1 inch. Air Content: 6 percent, plus or minus 1 percent at point of delivery for 1-inch nominal maximum aggregate size.
- C. Proportion self consolidating architectural concrete mixtures as follows:
 1. Compressive Strength (28 Days): 6000 psi.
 2. Maximum Water-Cementitious Materials Ratio: 0.40.
 3. Flow Limit: 25 inches, plus or minus 3 inches.
 4. Air Content: 5 percent, plus or minus 1 percent at point of delivery for 1-inch nominal maximum aggregate size.
- D. Cementitious Materials: For cast-in-place architectural concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.
- E. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- F. Admixtures: Use admixtures according to manufacturer's written instructions.

2.8 CONCRETE MIXING

- A. Ready-Mixed Architectural Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.
 1. Clean equipment used to mix and deliver cast-in-place architectural concrete to prevent contamination from other concrete.
 2. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. General: Comply with Section 033000 "Cast-in-Place Concrete" for formwork, embedded items, and shoring and reshoring.

- B. Limit deflection of form-facing panels to not exceed ACI 303.1 requirements.
- C. In addition to ACI 303.1 limits on form-facing panel deflection, limit cast-in-place architectural concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm).
- D. Fabricate forms to result in cast-in-place architectural concrete that complies with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-in-place surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.
 - 1. Seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
 - 2. Do not use rust-stained steel form-facing material.
- F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- G. Do not chamfer exterior corners and edges of cast-in-place architectural concrete. Provide 1/8" maximum radius at exterior corners and edges of cast-in-place architectural concrete by applying tooled sealant joint at interior face of forms where outside edges occur. Provide 1/8" maximum radius tooled edge at finished top of wall edges where occur. Tooled edges shall not alter smooth as-cast face of wall finish provided by forms.
- H. Coat contact surfaces of wood rustications and chamfer strips with sealer before placing reinforcement, anchoring devices, and embedded items.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- M. Coat contact surfaces of forms with surface retarder, according to manufacturer's written instructions, before placing reinforcement.
- N. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting. Prevent form liners from sagging and stretching in hot weather. Seal joints of form liners and form liner accessories to prevent mortar leaks. Coat form liner with form-release agent.

3.2 REINFORCEMENT AND INSERTS

- A. General: Comply with Section 033000 "Cast-in-Place Concrete" for fabricating and installing steel reinforcement. Securely fasten steel reinforcement and wire ties against shifting during concrete placement.
- B. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.3 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Schedule form removal to maintain surface appearance that matches approved mockups.
 - 2. Cut off and grind glass-fiber-reinforced plastic form ties flush with surface of concrete. Care shall be taken to not damage finished architectural concrete surface.
- B. Clean and repair surfaces of forms to be reused in the Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material. 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 cast-in-place architectural concrete surfaces.

3.4 JOINTS

- A. Construction Joints: Install construction joints true to line with faces perpendicular to surface plane of cast-in-place architectural concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete. Align construction joint within rustications attached to form-facing material.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the 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 the top of footings or floor slabs.
 - 5. Space vertical joints in walls as indicated. If not indicated, verify location with Architect. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 6. Use bonding agent or epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- B. Contraction Joints: Form weakened-plane contraction joints true to line with faces perpendicular to surface plane of cast-in-place architectural concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, form-release agent, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- 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 between construction joints. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 303.1.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least **6 inches (150 mm)** into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. Do not permit vibrators to contact forms.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below **40 deg F (4.4 deg C)** for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
 - 4. Do not use chemical accelerators unless otherwise specified and approved in design mixtures.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below **90 deg F (32 deg C)** 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.

3.6 FINISHES, GENERAL

- A. Architectural Concrete Finish: Match Architect's design reference sample, identified and described as indicated, to satisfaction of Architect. If no design reference sample is indicated, match finish of approved mock-up unless noted otherwise.

- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.
 - 1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.
- C. Maintain uniformity of special finishes over construction joints unless otherwise indicated.

3.7 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.
- B. Form-Liner Finish: Produce a textured surface free of pockets, streaks, and honeycombs, and of uniform appearance, color, and texture.

3.8 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 with ACI 301 for hot-weather protection during curing.
- B. Begin curing cast-in-place architectural concrete immediately after removing forms from concrete. Forms to remain in place for 72 hours after concrete placement. Once forms have been removed, cure according to ACI 308.1, by one or a combination of the following methods that will not mottle, discolor, or stain concrete:
 - 1. Moisture Curing: Keep exposed surfaces of cast-in-place architectural concrete continuously moist for no fewer than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - 2. Curing Compound: Mist concrete surfaces with water. Apply curing compound uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.9 FIELD QUALITY CONTROL

- A. General: Comply with field quality-control requirements in Section 033000 "Cast-in-Place Concrete."

3.10 REPAIRS, PROTECTION, AND CLEANING

- A. Repair and cure damaged finished surfaces of cast-in-place architectural concrete when approved by Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.

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1. Remove and replace cast-in-place architectural concrete that cannot be repaired and cured to Architect's approval.
 2. Full replacement of architectural finish concrete elements will be required as directed by the Architect, at contractor's expense, and without compensable delays to the project schedule, when architectural concrete work does not conform to performance requirements, tolerances, or referenced standards indicated, or where aesthetic quality of work is not equal or consistent with the approved architectural concrete mock-up.
- B. Protect corners, edges, and surfaces of cast-in-place architectural concrete from damage; use guards and barricades.
- C. Protect cast-in-place architectural concrete from staining, laitance, and contamination during remainder of construction period.
- D. Clean cast-in-place architectural concrete surfaces after finish treatment to remove stains, markings, dust, and debris.
- E. Wash and rinse surfaces according to concrete finish applicator's written instructions. Protect other Work from staining or damage due to cleaning operations.
1. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural concrete finishes.

END OF SECTION 033300

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Structural steel.
- 2. Grout.

B. Related Sections:

- 1. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
- 2. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.
- 3. Section 099600 "High-Performance Coatings" for surface-preparation and priming requirements in addition to and coordination with requirements specified in this section.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches (38 mm).
 - 2. Welded built-up members with plates thicker than 2 inches (50 mm).
 - 3. Column base plates thicker than 2 inches (50 mm).
- D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- E. 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.

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
 - 1. Review designations of members scheduled to receive fireproofing and coordinate prime painting limitations of members receiving spray applied or intumescent fireproofing with fireproofing contractor.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

- 1.6 Preinstallation Conference: Conduct conference at Project site.

1.7 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 5. Identify members and connections of the seismic-load-resisting system.
 - 6. Indicate locations and dimensions of protected zones.
 - 7. Identify demand critical welds.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," 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. Qualification Data: For qualified Installer , fabricator, testing agency.
- E. Welding certificates.
- F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- G. Mill test reports for structural steel, including chemical and physical properties.
- H. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.

3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Nonsrink grout.

- I. Source quality-control reports.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC Certified Erector, Category ACSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 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. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- D. Comply with applicable provisions of the following specifications and documents:
 1. AISC 303.
 2. AISC 341 and AISC 341s1.
 3. AISC 360.
 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. W-Shapes: ASTM A 992/A 992M.
- C. Channels, Angles Shapes: ASTM A 36/A 36M.
- D. Plate and Bar: ASTM A 36/A 36M.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
- G. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: **ASTM A 325 (ASTM A 325M)**, Type 1, heavy-hex steel structural bolts; **ASTM A 563, Grade C, (ASTM A 563M, Class 8S)** heavy-hex carbon-steel nuts; and **ASTM F 436 (ASTM F 436M)**, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: **ASTM F 959, Type 325 (ASTM F 959M, Type 8.8)**, compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: **ASTM A 490 (ASTM A 490M)**, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; **ASTM A 563, Grade DH, (ASTM A 563M, Class 10S)** heavy-hex carbon-steel nuts; and **ASTM F 436 (ASTM F 436M)**, Type 1, hardened carbon-steel washers with plain finish.
 - 1. Direct-Tension Indicators: **ASTM F 959, Type 490 (ASTM F 959M, Type 10.9)**, compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: **ASTM A 325 (ASTM A 325M)**, Type 1, heavy-hex steel structural bolts; **ASTM A 563, Grade DH (ASTM A 563M, Class 10S)** heavy-hex carbon-steel nuts; and **ASTM F 436 (ASTM F 436M)**, Type 1, hardened carbon-steel washers.
 - 1. Finish: Mechanically deposited zinc coating.
 - 2. Direct-Tension Indicators: **ASTM F 959, Type 325 (ASTM F 959M, Type 8.8)**, compressible-washer type with mechanically deposited zinc coating] [mechanically deposited zinc coating, baked epoxy-coated finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Mechanically deposited zinc coating.
- E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

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- F. Unheaded Anchor Rods: Per Structural Plans.
 - 1. Configuration: Per Plans
- G. Headed Anchor Rods: Per Structural Plans.
 - 1. Finish: Plain.
- H. Threaded Rods: ASTM A 36/A 36M.
 - 1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C, Mechanically deposited zinc coating, ASTM B 695, Class 50.
- I. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

2.3 PRIMER

- A. Primer, for members exposed to view: Comply with Division 09 painting Sections.
- B. Primer, for members not exposed to view: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- C. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 ASTM A 780.

2.4 GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

- E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.
- G. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than **10 inches (250 mm)** o.c. unless otherwise indicated.
- H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. 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.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of **2 inches (50 mm)**.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. For members exposed to the exterior, clean per SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning." Ease all edges and grind smooth welds and splatter.

- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 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. Galvanize lintels, shelf angles, and welded door frames attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

- A. If required by the Authority Having Jurisdiction, Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, field-welded CJP connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with 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 bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. 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.
 - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- 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 will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.

- F. Do not use thermal cutting during erection. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and 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 where indicated, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

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

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Roof deck.

- B. Related Sections include the following:

- 1. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
 - 2. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 3. Division 09 painting Sections for repair painting of primed deck.

1.3 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: For each type of steel deck, signed by product manufacturer.
- D. Welding certificates.
- E. Field quality-control test and inspection reports.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
- G. Research/Evaluation Reports: For steel deck.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- B. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

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1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- C. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- D. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
 - B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Steel Deck:
 - a. ASC Profiles, Inc.
 - b. Canam Steel Corp.;The Canam Manac Group.
 - c. Consolidated Systems, Inc.
 - d. DACS, Inc.
 - e. D-Mac Industries Inc.
 - f. Epic Metals Corporation.
 - g. Marlyn Steel Decks, Inc.
 - h. New Millennium Building Systems, LLC.
 - i. Nucor Corp.; Vulcraft Division.
 - j. Roof Deck, Inc.
 - k. United Steel Deck, Inc.

- l. Valley Joist; Division of EBSCO Industries, Inc.
- m. Vercor Manufacturing Co.
- n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.3 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and as specified in the structural notes on the drawings.
 - 1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G90 (Z275) zinc coating.

2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, 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. 12 (4.8-mm) 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 (230 MPa), not less than 0.0359-inch (0.91-mm) 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.
- G. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch (1.90 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.
- I. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and level or sloped recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.
- J. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.
- K. Galvanizing Repair Paint: ASTM A 780 SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, 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.

3.3 ROOF-DECK INSTALLATION

- 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 (38 mm)** long, and as noted in the structural drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as noted in the structural drawings.
 - 1. End Bearing: Install deck ends over supporting frame with a minimum end bearing of **1-1/2 inches (38 mm)** as noted in the structural drawings
- C. 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 (305 mm)** apart with at least one weld or fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

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1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls wherever required to provide airtight weather seal between interior and exterior unless another closure system is noted in the drawings . Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

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

3.5 REPAIRS AND PROTECTION

- A. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for countertops.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Miscellaneous steel trim.
6. Metal bollards.
7. Pipe Downspout.
8. 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. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Division 05 Section "Structural Steel Framing."

1.3 COORDINATION

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

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Paint products.
 - 3. Grout.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- D. Welding certificates.
- E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 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, "Structural Welding Code - Stainless Steel."

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS, GENERAL

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- F. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallurgically bonded to steel.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. IKG Industries, a division of Harsco Corporation; Mebac.
 - b. SlipNOT Metal Safety Flooring, a W. S. Molnar company; SlipNOT.
- G. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- H. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- I. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm) or as indicated.
 - 2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 (Z275) coating; 0.079-inch (2-mm) minimum nominal thickness.
- J. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

- E. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).
- F. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
- G. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- H. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.
- I. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.5 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or [ASTM F 1941 \(ASTM F 1941M\)](#), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, [ASTM A 307, Grade A \(ASTM F 568M, Property Class 4.6\)](#); with hex nuts, [ASTM A 563 \(ASTM A 563M\)](#); and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, [ASTM A 325, Type 3 \(ASTM A 325M, Type 3\)](#); with hex nuts, [ASTM A 563, Grade C3 \(ASTM A 563M, Class 8S3\)](#); and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, [ASTM F 593 \(ASTM F 738M\)](#); with hex nuts, [ASTM F 594 \(ASTM F 836M\)](#); and, where indicated, flat washers; Alloy Group [1 \(A1\)](#).
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; 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. Eyebolts: ASTM A 489.
- G. Machine Screws: [ASME B18.6.3 \(ASME B18.6.7M\)](#).
- H. Lag Screws: [ASME B18.2.1 \(ASME B18.2.3.8M\)](#).
- I. Wood Screws: Flat head, ASME B18.6.1.
- J. Plain Washers: Round, [ASME B18.22.1 \(ASME B18.22M\)](#).
- K. Lock Washers: Helical, spring type, [ASME B18.21.1 \(ASME B18.21.2M\)](#).

- L. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- M. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 09 painting Sections.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- I. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.7 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the 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 (1 mm) 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 and contour of welded surface matches that of adjacent surface.
- 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 will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, **1/8 by 1-1/2 inches (3.2 by 38 mm)**, with a minimum **6-inch (150-mm)** embedment and **2-inch (50-mm)** hook, not less than **8 inches (200 mm)** from ends and corners of units and **24 inches (600 mm)** o.c., unless otherwise indicated.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated. with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with primer specified in Division 09 Section "Painting" where indicated.

2.9 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive **3/4-inch (19-mm)** bolts, spaced not more than **6 inches (150 mm)** from ends and **24 inches (600 mm)** o.c., unless otherwise indicated.

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1. Provide mitered and welded units at corners.
 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately **2 inches (50 mm)** larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls where indicated to be painted with primer specified in Division 09 Section "Painting."
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.10 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. Galvanize exterior miscellaneous steel trim where not scheduled to be painted.
- D. Prime miscellaneous steel trim with primer specified in Division 09 Section "Painting."

2.11 METAL BOLLARDS

- A. Fabricate metal bollards from steel shapes, as indicated.
1. Cap bollards with **1/4-inch- (6.4-mm-)** thick steel plate.
 2. Where bollards are indicated to receive controls for door operators, provide necessary cutouts for controls and holes for wire.
 3. Where bollards are indicated to receive light fixtures, provide necessary cutouts for fixtures and holes for wire.
- B. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or **1/4-inch (6.4-mm)** wall-thickness steel tubing with an OD approximately **1/16 inch (1.5 mm)** less than ID of bollards. Match drill sleeve and bollard for **3/4 inch (19 mm)** steel machine bolt.
- C. Prime bollards with primer specified in Division 09 Section "Painting."

2.12 METAL PIPE DOWNSPOUTS

- A. Fabricate metal pipe downspouts from Schedule 40 steel pipe, spanning from the underside of the soffit to the concrete island below. Provide painted steel yokes as required for downspout support as indicated in drawings.

- B. Galvanize metal pipe downspouts.
- C. Prime metal pipe downspouts with primer specified in Division 09 Section "Painting."

2.13 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates scheduled for exterior locations.
- C. Prime plates scheduled for interior locations with primer specified in Division 09 Section "Painting."

2.14 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than **8 inches (200 mm)** unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with [primer specified in Division 09 Section "Painting."

2.15 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.16 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. Prime exterior miscellaneous steel trim with zinc-rich primer.

2.17 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.18 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Division 09 painting Sections.
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements specified in Division 09 painting Sections.
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.19 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. 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 will 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: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 - 1. Do not fill removable bollards with concrete.
- B. Anchor bollards in place with concrete footings. Center and align bollards in holes **3 inches (75 mm)** above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

- C. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.
- D. Place removable bollards over internal sleeves and secure with 3/4-inch (19-mm) machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner will furnish padlocks.

3.4 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Wood blocking and nailers.
 - 2. Wood furring
 - 3. Utility shelving.
 - 4. Plywood backing panels.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of **2 inches nominal (38 mm actual)** or greater but less than **5 inches nominal (114 mm actual)** in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NLGA: National Lumber Grades Authority.
 - 2. WCLIB: West Coast Lumber Inspection Bureau.
 - 3. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Preservative-treated wood.
 - 2. Fire-retardant-treated wood.

3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Certified Wood: Lumber and plywood shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 3. Provide dressed lumber, S4S, unless otherwise indicated.
- C. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, [furring,] [stripping,] and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than **18 inches (460 mm)** above the ground in crawl spaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than **10.5 feet (3.2 m)** beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- E. Application: Treat all miscellaneous carpentry unless otherwise indicated on Drawings

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.

7. Utility shelving.

- B. For items of dimension lumber size, provide Construction or No. 2 [and the following species:
 - 1. Western woods; WCLIB or WWPA.
- C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- D. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, AC Exposure 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than **3/4-inch (19-mm)** nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners[with hot-dip zinc coating complying with ASTM A 153/A 153M] [of Type 304 stainless steel].
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Metal Framing: [ASTM C 1002] [ASTM C 954], length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: **ASME B18.2.1 (ASME B18.2.3.8M)**.
- G. Bolts: Steel bolts complying with **ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6)**; with **ASTM A 563 (ASTM A 563M)** hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.7 METAL FRAMING ANCHORS

- A. Hot-Dip Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); **G185 (Z550)** coating designation; and not less than **0.036 inch (0.9 mm)** thick.
 - 1. Use for wood-preservative-treated lumber and where indicated.

2.8 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing [Furring] [and] [Sleepers] to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal (38-mm actual) thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
- I. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function

of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

- J. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 064113 - WOOD-VENEER-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Architectural wood cabinets.
- 2. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets unless concealed within other construction before cabinet installation.
- 3. Shop finishing of architectural wood cabinets.

B. Related Requirements:

- 1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products, cabinet hardware and accessories and finishing materials and processes.

B. Sustainable Design Submittals:

- 1. Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification and chain of custody requirements.
- 2. For adhesives and composite wood products: Documentation indicating that products contain no urea formaldehyde.

- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

- 1. Show details full size.
- 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural wood cabinets.
4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
5. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. Shop-applied opaque finishes.
3. Solid hardwood edge material.
4. PVC edge material.
5. High Pressure Laminate Panels.

E. Samples for Verification:

1. Lumber for transparent finish, not less than 5 inches wide by 24 inches long, for each species and cut, finished on one side and one edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent-finished cabinets.
3. Lumber and panel products with shop-applied opaque finish, 5 inches wide by 24 inches long for lumber and 12 by 12 inches for panels, for each finish system and color, with one-half of exposed surface finished.
4. High Pressure Laminate panels, 12 by 12 inches for each color, pattern, and surface finish with edge banding on one edge.
5. Corner pieces as follows:
 - a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
 - b. Miter joints for standing trim.
6. Exposed cabinet hardware and accessories, one unit for each type and finish.
7. Semi exposed and concealed hardware and accessories, one unit for each type and finish.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Product Certificates: For each type of product and the following:
 1. Composite wood and agrifiber products.
 2. Thermoset decorative panels.
 3. Glass.
 4. Adhesives.
- C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

- D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Fabricator of products or Certified participant in AWI's Quality Certification Program.
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups of typical architectural wood cabinets as directed by Architect.
 - a. Mockup to include as a minimum: Construction of one typical base cabinet, 24-inches wide by height and depth indicated in drawings.
 - 1) In material, finish, grain, cut, and hardware specified.
 - 2) With a minimum of two doors with gap specified.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

- A. Coordinate and illustrate on shop drawings submittal: sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood-veneer-faced architectural cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOOD CABINETS, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural wood cabinets indicated for construction, finishes, installation, and other requirements.
 1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.

2.2 WOOD CABINETS FOR TRANSPARENT FINISH

- A. Grade: Premium
- B. Certified Wood: Architectural Wood Cabinets shall be made from wood products certified at FSC Pure or FSC Mixed Credit according to FSC STD-01-001, "FSC principles and Criteria for Forest Stewardship." And FSC STD-40-004, "FSC Standard for Chain of Custody Certification."
- C. Type of Construction: Match existing
- D. Cabinet and Door and Drawer Front Interface Style: Match existing
- E. Reveal Dimension: 1/8 inch
- F. Wood for Exposed Surfaces:
 1. Species: Match existing.
 2. Cut: Match existing.
 3. Grain Direction: Match existing.
 4. Matching of Veneer Leaves: Match existing.

5. Veneer Matching within Panel Face: Match existing.
 - a.
6. Veneer Matching within Room: Provide cabinet veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.

G. Semiexposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: High Pressure decorative laminate, NEMA LD 3, Grade VGS
 - a. Edges of Panel Shelves: 3mm PVC edge banding matching laminate in color, pattern, and finish.
 - b. For semiexposed backs of panels with exposed plastic laminate surfaces, provide surface of high-pressure decorative laminate, NEMALD3, Grade VGS
 - c. Color and finish of High Pressure decorative laminate at semiexposed surfaces:
 - 1) Formica, 949 Plastic Laminate, Matte.
2. Drawer Subfronts, Backs, and Sides: Varnished 1/2-inch 9 ply B/BB Baltic Birch plywood.
3. Drawer Bottoms: Varnished 1/2-inch 9 ply B/BB Baltic Birch plywood.
4. Notify architect if G.1, G.2 and G.3 above vary from existing.

H. Dust Panels: High Pressure Laminate on 1 1/16 – inch MDF core.

I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued dovetail joints.
2. Join bottoms with glued dado joints.

2.3 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
- B. Grade: Premium.
- C. Certified Wood: Plastic-laminate cabinets shall be made from wood products certified as "FSC Pure"[or "FSC Mixed Credit"] according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and FSC STD-40-004, "FSC Standard for Chain of Custody Certification."
- D. Type of Construction: Match existing.

- E. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- F. Reveal Dimension: 1/8 inch.
- G. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
- H. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS
 - 4. Edges: Grade HGS or as detailed on the drawings.
 - 5. Pattern Direction: Match existing.
- I. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS
 - a. Edges of Plastic-Laminate Shelves: 3 mm PVC edging matching laminate in color, pattern, and finish
 - b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
 - c. Color and finish of High Pressure decorative laminate at semiexposed surfaces:
 - 1) Match color and finish of laminate cladding exposed surfaces.
 - d. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS
 - 2. Drawer Sides and Backs: Varnished ½" 9 ply B/BB Baltic Birch plywood.
 - 3. Drawer Bottoms: Varnished ½" 9 ply B/BB Baltic Birch plywood.
 - 4. Notify architect if I.1, I.2 and I.3 above vary from existing.
- J. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- K. Dust Panels: High Pressure Laminate on 11/16 – inch MDF core.
- L. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued dovetail joints.
 - 2. Join bottoms with glued dado joints.
- M. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated on the drawings.

2. Match existing.

2.4 PLASTIC-LAMINATE COUNTERTOPS

- A. High-Pressure Decorative Laminate Grade: HGS.
- B. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 1. Match existing.
- C. Grain Direction: Match existing.
- D. Edge Treatment: Match existing.
- E. Core Material: Medium-density fiberboard.
- F. Core Material at Sinks: Medium-density fiberboard made with exterior glue or exterior-grade plywood.
- G. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.5 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
 2. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130 made with binder containing no urea formaldehyde.
 2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
 3. Veneer-Faced Panel Products: Hardwood, 9 ply Baltic Birch, Plywood.
 4. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.6 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets to match existing.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

- C. Back-Mounted Pulls: BHMA A156.9, B02011.
 - D. knob Pulls: Back mounted, solid metal, to match existing.
 - E. Catches: to match existing.
 - F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081; BHMA A156.9, B04102; with shelf brackets, B04112.
 - G. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
 - H. Drawer Slides: BHMA A156.9.
 - 1. Grade 1: Side mounted and extending under bottom edge of drawer, full-extension type; epoxy coated steel with polymer rollers.
 - 2. Grade 1HD-100: Side mounted; full- extension type; zinc-plated-steel ball-bearing slides.
 - 3. Grade 1HD-200: Side mounted; full-overtravel-extension type; zinc-plated-steel ball-bearing slides.
 - 4. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
 - 5. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-200.
 - 6. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
 - 7. For computer keyboard shelves, provide Grade 1.
 - 8. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-200.
 - I. Door Locks: BHMA A156.11, E07121. Cam lock, Basis of Design: Hafele 235.10.301
 - J. Drawer Locks: BHMA A156.11, E07041. Cam lock, Basis of Design: Hafele 235.10.301
 - K. Door and Drawer Silencers: BHMA A156.16, L03011.
 - L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Match existing.
 - M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- 2.7 MISCELLANEOUS MATERIALS
- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.8 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets: 1/32 inch unless otherwise indicated.
- C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- E. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.9 SHOP FINISHING

- A. General: Finish architectural wood cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural wood cabinets, as applicable to each unit of work.
 - 1. Back priming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of cabinets.
- C. Transparent Finish:

1. Grade: Premium
2. Finish: Catalyzed polyurethane, match existing sheen unless otherwise directed by the Architect.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/16 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 1. Install cabinets with no more than 1/16 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Maintain veneer sequence matching of cabinets with transparent finish.
 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 12 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips; No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
3. Caulk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

H. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064113

SECTION 071900 - WATER AND GRAFFITI REPELLENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes penetrating water-repellent treatments to be applied to the following vertical and horizontal surfaces:
 - 1. Architectural concrete.
- B. Related Sections:
 - 1. Section 033300 "Architectural Concrete"

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Water repellents shall meet performance requirements indicated without failure due to defective manufacture, fabrication, or installation.
 - 1. Water Repellents: Comply with performance requirements specified, as determined by testing substrate assemblies representing those indicated for this Project.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include manufacturer's printed statement of VOC content.
 - 2. Include manufacturer's standard colors.
 - 3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Applicator.
- B. Product Certificates: For each type of water repellent, from manufacturer.
- C. Field quality-control reports.
- D. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

- A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.
- B. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
 - 1. Concrete surfaces and mortar have cured for not less than 28 days.
 - 2. Building has been closed in for not less than 30 days before treating wall assemblies.
 - 3. Ambient temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C) and will remain so for 24 hours.
 - 4. Substrate is not frozen and substrate-surface temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C).
 - 5. Rain or snow is not predicted within 24 hours.
 - 6. Not less than seven days have passed since surfaces were last wet.
 - 7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PENETRATING WATER AND GRAFFITI REPELLENTS

- A. Penetrating Water and Graffiti Repellent: Clear, solvent based silicone elastomer containing 9 percent solids, ASTM D 2369; with alcohol, mineral spirits, water, or other proprietary solvent carrier.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. PROSOCO, Inc.; Sure Klean Weather Seal Blok-Guard and Graffiti Control.
- B. Apply to concrete retaining and screening walls where indicated on drawings to receive Water and Graffiti Repellent.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
 - 1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
 - 2. Inspect for previously applied treatments that may inhibit penetration or performance of water repellents.
 - 3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
 - 4. Verify that required repairs are complete, cured, and dry before applying water repellent.
- B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions[and as follows:][.]
 - 1. Cast-in-Place Concrete, Precast Concrete, Cast Stone, and Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM E 1857.
 - 2. Clay Brick Masonry: ASTM D 5703.
 - 3. Portland Cement Plaster (Stucco): ASTM E 1857.
- B. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.
- C. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.
- D. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
 - 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

- B. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using pressure spray with a fan-type spray nozzle as recommended by manufacturer, to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
 - 1. Precast Concrete and Cast Stone: At Contractor's option, first application of water repellent on units may be completed before installing them. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces.
- C. When recommended by manufacturer, apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

- A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:
 - 1. Owner will engage the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
 - 3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect
- B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.
 - 1. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
 - 2. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.
- B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071900

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system (Indicated as Type 1 on the drawings).
2. Substrate Board
3. Roof insulation.

B. Related Sections:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, counterflashings copings and roof edge metal.
3. Division 7 Section "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
4. Division 22 Section "Storm Drainage Piping Specialties" for roof drains.

1.3 DEFINITIONS

- A. TPO: Thermoplastic polyolefin.

- B. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

- C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.

- D. Wind Uplift:

1. Provide assembly that is resistant to the following design wind loads:
 - a. Basic Wind Speed: As indicated on the Structural Drawings
 - b. Wind Importance Factor: As indicated on the Structural Drawings
 - c. Wind Exposure: As indicated on the Structural Drawings.
 - d. Components and cladding design wind pressures (ULTIMATE LOADS):
 - 1) Roof, field: -24 lbf/sq. ft.
 - 2) Roof, edges: -40 lbf/sq. ft.
 - 3) Roof, corners: -61 lbf/sq. ft.
 - E. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
 1. Fire/Windstorm Classification Class 1A-120
 2. Hail Resistance: SH.
 - F. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
 - G. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- 1.5 SUBMITTALS
- A. Product Data: For each type of product indicated.
 - B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 1. Base flashings and membrane terminations.
 2. Tapered insulation, including slopes.
 3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 - C. Samples for Verification: For the following products:
 1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
 2. Roof insulation.
 3. Walkway pads or rolls.
 4. Metal termination bars.
 5. Battens.
 - D. Qualification Data: For qualified Installer and manufacturer.
 - E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 1. Submit evidence of compliance with performance requirements.
 - F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
 - G. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.

- H. Field quality-control reports.
- I. Maintenance Data: For roofing system to include in maintenance manuals.
- J. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
- C. Source Limitations: Obtain components including roof insulation, fasteners, for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
- D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- F. Preinstallation Roofing Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and other components of membrane roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TPO MEMBRANE ROOFING

- A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible TPO sheet.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products Company.
 - c. GAF Materials Corporation.

- d. GenFlex Roofing Systems.
 - e. Johns Manville.
 - f. Versico Incorporated.
2. Thickness: 60 mils (1.5 mm), nominal.
 3. Exposed Face Color: White.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesive: 80 g/L.
 - f. Other Adhesives: 250 g/L.
 - g. Single-Ply Roof Membrane Sealants: 450 g/L.
 - h. Nonmembrane Roof Sealants: 300 g/L.
 - i. Sealant Primers for Nonporous Substrates: 250 g/L.
 - j. Sealant Primers for Porous Substrates: 775 g/L.
- B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard.
- D. Slip Sheet: Manufacturer's standard, of thickness required for application.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- F. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.
- G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
1. No fasteners will be permitted to penetrate any portion of the flutes of the metal deck, supporting structure or steel knife edge. Any fasteners that penetrate the deck, supporting or knife edge will be required to be prepared at no expense to the owner.
- H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.3 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch thickness or as required by roofing membrane manufacturer for intended system assembly application and warranty period.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Georgia-Pacific Corporation; Dens Deck.

2.4 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by TPO membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 felt or glass-fiber mat facer on both major surfaces.
- C. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
 - 1. Type VII, glass-mat-faced gypsum board facer, 1/4 inch (6 mm) thick.
- D. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated on Drawings
- E. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
 - 1. No fasteners will be permitted to penetrate any portion of the flutes of the metal deck, supporting structure or steel knife edge. Any fasteners that penetrate the deck, supporting or knife edge will be required to be prepared at no expense to the owner.
- C. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- D. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 SUBSTRATE BOARD

- 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.
 - 1. Adhere substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions for adhered roof systems.

3.4 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is **2 inches (50 mm)** or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of **6 inches (150 mm)** in each direction.

1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- G. Adhered Insulation: Adhere insulation per manufacturer's specific requirements.
 1. Adhere insulation to resist uplift pressure at corners, perimeter, and field of roof.
- H. Loosely Laid Insulation: Loosely lay insulation units over substrate.

3.5 ADHERED ROOFING INSTALLATION

- A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.
 1. No fasteners will be permitted to penetrate any portion of the flutes of the metal deck, supporting structure or steel knife edge. Any fasteners that penetrate the deck, supporting or knife edge will be required to be prepared at no expense to the owner.
- F. Apply roofing with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.
 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.6 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings.

3.7 FIELD QUALITY CONTROL

- A. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - 1. Flood to an average depth of 2-1/2 inches (65 mm) with a minimum depth of 1 inch (25 mm) and not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (50 mm) of clearance from top of base flashing.
 - 2. Flood each area for 24 hours.
 - 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional flood testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.8 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.9 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: <Insert name of Owner>.
 2. Address: <Insert address>.
 3. Building Name/Type: <Insert information>.
 4. Address: <Insert address>.
 5. Area of Work: <Insert information>.
 6. Acceptance Date: <Insert date>.
 7. Warranty Period: <Insert time>.
 8. Expiration Date: <Insert date>.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. Lightning;
 - b. Peak gust wind speed exceeding 115 mph;
 - c. Fire;
 - d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. Vapor condensation on bottom of roofing; and
 - g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin,

or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

1. Authorized Signature: <Insert signature>.
2. Name: <Insert name>.
3. Title: <Insert title>.

END OF SECTION 075423

SECTION 076200 –SHEET METAL WALL AND SOFFIT PANELS, FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Formed Products:

- a. Formed roof drainage sheet metal fabrications.
- b. Formed low-slope roof sheet metal fabrications.
- c. Formed exposed trim, gravel stops, and fascia.
- d. Formed roof edge flashings.
- e. Formed copings.
- f. Formed metal flashings, counter flashings, reglets, and through-wall flashings.

B. Related Sections:

- 1. Division 05 Section "Structural Steel Framing" for sheet metal flashing and trim integral with structural steel framing.
- 2. Division 05 Section "Metal Fabrications" for sheet metal flashing and trim integral with metal fabrications.
- 3. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
- 4. Division 07 Section "Thermoplastic Polyolefin (TPO) Roofing" for installing sheet metal flashing and trim integral with membrane roofing.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

- 1. Identification of material, thickness, weight, and finish for each item and location in Project.
- 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
- 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
- 4. Details of termination points and assemblies, including fixed points.
- 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.

6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Detail formed flashing and trim at a scale of not less than **3 inches per 12 inches (1:5)**.

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

1. Sheet Metal Flashing: **12 inches (300 mm)** long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: **12 inches (300 mm)** long and in required profile. Include fasteners and other exposed accessories.
3. Accessories and Miscellaneous Materials: Full-size Sample.
4. Metallic-coated steel sheet Samples: Samples to show full range to be expected for each color required.

D. Qualification Data: For qualified fabricator.

E. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

F. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that 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.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Copper Sheet Metal Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical prefinished sheet metal roof edge and fascia at roof knife edge, approximately **4 feet** long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
2. Build mockups of typical roof prefinished sheet metal counter flashings at roof to steel beam, approximately 4 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviation in writing.
4. Approval of mockups may become part of the completed work if undisturbed at time of substantial completion.

- E. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
 - 2. Review methods and procedures related to sheet metal flashing and trim.
 - 3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 - 4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
 - 5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.6 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. FM Approvals Listing: Manufacture and install copings and roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90 Identify materials with name of fabricator and design approved by FM Approvals.

- D. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting wind loads as follows:
1. Provide assembly that is resistant to the following design wind loads:
 - a. Basic Wind Speed: As indicated on the Structural Drawings
 - b. Wind Importance Factor: As indicated on the Structural Drawings
 - c. Wind Exposure: As indicated on the Structural Drawings.
 - d. Components and cladding design wind pressures (ULTIMATE LOADS):
 - 1) Roof, field: -24 lbf/sq. ft.
 - 2) Roof, edges: -40 lbf/sq. ft.
 - 3) Roof, corners: -61 lbf/sq. ft.
- E. 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: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.
1. Finish: Unless noted otherwise, 2D (dull, cold rolled) finish where concealed and not exposed to view; 4 (polished directional satin) finish where exposed to view.
 2. Surface: Smooth, flat.
- C. Metallic-Coated Steel Sheet (also referred to within the drawings as "Prefinished Sheet Metal"): Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, **G90 (Z275)** coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, **Class AZ50 (Class AZM150)** coating designation, **Grade 40 (Grade 275)**; prepainted by coil-coating process to comply with ASTM A 755/A 755M.
1. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on unexposed side.
 2. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Color: To match Architects sample of product indicated on the drawings.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing

and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

- B. Fasteners: Wood screws, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 4. Fasteners for Zinc-Tin Alloy-Coated Stainless-Steel Sheet: Series 300 stainless steel.
 - 5. Fasteners for Zinc-Coated (Galvanized), Aluminum-Zinc Alloy-Coated Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
 - 6. Fasteners for Zinc Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
- C. Solder:
 - 1. For Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
 - 2. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
 - 3. For Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.
 - 4. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.
 - 5. For Zinc: ASTM B 32, 40 percent tin and 60 percent lead with low antimony, as recommended by manufacturer.
- 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 (13 mm)** wide and **1/8 inch (3 mm)** thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions.

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1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cheney Flashing Company.
 - b. Fry Reglet Corporation.
 - c. Heckmann Building Products Inc.
 - d. Hickman, W. P. Company.
 - e. Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
 - f. Keystone Flashing Company, Inc.
 - g. National Sheet Metal Systems, Inc.
 - h. Sandell Manufacturing Company, Inc.
 2. Material: Unless otherwise noted on the drawings, where concealed and not exposed to view, Stainless steel, 0.019 inch (0.48 mm) thick; where exposed to view, Aluminum, 0.040 inch (1.02 mm)
 3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 4. Accessories:
 - a. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
 5. Finish: As indicated in the Drawings.
- B. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
- F. Fabricate cleats and attachment devices from material indicated on drawings. If not indicated on drawings, fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- G. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

- H. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
- I. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, **4-inch- (100-mm-)** wide wall flanges to interior, and base extending **4 inches (100 mm)** beyond cant or tapered strip into field of roof. Fabricate from the following materials:
 - 1. Metallic-coated steel sheet: Thickness and color as indicated on drawings.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof-Edge Flashing and Fascia: Unless otherwise noted, fabricate in minimum **96-inch- (2400-mm-)** long, but not exceeding **10-foot- (3-m-)** long, sections. Furnish with continuous cleats to support edge of external leg. Miter corners, seal, and solder or weld watertight.
 - 1. Profile: As indicated on drawings.
 - 2. Joint Style: Flush butt seam with 4" backup plate, set overlapping coping in continuous 4" wide sealant bed over backup plate and as required for watertight construction.
 - 3. Fabricate from the following materials:
 - a. Metallic-coated steel sheet: Thickness and color as indicated on drawings.
- B. Copings: Fabricate in minimum **96-inch- (2400-mm-)** long, but not exceeding **10-foot- (3-m-)** long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
 - 1. Profile: As indicated on drawings.
 - 2. Joint Style: Flush butt seam with 4" backup plate, set overlapping coping in continuous 4" wide sealant bed over backup plate and as required for watertight construction.
 - 3. Fabricate from the following materials:
 - a. Metallic-coated steel sheet: Thickness and color as indicated on drawings.
- C. Roof to Wall Transition, Roof to Roof Edge Flashing Transition, Roof to Roof Edge Flashing and Fascia Transition, Expansion-Joint Cover: Fabricate from the following materials:
 - 1. Profile: As indicated on drawings.
 - 2. Fabricate from the following materials:
 - a. Metallic-coated steel sheet: Thickness and color as indicated on drawings.
 - b. Stainless Steel: Gauge as indicated on drawings.
- D. Base Flashing: Fabricate from the following materials:
 - 1. Profile: As indicated on drawings.
 - 2. Fabricate from the following materials:
 - a. Metallic-coated steel sheet: Thickness and color as indicated on drawings.
 - b. Stainless Steel: Gauge as indicated on drawings.

- E. Counterflashing: Fabricate from the following materials:
 - 1. Profile: As indicated on drawings.
 - 2. Fabricate from the following materials:
 - a. Metallic-coated steel sheet: Thickness and color as indicated on drawings.
 - b. Stainless Steel: Gauge as indicated on drawings.
- F. Flashing Receivers: Fabricate from the following materials:
 - 1. Profile: As indicated on drawings.
 - 2. Fabricate from the following materials:
 - a. Metallic-coated steel sheet: Thickness and color as indicated on drawings.
 - b. Stainless Steel: Gauge as indicated on drawings.
- G. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch (0.46 mm) thick.
- H. Roof-Drain Flashing: Fabricate from the following materials:
 - 1. Zinc-Tin Alloy-Coated Stainless Steel: 0.025 inch (0.64 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the 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.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 5. Install sealant tape where indicated.
 6. Torch cutting of sheet metal flashing and trim is not permitted.
 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
1. Coat back 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 directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate [wood sheathing not less than 3/4 inch (19 mm) for wood screws, metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder metallic-coated steel and aluminum sheet.
 2. Pre-tinning is not required for zinc-tin alloy-coated stainless steel and zinc-tin alloy-coated copper.
 3. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 4. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
 5. Copper Soldering: Tin edges of uncoated copper sheets using solder for copper.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - 1. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
- C. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of **4 inches (100 mm)** in direction of water flow.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered **3-inch (75-mm)** centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.
 - 1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at **16-inch (400-mm)** centers.
 - 2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at **16-inch (400-mm)** centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of **4 inches (100 mm)** over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing **4 inches (100 mm)** over base flashing. Lap counterflashing joints a minimum of **4 inches (100 mm)** and bed with sealant. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof.

3.5 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.

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)** on slope and location lines as indicated and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- 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 076200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Latex joint sealants.
 - 4. Acoustical joint sealants.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in ~~1/2-inch- (13-mm-)~~ wide joints formed between two ~~6-inch- (150-mm-)~~ long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- E. Qualification Data: For qualified Installer.
- F. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- H. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

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- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
- D. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 - 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.

1.6 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the 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

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

- B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- E. Colors of Exposed Joint Sealants: Match Architect's samples.

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Dow Corning Corporation; 790.
- B. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Dow Corning Corporation; 790.
- C. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pecora Corporation; 898.

2.3 URETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
 - b. Tremco Incorporated; Vulkem 921.

- B. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use T.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Polymeric Systems, Inc.; PSI-270.
 - b. Tremco Incorporated; Dymeric 240 FC.

2.4 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. Pecora Corporation; AC-20+.
 - d. Tremco Incorporated; Tremflex 834.

2.5 SOLVENT-RELEASE-CURING JOINT SEALANTS

- A. Acrylic-Based Joint Sealant: ASTM C 1311.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Schnee-Morehead, Inc.; Acryl-R Acrylic Sealant.
 - b. Tremco Incorporated; Mono 555.
- B. Butyl-Rubber-Based Joint Sealant: ASTM C 1311.
 - 1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Bostik, Inc.; Chem-Calk 300.
 - b. Pecora Corporation; BC-158.
 - c. Tremco Incorporated; Tremco Butyl Sealant.

2.6 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pecora Corporation; AC-20 FTR.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.

2.7 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, 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.
 - e. Surfaces of dimensional stone cladding.
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 preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant 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.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. 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.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form

smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

- a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

- G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:
 - a. Control, construction, and expansion joints in cast-in-place concrete slabs.
 - b. Isolation and contraction joints in cast-in-place concrete slabs.
 - c. Joints between plant-precast architectural concrete paving units.
 - d. Joints between different materials listed above.
2. Urethane Joint Sealant: Multicomponent, nonsag, traffic grade, Class 50.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations: all exterior joints other than those noted above where sealant is noted on the drawings
2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50. Dow Corning 790
3. Joint-Sealant Color: Match Architect's sample.

- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - 1. Joint Locations: All interior joints horizontal surfaces where sealant is indicated.
 - 2. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing. Dow Corning 790.
 - 3. Joint-Sealant Color: Match Architect's sample.

- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - d. Other joints as indicated.
 - 2. Joint Sealant: Latex.
 - 3. Joint-Sealant Color: Match Architect's sample.

- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated. By Section 93000 Tiling
 - c. Tile wall to wall corner joints, wall to floor corner joints, and wall to wall transition joints. By Section 93000 Tiling.
 - d. At all millwork and counter top backsplashes where sinks occur.
 - e. Joints between dissimilar materials at all interior locations exposed to water.
 - f. Other joints as indicated.
 - 2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone. Pecora 898.
 - 3. Joint-Sealant Color: Match Architect's sample.

- F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Location:
 - a. Acoustical joints where indicated.
 - b. At top and bottom track and penetrations where acoustical batt insulation is installed.
 - c. Other joints as indicated.
 - 2. Joint Sealant: Acoustical.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 07920

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Suspension systems for interior gypsum ceilings and soffits.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: Manufacturer's standard rust inhibiting coating.
- C. Studs and Runners: ASTM C 645.
 - 1. Steel Studs and Runners:

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- a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm) or as indicated on the drawings.
 - b. Depth: As indicated on Drawings
- D. Slip-Type Head Joints: Where indicated, provide the following:
1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs and .054 inch thick outer runner sized to friction fit inside runner.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm) or as indicated on the drawings.
- F. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
1. Depth: 1-1/2 inches (38 mm).
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness 0.033 inch (0.84 mm)
 2. Depth: 7/8 inch (22.2 mm.)
- H. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical.
- 2.3 SUSPENSION SYSTEMS
- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
- B. Hanger Attachments to Concrete:
1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Cast-in-place anchor, designed for attachment to concrete forms or Postinstalled, chemical anchor.
 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
 - 1. Depth: 2-1/2 inches (64 mm).
- E. Furring Channels (Furring Members):
 - 1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
 - a. Minimum Base-Metal Thickness 0.033 inch (0.84 mm.)
 - 2. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
 2. Multilayer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
 3. Tile Backing Panels: 16 inches (406 mm) o.c. unless otherwise indicated.
- B. Install studs so flanges within framing system point in same direction.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

D. Furring:

1. Attach clips to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners. Attach furring studs to clips as detailed on the drawings.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than **1/8 inch (3 mm)** from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: **48 inches (1219 mm)** o.c.
2. Carrying Channels (Main Runners): **48 inches (1219 mm)** o.c.
3. Furring Channels (Furring Members): **24 inches (610 mm)** o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems

F. Installation Tolerances: Install suspension systems that are level to within [**1/8 inch in 12 feet (3 mm in 3.6 m)**] measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.
- B. Related Requirements:
 - 1. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8inch (12.7 mm).
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch (12.7 mm).
 - 2. Long Edges: Tapered.
- D. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M, Level 1.
 - 1. Core: 5/8 inch (15.9 mm), Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- E. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch (15.9 mm), Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
 - 1. Manufacturers

- a. Certainteed Corporation
 - b. Georgia Pacific
 - c. National Gypsum Company
 - d. Temple Inland Building Products
2. Core: **5/8 inch (15.9 mm)**, Type X.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers
 - a. Fry Reglet Corporation
 - b. Pittcon Industries
2. Aluminum: Alloy and temper with not less than the strength and durability properties of **ASTM B 221 (ASTM B 221M)**, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints[, rounded or beveled panel edges,] and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound

D. Joint Compound for Tile Backing Panels:

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1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 1. Acoustical joint sealant shall have a VOC content of 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- F. Vapor Retarder: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than **1/16 inch (1.5 mm)** of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than **8 sq. ft. (0.7 sq. m)** in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow **1/4- to 3/8-inch- (6.4- to 9.5-mm-)** wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide **1/4- to 1/2-inch- (6.4- to 12.7-mm-)** wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Wallboard Type: Vertical surfaces unless otherwise indicated.
 - 2. Type X: Where required for fire-resistance-rated assembly
 - 3. Ceiling Type: Ceiling surfaces.
 - 4. Abuse-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

- C. Multilayer Application:
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- E. Curved Surfaces:
 - 1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.

3.4 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile]. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints [at locations indicated on Drawings] [according to ASTM C 840 and in specific locations approved by Architect for visual effect].
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges
 - 3. L-Bead: Use where indicated
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints[, rounded or beveled edges,] and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

2. Level 4: Store rooms, utility rooms and other spaces not normally exposed to public view.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
3. Level 5: At all locations exposed to public view.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

- E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.
- F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Steel.
 - 2. Primed hollow metal doors and frames
 - 3. Gypsum board.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
 - 2. Section 099600 "High-Performance Coatings" for high-performance and special-use coatings.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 - 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 1percent, but not less than [1 gal. (3.8 L)] of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with specified requirements approved manufacturers include but are not limited to the following:
 1. Sherwin Williams
 2. PPG
 3. Benjamin Moore

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Primers, Sealers, and Undercoaters: 200 g/L.
 4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
- D. Colors: As indicated in a color schedule
 1. 10 percent of surface area will be painted with deep tones.

2.3 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior:[MPI #4.]
 1. < As listed in MPI Approved Products List >.

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2.4 PRIMERS/SEALERS

A. Primer Sealer, Latex, Interior:[MPI #50.]

1. <Insert, in separate subparagraphs, manufacturer's name; product name or designation>.

2.5 METAL PRIMERS

A. Primer, Alkyd, Quick Dry, for Metal:[MPI #76.]

1. < As listed in MPI Approved Products List >.

2.6 WATER-BASED PAINTS

A. Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss (Gloss Level 5):[MPI #147.]

1. <Insert, in separate subparagraphs, manufacturer's name; product name or designation>.

B. Latex, Interior, High Performance Architectural, Semi-Gloss (Gloss Level 5):[MPI #141.]

1. <Insert, in separate subparagraphs, manufacturer's name; product name or designation>.

2.7 SOLVENT-BASED PAINTS

A. Alkyd, Interior, Semi-Gloss (Gloss Level 5):[MPI #47.]

1. < As listed in MPI Approved Products List >.

B. Alkyd, Interior, Gloss (Gloss Level 6):[MPI #48.]

1. < As listed in MPI Approved Products List >.

2.8 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

- B. 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.

- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Uninsulated metal piping..
 - b. Pipe hangers and supports.
 - c. Metal conduit.

 - 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.

 - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall 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, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Steel Substrates:
 1. Alkyd System for structural and miscellaneous steel and primed metal deck and exposed metal piping and conduit:
 - a. Prime Coat: Primer, alkyd, quick dry, for metal[, MPI #76] or Shop primer specified in Section where substrate is specified.
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, semi-gloss (Gloss Level 5, verify sheen to match existing)[, MPI #47].
 2. Alkyd system for hollow metal doors and frames (not exposed to the exterior):
 - a. Prime Coat: Shop primer specified in Section where substrate is specified.
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, gloss (Gloss Level 6, verify sheen to match existing)[, MPI #48].
- B. Gypsum Board :
 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer sealer, latex, interior[, MPI #50].
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, semi-gloss (Gloss Level 5, verify sheen to match existing)[, MPI #141].

END OF SECTION 099123

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes shop and field surface preparation and the application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Steel.
- B. Related Sections include the following:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
 - 2. Section 055000 "Metal Fabrications" for shop priming of metal substrates with primers specified in this Section.
 - 3. Section 053100 "Steel Decking" for shop priming of metal substrates with primers specified in this Section.

1.2 REFERENCES

- A. Section contains references to the governing standards and documents listed below. They are a part of this Section as specified and modified; the current version shall apply unless otherwise noted. In case of conflict between the requirements of this section and those of the listed documents, the more stringent of the requirements shall prevail.
- B. ASTM International (ASTM)
 - 1. ASTM B 117—Standard Practice for Operating Salt Spray (Fog) Apparatus
 - 2. ASTM D 522—Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
 - 3. ASTM D 3363—Standard Test Method for Film Hardness by Pencil Test
 - 4. ASTM D 4060—Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
 - 5. ASTM D4414 – Standard Practice for Measurement of Wet Film Thickness by Notch Gages
 - 6. ASTM D4417 – Standard Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel.
 - 7. ASTM D 4541—Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
 - 8. ASTM D 4585—Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation
 - 9. ASTM D 4587—Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
 - 10. ASTM D 5590—Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay
- C. The Society for Protective Coatings (SSPC)
 - 1. SSPC-PA 1 - Shop, Field, and Maintenance Painting of Steel
 - 2. SSPC-PA 2 - Procedure for Determining Conformance to Dry Coating Thickness Requirements

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3. SSPC-PA 11 - Protecting Edges, Crevices, and Irregular Steel Surfaces by Stripe Coating
4. SSPC-SP1 – Solvent Cleaning
5. SSPC-SP 6/NACE 3—Commercial Blast Cleaning.
6. SSPC-SP11 – Power Tool Cleaning to Bare Metal
7. SSPC-VIS 1 - Guide to Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

D. Unless otherwise specified, references to documents shall mean the documents in effect at the time of the receipt of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents, the last version of the document before it was discontinued.

1.3 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data Sheets: Copies of current technical data for each component specified and applied as outlined in this Section.
- C. Safety Data Sheets: Copies of current Safety Data Sheets (SDS) for any materials brought on-site, including clean-up solvents.
- D. Qualification Data: Submit proof of acceptability of the Applicator by manufacturer to Architect.
- E. Written verification of shop surface preparation and shop primer applied as specified in 051200 Structural Steel Framing and 05500 Metal Fabrications, as specified herein.
- F. Warranty: Prequalified Advanced Draft for signatures
- G. Jobsite Reports: Submit at the completion of Work
 1. Daily Reports: Include surface preparation, substrate conditions, ambient conditions application procedures, materials applied, material quantities, material batch number, description of work completed and location thereof.
 2. The Applicator shall maintain a copy of records until the expiration of the specified warranty period
- H. Color Selection: One complete set of color chips representing manufacturer's full range of available colors.
 1. For each color selected submit two samples, minimum size 3 X 4 inch square, and representing actual product and color.
- I. Shop Drawings:
 1. Submit a complete list of products proposed for use, including identifying product names and catalog numbers.
 - a. Arrange in same format as Schedule of Paint Finishes below.
 - b. Include applicable manufacturer's data and recommendations.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications:

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1. Applicator shall have a minimum of five (5) years experience performing this type of coating application with documented skill and successful experience in the installation of the specified coating systems.
2. Application equipment shall be acceptable to the manufacturer.
3. Applicator shall establish quality control procedures and practices to monitor phases of storage, surface preparation, mixing, application, and inspection throughout the duration of the project.
4. Applicator shall provide a fulltime, on-site person whose dedicated responsibilities will include quality control of the coating application.
5. Applicator's quality control procedures and practices shall include the following items:
 - a. Training of personnel in the proper surface preparation requirements.
 - b. Training of personnel in the proper storing, mixing, and application and quality control testing.

B. Pre-Application Meeting:

1. Before start of Work - General Contractor, Applicator, and Manufacturer's Technical Representative shall meet on-site with Architect to discuss approved products and workmanship to ensure proper surface preparation and application of the coatings.
2. Review foreseeable methods and procedures related to the coating Work including but not necessarily limited to the following:
 - a. Review Project requirements and the Contract Documents.
 - b. Review required submittals.
 - c. Review warranty requirements
 - d. Review requirements of on-site quality control inspection and testing.
 - e. Review the requirements for preparing the quality control report as specified herein.
 - f. Review availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
 - g. Review material storage and staging.
 - h. Review equipment storage and staging.
 - i. Review waste management and disposal.
 - j. Review environmental conditions, other Project conditions, and procedures for coping with unfavorable conditions.
 - k. Review regulations concerning code compliance, environmental protection, health, safety, fire and similar considerations.
 - l. Review procedures required for the protection of the completed work during the remainder of the construction period.

C. Single-Source Responsibility:

1. Materials shall be products of a single manufacturer or items standard with manufacturer of specified coating materials.
2. Provide secondary materials which are produced or are specifically recommended by coating system manufacturer to ensure compatibility of system.

D. Regulatory Requirements: Conform to applicable codes and ordinances for flame, fuel, smoke and volatile organic compounds (VOC) ratings requirements for finishes at time of application.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Deliver material in manufacturer's original, unopened and undamaged packages.
2. Clearly identify manufacturer, brand name, contents, color, batch number, and any personal safety hazards associated with the use of or exposure to the materials on each package.
3. Packages showing indications of damage that may affect condition of contents are not acceptable.

B. Storage of Materials:

1. Materials shall be stored in accordance with manufacturer's recommendations in enclosed structures and shall be protected from weather and adverse temperature conditions. Flammable materials shall be stored in accordance with state and local codes. Store materials only in area or areas designated by the Architect solely for this purpose.
2. Materials exceeding storage life as defined by the manufacturer shall be removed promptly from the site.
3. Store in original packaging under protective cover and protect from damage.
4. Stack containers in accordance with manufacturer's recommendations.

C. Handling of Materials: Handle materials in such a manner as to prevent damage to products or finishes.

1.6 PROJECT CONDITIONS

A. Environmental Requirements:

1. Proceed with Work only when temperature and moisture conditions of substrates, air temperature, relative humidity, dew point and other conditions comply with the manufacturer's written recommendations and when no damaging environmental conditions are forecasted for the time when the material will be vulnerable to such environmental damage. Record such conditions and include in final Site Quality Control Report.
2. Maintain recommended substrate temperature and ambient temperature before, during and after installation in accordance with manufacturer's instructions.
3. Provide adequate ventilation during instillation and full curing periods of the coating.
4. Coating shall not be applied when ambient air temperature is within 5°F of the dew point and falling.

B. Dust and Contaminants:

1. Schedule coating work to avoid excessive dust and airborne contaminants.
2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

1.7 WARRANTY

A. Special Manufacturer's Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace finish that shows evidence of deterioration of finishes within specified warranty period.

1. Warranty must be prequalified prior to start of painting
2. Applicator must comply to terms and conditions of the warranty
3. Owner acceptance by signature on an advance draft of the warranty prior to start of painting.
4. Coating system applied to manufacturer supplied panels
5. Coverage:

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- a. Check, crack, blister or delaminate from the substrate.
 - b. Change color in excess of 5 DE Hunter units as determined in accordance with ASTM D2244.
 - c. Exhibit loss of gloss in excess of 24 units as measured by a gloss meter in accordance with ASTM D523-89 with 60 degree geometry.
 - d. Chalk in excess of a rating of 8 as measure in accordance with ASTM D4214, Method A.
6. Length of Coverage: 15 years
- B. Special Applicator Warranty: Applicator agrees to correct failures of Special Coating installations due to improper workmanship, substrate preparations or application techniques. Remedy is to include removal and replacement of defective installation. All labor and material is to be included.
1. Length of Coverage: 5 years

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products of Tnemec Company, Inc., Kansas City, Missouri are listed to establish a standard of performance and quality. Local Representation: Call Coating Consultants, 801-282-2327, ccc@tnemec.com
- B. Materials specified are those that have been evaluated for the specific service. Request for material substitutions shall be in accordance with requirements of the project specifications. Equivalent materials of other manufacturers may be submitted on written approval of the Architect. No request for substitution shall be considered that would decrease film thickness or offer a change in the generic type of coating specified. In no case will the request be considered unless information is received, in writing, ten (10) days prior to the bid opening date.
- C. Requests for substitution shall include:
1. Manufacturer's literature for each product giving name, product number, generic type, descriptive information, laboratory testing showing results equal to the performance criteria of the products specified herein.
 2. Side by side comparison of the performance attributes of the proposed materials as compared to the specified coating system.
 3. List of ten (10) projects in which each product has been used and rendered satisfactory service.
 4. The sum which will be added to or deducted from the base bid should alternate materials be accepted.
- D. After first submittal, Architect/Owner's Agent hourly rate will be charged to review further submittals.

2.2 HIGH PERFORMANCE COATINGS GENERAL

- A. Materials Compatibility: Provide shop and field primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

2.3 COATING SYSTEMS FOR STEEL—EXTERIOR STEEL

- A. Primer Coat: Zinc-Rich Urethane

1. Tnemec Series 90-97 Tneme-Zinc
 - a. Generic Type: Aromatic Urethane, Zinc-Rich
 - b. Solids by Volume: 63%
 - c. Zinc Dust Content: 83% by weight in dried film
 - d. Volatile Organic Compounds, Unthinned: 2.68 lbs/gallon (321 grams/liter)
 - e. Curing Time at 75°F (24°C)
 - 1) To Handle: 1 hour
 - 2) To Recoat: 4 hours (For faster curing and low-temperature applications, add Series 44-710 Urethane Accelerator.)
 2. Tnemec Series 94-H₂O Hydro-Zinc
 - a. Generic Type: Aromatic Urethane, Zinc-Rich
 - b. Solids by Volume: 62%
 - c. Zinc Dust Content: 83% by weight in dried film
 - d. Volatile Organic Compounds, Unthinned: 0.8 lbs/gallon (96 grams/liter)
 - e. Curing Time at 75°F (24°C)
 - 1) To Handle: 2 hours
 - 2) To Recoat: 8 hours (For faster curing and low-temperature applications, add Series 44-710 Urethane Accelerator.)
- B. Intermediate Coat: Polyamide Epoxy
1. Tnemec Series 66HS Hi-Build Epoxoline
 - a. Generic Type: Polyamide Epoxy
 - b. Finish: Satin
 - c. Solids by Volume: 78%
 - d. Volatile Organic Compounds, Unthinned: 1.54 lbs/gallon (184 grams/liter)
 - e. Curing Time at 75°F (21°C)
 - 1) To Handle: 8 hours
 - 2) To Recoat: 12-16 hours (For faster curing and low-temperature applications use Series 161HS)
- C. Exterior Steel Finish Coat: Fluoropolymer, Pigmented Topcoat
1. Tnemec Series 1070V Fluoronar
 - a. Generic Type: Advanced Thermoset Solution Fluoropolymer
 - b. Finish: Gloss
 - c. Solids by Volume: 56%
 - d. Volatile Organic Compounds, Unthinned: 0.83 lbs/gallon (99 grams/liter)
 - e. Curing Time at 70°F (21°C)
 - 1) To Touch: 30 minutes
 - 2) To Handle: 4–6 hours
 - 3) To Recoat: 12–16 hours (For faster curing and low-temperature applications, add Series 44-710 Urethane Accelerator.)
- D. Performance Criteria
1. Abrasion
 - a. Method: ASTM D 4060, (CS-17 Wheel, 1,000 gram load)
 - b. System: Two coats Modified Polycarbamide cured 30 days at 75°F (24°C).

- c. Requirement: No more than 129 mg loss after 1,000 cycles, average of three tests.
2. Adhesion
 - a. Method: ASTM D 4541 (Type II Tester)
 - b. System: One coat polyamidoamine epoxy and one coat Modified Polycarbamide applied to SSPC-SP10 Near-White Metal Blast Cleaned steel and cured 14 days at 75°F (24°C).
 - c. Requirement: No less than 1,633 psi (11.25 MPa) pull, average of three tests.
3. Fungal and Algal Defacement
 - a. Method: ASTM D 5590
 - b. System: One coat polyamidoamine epoxy and one coat Modified Polycarbamide applied to glass fiber filter paper and cured 14 days at 75°F (24°C). Spore suspensions: (1) Aspergillus niger (ATTC 6275) and Penicillium funiculosum (ATTC 11797) and (2) Auereobasidium pullulans (ATTC 9348).
 - c. Requirement: No fungal or algal growth after 4 weeks exposure.
4. Flexibility
 - a. Method: ASTM D 522 (Method A – Conical Mandrel)
 - b. System: One coat polyamidoamine epoxy and one coat Modified Polycarbamide applied to SSPC-SP10 Near-White Metal Blast Cleaned steel and cured 30 days at 75°F (24°C).
 - c. Requirement: No less than 4% elongation, average of three tests.
5. Hardness
 - a. Method: ASTM D 3363
 - b. System: One coat polyamidoamine epoxy and one coat Modified Polycarbamide applied to SSPC-SP7 Brush-Off Blast Cleaned steel and cured 30 days at 75°F (24°C).
 - c. Requirement: No gouging or scratching with an HB or less pencil.
6. Humidity
 - a. Method: ASTM D 4585
 - b. System: One coat polyamidoamine epoxy and one coat Modified Polycarbamide applied to SSPC-SP10 Near-White Metal Blast Cleaned steel and cured 14 days at 75°F (24°C).
 - c. Requirement: No blistering, cracking, rusting or delamination of film after 2,000 hours exposure.
7. QUV Exposure
 - a. Method: ASTM D 4587 (UVA-340 Bulbs, Cycle 4:8 hours UV/4 hours condensation)
 - b. System: One coat polyamidoamine epoxy and one coat Modified Polycarbamide applied to SSPC-SP1 Solvent Cleaned aluminum and cured seven days at 75°F (24°C).
 - c. Requirement: No blistering, cracking, chalking or delamination of film. No less than 84% gloss retention, no more than 13 units gloss loss and no more than 1.31 DE₀₀ color change after 10,000 hours exposure.
8. Salt Spray (Fog)

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- a. Method: ASTM B 117
 - b. System: One coat polyamidoamine epoxy and one coat Modified Polycarbamide applied to SSPC-SP10/NACE 2 Near-White Metal Blast Cleaned steel and cured 14 days at 75°F (24°C).
 - c. Requirement: No blistering, cracking, rusting or delamination of film. No more than 3/16 inch rust creepage at scribe after 2,500 hours exposure.
9. Abrasion
- a. Method: ASTM D 4060, (CS-17 Wheel, 1,000 grams load)
 - b. System: One coat thermoset fluoropolymer cured 30 days at 75°F (24°C)
 - c. Requirement: No more than 103 mg loss after 1,000 cycles.
10. Adhesion
- a. Method: ASTM D 4541 (Method B, Type II Tester)
 - b. System: One coat aromatic urethane zinc-rich, one coat aliphatic acrylic polyurethane and one coat thermoset fluoropolymer applied to SSPC-SP10 Near-White Metal Blast Cleaned steel and cured 14 days at 75°F (24°C).
 - c. Requirement: No less than 1,333 psi (9.19 MPa) pull, average of three tests.
11. Adhesion
- a. Method: ASTM D 4541 (Method E, Type V Tester)
 - b. System: One coat aromatic urethane zinc-rich, one coat aliphatic acrylic polyurethane and one coat thermoset fluoropolymer applied to SSPC-SP10 Near-White Metal Blast Cleaned steel and cured 14 days at 75°F (24°C).
 - c. Requirement: No less than 1,930 psi (13.3 MPa) pull, average of three tests.
12. Exterior Exposure
- a. Method: South Florida marine exposure
 - b. System: One coat polyamide epoxy and one coat thermoset fluoropolymer applied to SSPC-SP1 Solvent Cleaned aluminum and cured 30 days at 75°F (24°C).
 - c. Requirement: No blistering, cracking or delamination of film. No less than 82% gloss retention, no more than 15 units gloss loss and no more than 0.53 DE₀₀ color change 36 months exposure, average of five colors.
13. Exterior Exposure
- a. Method: ASTM D 4141, Method C (EMMAQUA)
 - b. System: One coat polyamide epoxy and one coat thermoset fluoropolymer (white) applied to SSPC-SP1 Solvent Cleaned aluminum and cured 30 days at 75°F (24°C).
 - c. Requirement: No blistering, cracking or chalking. No less than 84% gloss retention, no more than 13 units gloss loss and 0.41 DE_{Hunter} color change after 3,500 M/J m² EMMAQUA exposure.
14. Flexibility
- a. Method: ASTM D 522 (Method A – Conical Mandrel)
 - b. System: One coat polyamide epoxy and one coat thermoset fluoropolymer applied to SSPC-SP7 Brush-Off Blast Cleaned steel and cured 7 days at 75°F (24°C).

- c. Requirement: No less than 14.83% elongation average of three tests.
15. Graffiti Resistance
- a. Method: Following graffiti material applied to coating and allowed to dry for seven days.
 - b. System: One coat polyamide epoxy and one coat thermoset fluoropolymer applied to SSPC-SP7 Brush-Off Blast Cleaned steel and cured 30 days at 75°F (24°C).
 - c.

Reagent:	Xylene	MEK
Acrylic Spray Paint	Removal	Removal
Epoxy Spray Paint	Removal	Removal
Markette Marker	Removal	Removal
Ball Point Ink	Removal	Removal
Crayon	Removal	Removal
Lipstick	Removal	Removal
 - d. Note: Some slight loss of gloss and/or softening may occur depending on the amount of effort required for removal of the graffiti and length of exposure of the underlying coating to the cleaning solvent.
16. Hardness
- a. Method: ASTM D3363
 - b. System: One coat polyamide epoxy and one coat thermoset fluoropolymer applied to SSPC-SP7 Brush-Off Blast Cleaned steel and cured 30 days at 75°F (24°C).
 - c. Requirement: No gouging with an 8H or less pencil.
17. Humidity
- a. Method: ASTM D 4585
 - b. System: One coat polyamide epoxy and one coat thermoset fluoropolymer applied to SSPC-SP10 Near-White Metal Blast Cleaned steel and cured 7 days at 75°F (24°C).
 - c. Requirement: No blistering, cracking, rusting or delamination of film after 3,000 hours exposure.
18. Impact
- a. Method: ASTM D 2794
 - b. System: One coat polyamide epoxy and one coat thermoset solution fluoropolymer applied to SSPC-SP10 Near-White Metal Blast Cleaned steel and cured 7 days at 75°F (24°C).
 - c. Requirement: No visible cracking or delamination of film after 34 inch-pounds (3.9 J) or less direct impact.
19. QUV
- a. Method: ASTM D 4587 (UVA-340 Bulbs, Cycle 4:8 hours UV/4 hours condensation)
 - b. System: One coat thermoset fluoropolymer (white) applied to SSPC-SP1 Solvent Cleaned aluminum and cured 30 days at 75°F (24°C).
 - c. Requirement: No blistering, cracking, or chalking. No less than 61% gloss retention (31.4 units gloss change) and 1.89 DE_{FMC2} color change after 25,000 hours exposure.
20. Salt Spray (Fog)

- a. Method: ASTM B 117
- b. System: One coat aromatic urethane zinc-rich, one coat polyamide epoxy and one coat thermoset solution fluoropolymer applied to SSPC-SP10/NACE 2 Near-White Metal Blast Cleaned steel and cured 7 days at 75°F (24°C).
- c. Requirement: No blistering, cracking, rusting or delamination of film. No more than 1/32 inch rust creepage at scribe after 10,000 hours exposure.

21. Salt Spray (Fog)

- a. Method: ASTM B 117
- b. System: One coat aromatic urethane zinc-rich applied to SSPC-SP10/NACE 2 Near-White Metal Blast Cleaned steel and cured 14 days at 75°F (24°C).
- c. Requirement: No blistering, cracking, rusting or delamination of film. No more than 1/8 inch rust creepage at scribe after 50,000 hours exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

- A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.
- B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.3 SURFACE PREPARATION OF STEEL

- A. Prepare steel surfaces in accordance with manufacturer's instructions.
- B. Prepare steel surfaces in accordance with SSPC-SP 6/NACE 3 Commercial Blast Cleaning with minimum angular anchor profile of 1.5 mils.
- C. Field Surface Preparation of Shop-primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas to comply with SSPC-PA 1 for touching up shop-primed surfaces. Clean the area in accordance with SSPC-SP1 Solvent Cleaning. After Solvent Cleaning, prepare the surface in accordance with SSPC-SP11 Power Tool Cleaning to Bare Metal. It is important that all loose coating and corrosion in the area be removed. In the area surrounding the damaged area that will be affected by the repair, feather all rough edges of sound existing coat coating with 80 to 100-grit sandpaper in a crosshatch pattern. It is important that any tightly adhering coating that will receive coating is de-glossed.
- D. Coordination of shop-applied prime coats is critical.
 - 1. Written verification of shop surface preparation and shop primer applied as specified in 051200 Structural Steel Framing.
 - 2. Written verification of shop surface preparation and shop primer applied as specified in 055000 Metal Fabrications.
 - 3. Remove incompatible primers and reprime substrate with compatible primer as required to produce coatings systems indicated.

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- E. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
- F. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.

3.4 APPLICATION

- A. Apply coatings in accordance with manufacturer's written instructions as outlined in the product data sheet.
- B. The application of protective coatings to steel substrates shall be in accordance with SSPC PA1 - Shop, Field, and Maintenance Painting of Steel.
- C. Keep containers closed when not in use to avoid contamination.
- D. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.
- E. Uniformly apply coatings at spreading rate required to achieve specified Dry Film Thickness (DFT).
- F. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems. Product sharp lines and color breaks.
- G. In accordance with SSPC-PA11 Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

3.5 FIELD QUALITY CONTROL, INSPECTION AND TESTING

- A. The Applicator shall perform the quality control procedures listed below in conjunction with the requirements of this section.
- B. Inspect materials upon receipt to ensure that products are supplied by the approved Manufacturer.
- C. Surface Profile and Degree of Surface Cleanliness: Inspect and record substrate profile (anchor pattern) and degree of cleanliness. Surfaces shall meet the manufacturer's recommended anchor profile and degree of blast cleaning.
 - 1. Visually confirm the specified degree of surface cleanliness of the ferrous metal surface in accordance with SSPC-VIS 1.
 - 2. The specified surface profile of the prepared substrate shall be verified in accordance with ASTM D4417 – Method C Replica Tape.
- D. Measure and record ambient air temperature, relative humidity and dew point temperature once every two hours of work shift.
- E. Measure and record substrate temperature once every two hours using an infrared or other surface thermometer.
- F. Verify surface preparation and coating application is as specified.
- G. Wet-Film Thickness shall be taken every 100 square feet in accordance with ASTM D4414 or other agreed-upon method.

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- H. Dry-Film Thickness (DFT) shall be measured in accordance with SSPC-PA2 Measurement of Dry Coating Thickness. Verify DFT of each coat and total DFT of each coating system are as specified.
- I. The Applicator is responsible for keeping the Architect informed of progress so that Architect may provide additional quality control at his discretion.
- J. Inspection by the Architect or others does not absolve the applicator from his responsibilities for quality control inspection and testing as specified herein or as required by the Manufacturer's instructions.

3.6 MANUFACTURER'S FIELD SERVICES

- A. Manufacturer's technical representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.7 REPAIR

- A. Damaged Materials: Repair or replace damaged materials and surfaces not scheduled to be coated.
- B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.
- C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.8 PROTECTION AND CLEANING

- A. Protect the completed Work from traffic, physical abuse, immersion and chemical exposure until the complete system has thoroughly cured as per manufacturer's written instructions.
- B. At the completion of the Work, Applicator shall remove materials and debris associated with the Work of this Section.
- C. Clean surfaces not designated to receive protective coating. Restore designated areas in a manner acceptable to Architect.
- D. Protect the completed Work from damage until Final Acceptance. Coating damaged in any manner shall be repaired or replaced at the discretion of Architect, at no additional cost to Owner.

3.9 ONE-YEAR INSPECTION

- A. Owner will set date for one-year inspection of coating systems.
- B. Inspection shall be attended by Owner, Contractor, Architect, and manufacturer's representative.
- C. Repair deficiencies in coating systems as determined by Architect in accordance with manufacturer's instructions.

3.10 SCHEDULES

A. Exterior Exposed Steel, Gloss Finish

1. Shop Surface Preparation: SSPC-SP6/NACE 3 Commercial Blast Cleaning with a minimum angular anchor profile of 1.5 mils
2. Shop Primer: Tnemec Series 90-97 Tneme-Zinc at 2.5 to 3.5 mils DFT.
3. Field Surface Preparation: SSPC-SP11 Power Tool Cleaning to Bare Metal
4. Field Touch-up Primer: Tnemec Series 94H-20 Hydro-Zinc at 2.5 to 3.5 mils DFT
5. Intermediate: Tnemec Series 66HS Hi-Build Epoxoline at 3.0 to 5.0 mils DFT.
6. Finish: Tnemec Series 1070V at 2.0 to 3.0 mils DFT
7. Total Dry Film Thickness: 8.5 to 12.5 mils DFT.

B. Interior Exposed Steel, Gloss Finish

1. Shop Surface Preparation: SSPC-SP6/NACE 3 Commercial Blast Cleaning with a minimum angular anchor profile of 1.5 mils
2. Shop Primer: Tnemec Series 90-97 Tneme-Zinc at 2.5 to 3.5 mils DFT.
3. Field Surface Preparation: SSPC-SP11 Power Tool Cleaning to Bare Metal
4. Field Touch-up Primer: Tnemec Series 94H-20 Hydro-Zinc at 2.5 to 3.5 mils DFT
5. Intermediate: Tnemec Series 66HS Hi-Build Epoxoline at 3.0 to 5.0 mils DFT.
6. Finish: Tnemec Series 740 UVX at 3.0 to 4.0 mils DFT
7. Total Dry Film Thickness: 8.5 to 12.5 mils DFT.

END OF SECTION 099600

SECTION 323113 - CHAIN LINK FENCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Materials and procedures for installing chain link fencing and gates.

1.3 SYSTEM DESCRIPTION

- A. Provide Chain Link Fencing according to materials, workmanship, and other applicable requirements of standard specifications of the Owner.

1.4 REFERENCES

- A. AASHTO M 111: Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
- B. AASHTO M 181: Chain Link Fence
- C. AASHTO M 232: Zinc Coating (Hot Dip) on Iron and Steel Hardware
- D. ASTM A 392: Zinc-Coated Steel Chain-Link Fence Fabric
- E. ASTM F 1083: Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

1.5 DELIVERY, STORAGE, & HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Class B Concrete. Refer to Section Concrete Specs.

2.2 FENCE COMPONENTS

- A. Pipe posts and rails:

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1. Schedule 40, hot-dip galvanized coated pipe. ASTM F 1083.
 2. All pipe posts, rails and couplings to be coated in extruded and adhered, fused and bonded black vinyl clad coating.
- B. Fitting: malleable cast iron or pressed steel coated as specified. AASHTO M 232.
1. All fittings to be coated in extruded and adhered, fused and bonded black vinyl clad coating.
- C. Caps: AASHTO M 232
1. Equip all pipe posts with a galvanized steel or malleable iron weather-resistant cap, designed to fit securely over the posts and carry an apron around the outside of the post.
 2. Provide cap to permit passage of top rail when top rail is used.
 3. All caps to be coated in extruded and adhered, fused and bonded black vinyl clad coating.
- 2.3 CHAIN LINK FABRIC
- A. Provide either Type I zinc-coated steel or Type II aluminum-coated steel fence fabric as specified. Refer to AASHTO M 181, ASTM A 392, and ASTM A 491. Fabric to be coated in extruded and adhered, fused and bonded black vinyl clad coating.
 - B. Use 0.148-inch diameter wire for fence fabric 6 ft or higher and 0.120-inch diameter wire for fabric less than 6 ft high.
 - C. Provide 0.177-inch diameter spiral material for tension wires.
 - D. Tie fabric to supporting members of the same diameter as the fence fabric.
- 2.4 GATES
- A. Construct gate posts and frames of the sizes following FG Series Standard Drawings.
 1. Fasten gate frame corners together with pressed steel or malleable iron corner ells, riveted or welded as shown.
 2. Galvanize welded steel gate frames after fabrication as specified. AASHTO M 111.
 3. Do not use closed cells that would prohibit dipping to galvanizing tanks.
 4. All gate materials to be coated in extruded and adhered, fused and bonded black vinyl clad coating.
 - B. Follow the same standards for chain link fence fabric for covering the gate frames as for another fence fabric.
 - C. Furnish each gate with the appropriate hinges, latch, and drop-bar locking device.

PART 3 - EXECUTION

3.1 INSTALL POSTS

- A. Do not exceed the following spacing requirements when placing posts:

Radii of Curve	Maximum Post Spacing
Tangent or 500 ft	10 ft
200 ft to 500 ft	8 ft
100 ft to 200 ft	6 ft
0 ft to 100 ft	5 ft

- B. Install brace posts at maximum 500 ft intervals or at angle points of 30 degrees or more.
- C. Set posts in concrete walls or masonry where required.
1. Set posts or post sockets in concrete walls to a minimum 18 in depth.
 2. Use 0.048-inch-thick galvanized metal pipe sleeve socket with an inside diameter that allows post to fit loosely.
 3. Coat the inside of the socket and the outside of the posts with bituminous paint.
 4. Use sulfur caulk or other expansive grout to fasten the post in the socket.
- D. Set posts in concrete bases.
1. Place concrete a minimum of 6 inches below each post.
 2. Construct at least 12-inch diameter bases for end posts, pull posts, corner posts, gate posts, and line posts.

3.2 INSTALL FENCE FABRIC

- A. Place fence fabric on the north side of posts unless otherwise specified.
1. Place fabric approximately 1 inch above the ground.
 2. Maintain a straight grade between posts by excavating high points of the ground.
 3. Fill depression in the natural ground to within 1 inch of the bottom of fence.
- B. Stretch the fabric taut and securely fasten to fence posts.
1. Use stretch bars and metal bands to fasten material to end, gate, corner, and pull posts.
 2. Space metal bands at 1 ft intervals along the post.
 3. Cut the fabric at all pull and corner posts.
 4. Fasten fabric to line posts with tie wires or metal bands at 14-inch intervals.
 5. Attach the top edge of fabric to the top rail or tension cable with wire ties at

approximately 24-inch intervals.

6. Attach bottom of fabric to bottom tension wire, and the bottom edge of the fabric to the bottom tension wire with wire ties spaced at 24-inch intervals.

3.3 INSTALL GATES

- A. Install single gate as specified. Install plumb, level, and secure for full opening without interference.
- B. Install ground-set items in concrete for anchorage as shown in the Standard Drawing or as recommended by the fence manufacturer. Adjust hardware for smooth operation.
- C. Set gate openings according to manufacturer's dimensions.
- D. Fabric description numbers:
 1. First number indicates height.
 2. Second number indicates width of fabric opening.

END OF SECTION

SECTION 32 8000 - LANDSCAPE IRRIGATION SYSTEM

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

- A. Before submitting a Bid each Contractor shall carefully examine the Contract Documents; shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and, shall include in the Bid the cost of all items required by the Contract Documents. If the Contractor observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations, or contain obvious erroneous or uncoordinated information, notify the Project Manager in writing of unsatisfactory conditions. Do not proceed until conditions have been corrected.
- B. Irrigation Work shall be suspended at any time when it may be subject to damage by climatic conditions. However, no substantial work suspension may be made without permission of the Project Manager.
- C. Visit the site and become familiar with all existing conditions and the extent of work being performed by other contractors on the site.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

- A. This Section includes piping, valves, sprinklers, specialties, controls, and wiring for automatic-control irrigation system.
- B. Related Sections include the following:
 - 1. Division 2 Section "Site Preparation and Demolition" for protection of existing trees and plantings, and site clearing.
 - 2. Division 2 Section "Earthwork" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
 - 3. Division 2 Section "Fiber Reinforced Concrete" for concrete edging.

1.04 WORK TO BE DONE

- A. Work to be done includes furnishing all labor, materials, equipment and services required to complete all irrigation work indicated on the Drawings, as specified herein, or both. It is the intention of these specifications, together with the accompanying drawings to accomplish the work of installing a complete and fully functional irrigation system which will operate in an efficient and satisfactory manner according to current industry irrigation standards. Included also will be maintenance and warranties.
- B. The Contractor shall perform, but not be limited to, all of the following functions: Paying all connection fees, deposits and all other charges related to the connection to the water source. Obtain all permits, complete all excavation, backfill, provide water meter/flow sensing device, tapping saddle, yoke, stop and waste, corp. cock, concrete vaults and miscellaneous pipe fitting.

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Make necessary road repairs, provide safety barrier, and make connection to water source. All in compliance to applicable codes and requirements of the utility companies involved.

- C. The electrical point of connection for the irrigation system shall be 120-volt building electrical supply. Coordinate with Electrical Drawings and Specifications.
- D. The Drawings and Specifications must be interpreted and are intended to complement each other. The Contractor shall furnish and install all parts, which may be required by the Drawings and omitted by the Specifications, or vice versa, just as though required by both. Should there appear to be discrepancies or question of intent, the Contractor shall refer the matter to the Landscape Architect for decision, and his interpretation shall be final, conclusive and binding.
- E. The Drawings and Specifications must be interpreted and are intended to complement each other. The Contractor shall furnish and install all parts, which may be required by the Drawings and omitted by the Specifications, or vice versa, just as though required by both. It will be the Contractor's responsibility to report to the Project Manager, in writing, any contradictions between the drawings, specifications, and site prior to submitting the Bid in sufficient time to allow the issuance of an addendum to the bid documents. Failure to do so will require the Contractor, at his/her own expense, to include any replacements and / or relocations necessary to complete a fully functional installation in full compliance with the contract documents, when such contradictions were identifiable before the Bid.
- F. All necessary changes to the Drawings to avoid any obstacles shall be made by the Contractor with the approval of the Landscape Architect.
- G. Trench excavation, back filling and bedding materials, together with the testing of the completed installation shall be included in this work.
- H. The work shall be constructed and finished in every respect in a good, workmanlike and substantial manner, to the full intent and meaning of the Drawings and Specifications. All parts necessary for the proper and complete execution of the work, whether the same may have been specifically mentioned or not, or indicated on the Drawings, shall be done or furnished in a manner corresponding with the rest of the work as if the same were specifically herein described.
- I. Record Drawing as well as Operating & Maintenance Manual generation, in accordance to these specifications shall also be included in this work.
- J. If electrical service is not already in place, the Contractor will be required to make all necessary arrangements with Rock Mountain Power including, but not limited to, paying fees, making power connections, providing poles, weatherhead and meter, etc., as specified on the plans. All permits, fees, and compliance with electrical company requirements, shall be the Contractor's responsibility. All permits, fees, and compliance with electrical company requirements, shall be the Contractor's responsibility.
- K. Irrigation piping shown on the drawings is essentially diagrammatic. Locations of all sprinkler heads, valves, piping, wiring, etc., will be changed only with the permission of the Owner's Representative.
- L. Do not combine differing plant materials or environments on the same zone (i.e., separate sod zones from shrub zones, flower zones from tree zones, hill zones from flat area zones, north facing shaded zones from full sun zones, etc.). Each zone is to serve plants with identical water requirements.

1.05 SCOPE

- A. The irrigation system shown on the Drawings and described within these Specifications represents an automatic controller irrigation system supplied from the water system. The system is designed for

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a maximum flow demand of per the drawings. The irrigation contractor shall verify water pressure prior to construction and report any differences to Landscape Architect.

1.06 RELATED WORK UNDER OTHER SECTIONS

- A. Carefully examine all of the Contract Documents for requirements that affect the Work of this Section.

1.07 ORDINANCES, PERMITS AND FEES

- A. The Work under this Section shall comply with all ordinances and regulations of authorities having jurisdiction.
- B. The Contractor shall obtain and pay for any and all permits, tests and certifications required for the execution of Work under this Section.
- C. Furnish copies of Permits, Certifications and Approval Notices to the Owner's Representative prior to requesting payment.
- D. Call Blue Stakes to verify location of existing utilities prior to commencement of work.

1.08 QUALITY ASSURANCE

- A. Installer: A firm that has at least five (5) years' experience in work of the type and size required by this Section and which is acceptable to the Owner's Representative.
- B. Landscape Irrigation Contractors (both prime contractors and subcontractors) who install or repair irrigation systems must have at least one direct employee with a current certification from the Irrigation Association (Irrigation Association Certified Irrigation Contractor, hereinafter referred to as "CIC").
- C. References: The Contractor must supply three (3) references for work of this type and size with their bid including names and phone numbers of contact person(s).
- D. Applicable requirements of accepted Standards and Codes shall apply to the Work of this Section and shall be so labeled or listed:
 - 1. American Society for Testing & Materials (ASTM)
 - 2. National Plumbing Code (NPC)
 - 3. National Electric Code (NEC)
 - 4. National Sanitary Foundation (NSF)
 - 5. American Society of Agricultural Engineers (ASAE)
 - 6. Underwriters Laboratories, Inc. (UL)
 - 7. Occupational Safety and Health Regulations (OSHA)

1.09 TESTS

- A. Observation: The Owner's Representative will be on site at various times to insure the system is being installed according to the Specifications and Drawings.
- B. Operational Test: After completion of the system, test the operation of entire system as directed by the Owner's Representative. Demonstrate to the Owner's Representative that all irrigated areas are being adequately covered (See Part 3 - Execution).

1.10 SUBMITTALS

- A. The Contractor shall provide copies of product specification sheets on all proposed equipment to be installed to the Owner's Representative for approval prior to the start of work, in accordance with the parameters of Division-1. Work on the irrigation system may not commence until product sheets are submitted and approved. Submittals shall be marked up to show proper sizes, flows, etc. Equipment to be included:
1. Valves: Non-Electric and Electric
 2. Valve Boxes
 3. Pipe and Fittings
 4. Wire and Connectors
 5. Miscellaneous Materials
 6. Washed Aggregate
 7. Sand
 8. Heads
 9. Irrigation Heads
 10. Dripperline System
 11. Pressure Reducing Valve
- B. The Contractor shall maintain complete Record Drawings of the system as the project proceeds. Each valve box location to be referenced by distance from a minimum of two permanent locations. Controllers, filter, gate valves, electric remote-control valves, manual valves, quick coupling valve assemblies, and all other equipment shall be indicated on the drawings. All wire routing, wire size and splices shall be indicated. Main line pipe, lateral line pipe, and wire route shall have three (3) distinctly different graphic symbols (line types). Diagrammatic location of irrigation system components is not acceptable when submitting record drawings – actual location of irrigation system equipment is required for locating in the field.
1. Actual routing of mainline with dimensions from fixed points.
 2. Actual routing of control wiring with dimensions from fixed points.
 3. Location of wire splices (must be placed in valve box and only used splices in approved locations)
 4. Actual routing of lateral lines and head locations
 5. Actual location of valve boxes with notes on type of valve used at each location.
 6. Actual location of sleeves with dimensions from fixed points.
 7. Actual location of stubbed mainlines or lateral lines (if applicable)
 8. Actual location of sensors and associated wiring (i.e. rain gauge, ET sensors, etc.)
 9. Provide legend of symbols/notes used on record drawings.
 10. Any other notes as necessary to enable the owner to understand and locate irrigation system equipment in the field upon completion of the project.

1.11 DELIVERY, STORAGE AND HANDLING

- A. Store and handle all materials in compliance with manufacturer instructions and recommendations. Protect from all possible damage. Minimize on-site storage.

1.12 GUARANTEE

- A. The Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities that the Contractor may have by law.
- B. In addition to the manufacturers guarantees the Contractor shall warrant the entire irrigation

system, both parts and labor for a period of one (1) year from the date of Final Acceptance by the Owner.

- C. As part of the one-year warranty the Contractor shall perform the first year-end winterization and spring start-up for the irrigation system. The Contractor shall operate, maintain until acceptance, and guarantee the new system until all lawn and plants planted on this project have become established and have been approved by the Landscape Architect.
- D. The Contractor shall correct any deficiencies when notified during the warranty period, and additionally correct, to the satisfaction of the Owner, any damage to buildings or grounds caused by the deficient work, without cost to the Owner. All guarantees shall be in writing. The written guarantee is due to the Project Manager / Owner's Representative for review and approval on or before the date of Final Acceptance.

1.13 WINTERIZATION

- A. All irrigation systems shall be winterized starting October 15th. If the Substantial Completion Certificate has not been issued before winterization, it will be the responsibility of the Contractor to work with the Owner's Representative to winterize the system and prevent all components from freezing. The Contractor will then be responsible to assist in the activation of the system in the spring to insure there are no problems.

B. COORDINATION

- A. The Contractor shall at all times coordinate his work closely with the Landscape Architect to avoid misunderstandings and to efficiently bring the project to completion. The Landscape Architect shall be notified as to the start of work, progression and completion, as well as any changes to the drawings before the change is made. The Contractor shall also coordinate his work with that of his sub-contractors.
- B. The Contractor shall be held responsible for and shall pay for all damage to other work caused by his work, workmen or sub-contractors. Repairing of such damage shall be done by the Contractor who installed the work, as directed by the Landscape Architect.

1.14 MAINTENANCE AND OPERATING INSTRUCTIONS

- A. Contractor shall include in their Bid an allowance for four (4) hours of instruction of Owner and/or Owner's personnel upon completion of check/test/start-up/adjust operations by a competent operator (The Landscape Architect's office shall be notified at least one (1) week in advance of check/test/start-up/adjust operations).

Upon approval of substantial completion and prior to application for acceptance and final payment, a minimum of three (3) three ring, hard cover binders titled MAINTENANCE AND OPERATING INSTRUCTIONS FOR WEBER COUNTY LIBRARY NORTH BRANCH IRRIGATION SYSTEM, shall be submitted to the Landscape Architect's office. After review and approval, the copies will be forwarded to the Owner. Included in the Maintenance and Operating binders shall be:

1. Table of Contents
2. Written description of Irrigation System.
3. System drawings:
 - a. One (1) copy of the original irrigation plan.
 - b. One (1) copy of the Record Drawing.
 - c. One (1) reproducible of the Record Drawing.
 - d. One (1) copy of the controller valve system-wiring diagram.

4. Listing of Manufacturers.
5. Manufacturers' data where multiple model, type and size listings are included, clearly and conspicuously indicating those that are pertinent to this installation.
 - a. "APPROVED" submittals of all irrigation equipment.
 - b. Operation.
 - c. Maintenance: including complete troubleshooting charts.
 - d. Parts list.
 - e. Names, addresses and telephone numbers of recommended repair and service companies. A copy of the suggested "System Operating Schedule" which shall call out the controller program required (zone run time in minutes per day and days per week) in order to provide the desired amount of water to each area under "no-rain" conditions.
6. Winterization and spring start-up procedures.
7. Guarantee data.

1.15 PROCEDURE

- A. Notify all city departments and/or public utility owners concerned, of the time and location of any work that may affect them. Cooperate and coordinate with them in the protection and/or repairs of any utilities.
- B. Provide temporary support, adequate protection and maintenance of all structures, drains, sewers, and other obstructions encountered. Where grade or alignment is obstructed, the obstruction shall be permanently supported, relocated, removed or reconstructed as directed by the Landscape Architect.
- C. SUBSTITUTION OF MATERIALS No substitutions of materials will be approved on the sprinkler irrigation system without approval of the Owner's Representative.
- D. SYSTEM PRESSURE The sprinkler irrigation system is designed for 30-40 pounds per square inch static pressure unless otherwise specified and is schematic only, with the intent to convey full coverage of the lawn and planting areas affected. The system must also provide the manufacturer's recommended minimum operating pressure or greater to every head while maintaining sufficient pressure to overcome the losses due to friction in the piping, fittings, and all other equipment.

PART 2 PRODUCTS

2.01 GENERAL

- A. All materials to be incorporated in this system shall be new and without flaws or defects and of quality and performance as specified and meeting the requirements of the system. All material overages at the completion of the installation are the property of the Contractor and shall be removed from the site.
- B. No material substitutions from the irrigation products described in these specifications and shown on the drawings shall be made without prior approval and acceptance from the Owner's Representative. If there is an existing irrigation system on the site, the Contractor shall remove any lines being abandoned, and cap or plug the ends of lines remaining in service with proper fittings and thrust blocks. The Contractor shall remove or relocate existing heads and/or connect new lines to existing lines, as indicated on the plans.
- C. Any existing head, valve, valve marker, valve box, or other existing equipment located where there will be a grade or surface material change, shall be adjusted up or down to its proper position in relation to the new finished grade, at no additional cost to the owner, unless the plans

show it to be relocated.

2.02 PIPE

- D. All piping, (except flex swing pipe) shall be Schedule 40 P.V.C. with ratings printed on pipe. See detailed drawings. No pipe shall be less than 3/4" inside diameter. Do not use galvanized fittings of any kind on any PVC lines or fittings. New pipe is to be new, free of cracks, holes, foreign material, blisters inside bubbles, wrinkles, and dents.
- E. Main Lines are to be sized appropriately to handle the gallons per minute (GPM) required to serve the three largest lateral systems. Main line piping shall be connected by solvent welded joints. Use primer and cement (glue) for the appropriate pipe type, applied per manufacturer's specifications. All connections on Main Lines must be allowed to set for twenty-four hours prior to pressurization.
- F. Main Lines shall have a thrust block of poured concrete installed at each change of direction. The thrust block shall be of sufficient size for the pipe involved and rest on undisturbed ground. Refer to detail.
- G. Lateral Pipe shall be either solvent weld or threaded connections. Solvent welded Lateral Lines shall have the same specifications described for the Main Line Pipe. Threaded connections shall have Teflon Tape and/or Rector Seal, applied per manufacturer's specifications.
- H. Flex or Swing Pipe shall be thick-walled polyethylene pipe, kink resistant, rated to at least 80 psi, and with a minimum of a two year warrantee; equal to Rain Bird SPX series swing pipe. This pipe is to be used only between heads and lateral lines and will not exceed lengths of 2 feet. Use only on heads with 3/4" or smaller inlets. For heads with 1" or larger inlets, install a prefabricated swing joint of appropriate size.
- I. Pipe and Fittings Table:

Size	Mainline Piping	Mainline Fittings	Lateral Piping	Lateral Fittings
1"	SCH 40	SCH 40	SCH 40	SCH 40
1-1/4"	SCH 40	SCH 40	SCH 40	SCH 40
1-1/2"	SCH 40	SCH 40	SCH 40	SCH 40
2"	SCH 40	SCH 80	SCH 40	SCH 80
2-1/2"	SCH 40	SCH 80	SCH 40	SCH 80

2.03 SLEEVES

- A. All sleeves shall be PVC class 200 or better pipe, 2 sizes larger than the total outside diameter of the piping contained in the sleeve. Sleeves shall be a minimum of 4" diameter.

2.04 IRRIGATION FITTINGS

- B. Fittings on all sizes of Main, and Lateral Lines two inches in size and larger shall be Schedule 80 pressure rated PVC. Refer to table in Section 328000 2.02.
- C. Fittings on lateral lines smaller than 2" diameter shall use Schedule 40 pressure rated PVC. Refer to table in Section 328000 2.02.

- D. Do not use galvanized fittings of any kind on any PVC lines or fittings.
- E. Fittings on Flex or Swing Pipe shall be equal to Toro Super Funny Pipe fittings or Rain Bird SB Series spiral barb fittings.

2.05 FILTER

- A. Irrigation system shall be down stream of existing irrigation filter.

2.06 ELECTRIC REMOTE CONTROL VALVES

- A. All electric remote control valves shall be of the size and type as specified on the Drawings.
- B. Each valve shall be installed using schedule 80 piping on both the upstream and downstream sides, to extend beyond the valve box. Refer to detail for Ball Valve Assembly and Valve Manifold.
- C. Master Valve shall be as specified on the Drawings or equal to per written approval.
- D. Electric Remote Control Valves shall be as specified on the Drawings or equal to per written approval.
- E. All valves will be tagged indicating the appropriate controller and station number.

2.07 DRIP VALVE ASSEMBLY

- A. Drip Valve Assemblies shall be as specified on the Drawings or equal to per written approval.

2.08 NON ELECTRIC VALVES

- A. Ball Valves shall be domestic solid brass, meeting Federal Specification WW-V- 54, CLASS A TYPE 1. Valve sizes are to be the same size as the line on which installed. Size and type shall be as specified on the Drawings or equal to per written approval.
- B. Gate Valves – Size and type shall be as specified on the Drawings or equal to per written approval.
- C. Install one Quick Coupler Valve per group of valves. The Quick Coupler is to be installed on a prefabricated swing joint. Size and type shall be as specified on the Drawings or equal to per written approval.

2.09 VALVE BOXES

- A. Use the same manufacturer's valve boxes throughout the construction site, equal to Carson & Brooks Specification Grade valve boxes with T-Lid.
- B. Heavy duty plastic boxes and lids shall MATCH surrounding ground or mulch material color. Tan in bark mulch areas and green in turf areas.

2.10 ELECTRIC CONTROLLER

- A. Connect to existing Electric Controller.

2.11 WIRE

- A. Electric Control Wire shall be Polyethylene (PE) UF DIRECT BURIAL type. Wire which is routed from

the Electric Remote Control valve to the controller shall be #14 AWG.

- B. Wire for Flow Sensor shall be shielded PE-39 communication cable.

2.12 WASHED AGGREGATE

- A. Washed aggregate stone shall be 1" x #8 washed aggregate. Washed aggregate stone shall be used under valve boxes at minimum of six inches in depth or as indicated on the Drawings.

2.13 IRRIGATION HEADS

- A. Irrigation Heads shall be as specified on the Drawings or equal to per written approval.

2.14 THRUST BLOCK

- A. Size and type shall be as specified on the Drawings.

2.15 DRIPPERLINE AND INTEGRAL DRIPPERLINE COMPONENTS

- A. Inline drip tubing shall be equal to Netafim Techline CV. Drip tubing shall be pressure compensating, have a continuously self-flushing drip emitter design, and have a 2 psi check valve in each emitter. Dripper flow rate and spacing shall be as indicated on drawings.
- B. Fittings: All Techline CV connections shall be made with approved Techline CV insert fittings as indicated on the Drawings or approved equal.
- C. Soil Staples: Anchor the drip tubing with stainless steel soil staples every 4 feet. Use two soil staples at each tee, elbow or cross.
- D. Flushing Valves: Flushing valves shall be equal to Netafim flushing valves as indicated on the Drawings or approved equal.
- E. Dripperline Manifolds shall be as specified on the Drawings or equal to per written approval.

PART 3 EXECUTION

3.01 GENERAL

- A. Examine all contract documents applying to this Section noting any discrepancies and bringing the same to the attention of the Owner's Representative for timely resolution.
- B. Make all field measurements necessary for the work noting the relationship of the irrigation work to the other trades. Coordinate with other trades (landscaping and other site work trades). Project shall be laid out essentially as indicated on the Irrigation Plans, making minor adjustments for variations in the planting arrangement. Major changes shall be reviewed with the Landscape Architect prior to proceeding.
- C. At all times, protect existing irrigation, landscaping, paving, structures, walls, footings, etc. from damage. Any inadvertent damage to the work of another trade shall be reported at once.
- D. The points of reference shall be the existing walks, buildings, and curbs. The staking shall be approved by the Landscape Architect prior to commencing installation operations. Any changes in the system which appear necessary, due to field conditions, must be called to the attention of the Landscape Architect and approved at the time.
- E. Irrigation heads, valves and quick coupler are shown on the drawings diagrammatically. It shall be the Contractor's responsibility to determine the exact location of each irrigation and valves to

accommodate the conditions found on the site in order to provide complete coverage of all areas. If a deficiency is found during the installation process, contact the Owner's Representative at that time. Do not exceed the manufacturer's recommended spacing. Do not make adjustments in the designed layout unless prior approved to clear existing fixed obstructions. All deviations from the drawings will be noted on the "As-Built" drawings.

- F. All Irrigation Heads are to be set perpendicular and flush to the finished grade unless otherwise designated on the drawings and specifications.
- G. There will be no mixing of head types in a zone.

3.02 PIPE AND FITTINGS INSTALLATION

- A. Trenches for Lateral Lines will be dug a minimum of 12" deep (8" minimum from grade to top of pipe) and as wide as necessary to properly install piping.
- B. Trenches for Main Lines shall be dug a minimum of 18" deep (from grade to top of pipe) and as wide as necessary to properly install piping. Route all electrical wiring in the Main Line trench as shown on Trench Detail. Attach the electrical wires every 15 feet with tape to the underside of the Main Line.
- C. Trenches with more than one pipe installed shall include a pipe separation distance of 4" between each pipe.
- D. Trenches for or with wiring shall be no shallower than 12 inches deep. Wire will be buried under pipe and with a separation from the pipe of no fewer than 3 inches.
- E. Trenches shall be at least 12" away from curbs, buildings, and sidewalks; and, three feet from all roads.
- F. Backfilling of Trenches: Backfill around and over the pipes in accordance with the Trench Detail. All material that is to come in contact with the pipes shall be less than 1" in diameter and shall be imported for this specific use. The existing material on site can only be used as backfill material above the piping upon the approval of the Project Manager; then, it may be used in accordance with Drawing Details. Compaction requirements shall generally be 95% under walks and roadways and 85% in lawn and shrub areas, unless information shown on Trench Detail or elsewhere on the drawings is more restrictive.
- G. The Contractor shall notify the Project Manager when irrigation piping will be tested. Piping shall be tested and inspection prior to backfilling.
- H. All joints will be solvent welded, or made with threaded fittings. Use Teflon tape for threaded fittings.
- I. Make all solvent-weld joints in strict accordance with manufacturer's recommendations, making certain not to apply an excess of primer or solvent, and wiping off excess solvent from each connection. Allow connections to set minimum 24 hours before pulling or pressure is applied to the system. Provide for expansion and contraction as recommended. Wire shall be laid in same trench as mainline and at pipe invert (see Wire Installation). All pipe joints shall be solvent welded together using IPS 70 Primer and IPS 711 cement.
- J. Cut plastic pipe with handsaw or pipe-cutting tool, removing all burrs at cut ends. All pipe cuts are to be square and true. Bevel cut end as required conforming to Manufacturer's Specifications.
- K. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. At times, when installation of the piping is not in progress, the open end(s) of the pipe shall be closed by a watertight plug or other means. All piping, which cannot temporarily be joined, shall be sealed to make as watertight as possible. This provision shall apply during the lunch hour as well as overnight. Pipe not to be installed that day shall not be laid out. Should water enter the trench during or after installation of the piping, no additional piping may be installed or back filled until all water is removed from the trench. Pipe shall not be installed when water is in the trench, when precipitation is occurring, or when the ambient temperature is at 35

degrees F or below. PVC pipe shall be snaked in the trench to accommodate for expansion and contraction due to changes in temperature.

- L. All pipes must be inspected before they can be buried. When pipe has passed inspection the Owner's Representative will give the contractor a pipe inspection form indicating which areas of pipe have passed. If pipe has not passed inspection the Owner's Representative reserves the right to have the pipe dug up to insure it meets the standards noted herein.

3.03 PIPE SLEEVING INSTALLATION

- A. Sleeving shall be installed wherever piping is going under a non-soil area, generally where indicated on the Drawings. Minimum cover over all sleeving pipe shall be as shown on the detail except where noted otherwise.
- B. Install sleeves in locations shown on the drawings and at the depths specified for Lateral and Main Lines.
- C. Coordinate the installation of sleeves with the location / installation of all hard surfaces. Mark the location of all sleeves by attaching a locating magnet in both ends of the sleeve, and mark their location on the As-Built Drawing. Where sleeves are buried under hardscape, mark the location of each sleeve by installing a magnetized masonry nail, flush with the hardscape, indicating the location of each end of the sleeve.
- D. Insure that adequate amounts of sleeving are installed for both water lines and electrical control wires.

3.04 VALVE BOXES AND ELECTRIC REMOTE-CONTROL VALVES

- A. Each Valve Box shall be placed on a bed of 1" x #8 washed gravel, 6" deep below the Valve Box. Use the same manufacturer's valve boxes throughout the construction site. Additionally, set the box on a foundation of brick, which is placed on undisturbed soil. Brick foundation shall be continuous on all sides. Note that there must be 4" clearance between the base of the valve and the gravel bed. Also note that there must be 3" clearance between the top of the valve and the valve box lid.
- B. Furnish and install valve access boxes for electric remote-control valves, quick coupling valve, isolation ball valve, gate valves, manual drain valves, and wire splices.
- C. Control valves shall be installed on a level aggregate base. Grade of base shall be consistent throughout. Valves shall be set plumb with adjusting handle and all bolts, screws and wiring accessible through the valve box opening.
- D. Adjust zone valve operation after installation using flow control device on valve.
- E. All valves will be tagged indicating the appropriate controller and station number.
- F. Install all Valve Boxes no closer than three feet from sidewalks, curbs, and all hard surfaced areas. Where three feet clearance from hardscape is not possible, locate the valve box as far as practical from areas of vehicle traffic. Do not install Valve Boxes at the low point of the landscaping.
- G. All valve box lids are to be branded with 3" tall lettering.
 - a. '00-00' for Clock & Valve # on RCV's, coordinate with Owner for clock and valve #.
 - b. 'WS' for wire splice.
 - c. 'BV' for ball valve.
 - d. 'S & W' for stop & waste.
 - e. 'LV' for line valve.
 - f. 'QC' for Quick Coupler.
 - g. 'DV' for drain valve,
 - h. 'HB' for hose bib.

- i. Branding tool source to be the found through the following or approved equal:
 Nova Tool Company 800 826-7606
 370 SW 25th Street #1 402-438-0169
 Lincoln NE 68522 Novatool.com

H. Limit the number valves per valve box. The maximum number allowed in each box is:

Valve Box Size	Electric Valve Size and Quantity
Standard Valve Box	One Valve per Box
Jumbo Valve Box	One 2" Valve, or Two 1-1/2" Valves, or Two 1" Valves
Little Giant	Two 2" Valve, or Three 1-1/2" Valves, or Three 1" Valves
Giant	Three 2" Valve, or Four 1-1/2" Valves, or Four 1" Valves

3.05 NON ELECTRIC VALVES

- A. A Ball Valve will be installed as an isolation valve on the upstream side of each automatic valve cluster. Each Ball Valve shall be placed in a standard valve box.
- A. Gate Valves valve must be installed below the frost line. Each valve will be accessible by an appropriately sized PVC standpipe and covered with an 8" round box. The round box shall be stabilized on brick and with a 12 inch gravel sump beneath the valve.
- B. Install one quick coupler per group of valves or as indicated on the drawings. The quick coupler is to be installed on a prefabricated swing joint.

3.06 WIRING INSTALLATION

- A. All wiring shall be direct run with no splices. Wire outside of valve manifold shall not be spliced without the approval of the Project Manager and Owner's Representative.
- B. Wire coloring shall follow the following coding:
 - 1. Ground wire shall be green.
 - 2. Common wire to a valve shall be white.
 - 3. Controller electrical power wire shall be black.
 - 4. Flow sensing wire, other than the common wire, shall be purple.
 - 5. Each control wire extending to a valve shall have a different color wire for each valve, excluding white, black, and green.
- C. Splices in Electric Control Wire at the Electric Remote Control Valve shall be twisted together, then soldered and fitted with a direct bury, UL listed, wire connector. All splices shall be contained in a valve box.
- D. An extra or "spare" control wire shall be provided to each valve group. This spare wire shall not be a single wire looped throughout the site.
- E. In addition to the "spare" control wire per each valve group, provide 2 extra pair of controller wire in a continuous loop from the controller following mainline back to controller without interruptions.

3.07 DRIPPERLINE INSTALLATION

- A. Install all dripperline as indicated on drawings and per manufacturer's specifications. Use only Teflon tape on all threaded connections.

- B. No point-source systems shall be permitted.
- C. Design Drip systems using an end feed, grid design.
- D. End feed pipes at each end of the grid (also known as footers, headers, or exhaust pipes) shall be 1" schedule 40 PVC of appropriate size, no smaller than 1".
- E. Clamp Techline fittings with Oetiker clamps when operating pressure exceeds specific dripperline fitting requirements.
- F. When installing Techline CV dripperline, install soil staples as listed below:
 - 1. Use one staple every four (4') feet and two (2') staples on each change of direction (tee, elbow, or cross).
- G. Cap or plug all openings as soon as lines have been installed to prevent the intrusion of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.
- H. Thoroughly flush all water lines before installing valves and other hydrants
- I. Test in accordance with Paragraph on Hydrostatic Tests.
- J. Bury the tubing 2 – 5 inches below the top of soil, not the top of mulch, see Sheet L-R502 Detail C.
- K. All of the devices in the manifold shall be spaced such that all of the devices are fully operational and accessible for maintenance purposes.
- L. Place manual line flushing valves at each dead end, and low point in the system. Line flush valves shall be placed in a 10 inch round box, stabilized on brick, and with a 12 inch gravel sump beneath the valve.

3.08 CONTROLLER INSTALLATION

- A. Install according to manufacturer's instructions. Connect to existing controller.
- B. Field verify exact location of the existing controller.
- C. Ground all clocks according to manufacturer's recommendations, using either a three rod grounding grid or a grounding plate with a rod combination. Grounding rods shall be 8 foot long, 5/8inch minimum diameter solid copper. Rods shall be placed a minimum of 8 feet apart. The grounding plate shall be manufactured for the purpose of grounding. The plate shall measure a minimum of four inches by 96 inches, and no thinner than six one-hundredths of an inch. Connect rods and/or plate using #6 AWG or larger bare, solid copper wire to interconnect all rods. Wire shall be run as straight as possible, with a bend of no tighter than ninety degrees and a radius no smaller than eight inches going into the controller. The ground wire entering the controller shall be of the shortest possible length and contain no bends kinks or coils in the wire. All grounding must be tested to 10 Ohms or less. See Grounding Details. If a three rod grounding triangle cannot be installed contact the Owner's Representative.
- D. Contractor to install controller at location indicated on drawings. Contractor to wire valves into controller and set proper program.
- E. Wire controller to 120-volt electrical supply.
- F. Keys shall be turned over to Owner's Representative.
- G. A valve controller of the type specified on the plans shall be mounted at eye level on the wall of the structure designated on the plans. It shall be the Contractors responsibility to install and supply a plugged outlet, junction box or separate breaker to furnish power to a new controller. Surge protection shall also be provided at the incoming power and low voltage power side grounding. See Detail.

3.09 FLUSHING AND PRELIMINARY TESTING

- A. Flush and Test each zone after installation of new piping, swing pipe, and prefabricated swing joints, but before installation of Irrigation Heads and before trenches have been completely backfilled. The Control Valve shall be opened fully and a full head of water used to flush out the system. Each automatic valve shall then be disassembled, inspected for rocks, cleaned, and reassembled. Install Irrigation Heads and test each zone for complete coverage.
- B. Testing shall be performed after completion of each circuit, and again after completion of the entire system. At this time any necessary repair work will be done at the Contractor's expense and the entire system will be in good working condition prior to the Substantial Completion Inspection.

3.10 CLEANING AND ADJUSTING

- A. Upon approval of substantial completion of the work, all parts of the installation shall be thoroughly cleaned. All equipment, pipe, valves and fittings shall be cleaned of grease, metal cuttings and sludge that may have accumulated by the operation of the system for testing.
- B. Adjust valve boxes to grade as required.

3.11 SYSTEM OPERATION TEST / SUBSTANTIAL COMPLETION INSPECTION

- A. Prior to the Substantial Completion Inspection, the Landscape Irrigation Contractor is required to coordinate with the Owner's Representative to subcontract with a Certified Landscape Irrigation Auditor (hereinafter referred to as "CLIA"), at the Contractor's expense. At a pre-approved time and date, the Contractor's CLIA auditor will be directed to a location or locations specified by the Owner's Representative to conduct the audit. The Substantial Completion Inspection will not be authorized until the CLIA report is acceptable to the Owner's Representative.
- B. During the Substantial Completion Inspection, the entire system, both electric and hydraulic, will be tested in the presence of the Project Manager and the Owner's Representative to insure Complete coverage of all areas to be watered. This test must be performed by using the irrigation controller. Any deficiencies identified at this time will require revisions by the Contractor at the Contractor's expense.

3.12 WINTERIZATION

- A. All irrigation systems shall be winterized starting October 15th. If the Substantial Completion Certificate has not been issued before winterization, it will be the responsibility of the Contractor to winterize the system and prevent all components from freezing. The Contractor will then be responsible to assist in the activation of the system in the spring to insure there are no problems.

3.13 GUARANTEE

- A. All work shall be guaranteed for compliance with the drawings and specifications for a period of one year after the date of Substantial Completion. The Contractor shall correct any deficiencies when notified during the warrantee period, and additionally correct, to the satisfaction of the Owner, any damage to buildings or grounds caused by the deficient work, without cost to the Owner. All guarantees shall be in writing. The written guarantee is due to the Project Manager / Owner's Representative for review and approval on or before the date of Substantial Completion.
- B. AS-BUILT DRAWINGS shall be furnished to the Landscape Architect at the time of the Systems Inspection before any Substantial Completion Date will be issued.

3.14 CLEAN UP

- A. Upon completion of all installation work, Contractor shall remove all leftover materials and equipment from the site in a safe and legal manner.

END OF SECTION 32 8000

SECTION 329213 - SEEDING

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall perform all the seed mix and all appurtenant work, complete, in accordance with the requirements of the Contract Documents.
- B. Scope of Work: Landscaping as referred to herein shall include, but not be limited to the following work: soil preparation, finish grading, seeding, cleanup, maintenance, and guarantee.
- C. The Section cross references the following sections:
 - 1. Reference Standards
 - 2. Contractor Submittals
 - 3. Project Closeout
 - 4. Landscaping 32 9300
 - 5. Landscape Irrigation System 32 8000

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards:
 - 1. ANSI/ASTM D 422 Method for Particle-Size Analysis of Soils
 - 2. ANSI Z601 Nursery Stock
 - 3. American Association of Rules and Grading Provisions Nurserymen, Inc.

1.3 CONTRACTOR SUBMITTALS

- A. General: The CONTRACTOR shall furnish a certificate with each delivery or bulk material delivery, stating source, quantity, and type of material. All materials shall conform to specification requirements. All certificates shall be delivered to the LANDSCAPE ARCHITECT (here in referred to as LA.) at time of each delivery. All bulk delivered materials shall be delivered with level load volume plainly marked on the truck bed.
- B. Topsoil Report: Topsoil report as well as literature on mulch "Silva-fiber" and Native Grass Seed Mix shall be submitted as specified in Contractor Submittals.

1.4 QUALITY ASSURANCE

- A. General: All Native Grass Seed Mix furnished by the CONTRACTOR shall be true to type or name as shown in the Contract Documents and shall be tagged in accordance with the standard practice recommended by the Agricultural Code of the State of Utah.

1.5 CLEANUP

- A. Upon completion of all seeding operations, the portion of the project site used for a work or storage area by the CONTRACTOR shall be cleaned of all debris, superfluous materials, and equipment. All such materials and equipment shall be entirely removed from the project site

as specified in Project Closeout.

- B. All walks or pavement shall be swept or washed clean upon completion of the WORK of this Section.

PART 2- PRODUCTS

2.1 SEED MIX

- A. Native Grass Seed Mix: As indicated on the Drawings (Native Grass Seed Mix).
- B. The Native Grass Seed Mix shall meet the minimum tested requirements of ANA. The Native Grass Seed Mix shall be the current year's crop, guaranteed by the supplier as follows:

80% Germination Rate
72% Purity and 80% pure live seed
No more than 2% inert matter
No noxious weeds and no more than 1/10% weed seed

- C. Native Grass Seed Mix shall be planted at the rate of specified on the drawings. Native Grass Seed Mix composition (percentage of each species) shall be as recommended by the supplier. Labels shall be obtained for the project Landscape Architect's file.

2.2 MULCH (CELLULOSE WOOD FIBER)

- A. Wood Fiber Mulch shall be a wood material which has been shredded, pulverized, or dissolved into small fibers. The mulch shall have been processed so that it will have no germination and so that it forms a blotter-like ground cover. The material shall be air dry and contain no more than 15% moisture by weight. Wood fiber mulch shall be Silva Fiber or equal.

2.3 MULCH (PEAT MOSS):

- A. Peat moss shall be pure sphagnum moss and shall have an organic content of not less than 95 percent. The moss shall be weed free and have a PH of not more than 6.0.

PART 3 - EXECUTION

3.1 GENERAL

- A. The landscape contractor may choose from or combine the following seeding methods to seed and turn over to the owner a healthy Native Grass Seed Mix with the quickest results. Seeding methods shall be discussed with and approved by the Landscape Architect.

3.2 PREPARING THE SEED BED

- A. The landscape work shall not begin until all other trades have repaired all areas of settlement, erosion, rutting, etc., and the soils have been re-established, recompacted, and refinished to finish grades. The LA shall be notified of all areas which prevent the landscape work from being executed.

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- B. Areas requiring grading by the landscaper including adjacent transition areas shall be uniformly level or sloping between finish elevations to within 0.10-ft above or below required finish elevations.
- C. The seeding work shall not proceed until after walks, curbs, pavings, edging, and irrigation systems are in place. The contract operations shall be completed to a point where the landscape areas will not be disturbed. The subgrade shall be cleaned free of waste materials of all kinds.
- D. During grading waste materials in the planting areas such as weeds, rocks (2 inches and larger) building materials, rubble, wires, cans, glass, lumber, sticks, etc., shall be removed from the site. Weeds shall be dug out by the roots.
- E. Topsoil additives, seed, peat, etc. subject to moisture damage shall be kept in a weatherproof storage place in such a manner that they will be kept dry.
- F. After removal of waste materials the planting areas subgrade shall be scarified and ripped to a depth of not less than 6 inches and all surface irregularities below the cover of topsoil removed.
- G. Finish sub-grade and topsoil placement and grading shall consist of:
 - 1. Prepare sub-grade by rough grading and removing all irregularities and debris, then till and scarify subsoil to a depth of 6 inches before placing topsoil. Dig sub-grade down as required in Native Grass Seed Mix areas for the placement of amended topsoil.
 - 2. Place 4 inches of amended topsoil per Section 32 9300-2.3 over the seeded areas unless shown or specified otherwise on plans. Sub-grade soil shall be in a loosened and rough surface finish before topsoil is placed over sub-grade. (Sub-grade surface shall not be smooth, but a rough surface shall exist for a transition zone of topsoil to subsoil.) If areas of sub-grade become compacted before topsoil is placed, sub-grade shall be tilled again before topsoil placement.
 - 3. Placing all soil additives.
 - 4. Tilling of seeded areas subsoil's and topsoil soils that are compacted.
 - 5. After tilling, bring areas to uniform grades by floating and or hand raking.
 - 6. Making minor adjustment of finish grades as directed by the LA or owner.
 - 7. Removing waste materials such as stones, roots, or other undesirable foreign material and raking, dishing, dragging, and smoothing soil ready for planting.
 - 8. No work to be under taken when soils are wet or frozen.
 - 9. Seed bed shall be watered to ensure a moisture depth of 18" prior to seeding.
- H. Any unusual subsoil condition that will require special treatment shall be reported to the LA.
- I. Topsoil shall be uniformly distributed over all areas where required. Subgrade and topsoil shall be damp and free from frost.
- J. Surface drainage shall be provided as shown by molding the surfaces to facilitate the natural run-off of water. Low spots and pockets shall be filled with topsoil and graded to drain properly.
- K. Finish grade of all seeded areas shall be 1 inches below finish grades of adjacent pavement of any kind.

3.3 SEEDING (PREFERRED METHOD)

- A. This method shall consist of:

1. Preparing the seed bed as specified in paragraph 3.2
2. Drilling the seed into the earth with a billion lawn seeder and making two complete passes at 30 degrees apart from one another over the entire area to be seeded as indicated on the plans. All slopes over 30 percent shall be seeded by hydro-mulching. Any slopes having a washing problem shall be mulched with straw, jute, fiber matting, enkamat, curlex blanket, or other erosion control materials as per the manufacturer's specifications. The material to be used shall be submitted by the Contractor for the Landscape Architect to be reviewed and approved.

B. One step seeding may be used from April 15 to September 15.

3.4 ONE STEP HYDRO-SEEDING

A. This method shall consist of:

1. Preparing the seed bed as specified above.
2. Combining the seed mixture at a rate of 5 pounds per 1,000 square foot with Silva Fiber Mulch a rate of 1500 pounds per acre, filling the tanks with water, agitating of these materials into a well-mixed slurry suspension, and spraying the mixture under pressure onto the prepared seed bed.

B. One step seeding may be used from April 15 to September 15.

3.5 TWO STEP HYRDO-SEEDING

A. This method shall consist of:

1. Preparing the seed bed as specified above.
2. Sowing the seed mixture at a rate of 5 pounds per 1,000 square foot in two directions with an approved mechanical seeder, (3) and spraying a mixture of water and Silva Fiber under pressure at a rate of 1500 pounds per acre onto the prepared seed bed.

B. Two steps seeding may be used from April 15 to September 15.

3.6 REPAIR AND SEEDING

A. Small area Native Grass Seed Mix repair and seeding shall consist of:

1. Preparing the seed bed as specified above.
2. Sowing the seed mixture as specified.
3. Raking the seed into the soil. Top dress seed bed with two 4 cu. ft. bales of sphagnum peat moss applied evenly per 1000 square feet of area.

B. Native Grass Seed Mix areas repairs may be sodded in place of seeding to have a healthy Native Grass Seed Mix acceptable and ready to turn over to the owner.

3.7 SEED ESTABLISHMENT

A. The Contractor shall establish the seed by watering; protecting; repairing eroded areas; re-seeding; and mulching as necessary; keeping the irrigation system operational and maintained by cleaning and replacing parts, heads, etc.; and keeping the area clean.

B. Protection: The CONTRACTOR shall provide adequate protection to all newly seeded areas

including the installation of approved temporary fences to prevent trespassing and damage, as well as erosion control, until acceptance.

- C. The contractor apply broadleaf weed killer to help control the weeds only until after the seed is established.
- D. The maintenance of the seed bed may take one year or longer to establish a healthy stand of Native Grass Seed Mix. The contractor's level on maintenance shall determine the time frame required to establish a healthy Native Grass Seed Mix. The contractor shall be responsible for all maintenance of seeded areas.

3.8 WATERING OF SEEDED AREAS

- A. The entire seeded area shall be watered with a completely operational sprinkler irrigation system at time of seeding. The seed bed shall be kept moist at all times without creating washing or puddling of the lawn and seeded area.

3.9 TIME PERIOD

- A. The establishment period for seeded areas shall be a minimum of 90 days from the time the seeding operations are completed.

3.10 FINAL INSPECTION

- A. Inspection of work of lawn and seeded areas will be made at conclusion of maintenance.
- B. Within 10 days of the end of the establishment period written notice requesting an inspection shall be submitted to the Landscape Architect by the Contractor. All areas designated for Native Grass Seed Mix on the plans shall be covered with a reasonable stand of Native Grass Seed Mix and acceptable to the Landscape Architect. All areas found not to be acceptable shall be re-seeded in accordance with the above re-seeding specifications. Such areas shall be maintained and guaranteed as stated above.
- C. Final acceptance of the WORK prior to guarantee period of the contract will be accepted upon written approval by the LA., on the satisfactory completion of all work, including maintenance, but exclusive of the replacement of plant material.
- D. Any delay in the completion of any item of work in the seeding operation which extends the seeding into more than one season shall extend the maintenance in accordance with the date of completion.
- E. The CONTRACTOR shall re-seed or sod, as soon as weather conditions permit, all bare areas or areas where the lawn and seeded areas is thin or not healthy.
- F. All work done under this contract shall be left in good order to the satisfaction of the OWNER and the LA and the CONTRACTOR shall, without additional expense to the OWNER.

3.11 FINAL ACCEPTANCE

- A. Maintenance by the Contractor shall cease upon his receipt of written notice from the Landscape Architect and or Owner indicating final acceptance of the Native Grass Seed Mix areas.

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- B. The guarantee of the Native Grass Seed Mixed areas irrigation system will continue for the one year guarantee as noted per section 32 8000 Irrigation Specification

END OF SECTION 32 09213

SECTION 32 9300 – LANDSCAPE PLANTING

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall perform all the landscaping and all appurtenant work, complete, in accordance with the requirements of the Contract Documents.
- B. Scope of Work: Landscaping as referred to herein shall include, but not be limited to the following work: soil preparation, weed control, finish grading, furnishing and installing plant materials, tree staking and tying, cleanup, maintenance, and guarantee.
- C. The Section cross references the following sections:
 - 1. Division 01 Section "Reference Standards"
 - 2. Division 01 Section "Contractor Submittals"
 - 3. Division 01 Section "Project Closeout"
 - 4. Division 03 Section "Concrete"
 - 5. Division 32 Section "Landscape Irrigation System"

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Federal Specifications:
 - 1. FS O-F-241 D Fertilizer, Mixed, Commercial
- B. Commercial Standards:
 - 1. ANSI/ASTM D 422 Method for Particle-Size Analysis of Soils
 - 2. ANSI Z601 Nursery Stock
 - 3. American Association of Rules and Grading Provisions Nurserymen, Inc.

1.3 CONTRACTOR SUBMITTALS

- A. General: The CONTRACTOR shall furnish a certificate with each delivery or bulk material delivery, stating source, quantity, and type of material. All materials shall conform to specification requirements. All certificates shall be delivered to the LANDSCAPE ARCHITECT (here in referred to as L.A.) at time of each delivery. All bulk delivered materials shall be delivered with level load volume plainly marked on the truck bed.
- B. Submittals required shall be submitted as specified in Division 01 Section "Contractor Submittals":
 - 1. Contractor to provide Topsoil Analysis / Report.
 - 2. Literature on Fertilizers and Additives – Topsoil Recommendations – refer to Section 3.2.A.
 - 3. Bark mulch
 - 4. Crushed gravel
 - 5. Soil Prep
 - 6. Weed Barrier Fabric
 - 7. Sod mixes
 - 8. Literature on staking materials

1.4 QUALITY ASSURANCE

- A. General: All plants furnished by the CONTRACTOR shall be true to type or name as shown in the Contract Documents and shall be tagged in accordance with the standard practice recommended by the Agricultural Code of the State of Utah; however, determination of plant species or variety will be made by the L.A..
- B. All plants shall comply with Federal and State laws requiring inspection for plant diseases and infestations. Inspection certificates required by law shall accompany each shipment of plants, and certificates shall be delivered to the L.A..
- C. All inspections herein specified will be made by the L.A. or its representative. The CONTRACTOR shall request inspection at least 24 hours in advance of the time inspection is required. Inspection will be required on the following stages of the WORK:
 - 1. During preliminary grading, soil preparation, and initial weeding.
 - 2. When trees are spotted for planting, but before planting holes have been excavated.
 - 3. When finish grading has been completed.
 - 4. When all specified work, except the maintenance period has been completed.
 - 5. Final inspection at the completion of the maintenance period.
- D. Plants shall be subject to inspection and approval or rejection by the L.A. at place of growth and upon delivery to the site at any time before or during progress of the WORK and according to:
 - 1. Quantity, quality, size, and variety;
 - 2. Ball and root condition; and
 - 3. Latent defects and injuries resulting from handling, disease, and insects.
- E. Plants approved at pre-planting inspection shall still be subject to rejection during planting if found to be below Specifications.
- F. Rejected plants shall be identified in an obvious manner, promptly removed from the site and replaced with acceptable equals.
- G. Plants shall have been grown in nurseries which have been inspected by the governing authorities. Inspection of plant materials required by City, County, State, or Federal authorities shall be the responsibility of the CONTRACTOR, who shall have secured permits or certificates prior to delivery of plants to site.

1.5 CLEANUP

- A. Upon completion of all planting operations, the portion of the project site used for a work or storage area by the CONTRACTOR shall be cleaned of all debris, superfluous materials, and equipment. All such materials and equipment shall be entirely removed from the project site as specified in Division 01 Section "Project Closeout".
- B. All walks or pavement shall be swept or washed clean upon completion of the work of this Section.
- C. During the entire Contract period, plant containers that have been cut or removed from plant materials shall be removed from the project site daily, in accordance with the provisions for maintenance and guarantee as specified in Division 01 Section "Project Closeout".

1.6 MAINTENANCE OF LANDSCAPE PLANTING PRIOR TO ACCEPTANCE OF PROJECT

- A. General: The CONTRACTOR shall be responsible for protecting, watering, and maintaining all planting and irrigation systems until final acceptance of all work under the contract.

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- B. At time of final acceptance of the complete project, the lawn shall be totally established with no bare spots, mowed a minimum of 2 times, and the grass shall be at least 1-1/2 to 2 inches in height.
- C. Watering: Trees and shrubs shall be thoroughly soaked after planting and provided with additional water at intervals as necessary to provide for good health and growth of the planting.
- D. Upon completion of lawn sodding, the entire area shall be soaked to saturation by a fine spray. The new planting shall be kept watered by the irrigation system existing on the site during dry weather or whenever necessary for proper establishment of the lawn. Care shall be taken to avoid excessive washing or puddling on the surface and any such damage caused thereby shall be repaired by the CONTRACTOR at its own expense.
- E. Protection: The CONTRACTOR shall provide adequate protection to all newly planted areas including the installation of approved temporary fences to prevent trespassing and damage, as well as erosion control, until acceptance.
- F. The CONTRACTOR shall replace any materials or equipment it has damaged or which has been damaged by its employees or subcontractors.
- G. Partial utilization of the project shall not relieve the CONTRACTOR of any of the requirements contained in the Contract Documents.
- H. Mowing of Lawn Areas: First mowing of lawn areas shall begin as soon as the grass has reached a height of 3 inches and subsequent mowing shall be at least once a week, or as often as necessary to maintain all lawn areas at a uniform height of 1-1/2 to 2 inches until Final Acceptance. Remove no more than 30 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.
- I. All lawns shall be fertilized every 3 weeks with 6 lb of 16-8-8 commercial fertilizer per 1000 sq ft for the first 7 weeks and fertilized thereafter once each 5 months prior to acceptance.
- J. Plants shall be maintained in a vigorous, thriving condition by watering, cultivating, weeding, pruning, spraying, and other operations necessary. No trees or shrubs will be accepted unless they are healthy and show satisfactory foliage conditions.
- K. All planted areas shall be cultivated at least every 2 weeks and raked smooth, to present a neat appearance and additional mulch shall be added where necessary.
- L. Maintenance shall include, in addition to the foregoing, cleaning, edging, repairs to stakes, wire, and wrappings, the repair of erosion, and all other necessary work of maintenance. Sidewalks and other paved areas shall be kept clean while planting and maintenance are in progress.
- M. Any and all irrigation lines broken or disrupted during this construction shall be replaced to proper working order prior to contract work and be acceptable to the OWNER.

1.7 INSPECTION, FINAL ACCEPTANCE AND GUARANTEE

- A. Inspection / Final Acceptance of work of lawns, landscape and planting will be made at conclusion of the maintenance period. In addition to the manufacturers guarantees the Contractor shall warranty all landscape, plant material, products, and labor for a period of one (1) year from the date of Final Acceptance by the Owner.
- B. Written notice requesting inspection shall be submitted to the L.A. at least 10 days prior to the anticipated inspection date.

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- C. Final Acceptance will not be portioned to designated areas of the project.
- D. Any delay in the completion of any item of work in the planting operation which extends the planting into more than one season shall extend the guarantee in accordance with the date of completion given above.
- E. The CONTRACTOR shall replace, as soon as weather conditions permit, all dead plants and all plants not in a vigorous, thriving condition which are noted at the end of the one year guarantee period.
- F. Plants used for replacement shall be of the same size and variety specified in the plant list. Plants shall be furnished, planted, staked, and mulched as specified.
- G. All work done under this contract shall be left in good order to the satisfaction of the OWNER and the L.A. and the CONTRACTOR shall, without additional expense to the OWNER, replace any trees, shrubs, etc., which develop defects or die during the one-year guarantee period.

1.8 GUARANTEE FOLLOWING ACCEPTANCE OF PROJECT

- A. General: The CONTRACTOR shall be responsible for a period of one year after date of Final Acceptance of all work under the Contract, for all necessary plant or tree replacements. The CONTRACTOR shall provide a written guarantee to the OWNER from the landscaping subcontractor, embodying the provisions of this Section of the Specifications.
- B. The WORK covered by the guarantee portions of these specifications consists of providing all replacements of plants, labor, materials, equipment, and supplies and in performing all operations in connection with guarantees.
- C. The CONTRACTOR shall clean-up and remove unused or waste materials from the site and leave the area in a neat condition (satisfactory to the OWNER) whenever it performs work during the guarantee Period.
- D. Final Inspection: The OWNER and CONTRACTOR shall make a final inspection at the end of the one-year guarantee period. Any plants and materials found defective at time of final inspection shall be replaced within a time agreed upon by both parties. If it is too late in the planting season for replanting, the replacements shall be made during the next planting season even though such planting may run beyond the maintenance and correction period.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All landscaping materials for soil conditioning, weed abatement, or planting shall be first- grade, commercial quality and shall have certificates indicating the source of material, analysis, quantity, or weight attached to each sack or container or provided with each delivery. Delivery certificates shall be given to the L.A. as each shipment of material is delivered. A list of the materials used, together with typical certificates of each material, shall be submitted to the L.A. prior to the final acceptance of the job.

2.2 TERMINOLOGY AND QUALIFICATIONS

- A. Plants or plant material having characteristics not conforming to terms as defined will not be accepted. The terms "plant material" or "plants" refer to all vegetation, whether trees, shrubs, ground cover, or herbaceous vegetation.
- B. Quality refers to structure and form, as evidenced by density and number of canes and branches, compactness, symmetry, and general development without consideration of size or condition. Standard quality indicates the least acceptable quality. Plants shall be typical of the species and variety of good average uniform growth, shall be well formed and uniformly branched, and shall have the minimum number of canes specified, free from irregularities, or shall conform to minimum quality index. Where the number of canes is not specifically stated in describing this grade, the standards of the "Horticultural Standards" as adopted by the American Association of Nurserymen, shall apply. In this case, the number of canes and other factors for the appropriate classification under "quality definition" in the Horticultural Standards shall be the Quality index. Plant material below this standard will be considered "culls" and are not acceptable. Plants shall be nursery grown.
- C. Specimen means an exceptionally heavy, symmetrical, tightly-knit plant, so trained or favored in its development and appearance as to be outstanding, superior in form, number of branches, compactness, and symmetry.
- D. Size is the factor controlled by dimensions representing height or spread, or both, without consideration of quality or conditions. For standard quality, a dimension is given for height or container size, or a dimension is given for height as well as container size.
- E. Height is usually indicated with a tolerance. The smaller dimension is the minimum acceptable. The larger dimension represents the maximum permissible. The average dimension of all plants must equal the average of the tolerance figures shown on each item
- F. Condition is the factor controlled by vitality and ability to survive and thrive and be comparable with normal plants of the same species and variety in the vicinity, at the same season of the year. In addition, plants shall be free from physical damage or adverse conditions that would prevent thriving. Conditions also sometimes refer to state of growth, i.e., whether "dormant condition" or "growing condition" and this state shall be comparable to plants of similar species in the vicinity or leaves, formation of buds, and the like.
- G. Cane means a primary stem which starts from the ground, or close to the ground, at a point not higher than 1/4 the height of the plant.
- H. Caliper shall be taken 12 inches above the finish grade or ground, as a guide, or where a dimension in trunk appears to form the head of the tree.
- I. Foliage line is maximum dimension in case of specimen plants. It measures from ground to lowest part of body of plant.
- J. Collected plants shall not be used.

2.3 TOPSOIL

- A. Imported topsoil borrow shall be obtained from naturally drained areas and shall be fertile, friable loam suitable for plant growth. Topsoil borrow shall be subject to inspection and approval at the source of supply and upon delivery.
- B. The topsoil borrow shall be of uniform quality, free from subsoil stiff or lumpy clay, hard clods, hardpan, rocks, disintegrated debris, plants, roots, seeds, and any other materials that would be

toxic or harmful to plant growth. Topsoil borrow shall contain no noxious weeds or noxious weed seeds.

- C. Contractor to provide Topsoil Analysis / Report for imported Topsoil Borrow or if existing topsoil is used. Imported Topsoil Borrow, or if existing soil is to be used and amended, shall meet all specifications below for either "Ideal" or "Acceptable" categories. Soil that falls within the "Not-Acceptable" range shall not be used.

2.4

TOPSOIL QUALITY*

Category	pH	Soluble Salts dS/m or mmho/cm	Sodium Absorption Ratio (SAR)	Organic Matter %	Sand %	Silt %	Clay %	Texture Class
Ideal	5.5- 7.5	<2	<3	>2.0	<70	<70	<30	Loam (L), Silt Loam (SiL)
Acceptable	5.0- 8.2	<4	3 to 7 SiL, SiCL, CL 3 to 10 SCL, SL, L	>1.0	<70	<70	<30	Sandy Clay Loam (SCL) Sandy Loam (SL) Clay Loam (CL) Silty Clay Loam (SiCL)
Not- Acceptable	<5.0 >8.2	>4	>10	<1.0	>70	>70	>30	Loamy Sand (LS) Sandy Clay (SC) Silty Clay (SiC) Sand (S), Silt (S), Clay (C)

COARSE FRAGMENTS*

Category	%>2 mm (>5.0% exceeds guidelines)	Rocks Present >1.5" (>1.5" exceeds guidelines)
Ideal	□2.0	—
Acceptable	2.1-5.0	—
Not-Acceptable	>5.0	—

TOPSOIL NUTRIENT SPECIFICATION*

	Nitrate Nitrogen ppm	Phosphorus ppm	Potassium ppm	Iron ppm
Ideal / Acceptable	>20	>15	>150	>10

*from "Topsoil Quality Guidelines for Landscaping", June 2002, AG/SO-02, prepared by Rich Koenig, Utah State University Cooperative Extension Soil Specialist, and Von Isaman, QA Consulting and Testing, LLC.

- A. Mechanical Analysis shall be performed and shall conform to ANSI/ASTM D 422.

2.5 COMPOST

- A. Topsoil shall meet requirements listed above and be amended with 3 cubic yards of compost/1000 sq. ft. for every 3-inches of soil depth. Compost shall be incorporated into topsoil by rototilling. Compost shall meet all specifications below for either "Ideal" or "Acceptable" categories. Compost that falls within the "Not-Acceptable" range shall not be used.

COMPOST QUALITY GUIDELINES FOR LANDSCAPING*

	pH	Soluble Salts dS/m	Sodium Absorption Ratio (SAR)	Carbon:Nitrogen Ratio (C:N)%	Moisture%	> 98% Coarse Material Passing (dry weight basis)
Ideal	6 to 8	<5	<10	<20:1	25 to 35	3/8"
Acceptable	5-6, 8-9	<10	<20	21:1 to 30:1	<25, >35	3/4"
Not-Acceptable	<5.0, >9.0	>10	>20	<10:1, >30:1	<20, >50	<98% 3/4"

*Von Isaman MS, Pres. Of QA Consulting and Testing, LLC., Dr. Rich Koenig, Utah State University Cooperative Extension Soils Specialist, and Dr. Teresa Cerny, USU Cooperative Extension Horticulturalist, 3 March 2003.

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2.6 FERTILIZER AND ADDITIVES

- A. Fertilizer and additives shall be determined by the Topsoil Analysis located in Appendix A and based on section 2.3.
- B. Fertilizer shall be furnished in bags or other standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon.
- C. Chemical fertilizers shall be a mixed commercial fertilizer conforming to FS O-F-241 D, Type I, with percentages of nitrogen, phosphoric acid, and potash at 5-10-5 and 16-16-8. The combined N-P-K content shall be following percentages of total weight: 5 percent nitrogen 10 percent phosphoric acid and 5 percent potash. Fertilizers shall be uniform in composition, dry, and free flowing.
- D. Tablets shall be 21 grams each 20-10-5 Agriform, Lesslie, or approved equal.

2.7 MULCH

- A. Bark Mulch ("Walk-On" Shredded bark, natural and non-dyed): Placed in planting beds as indicated on the Drawings placed to a depth of 4 inches. Mulch shall be placed starting 3 inches back from tree trunks. Available from the following supplier:
 - 1. Miller Companies, Hyrum, UT 435.754.6527 (Jessica in sales) or approved equal
- B. Crushed Gravel – ¾ minus crushed gravel – tan in color.

2.8 WEED BARRIER FABRIC

- A. Weed barrier fabric shall be one of the following:
 - 1. "Dewitt® Weed Barrier Pro 5, aTylar® #3301, "Polyspun" XL, or approved equal.

2.9 PLANT MATERIALS

- A. Plants shall meet requirements of the Contract Documents and shall be in accordance with the botanical names and applicable standards of quality, size, condition, and type. They shall be true to name, genera, species, and variety in accordance with reference publications.
- B. Plant names are defined in "Standardized Plant Names" and "Bailey's Encyclopedia of Horticulture." When a name is not found in either reference, the accepted name used in the nursery trade shall apply.
- C. Plants shall be marked for identification. Each bundle of plants and at least 25 percent of each species and variety of separate plants in any one shipment shall have legible labels securely attached before delivery to the site. Leave labels on the trees after installation.
- D. All trees and shrubs shall be measured while their branches are in their normal position. Height and spread dimensions specified refer to the main body of the plant and not from branch or root tip to tip. No trees will be accepted with their leaders cut, or so damaged that cutting is necessary.
- E. All plants shall be symmetrical and shall conform to the size, age, and condition as specified on the plant list shown in the Contract Documents. Exceptions are as follows:
 - 1. Plants larger than specified in the plant list may be used if approved by the L.A., but use of such plants shall not increase the contract price. If the use of larger plants is approved, the spread of roots or ball earth shall be increased in proportion to the size of the plant. Bare

root plants furnished in size greater than specified shall be balled and burlaped when required by the L.A.

2. Where caliper or other dimensions of any plant materials are omitted from the Plant List, it shall be understood that such plant materials shall be normal stock for type
- F. Plants shall be of sound health, vigorous, and free from plant disease and shall be well-branched, shall have full foliage when in leaf, and shall have a healthy well-developed normal root system. Cold storage plants will not be accepted. Plants that are sensitive to shock from elevation change shall be grown at elevations close enough to site to alleviate any plant damage due to such change for at least 2 years.
- G. Bare rooted (BR) plants shall have well-developed branch systems and vigorous root systems. They shall be dug to sufficient depth to insure full recovery and development of the plants. Roots of these plants shall be covered with a uniformly thick coating of mud being puddled immediately after they are dug
- H. Balled and burlaped (BB) plants shall have firm, natural balls of earth, or diameter not less than that specified and of sufficient depth to include all the fibrous and feeding roots. No plant moved with a ball will be accepted if the ball is cracked or broken before or during plant operations, except on special approval of the L.A.
- I. Roots or balls of all plants shall be adequately protected at all times from sun and drying winds.
- J. Plants (indicated to be in marked cans, pots, or other containers on the plant list) shall have been grown in the containers for a minimum of 6 months and a maximum of 2 years. Roots shall fill the containers but show no evidence of being or having been root bound.
- K. Trees shall have straight trunks and all old abrasions and cuts shall be completely callused over. In no case shall trees be topped before delivery.
- L. Plants shall have been transplanted or root-pruned at least once in the 2 years. Plants shall not be pruned prior to delivery except as authorized by the L.A..

2.10 SOD GRASS

- A. The sod shall be nursery grown and as indicated on Drawings. It shall be uniformly cut approximately 3/4-inch or more thick and shall be well rooted, 2-year old growth of permanent and desirable grasses indigenous to this general location. The sod shall be practically free from weeds and undesirable grasses. Ensure all sod matches to avoid variations throughout the site and the sod is all purchased from the same sod farm.

2.11 STAKING MATERIALS

- A. Staking System: As indicated on Drawings
- B. Guying System: As indicated on Drawings.
- C. Flags: Standard surveyor's plastic flagging tape, white, 8 inches long.

PART 3 - EXECUTION

3.1 GENERAL

- A. The landscape work shall not be performed at any time when it may be subject to damage by climatic conditions.
- B. The CONTRACTOR shall verify all dimensions in the Contract Documents. Dimensions and plant locations shown shall be coordinated with L.A. and final location shall be site-oriented by the planter and L.A.. Any discrepancies or inconsistencies discovered shall be brought to the attention of the L.A..
- C. In case of conflict between the plant list totals and total plant count of the Contract Documents, the CONTRACTOR shall provide the higher number of plants.
- D. Delivery of materials may begin only after samples, submittals and tests have been approved by the L.A. All materials furnished for the work shall be not less than the approved sample.
- E. Substitutions for the indicated plant materials may be permitted pursuant to the Contract Documents.
- F. The CONTRACTOR shall provide temporary fencing, barricades, covering, or other protections to preserve existing landscaping items indicated to remain and to protect the adjacent properties and other structures when they may be damaged by the landscape work. As indicated on Drawings.
- G. Waste materials shall be removed and disposed of off the OWNER's property, unless otherwise indicated.
- H. It shall be the responsibility of the CONTRACTOR to avail itself of any information regarding utilities which are in the area of work and to prevent damage to the same. The CONTRACTOR shall provide protection to the utilities as necessary.
- I. Burning of combustible materials on the site shall not be permitted.
- J. The CONTRACTOR shall provide protection to structures, sidewalks, pavements, and other facilities in areas of work which are subject to damage during landscape work. Open excavations shall be provide with barricades and warning lights which conform to the requirements of governing authorities and the State's OSHA safety requirements from dusk to dawn each day and when needed for safety.
- K. Planting areas include all areas to be landscaped unless, specified or shown, otherwise.

3.2 SOIL PREPARATION

- A. PRIOR to the placement of the topsoil and amending of the topsoil, the contractor shall demonstrate that the existing and/or proposed topsoil shall meet the above specifications in Section 2.3 Topsoil requirements. If amendments are proposed in order to bring the topsoil in line with Section 2.3, the contractor shall submit their proposed recommendations in a submittal for approval by the L.A. and Owner.
- B. The landscape work shall not begin until all other trades have repaired all areas of settlement, erosion, rutting, etc., and the soils have been re-established, re-compacted, and refinished to finish grades. The L.A. shall be notified of all areas which prevent the landscape work from being executed.

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- C. Areas requiring grading by the landscaper including adjacent transition areas shall be uniformly level or sloping between finish elevations to within 0.10-ft above or below required finish elevations.
- D. The landscape work shall not proceed until after walks, curbs, pavings, edging, and irrigation systems are in place. The contract operations shall be completed to a point where the landscape areas will not be disturbed. The subgrade shall be cleaned free of waste materials of all kinds.
- E. During grading waste materials in the planting areas such as weeds, rocks (1 inches and larger) building materials, rubble, wires, cans, glass, lumber, sticks, etc., shall be removed from the site. Weeds shall be dug out by the roots.
- F. Fertilizers, additives, peat, etc. subject to moisture damage shall be kept in a weatherproof storage place in such a manner that they will be kept dry.
- G. After removal of waste materials the planting areas subgrade shall be scarified and pulverized to a depth of not less than 6 inches and all surface irregularities below the cover of soil removed.
- H. Finish subgrade and amended topsoil placement and grading shall consist of:
 - 1. Prepare subgrade by rough grading and removing all irregularities and debris, then till and scarify subsoil to a depth of 6 inches before placing topsoil. Dig subgrade down as required in shrub beds, turf areas for the placement of amended topsoil. Provide laser leveling on large flat areas to create a uniform level subgrade.
 - 2. Landscape contractor is responsible for the last 7 inches of grade in turf sod areas (6 inches of topsoil and 1 inch for sod) and 18 inches in shrub bed areas (6 inches of bark mulch and 12" of amended topsoil) or as indicated on the Drawings. Refer to grading plan for finish grade and drainage. Subgrade soil shall be in a loosened and rough surface finish before amended topsoil is placed over subgrade. (Sub-grade surface shall not be smooth, but a rough surface shall exist for a transition zone of amended topsoil to subsoil.) If areas of subgrade become compacted before amended topsoil is placed, subgrade shall be tilled again before amended topsoil placement.
 - 3. Placing all amendments, soil additives and fertilizers for the areas as noted on the plan and per the topsoil report refer to 3.2.A.
 - 4. Till lawn and planting area subsoil's and topsoil's that are compacted.
 - 5. After tilling, bring areas to uniform grades by floating and/or hand raking. In large open level areas, perform laser leveling to create uniform level areas.
 - 6. Make minor adjustment of finish grades as directed by the landscape architect or owner.
 - 7. Remove waste materials over 1" in size such as stones, roots, or other undesirable foreign materials and finish raking, dishing, dragging, and smoothing soil ready for planting.
 - 8. No grading or soil placement shall be undertaken when soils are wet or frozen
- I. Any unusual subsoil condition that will require special treatment shall be reported to the L.A.
- J. Amended topsoil shall be uniformly distributed over all areas where required. Subgrade and amended topsoil shall be damp and free from frost.
- K. Surface drainage shall be provided as shown by molding the surfaces to facilitate the natural run-off of water. Low spots and pockets shall be filled with amended topsoil and graded to drain properly.
- L. Finish grade for sodded areas shall be 1 inches below finish grade of adjacent pavement. Finish grade (top of bark mulch) shrub bed areas shall be 1 inches below finish grades of adjacent pavement.

3.3 DELIVERY, STORAGE, AND HANDLING OF PLANT MATERIALS

- A. No plants other than the required samples shall be dug or delivered to the site until the required inspections have been made and the plant samples are approved
- B. Plants shall not be pruned prior to delivery except upon approval by the L.A..
- C. Plant material shall be planted on the day of delivery if possible. The CONTRACTOR shall protect the stock in a temporary nursery at the project site where it shall be protected from sun and drying winds and shall be shaded, kept moist, and protected with damp soil, moss, or other acceptable material. Plants shall be planted within 2 days after delivery.
- D. All balled and burlapped plants which cannot be planted immediately in delivery shall be set on the ground and shall be well protected with soil, wet moss, or other acceptable material. Bare rooted plants, which cannot be planted immediately, shall be planted on heeled-in trenches immediately upon delivery. No material heeled-in more than one week may be used. Bundles of plants shall be opened and the plants separated before the roots are covered. Care shall be taken to prevent air pockets among the roots.
- E. During planting operations, bare roots shall be covered with canvas, wet straw, or other suitable materials. No plants shall be bound with wire or rope at any time so as to damage the bark or break branches.
- F. Plants shall not be picked up or moved by stem or branches, but shall be lifted the ball or container.
- G. Plants shall be lifted and handled from the bottom of the ball or container. Plants with balls cracked or broken before or during planting operations will not be accepted and shall be immediately removed from the site.

3.4 TREE AND PLANT LOCATIONS

- A. The CONTRACTOR shall locate and stake all tree and shrub locations and have the locations approved by the L.A. before starting excavation for same. The plant locations shall be observed, and their locations shall be adjusted as directed by L.A. before final approval.
- B. No trees shall be located closer than 72 inches to structures unless otherwise shown. Ground covers and shrubs may be planted up to structures or curbs.

3.5 PLANT PITS

- A. Plant pits, centered on location stakes, shall be excavated circular pits with vertical sides and flat or saucer shape bottom in accordance with the following sizes unless shown
 1. Tree pits shall be at least 3 times greater in diameter than the specific diameter of ball or spread of roots, and at depth of ball or roots.
 2. PRIOR to installation of the trees, a test shall be performed to ensure proper drainage. This shall be performed by USU Analytical Labs or approved equal Soil Engineer at contractor's expense. If tree pits are not properly draining, a drainage sump shall be provided or contractor shall provide recommendations for approval based on the of the Certified Soil Engineer analysis.
 3. Shrubs shall be planted in pits or holes of soil the depth of ball below finished grade, or as much deeper as necessary to properly set the plant at finished grade.
 4. Evergreen and Deciduous Trees shall be set plumb and straight, and at such a level that after settlement that the crown of the plant will be 2 inches above the finished grade.

3.6 PREPARED BACKFILL

- A. Tree and shrub pit backfilling soil shall consist of amended topsoil. Refer to Plans.
- B. Tree and shrub pits shall be provided with fertilizer tablets as follows:
 - 1. 1 per one-gallon can plant
 - 2. 3 per 5-gallon can plant
 - 3. 4 per trees

3.7 ROCKS OR UNDERGROUND OBSTRUCTIONS

- A. In the event that rock or underground obstructions are encountered in the excavation of plant pits, alternative locations shall be selected by the L.A.. Moving of trees to alternative locations shall not entail additional costs to the OWNER.

3.8 SETTING PLANT MATERIALS

- A. The soil shall not be worked when the moisture content is so great that excessive compaction will occur, nor when it is so dry that a dust will form in the air or that clods will not break readily. Water shall be applied if necessary to provide ideal moisture for filling and for planting as herein specified.
- B. Plants shall be set in center of pits as shown in the Contract Documents. They shall be set plumb and straight, and at such a level that after settlement that the crown of the plant will be 1 inch above the finished grade. Evergreen and Deciduous Trees shall be set plumb and straight, and at such a level that after settlement that the crown of the plant will be 2 inches above the finished grade.
- C. Balled and burlapped trees shall have planting soil placed and compacted around base of ball to fill all voids. All burlap ropes or wires shall be removed from the sides and tops of balls.
- D. All ground cover plants shall be evenly spaced, staggered in rows, and set at intervals specified, so as to produce a uniform effect. Plants shall be watered immediately after planting operations have been completed.
- E. All shrubs and vines shall be pruned to remove damaged branches. All bare root shrubs shall be pruned and shaped to compensate for transplant root loss.
- F. Planting soil around roots or balls shall be thoroughly compacted and watered. After planting, the soil in the shrub beds shall be cultivated between shrubs, raked smooth, and neatly outlined. Muddy soil shall not be used for backfilling. All broken or frayed roots shall be properly cut off.
- G. Trees and shrubs on slopes steeper than 6 to 1 shall be provided with watering dams or berms at least 6 inches high and 8 inches wider than planting pit (hole) unless specified or shown otherwise.
- H. All trees shall be thoroughly watered immediately after planting.
- I. Leave all tags and labels on plant material.

3.9 STAKING AND TREE WRAPPING

- A. Staking of trees shall be done immediately after they are planted. Plants shall stand plumb after staking. Staking shall be as indicated on Drawings.

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- B. Trees 2-inch caliper and less shall be supported by 2 stakes placed diametrically opposite at perimeter line of ball and to sufficient depth to hold tree rigid. Stakes shall be driven vertically and not twisted or pulled. Trees shall be wired to each stake as indicated on Drawings.
- C. All deciduous trees greater than 2-inch caliper and all evergreen trees 6'-0" and taller shall be triple staked or guyed as indicated on Drawings.

3.10 PRUNING AND MULCHING

- A. Each tree and shrub shall be pruned in accordance with standard horticultural practice to preserve the natural character of the plant in the manner fitting its use in the landscape design. Prune plant material only as approved by the L.A..
- B. All dead wood or suckers and all broken or badly bruised branches shall be removed by thinning out and shortening branches. Deciduous bare-rooted plants shall have not less than 1/3 of their respective leaf surfaces removed. All cuts shall be made just above a healthy bud. Pruning shall be done with clean, sharp tools.
- C. Plants shall be mulched after planting and cultivating have been completed. A layer of mulch materials, as hereinbefore specified, shall be spread on finished landscaping grade within all planting areas to depths as indicated on the drawings. The mulch around isolated trees shall be 3 feet in diameter. All shrub and ground cover beds shall be completely covered with the mulch as indicated on the Drawings.

3.11 SODDING

- A. Grass sod shall be provided where shown or specified and shall be maintained.
- B. The soil shall be prepared and fertilized before sodding. The CONTRACTOR shall prepare only enough ground that can be planted within 24 hours thereafter.
- C. Soil preparation shall consist of the following:
 - 1. Preparation of sub-grade grading shall be per "Part 3 -- Execution" in Paragraphs entitled "General" and "Soil Preparation," herein.
- D. Sod shall be cut and laid on site the same day.
- E. The sod shall be placed over leveled, compacted, and prepared finish graded soil. The amended topsoil and sub-base shall be moist enough to resist shifting.
- F. Sod may be placed at any time when the ground is not frozen. The surface on which the sod is to be laid should be firm and free from footprints or other depressions. A string or line of boards may be used as a guide for setting the first line of sod across the area. Sods of the next course are matched against the edge of this first line in such a way the joints between the individual sod pieces in the 2 lines do not coincide. Successive courses are matched against the last line laid, in the same manner.
- G. Sod shall always be laid across slopes.
- H. After sodding has been completed, the sodded area shall be cleaned up and thoroughly moistened by irrigation system.
- I. Soil preparation shall consist of the following:
 - 1. Preparation of sub-grade grading shall be per Paragraphs entitled "General" and "Soil Preparation," respectively, herein.

2. Finish grading of soil per Paragraph entitled "Soil Preparation", herein.

3.12 MISCELLANEOUS ITEMS

- A. Mulch shall be placed in the planting areas as shown, spread carefully and evenly to depths as indicated on the drawings over the entire area.

END OF SECTION