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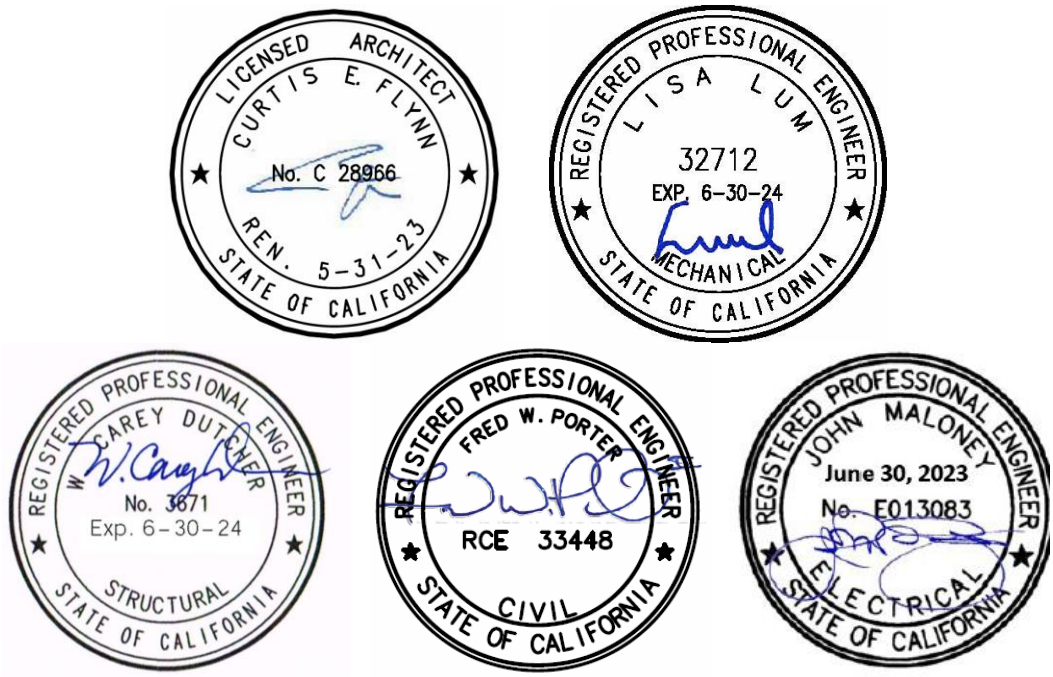
PROJECT MANUAL
CONTRACTUAL-LEGAL REQUIREMENTS
SPECIFICATIONS

MLK WELLNESS CENTER
BAKERSFIELD CITY SCHOOL DISTRICT
BAKERSFIELD, CALIFORNIA



Project No. 5527 Set No. ____

CURTIS E. FLYNN
Project Architect

Integrated Designs by SOMAM, Inc.
6011 N. Fresno Street, Suite 130
Fresno, California 93710

5527 BAKERSFIELD CITY SCHOOL DISTRICT

MLK WELLNESS CENTER

TABLE OF CONTENTS

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, below slab vapor retarder, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Concrete toppings.
5. Concrete Curb & Gutters
6. Concrete Sidewalks

B. Related Sections:

1. Section 033300 “Diamond Polishing Concrete Floors” for polished concrete.

1.3 Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.

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. Note: Special design mix for diamond polished concrete.

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. Construction Joint Layout: Indicate proposed construction joints required to construct the structure, and to achieve visual patterns as indicated in drawings or selected by Architect.

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

E. Samples: For vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer. 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. Fiber reinforcement.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Semirigid joint filler.
11. Repair materials.

B. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Alkalinity per ASTM F710 (ph 8to 10).
2. Moisture vapor transmission rate per ASTM F1869 <5Ibs/100 sq. ft. in 24 hrs.
3. Relative humidity per ASTM F2170 not more than 75%.

C. Floor surface flatness and levelness measurements indicating compliance with specified tolerances. Verify compliance for flatness as indicated for diamond polished concrete slabs.

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 requirements for production facilities and equipment.

C. 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.

D. 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 and Section 7, "Lightweight Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Concrete Mockup for Diamond Polishing and Penetrating Dye:

1. Provide mockup at least 100 square feet in area under Division 01 Section “Quality Control”. Construct at least one month before start of other concrete work to allow concrete to cure before observation.
2. At location acceptable to Architect, demonstrate methods used for construction, including forming and finishing conditions required for project using materials, workmanship, joint treatments, and curing methods to be used throughout project.
3. Accepted mockup provides visual standards for work of section.
4. Mockup may remain as part of work.

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.7 DELIVERY, STORAGE, AND HANDLING

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

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. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. Medium-density overlay, Class 1 or better; mill-release agent treated 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. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

D. 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.

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

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2. Furnish ties that, when removed, will leave holes no larger than 1 in 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. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

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

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Deformed-Steel Wire: ASTM A 496.

E. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

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

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

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 C.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

2. Note: Total Admixture volume for slabs to receive diamond polishing shall not exceed 10% of the portland cement volume.

B. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

3. Note: A uniformly graded mix of not less than aggregate sizes - fine, intermediate, and large shall be used for slabs to receive diamond polishing.

C. Lightweight Aggregate: ASTM C 330, 1-inch nominal maximum aggregate size.

D. Water: ASTM C 94 and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260. Note: slabs to receive diamond polishing shall not be air entrained.

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, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

C. Color Pigment for Integral Colored Concrete where indicated: 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. BASF Corporation; Construction Systems.
b. Butterfield Color.
c. Davis Colors.
d. Euclid Chemical Company (The); an RPM company.

2. Color: As selected by Architect from manufacturer's full range.

2.6 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Monofilament or fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long. Do not use fiber reinforcement for exposed view slabs including those to receive diamond polished finish.

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. Fibrillated Micro-Fibers:

1) Axim Italcementi Group, Inc.; Fibrasol F.
2) Euclid Chemical Company (The), an RPM company; Fiberstrand F.

3) FORTA Corporation; FORTA [Econo-Net] [Ultra-Net].
4) Grace Construction Products, W. R. Grace & Co.; Grace Fibers.
5) Nycon, Inc.; ProConF.
6) Propex Concrete Systems Corp.; Fibermesh 300.
7) Sika Corporation; Sika Fiber PPF.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A, except with maximum perm rating of .0052. Include manufacturer's recommended adhesive or pressure-sensitive tape, edge sealing tape, flexible sealants and other accessories needed for avoidance of below slab moisture transmission.

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. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
b. Fortifiber Building Systems Group; Moistop Ultra 15.
c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
d. Insulation Solutions, Inc.; Viper VaporCheck 16.
e. Meadows, W. R., Inc.; Perminator 15 mil.
f. Raven Industries Inc.; Vapor Block 15.
g. Reef Industries, Inc.; Griffolyn Type-65G.
h. Stego Industries, LLC; Stego Wrap 15 mil Class A.

2. Vapor barrier shall have a tensile strength not less than 45 Ibf/inch and puncture resistance of at least 2200 grams.

2.8 BELOW-SLAB FILL

A. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 3/4-inch sieve and 0 to 5 percent passing a No. 8 sieve.

B. 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 sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Note: surface applied curing compounds and similar products not compatible with flooring and adhesives are not permitted for slabs indicated to receive floor coverings.

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. 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. Lambert Corporation; LAMBCO Skin.
i. L&M Construction Chemicals, Inc.; E-CON.
j. Meadows, W. R., Inc.; EVAPRE.
k. Sika Corporation; SikaFilm.
l. Symons by Dayton Superior; Finishing Aid.

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

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semi rigid Joint Filler: Two-component, semi rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 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 IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

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

2.11 REPAIR MATERIALS

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

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

A. Mix and deliver concrete in accordance with Section 1905A, California Building Code. Deliver concrete in transit mixers only. Discharge loads in less than 1-1/2 hours after water is first added.

1. Design Mix: Section 1905A and ACI 318 section 5. Ingredients and proportions for design mix shall be selected by a DSA approved Testing Laboratory certified by a registered civil engineer licensed in California.
2. Required Strength: As noted on the structural drawings. Note that floor slabs on grade and on metal decks will have a different mix design from footings and other structural concrete to help control moisture migration.
3. Select proportions by volume for concrete in accordance with the approved design mix.
4. All mix designs for this project shall include a 15% fly ash substitute for cement by volume, except up to 10% fly ash shall be used at slabs indicated for diamond polishing.
5. Do not exceed water-cement ratios by weight for concrete items as specified on the structural drawings. All concrete slabs shall be minimum 3,500 psi design strength for controlling moisture migration.
6. Comply with structural drawings for other limitations to each mix design specified.
7. Miscellaneous Sitework Concrete: Specified in Section 32 13 13, Site Concrete Improvements.
8. Add colored admixture to integrally colored concrete mix according to manufacturer's written instructions.
9. Slabs indicated for diamond polishing: follow recommendations of Concrete Polishing Association of America for mix design.

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

1. Fly Ash: 15 percent (10% at slabs indicated for diamond polishing).
2. Combined Fly Ash and Pozzolan: 20 percent.
3. Ground Granulated Blast-Furnace Slag: 30 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 30 percent portland cement minimum, with fly ash or pozzolan not exceeding 15 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.

3. Slump Limit: 4 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content: 1.0 percent, plus or minus 0.5 percent at point of delivery for 1-inch nominal maximum aggregate size. Provide 0.5 percent maximum for diamond polished concrete with ¾" nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 1.5 percent.
7. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 4.0 lb/cu. yd., only where slabs are concealed by floor coverings.
8. Uniformly graded mix of not less than 3 aggregate sizes: fine, intermediate and large.

D. Cocnrete Curbs, Gutters, Sidewalks: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.55.
3. Slump Limit: 4 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

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, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

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 for smooth-formed finished surfaces.
2. Class B, 1/4 inch 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. 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."

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 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 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 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. 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 RETARDER OVER GRANULAR COURSE

A. Granular Course: Place a minimum of 3” thick granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch over compacted engineered fill and subgrade in accordance with recommendations of the Geotechnical Report.

1. Place and compact a 1/2-inch to 2 inch thick layer of fine-graded granular material over granular fill as needed for final leveling below vapor retarder and to achieve uniform thickness of slab above.

2. Total thickness of granular course (granular fill plus fine graded granular material) shall be 4” to 6” thick.

B. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions over the granular fill for placement of concrete slab directly over vapor retarder.

1. Lap joints 6 inches and seal with manufacturers recommended tape. Seal all penetrations water-tight with tape and flexible sealant.
2. Seal sheet vapor retarder at all perimeters to footings with sealant and/or manufacturer approved mechanical/friction method.

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.

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

E. Install welded wire reinforcement where indicated in structural drawings 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.

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 into concrete.
3. Locate joints for slabs in the middle third of spans
4. Use a bonding agent 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:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

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. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
2. 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 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed. Verify vapor retarder is properly installed with all penetrations fully sealed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. 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 directly over vapor retarder 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 and 318.
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 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.

D. 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. 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.

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 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.

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

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms and steel reinforcement just before placing concrete.

3.9 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 defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3.10 FINISHING FLOORS AND SLABS

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

B. 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 in one direction.

1. Apply scratch finish to surfaces to receive mortar setting beds for ceramic tile or other 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 restraightening 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 tile set over a cleavage membrane.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

3. Finish and measure surface so gap at any point between concrete surface and an

E. Trowel and Fine-Broom Finish: Apply a first trowel finish unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.to surfaces where ceramic tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

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. Diamond Polished Finish: Comply with specification section 03 35 43 and Concrete Polishing Association of America (CPAA) recommendations (attached at end of this section).

3.11 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. 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.

C. 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.

3.12 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 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. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

D. 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 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, 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. 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.

3.13 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. 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 semi rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 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 sieve, using only enough water for handling and placing.

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

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. 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 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. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

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.

3.15 FIELD QUALITY CONTROL

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

B. Inspections:

1. Steel reinforcement placement.
2. Headed bolts, studs and other embedded steel items.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from 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, but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

    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.

2. 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.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, 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.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. 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.
6. Compression Test Specimens: ASTM C 31.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. 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.
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
14. As part of project closeout requirements, submit required testing and inspection results to the Division of the State Architect (DSA) in accordance with current state regulations.

END OF SECTION 033000

SECTION 033543 - DIAMOND POLISHING CONCRETE FLOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Products and procedures for coloring and diamond polishing concrete floors using multi-step wet/dry mechanical process, and accessories indicated, specified, or required to complete polishing. Provide decorative score lines and penetrating dye coloring where indicated.

1.2 DEFINITIONS

A. Terminology: As defined by Concrete Polishing Association of America (CPAA).

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.

B. Installer Qualifications: Data for company, principal personnel, experience, and training specified in PART 1 "Quality Assurance" Article.

C. Field Quality Control – Static Coefficient of Friction Test Reports: Reports of testing specified in PART 3 "Field Quality Control" Article.

D. Maintenance Data: For inclusion in maintenance manual required by Division 01.

1. Include manufacturer's instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

E. Color samples of entire line of standard and custom colors for penetrating translucent dyes on 4000 PSI Portland cement concrete.

1.4 QUALITY ASSURANCE

A. Polisher Qualifications:

1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.

   Supervision: Maintain competent supervisor who is at Project during times specified work is in progress, and is currently certified as Craftsman or Master Craftsman by CPAA or other nationally recognized Diamond Polishing association.

2. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.

B. Walkway Auditor: Certified by NFSI to test polished floors for static coefficient of friction according to NFSI 101-A.

C. Static Coefficient of Friction: Achieve not less than 0.6 for level floor surfaces as determined by quality control testing according to NFSI 101-A.

D. Field Mock-up for Aesthetic Purposes: Before performing work of this Section, provide as many field mock-ups required to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless such deviations are specifically approved by Architect in writing.

1. Grind, hone, and polish 10 ft square floor area for each finish approved under sample submittals; include edges and joints.
2. Use same personnel, including supervisors, which will perform work.
3. Install products and materials according to specified requirements.
4. Work shall be representative of those to be expected for work.
5. Finish various components to show maximum variation that will exist in work.
6. Approval is for following aesthetic qualities:

    a. Compliance with approved submittals.
    b. Uniformity of exposed aggregate.
    c. Uniformity of sheen.
    d. Uniformity of colors.

7. Obtain Architect's approval before starting work on Project.
8. Protect approved field mock-ups from elements with weather resistant covering.
9. Maintain field mock-ups during construction in an undisturbed condition as a standard for judging completed work.
10. Do not demolish, alter, or remove field mock-ups until acceptable to Owner and Architect, and for comparison to final installation to verify final acceptability.

E. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

    a. Owner.
    b. Architect.
    c. Contractor, including supervisor.
    d. Concrete producer.
    e. Concrete finisher, including supervisor.
    f. Concrete polisher, including supervisor.
    g. Technical representative of liquid applied product manufacturers.
    h. Walkway auditor.

2. Minimum Agenda: Polisher shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:

    a. Tour mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
    b. Review Contract Document requirements.
    c. Review approved submittals.
    d. Review procedures, including, but not limited to:

        1) Details of each step of grinding, honing, and polishing operations.
        2) Application of liquid applied products.
        3) Protecting concrete floor surfaces until polishing work begins.
        4) Protecting polished concrete floors after polishing work is completed.

3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.5 FIELD CONDITIONS

A. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished.

1. Prohibit vehicle parking over concrete surfaces to be polished.
2. Prohibit pipe cutting operations over concrete surfaces to be polished.
3. Prohibit storage of any items over concrete surfaces to be polished for not less than 28 days after concrete placement.
4. Prohibit ferrous metals storage over concrete surfaces to be polished.
5. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces to be polished.
6. Protect from acids and acidic detergents contacting concrete surfaces to be polished.
7. Protect from painting activities over concrete surfaces to be polished.

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

PART 2 - PRODUCTS

2.1 LIQUID APPLIED PRODUCTS

A. Liquid Densifier: Odorless, non-hazardous, silicate that penetrates concrete to react with free lime and calcium hydroxide to produce permanent chemical reaction that hardens and densifies concrete surface.

B. Dyes: Extremely fine molecules of color solvent or dye for mixing with acetone that is designed to penetrate and color concrete surface. Two colors anticipated for use where indicated per layout to be provided by Architect. Manufacturers with products that may be acceptable subject to approval of Architect, include the following:

1. Bomanite Custom Polishing Systems
2. Ameripolish
3. Solomon Colors
4. Scofield
5. Nanoset by New Look International
6. Vivid by L&M Construction Chemicals, Inc.

C. Polish Guard: Non-film forming, stain resistant, food resistant, chemical stain resistant, impregnating sealant designed to be used on concrete surfaces previously densified.

2.2 ACCESSORIES

A. Patching Compound: Compound composed of 40 percent portland cement, 45 percent limestone, and 15 percent vinyl acetate copolymer, when mixed with dust salvaged from grinding process forms a paste that hardens when surface imperfections are filled.

B. Grout Material: Clear modified silicate sealant, containing no pore clogging latex, when mixed with dust salvaged from grinding process forms a paste that reacts with calcium hydroxide in concrete that hardens when surface imperfections are filled.

C. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

2.3 POLISHING EQUIPMENT

A. Field Grinding and Polishing Equipment:

1. Variable speed, multiple head, counter-rotating, walk-behind machine with not less than 600 pounds of down pressure on grinding or diamond polishing pads.
2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.

B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.

C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

D. Metal Bonded Pads: Grinding pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.

E. Resin Bonded Pads: Polishing pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.

F. Burnishing Pads: Maintenance pads for use with high speed burnishing equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Cleaning New Concrete Surfaces:

1. Prepare and clean concrete surfaces.
2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

3.3 VAPOR TESTING CONCRETE FLOORS

A. Alkalinity:

1. Test method: Measure pH according to method indicated ASTM F 710.
2. Acceptable Results: pH between 8 and 10.

B. Moisture Vapor Transmission Rate:

1. Test method: Perform anhydrous calcium chloride test according to ASTM F 1869.
2. Acceptable Results: not more than 5 pounds per 1000 square feet in 24 hours.

C. Relative Humidity:

1. Test Method: Perform relative humidity test using in situ probes according to ASTM F 2170.
2. Acceptable Results: Not more than 75 percent.

3.4 COLORING CONCRETE FLOORS

A. Dye Application:

1. Apply solution by methods and techniques required by manufacturer to produce finish matching approved mock-ups.
2. Maintain wet edge, working newly applied solution into edges of adjacent wet edges of previously treated surfaces.

3. Maintain consistent saturation throughout application.
4. Avoid splashing, dripping, or puddling of solution on adjacent substrates.
5. When color matches approved mock-ups, neutralize as required by manufacturer.

3.5 POLISHING CONCRETE FLOORS

A. Sequence of Polishing: Perform polishing after partition studs are erected, but before gypsum board is installed.

B. Initial Grinding:

1. Use grinding equipment with metal bonded grinding pads.
2. Begin grinding in one direction using sufficient size grit pad.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to150 grit.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Vacuum floor using squeegee vacuum attachment after each pass.
6. Continue grinding until aggregate exposure matches approved field mock-ups.

C. Treating Surface Imperfections:

1. Mix patching compound and grout material with dust created by grinding operations to match color of adjacent concrete surface.
2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids.
3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable
   when viewed from 10 feet away under lighting conditions that will be present after construction.

D. Liquid Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow to cure according to manufacturers instructions.

E. Grout Grinding:

1. Use grinding equipment and appropriate grit grinding pads.
2. While applying fresh grout material prior to, grind concrete in direction perpendicular to initial grinding to remove scratches.
3. Vacuum floor using squeegee vacuum attachment after each pass.

F. Honing:

1. Use grinding equipment with resin bonded grinding pads.
2. Grind concrete in one direction starting with 50 grit pad and make as many sequential passes required to remove scratches, each pass perpendicular to previous pass, up to 400 grit pad reaching maximum refinement with each pass before proceeding to finer grit pads.
3. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.

G. Polishing:

1. Use polishing equipment with resin bonded polishing and burnishing pads.

2. Begin polishing in one direction starting with 800 grit pad.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 3000 grit.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.
6. Continue polishing until gloss appearance, as measured according to ASTM E 430, matches approved field mock-ups.

H. Polish Guard: Uniformly apply and remove excessive liquid according to manufacturer's instructions.

I. Final Polish: Using burnishing equipment and finest grit burnishing pads, burnish to uniform sheen matching approved mock-up.

J. Final Polished Concrete Floor Finish:

1. Class C – Medium Aggregate Finish: Remove not more than 1/8 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying medium aggregate with no, or small amount of, large aggregate at random locations.

2. Level 2 – Medium Gloss Appearance:

a. Procedure: Not less than 5 step process with full refinement of each diamond pad up to 800 grit resin bonded pad with one application of densifier.
b. Gloss Reading: Not less than 55 according to ASTM E 430 before polish guard application.

3.6 FIELD QUALITY CONTROL

A. Field Testing: Engage a qualified walkway auditor to perform field testing according to NFSI 101-A to determine if polished concrete floor finish complies with specified static coefficient of friction.

3.7 CLOSEOUT ACTIVITIES

A. Maintenance Training: CPAA Master Craftsman shall train Owner's designated personnel in proper procedures for maintaining polished concrete floor.

3.8 PROTECTION

A. Covering: After completion of polishing, protect polished floors from subsequent construction activities with protective covering. Verify with General Contractor for covering by this Section, G.C. or other trade.

END OF SECTION 033543

SECTION 042613 - MASONRY VENEER

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. Decorative concrete masonry units.
2. Stone trim units.
3. Mortar.
4. Ties and anchors.
5. Miscellaneous masonry accessories.
6. Section 092400 "Cement Plastering" for scratch coat over metal lath on wall surfaces.

B. Related Requirements:

1. Section 092400 "Cement Plastering" for scratch coat over metal lath on wall surfaces.

1.3 DEFINITIONS

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

1.4 REFERENCES:

A. Masonry Veneer Manufacturing Association.

1. Figure 1, Installation over wood framing.
2. Figure 2, Installation over concrete or masonry units.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

C. Samples for Verification: For each type and color of the following:

1. Decorative CMUs.

2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Weep holes.
4. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.

2. Integral water repellant used in decorative CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Anchors, ties, and metal accessories.

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

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

C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of veneer, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down face of veneer, and hold cover securely in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

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

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 CONCRETE MASONRY UNITS

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

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

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

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

C. Decorative CMUs: ASTM C 90.

1. Density Classification: Lightweight.
2. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less than nominal 8”x6” dimensions.
3. Pattern and Texture:

    a. Standard pattern, split-face finish.

4. Colors: As selected by Architect from manufacturer's full range.

2.3 MORTAR MATERIALS

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

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

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

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

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

1. Colored Portland Cement-Lime Mix:

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of portland cement by weight.

E. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. White-Mortar Aggregates: Natural white sand or crushed white stone.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

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

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

H. Water: Potable.

2.4 ANCHORS AND TIES

A. Anchors and ties shall be of zinc-coated steel or copper coated steel. Except for steel wire, zinc coating shall conform to ASTM A153. Steel wire shall be zinc coated in accordance with ASTM A641 for class 2 coating. The extent and location of anchors and ties shall be as indicated on the drawings and as hereinafter specified. The anchor ties shall have a lip or hook on the extended leg that will engage or enclose the horizontal joint reinforcement.

1. Anchors at Wood Studs: Equivalent to DA 213 anchors as manufactured by Dur-O-Wall, Inc., Arlington Heights, Illinois. Anchors shall be constructed of 14 ga hot dipped galvanized steel. Ties shall be 3/16 inch diameter wire pintles with hot dipped galvanized finish. Provide two #10 stainless steel self tapping wood screws (Durowall Fastener) for connecting each anchor to studs. Each layer of masonry where anchors are placed shall also have one 9 gauge galvanized steel wire placed horizontally in the center 1/3 of the width of the masonry veneer. Provide 16 gauge x 1.5" square galvanized tie (Duroclip) to connect 9 gauge wire to pintle.

B. Horizontal Joint Reinforcement: 9 gauge wire per ASTM A82

2.5 MISCELLANEOUS MASONRY ACCESSORIES

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

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

1. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4 inches long.
2. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches long.
3. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
4. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.

2.6 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.7 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

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

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Use Type N unless another type is indicated.

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

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Mix to match Architect's sample.
3. Application: Use pigmented mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 INSTALLATION, GENERAL

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

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

C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

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

B. Lines and Levels:

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

C. Joints:

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

3.4 LAYING MASONRY WALLS

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

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

C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

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

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

3.5 MORTAR BEDDING AND JOINTING

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

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

1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

3.6 MASONRY VENEERS

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

1. Install masonry over CMU walls and over wood framing in compliance with the Masonry Veneer Manufacturers Association Figure 1, Installation Over Wood Framing and Figure 2, Installation Over Concrete Masonry Units.

3.7 FIELD QUALITY CONTROL

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

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

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

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

3.8 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

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

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

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.9 MASONRY WASTE DISPOSAL

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

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

END OF SECTION 042613

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 014000 "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other metal items not defined as structural steel.

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."

1.4 PERFORMANCE REQUIREMENTS:

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

1.5 ACTION 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.
5. For structural-steel connections indicated to comply with design loads, include structural analysis data [signed and sealed by the qualified professional engineer responsible for their preparation].

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 qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

1.6 INFORMATIONAL SUBMITTALS:

A. Qualification Data: For qualified Installer, fabricator and testing agency.

B. Welding certificates.

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

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

E. Product Test Reports: For the following:

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

F. Source quality-control reports.

1.7 QUALITY ASSURANCE:

A. Shop-Painting Applicators: Qualified according to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

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

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. Steel Construction manual, 14th edition.

1.8 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.

1.9 COORDINATION:

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

B. 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.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS:

A. Per structural drawings

B. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS:

A. General Use: Regular hexagon head type, ASTM A 307, Grade A.

B. Threaded Rods: Per structural drawings.

1. Nuts: ASTM A 563.
2. Washers: ASTM F 436
3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

2.3 PRIMER:

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the

Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

C. Galvanizing Repair Paint: ASTM A 780.

2.4 GROUT:

A. 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, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

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

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."

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

G. 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.

H. 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.

I. 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 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

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.

D. Painting: Prepare steel and apply a one-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

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.

2.9 SOURCE QUALITY CONTROL:

A. Testing Agency: 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 tested and 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, shop-welded 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.

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

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack 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.

G. Do not enlarge holes in members by burning or using drift pins. Ream pre-approved 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, 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 PREFABRICATED BUILDING COLUMNS:

A. Install prefabricated building columns to comply with AISC 360, manufacturer's written recommendations, and requirements of testing and inspecting agency that apply to the fire-resistance rating indicated.

3.6 FIELD QUALITY CONTROL:

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds.

B. Bolted Connections: Bolted connections will be 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. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.7 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 Section 099000 "Painting".

END OF SECTION 051200

SECTION 054000 - COLD-FORMED 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. Types of cold-formed metal framing units include the following:

1. C-shaped load bearing unpunched and non-load bearing punched channel studs and joists with stiffened flanges.
2. U-shaped load-bearing and non-load-bearing steel stud wall track and slip track.
3. C-shaped unpunched blockings, headers, and miscellaneous components.
4. Light gauge straps, angles, and z-shaped furring.

B. Related Requirements:

1. Section 09 22 16 “Non-Structural Metal Framing” for additional requirements for interior metal framing.

1.3 SUBMITIALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Product data and installation instructions for each item of cold-formed metal framing and accessories.
2. Shop drawings for special components and installations not fully dimensioned or detailed in manufacturer's product data.

a. Include placing drawings for framing members showing size and gage designations, number, type, location, and spacing. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation.

1.4 QUALITY ASSURANCE

A. Component Design: Calculate structural properties of custom studs and custom joists in accordance with American Iron and Steel Institute (AISI) "Specification for Design of Cold-Formed Steel structural Members."

B. All component section properties shall comply with the Steel Stud Manufacturer's Association (SSMA). Refer to structural drawings for minimum section properties for each component used.

C. Fire-Rated Assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units that have been approved by governing authorities that have jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, Manufacturer shall be a member of the Steel Stud Manufacturer's Association (SSMA).

2.2 METAL FRAMING

A. System Components: Manufacturer's components shall comply with the section properties of the SSMA. Manufacturers' standard load-bearing steel studs and joists of type, size, shape, and gauge as indicated. With each type of metal framing required, provide manufacturer's standard, steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories for applications indicated, as needed to provide a complete metal framing system. All framing components shall be minimum 20 gage steel except as otherwise indicated or required by SSMA.

B. Materials and Finishes:

1. Fabricate metal framing components of structural quality steel sheet with a minimum yield point as specified on the structural drawings.
2. Provide galvanized finish to metal framing components complying with ASTM A 525 for minimum G 60 coating.
3. Fasteners: Provide nuts, bolts, washers, screws, and other fasteners with corrosion-resistant plated finish.
4. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

2.3 FABRICATION

A. General: Framing components may be prefabricated into assemblies before erection. Fabricate panels plumb, square, true to line, and braced against racking with joints welded. Perform lifting of prefabricated units to prevent damage or distortion.

B. Fabricate units in jig templates to hold members in proper alignment and position and to assure consistent component placement.

C. Fastenings: Attach similar components by screw fasteners. Attach dissimilar components by bolting, or screw fasteners, as standard with manufacturer.

D. Wire tying of framing components is not permitted.

E. Welding of framing components is not permitted.

F. Fabrication Tolerances: Fabricate units to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Bent, distorted or otherwise damaged components shall not be used.

3.2 INSTALLATION

A. General: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations.

B. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24 inches o.c. spacing for nail or power-driven fasteners or 16 inches o.c. for other types of attachment. Provide fasteners at corners and ends of tracks.

C. Installation of Wall Studs: Secure studs to top and bottom runner tracks by screw fastening at both inside and outside flanges.

D. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

E. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.

F. Install supplementary framing, blocking, strapping, and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, accessories, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported. As a minimum, where not indicated otherwise, provide 8" wide 16 gage flat strapping with 2 screws per stud.

G. Frame wall openings per structural drawings. Where details for openings are not provided, frame non-bearing wall openings smaller than 4 feet span with double 4" stud section header, single jamb stud, single king stud and single sill track. Frame openings larger than 4 feet span, but not exceeding 8 feet span, single sill track. All structural bearing wall openings and non-bearing openings larger than 8 foot span require special details, see structural drawings.

H. Frame both sides of expansion and control joints with separate studs; do not bridge the joint with components of stud system.

I. Install horizontal strap and block stiffeners in stud system, spaced at not more than 48 inches o.c. See structural drawings for other requirements.

J. Erection Tolerances: Bolt wall panels (at both horizontal and vertical junctures) to produce flush, even, true-to-line joints.

1. Maximum variation in plane and true position between prefabricated assemblies should not exceed 1/16 inch.

K. Installation of Joists: Install level, straight, and plumb, complete with bracing and reinforcing as indicated on drawings. Provide not less than 1-1/2-inch end bearing.

L. Reinforce ends with end clips, steel hangers, steel angle clips, steel stud section, or as otherwise recommended by joist manufacturer.

M. Where required, reinforce joists at interior supports with single short length of joist section located directly over interior support.

N. Secure joists to interior support systems to prevent lateral movement of bottom flange.

O. Field Painting: Touch-up damaged shop-applied protective coatings. Use galvanizing repair system for galvanized surfaces.

3.3 REPAIRS AND PROTECTION

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

B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing. Paint framing surfaces with same type of shop paint used on adjacent surfaces.

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

END OF SECTION 054000

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 overhead doors and grilles.
2. Steel framing and supports for countertops.
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. Steel pipe columns for supporting wood frame construction.
6. Metal ladders.
7. Miscellaneous steel trim including steel angle corner guards steel edgings and loading-dock edge angles.
8. Metal bollards.
9. Abrasive metal nosings.

B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete.

C. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 051200 "Structural Steel Framing."
3. Section 129300 "Site Furnishings" for bicycle racks.

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. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Metal nosings and treads.
2. Paint products.
3. Grout.

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

1. Steel framing and supports for overhead doors.
2. Steel framing and supports for countertops.
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. Steel pipe columns for supporting wood frame construction.
6. Metal ladders.
7. Miscellaneous steel trim including steel angle corner guards steel edgings and loading-dock edge angles.
8. Metal bollards.
9. Abrasive metal nosings

C. Samples for Verification: For each type and finish of extruded nosing

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

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

C. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

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

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance of Aluminum Ladders: Aluminum ladders shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches.
2. Material: Galvanized steel, ASTM A 653, commercial steel, Type B, with G90 (Z275) coating; 0.108-inch nominal thickness.
3. Material: Cold-rolled steel, ASTM A 1008, commercial steel, Type B; 0.0966-inch (2.5-mm) minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.

C. Cast Iron: Either gray iron, ASTM A 48, or malleable iron, ASTM A 47, unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 194, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required..

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.
3. Provide stainless-steel fasteners for fastening nickel silver.

B. 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.

C. 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.

D. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

E. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594

F. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. 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.

F. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

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

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing 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 are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated, coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

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. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.

2. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.

E. Galvanize miscellaneous framing and supports where indicated.

F. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

G. Aluminum Ladders:

1. Basis-of-Design Product: Subject to compliance with requirements, Okeefs Inc. 500 Access Ladder or comparable product by one of the following:

a. ACL Industries, Inc.
b. Alco-Lite Industrial Products.
c. Halliday Products.
d. Precision Ladders, LLC.
e. Royalite Manufacturing, Inc.
f. Thompson Fabricating, LLC.

2. Siderails: Continuous extruded-aluminum tubes, not less than 2 inches deep, 4 inch wide, and 3/16 inch thick.
3. Rungs: Extruded-aluminum tubes, not less than 1-1/4 inch square and not less than 1/8 inch thick, with ribbed tread surfaces.
4. Fit rungs in centerline of siderails; fasten with stainless-steel fasteners.
5. Support each ladder with welded or bolted aluminum brackets.

2.7 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 and prime miscellaneous steel trim.

2.8 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe 1/4-inch wall-thickness.

1. Cap bollards with 1/4-inch-thick steel plate.

B. Prime bollards with zinc-rich primer.

2.9 ABRASIVE METAL NOSINGS

A. Cast-Metal Units: Cast aluminum, with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Babcock Davis Ribbed Bar Abbrasive Nosing or comparable product by one of the following:

    a. Balco, Inc.
    b. Safe-T-Metal Company, Inc.
    c. Wooster Products Inc.

2. Nosings: Cross-hatched units, 4 inches wide with 1-inch lip, for casting into concrete.
3. Treads: Cross-hatched units, full depth of tread with 3/4-by-3/4-inch nosing, for application over bent plate treads or existing stairs.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply bituminous paint to concealed surfaces of cast-metal units.

2.10 STEEL WELD PLATES AND ANGLES

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

2.11 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153 for steel and iron hardware and with ASTM A 123 for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Other Items: SSPC-SP 3, "Power Tool Cleaning."

E. 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.

2.13 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

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 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 and overhead doors securely to, and rigidly brace from, building structure.

C. Support steel girders on steel pipe columns. Secure girders with anchor bolts with bolts through top plates of pipe columns.

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 concrete in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

C. Fill bollards solidly with concrete, mounding top surface to shed water.

3.4 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 "Joint Sealants" to provide a watertight installation.

3.5 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with timber.
3. Framing with engineered wood products.
4. Rooftop equipment bases and support curbs.
5. Wood blocking and nailers.
6. Wood furring.
7. Wood sleepers.
8. Utility shelving.
9. Plywood backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for wall and roof sheathing, subflooring, and underlayment.
2. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) size or greater but less than 5 inches nominal (114 mm actual) size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

E. Timber: Lumber of 5 inches nominal (114 mm actual) size or greater in least dimension.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used 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.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.
5. Power-driven fasteners.
6. Post-installed anchors.
7. Metal framing anchors.

1.6 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.

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Dress lumber, S4S, unless otherwise indicated.

B. 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 unless otherwise indicated.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

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 crawlspaces 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, materials shall comply 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. Treatment shall 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. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by testing agency.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:

1. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade or as indicated in structural drawings.

B. Load-Bearing Partitions: As indicated in structural drawings.

C. Load-Bearing Partitions: Any species of machine stress-rated dimension lumber with a grade of not less than 2400f-2.0E, unless indicated otherwise in structural drawings.

D. Ceiling Joists: As indicated in structural drawings.

E. Joists, Rafters, and Other Framing Not Listed Above: As indicated in structural drawings.

F. Exposed Framing Indicated to Receive a Stained or Natural Finish: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species and Grade: Douglas fir-larch; No. 1 grade; WCLIB or WWPA.
2. Species and Grade: Douglas fir-south; No. 1 grade; WWPA.
3. Species and Grade: Hem-fir; No. 1 grade; WCLIB or WWPA.
4. Species and Grade: Douglas fir-larch (north); No. 1 grade; NLGA.
5. Species and Grade: Redwood; Clear Structural or No. 1 grade; RIS.
6. Other species and grades indicated in drawings

2.5 TIMBER FRAMING

A. Comply with the following requirements, according to grading rules of grading agency indicated:

1. Species and Grade: Douglas fir-larch, Douglas fir-larch (north), or Douglas fir-south; No. 1 grade or better; NLGA, WCLIB, or WWPA.
2. Additional Restriction: Free of heart centers.

2.6 ENGINEERED WOOD PRODUCTS

A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

B. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.

1. ICC approved in accordance with ESR-1387.
2. Extreme Fiber Stress in Bending, Edgewise: 2400 psi for 12-inch nominal- (286-mm actual-) depth members.
3. Modulus of Elasticity, Edgewise: 2,400,000 psi.

C. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.

1. ICC approved in accordance with ESR-1387.
2. Extreme Fiber Stress in Bending, Edgewise: 2900 psi (20 MPa) for 12-inch nominal-(286-mm actual-) depth members.
3. Modulus of Elasticity, Edgewise: 2,200,000 psi (15 100 MPa).

D. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Comply with material requirements of and with structural capacities established and monitored according to ASTM D 5055.

1. Provide ICC approved products as indicated in structural drawings.

E. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research or evaluation report for I-joists.

1. Manufacturer: Provide ICC approved products by same manufacturer as I-joists.

2.7 SHEAR WALL PANELS

A. See section 061600 “Sheathing”.

2.8 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. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. Utility Shelving: Lumber with 19 percent maximum moisture content of any of the following species and grades:

1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.
2. Mixed southern pine or southern pine; No. 2 grade; SPIB.
3. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
4. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:

1. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
2. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
3. Northern species; No. 2 Common grade; NLGA.
4. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

F. 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.

G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.9 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 5/8-inch (16-mm) nominal thickness with 7-ply construction.

2.10 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.11 METAL FRAMING ANCHORS

A. Basis of Design Manufacturer: Simpson Strong-tie or approved equal.

B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated and of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

D. 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.

E. Stainless-Steel Sheet: ASTM A 666, Type 304.

1. Use for exterior locations and where indicated.

F. Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges at least 85 percent of joist depth unless indicated otherwise on drawings.

1. Thickness: 0.062 inch (1.6 mm).

G. I-Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord unless indicated otherwise on drawings

1. Thickness: 0.062 inch (1.6 mm).

H. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member unless indicated otherwise on drawings.

1. Strap Width: 1-1/2 inches (38 mm) minimum unless indicated otherwise on drawings.
2. Thickness: 0.062 inch (1.6 mm) unless indicated otherwise on drawings.

I. Bridging: Rigid, V-section, nailless type, 0.050 inch (1.3 mm) thick, length to suit joist size and spacing.

J. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch (25 mm) above base and with 2-inch- (50-mm-) minimum side cover, socket 0.062 inch (1.6 mm) thick, and standoff and adjustment plates 0.108 inch (2.8 mm) thick.

K. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports as indicated.

L. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches (38 mm) wide by 0.050 inch (1.3 mm) thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.

M. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches (57 mm) wide by 0.062 inch (1.6 mm) thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

N. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches (32 mm) wide by 0.050 inch (1.3 mm) thick by 36 inches (914 mm) long.

O. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base as indicated on drawings.

2.12 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

D. 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.

E. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

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. Install shear wall panels as indicated and to comply with manufacturer's written instructions.

F. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

H. Do not splice structural members between supports unless otherwise indicated.

I. 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.

J. 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.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.

K. Sort and select lumber so that natural characteristics do 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.

L. 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.

M. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

N. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in 2019 CBC.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

O. 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.

P. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with indicated fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

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 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring horizontally and vertically at 24 inches (610 mm) o.c.

C. Furring to Receive Gypsum Board or Plaster Lath: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically at 16 inches (406 mm) o.c.

3.4 WALL AND PARTITION FRAMING INSTALLATION

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal (38-mm actual) thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions[and for load-bearing partitions where framing members bearing on partition are located directly over studs]. Fasten plates to supporting construction unless otherwise indicated.

1. For exterior walls, provide 2-by-6-inch nominal- (38-by-140-mm actual-) size wood studs spaced 16 inches (406 mm) o.c. unless otherwise indicated.
2. For interior partitions and walls, provide 2-by-6-inch nominal- (38-by-140-mm actual-) size wood studs spaced 16 inches (406 mm) o.c. unless otherwise indicated.
3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches (2438 mm) high, using members of 2-inch nominal (38-mm actual) thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal (89-mm actual) depth for openings 48 inches (1200 mm) and less in width, 6-inch nominal (140-mm actual) depth for openings 48 to 72 inches (1200 to 1800 mm) in width, 8-inch nominal (184-mm actual) depth for openings 72 to 120 inches (1800 to 3000 mm) in width, and not less than 10-inch nominal (235-mm actual) depth for openings 10 to 12 feet (3 to 3.6 m) in width.
2. For load-bearing walls, provide double-jamb studs for openings 60 inches (1500 mm) and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.

3.5 CEILING JOIST AND RAFTER FRAMING INSTALLATION

A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.

1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate, and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- (19-by-184-mm actual-) size or 2-by-4-inch nominal- (38-by-89-mm actual-) size stringers spaced 48 inches (1200 mm) o.c. crosswise over main ceiling joists.

B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against valley rafters.
2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against hip rafter.

C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal- (19-by-140-mm actual-) size boards between every third pair of rafters, but not more than 48 inches (1219 mm) o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.

D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.6 TIMBER FRAMING INSTALLATION

A. Install timber beams with crown edge up and provide not less than 4 inches (102 mm) of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports as indicated if not continuous.

B. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide 1/2-inch (13-mm) airspace at sides and ends of wood members.

C. Install wood posts using metal anchors indicated.

D. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.

3.7 PROTECTION

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

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

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. Wall sheathing.
2. Roof sheathing.
3. Flooring.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for plywood backing panels.
2. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Power driven fasteners.

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

PART 2 - PRODUCTS

2.1 WOOD PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior for exterior construction not in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 PANEL PRODUCTS

A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

D. PRESERVATIVE-TREATED PLYWOOD

E. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

F. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

G. Application: Treat plywood in contact with concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings.

2.5 WALL SHEATHING

A. Plywood Sheathing: As scheduled on structural drawings.

2.6 ROOF SHEATHING

A. Plywood Sheathing: As scheduled on the structural drawings.

2.7 FLOOR SHEATHING:

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exterior, Structural I, C-C Plugged single-floor panels. Georgia Pacific Plytanium or equivalent.

1. Nominal Thickness: Not less than 1 1/8".
2. Edge Detail: Tongue and groove.
3. Surface Finish: Fully sanded face.

2.8 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof, parapet and wall sheathing provide fasteners with hot-dip zinc coating complying with ASTM A 153.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

2.9 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

EXECUTION

2.10 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the CBC, California Building Code, Title 24.
2. ICC-ES evaluation report for fastener.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall, parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

2.11 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. T&G Flooring:

a. Glue and screw to wood framing.
b. Screw to cold-formed metal framing.

2. Wall and Roof Sheathing:

a. Nail to wood framing.
b. Screw to cold-formed metal framing.
c. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 061600

SECTION 062023 - INTERIOR FINISH 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. Interior trim.
2. Interior board paneling.

B. Related Requirements:

1. Section 054000 “Cold-Formed Metal Framing” for metal backing to attach MDF paneling and wood trim.
2. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
3. Section 099000 "Painting" for priming, backpriming and painting of interior finish carpentry.
4. Section 092900 “Gypsum Board” for substrate below, MDF paneling and wood trim.

1.3 DEFINITIONS

A. MDF: Medium-density fiberboard.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

B. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

C. Samples for Verification:

1. For each species and cut of lumber and panel products with nonfactory-applied finish, with half of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.

1.5 DELIVERY, STORAGE, AND HANDLING

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

B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's Board of Review. Grade lumber by an agency certified by the American Lumber Standard Committee's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber, mark grade stamp on end or back of each piece.

B. Softwood Plywood: DOC PS 1.

C. Hardboard: ANSI A135.4.

D. MDF: ANSI A208.2, Grade 130.

2.2 INTERIOR TRIM

A. Softwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: Douglas fir-larch or Douglas fir south, Superior or C & Btr finish; NLGA, WCLIB, or WWPA.

2. Maximum Moisture Content: 15 percent.
3. Finger Jointing: Not Allowed.
4. Face Surface: Surfaced (smooth).

B. Hardwood Lumber Trim for Opaque Finish:

1. Species and Grade: Any hardwood specie, B Finish.
2. Maximum Moisture Content: 13 percent.
3. Finger Jointing: Allowed.
4. Face Surface: Surfaced (smooth).

C. Lumber Trim for Opaque Finish (Painted Finish):

1. Species and Grade: Douglas fir-larch or Douglas fir south, Superior or C & Btr finish; NLGA, WCLIB, or WWPA.
2. Maximum Moisture Content: 15 percent.
3. Finger Jointing: Allowed.
4. Face Surface: Surfaced (smooth.

2.3 PANELING

A. MDF Paneling: ANSI A208.2, Grade 130 used for paneling.

1. Thickness: 5/8 inch.
2. Sheet Size: 48”x96”.

2.4 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Low-Emitting Materials: Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Paneling Adhesive: Comply with paneling manufacturer's written recommendations for adhesives.

2.5 FABRICATION

A. Chamfer edges of 2x trim lumber ½-inch.

B. Chamfer vertical edges of MDF paneling ¼-inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for sheet metal backing installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

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

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as required for finishing.
2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.

1. Install trim after gypsum-board joint finishing operations are completed.

2. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.
3. Gypsum-Board Substrate: Install wood trim with #10 x 3” flat head machine screws at 24 inches on center to sheet metal backing below gypsum board substrate.

3.5 PANELING INSTALLATION

A. MDF Paneling: Butt adjacent panels with moderate contact. Use Flat head machine screws countersink and plug, sand and prepare painting.

1. Gypsum-Board Substrate: Install paneling over gypsum board after joint finishing operations are completed with #8 x 2” flat head machine screws at 24 inches each way on center to sheet metal backing below gypsum board substrate, countersink and plug, sand and prepare for painting. Use adhesive at all edges and, joints to secure paneling to substrate.

3.6 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.7 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

SECTION 064023 - ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim.
2. Wood veneer faced plywood cabinets and library shelving.
3. Solid surface countertops.
4. All Cabinet hardware for complete and proper operation.
5. Provide Woodwork Institute certification and inspection of all new cabinetry.

B. Related Sections include the following:

1. Division 05 Section “Metal Fabrications” for metal supports for installing woodwork.
2. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
3. Division 08 Section “Glazing” for glass counters, shelves, panels and accessories in architectural woodwork.

C. Cabinet Locks:

1. Provide locking hardware for cabinetry doors and drawers as indicated by the schedule at the end of the section.

1.2 REFERENCES

A. California Title 17 Division 3 Subchapter 7.5 Air Bourne Toxic Control Measures, Section 93120.1 through 93120.12.

B. SCAQMD – South Coast Air Quality Management District Regulations Rule 1168 Adhesive and Sealant Applications.

C. SJVAPCD – San Joaquin Valley Air Pollution Control District regulations.

D. FSC – Forest Stewardship Council Principles and Criteria.

E. Green Seal Standard GS-36, Commercial Adhesives.

F. CHPS Low-emitting Materials list (http://ww.chps.net/manual/lem_table.htm).

G. Greenguard Children and Schools(http://www.greenguard.org/).

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including hardwood veneers, cabinet hardware and accessories and finishing materials and processes.

B. Product Data: For wood-veneer-faced plywood, adhesive for bonding veneer, cabinet hardware and accessories, and finishing materials and processes.

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

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, electrical devices and other items installed in architectural woodwork.
3. Apply WI-certified compliance label to first page of Shop Drawings.

D. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. Shop-applied opaque finishes.
3. Solid surface countertops.
4. Hardwood edge material.

E. Samples for Verification:

1. Lumber and panel products with shop-applied opaque finish, min. 12” long x width of material for lumber and 8 by 10 inches for panels, for each finish system and color, with 1/2 of exposed surface finished.
2. Pre-finished wood veneer, 8 by 10 inches, for each type, color, pattern, and surface finish, with 2 samples (one for District approval) applied to core material with specified edge material applied to 1 edge.

F. Product Certificates: For each type of product, signed by product manufacturer.

G. Woodwork Quality Standard Compliance Certificates: WI-certified compliance certificates.

H. Qualification Data: For fabricator.

1.5 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 licensee of WI's Certified Compliance Program.

B. Installer Qualifications: Fabricator of products Licensee of WI's Certified Compliance Program.

C. Quality Standard: Unless otherwise indicated, comply with WI's "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide WI-certified compliance labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified. Provide shop preliminary inspection prior to delivery and in-place inspection following installation. Contractor shall pay all WI inspection/certification fees including follow-up of deficiencies.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish: Provide AA white maple, plain sliced and of uniform color and grain pattern, or other equivalent species/grade as selected by Architect.

C. Wood Species for Opaque Finish: Any closed-grain hardwood.

D. Wood Products: Comply with the following:

1. Hardboard: AHA A135.4.
2. Softwood Plywood: DOC PS 1.

3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde. Use white maple ¾" plywood, classic core with white cabinet liner or melamine at concealed interior faces.
4. Cabinet box construction shall be dado and glued joints, with bases. Use white maple FAS hardwood for face frames.
5. Drawer sides and backs shall be minimum ½" 7-9 ply Baltic Birch plywood ¾" 12 ply for drawers more than 20" wide.
6. Doors shall be ¾" white maple classic core with white maple edge banding on four sides.

E. Cabinet Finish: Premium factory finish with a minimum of one coat sanding, sealer and 3 coats non-yellowing water based lacquer.

F. Solid Surface Counters and Facing: Cut, formed, built-up and machined to shapes and dimensions indicated in drawings and in accordance with manufacturer's recommendations.

1. Dupont Corian with minimum 12 mm thick countertops, minimum 4 inch high backsplashes and thickened edges as indicated with 1/8" radius corners.
2. Color: Fossil or other equal priced color as selected by Architect.

G. Glass counters, supports, shelving and related accessories, attachments etc. as indicated: Provided by Division 8 Section, Glazing. Coordinate for fit and attachment.

2.2 CABINET HARDWARE AND ACCESSORIES

A. Provide hardware as indicated on the Drawings and as listed in the Architectural Woodwork Standards, but no less than the following: (all hardware, where exposed to view) must be finished in a Brushed Chrome (Verify prior to ordering) uniform finish.

1. Adjustable shelf standards and supports: Flush mounted

a. Knape and Vogt/No. 255 with No. 256 supports.

2. Cabinet Hinges: Minimum 160° opening.

a. Rockford Process Control (RPC) or approved equal/5 Knuckle Hinges of wrap-around or overlay/specialty configuration to suit conditions for minimal exposure as approved by Owner. Let-in hinges to achieve uniform 1/8 inch maximum reveals.

3. Cabinet Pulls: Wire type, 4" center to center, Brushed Chrome.

a. Baldwin Hardware manufacturing Corp./No. 4674
b. Stanley hardware/No. 448 4"
c. The Engineered Products Co./No. MX-4024

4. Drawer Slides: 22" Full extension, minimum 100 lb. capacity type with ball bearing steel rollers.

a. Grant Hardware Co./No. 529
b. Accuride 3832 (3834 at file drawers) – preferred product.

5. Drawer Locks:

    a. Door and drawer locks shall be Olympus #500DR CCL and 600 DW CCL respectively.

6. Elbow Catches for inactive door at pair:

    a. Bradley Co. No. 2a-92 Ives A10

7. Chain Bolts:

    a. Stanley 1055 3”

8. Flipper Door Slide: Install with appropriate bumpers and bearings so as door is not adversely affected by operation nor does the hardware contact the face of the door.

    a. Grant #513
    b. Accuride #113 – preferred product, or approved equal.

9. Label holders (if specified)

    a. Brainerd 0736 – B.P.

10. Lock number tag

    a. MCS 89602

11. Wardrobe Hanger Rod

    a. Hettich oval 2mm x 15mm nickel plated w/009-033 sockets injection molded Plastic Cable Grommet (hole cover) Hafele America Co./No 429-99 series 40mm with outer ring and cover other as available.

B. Grommets for Cable Passage through Countertops: 2-3/8” OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

    1. Product: Subject to compliance with requirements, provide "OG series" by Doug Mockett & Company, Inc.

C. Exposed Hardware Finishes: Brushed Chrome unless indicated to match other existing hardware and finishes (verify).

D. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors. Attach casework to walls using #14 wood screws that penetrates 2" minimum into wall framing or backing.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) or other latest adopted regulations:

1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard at hardwood veneer cabinets and at shelving and other casework with visible/open interiors.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
3. Casework shall be assembled using confirmat screws in addition to WI required dados, joinery and glue.

D. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish and waterproof sealant.

2.5 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Premium.

B. Wood Species and Cut: Match adjacent casework.

C. For trim items wider than available lumber, use veneered construction. Do not glue for width.

D. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

E. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.

2.6 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Grade: Custom.

B. Wood Species: Any closed-grain hardwood.

C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

D. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.

2.7 CLOSET AND UTILITY SHELVING

A. Grade: Custom.

B. Shelf Material: Full 1-inch thermoset decorative panel with PVC or polyester edge banding on plywood (no particle board).

C. Cleats: 3/4-inch thermoset decorative panel.

D. Opaque Finish:

1. Grade: Custom.
2. WI Finish System 2: Water-reducible acrylic lacquer.
3. Color: As selected by Architect from manufacturer's full range.
3. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

2.8 HARDWOOD CABINETS & COMPONENTS

A. Grade: Premium: WI Construction: Flush overlay, style A, Type 1.

B. All library stacks shelving and other cabinet shelving more than 26” wide shall be full 1” thick hardwood veneer faced plywood.

C. Provide premium factory finish as indicated in Contract Documents for field applied transparent finish in accordance with Division 9 Section “Painting” and in compliance with WI requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Stagger joints in adjacent and related standing and running trim.
2. Cope at returns and miter at corner to produce tight-fitting joints with full surface contact throughout length of joint.
3. Use scarf joints for end to end joints.
4. Match color and grain pattern across joints.
5. Install trim after gypsum board joint-finishing operations are completed.
6. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads and fill holes with wood putty matching wood surface, and sand smooth.
7. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
8. Install wall railings on indicated metal brackets securely fastened to wall framing.
9. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, within 3” of cabinet ends and not more than 12 inches o.c. with No. 14 wafer-head screws sized for 1-inch penetration min. 16 GA. Steel strapping or 1-1/2-inch penetration into wood framing, blocking, or hanging strips. Anchors into concrete walls/curbs/floors shall be 3/8” dia. Hilt6i Kwick Bolt TZ or Simpson Strong-Bolt 2 expansion bolts with 2” embedment.,

H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Supplement with construction adhesive approved by manufacturer of solid surface top.

1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
3. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

I. Miscellaneous: Existing laminates to be covered with new laminate shall be roughed (80 grit) and cleaned before installation of new laminate.

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

K. Refer to Division 09 Sections for final finishing of installed architectural woodwork not indicated to be shop finished.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.4 CABINET LOCK SCHEDULE:

A. Provide locks at doors and drawers as described elsewhere in this section at the following locations (verify specific door/drawers w/Owner):

Provide locks at all doors and drawers in every new cabinet provided throughout entire project. At double doors, provide one leaf with a lock and the other leaf with a finger catch.

B. All cabinet locks within a room shall be keyed alike unless noted otherwise.

END OF SECTION 064023

SECTION 066400 - PLASTIC PANELING

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 glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

1.3 ACTION SUBMITTALS

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

B. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.
3. Testing Agency: UL.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC SHEET PANELING FRP-1

A. General: FRP-1 Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319. For use in Falculty unisex restrooms, kitchen and other locations where scheduled or indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Marlite; Artizan FRP (for use at kitchen and single use restrooms) or comparable product by one of the following:

a. Crane Composites
b. Kemlite Company Inc.
c. Nudo Products, Inc.

2. Nominal Thickness: Not less than 0.09 inch.
3. Surface Finish: Molded pebble texture.
4. Color: As selected by Architect from manufacturer's full range..
5. Nominal Thickness: Not less than 0.09 inch.
6. Surface Finish: Smooth.
7. Color: As selected from manufacturers full range of colors and lecturers.

2.2 PLASTIC SHEET PANELING FRP-2

A. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319. For use at Janitors rooms and utility spaces where scheduled.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Marlite; Standard FRP (for use at janitors closets) or comparable product by one of the following:

a. Crane Composites
b. Kemlite Company Inc.
c. Nudo Products, Inc.

2. Nominal Thickness: Not less than 0.09 inch.
3. Surface Finish: Molded pebble texture.
4. Color: As selected by Architect from manufacturer's full range..
5. Nominal Thickness: Not less than 0.09 inch.
6. Surface Finish: Molded pebble texture.
7. Color: As selected from manufacturers full range of colors and textures.

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Adhesive: As recommended by plastic paneling manufacturer.

1. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.

C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.

1. Mark plumb lines on substrate at panel joint locations for accurate installation.
2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive and staples. Do not fasten through panels.

D. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant. Use food grade silicon sealant at kitchen.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

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. Modified bituminous sheet waterproofing at retaining walls, raised planter walls and similar conditions at and below finished grade.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

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

1.6 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil-thick, polyethylene-film reinforcement, and with release liner on adhesive side.

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. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
b. Grace, W. R., & Co. - Conn.; or Bituthene 4000.
c. Henry Company; Blueskin WP 100/200.
d. Meadows, W. R., Inc.; SealTight Mel-Rol.
e. Protecto Wrap Company; PW 100/60.
f. Tamko Building Products, Inc.; TW-60.

2. Physical Properties:

a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
g. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.

3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

B. Mastic, Adhesives, and Detail Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.

1. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

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

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

D. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of.

E. Bridge and cover isolation joints expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.

F. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:

a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.

G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.

E. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

F. Seal edges of sheet-waterproofing terminations with mastic.

G. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

I. Immediately install protection course with butted joints over waterproofing membrane.

3.4 PROTECTION, REPAIR, AND CLEANING

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071326

SECTION 071900 - WATER 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 film-forming water-repellent treatments for the following vertical and horizontal surfaces not indicated or specified in other sections to receive water repelling sealers, paint or other coatings:

1. Concrete unit masonry.
2. Portland cement plaster (stucco).
3. Exposed concrete walls.

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 on manufacturer's standard substrate assemblies representing those indicated for this Project.

B. Water Absorption: Minimum 80 percent reduction of water absorption after 24 hours in comparison of treated and untreated specimens.

1. Concrete Masonry Units: ASTM C 140.
2. Clay Brick: ASTM C 67.
3. Portland Cement Plaster (Stucco): ASTM D 6532.

C. Water-Vapor Transmission: Comply with one or both of the following:

1. Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, according to ASTM E 96/E 96M.
2. Minimum 80 percent water-vapor transmission in comparison of treated and untreated specimens, according to ASTM D 1653.

D. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, according to ASTM E 514.

E. Durability: Maximum 5 percent loss of water-repellent properties after 2500 hours of weathering according to ASTM G 154 in comparison to water-repellent-treated specimens before weathering.

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. Preconstruction Testing Reports: For water-repellent-treated substrates.

D. Field quality-control reports.

E. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

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 and below 100 deg F and will remain so for 24 hours.
4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
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 REPELLENTS

A. Siloxane, or Silane/Siloxane-Blend Penetrating Water Repellent: Clear, containing **10** percent or more solids of oligomerous alkylalkoxysiloxanes; with water as carrier; and with 50 g/L or less of VOCs.

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. Chemical Products Industries, Inc.; CP-500W.
b. ChemMasters; Aquanil Plus WB.
c. Dayton Superior Corporation; Weather Worker WB (J-26-WB).
d. Euclid Chemical Company (The), an RPM company; Euco-Guard VOX.
e. Rainguard Products Company; MicroSeal.
f. Specco Industries, Inc.; Waterstopper S-10 WB Siloxane.
g. Tamms Industries, Inc., Euclid Chemical Company (The); Baracade M.E.

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. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
3. 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. [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.

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 15 psi-pressure spray with a fan-type spray nozzle, roller or brush 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.

C. 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 072100 - THERMAL INSULATION

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. Extruded polystyrene foam-plastic board.
2. Glass-fiber blanket.
3. Mineral-wool blanket.

B. Related Requirements:

1. Section 075423 “Thermoplastic Polyolefin Roofing” for rigid thermal insulation installed with roofing system.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.

B. Extruded Polystyrene Board, Type IV, XPS-1: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

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. DiversiFoam Products.
    b. kingston Insulation.
    c. Owens Corning.

2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.3 MINERAL-WOOL BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Fibrex Insulations Inc.
2. Owens Corning.
3. Roxul Inc.
4. Thermafiber.

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

2.4 VAPOR RETARDERS

A. Reinforced-Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft., with maximum permeance rating of 0.0507 perm.

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. Raven Industries Inc.; DURA-SKRIM 6WW.
b. Reef Industries, Inc.; Griffolyn T-65.

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

C. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

2.5 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

2.6 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

1. Products: Subject to compliance with requirementsavailable products that may be incorporated into the Work include, but are not limited to, the following:

a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
b. Gemco; Spindle Type.

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. AGM Industries, Inc.; RC150
b. Gemco; R-150

2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:

    a. Ceiling plenums.
    b. Attic spaces.

C. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 inch between face of insulation and substrate to which anchor is attached.

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. Gemco; Clutch Clip.

D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

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. AGM Industries, Inc.; TACTOO Adhesive.
    b. Gemco; Tuff Bond Hanger Adhesive.

E. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:

    a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072500 - WEATHER BARRIERS

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. Weather barrier membrane.
2. Seam tape.
3. Membrane flashing (straight, flexible and thru-wall).
4. Fasteners (with caps).

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing joint and penetration treatment.
2. Section 076200 “Sheet Metal Flashing and Trim” for metal flashing to be installed at openings in addition to weather barrier.
3. Section 092400 “Portland Cement Plastering” for additional water resistant membranes over weather barrier as part of the cement plaster assembly.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures.

B. Product Data: Submit manufacturer current technical literature for each component.

C. Samples: Weather Barrier Membrane, minimum 8-1/2 inches by 11 inch.

D. Quality Assurance Submittals

1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
2. Manufacturer Instructions: Provide manufacturer’s written installation instructions.
3. Manufacturer’s Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier assembly installation.

E. Closeout Submittals

1. Refer to Section 017800 Closeout Submittals.
2. Weather Barrier Warranty: Manufacturer’s executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.4 QUALITY ASSURANCE

A. Qualifications

1. Installer shall have experience with installation of weather barrier assemblies under similar conditions.
2. Installation shall be in accordance with weather barrier manufacturer's installation guidelines and recommendations.
3. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

B. Mock-up

1. Install mock-up using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer's current printed instructions and recommendations.

    a. Mock-up size: 10 feet by 10 feet minimum.
    b. Mock-up Substrate: Match wall assembly construction, including window opening (head jamb and sill).
    c. Mock-up may remain as part of the work.

2. Contact manufacturer's designated representative prior to weather barrier assembly installation, to perform required mock-up visual inspection and analysis as required for warranty.

C. Pre-installation Meeting

1. Refer to Section 01 31 00 Project Management and Coordination.
2. Hold a pre-installation conference, two weeks prior to start of weather barrier installation. Attendees shall include Contractor, Architect, Consultant, Installer, Owner's Representative, and Weather Barrier Manufacturer's Designated Representative.
3. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.5 WARRANTY

A. Refer to Section 01 60 00 Product Requirements for Special Warranties.

B. Special Warranty

1. Special weather-barrier manufacturer's warranty for weather barrier for a period of ten (10) years from date of final weather barrier installation.
2. Pre-installation meetings and jobsite observations by weather barrier manufacturer for warranty is required prior to assembly installation.
3. Warranty Areas: All walls and wall openings/penetrations where weather barrier is to be installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Basis of Design: spunbonded polyolefin, non-woven, non-perforated, weather barrier is based upon DuPont™ Tyvek® CommercialWrap® and related assembly components. Other manufacturers who may have acceptable products, subject to pre-bid substitution request to demonstrate compliance with requirements include the following:

1. Raven Industries Inc.; Fortress Pro
2. Reemay, Inc.; Typar Building Wrap

B. Performance Characteristics:

1. Air Penetration: 0.001 cfm/ft^2 at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677. ≤0.04 cfm/ft^2 at 75 Pa, when tested in accordance with ASTM E2357.
2. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
3. Water Penetration Resistance: Minimum 280 cm when tested in accordance with AATCC Test Method 127.
4. Basis Weight: Minimum 2.7 oz/yd^2, when tested in accordance with TAPPI Test Method T-410.
5. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
6. Tensile Strength: Minimum 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
7. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: 10, Smoke Developed: 10.

2.2 ACCESSORIES

A. Seam Tape: 3 inch wide tape for commercial applications.

B. Fasteners:

1. To Steel Framing: Manufacturers 1-5/8 inch rust resistant screw with 2-inch diameter plastic cap or manufacturer approved 1-1/4” or 2” metal gasketed washer for attachement of membrane to metal framing.
2. To Wood Framing: #4 nails with large 1-inch plastic cap fasteners, or 1-inch plastic cap staples with leg length sufficient to achieve a minimum penetration of 5/8-inch into the wood stud, or other fastener as approved by manufacturer.

C. Sealants

1. Provide sealants that comply with ASTM C920, elastomeric polymer sealant to maintain watertight conditions.
2. Products: Sealants recommended by the weather barrier manufacturer.

D. Adhesives:

1. Provide adhesive recommended by weather barrier manufacturer.
2. Products:

a. Liquid Nails LN-109
b. Denso Butyl Liquid
c. 3M High Strength 90
d. SIA 655
e. Adhesives recommended by the weather barrier manufacturer.

E. Primers:

1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.

F. Flashing

1. Flexible membrane flashing materials for window openings and penetrations recommended by manufacturer.
2. Straight flashing membrane materials for flashing windows and doors and sealing penetrations such as masonry ties, etc. recommended by manufacturer.
3. Thru-Wall flashing membrane materials for flashing at changes in direction or elevation (shelf angles, foundations, etc.) and at transitions between different assembly materials as recommended by manufacturer.
4. Preformed Inside and Outside Corners and End Dams per manufacturers recommendations: Preformed three-dimensional shapes to complete the flashing system used in conjunction with Thru-Wall Flashing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.2 INSTALLATION – WEATHER BARRIER

A. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.

B. Install weather barrier prior to installation of windows and doors.

C. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.

D. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain weather barrier plumb and level.

E. Sill Plate Interface: Extend lower edge of weather barrier over sill plate interface 3-6 inches. Secure to foundation with elastomeric sealant as recommended by weather barrier manufacturer.

F. Window and Door Openings: Extend weather barrier completely over openings.

G. Overlap weather barrier

1. Exterior corners: minimum 12 inches.
2. Seams: minimum 6 inches.

H. Weather Barrier Attachment:

1. Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommend fasteners, space 12-18 inches vertically on center along stud line, and 24 inch on center, maximum horizontally.

I. Apply 4 inch by 7 inch piece of straight flashing or weather barrier manufacturer approved alternate to weather barrier membrane prior to installing cladding anchors.

3.3 SEAMING

A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.

B. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.4 OPENING PREPARATION (for use with non-flanged windows - all cladding types)

A. Flush cut weather barrier at edge of sheathing around full perimeter of opening.

B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.5 FLASHING (for use with non-flanged windows - all cladding types)

A. Cut 9 inch wide flexible wrap a minimum of 12 inches longer than width of sill rough opening. Apply primer as required by manufacturer.

B. Cover horizontal sill by aligning flexible wrap edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.

C. Fan flexible wrap at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.

D. Apply 9-inch wide strips of straight flashing at jambs. Align flashing with interior edge of jamb framing. Start straight flashing at head of opening and lap sill flashing down to the sill.

E. Spray-apply primer to top 6 inches of jambs and exposed sheathing.

F. Install flexible wrap at opening head using same installation procedures used at sill. Overlap jamb flashing a minimum of 2 inches.

G. Coordinate flashing with window installation.

H. On exterior, install backer-rod in joint between window frame and flashed rough framing. Apply sealant at jambs and head, leaving sill unsealed. Apply sealants in accordance with sealant manufacturer's instructions and ASTM C1193.

I. Position weather barrier head flap across head flashing. Adhere using 4-inch wide straight flashing over the 45-degree seams.

J. Tape top of window in accordance with manufacturer recommendations.

K. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C1193.

3.6 OPENING PREPARATION (for use with flanged windows)

A. Cut weather barrier in an "I-cut" pattern. A modified I-cut is also acceptable.

1. Cut weather barrier horizontally along the bottom and top of the window opening.
2. From the top center of the window opening, cut weather barrier vertically down to the sill.
3. Fold side and bottom weather barrier flaps into window opening and fasten.

B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.7 FLASHING (for use with flanged windows)

A. Cut 9-inch wide flexible wrap a minimum of 12 inches longer than width of sill rough opening.

B. Cover horizontal sill by aligning flexible wrap edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.

C. Fan flexible wrap at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.

D. On exterior, apply continuous bead of sealant to wall or backside of window mounting flange across jambs and head. Do not apply sealant across sill.

E. Install window according to manufacturer's instructions.

F. Apply 4-inch wide strips of straight flashing at jambs overlapping entire mounting flange. Extend jamb flashing 1-inch above top of rough opening and below bottom edge of sill flashing.

G. Apply 4-inch wide strip of straight flashing as head flashing overlapping the mounting flange. Head flashing should extend beyond outside edges of both jamb flashings.

H. Position weather barrier head flap across head flashing. Adhere using 4-inch wide straight flashing over the 45-degree seams.

I. Tape head flap in accordance with manufacturer recommendations.

J. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C 1193.

3.8 THRU-WALL FLASHING INSTALLATION

A. Apply primer per manufacturer's written instructions.

B. Install preformed corners and end dams bedded in sealant in appropriate locations along wall.

C. Starting at a corner, remove release sheet and apply membrane to primed surfaces in lengths of 8 to 10 feet.

D. Extend membrane through wall and leave ¼ inch minimum exposed to form drip edge.

E. Roll flashing into place. Ensure continuous and direct contact with substrate.

F. Lap ends and overlap preformed corners 4 inches minimum. Seal all laps with sealant.

G. Trim exterior edge of membrane 1-inch and secure metal drip edge per manufacturer's written instructions, typical where indicated for sheet metal head flashing at windows, doors and similar openings.

H. Apply sealant bead at each termination.

3.9 THRU-WALL FLASHING / WEATHER BARRIER INTERFACE AT BASE OF WALL

A. Overlap thru-wall flashing with weather barrier by 6-inches.

B. Mechanically fasten bottom of weather barrier through top of thru-wall flashing.

C. Seal vertical and horizontal seams with tape or sealing membrane.

3.10 THRU-WALL FLASHING / WEATHER BARRIER INTERFACE AT SHELF ANGLE

A. Seal weather barrier to bottom of shelf angle with sealing membrane.

B. Apply thru-wall flashing to top of shelf angle. Overlap thru-wall flashing with weather barrier by 6-inches.

C. Seal bottom of weather barrier to thru-wall flashing with tape or sealing membrane.

3.11 THRU-WALL FLASHING / WEATHER BARRIER INTERFACE AT WINDOW HEAD

A. Cut flap in weather barrier at window head.

B. Prime exposed sheathing.

C. Install lintel as required. Verify end dams extend 4 inches minimum beyond opening.

D. Install end dams bedded in sealant.

E. Adhere 2 inches minimum thru-wall flashing to wall sheathing. Overlap lintel with thru-wall flashing and extend ¼ inch minimum beyond outside edge of lintel to form drip edge.

F. Apply sealant along thru-wall flashing edges.

G. Fold weather barrier flap back into place and tape bottom edge to thru-wall flashing.

H. Tape diagonal cuts of weather barrier.

I. Secure weather barrier flap with fasteners.

3.12 FIELD QUALITY CONTROL

A. Notify manufacturer's designated representative to obtain required periodic observations of weather barrier assembly installation.

3.13 PROTECTION

A. Protect installed weather barrier from damage.

END OF SECTION 072500

SECTION 074113 - METAL ROOF PANELS

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. Standing-seam metal roof panels and vertical wall panels.
2. Underlayment, slip sheet, self-adhering membrane and all related flashing and accessories.

B. Related Sections:

1. Section 061600 "Sheathing" for plywood roof deck supporting metal roof panels
2. Section 076200 "Sheet Metal Flashing and Trim" for field-formed fasciae, copings, flashings, roof drainage systems, and other sheet metal work not part of metal roof and wall panel assemblies.
3. Section 079200 "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.3 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Air Infiltration: Air leakage through assembly of not more than 0.02 cfm per linear foot of joint when tested in accordance with ASTM E 283 at static test pressure differential of 20.0 psf

C. Water Penetration Under Static Pressure: No leakage through panel joints when tested in accordance with ASTM E 331 at static pressure differential of 25.0 psf.

D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90. For wind uplift, see detail 2/S1.01.
2. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Energy Performance: Provide roof panels with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:

a. Flashing and trim.
b. Gutters.
c. Downspouts.

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

1. Metal Roof Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal roof panel accessories.
2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch-long Samples for each type of accessory.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

C. Field quality-control reports.

D. Warranties: Samples of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal roof panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of metal roof panels from single source from single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, metal roof panel Installer, metal roof panel manufacturer's representative, deck Installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal roof panel installation, including manufacturer's written instructions.
4. Examine deck substrate purlin and rafter conditions for compliance with requirements, including flatness and attachment to structural members.
5. Review structural loading limitations of deck purlins and rafters during and after roofing.
6. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
8. Review temporary protection requirements for metal roof panel assembly during and after installation.
9. Review roof observation and repair procedures after metal roof panel installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.11 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal roof panels with rain drainage work, flashing, trim, and construction of decks, purlins and rafters, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 25 years from date of Substantial Completion.

C. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; structural quality.

2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40; structural quality.
3. Surface: Smooth, flat finish.
4. Exposed Coil-Coated Finish:

    a. 3-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

5. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 UNDERLAYMENT MATERIALS

A. Felt Underlayment: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

C. Self-adhering Peel & Stick Membrane: Grace Ultra, RUFTAK by Henry Co. or ST40 by MB Technology applied to vertical sheathing under wall panels.

2.3 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and snapping panels together.

1. Basis-of-Design Product: Subject to compliance with requirements, provide AEP Span, Select Seam Narrow Batten 18 inch or comparable product by one of the following:

a. Architectural Building Components.
b. CENTRIA Architectural Systems.
c. Fabral.
d. IMETCO.
e. Integris Metals.
f. Merchant & Evans.
g. Metal-Fab Manufacturing, LLC.
h. Metal Sales Manufacturing Corporation.
i. Petersen Aluminum Corporation.
j. Ultra Seam Incorporated.

2. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (24 gage) nominal thickness, except where thicker/heavier gage material is indicated in drawings.

a. Exterior Finish: 3-coat fluoropolymer.
b. Color: As selected by Architect from manufacturer's full range.

2.5 ACCESSORIES

A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fascia, hanging gutters, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from same material as roof panels, prepainted with coil coating, minimum 0.018 inch thick. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

C. Gutters: Formed from same material as roof panels. Match profile indicated in drawings, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.

D. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot-long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual". Finish downspouts to match gutters.

2.6 FABRICATION

A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly. Provide minimum 24 gage pre-finished sheet metal for miscellaneous trim/flashing and minimum 18 gage for gutters, downspouts and similar larger components.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. End Seams for Other Than Aluminum: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

6. Provide 3 surface screw fasteners at top of each vertical wall panel, covered by flashing above, and interlock with bottom flashing for support of lower edge.

2.7 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.

B. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

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

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Ensure deck fasteners are set tight and flush with deck surface, with no protrusions that could damage underlayment.

3.3 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Apply at locations indicated below, in shingle fashion to shed water, and with lapped joints of not less than 2 inches.

1. Apply over entire roof surface.

B. Apply slip sheet over underlayment before installing metal roof panels.

C. Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

D. Seal edges of roof deck area with peel & stick self-adhering membrane straps that are a minimum of 8” wide.

3.4 METAL ROOF PANEL INSTALLATION, GENERAL

A. Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

B. Thermal Movement. Rigidly fasten metal roof panels to structure at one and only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction. Predrill panels for fasteners.

1. Point of Fixity: Fasten each panel along a single line of fixing located at ridge center of panel length locations indicated on Drawings Insert location.
2. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.

C. Install metal roof panels as follows:

1. Commence metal roof panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative. Install vertical wall panels first and locate ribs to align with roof panel ribs above.
2. Field cutting of metal panels by torch is not permitted.
3. Locate and space fastenings in uniform vertical and horizontal alignment.
4. Provide metal closures at rake edges rake walls and each side of ridge and hip caps.
5. Flash and seal metal roof panels with weather closures at eaves, rakes, and perimeter of all openings.
6. Install ridge and hip caps as metal roof panel work proceeds.
7. Install metal flashing to allow moisture to run over and off metal roof panels.

D. Fasteners:

1. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized-steel fasteners for surfaces exposed to the interior.

E. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

F. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.

G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

1. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

A. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

B. Standing-seam Metal Wall Panels: Install similar to roof panels except with 3 fasteners at top, anchor clips toward bottom and with flashing to conceal top fasteners and to interlock with panels for bottom support. Install over self-adhering membrane over plywood substrate.

3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with continuous flanges or gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

3.7 ERECTION TOLERANCES

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

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113

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 TPO membrane roofing system.
2. Adhered TPO walkway traffic pads.
3. Roof insulation, including tapered insulation at crickets.
4. Cover board.
5. All fasteners and accessories.

B. Related Sections:

1. Section 05 31 10 “Steel Decking” for steel deck substrate below roofing system.
2. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 06 16 00 “Sheathing” for wood roof deck substrate below roofing system.
4. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
5. Section 07 92 00 "Sealants" for joint sealants, joint fillers, and joint preparation.

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 per detail 2/S1.01, 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. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

D. Energy Performance: Provide roofing system with initial solar reflectance not less than and emissivity not less than 0.75 when tested according to CRRC-1.

1.5 ACTION 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.

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.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer.

B. 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.

C. 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.

D. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.

E. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.

B. Source Limitations: Obtain components including roof insulation fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

C. 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.

D. 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.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, 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.

1.10 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.

1.11 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, roofing accessories, and other components of membrane roofing system.
2. Warranty Period: 20 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 fabric backed TPO sheet.

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. Carlisle SynTec Incorporated.
b. Custom Seal Roofing.
c. Firestone Building Products Company.
d. GAF Materials Corporation.
e. GenFlex Roofing Systems.
f. Johns Manville.
g. Mule-Hide Products Co., Inc.
h. Stevens Roofing Systems; Division of JPS Elastomerics.

2. Thickness: 60 mils, 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. Multipurpose Construction Adhesives: 70 g/L.
c. Fiberglass Adhesives: 80 g/L.
d. Single-Ply Roof Membrane Adhesives: 250 g/L.
e. Other Adhesives: 250 g/L.
f. Single-Ply Roof Membrane Sealants: 450 g/L.
g. Nonmembrane Roof Sealants: 300 g/L.
h. Sealant Primers for Nonporous Substrates: 250 g/L.

i. Sealant Primers for Porous Substrates: 775 g/L.

3. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils thick, minimum, of same color as sheet membrane.

C. Bonding Adhesive: Manufacturer's standard, water based.

D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

E. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

F. 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.

G. 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 Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum cover board, 1/2 inch thick.

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 Prime.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate cover board to roof 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 I, Grade 3, felt or glass-fiber mat facer on both major surfaces.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/2 inch per 12 inches unless otherwise indicated.

D. 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.

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.

2.6 WA LKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway rolls, approximately 80 mil thick, and acceptable to membrane roofing system manufacturer.

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. Carlisle SynTec Incorporated.
    b. Custom Seal Roofing.
    c. Firestone Building Products Company.
    d. GAF Materials Corporation.
    e. GenFlex Roofing Systems.
    f. Johns Manville.
    g. Mule-Hide Products Co., Inc.
    h. Stevens Roofing Systems; Division of JPS Elastomerics.

2. Thickness: 80 mils, nominal.
3. Exposed Face Color: Gray.

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.

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 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 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches 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 with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
2. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together.

1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.4 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane 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 membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane 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 membrane.
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 does not comply with requirements.

H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

3.5 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions. Where possible within manufacturers guidelines, install base flashing up and over top of parapet walls.

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. Utilize battens to securely anchor top edge of lower sheet at intermediate horizontal seam laps as recommended by manufacturer.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars, except where base flashing can be installed up and over top of parapet walls, in accordance with manufacturer’s recommendations.

3.6 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work 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.

END OF SECTION 075423

SECTION 076200 - SHEET METAL 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. Counterflashing for Manufactured reglets specified in Section “09 24 00 Cement Plastering”.
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.
4. Formed steep-slope roof sheet metal fabrications.
5. Formed wall sheet metal fabrications.
6. Formed equipment support flashing.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 072500 “Weather barriers” for sheet metal drips and flashings to be installed in conjunction with weather barrier assembly.
3. Section 074113 “Metal Roof Panels” for prefinished sheet metal trim and flashing indicated to be provided by metal roof panel installer.
4. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing, weather barrier, wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

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

1. Include plans, elevations, sections, and attachment details.

2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes, including those indicated to match prefinished metal roof panel color.

D. Samples for Verification: For each type of exposed finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.8 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 extent necessary for period of sheet metal flashing and trim installation.

1.9 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, 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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings tested according to SPRI ES-1 and capable of resisting the following design pressure:

1. Design Pressure110 MPH.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

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

B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755.

1. Surface: Smooth, flat and mill phosphatized for field painting steel not factory finished.
2. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on both sides for factory finished sheet metal..

3. Exposed Coil-Coated Finish:

    a. Three-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.

4. Color: As selected by Architect from manufacturer's full range.
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners**,** solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

    a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
    c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Zinc-Coated (Galvanized) and Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329.

C. Solder:

1. 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 with maximum lead content of 0.2 percent.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; 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 according to ASTM D 1187.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

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

1. Material: Galvanized steel, 0.022 inch (26 ga.) thick, minimum as indicated in drawings.
2. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
3. Accessories:

    a. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.

4. Finish: With manufacturer's standard color coating.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. 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 to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

H. Do not use graphite pencils to mark metal surfaces.

2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners**.**

1. Gutter Profile: Style B according to cited sheet metal standard, unless otherwise indicated in drawings.
2. Expansion Joints: Lap type, welded water tight.
3. Accessories: Wire-ball downspout strainer.
4. Gutters with Girth up to 15 Inches: Fabricate from the following materials:

    a. Galvanized Steel: 0.052 inch (18 ga.) thick.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

1. Fabricated Hanger Style: Fig 1-35A according to SMACNA's "Architectural Sheet Metal Manual."
2. Fabricate from the following materials:

    a. Galvanized Steel: 0.052 inch (18 ga.) thick.

C. Splash Pans: Fabricate to dimensions and shape required and from the following materials:

1. Zinc: 0.032 inch (20 ga.) thick.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, solder or weld watertight. Shop fabricate interior and exterior corners.

1. Coping Profile: Fig 3-4B according to SMACNA's "Architectural Sheet Metal Manual."
2. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate.
3. Fabricate from the Following Materials:

    a. Galvanized Steel: 0.040 inch (20 GA,) thick.

B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (24 GA,) thick.

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (24 ga.) thick.

D. Flashing Receivers: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (24 ga.) thick.

2.9 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Drip Edges: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (24 GA.) thick.

B. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (24 ga.) thick.

C. Flashing Receivers: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (24 GA.) thick.

2.10 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.034 inch (22 ga.) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, 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.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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

3.2 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

B. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners**,** solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, 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.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not use torches for soldering.
2. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters: Join sections with joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Anchor and loosely lock back edge of gutter to continuous cleat.
3. Anchor back of gutter that extends onto roof deck with continuous flange or cleats spaced not more than 36 inches apart.
4. Anchor gutter with straps spaced not more than 36 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.

5. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints.

1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.
2. Provide elbows at base of downspout.

D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in elastomeric sealant compatible with the substrate.

3.5 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
2. Anchor interior leg of coping with continuous cleat anchored to substrate at 24-inch centers.
3. Provide Springlok flashing system below copings to provide positive upward pressure om coping..

C. 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 over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of snap-in installation and sealant unless otherwise indicated.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.6 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Reglets: Installation of reglets is specified in Section 09 24 00 "Portland Cement Plastering."

C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Coordinate with installation of weather barrier membrane and flexible flashing to properly direct moisture to the exterior of wall assemblies.

3.7 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.

3.8 ERECTION TOLERANCES

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

3.9 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof hatches.
2. Hatch-type heat and smoke vents.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 ACTION SUBMITTALS

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

B. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.5 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation.

1. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil. for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Steel Shapes: ASTM A 36, hot-dip galvanized according to ASTM A 123 unless otherwise indicated.

C. Steel Tube: ASTM A 500, round tube.

D. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123.

E. Steel Pipe: ASTM A 53, galvanized.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

D. Underlayment:

1. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.
2. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153 or ASTM F 2329.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

G. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

2.3 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Babcock-Davis BRHPW30X54S1T or comparable product by one of the following:

    a. Bilco Company (The).
    b. Bristolite Skylights.
    c. Custom Solution Roof and Metal Products.
    d. Dur-Red Products.
    e. J. L. Industries, Inc.
    f. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
    g. Nystrom.
    h. O'Keeffe's Inc.

B. Type and Size: Single-leaf lid, 30 by 36 inches, or larger size where indicated in drawings.

C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. internal uplift load.

D. Hatch Material: Zinc-coated (galvanized) steel sheet, 0.079 inch thick.

1. Finish: Baked enamel or powder coat.
2. Color: White.

E. Construction:

1. Insulation: Cellulosic-fiber board.
2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
4. Fabricate curbs to minimum height of 14 inches unless otherwise indicated.

F. Hardware: Galvanized-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with SRCG30X54SG requirements and authorities having jurisdiction.

1. Height: 42 inches above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
8. Fabricate joints exposed to weather to be watertight.
9. Fasteners: Manufacturer's standard, finished to match railing system.
10. Finish: Baked enamel or powder coat.

    a. Color: White.

2.4 HEAT AND SMOKE VENTS

A. Hatch-Type Heat and Smoke Vents: Manufacturer's standard, with double-walled insulated curbs, welded or mechanically fastened and sealed corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-walled lid and continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms and UL-listed fusible links rated at 165 deg F smoke-detection system.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Babcock-Davis Acoustivent smoke vent or comparable product by one of the following:

    a. Bilco Company (The).
    b. Dur-Red Products.
    c. J. L. Industries, Inc.
    d. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
    e. Nystrom.
    f. O'Keeffe's Inc.
    g. Pate Company (The).

2. Type and Size: Double-leaf lid, 48 by 72 inches minimum or larger size indicated in drawings.
3. Loads: Minimum40-lbf/sq. ft. external live load and 30-lbf/sq. ft. internal uplift load.

    a. When release is actuated, lid shall open against 10-lbf/sq. ft snow or wind load and lock in position.

4. Heat and Smoke Vent Standard: Provide units that have been tested and listed to comply with UL 793 and are FM Approved.

5. Curb, Framing, and Lid Material: 14 gage galvaneal.

   a. Finish: .Baked enamel or powder coat**.**
   b. Color: White.

6. Construction:

   a. Insulation: Mineral wool sound batt, R-10.
   b. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
   c. Fabricate curbs to minimum height of **12 inches** unless otherwise indicated.
   d. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant. Equip hatch with water diverter or cricket on side that obstructs water flow.
   e. Security Grille: Provide where indicated.

7. Hardware: Manufacturer's standard, corrosion resistant or hot-dip galvanized; with hinges, hold-open devices, and independent manual-release devices for **inside** operation of lids.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.

3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.

C. Roof-Hatch Installation:

1. Install roof hatch so top surface of hatch curb is level.
2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
3. Attach safety railing system to roof-hatch curb.

D. Heat and Smoke Vent Installation:

1. Install heat and smoke vent so top perimeter surfaces are level.

E. Install and test heat and smoke vents and their components for proper operation according to NFPA 204.Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

B. Clean exposed surfaces according to manufacturer's written instructions.

C. Clean off excess sealants.

END OF SECTION 077200

SECTION 079200- JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Included: Throughout the Work, fill and seal all joints as indicated and as required to provide a positive barrier against passage of air and moisture.

B. Related Work:

1. Section 078413 and 078443 for firestopping of floor, wall, ceiling and joint systems in fire rated assemblies.
2. Section 088000 “Glazing” for sealants used in glazing.

C. Related Documents: Drawings and general provisions of Contract including General and Supplementary conditions and other Division 1 specifications, apply to this Section.

1.2 SUBMITTALS

A. General: Submit the following according to the Conditions of the contract and Division 1 specifIcation Sections.

B. Product Data:

1. Manufacturers Product literature for Sealants.

2. Installation instructions

C. Samples:

1. Provide four manufacturers standard color charts for initial color selection purposes.
2. Provide three cured two inch samples of colors selected for verification of sealant color prior to installation of sealants.

1.3 QUALITY ASSURANCE

A. Qualifications of Manufacturers: Products used in the work of this section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

B. Qualifications of Installers:

1. Proper installation of sealants require that installers be thoroughly trained and experienced in the necessary skills and thoroughly familiar with the specified requirements.

2. For installation of sealants throughout the work, use only personnel who have been specifically trained in such procedures and who are completely familiar with the joint details shown on the drawings and the installation requirements called for in this section.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage: Deliver all materials of this section to the job site in the original unopened containers with all labels intact and legible at time of use. Store only under conditions recommended by the manufacturers. Do not retain on the job site any material which has exceeded the shelf life recommended by its manufacturer.

B. Protection: use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 SEALANTS

A. Use sealant systems as scheduled in this section and identified on the drawings.

B. Colors:

1. Colors for each sealant installation will be selected by the Architect from standard colors normally available from the sealant and caulking manufacturers.
2. In concealed installations, and in partially or fully exposed installations where so approved by the Architect, standard gray or black sealant may be used.

2.2 PRIMERS

A. Use only those primers which are non-staining, have been tested for durability on the surfaces to be sealed, and are specifically recommended for this installation by the manufacturer of the sealant used.

2.3 BACKUP MATERIALS

A. General: Use only those backup materials which are specifically recommended for this installation by the manufacturer of the sealant used, and which are nonabsorbent and nonstaining.

B. Backer Rod: Open or closed cell polyethylene or polyurethane as recommended by sealant manufacturer.

2.4 BOND-PREVENTIVE MATERIALS

A. Use only one of the following as best suited for the application and as recommended by the manufacturer of the sealant used.

1. Polyethylene tape, pressure-sensitive adhesive, with the adhesive required only to hold tape to the construction materials as indicated.

2. Aluminum foil conforming to MIL-SPEC-MIL-A-148E.

3. Wax paper conforming to Fed. Spec. UU-P-270.

2.5 MASKING TAPE: For masking around joints, provide masking tape conforming to Fed. Spec. UU-T-106c.

2.6 OTHER MATERIALS: All other materials, not specifically described, but required for complete and proper calking and installation of sealants, shall be first quality of their respective kinds, new, and as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 INSPECTION

A. Substrate surface shall be inspected to ensure that no bond-breaker materials contaminate the surface to which the sealant is to adhere and to ensure that unsound substrates are repaired. Installation of sealant shall be evidence of acceptance of the substrate.

B. Joint dimensions shall be verified prior to installation of the sealant to ensure that all dimensions are within tolerance established in the manufacture's literature. Unacceptable variations shall be called to the architects attention for resolution prior to installing any material.

3.2 PREPARATION

A. General: Prepare all joints in accordance with manufacturer's recommended instructions to ensure maximum adhesion. Prime as required, protecting all adjacent exposed surfaces.

B. Concrete and Ceramic Tile and Similar Surfaces:

1. All surfaces in contact with sealant shall be dry, sound, and well brushed and wiped free from dust.
2. Use materials acceptable to sealant manufacturer and conforming to local V.O.C. requirements, to remove oil and grease, wiping the surfaces with clean rags.
3. Where surfaces have been treated, remove the surface treatment by sandblasting or wire brushing.
4. Remove all laitance and mortar from the joint cavity.

5. Where backup is required, insert the approved backup material in the joint cavity to the depth required.

C. Steel Surfaces:

1. Steel surfaces in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish, the metal shall be scraped or wire-brushed to remove mill scale.
2. Use materials acceptable to sealant manufacturer complying with local V.O.C. regulations to remove oil and grease, wiping the surfaces with clean rags.
3. Remove protective coatings on steel by sandblasting or by materials that leave no residue.

D. Aluminum Surfaces:

1. Aluminum surfaces in contact with sealant shall be cleaned of temporary protective coatings, dirt, oil, and grease.
2. When masking tape is used for a protective cover, remove the tape, and tape adhesives remaining on Aluminum, just prior to applying the sealant.
3. Use only such materials to remove protective coatings as are recommended for that purpose by the manufacturer of the aluminum work, which are nonstaining and comply with local V.O.C. regulations.

3.3 INSTALLATION OF BACKUP MATERIAL

A. Use only the backup material recommended by the manufacturer of the sealant and approved by the Architect for the particular installation, compressing the backup material 25% to 50% to secure a positive and secure fit. When using backup of tube or rod stock, avoid lengthwise stretching of the material. Do not twist or braid hose or rod backup stock.

3.4 PRIMING

A. Use only the primer recommended by the manufacturer of the sealant and approved by the Architect for the particular installation. Apply the primer in strict accordance with the manufacturer's recommendations as approved by the Architect.

3.5 BOND-BREAKER INSTALLATION

A. Install an approved bond-breaker where recommended by the manufacturer of the sealant and where directed by the Architect, adhering strictly to the installation recommendations as approved by the Architect.

3.6 INSTALLATION OF SEALANTS

A. General: Prior to start of installation in each joint, verify the joint type and verify that the required proportion of width of joint to depth of joint has been secured.

B. Equipment: Apply sealant under pressure with hand or power- actuated gun or other appropriate means. Guns shall have nozzle of proper size and shall provide sufficient pressure to completely fill joints as designed.

C. Masking: Thoroughly and completely mask all joints where the appearance of sealant on adjacent surfaces would be objectionable.

D. Installation of Sealant: Install the sealant in strict accordance with the manufacturer's recommendations as approved by the Architect, thoroughly filling all joints to the recommended depth.

E. Tooling: Tool all joints to the profile shown or as directed by Architect.

F. Cleaning Up:

1. Remove masking tape immediately after joints have been tooled.
2. Clean adjacent surfaces free from sealant as the installation progresses. Use solvent or cleaning agent as recommended by the sealant manufacturer.

3.7 SCHEDULE OF SEALANTS

A. See Appendix #1 for recommended sealant schedule.

B. See Appendix #2 for product descriptions of sealants.

C. All sealants proposed for use shall be reviewed and approved by the manufacturer as to the appropriateness of its application to the designated use. No sealant shall be selected or used for locations or conditions not in compliance with the manufacturer’s recommendations.

APPENDIX #1 - SCHEDULE

Typical joint types and potential movement requirements	Recommended sealant *(See Appendix #2)*
A. Extreme Movement Sealants (+100% or -50% movement capability)	
Vertical/horizontal joint, such as expansion joints, precast planks, and prestressed concrete joints.	S-6
B. Significant Movement Sealants (+25% or -25% movement capability)	
1. Vertical or inclined joints such as panel, coping, expansion, precast planks, and prestressed concrete joints, and sloped pavement.	S-1, 3 or 6
2. Horizontal joints exposed to fuel or gas spillage.	S-10
3. Horizontal joints not exposed to fuel or gas spillage.	S-1, 2, 3, 4, 6 or 7
C. Minimal Movement Sealants (+25% or -25% movement capability)	
1. Vertical or inclined joints such as perimeters of doors, windows, wall penetrations.	S-1, 3, 4, or 6
2. Horizontal joints not exposed to fuel or gas spillage.	S-2, or 5
D. Glazing Sealants (verify with Section 088000)	
1. Structural Glazing (Requires pre-testing and prior written approval from the sealant manufacturer before specifying.)	S-7, or 8
2. Non-structural	S-7, or 8
E. Interior Sealants	
1. General	S-1, 3, 4 or 6
2. Special	
a. Bathrooms and kitchens	S-9
b. Exposed acoustical	S-9, or C-2
c. Non-exposed acoustical	S-9, or C-3

APPENDIX #2

S = Sealants

REF #	ASTM SPEC	FED. SPEC	PRODUCT DESCRIPTION
S-1	C-290-87 Type M Class 25 Grade NS	TT-S-227(e) Class A Type II	-Two component, non-sag, polyurethane or polysulfide sealant - Shore A hardness of 20-40 -Joint movement range of +/- 25%
S-2	C-920-79 Type M Class 25 Grade NS	TT-S-227(e) Class A Type I	-Two component, self leveling, polyurethane or polysulfide sealant - Shore A hardness of 25-40 -Joint movement range of +/- 25%
S-3	C-920-79 Type S Class 25 Grade NS	TT-S-203(c) Class A Type II	-Low modulus, one component, non-sag, polyurethane or polysulfide sealant -Shore A hardness of 15-25 -Joint movement range of +/- 50% -Minimum elongation of 700%
S-4	C-920-79 Type S Class 25 Grade NS	TT-S-203(c) Class A Type II	-One component, non-sag, polyurethane or polysulfide sealant -Shore A hardness of 25-40 -Joint movement range of +/- 25%
S-5	C-920-79 Type S Class 25 Grade P	TT-S-230(c) Class A Type I	-One component, self leveling, polyurethane or polysulfide sealant -Shore A hardness of 15-45 -Joint movement of +/- 25%
S-6	C-920-79 Type S Class 25 Grade NS	TT-S-1543(a) Class A	-Low modulus, one component, non-sag, neutral cure, silicone sealant -Shore A hardness of 15-20 -Joint movement range of +100% to -50% -Joint size may be as little as two times joint movement -Minimum elongation of 1200%
S-7	C-920-79 Type S Class 25 Grade NS	TT-S-1543(a) Class A	-One component, neutral cure, non-sag, silicone sealant -Shore A hardness of 25-30 -Joint movement range of +/- 25% *

REF #	ASTM SPEC	FED. SPEC	PRODUCT DESCRIPTION
S-8	C-920-79 Type S Class 25 Grade NS	TT-S-1543(a) Class A	-One component, acetoxy cure, non-sag, silicone sealant -Shore A hardness of 25-30
S-9	C-920-79 Type S Class 25 Grade NS	TT-S-1543(a) Class A	-One component, non-sag, mildew resistant silicone sealant -Shore A hardness of 25-30
S-10	C-920-79 Type M/S Class 25 Grade P/NS	SS-S-200(d) Type H	-One or two component, coal tar extended, fuel resistant polyurethane sealant -Shore A hardness of 15-35

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS, WINDOWS AND FRAMES

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 hollow-metal work for doors, windows, frames, frame insulation, louvers in all doors, view panel moldings in all doors, preparation for hardware anchors and all related accessories.

B. Related Requirements:

1. Section 076200 “Sheet Metal Flashing and Trim” for metal flashings at hollow metal framed doors and windows.
2. Section 079200 "Joint Sealants" for sealants around hollow metal frames.
3. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
4. Section 088000 “Glazing” for glass and glazing of door vision panels and window on hollow metal frames.
5. Section 099000 “Painting” for finish preparation and field painting of hollow metal frames and components.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.

3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

C. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.

D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amweld International, LLC.
2. Ceco Door Products; an Assa Abloy Group company.
3. Curries Company; an Assa Abloy Group company.
4. Republic Doors and Frames.
5. Steelcraft; an Ingersoll-Rand company.
6. Stiles Custom Metal, Inc.
7. West Central Mfg. Inc.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings[**and temperature-rise limits**] indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 3..

1. Physical Performance: Level A according to SDI A250.4.

2. Doors:

   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches.
   c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.050 inch (18 ga.).
   d. Edge Construction: Model 2, Seamless.
   e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:

   a. Materials: Uncoated, steel sheet, minimum thickness of 0.060 inch (16 ga.).
   b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
   c. Construction: Full profile welded.

4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level A according to SDI A250.4.

2. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches
c. Face: Metallic-coated steel sheet, minimum thickness of 0.060 inch (16 ga.), with minimum A40 coating.
d. Edge Construction: Model 2, Seamless.
e. Core: Polyisocyanurate.

1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

3. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.075 inch (14 ga.), with minimum A40 coating.
b. Construction: Full profile welded.

4. Exposed Finish: Prime.

2.5 BORROWED LITES AND WINDOWS

A. Hollow-metal frames of metallic-coated steel sheet, minimum thickness of 0.060 inch (16 ga.) at interior locations and 0.075 inch (14 ga.) at exterior locations.

B. Construction: Full profile welded.

2.6 FRAME ANCHORS

A. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (20 ga.) thick.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (20 ga.), and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.7 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A 879, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 or ASTM A 1011, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Mineral -Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics. Four pounds per cubic post density.

H. Glazing: Comply with requirements in Section 088000 "Glazing.

2.8 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Fire Door Cores: As required to provide fire-protection ratings indicated.
2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
3. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
4. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
6. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelite Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
3. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

4. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.9 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.10 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of minimum 0.050-inch-thick (18 ga.), cold-rolled steel sheet set into 0.060-inch-thick (16 ga.) steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.

B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable stops located on secure side of opening.
    d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.

4. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.

5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

6. Insulation: Pack hollow metal frame full with 4 pound rock wool at all exterior frames and at all interior frames located in sound rated walls including classrooms, meeting rooms and offices.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

    a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
    c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
    d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

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. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 062023 "Interior Finish Carpentry".
2. Section 081113 "Hollow Metal Doors, Windows and Frames" for wood doors on hollow metal frames.
3. Section 087111 "Door Hardware" for hardware specifications related to door preparation.
4. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.
7. Fire-protection ratings for fire-rated doors.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

2. Louver blade and frame sections, 6 inches long, for each material and finish specified.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

B. Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span, or is visually apparent when viewed from 6 feet away.

2. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Algoma Hardwoods, Inc.
2. Ampco.
3. Eggers Industries.
4. General Veneer Manufacturing Co.

5. Graham Wood Doors; an Assa Abloy Group company.
6. Haley Brothers, Inc.
7. Marshfield Door Systems, Inc.
8. Mohawk Doors; a Masonite company.
9. Vancouver Door Company.
10. VT Industries, Inc.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards.

1. Provide WI Certified Compliance Labels indicating that doors comply with requirements of grades specified.
2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.
2. Extra Heavy Duty: janitor's closets, assembly spaces, exits and conference rooms.
3. Standard Duty: Closets (not including janitor's closets).

D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

E. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

F. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware as follows:

a. 5-inch top-rail blocking, in doors indicated to have closers.

b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.

3. Provide doors with glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices or for doors indicated to receive half-lite or full-lite glass vision panels.

G. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

a. Screw Withdrawal, Face: 700 lbf.

H. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:

a. 5-inch top-rail blocking.
b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
c. 5-inch midrail blocking, in doors indicated to have armor plates.
d. 5-inch midrail blocking, in doors indicated to have exit devices.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA faces.
2. Species: White maple or equal priced species as selected by Architect.
3. Cut: Rift or plane sliced as selected by Architect.
4. Match between Veneer Leaves: Slip or book match as selected by Architect.
5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
6. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
7. Exposed Vertical and Top Edges: Same species as faces - edge Type A.
8. Core: Particleboard or structural composite lumber core where required.
9. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.]
10. WDMA I.S.1-A Performance Grade: As indicated.

2.4 LIGHT FRAMES AND LOUVERS

A. Metal Frames for Lite Openings in Non-Rated and Fire-Rated Doors: Manufacturer's standard frame formed of minimum 0.048-inch-(18 ga.) thick, cold-rolled steel sheet; prime coated for field enamel finish; and approved for use in doors of fire-protection rating indicated.

B. Metal Louvers:

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. Air Louvers, Inc.
    b. Anemostat; a Mestek company.
    c. L & L Louvers, Inc.
    d. Louvers & Dampers, Inc.; a division of Mestek, Inc.
    e. McGill Architectural Products.

2. Blade Type: Vision-proof, inverted Y.
3. Metal and Finish: Hot-dip galvanized steel, minimum 0.079-inch (14 ga.) thick, with baked-enamel- or powder-coated finish.

2.5 FABRICATION

A. Openings: Factory cut and trim openings through doors.

1. Lite Openings: Trim openings with primed steel frames for glass thickness indicated to be installed by others.
2. Glazing: Provided by Section 088000 "Glazing."
3. Louvers: Factory install louvers in prepared openings, removable from interior side for field painting.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Grade: Custom.
2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 5, conversion varnish.
3. Staining: As selected by Architect from manufacturer's full range.
4. Sheen: Semigloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

    a. Comply with NFPA 80 for fire-rated doors.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

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. Access doors and frames for walls and ceilings.

B. Related Requirements:

1. Section 077200 "Roof Accessories" for roof hatches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail fabrication and installation of access doors and frames for each type of substrate.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Babcock-Davis products as indicated or comparable product by one of the following:

1. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
2. Karp Associates, Inc.
3. Larsen's Manufacturing Company.
4. Milcor Inc.
5. Nystrom, Inc.
6. Williams Bros. Corporation of America (The).

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges:

1. Basis-of-Design Product: Babcock-Davis B1TK.
2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
3. Locations: Wall and ceiling.
4. Door Size: 24X36 or as otherwise indicated in drawings.
5. Uncoated Steel Sheet for Door: 14 gage.
    a. Finish: Factory prime.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Flush, continuous piano hinge.
8. Hardware: Lock.

D. Fire-Rated, Flush Access Doors with Exposed Flanges:

1. Basis-of-Design Product: Babcock-Davis.
2. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
3. Locations: Ceiling.
4. Fire-Resistance Rating: Not less than 1 hour.
5. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage.
    a. Finish: Factory prime.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Manufacturer's standard.
8. Hardware: Lock.

2.3 MATERIALS

A. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879, with cold-rolled steel sheet substrate complying with ASTM A 1008, Commercial Steel (CS), exposed.

B. Frame Anchors: Same type as door face.

C. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. Provide mounting holes in frames for attachment of units to metal or wood framing.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed. At exterior locations, provide manufacturer keyed lock with two keys, all doors keyed alike.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION - 083113

SECTION 087111 - DOOR HARDWARE

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. Mechanical door hardware for the following:

a. Swinging doors.

2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

B. Related Sections:

1. Section 064113 "Wood Veneer-Faced Architectural Cabinets " for cabinet door hardware provided as part of architectural woodwork.
2. Section 081113 "Hollow Metal Doors and Frames" for astragals provided as part of labeled fire-rated assemblies and for door silencers provided as part of hollow-metal frames.
3. Section 083113 "Access Doors and Frames" for access door hardware, including cylinders.
4. Section 083323 "Overhead Coiling Doors" for door hardware provided as part of overhead door assemblies.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Details of electrified door hardware, indicating the following:

C. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.

D. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.

1. Sample Size: Full-size units or minimum Samples for sheet and 4-inch long Samples for other products.

E. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

    a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
    b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
    c. Content: Include the following information:

        1) Identification number, location, hand, fire rating, size, and material of each door and frame.
        2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
        3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
        4) Fastenings and other pertinent information.
        5) Explanation of abbreviations, symbols, and codes contained in schedule.
        6) Mounting locations for door hardware.
        7) List of related door devices specified in other Sections for each door and frame.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

C. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:

1. For door hardware, an [Architectural Hardware Consultant (AHC.

C. Source Limitations: Obtain each type of door hardware from a single manufacturer.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

E. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

F. Accessibility Requirements: Door and gate hardware shall comply with the 2019 California Building Code.

1. Provide operating devices that are operable with one hand and do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
3. Accessible door handles, pulls, latches, locks and other operable parts on doors and gates shall be operable with one hand and shall not require tight grasping, tight pinching, or twisting of the wrist.
4. Operable parts of such hardware shall be 34 inches minimum to 44 inches maximum above the finished floor or ground.
5. Door and gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum. Door and gate spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed poition in 1.5 seconds minimum.
6. The force for pushing or pulling open a door or gate shall be 5 pounds maximum for interior and exterior hinged doors and gates; and shall not exceed 15 pounds for required fire doors.
7. Floor-mounted door stops and similar obstructions shall be installed at a maximum of 4 inches from the face of a wall, partition, or fence.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys[and permanent cores to Owner by registered mail or overnight package service.

1.8 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures including excessive deflection, cracking, or breakage.
    b. Faulty operation of doors and door hardware.
    c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

    a. Exit Devices: Two years from date of Substantial Completion.
    b. Manual Closers: 10 years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by descriptive titles corresponding to requirements specified in Part 2.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A 156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Types.

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
b. Sizes from 3' 1" to 4'0": 5" standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:

a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

1) Out-swinging exterior doors.
2) Out-swinging access controlled doors.
3) Out-swinging lockable doors.

5. Acceptable Manufacturers:

    a. Hager Companies (HA).
    b. Ives (IV)
    c. McKinney Products (MK).
    d. Stanley Hardware (ST).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Provide concealed flush mount (with or without inset), full surface, or half surface, in standard and heavy duty models, as specified in the Hardware Sets. Concealed continuous hinges to be U.L. listed for use on up to and including 90 minute rated door installations and U.L. listed for windstorm components where applicable. Factory cut hinges for door size and provide with removable service power transfer panel where indicated at electrified openings.

1. Acceptable Manufacturers:

    a. Ives (IV)
    b. McKinney Products (MK).
    c. Pemko Manufacturing (PE).
    d. Stanley Hardware (ST).
    e. Hager Companies (HA).

2.3 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
3. Deadbolts: Minimum 1-inch bolt throw.

C. Lock Backset: 2-3/4 inches, unless otherwise indicated.

D. Lock Trim:

1. Description: As indicated in hardware schedule.
2. Levers: Cast.

    a. Schlage Rhodes design

3. Escutcheons (Roses): Pressure Cast.
4. Dummy Trim: Match lever lock trim and escutcheons.
5. Operating Device: Lever with escutcheons (roses).

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

2.4 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

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

a. Cal-Royal Products, Inc.
b. Door Controls International, Inc.
c. IVES Hardware; an Ingersoll-Rand company.
d. Trimco.

B. Automatic Flush Bolts: Grade 1, fabricated from steel and brass components, with spring-activated bolts that automatically retract when active leaf is opened and that automatically engage when active door depresses bolt trigger. Provide brass or stainless-steel cover plate, top and bottom matching dustproof strikes, guides, guide supports, wear plates, and shims.

C. Dustproof Strikes: Locking type, Grade 1, polished wrought brass, with 3/4-inch-diameter, spring-tension plunger.

2.5 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

a. Precision Hardware, Inc.; Division of Stanley Security Solutions, Inc. (District Standard)

B. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

C. Rim Exit Devices: Grade **1**.

1. Type: Type 1, rim.
2. Grade: Grade 1.
3. Actuating Bar: Narrow-stile push pad.
4. Material: Stainless steel.

D. Exit Device Outside Trim: Lever with cylinder; material and finish to match locksets, unless otherwise indicated.

1. Match design for lock trim, unless otherwise indicated.

2.6 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturers: Provide products by Schlage Commercial Lock Division; an Ingersoll-Rand company

B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset. All locks shall be Schlage “Primus” keyway.

1. Number of Pins: Six.
2. Type: Bored-lock type.

C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

D. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.7 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.

2. Keyed Alike: Key all cylinders to same change key.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2. Quantity: In addition to one extra key blank for each lock, provide the following:

a. Cylinder Change Keys: Three.
b. Master Keys: Five.
c. Grand Master Keys: Five.

2.8 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of **150** percent of the number of locks.

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. American Key Boxes and Cabinets.
b. GE Security, Inc.
c. HPC, Inc.
d. Lund Equipment Co., Inc.
e. MMF Industries.
f. Tri Palm International.

2. Portable Cabinet: Tray for mounting in file cabinet, equipped with key-holding panels, envelopes, and cross-index system.

2.9 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

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. Burns Manufacturing Incorporated.
b. Don-Jo Mfg., Inc.
c. Forms + Surfaces.
d. Hager Companies.
e. IVES Hardware; An Ingersoll-Rand Company.
f. Trimco.

B. Flat Push Plates: 0.050 inch thick, 4 inches wide by 16 inches with square corners and beveled edges; secured with exposed screws.

C. Straight Pull-Plate Door Pulls: 0.050-inch-thick plate, 4 inches wide by 16 inches high with square corners and beveled edges; pull with minimum clearance of 1-1/2 inches from face of door.

1. Type: 3/4-inch constant-diameter pull.
2. Mounting: Back to back with threaded sleeves.
3. Overall Pull Length: 9 inches.

2.10 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.

B. Rigid, Housed Astragals: BHMA A156.22; gasket material held in place by metal housing; fastened to face of door with screws.

1. Gasket Material: Neoprene.
2. Housing Material: Aluminum.

2.11 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

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

    a. LCN Closers; an Ingersoll-Rand company.

B. Cast-Aluminum Surface Closers: Grade 1; Traditional Type with mechanism enclosed in cast-aluminum alloy shell.

1. Mounting: Hinge side or as specified in hardware schedule.
2. Type: Regular arm.
3. Backcheck: Adjustable, effective between 60 and 85 degrees of door opening.
4. Cover Material: Aluminum.
5. Closing Power Adjustment: At least **50** percent more than minimum tested value.

2.12 CLOSER HOLDER RELEASE DEVICES

A. Closer Holder Release Devices: BHMA A156.15; Grade 1; closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door shall become self-closing on interruption of signal to release device. Automatic release is activated by smoke detection system.

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

    a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
    b. DORMA Architectural Hardware; Member of The DORMA Group North America.
    c. LCN Closers; an Ingersoll-Rand company.
    d. Norton Door Controls; an ASSA ABLOY Group company.
    e. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
    f. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2. Type: Single-point hold open].
3. Mounting: Surface mounted on face of door.
4. Options: Adjustable backcheck.

2.13 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.

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

a. Don-Jo Mfg., Inc.
b. Hager Companies.
c. IVES Hardware; an Ingersoll-Rand company.
d. Stanley Commercial Hardware; Div. of The Stanley Works.
e. Trimco.

B. Rigid-Type Floor Stop: Grade 1; with rubber bumper; for surface-screw application.

C. Dome-Type Floor Stop: Grade 1; with minimum 1-inch-high bumper for doors without threshold and 1-3/8-inch-high bumper for doors with threshold ; provide with extruded aluminum riser for carpet installations.

D. Wall Bumpers: Grade 1; with rubber bumper; 2-1/2-inch diameter, minimum 3/4-inch projection from wall; with backplate for concealed fastener installation; with convex bumper configuration.

2.14 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

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

a. Hager Companies.
b. National Guard Products.
c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
d. Reese Enterprises, Inc.
e. Zero International.

B. Adhesive-Backed Perimeter Gasketing: Neoprene bulb gasket material applied to frame rabbet with self-adhesive.

C. Adjustable Astragals for Meeting Stiles: Screw-adjustable neoprene gasket material held in place by aluminum housing; mounted with screws.

1. Mounting: Surface mounted on face of each door.

2.15 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

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

a. Hager Companies.
b. National Guard Products.
c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
d. Reese Enterprises, Inc.
e. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
f. Zero International.

B. Saddle Thresholds:

1. Type: Fluted top, barrier free.
2. Base Metal: Aluminum.

2.16 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

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

a. Baldwin Hardware Corporation.
b. IPC Door and Wall Protection Systems, Inc.; Div. of InPro Corporation.
c. IVES Hardware; an Ingersoll-Rand company.
d. Pawling Corporation.
e. Trimco.

B. Kick Plates: 10 inches high by door width with allowance for frame stops.

2.17 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

    a. Wood or Machine Screws: For the following:

        1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
        2) Strike plates to frames.
        3) Closers to doors and frames.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.18 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.

E. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening with electrified door hardware.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 HARDWARE TYPES:

EACH TO HAVE:

TYPE 1 – EXAM ROOM / OPTICAL ROOM

1 ½	Pr.	Butts BB1279 4 ½ x 4 ½ NRP	US26D	Hager
1	Only	Lockset Rhodes ND44S	626	Schlage
1	Only	Threshold 271A		Pemko
1	Only	Closer 4041PA Aluminum		LCN
1	Only	Wall Stop & Holder 1254	626	Trimco
1	Only	10" Protection Plate K0050	626	Trimco
1	Only	Adhesive Gasketing S88BL		Pemko
1	Only	Door Bottom 211 APK		Pemko

TYPE 2 – OFFICES / TRAINING ROOM / BREAK ROOM / THERAPY

1 ½	Pr.	Butts BB1279 4 ½ x 4 ½	US26D	Hager
1	Only	Lockset Rhodes ND50PD	626	Schlage
1	Only	Closer 4041PA Aluminum		LCN
1	Only	10" Protection Plate K0050	626	Trimco
1	Only	Wall Bumper 1270 CXSV	626	Trimco

TYPE 4 – UNISEX TOILETS INTERIOR

1 ½	Pr.	Butts BB1279 4 ½ x 4 ½	US26D	Hager
1	Only	Lockset Rhodes ND50PD	626	Schlage
1	Only	Closer 4041PA Aluminum		LCN
1	Only	Wall Bumper 1270 CXSV	626	Trimco
1	Only	10" Protection Plate K0050	626	Trimco
1	Only	Fire/Smoke Seal S88BL (At Fire Rated Doors Only)		Pemko

TYPE 4 – JANITOR / STORAGE / MECHANICAL / ELECTRICAL

1 ½	Pr.	Butts BB1279 4 ½ x 4 ½	US26D	Hager
1	Pr.	Lockset Rhodes ND80PD		Schlage
1	Only	Threshold 271A (Exterior Only)		Pemko
1	Only	Closer 4041PA Aluminum		LCN
1	Only	Wall Stop & Holder 1254	626	Trimco 36” at B9A, B, C
1	Only	10" Protection Plate K0050	626	Trimco
1	Only	Adhesive Gasketing S88BL (Exterior Only)		Pemko
1	Only	Door Bottom 211 APK		Pemko

TYPE 5 – EXTERIOR PANIC SINGLE DOOR

1 ½	Pr.	Butts BB1279 4 ½ x 4 ½ NRP	US26D	Hager
1	Only	Panic Hardware 2108X4908A	626	Precision
1	Only	Closer 4041PA Aluminum		LCN
1	Only	Threshold 271A		Pemko
1	Only	Wall Stop & Holder 1254	626	Trimco
1	Only	Adhesive Gasketing S88BL		Pemko
1	Only	Door Bottom 211 APK		Pemko
1	Only	10" Protection Plate K0050	626	Trimco
1	Only	Rim Cylinder (Verify with Owner)		Schlage

TYPE 6 – INTERIOR PANIC SINGLE DOOR

1 ½	Pr.	Butts BB1279 4 ½ x 4 ½	US26D	Hager
1	Only	Panic Hardware 2108X4908A	626	Precision
1	Only	Rim Cylinder (Verify with Owner)		Schlage
1	Only	Closer 4041PA Aluminum		LCN
1	Only	Wall Bumper 1270 CXSV	626	Trimco
1	Only	10" Protection Plate K0050	626	Trimco
1	Only	Fire/Smoke Seal S88BL (At Fire Rated Doors Only)		Pemko

HARDWARE NOTES:

1. Effort to Operate Doors. Maximum effort to operate doors shall not exceed 5 pounds for exterior door and 5 pounds for interior doors, such pull or push effort being applied at right angles to hinged door and at the center plane of sliding or folding doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the door may be increased not be exceed 15 lbs.

2. Hand activated door opening hardware shall be centered between 30- inches and 44 inches above the floor. Latching and locking doors that are hand activated and which are in a path of travel shall be operable with a single effort by lever type hardware by panic bars, push-pull activating bars, or other hardware designed to provide passage without requiring the ability to grasp the opening hardware. Locked exit doors shall operate as above in egress direction.

3. All rated doors are to be positive latching and self-closing.

4. "Label" shall mean "Assembly" as defined in section 703A, California Building Code (CBC), 2019 Edition .

5. All 20-minute rated assemblies shall be provided with approved gasketing material so installed to provide a seal where the door meets the stop on both sides and across the top.

6. Exit doors shall be operable from the inside without the use of a key or any special knowledge or effort.

7. All exterior doors shall be provided with Pemko 303AS weatherstripping at jambs and head, and with Pemko 307AV exterior door bottom sweep unless scheduled for a bottom door shoe or otherwise indicated for weather/smoke/fire seals.

END OF SECTION 087111

SECTION 088000 - GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed entrances.

B. Related Sections:

1. Section 081113 "Hollow Metal Doors, Windows and Frames" for glazing in hollow metal frames and doors.
2. Section 081416 “Flushed Wood Doors” for glazing lites in prefinished wood doors.
3. Section 083213 "Sliding Aluminum-Framed Glass Doors" for glazing in aluminum frames.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

1. Design Wind Pressures: As indicated on Drawings.

a. Basic Wind Speed: 85 mph.
b. Importance Factor: 1.
c. Exposure Category: C.

2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers.

B. Product Certificates: For glass and glazing products, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulating glass and glazing sealants.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass: Obtain insulating glass from single source from single manufacturer for each glass type.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

E. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

G. Fire Rated Glass: Each lite shall bear a permanent, non-removable label of Underwriters Laboratories and/or Interek Testing Services (Warnock-Hersey) certifying it for use in tested and rated fire protective assemblies.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

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

B. Fire Rated Glazing and Frame System: 5 years from date of final completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites thickness indicated.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.

C. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Vitro or comparable product by one of the following:

   a. Oldcastle.
   b. Pilkington.
   c. Guardian.

2. Tint Color: Solargray
3. Visible Light Transmittance: 44 percent minimum.
4. Solar Heat Gain Coefficient: 0.58
5. Light to Solar Gains: 0.76

2.3 INSULATING GLASS

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

1. Vitro.
2. Oldcastle.
3. Pilkington.
4. Guardion.

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or blend of both.
4. Coating: Solarban Low-e on surface 2.

C. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.4 OTHER GLASS TYPES

A. Laminated Glass: ASTMC 1172, and complying with other requirements specified and with the following:

1. Interlayer: Polyvinyl butyral or cured resin of .03 inch minimum thickness or as otherwise indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.

a. For polyvinyl butyral interlayers, laminate lites in autoclave with heat plus pressure.
b. For cured-resin interlayers, laminate lites with laminated-glass manufacturer's standard cast-in-place and cured-transparent-resin interlayer.

2. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.

B. Wired Glass: ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Quality-Q-6; and of form and mesh pattern specified.

C. Fire Rated Glass (20 minute door lites): ASTM E 2010, ASTM E 2074, monolithic, radiant heat reducing flat glass. Manufactured by Safti First or approved Equal.

D. FIRE RATED / TEMPERATURE RISE GLASS AND FRAMING SYSTEM

1. System Includes Fire Rated Glass and Framing System by VETROTECH Saint-Gobain NA or approved equal.

a. Glass Product: CONTRAFLAM; clear, fire and safety rated glazing.
b. Frame Product: VDS Fire Rated Steel Door & Framing System.
c. Substitutions prior to bid only, in accordance with Section 01 25 00.

2. Performance Requirements:

a. Fire Rating: 60-minutes.
b. Certification: System tested in accordance with ASTM E-119, NFPA 251, UBC 7-1, UL 263. Temperature on the non-fire side of the system at the conclusion of fire test shall be below 250 degree F (121 degree C) above ambient room temperature.
c. Listing / Label: Fire Testing shall be conducted by an approved independent test laboratory similar to Underwriters Laboratories, Inc. (UL).

3. Steel Framing System:

    a. Steel profiles mechanically joined with steel pins.
    b. Insulation: Insulate framing system against effects of fire and heat from both sides. Insulate steel tubes incorporating calcium silicate material. Perimeter of framing system to the rough opening shall be firmly packed with mineral wool fire stop insulation or intumescent sealant.
    c. Glazing beads: Proprietary steel beads as recommended by manufacturer to comply with listing.
    d. Fasteners: As recommended by manufacturer.
    e. Glazing accessories: Glazing pocket shall be lined with intumescent tape as supplied by manufacturer. Fire rated glass shall be set on calcium silicate / hardwood / neoprene / setting block.
    f. Glazing Compounds: Fire rated glass shall be glazed with approved chloroprene vinyl as supplied by manufacturer, closed cell PVC foam tape or pure silicone sealant.

4. Contraflam 60 Fire and Safety-Rated Tempered Glass: Fire rated, wireless, optically clear glazing material with intumescent interlayers for use in impact safety rated locations such as doors, transoms, borrowed lites and wall applications. Provides smoke and flame barrier. Provides protection from radiant and conductive heat transfer with limited temperature rise on the unexposed face in accordance with the requirements of ASTM E 119. For use in interior applications. Provide units with the following properties:

    a. Thickness of Contraflam 60-N2: 1 inch (25 mm).
    b. Weight of Contraflam: 60 11.0 Ibs / sq. ft. (54 kg per sq. meter).
    c. Approximate Visible Light Transmission: 82 percent.
    d. Finish: Standard primed for field painting.
    e. Impact Safety Rating: ANSI Z97.1 and CPSC 16CFR1201 (Cat I & II).
    f. Labeling: Each lite shall be labeled with a permanent logo including the name of product, manufacturer, testing laboratory (Underwriters Laboratories), fire rating period and safety glazing standards.
    g. Fire-Rating of Contraflam 60 is 60-minutes (with hose stream test).
    h. Fire Rating Testing: Fire rating tested and listed by Underwriters Laboratories; tested in accordance with ASTM E 119, ASTM E 2010, ASTM E 2074, NFPA 251, NFPA 252, NFPA 257, UL 9, UL 10B, UL 10C, and UL 263.
    i. Framing System: Standard fire rated doors and frames as applicable and indicated in drawings.
    j. Glazing compound: Glazing tape, silicone sealant, setting blocks and cleaners as recommended by manufacturer or required for testing compliance.

2.5 GLAZING GASKETS

A. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

    1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

B. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

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; Omniseal 50.
    b. Dow Corning Corporation; 756 SMS
    c. GE Advanced Materials - Silicones; SilGlaze II SCS2800.
    d. Pecora Corporation; 864
    e. Sika Corporation, Construction Products Division; SikaSil-C995.
    f. Tremco Incorporated; Spectrem 2.

2. Applications: glass in hollow metal frames and aluminum storefront doors.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.10 MONOLITHIC-GLASS TYPES

A. Glass Type GL-1: Clear fully tempered float glass.

1. Thickness: 6.0 mm.
2. Provide safety glazing labeling.

B. Glass Type GL-2: Solargrey tinted fully tempered float glass.

1. Thickness: 6.0 mm.
2. Provide safety glazing labeling.

2.11 INSULATING-GLASS TYPES

A. Glass Type GL-3: Clear insulating glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: : Clear heat-strengthened float glass (fully tempered where required).
4. Interspace Content: Argon.
5. Indoor Lite: Clear heat-strengthened float glass (fully tempered where required).
6. Winter Nighttime U-Factor: .29 maximum.
7. Summer Daytime U-Factor: .27 maximum.
8. Solar Heat Gain Coefficient: .39 maximum.

9. Provide safety glazing labeling.

B. Glass Type GL-4: Solargray tinted insulating glass (Vitro Solarban 60 or approved equal).

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Tinted Solar Gray heat-treated (tempered where required) float glass.
4. Coating: Solarban 60 low-e on surface no. 2.
5. Interspace Content: Argon.
6. Indoor Lite: Clear heat-treated (tempered where required) float glass.
7. Winter Nighttime U-Factor: 0.24 maximum.
8. Visible Light Transmittance: 35%.
9. Solar Heat Gain Coefficient: 0.25 maximum.
10. Light to Solar Gain (LSG): 1.40
11. Provide safety glazing labeling.

2.12 OTHER GLASS TYPES

A. Glass Type GL-5: Laminated glass.

1. Clear glass (unless otherwise indicated for tint), ¼ inch minimum overall thickness or as indicated by drawings and schedule for sound, safety and/or security purposes.

B. Glass Type GL-6: Wired glass.

1. Clear, minimum thickness ¼-inch as indicated by drawings.

C. Glass Type GL-7: Fire rated glass.

1. Provide where indicated for vision lites in 20 minute rated doors.

D. Glass Type GL-8: 60 minute fire rated glazing system.
1. Provide in conjunction with 60 minute rated steel framing system.

2.13 INFILL WINDOWS

A. Nissen Aluminum Framed Service Window: Series E.

1. Clear anodized aluminum frame, size as indicated in drawings installed within a hollow metal frame at jambs and head, and on a stainless steel counter.
2. Provide with glass type GL-2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Provide gasket glazing for glazing aluminum entrance doors.

B. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

C. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

D. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

F. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Provide sealant glazing at hollow metal window frames.

B. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

C. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

D. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 088000

SECTION 089000 - LOUVERS AND VENTS

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. Fixed, extruded-aluminum and formed-metal louvers.

B. Related Sections:

1. Section 081113 "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.
2. Section 081416 "Flush Wood Doors" for louvers in flush wood doors.
3. Section 099113 "Exterior Painting" for field painting louvers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. Design earthquake spectral response acceleration, short period (Sds), using value for Project location.
2. Component Importance Factor is 1.0.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

1. Temperature Change (Range): 120 deg Fambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

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

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of metal finish required.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

1. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated.

C. Maintain equal louver blade spacing to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide subsills made of same material as louvers or extended sills for recessed louvers.

G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Sightproof, Drainable-Blade Louver LV-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties Inc. model B 5157 or comparable product by one of the following:

    a. Airolite Company, LLC (The)).
    b. Arrow United Industries; a division of Mestek, Inc.
    c. Greenheck Fan Corporation.
    d. Industrial Louvers, Inc.
    e. NCA Manufacturing, Inc.
    f. Nystrom Building Products.
    g. Ruskin Company; Tomkins PLC.

2. Louver Depth: 5 inches or as indicated in drawings.
3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
4. Mullion Type: Exposed.
5. Louver Performance Ratings:

    a. Free Area: Not less than 8.3 sq. ft. for 48-inch-wide by 48-inch-high louver.
    b. Point of Beginning Water Penetration: Not less than 750 fpm.
    c. Air Performance: Not more than 0.10-inch wg static pressure drop at 550-fpm free-area exhaust velocity.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening.

B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

1. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.6 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

1. Color: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 89000

SECTION 092400 - PORTLAND CEMENT PLASTERING

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. Exterior portland cement plasterwork (stucco) on metal lath and water resistant paper backing.
2. All accessories required for a complete assembly as indicated in drawings including screeds, grounds, expansion joints, reveals, cornerbeads, corner-rite and miscellaneous trim.

B. Related Sections:

1. Section 051200 "Structural Steel Framing" for steel framing and furring not included in Portland cement plaster assemblies.
2. Section 061000 "Rough Carpentry" for wood framing, grounds and furring included in portland cement plaster assemblies.
3. Section 072500 "Weather Barriers" for air and moisture membrane beneath portland cement plaster assemblies.
4. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support lath and portland cement plaster.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

C. Samples for Verification: For each type of factory-prepared finish coat indicated; 12 by 12 inches, and prepared on rigid backing.

1.4 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Where indicated, provide portland cement plaster 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.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

B. Mockups: Before plastering, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for each type of finish indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F.
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 METAL LATH

A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653, G60, hot-dip galvanized zinc coating.

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. Alabama Metal Industries Corporation; a Gibraltar Industries company.
b. CEMCO.
c. Clark Western Building Systems.
d. Dietrich Metal Framing; a Worthington Industries company.
e. MarinoWARE.
f. Phillips Manufacturing Co.

2. Flat Rib Lath: Rib depth of not more than 1/8 inch, 3.4 lb/sq. yd. (walls).
3. 3/8-Inch Rib Lath: 4.3 lb/sq. yd. (ceilings/soffits).

B. Paper Backing: FS UU-B-790, Type I, Grade B, Style 1a vapor-retardant paper.

1. Provide paper-backed lath at exterior locations.
2. Install over weather barrier to make a double layer of backing over solid sheathed walls.

2.2 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:

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. Alabama Metal Industries Corporation; a Gibraltar Industries company.
    b. CEMCO.
    c. Clark Western Building Systems.
    d. Dietrich Metal Framing; a Worthington Industries company.
    e. MarinoWARE.
    f. Phillips Manufacturing Co.

2. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653, G60 zinc coating.
3. Cornerite: Fabricated from metal lath with ASTM A 653, G60, hot-dip galvanized zinc coating.
4. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653, G60, hot-dip galvanized zinc coating.
5. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.

    a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
    b. Bull nose cornerbead, radius 3/4 inch minimum, with expanded flanges; use at locations indicated on Drawings.

6. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
7. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
8. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
9. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inc wide; with perforated flanges.
10. Reglet: STX stucco reglet, Fry reglet, color as selected by architect.
11. Verify conditions and accessory shapes required as indicated in drawings.

2.3 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.

C. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.

D. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

2.4 PLASTER MATERIALS

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

B. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

C. Sand Aggregate: ASTM C 897.

D. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.

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. Bonsal American, an Oldcastle Company; Marblesil Stucco Mix.
    b. California Stucco Products Corp.; Conventional Portland Cement Stucco.
    c. El Rey Stucco Company, Inc., a brand of ParexLaHabra, Inc.; Premium Stucco Finish.
    d. Florida Stucco; Florida Stucco.
    e. LaHabra, a brand of ParexLaHabra, Inc.; Exterior Stucco Color Coat.
    f. Omega Products International, Inc.; ColorTek Exterior Stucco.
    g. QUIKCRETE; QUIKCRETE Finish Coat Stucco, No. 1201.
    h. Shamrock Stucco LLC; Exterior Stucco.
    i. SonoWall, BASF Wall Systems, Inc.; Thoro Stucco.
    j. USG Corporation; Oriental Exterior Finish Stucco.

2. Color: As selected by Architect from manufacturer's full range to closely match subsequent paint color.
3. All cement plaster to be painted (under specification section 099000).

2.5 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Acoustical Sealant: As specified in Section 079200 "Joint Sealants."

2.6 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. of cementitious materials.

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:

1. Portland Cement Mixes:

a. Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

C. Job-Mixed Finish-Coat Mixes:

1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 1-1/2 to 2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.

D. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters, comply with manufacturer's written instructions.

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. Verify weather barrier is securely installed without tears or holes and is ready to receive paper backing, lath and accessories.

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

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.3 INSTALLATION, GENERAL

A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

B. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

C. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

3.4 INSTALLING METAL LATH

A. Expanded-Metal Lath: Install according to ASTM C 1063.

1. Partition Framing and Vertical Furring: Install flat rib lath over paper backing.
2. Flat-Ceiling and Horizontal Framing: Install 3/8-inch rib lath.
3. Install lath with corrosion resistant screws. Staples are not permitted.

3.5 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Reinforcement for External Corners:

1. Install lath-type, external-corner reinforcement at exterior corner locations.
2. Install cornerbead at interior corner locations.

C. Control Joints: Install control joints at locations indicated on Drawings.

3.6 PLASTER APPLICATION

A. General: Comply with ASTM C 926.

1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Walls; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 7/8-inch total thickness.

1. Portland cement mixes.

C. Ceilings; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 3/4 inch total thickness.

1. Portland cement mixes.

D. Plaster Finish Coats: Apply troweled finish with light float texture to match sample approved by Architect.

E. Concealed Exterior Plasterwork: Where plaster application will be used as a base for adhered finishes, such as tile or adhered masonry veneer, omit finish coat.

3.7 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.8 PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 092400

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, including moisture barrier.
3. Texture finishes.

B. Related Requirements:

1. Section 093000 "Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.
2. Textured Finishes: 24” x 24” for each textured finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

1.5 DELIVERY, STORAGE AND HANDLING

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

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 GYPSUM BOARD, GENERAL

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

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Lafarge North America Inc.
5. National Gypsum Company.
6. PABCO Gypsum.
7. Temple-Inland.
8. USG Corporation.

B. Gypsum Board, Type X: ASTM C 1396. Use Type X typically throughout except where moisture resistant board is required.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Gypsum Ceiling Board: ASTM C 1396. Use Type C (added sag resistance) gypsum board (fire rated where required for fire assemblies).

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396M. With moisture- and mold-resistant core and paper surfaces. Use typically at plumbing walls not otherwise indicated to receive tile backing panels.

1. Core: 5/8 inch.
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. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

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. C-Cure; C-Cure Board 990.
b. CertainTeed Corp.; FiberCement BackerBoard.
c. Custom Building Products; Wonderboard.
d. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
e. James Hardie Building Products, Inc.; Hardiebacker.
f. National Gypsum Company, Permabase Cement Board.
g. USG Corporation; DUROCK Cement Board.

2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B. Polyethylene 10 mil thick membrane moisture barrier installed over wall framing below all tile backing panels.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized steel sheet.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.6 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 drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer for water resistant application within 24 hours of application.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
    b. Grabber Construction Products; Acoustical Sealant GSC.
    c. Pecora Corporation; AC-20 FTR.
    d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
    e. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.8 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Non-Aggregate Finish: Pre-mixed, vinyl texture finish for spray application.

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. CertainTeed Corp.; ProRoc Easi-Tex Spray Texture.
b. National Gypsum Company; Perfect Spray EM Texture.
c. USG Corporation; BEADEX FasTex Wall and Ceiling Spray Texture.

C. Finishes: Comply with finish as scheduled or noted and as defined by Drywall Industry Trust Fund, 9800 Sepulveda Blvd. Los Angeles, California 90005, Phone (213) 776-4555 or (415) 568-4060.

1. Schedule Designation/Finish:

a. G.B.1 – Fog and Splatter
b. G.B.2 – Skip Trowel
c. G.B.3 – Ceiling textur Heavy Finish
d. G.B.4 – Smooth
e. G.B.5 – Knock Down
f. G.B.6 – Fog
g. G.B.7 – Orange Peel (Light) - Typical for painted walls unless indicated otherwise
h. G.B.8 - Orange Peel (Heavy)
i. G.B.9 – Roller Texture
j. G.B.10 – Swirl Texture

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

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

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

H. Prior to installing tile backer units, install moisture barrier membrane over wall framing and secure to wood studs with staples and to metal studs with manufacturer approved adhesive and tape. Trim perimeter edges to avoid visible membrane.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Type X: Where required for fire-resistance-rated assembly.
3. Ceiling Type: Ceiling surfaces.
4. Moisture- and Mold-Resistant Type: At restrooms and food service areas.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
3. Fastening Methods: Apply gypsum panels to supports with steel wallboard bugle head screws.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

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.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges.

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. Fully embed tape in joint compound.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Where indicated on Drawings to be covered by tackboard or wainscot.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view.
5. Levet 5: At smooth and level finshed panels.

E. Cementitious Backer Units: Finish according to manufacturer's written instructions, ready to receive thin set tile.

3.7 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.8 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILING

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. Ceramic tile, mortar beds, setting adhesive, grout, sealer and accessories.

B. Related Sections:

1. Section 092900 "Gypsum Board" for cementitious backer units.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products provide slip resistant floor tiles per ANSI A137.1:

1. Level Surfaces: Minimum 0.6.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type of trim and accessory for each color and finish required.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of product, signed by product manufacturer.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile from one producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Joint sealants.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.2 TILE PRODUCTS

A. Tile Type CT-1: Glazed wall tile;

1. Basis-of-Design Product: Subject to compliance with requirements, provide Dal-Tile International Inc Glazed Wall Tile Semi-Gloss or Matte Groups 2, 3, 4, and 5 or comparable product by one of the following:

a. Crossville, Inc.
b. Lone Star Ceramics Company.
c. Grupo Porcelanite.
d. Portobello America, Inc.
e. Seneca Tiles, Inc.

2. Composition: Impervious natural clay or porcelain.

3. Module Size:

    a. Wall Tile: 4-inch by 4-inch.

4. Thickness: 5/16 inch.
5. Face: Pattern of design indicated, with square edges.
6. Surface: Smooth, without abrasive admixture.
7. Finish: Mat, clear glaze.
8. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
9. Grout Color: As selected by Architect from manufacturer's full range.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base Cove: Slimfoot Cove, module size 4 inch by 6 inch.
    b. External Corners for Thin-Set Mortar Installations: Surface bullnose, module size 2 by 2 inches.

11. Tile Color and Pattern: As selected by Architect from manufacturer's full range.

B. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as used for adjoining wall tile.

2.3 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
2. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.

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. Bonsal American; an Oldcastle company.
    b. Bostik, Inc.
    c. C-Cure.
    d. Custom Building Products.
    e. Jamo Inc.
    f. Laticrete International, Inc.
    g. Summitville Tiles, Inc.

2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

2.4 GROUT MATERIALS

A. Polymer-Modified Tile Grout: ANSI A118.7.

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. Bonsal American; an Oldcastle company.
    b. Bostik, Inc.
    c. C-Cure.
    d. Custom Building Products.
    e. Jamo Inc.
    f. Laticrete International, Inc.
    g. Summitville Tiles, Inc.

2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

2.5 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section 079200 "Sealants and Caulking."

1. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:

    a. DAP Inc.; Titanium Enriched Kitchen and Bath Sealant.
    b. Dow Corning Corporation; Dow Corning 786.
    c. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
    d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
    e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
    f. Tremco Incorporated; Tremsil 600 White.

2.6 MISCELLANEOUS MATERIALS

A. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

B. Grout Sealer: Manufacturer's standard **silicone** product for sealing grout joints and that does not change color or appearance of grout.

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. Bonsal American; an Oldcastle company; Grout Sealer.
b. Bostik, Inc.; CeramaSeal Grout & Tile Sealer.
c. C-Cure; Penetrating Sealer 978.
d. Custom Building Products; Surfaceguard
e. Sealer.
f. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout.
g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.

2.7 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. Where adjoining tiles on base, walls, or trim are specified or indicated to be same size, align joints.
2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Wall Tile: ¼ inch.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

H. Grout Sealer: Apply grout sealer to grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.5 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Wall Installations, Wood Studs or Furring:

1. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA W244.

a. Tile Type: CT-1.
b. Thin-Set Mortar: Latex-portland cement mortar.
c. Grout: Polymer-modified sanded grout.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for interior ceilings including Armstrong Woodworks Straight Linear Veneered Panels where indicated at Library and installed in accordance with manufacturers recommendations.

1.3 CODES AND STANDARDS

A. 2016 California Building Code.

B. Comply with requirements of California Department of General Services, Division of State Architect Interpretative of Regulations Document IR 25-2.13 Metal Suspension Systems for Lay-In Panel Ceilings.

C. Guidelines For seismic Restraint For Direct Hung suspended Ceiling assemblies. Seismic Zones 3 and 4, seismic design categories D, E and F. CISCA latest edition.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Initial Selection: For components with factory-applied finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: Set of 6-inch-square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.
3. Clips: Full-size hold-down and seismic clips.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.
4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.
    g. Perimeter moldings.

7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
8. Minimum Drawing Scale: 1/8 inch = 1 foot.

B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 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. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Seismic Clips: Equal to 2 percent of quantity installed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS ACP-1 - ALL CLASSROOMS, ADMINISTRATION OFFICES, MULTIPURPOSE LOBBY AND HALLS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc Cortega 703. or comparable product by one of the following:

a. American Gypsum.
b. CertainTeed Corporation.
c. Chicago Metallic Corporation.
d. Rockfon (Roxul Inc.).

B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide panels as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
2. Pattern: CD (perforated, small holes and fissured).

D. Color: White.

E. Light Reflectance (LR): Not less than 0.82.

F. Ceiling Attenuation Class (CAC): Not less than 33.

G. Edge/Joint Detail: Angled tegular.

H. Thickness: 5/8 inch.

I. Modular Size: 24 by 48 inches or 24 by 24 inches where indicated in drawings.

J. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

K. Woodwork Linear Veneered Panels: Provide 6” straight panels with ¼ inch reveals in natural maple color and with 1” black acoustical insulation above for a complete system as indicated in drawings and as recommended by manufacturer.

2.4 ACOUSTICAL PANELS ACP-2 - KITCHEN AREA

B. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc Clean Room VL Unperforated 870 or comparable product by one of the following:

a. American Gypsum.
b. CertainTeed Corporation.
c. Chicago Metallic Corporation.
d. Rockfon (Roxul Inc.).

B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide panels as follows:

1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face.
2. Pattern: E (unperforated)

D. Color: White.

E. Light Reflectance (LR): Not less than 0.80.

F. Ceiling Attenuation Class (CAC): Not less than 40.

G. Edge/Joint Detail: Square.

H. Thickness: 5/8 inch.

I. Modular Size: 24 by 48 inches.

J. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.5 METAL SUSPENSION SYSTEM

A. Basis of Design Subject to compliance with requirements, provide Armstrong World Industries, Inc Prelude 15/16 inch exposed tee ESR 1308 or comparable product by one of the following:

1. CertainTeed Corporation.
2. Chicago Metallic Corporation.
3. USG Interiors, Inc.; Subsidiary of USG Corporation.
4. Rockfon (Roxul Inc.)

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635 and designated by type, structural classification, and finish indicated.

C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653, not less than G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges' ESR 1308.

1. Structural Classification: Heavy-duty system.
2. Face Finish: Painted white.

D. Seismic Beam Retaining Clip:

1. ArmstrongBERC2 beam retaining clip.

E. Woodwork Linear Veneered Panels: Provide Armstrong Prelude XL Suspension System (black) complete with all attachments accessories, edge moldings and trim as indicated in drawings.

2.6 METAL SUSPENSION SYSTEM - KITCHEN

A. Basis of Design Subject to compliance with requirements, provide Armstrong World Industries, Inc. Clean Room Aluminum exposed tee ESR 1308 or comparable product by one of the following:

1. CertainTeed Corporation.
2. Chicago Metallic Corporation.

3. USG Interiors, Inc.; Subsidiary of USG Corporation.
4. Rockfon (Roxul Inc.)

B. Metal Suspension-System Standard: Provide manufacturer’s standard, direct-hung, metal suspension system and accessories according to ASTM C 635 and designated by type. Structural classification, and finish indicated.

C. Wide-Faced, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653, not less than G30 coating designation; with prefinished 15/16-inch - wide metal caps on flanges’ ESR 1308.

1. Structural Classification: Heavy-duty system.
2. Face Finish: Painted white.

D. Seismic Beam Retaining Clip:

1. Armstrong BERC2 beam retaining clip.

2.7 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.135-inch- diameter wire.

C. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

2.8 METAL EDGE MOLDINGS AND TRIM

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

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.
4. Fry Reglet Corporation.
5. Gordon, Inc.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

2.9 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636, seismic design requirements, and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
6. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
3. Install seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

a. Hold-Down Clips: Space 24 inches o.c. on all cross runners.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 095123 - ACOUSTICAL TILE CEILINGS

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. Acoustical tiles for interior ceilings.
2. Direct attachment of tiles to substrates with adhesive.

B. Related Requirements:

1. Section 095113 "Acoustical Panel Ceilings" for ceilings consisting of mineral-base and glass-fiber-base acoustical panels and exposed suspension systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Tiles: Set of full-size Samples of each type, color, pattern, and texture.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

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. Acoustical Ceiling Units: 1 box of full-size tiles.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations:

1. Directly Attached Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class B according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL TILES ATC-1

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc 741Fine Fissured Medium Textured Tile or comparable product by one of the following:

1. American Gypsum.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation

B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide tiles as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
2. Pattern: CE (perforated, small holes and lightly textured).

D. Color: White.

E. Light Reflectance (LR): Not less than 0.85.

F. Noise Reduction Coefficient (NRC): Not less than 0.55.

G. Edge/Joint Detail: Toung and groove.

H. Thickness: 5/8 inch.

I. Modular Size: 12 by 12 inches.

J. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 MISCELLANEOUS MATERIALS

A. Acoustical Tile Adhesive: Type recommended in writing by acoustical tile manufacturer, bearing UL label for Class 0-25 flame spread.

B. Staples: 5/16-inch-long, divergent-point staples.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF DIRECTLY ATTACHED ACOUSTICAL TILE CEILINGS

A. Adhesive Installation: Install acoustical tile by bonding to substrate, using acoustical tile adhesive and procedure recommended in writing by tile manufacturer and as follows:

1. Wipe and prime ceiling.
2. Remove loose dust from backs of tiles by brushing.
3. Install splines in joints between tiles and maintain bottom surface to a uniform level. Shim tile or correct substrate as required to maintain levelness.
4. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.

B. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.

3.4 ERECTION TOLERANCES

A. Directly Attached Ceilings: Install bottom surface of tiles to a tolerance of 1/8 inch in 12 feet and not exceeding 1/4 inch cumulatively.

3.5 -ADJUSTING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

B. Related Sections:

1. Section 096519 "Resilient Tile Flooring" for resilient floor tile.

1.3 ACTION SUBMITTALS

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

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base:

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. Allstate Rubber Corp.; Stoler Industries.
b. Armstrong World Industries, Inc.
c. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
d. Endura Rubber Flooring; Division of Burke Industries, Inc.
e. Johnsonite.
f. Mondo Rubber International, Inc.
g. Musson, R. C. Rubber Co.
h. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
i. Roppe Corporation, USA.

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic).
2. Manufacturing Method: Group I (solid, homogeneous).
3. Style: Cove (base with toe) at resilient floor coverings and exposed concrete floors; Straight (flat or toeless) at carpeted flooring..

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches, 6inches as scheduled or indicated. Provide taller base, custom trimmed to treads at stairs as indicated.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Preformed.

H. Finish: Matte.

I. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:

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. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
    b. Johnsonite.
    c. R.C.A. Rubber Company (The).
    d. Roppe Corporation, USA.

B. Description: Reducer strip for resilient floor covering or exposed concrete floors where abutting carpet or other flooring of different height.

C. Material: Rubber.

D. Profile and Dimensions: Burke 174 wedge shape reducer or other shape as selected by Archtect to suit differing conditions.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

C. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed in straight lines or uniform radiused curves as indicated.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096800 - CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Tufted carpet.
2. Walk-off carpet at exterior doors.
3. Accessories.
4. Third party testing of concrete slab for moisture and PH levels.

B. Related Sections include the following:

1. Division 09 Section “Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.

1.2 SUBMITTALS

A. Product Data: For the following, including installation recommendations for each type of substrate:

1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Seam locations, types, and methods.
4. Type of subfloor.
5. Type of installation.
6. Pattern type, repeat size, location, direction, and starting point.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples for Initial Selection: Provide full range of colors and patterns of carpet and of exposed accessories available from the proposed manufacturers in the specified qualities.

D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet: Three 12-inch- square samples of each specified color and pattern from the stock proposed to be installed. Secure the Architects approval of these samples prior to installation.
2. Exposed Edge, Transition, and other Accessory Stripping: A minimum of two 12-inch-long samples.

3. Carpet Seam: 6-inch sample.
4. Carpet base with edge binding: Two 12 inch long samples.

E. Product Schedule: For carpet use the same designations indicated on Drawings.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

G. Submit certified laboratory test data indicating that carpet meets or exceeds specified test requirements.

H. Certification: Submit the manufacturer's Certification stating that the materials furnished comply with the specified requirements.

I. Submit test results from the Performance and Moisture Test before proceeding with installation.

J. Maintenance Data: For carpet to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

K. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. Testing Agency: Submit qualifications of independent third party testing agency to perform concrete slab moisture and alkalinity testing for acceptance by Owner.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.5 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Testing: Flooring contractor shall retain an independent third party testing agency to perform testing of interior concrete slabs that are to receive resilient backed carpet for moisture and alkalinity levels in accordance with ASTM F 2170 (drilled inserts). Testing shall occur no sooner than 10 days following ventilation and temperature control startup per CRI 104 and no later than 14 days prior to date scheduled for flooring installation. Testing agency shall submit a written report of results and flooring installation may not proceed until moisture levels are below 75% humidity and alkalinity levels are below 90ph or as acceptable to flooring manufacturer.

D. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

1.6 WARRANTY

A. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, zippering, static, loss of tuft bind strength, backing resiliency loss, and delamination.
3. Warranty Period: 25 years, non-prorated from date of Substantial Completion.

B. Installer’s installation guarantee: Repair any carpet defects, including labor and materials due to workmanship or materials for a period of two years.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.
2. Carpet Base(if provided): Full size pieces equal to 5 percent of the amount installed for each type used, but not less than 6 foot long for any piece.
3. Walk-off carpet: 1 additional interchangeable piece for each 10 pieces of each color and size installed in project.

PART 2 - PRODUCTS

2.1 TUFTED CARPET

A. Basis-of-Design Product: Subject to compliance with requirements, provide Tandus style “Crayon”, color “Outside the Lines” no. 48005 and/or other color selected by Architect from same type and price range as follows:

B. Construction: Textured Loop.

1. Fiber System: TDX nylon with Ensure
2. Dye Method: 55% solution dyed/45% yarn dyed.
3. Soil Stain Protection: Ensure
4. Pile Height Average: .109" for finished carpet per ASTM D 418.
5. Stitches per inch: 9.0, ASTM D418
6. Gage: 1/13 ends per inch.
7. Total Weight: 77.0 oz per square yard (± 5%) for finished carpet.
8. Backing System: Powerbond RS Vinyl Cushion
9. Width: 6 feet.
10. Applied Soil-Resistance Treatment: Ensure.
11. Performance Characteristics:

    a. Electrostatic Propensity: Less than 3.0 kV per AATCC 134.
    b. Flooring Radiant Panel Test: Class1, mean average Critical Radiant Flux: 0.45 w/square cm or higher.
    c. Smoke Density: Flaming mean average 450 or less.

2.2 CARPET BASE

A. Provide edge bound carpet base (if scheduled to be provided) in as long of lengths of carpet roll. Bind edges in 4 inch heights. Carry base up full height of toe space where higher than 4" at cabinets, stair side walls and similar locations where indicated and as directed by Architect. Match adjacent floor carpet.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Primers: As recommended by the floor covering manufacturer for the substrate to be covered.

C. Adhesives: Microencapsulated Tackifier applied during manufacturing.

D. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet (and to be ½" high manimum with beveled edge in compliance with CBC for accessibility), and of maximum lengths to minimize running joints.

F. Vinyl or Rubber Transition Strips: For transition of carpet to other surfaces. Color as selected by the Architect. Strips shall be of maximum lengths to minimize running joints. See section 09 65 13 for additional criteria.

PART 3 - WALK-OFF CARPET

A. Provide District standard abrasive action removable and washable walk-off carpets at exterior doors as indicated: Tandus 02578 “Abrasive Action”, 18” x 18” modular tiles with Powerbond backing arranged in a minimum 4’-6”x6’-0”square pattern at entry doors from the outdoors or as otherwise indicated, in the drawings. Color to be “Charcoal” no. 19100. Use black RTSB.

PART 4 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects. See paragraph 1.05, C. for flooring contractor’s third party testing requirements.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
2. Subfloor finishes comply with requirements specified in Division 03 Section "Miscellaneous Cast-in-Place Concrete" for slabs receiving carpet.
3. Subfloors are free of cracks, ridges, loose material, depressions, scale, and foreign deposits.

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

3.2 PREPARATION

A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone,
without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

E. All floors must be inspected and approved by a manufacturing representative and the installation contractor prior to installation of carpet.

F. There will be no exceptions to the provisions stated on the manufacturer’s installation instructions.

3.3 INSTALLATION

A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:

1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

1. Level adjoining border edges.
2. Installation shall be by a certified Tandus/Collins & Aikman installer.

C. Do not bridge expansion joints with carpet.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, cabinet knee space, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install patterns parallel to walls and borders.

H. Install base uniform and level, securely anchored to substrate.

I. Install walk-off carpet in uniform sizes tight to abutting carpet for smooth transition and cut to walls and doorways tight and uniform that will allow removal, cleaning and swapping of walk-off carpet tiles from room to room as much as practical.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.

3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION 096800

SECTION 097217 - VINYL-COVERED TACKBOARD

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 adhesively applied vinyl covered tackboard panels and plastic moldings.

B. Related Sections:

1. Section 092900 - Gypsum Board for surface tackboard is being applied to..

1.3 ACTION SUBMITTALS

A. Product Data: For vinyl material, each type of panel edge, core material, and mounting indicated.

1. Complete materials list of all items proposed to be furnished and installed under this section.
2. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
3. Manufacturer's recommended installation procedures.

B. Shop Drawings: For vinyl covered tackboard. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge and core materials.

1. Include elevations showing panel sizes and direction of fabric weave.

C. Samples for Verification: For the following products, prepared on Samples of size indicated below:

1. Samples for Initial Selection: Provide 3 color cards 6 inch square, for vinyl facing from vinyl-wrapped wall panel manufacturer’s full range of colors and textures.
2. Core Material: 12-inch-square.

D. Product Data:

1. Complete materials list of all items proposed to be furnished and installed under this section.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets, switches, and thermostats.
2. Items penetrating or covered by tackboard wall panels including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Alarms.
    e. Sprinklers.
    f. Access panels.

3. Show operation of hinged and sliding components covered by or adjacent to fabric-wrapped wall panels.

B. Product Certificates: For each type of fabric-wrapped tackboard panel, from manufacturer.

C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tackboard wall panels to include in maintenance manuals. Include tackboard fabric manufacturers' written cleaning and stain-removal recommendations.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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

1. Tackboard panels: 2 percent of each color installed..
2. Mounting Material: One gallon of unopened adhesives.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain tackboard wall panels from single source from single manufacturer.

B. Fire-Test-Response Characteristics: Provide tackboard wall panels meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with tackboard wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tackboard wall panels until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install fabric-wrapped wall panels until a permanent level of lighting is provided on surfaces to receive tackboard wall panels.

C. Field Measurements: Verify locations of fabric-wrapped wall panels and actual dimensions of openings and penetrations by field measurements before fabrication.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of tackboard wall panels that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Fabric sagging, distorting, or releasing from panel edge.
b. Warping of core.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - 2-01 PRODUCTS

2.1 TACKBOARD WALL PANELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Chatfield - Clarke Company, Inc.
2. Do + Able Products, Inc.

B. General Requirements for Tackboard Wall Panels: Panels shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Tackboard Wall Panel: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.

1. Mounting: Edge mounted with splines secured to substrate.

   a. Finish Color at Exposed Edges: Match color of facing material.

2. Mounting: Back mounted with manufacturer's standard adhesive, secured to substrate.
3. Core: Wood fiber.
4. Edge Construction: Manufacturer's standard.
5. Edge Profile: Square.
6. Corner Detail in Elevation: Square with continuous edge profile indicated.
7. Reveals between Panels: Flush reveals.
8. Facing Material: Vinyl fabric.
9. Nominal Overall Panel Thickness: ½ inch.
10. Panel Width: 48 inches
11. Panel Height: Full height between floor and ceiling
12. Minimum vinyl weights:

a.	Total Weight (Oz./Lin. Yd)	15.
b.	Fabric Weight (Oz/Lin. Yd)	2.
c.	Vinyl Weight (Oz/Lin. Yd)	13.

13. Vinyl when tested in accordance with ASTM E-84 (surface burn characteristics of building materials), yielded the following results:

a.	Flame Spread	15
b.	Fuel Contributed	0
c.	Smoke Developed	5

1. Vinyl shall be wrapped around long edges to permit non-covered butt joints.
2. "J" and "H" moldings and corner moldings to match vinyl covered tackboard.

D. Adhesive: Adhesive for applying panels directly to gypsum wallboard and existing plywood shall be as recommended by the panel manufacturer, subject to Architect's review.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated panels, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of tackboard wall panels.

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

3.2 INSTALLATION

A. Install tackboard wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with tackboard, wall panel manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.

C. Align and level fabric pattern and grain among adjacent panels.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch.

B. Variation of Panel Joints from Hairline: Not more than 1/32 inch wide.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 097217

SECTION 099000 - PAINTING

PART 1: GENERAL

1.1 SUMMARY:

A. Included: Paint or otherwise finish all interior and exterior exposed surfaces, except as specifically excluded herein and as customarily excluded by general practices of the industry.

B. Work Not Included:

1. Do not include painting which is specified under other sections.
2. Unless otherwise indicated, painting is not required on surfaces in concealed areas and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces and duct shafts.
3. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require painting under this Section except as may be specified herein.
4. Do not paint any moving parts of operating units; mechanical or electrical parts such as valve operators, linkages, sensing devices, and motor shafts, unless otherwise indicated.
5. Do not paint over any required labels or equipment identification, performance rating, name, or nomenclature plates.
6. Do not paint piping, conduit, panels and similar items in mechanical rooms, except when mechanical, storage, janitor or other such rooms are scheduled to receive a painters or integrally colored finish.

C. Related Sections:

1. Paint: Priming or priming and finishing of certain surfaces are specified to be factory performed or installer performed under other pertinent sections.

1.2 DEFINITIONS:

A. All paint coating system materials include primers, emulsions, epoxy, enamels, sealers, fillers, stain, lacquer, varnish, and other applied materials whether used as prime, intermediate, or finish coats.

1.3 SUBMITTALS:

A. General: Submit the following according to Conditions of the contract and Division 1 Specifications Sections.

B. Product Data: For each paint system specified:

1. Manufacturer’s technical information, including label analysis, instructions for handling, storage and application of each material.
2. Material listing by cross referencing specific coating, finish system and application. Identify each material by the manufacturers catalog numbers and classification.

3. Indicate by transmittal that a copy of each manufacturer's instructions have been submitted to the applicator.

C. Certification: Manufacturers certification that products supplied comply with local regulations controlling use of volatile organic compounds (V.O.C.'s)

D. Samples: Provide manufacturers color charts for initial color selection.

E. Samples: For verification purposes provide four 12"x12" swatches of color and finish for each system specified on actual substrate and texture scheduled to receive finishes.

1.4 QUALITY ASSURANCE:

A. Qualifications of Manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of painting products and with a history of successful production acceptable to the Architect.

B. Applicator Qualifications:

1. Provide at least one person who shall be present at all times during execution of the work of this Section, who shall be thoroughly familiar with the specified requirements and the materials and methods needed for their execution, and who shall direct all work performed under this Section.
2. Provide adequate numbers of workmen skilled in the necessary crafts and properly informed of the methods and materials to be used.

C. Single-Source Responsibility: Provide primers and undercoat paint products produced by the same manufacturers as the finish coats.

D. Paint Coordination:

1. Provide finish coats which are compatible with the prime coats used.
2. Review other sections of these Specifications as required, verifying the prime coats to be used and assuring compatibility of the total coating system for the various substrata.
3. Upon request, furnish information on the characteristics of the specific finish materials to ensure that compatible prime coats are used.
4. Provide barrier coats over noncompatible primers, or remove the primer and reprime as required.
5. Notify the Architect in writing of anticipated problems in using the specified coating systems over prime coating supplied under other sections.

E. Field Samples: On wall surfaces and other exterior and interior components, duplicate finishes of prepared samples. Provide full-coat finish samples on at least 100 sq. ft. of surface until required sheen, color, and texture are obtained; simulate finished lighting conditions for review of in-place work.

1. Final acceptance of colors will be from job-applied samples.

2. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted. Apply coatings in this room or surface according to the schedule or as specified.

a. After finishes are accepted, this room or surface will be used to evaluate coating systems of a similar nature.

1.5 PRODUCT HANDLING:

A. Delivery of Materials: Deliver all materials to the job site in original, new, and unopened containers bearing the manufacturer's name and label showing at least the following information:

1. Name or title of the material
2. Product description
3. Manufacturer's stock number and date of manufacture
4. Contents by volume, for pigment and vehicle constituents
5. Thinning instructions
6. Application instructions
7. Color name and number
8. M.S.D.S. sheets for each product specified.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg. C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.6 JOB CONDITIONS:

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F. (10 deg C) and 90 deg F (32 deg C).

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg. F (7 deg C) and 95 deg F (35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

1.7 PROTECTION:

A. Protect adjacent surfaces from damage or defacement resulting from the work of this Section.

1.8 EXTRA STOCK:

A. Amount: Upon completion of the work of this Section, deliver to the Owner an extra stock equaling 5% of each color, type, and gloss of paint used on the work.

B. Packaging: Tightly seal each container and clearly label with the contents and location used.

PART 2: PRODUCTS

2.1 PAINT MATERIALS:

A. Design is based upon the use of paint products manufactured by PPG Industries, Inc., and the systems of that manufacturer are listed in the SCHEDULE OF PAINT SYSTEMS included in PART 3 of this Section. Commensurate products and systems of Dunn Edwards, Sherwin-Williams Company, Kelly- Moore or approved equal will be considered for approval. Products must comply with requirements of current regulations of the California Air Resources Board and local authority having jurisdiction.

B. Durability: Provide paints of durable and washable quality. Do not use paint materials which will not withstand normal washing as required to remove pencil marks, ink, ordinary soil, and similar material without showing discoloration, loss of gloss, staining, or other damage.

C. Colors and Glosses: The Architect will select colors to be used in the various types of paint specified and will be the sole judge of acceptability of the various glosses obtained from the material proposed to be used in the work.

D. Undercoats and Thinners: Provide undercoat paint produced by the same manufacturer as the finish coat. Use only the thinners recommended by the paint manufacturer, and use only to the recommended limits. Insofar as practicable, use undercoat, finish coat, and thinner material as parts of a unified system of paint finish.

2.2 APPLICATION EQUIPMENT:

A. General: For application of the approved paint, use only such equipment as is recommended by the manufacturer of the particular paint, and as reviewed by the Architect.

B. Compatibility: Prior to actual use of application equipment, use all means necessary to verify that the proposed equipment is actually compatible with the material to be applied and that the integrity of the finish will not be jeopardized by use of the proposed application equipment.

2.3 OTHER MATERIALS: All other materials, not specifically described but required for a complete and proper installation of the work of this Section, shall be new, first-quality of their respective kind, and as selected by the Contractor subject to review by the Architect.

PART 3: EXECUTION

3.1 SURFACE CONDITIONS:

A. Inspection: Prior to installation of the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where the work of this Section may properly commence. Verify that painting may be completed in strict accordance with the original design and with the manufacturers' recommendations as reviewed by the Architect.

B. Discrepancies: Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 MATERIALS PREPARATION:

A. General:

1. Mix and prepare painting materials in strict accordance with the manufacturer's recommendations.
2. Store materials not in actual use in tightly covered containers.
3. Maintain containers used in storage, mixing, and application of paint in a clean condition, free from foreign materials and residue.

B. Stirring: Stir all materials before application and as required during application to produce a uniform mixture. Do not stir surface film which may develop into the material; strain the material if necessary before using.

3.3 SURFACE PREPARATION:

A. General:

1. Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's recommendations as approved by the Architect.
2. Remove all removable items which are in place and are not scheduled to receive paint finish, or provide surface-applied protection prior to surface preparation and painting operations.
3. Following completion of painting in each space or area, reinstall the removed items by using workmen skilled in the necessary trades.
4. Clean and prepare each surface to be painted prior to applying paint or surface treatment.
5. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall onto wet newly painted surfaces.

B. Preparation of Wood Surfaces:

1. Clean all wood surfaces until they are free from dirt, oil, and all other foreign substance.
2. Smooth all finished wood surfaces exposed to view, using the proper sandpaper. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.

3. Unless specifically directed by the Architect, do not proceed with painting of wood surfaces until the moisture content of the wood is 12% or less as measured by a moisture-meter.

C. Preparation of Metal Surfaces:

1. Thoroughly clean all surfaces until they are completely free from dirt, oil, and grease.
2. On galvanized surfaces, prepare per paint manufacturer's recommendations for specified paint system.
3. Allow to dry thoroughly before application of paint.

D. Preparation of Concrete, Plaster or Gypsum Wallboard Surfaces:

1. Thoroughly clean all surfaces until they are free of dust, dirt, oil and grease.
2. Patch holes and cracks to render patch as imperceptible as reasonably possible.

E. Surfaces Not Mentioned:

1. Prepare surfaces not mentioned above in accordance with manufacturer's printed directions. In the absence of manufacturer's directions, prepare in accordance with procedures customarily employed, subject to review by the Architect.

3.4 PAINT APPLICATION:

A. General:

1. Slightly vary the color of succeeding coats. Do not apply additional coats until the complete coat has been inspected. Only the inspected and reviewed coats of paint will be considered in determining the number of coats applied.
2. Sand and dust between enamel coats to remove all defects visible to the unaided eye from a distance of five feet.
3. On all removable panels and all hinged panels, paint the back sides to match the exposed sides.

B. Drying:

1. Allow sufficient drying time between coats. Modify the period as recommended by the material manufacturer to suit adverse weather conditions.

C. Brush Application: Brush out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.

D. Spray Application:

1. Confine spray application to metal framework and similar surfaces where hand brush work would be inferior.
2. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of two coats in one pass.

E. Exposed Plumbing, Mechanical and Electrical Items:

1. Except when specified otherwise, paint conduits, pipes, ducts, grilles, registers, vents, access panels and similar items to match adjacent wall and/or ceiling finish. Paint visible surfaces behind registers, etc., flat black. Do not paint valve stems and bonnets.

F. Doors: In addition to both faces of doors, paint all four edges. Paint surfaces inaccessible after doors are installed prior to hanging.

G. Drawers and Shelves: Provide one coat of clear lacquer or approved equal to all interior surfaces of drawers, concealed shelves and the interior of casework at shelves.

H. Repainting: Extend finish material to a corner or similar transitional line, i.e., blend-in paint at patched area. When required, painting an entire wall may be necessary to achieve a reasonably imperceptible appearance at patched area.

I. Completed work shall match the approved samples for color, texture, and coverage. Remove, refinish, or repaint all work not in compliance with specified requirements.

3.5 PAINT SYSTEMS:

A. Paint system scheduled and noted on drawings. Refer to the complete corresponding paint systems as hereinafter specified. Major areas only are scheduled, but all miscellaneous items and areas within the room or space shall be treated with a suitable system.

B. The number of coats specified is the minimum number acceptable. If full coverage is not obtained with the specified number, additional coats shall be applied without additional cost to the Owner, as necessary to produce a finish acceptable to Architect.

3.6 SURFACES NOT SPECIFIED:

A. Other surfaces not included in the above schedule but which are scheduled or otherwise required to be painted shall be prepared and painted with a system selected by the Contractor subject to Architect's review.

PAINT SYSTEMS SCHEDULE
Paint systems used on this project are identified by an X in the finish schedule designation.

Surface		Finish Schedule Designation		Manufacturer's System Designation		
A. Interior						
(1)	Gypsum Drywall	P12.A	Flat, Latex Emulsion	1st Coat	6-2	PPG Speedhide Interior Latex Primer Sealer 6-2.
				2nd Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.
				3rd Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.
		P12.B X	Semi-Gloss Latex Emulsion	1st Coat	6-2	PPG Speedhide Interior Latex Primer Sealer 6-2.
				2nd Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
				3rd Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
		P12.C X	Eggshell Enamel Latex	1st Coat	6-2	PPG Speedhide Interior Latex Primer Sealer 6-2.
				2nd Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
				3rd Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
		P12.D X	Semi-Gloss Enamel, Alkyd	1st Coat	6-2	PPG Speedhide Interior Latex Primer Sealer 6-2.
				2nd Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
				3rd Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
	(Textured)	P12.E	Flat	1st Coat	47-110	PPG MULTI-PRO™ Interior Flat Latex Wall & Ceiling Paint 47-110 Series.
(2)	Interior Wood	P13.A X	Semi-Gloss Latex	1st Coat	17-951	PPG SEAL GRIP® Interior Primer/Finish
				2nd Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss

Surface		Finish Schedule Designation			Manufacturer's System Designation	
						12-510 Series.
				3rd Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
		P13.BX	Eggshell Enamel, Latex	1st Coat	17-951	PPG SEAL GRIP® Interior Primer/Finish 17-951.
				2nd Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
				3rd Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
		P13.C	Semi-Gloss Enamel Alkyd	1st Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.
				2nd Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
				3rd Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
		P13.D	Lacquer Flat	Stain	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
				1st Coat	500-0279	Gemini Gem Coat Low V.O.C Flat Lacquer
				2nd & 3rd Coat	500-0279	Gemini Gem Coat Low V.O.C Flat Lacquer
		P13.E	Lacquer Satin	Stain	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
				1st Coat	41061	PPG OLYMPIC Premium Interior Water Based Sanding Sealer 41061.
				2nd & 3rd Coat	42786	PPG OLYMPIC® Premium Interior Water Based **Polyurethane** Clear 42786
		P13.F	Lacquer Semi-Gloss	Stain	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
				1st Coat	500-0277	Gemini Gem Coat Low V.O.C Semi-gloss Lacquer
				2nd & 3rd Coat	500-0277	Gemini Gem Coat Low V.O.C Semi-gloss Lacquer
		P13.G	Lacquer Gloss	Stain	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
				1st Coat	41061	PPG OLYMPIC Premium Interior

Surface		Finish Schedule Designation			Manufacturer's System Designation	
						Water Based Sanding Sealer 41061.
				2nd & 3rd Coat	42784	PPG OLYMPIC® Premium Interior Water Based **Polyurethane** Clear 42784.
		P13.H	Varnish Flat	Stain	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
				1st Coat	42784	PPG OLYMPIC® Premium Interior Water Based Satin Polyurethane Clear 42784.
				2nd & 3rd Coat	42784	PPG OLYMPIC® Premium Interior Water Based Satin Polyurethane Clear 42784.
		P13.I	Varnish Velvet	Stain	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
				1st Coat	42784	PPG OLYMPIC® Premium Interior Water Based Satin Polyurethane Clear 42784.
				2nd & 3rd Coat	42784	PPG OLYMPIC® Premium Interior Water Based Satin Polyurethane Clear 42784.
		P13.J	Varnish Semi-Gloss	Stain	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
				1st Coat	42784	PPG OLYMPIC® Premium Interior Water Based Polyurethane Clear 42784.
				2nd & 3rd Coat	42784	PPG OLYMPIC® Premium Interior Water Based Polyurethane Clear 42784.
		P13.K	Varnish Clear Gloss	Three Coats	42786	PPG OLYMPIC® Premium Interior Water Based Gloss Polyurethane Clear 42786
		P13.L	Stain and Varnish	1st Coat	44500	PPG OLYMPIC® Interior Oil Based Wood Stain 44500.
				2nd Coat	42784	PPG OLYMPIC® Premium Interior Water Based Satin Polyurethane Clear 42784
				3rd Coat	42784	PPG OLYMPIC® Premium Interior Water Based Satin Polyurethane Clear 42784
		P13. M	Fire Retardant Intumescent Paint (sheen as selected by	1st Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.
				2nd Coat	42-7	PPG Speedhide Interior Fire

Surface		Finish Schedule Designation			Manufacturer's System Designation	
			Architect)			Retardant Flat Latex 42-7.
				3rd Coat	42-7	PPG Speedhide Interior Fire Retardant Flat Latex 42-7.
		P13.N	Waterborne Epoxy Semi-Gloss	1st Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.
				2nd Coat	98-1	PPG Aquapon WB Water Base Epoxy 98-1 Series.
				3rd Coat	98-1	PPG Aquapon WB Water Base Epoxy 98-1 Series.
(3)	Interior Ferrous Metal	P14.A	Flat Latex	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				3rd & 4th Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.
		P14.B	Semi-Gloss Latex	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				3rd & 4th Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
		P14.C	Eggshell Latex	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				3rd & 4th Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
		P14.D	Semi-Gloss Alkyd	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial

Surface		Finish Schedule Designation			Manufacturer's System Designation	
						Primer 90-912 Series.
				3rd & 4th Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
		P14.E	Waterborne Epoxy Semi-gloss	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	98-1	PPG Aquapon WB Water Base Epoxy 98-1 Series.
				3rd Coat	98-1	PPG Aquapon WB Water Base Epoxy 98-1 Series.
		P14.F	Aquacrylic Dryfall Semi-gloss Primer & Finish	One Coat	6-724XI	PPG SPEEDHIDE® SUPER TECH® WB Interior 100% Acrylic Dry-Fog Semi-Gloss Latex 6-724XI.
(4)	Interior Galvanized Metal/Aluminum	P15.A	Flat Latex	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.
		P15.B	Semi-Gloss Latex	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
				3rd Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
		P15.C	Eggshell Latex	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
				3rd Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
		P15.D	Semi-Gloss Alkyd	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	6-1510	PPG SPEEDHIDE®

Surface		Finish Schedule Designation			Manufacturer's System Designation	
						Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
				3rd Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
(5)	Interior Plaster, Concrete, Brick, Stucco	P16.A	Flat Latex	1st Coat	17-9801	PPG Seal Grip Perm Sealer Vapor Barrier 17-9801
				2nd Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.
				3rd Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.
		P16.B	Semi-Gloss Latex	1st Coat	17-9801	PPG Seal Grip Perm Sealer Vapor Barrier 17-9801
				2nd Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
				3rd Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
		P16.C	Eggshell Latex	1st Coat	17-9801	PPG Seal Grip Perm Sealer Vapor Barrier 17-9801
				2nd Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series
				3rd Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
		P16.D	Semi-Gloss Alkyd	1st Coat	17-9801	PPG Seal Grip Perm Sealer Vapor Barrier 17-9801
				2nd Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
				3rd Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
(6)	Interior Concrete Block	P17.A	Flat latex	1st Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2nd Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior Wall and Ceiling Latex Flat 12-110 Series.
				3rd Coat	12-110	PPG SPEEDHIDE® Pro-EV Interior

Surface		Finish Schedule Designation			Manufacturer's System Designation	
						Wall and Ceiling Latex Flat 12-110 Series.
		P17.B	Semi-Gloss Latex	1st Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2nd Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
				3rd Coat	12-510	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Semi-Gloss 12-510 Series.
		P17.C	Eggshell Latex	1st Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2nd Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
				3rd Coat	12-310	PPG SPEEDHIDE® Pro-EV Interior Enamel Latex Eggshell 12-310 Series.
		P17.D	Semi-Gloss Alkyd	1st Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2nd Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
				3rd Coat	6-1510	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series.
(7)	Interior Acoustical Ceiling Tile/ Plaster	P18.A	Latex	One Coat to Cover	14-110	PPG MULTI-PRO™ Interior Flat Latex Wall & Ceiling Paint 47-110 Series.

B. Exterior						
(1)	Exterior Plaster, Concrete	P50.A	Flat, Acrylic Emulsion	1st Coat	4-503	PPG PERMA-CRETE® Concrete and Stucco Primer 4-503.
				2nd Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
		P50.B	Low Sheen Enamel	1st Coat	4-503	PPG PERMA-CRETE® Concrete and Stucco Primer 4-503.

Surface		Finish Schedule Designation			Manufacturer's System Designation	
			Acrylic	2nd Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76- 45 Series (76-110)
		P50.C	Flat Latex	1st Coat	4-503	PPG PERMA-CRETE® Concrete and Stucco Primer 4-503.
				2nd Coat	6-610XI	PPG SPEEDHIDE® Exterior 100% Acrylic Latex Flat 6-610XI Series.
		P50.DX	Elastomeric (Smooth) 5 yr. warranty	1st Coat	4-503	PPG PERMA-CRETE® Concrete and Stucco Primer 4-503.
				2nd Coat	4-110	PPG PERMA-CRETE® Pitt-Flex Elastomeric Coating 4-110.
				Spray Application	4-110	PPG PERMA-CRETE® Pitt-Flex Elastomeric Coating 4-110.
		P50.E	Elastomeric (Medium Aggregate) 5 yr. warranty	1st Coat	4-503	PPG PERMA-CRETE® Concrete and Stucco Primer 4-503.
				2nd Coat	4-60	PPG PERMA-CRETE® Medium Texture
		P50.F	Elastomeric (Coarse Aggregate) 5 yr. warranty	1st Coat	4-503	PPG PERMA-CRETE® Concrete and Stucco Primer 4-503.
				2nd Coat	4-70	PPG PERMA-CRETE® Coarse Texture
(2)	Exterior Concrete Block	P51.A	Flat, acrylic emulsion	1st Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2nd Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
				3rd Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
		P51.B	Flat Latex	1st Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2nd Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)
				3rd Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)
		P51.C	Elastomeric (Smooth) 5 Yr. warranty	1st Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2nd Coat	4-110	PPG PERMA-CRETE® Pitt-Flex Elastomeric Coating 4-110.
				Spray	4-110	PPG PERMA-CRETE® Pitt-Flex

Surface		Finish Schedule Designation			Manufacturer's System Designation	
				Application		Elastomeric Coating 4-110.
		P51.D	Elastomeric (Medium Aggregate) 5 yr warranty	1st Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2nd Coat	4-60	PPG PERMA-CRETE® Medium Texture
		P51.E	Elastomeric (Coarse Aggregate) 5yr warranty	1st Coat	6-15	PPG SPEEDHIDE® Int./Ext. Acrylic Masonry Block Filler 6-15.
				2nd Coat	4-70	PPG PERMA-CRETE® Coarse Texture
	Exterior Masonry	P51.F	Clear Water Repellent	One Coat	4-6200	PPG PERMA-CRETE® Plex-Seal™ WB Interior/Exterior Clear Sealer 4-6200.
(3)	Exterior Wood	P53.A	Flat Acrylic Emulsion	1st Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.
				2nd Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
				3rd Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
		P53.B	Flat Latex	1st Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.
				2nd Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)
				3rd Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)
		P53.C	Semi-Gloss Acrylic	1st Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.
				2nd Coat	78-45	PPG Sun-Proof Exterior Semi-Gloss Acrylic Latex 78-45 Series.
				3rd Coat	78-45	PPG Sun-Proof Exterior Semi-Gloss Acrylic Latex 78-45 Series.
		P53.D	Low Sheen Enamel Acrylic	1st Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.
				2nd Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)

Surface		Finish Schedule Designation			Manufacturer's System Designation	
				3rd Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)
		P53.E	Gloss; Alkyd Enamel	1st Coat	17-921	PPG SEAL GRIP Interior/Exterior Acrylic Universal Primer/Sealer 17-921.
				2nd Coat	6-1610	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Gloss 6-1610 Series.
				3rd Coat	6-1610	PPG SPEEDHIDE® Interior/Exterior WB Alkyd Gloss 6-1610 Series.
		P53.F	Flat, Stain Oil Base Semi-Transparent	Two Coats	77-1460	PPG SUN-PROOF Deck, Fence, Siding Semi-Transparent Stain 77-1460.
		P53.G	Flat, Stain Opaque	Two Coats	77-1110	PPG SUN-PROOF Deck, Fence, Siding Solid Color Latex Stain 77-1110 Series
(4)	Exterior Ferrous Metal	P55.A	Flat Acrylic	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				3rd & 4th Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
		P55.B	Flat Latex	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				3rd & 4th Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)
		P55.C	Semi-Gloss	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.

Surface		Finish Schedule Designation			Manufacturer's System Designation	
				3rd & 4th Coat	78-45	PPG Sun-Proof Exterior Semi-Gloss Acrylic Latex 78-45 Series.
		P55.D	Gloss	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				3rd & 4th Coat	90-1310	PPG Pitt-Tech® Plus Interior/Exterior High Gloss DTM Industrial Enamel 90-1310 Series.
		P55.E	Elastomeric	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				Spray Application	4-110	PPG PERMA-CRETE® Pitt-Flex Elastomeric Coating 4-110.
(5)	Exterior Galvanized Metal	P56.A	Flat, Acrylic Emulsion	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd & 3rd Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
		P56.B	Flat, latex	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd & 3rd Coat	76-45 76-110	PPG SUN-PROOF® Exterior House and Trim Satin Latex 100% Acrylic 76-45 Series (76-110)
		P56.C	Semi-Gloss	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd & 3rd Coat	78-45	PPG Sun-Proof Exterior Semi-Gloss Acrylic Latex 78-45 Series.
		P56.D	Gloss	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				3rd & 4th	90-1310	PPG Pitt-Tech® Plus

Surface		Finish Schedule Designation			Manufacturer's System Designation	
				Coat		Interior/Exterior High Gloss DTM Industrial Enamel 90-1310 Series.
		P56.EX	Elastomeric	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	4-110	PPG PERMA-CRETE® Pitt-Flex Elastomeric Coating 4-110.
				Spray Application	4-110	PPG PERMA-CRETE® Pitt-Flex Elastomeric Coating 4-110.
(6)	Exterior Aluminum	P58.A	Flat, Acrylic Emulsion	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
				3rd Coat	72-45	PPG Sun-Proof Exterior House & Trim Flat Acrylic Latex 72-45 Series.
		P58.B	Flat, latex	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	6-610XI	PPG SPEEDHIDE® Exterior 100% Acrylic Latex Flat 6-610XI Series.
				3rd Coat	6-610XI	PPG SPEEDHIDE® Exterior 100% Acrylic Latex Flat 6-610XI Series.
		P58.C	Semi-Gloss Enamel	1st Coat	90-912	PPG Pitt-Tech® Plus Interior/Exterior DTM Industrial Primer 90-912 Series.
				2nd Coat	78-45	PPG Sun-Proof Exterior Semi-Gloss Acrylic Latex 78-45 Series.
				3rd Coat	78-45	PPG Sun-Proof Exterior Semi-Gloss Acrylic Latex 78-45 Series.

END OF SECTION 099000

SECTION 101100 - VISUAL DISPLAY UNITS

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. Visual display board assemblies, size as indicated in drawings.
2. Display rails.

B. Related Requirements:

1. Section 097217 "Vinyl Covered Tackboard" for tackable, fabric-covered panels mounted on walls.
2. Section 099000 “Painting” for painting of substrates to receive markerboards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
2. Include electrical characteristics for motorized units.

B. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work.
2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
3. Include sections of typical trim members.

C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:

1. Samples of facings for each visual display panel type, indicating color and texture.

D. Samples for Verification: For each type of visual display unit indicated.

1. Visual Display Panel: Not less than 8-1/2 by 11 inches, with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6-inch-long sections of each trim profile.
3. Display Rail: 6-inch-long section of each type.
4. Accessories: Full-size Sample of each type of accessory.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For visual display units to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.8 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.
b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

B. VISUAL DISPLAY BOARD ASSEMBLY

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

1. Architectural School Products Ltd.
2. Best-Rite; MooreCo, Inc.
3. Claridge Products and Equipment, Inc.
4. Marsh Industries, Inc.
5. Peter Pepper Products, Inc.

D. Visual Display Board Assembly: factory fabricated.

1. Assembly: Markerboard.
2. Corners: Square.
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting Method: Direct to wall.

E. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.

1. Color: White.

F. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-thick, extruded aluminum; standard size and shape.

1. Field-Applied Trim: Manufacturer's standard, snap-on trim with no visible screws or exposed joints.
2. Aluminum Finish: Manufacturer's standard baked-enamel or powder-coat finish.

a. Color: As selected by Architect from full range of industry colors and color densities.

G. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.

H. Chalktray: Manufacturer's standard; continuous.
1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

I. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, designed to hold accessories.

1. Size: 2 inches high by full length of visual display unit.
2. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of display rail or fraction thereof.
3. Flag Holder: One for each room.

J. Paper Holder Display Rail: Extruded aluminum; designed to hold paper by clamping action.

2.2 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

B. Hardboard: ANSI A135.4, tempered.

C. Particleboard: ANSI A208.1, Grade M-1.

D. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.3 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.4 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603, except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.

C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.

1. Mounting Height for Grades K through 3: 24 inches above finished floor to top of chalktray.
2. Mounting Height for Grades 4 through 6 Insert description: 28 inches above finished floor to top of chalktray.
3. Mounting Height for Grades 7 and Higher: 36 inches above finished floor to top of chalktray.

3.4 CLEANING AND PROTECTION

A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Plaques.
2. Dimensional characters.
3. Panel signs.

B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
2. Division 22 Section "Identification for Plumbing Piping and Equipment for labels, tags, and nameplates for plumbing systems and equipment.
3. Division 23 Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
4. Division 26 Sections for electrical service and connections for illuminated signs.
5. Division 26 Section "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
6. Division 26 Section "Interior Lighting" for illuminated Exit signs.

1.3 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Standards for Accessible Design, 2010.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details for signs.

1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:

1. Aluminum.
2. Acrylic sheet.
3. Polycarbonate sheet.
4. Die-cut vinyl characters and graphic symbols. Include representative samples of available typestyles and graphic symbols.

D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:

1. Plaque Casting: 6 inches square including border.
2. Dimensional Characters: Full-size Samples of each type of dimensional character (letter, number, and graphic element).
3. Aluminum: For each form, finish, and color, on 6-inch-long sections of extrusions and squares of sheet at least 4 by 4 inches.
4. Acrylic Sheet: 8 by 10 inches for each color required.
5. Polycarbonate Sheet: 8 by 10 inches for each color required.
6. Fiberglass Sheet: 8 by 10 inches for each color required.
7. Panel Signs: Not less than 12 inches square including border.
8. Accessories: Manufacturer's full-size unit.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products

B. 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.

C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

D. Regulatory Requirements: Comply with applicable provisions in 2019 CBC Chapter 11B.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of metal and polymer finishes beyond normal weathering.
b. Deterioration of embedded graphic image colors and sign lamination

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.

B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.

C. Bronze Castings: ASTM B 584, Alloy UNS No. C86500 (No. 1 manganese bronze).

D. Steel:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial or forming steel.
2. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008/A, commercial steel, Type B, exposed [or] electrolytic zinc-coated, ASTM A 591, with steel sheet substrate complying with ASTM A 1008, commercial steel, exposed.
3. Stainless-Steel Sheet: ASTM A 240 or ASTM A 666, Type 304, stretcher-leveled standard of flatness.

4. Steel Members Fabricated from Plate or Bar Stock: ASTM A 529 or ASTM A 572, 42,000-psi minimum yield strength.
5. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.

E. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

F. Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating:

1. Impact Resistance: 16 ft-lbf/in. per ASTM D 256, Method A.
2. Tensile Strength: 9000 lbf/sq. in. per ASTM D 638.
3. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. per ASTM D 790.
4. Heat Deflection: 265 deg F at 264 lbf/sq. in. per ASTM D 648.
5. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044.

G. Graphic Content and Style: Provide sign copy that complies with CBC Section 11B-703, Signs and requirements indicated on Drawings for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage. Where copy has not been determined or is not indicated, provide copy as selected by Architect. All indicated copy is subject to change without additional cost to Owner until released for production following approval by Owner and Architect.

H. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with CBC 2019 Requirements, 2010 ADA Standards for Accessible Design. Text shall be accompanied by California contracted (Grade 2) Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks in contrasting color from background.

1. Panel Material: Photopolymer and Clear acrylic sheet with opaque color coating, subsurface applied.
2. Raised-Copy Thickness: Not less than 1/32 inch raised letters in Sans Serif upper case characters.
3. Braille shall comply with CBC 11B-703.3 and have domed or rounded dots to comply with Table 11B-703.3.1. Dots shall be 1/10 inch on center in each cell with 3/10 inch space between cells and raised .025-.037 inch above the background.

I. Subsurface Copy: Apply minimum 4-mil-thick vinyl copy to back face of clear acrylic sheet forming panel face to produce precisely formed opaque image. Image shall be free from rough edges.

J. Applied Copy: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing. Apply copy to glass and wall surfaces where indicated.

K. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing, suitable for exterior applications.

2.2 PLAQUES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Gemini Incorporated Bronze Dedication Plaque or a comparable product by one of the following:

1. Advance Corporation; Braille-Tac Division.
2. A. R. K. Ramos.
3. Matthews International Corporation; Bronze Division.
4. Metal Arts; Div. of L&H Mfg. Co.
5. Mills Manufacturing Company.
6. Nelson-Harkins Industries.
7. Southwell Company (The).

B. Cast Plaques: Provide castings free of pits, scale, sand holes, and other defects, as follows:

1. Plaque Material: Bronze.
2. Background Texture: Manufacturer's standard leatherette texture.
3. Border Style: Raised flat band.
4. Mounting: Rosettes and fasteners matching plaque finish, noncorroding for substrates encountered.

C. Plaque Schedule:

1. Plaque Type:

a. Plaque Size: 12 by 18 inches.
b. Character Size: ¾ inch.
c. Character Finish/Color: Polished bronze**.**
d. Text/Message: As indicated.
e. Location: As indicated
f. Quantity: One**.**

2.3 DIMENSIONAL CHARACTERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Gemini Incorporated, Flat Cut Metal Letters or a comparable product by one of the following:

1. A. R. K. Ramos.
2. ASI-Modulex, Inc.
3. Metalic Arts; Div. of L&H Mfg. Co.
4. Mills Manufacturing Company.
5. Mohawk Sign Systems.
6. Nelson-Harkins Industries.
7. Southwell Company (The).
8. Signs of Success

B. Cutout Characters: Provide characters with square-cut, smooth, eased edges. Comply with the following requirements:

1. Aluminum Sheet: 0.25 inchthick.

a. Finish: Anodized.

2. Mounting: Projected with concealed noncorroding studs for substrates encountered.

C. Dimensional Character Sign Schedule:

1. Sign Type: Building Sign:

a. Sign Size: 12” letters .
b. Character Size: Cooperplate Gothic Bold 12” letters.
c. Location: As indicated.

D. Cast Characters: Form individual letters and numbers by casting. Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Comply with requirements indicated for finish, style, and size.

1. Material: Formed-acrylic sheet or metal as indicated.

2.4 PANEL SIGNS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Vomar 100 series signs or a comparable product by one of the following:

1. A. R. K. Ramos.
2. ASI-Modulex, Inc.
3. Metalic Arts; Div. of L&H Mfg. Co.
4. Mills Manufacturing Company.
5. Mohawk Sign Systems.
6. Nelson-Harkins Industries.
7. Southwell Company (The).
8. Signs of Success

B. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following requirements:

1. Acrylic Sheet: 0.125-inch-thick, extruded, high-impact acrylic sheet in color to match face color.
2. Edge Condition: Beveled.
3. Corner Condition: Rounded to 1/8” radius or as indicated.
4. Mounting: Unframed.

a. Wall mounted with two-face tape.
b. Manufacturer's standard anchors for substrates encountered.

5. Color: As selected by Architect from manufacturer's full range.

6. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surface with contrasting colors.

C. Exterior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following requirements:

1. Acrylic Sheet: 0.125-inch-thick, extruded, high-impact acrylic sheet in color to match face color.
2. Edge Condition: Beveled.
3. Corner Condition: Rounded to 1/8” radius or as indicated.
4. Mounting: Unframed.

    a. Wall mounted.
    b. Manufacturer's standard non-corroding anchors for substrates encountered.

5. Color: As selected by Architect from manufacturer's full range.

D. Toilet Room Door Symbols: Refer to drawings for graphic layout. Provide door sign plaques with the following attributes:

1. Material: Cast-acrylic sheet.
2. Plaque color: Blue (or other approved contrasting color).
3. Symbol color: White (or other approved contrasting color).
4. Perimeter: Unframed.
5. Size: Men's door shall have an equilateral triangle with 12" sides, 1/4" thick with a vertex pointing upward with figure indicated.
6. Size: Women's door shall have a 12" diameter circle, 1/4" thick with figure as indicated.
7. Size: A unisex door shall have a 12" diameter circle, 1/4" thick, and a 1/4" thick triangle inscribed and superimposed on the circle with figure indicated.
8. Margins: Center/center.
9. Colors: As selected by Architect, subject to jurisdictional approval.

E. Tactile Toilet Room Wall Signs: Refer to drawings for graphic layout. Provide wall sign plaques to latch side of door with the following attributes:

1. Material: Cast-acrylic sheet (Non-Glare).
2. Plaque color: Blue (or other approved contrasting color).
3. Type color: White (or other approved contrasting color)
4. Perimeter: Unframed with ¼” radiused comers
5. Size: 8” minimum width x 9” minimum height with a minimum 6” high field for raised wheelchair logo and adjacent man/woman 5” to 6” high pictogram.
6. Margins: Center/center.
7. Copy: ¾” high (minimum) Sans Serif Bold raised (1/32”) letters stating gender with California contracted (Grade 2) Braille below repeating gender (or reading "RESTROOM" or "STAFF") at Unisex toilets.
8. Text color: White (or other approved contrasting color).

F. Tactile Exit Signs: Accessible exit and exit route sign text and locations shall be as indicated by the drawings.

1. Material: 1/8 inch thick x 4 inch minimum high non-glare acrylic plate.
2. Plaque color: As selected by Architect from manufacturer's full range.

3. Perimeter: Unframed with 1/4" radiused corners.
4. Size: As indicated by the drawings and as required for length of text.
5. General: Sub-surfaces Process, with 1/32 inch raised letters with integral contracted (Grade 2) Braille centered below letters.
6. Text: 3/4 inch high Sans Serif Bold lettering.

G. Tactile Room Identification Signs (Exterior and Interior): Sign locations shall be as indicated by the drawings.

1. Material: 1/8 inch thick x 4 inch minimum high non-glare acrylic plate.
2. Plaque color: As selected by Architect from manufacturer's full range.
3. Perimeter: Unframed with 1/4" radiused corners.
4. Size: As indicated by the drawings and as required for length of text.
5. General: Sub-surfaces Process, with 1/32 inch raised border with California Contracted integral Grade 2 Braille copy.
6. Text: 1- inch high Sans Serif Bold lettering.
7. Locations: Provide one sign at each main room entry door plus additional signs as required to comply with ADA-ABA and CBC standards and as indicated by drawings.
8. Text allowance: Allow fifteen (15) letters and three (3) numerals for each sign. Classrooms shall be identified by room number (2" high) below the word “Classroom” (1" high) and with Braille below.

H. Occupancy Signs: Sign text and locations shall be as indicated by the drawings.

1. Material: 1/8 inch thick x 6 inch high non-glare acrylic plate.
2. Plaque color: As selected by Architect from manufacturer's full range.
3. Perimeter: Unframed with 1/4" radiused corner.
4. Size: As indicated by the drawings and as required for length of text.
5. General: Sub-surfaces Process, with 1/32 inch raised letters with integral Grade 2 Braille copy.
6. Text: 1/2 inch high (48 point) Sans Serif lettering.
7. Wording for Sign at Assembly Rooms: As indicated by the drawings.

I. International Symbol of Accessibility Signs: As indicated by drawings.

1. Figure Symbols: Building Entrance Sign; Size: 6" x 6", typical.
2. Assistive Listening Systems: At assembly room with public address systems provide symbol of Access for Hearing loss in accordance with 2019 CBC 11 B-703.7.2.4.

J. Metal Signs: General

1. Materials: Reflectorized sign shall be porcelain on steel with beaded text; galvanized steel post and concrete footing. See civil drawings for text.
2. Type Imagery:

    a. Type Style: Helvetica Medium, all upper case.
    b. Arrangement: Use standard spacing between letters, words, numbers and lines; centered typically.

K. Accessible Parking Signs: As indicated by drawings.

1. Material: 0.080-inch aluminum or other noncorrosive material.
2. Background Color: Blue.

3. Copy-Material: Reflective vinyl.
4. Mounting: Post mounted. Wall/fence mounted where applicable and indicated by drawings.

L. Symbols of Accessibility: Provide 6-inch high symbol fabricated from opaque non-reflective vinyl film, 0.0035-inch nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

2.5 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

B. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit panel sign construction and mounting conditions indicated. Factory-paint brackets in color matching Architect’s sample.

2.6 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.

1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish, complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, are sized and located to accommodate signs.

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

3.2 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Shim Plate Mounting: Provide 1/8-inch-thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
3. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
4. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.
5. Where bracket mounted signs are indicated or where face mounting is not possible: provide manufacturer’s standard brackets, fittings, and hardware as appropriate for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring devices to comply with manufacturer’s written instructions.

C. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

1. Projected Mounting: Mount characters at projection distance from wall surface indicated.

D. Cast-Metal Plaques: Mount plaques using standard fastening methods to comply with manufacturer's written instructions for type of wall surface indicated.

1. Face Mounting: Mount plaques using exposed fasteners with rosettes attached through face of plaque into wall surface.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 102605 - CORNER GUARDS

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. Corner guards.

B. Related Sections:

1. Section 087100 "Door Hardware" for metal armor, kick, mop, and push plates.

1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

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

1. Corner Guards: 12 inches long. Include examples of joinery, corners, end caps, top caps, and field splices.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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

1. Corner-Guard Covers: Provide 8 full-size 4-foot-long plastic covers.

B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 014000 "Quality Requirements."

D. Revise subparagraph below to suit Project.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store corner-guard covers off the floor in a vertical or fully supported position to keep covers straight.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of plastic and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded material, thickness as indicated.

1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
2. Chemical and Stain Resistance: Tested according to ASTM D 543.
3. Self-extinguishing when tested according to ASTM D 635.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.

B. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 CORNER GUARDS

A. Surface-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.

1. Basis-of-Design Product: Subject to compliance with requirements, provide C/S Acrovyn corner guards or comparable product by one of the following:

a. American Floor Products Co., Inc.
b. Construction Specialties, Inc.
c. IPC Door and Wall Protection Systems; Division of InPro Corporation.
d. Korogard Wall Protection Systems; a division of RJF International Corporation.
e. Musson Rubber Company.
f. Pawling Corporation.
g. Tepromark International, Inc.
h. WallGuard.com.

2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; as follows:

    a. Profile: Nominal 3-inch- long leg and 1/4-inch corner radius.
    b. Height: 4 feet.
    c. Color and Texture: As selected by Architect from manufacturer's full range.

3. Retainer: Minimum 0.060-inch-thick, one-piece, extruded aluminum.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.3 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances[**,** and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

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

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings or, if not indicated, at heights indicated below:

a. Corner Guards: At all outside corners of interior spaces, from top of wall base, up 4 feet high.

2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

a. Provide anchoring devices to withstand imposed loads.
b. Adjust top caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

END OF SECTION 102605

SECTION 102800 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Underlavatory guards.
3. Custodial accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.7 COORDINATION

A. Coordinate accessory locations (including wall recess opening) with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.8 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

A. Basis-of-Design Products: Subject to compliance with requirements, provide Bobrick or comparable products by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bradley Corporation.
4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
5. Tubular Specialties Manufacturing, Inc.

B. Toilet Tissue (Roll) Dispenser TP-1

1. Basis-of-Design Product: B-3888
2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
3. Mounting: Recessed.
4. Operation: Noncontrol delivery with theft-resistant spindle.
5. Capacity: Designed for 5-inch-diameter tissue rolls.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

C. Toilet Tissue (Roll) Dispenser TP-2

1. Basis-of-Design Product: B-2888
2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
3. Mounting: Surface.
4. Operation: Noncontrol delivery with theft-resistant spindle.
5. Capacity: Designed for 5-inch-diameter tissue rolls.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

D. Toilet Tissue (Roll) Dispenser TP-3:

1. Basis-of-Design Product: B-6677.
2. Description: Single-roll dispenser.

3. Mounting: Recessed.
4. Operation: Noncontrol delivery with standard spindle.
5. Capacity: Designed for 5-inch-diameter tissue rolls.
6. Material and Finish: Satin-Stainless steel with chrome plastic spindle,.

E. Paper Towel (Folded) Dispenser PT-1:

1. Basis-of-Design Product: B-359.
2. Mounting: Recessed.
3. Minimum Capacity: 300 C-fold or 400 multifold towels.
4. Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.
6. Refill Indicators: Pierced slots at sides or front.

F. Paper Towel (Folded) Dispenser PT-2:

1. Basis-of-Design Product: B-262.
2. Mounting: Surface.
3. Minimum Capacity: 300 C-fold or 400 multifold towels.
4. Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.
6. Refill Indicators: Pierced slots at sides or front.

G. Liquid-Soap Dispenser SD-1

1. Basis-of-Design Product: B-2111>.
2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 40 oz.
5. Materials: body of stainless steel, No. 4 finish (satin). Valve of black molded push button and spout, soap head-holding mushroom valve. Stainless steel spring and duckbill.
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

H. Grab Bar GB-1:

1. Basis-of-Design Product: B-6806.99.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: Straight, 36 inches minimum.

I. Grab Bar GB-2:

1. Basis-of-Design Product: B-6806.99.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: Straight, 42 inches minimum.

J. Seat-Cover Dispenser SC-1:

1. Basis-of-Design Product: B-301.
2. Mounting: Recessed.
3. Minimum Capacity: 500 seat covers.
4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.

K. Mirror Unit MIR-1

1. Basis-of-Design Product: B-2908.
2. Frame: Stainless-steel angle, 0.05 inch.

    a. Corners: Welded and ground smooth.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

    a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

4. Size: 18” X 36”

2.2 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Plumberex Specialty Products, Inc.
2. Truebro by IPS Corporation.

B. Underlavatory Guard LG-1:

1. Basis-of-Design Product: Lavguard 2.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.3 CUSTODIAL ACCESSORIES

A. Basis-of-Design Products: Subject to compliance with requirements, provide Bobrick or comparable products by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
6. Tubular Specialties Manufacturing, Inc.

B. Mop and Broom Holder MBH-1:

1. Basis-of-Design Product: B-239.

2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 34 inches .
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

    a. Shelf: Not less than nominal 0.05-inch-thick stainless steel.

C. Paper Towel (Folded) Dispenser PT-2:

1. Basis-of-Design Product: B-262.
2. Mounting: Surface mounted.
3. Minimum Capacity: 400 C-fold or 525 multifold towels.
4. Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.
6. Refill Indicators: Pierced slots at sides or front.

D. Liquid-Soap Dispenser SD-1

1. Basis-of-Design Product: B-2111>.
2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 40 oz.
5. Materials: body of stainless steel, No. 4 finish (satin). Valve of black molded push button and spout, soap head-holding mushroom valve. Stainless steel spring and duckbill.
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to Drawing Plans, Details, Notes and Interior Elevations for locations and mounting heights of all accessories. Verify all accessories can be mounted to comply with applicabl disabled access requirements per 2019 CBC Chapter 11B, Division 6 and notify Architect of any conflicts prior to installing blocking/backing, cutting-in of openings and ordering of any related materials. Provide alternative units of equal or better quality and capacity to suite the specific accessory location. Paper towel dispensers, hair dryers, napkin dispensers and similar accessories located in accessible path of travel within toilet rooms shall not protrude more than 4" from the face of the wall along the accessible route to fixtures.

B. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected

3.2 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. All accessories mounted on toilet partitions shall use tamper-resistant torx through bolts.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Install grab bars to withstand a downward load of at least 250 Ibf, when tested according to method in ASTM F 446.

1. Where mounting gab bars to toilet partitions provide stainless steel backing plate and thru-anchors (Bobrick 2583 or equal).

3.3 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION 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. Fire protection cabinets for the following:

a. Portable fire extinguishers.
b. Fire hose valves.
c. Fire hoses and racks.

B. Related Sections:

1. Section 101400 "Signage" for directional signage to out-of-sight fire extinguishers and cabinets.
2. Section 104416 "Fire Extinguishers."

1.3 ACTION SUBM ITTALS

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

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Samples: For each type of exposed finish required.

D. Selection: For each type of fire protection cabinet indicated.

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

F. Size: 6 by 6 inches square.

G. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.6 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 SEQUENCING

A. Apply vinyl lettering on field-painted, fire protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

1. Sheet: ASTM B 209.
2. Extruded Shapes: ASTM B 221.

B. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 6 mm thick, with Finish 1 (smooth or polished).

C. Acrylic Bubble: One piece.

2.3 FIRE PROTECTION CABINET FE-1.

A. Cabinet Type: Suitable for fire extinguisher.

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. J. L. Industries, Inc., a division of Activar Construction Products Group; Clear View Fire Extinguisher cabinet.
b. Larsen's Manufacturing Company; Cameo series Fire Extinguisher Cabinet.
c. Potter Roemer LLC; Loma series Fire Extinguisher Cabinet.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Aluminum sheet.

D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.

1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Aluminum sheet.

G. Door Style: Full bubble with frame.

H. Door Glazing: Molded acrylic bubble.

1. Acrylic Bubble Color: Clear, transparent.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide manufacturer's standard.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Accessories:

1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location

a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet glazing.
2) Application Process: Decals.
3) Lettering Color: White.

4) Orientation: Vertical.

K. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:

a. Exterior of cabinet , door frame, and trim except for those surfaces indicated to receive another finish.
b. Interior of cabinet

2.4 FIRE PROTECTION CABINET FE-2.

A. Cabinet Type: Suitable for fire extinguisher.

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. J. L. Industries, Inc., a division of Activar Construction Products Group; Clear View Fire Extinguisher cabinet.
b. Larsen's Manufacturing Company; Cameo series Fire Extinguisher Cabinet.
c. Potter Roemer LLC; Loma series Fire Extinguisher Cabinet.

B. Cabinet Construction: 1-Hour Rated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch-thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Aluminum sheet.

D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.

1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Aluminum sheet.

G. Door Style: Full bubble with frame.

H. Door Glazing: Molded acrylic bubble.

1. Acrylic Bubble Color: Clear, transparent.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide manufacturer's standard.

2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Accessories:

1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location

a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet glazing.
2) Application Process: Decals.
3) Lettering Color: White.
4) Orientation: Vertical.

K. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:

a. Exterior of cabinet , door frame, and trim except for those surfaces indicated to receive another finish.
b. Interior of cabinet.

2.5 FIRE PROTECTION CABINET FH-1.

A. Cabinet Type: Suitable for hose, rack, and valve.

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. J. L. Industries, Inc., a division of Activar Construction Products Group; Clear View Fire Extinguisher cabinet.
b. Larsen's Manufacturing Company; Cameo series Fire Extinguisher Cabinet.
c. Potter Roemer FRC 1300 series Fire Extinguisher Cabinet.

B. Cabinet Construction: 1-hour rated (min) per UL 7N43.

C. Cabinet Material: Minimum 20 Ga. Cold-rolled steel sheet with minimum 5/8 inch thick fire barrier material.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: 18 Ga. Cold-rolled steel sheet.

F. Door Material: 20 Ga. Tubular steel.

G. Door Style: Solid opaque panel with frame.

H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide manufacturer's standard.
2. Provide continuous hinge, of same material and finish as trim permitting door to open 180 degrees.

I. Accessories:

1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE HOSE."

1) Location: Applied to cabinet door.
2) Application Process: Pressure-sensitive vinyl letters.
3) Lettering Color: White.
4) Orientation: Vertical

J. Materials:

1. Aluminum: ASTM B 221, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet. ASTM B 221 for extruded shapes.

a. Finish: Baked enamel or powder coat.
b. Color: As selected by Architect from full range of industry colors and color densities.

2.6 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated. See 10/A8.01.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

C. Identification: Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers.

B. Related Sections:

1. Section 104413 "Fire Extinguisher Cabinets."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.

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. Amerex Corporation.
b. Ansul Incorporated; Tyco International Ltd.
c. Badger Fire Protection; a Kidde company.
d. J. L. Industries, Inc.; a division of Activar Construction Products Group.
e. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
f. Larsen's Manufacturing Company.
g. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
h. Potter Roemer LLC.

2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

C. Provide mounting brackets where required or where extinguisher is indicated for mounting directly to wall without a cabinet.

D. Provide additional specialty extinguisher at kitchen and other locations as indicated in drawings, k-type, bracket mounted to wall where indicated in kitchen and as approved by local fire authority.

2.2 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

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

2.3 INSTALLATION

A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

SECTION 114500 - FLAT PANEL T.V. MOUNTING BRACKETS

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. Wall mounted T.V. brackets for a 32” to 50” Flat Panel / LCD television. Mount for bottom of T.V. 80” minimum above finish floor.

B. Related Sections:

1. Section 061000 – Rough Carpentry
2. Division 26 - Electrical

1.3 SUBMITTALS:

A. Manufacturer's Data:

1. Product literature showing construction details of the manufactured units and installation details.

1.4 QUALITY ASSURANCE:

A. Qualifications of Manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

B. Qualifications of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

PART 2: PRODUCTS

2.1 MANUFACTURER:

A. Peerless SmartMount articulating wall arm TV Mount model no. SA746PU as manufactured by Peerless Industries, Melsrose Park, IL, or equivalent by Lucasey Manufacturing Corp., Da-lite Screen Co., Inc. or Bretford Inc.

B. Accessories: Metal stud fastener kit ACC615 for metal stud construction, A/V Component mount connector model no. ACC932, Adjustable A/V component mount model no. DS35.

PART 3: EXECUTION

3.1 Install the work of this Section in strict accordance with the manufacturers' recommendations, and as indicated on the drawings anchoring into position for long life under hard use.

END OF SECTION 114500

SECTION 122116 - VERTICAL LOUVER BLINDS

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. Vertical louver blinds with PVC and fabric insert vanes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for vertical louver blinds.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long.

D. Samples for Initial Selection: For each type of vertical louver blind.

1. Include similar Samples of accessories involving color selection.

E. Samples for Verification: For each type of vertical louver blind.

1. Vane: Not less than 12 inches long.

a. Fabric: 3-1/2 inches wide from dye lot used for the Work. Mark top and face of material.

2. Vertical Louver Blind: Full-size unit, not less than 36 inches wide by 36 inches long.
3. Valance: Full-size unit, not less than 12 inches wide.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For vertical louver blinds to include in maintenance manuals.

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. Vertical Louver Blinds: Full-size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and finish indicated, but no fewer than two units.
2. Vanes: Furnish quantity of full-size units equal to 5 percent of quantity installed for each type, size, texture, pattern, and finish indicated, but no fewer than two units.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver vertical louver blinds in factory packages, marked with manufacturer and product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install vertical louver blinds until construction and wet and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where vertical louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain vertical louver blinds from single source from single manufacturer.

2.2 VERTICAL LOUVER BLINDS, PVC VANES WITH FABRIC VANE INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hunter Douglas Contract.
2. Levolor Contract; a Newell Rubbermaid company.
3. Springs Window Fashions.

B. Vanes: Lead-free, UV-stabilized, permanently flexible, extruded PVC that will not crack or yellow; with not less than 3/8-inch overlap when vanes are rotated fully closed. Provide integrally colored, opaque vane with clear grooves for holding fabric insert.

1. Width: 3-1/2 inches.
2. Fabric Insert: Manufacturer's standard; stain and fade resistant.

C. Headrail: Channel, formed steel or extruded aluminum with long edges returned or rolled and ends capped. Headrail encloses operating mechanisms including carrier-spacing mechanism that provides uniform vane spacing when blinds are traversed fully across headrail (closed).

1. Manual Traverse Control: Nickel-plated metal bead chain.
2. Manual Rotation Control: Nickel-plated metal bead chain.
3. Manual Control Locations: As indicated on Drawings.
4. Draw and Stack: Two way, center split.
5. Cord-Tensioner Mounting: Wall.

D. Carriers: Engineered plastic with gears to align and synchronize vane rotation and stems that allow vane removal and replacement. Lead carriers have self-lubricating wheels or elongated bearing surfaces; following carriers have self-lubricating wheels.

E. Valance: Manufacturer's standard with vane insert.

F. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.

1. Type: Wall.
2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.

G. Colors, Textures, and Patterns:

1. Vanes:

a. Fabric Inserts: As selected by Architect from manufacturer's full range.

2.3 VERTICAL LOUVER BLIND FABRICATION

A. Product Safety Standard: Fabricate vertical louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to cover window and other openings as follows, measured at 74 deg F:

1. Outside of Jamb Installation: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Rotation-and-Traverse Mechanisms: With permanently lubricated moving parts.

D. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail[**, valance,**] and operating hardware and for bracket positions and blind mounting method indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

F. Color-Coated Finish: For metal components exposed to view unless anodized or plated finish is indicated. Apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.

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

3.2 INSTALLATION

A. Install vertical louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.

1. Locate so exterior vane edges are not closer than 2 inches from interior faces of glass and not closer than 1-1/2 inches from interior faces of glazing frames through full operating ranges of blinds.
2. Install mounting and intermediate brackets to prevent deflection of headrails.
3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.3 ADJUSTING

A. Adjust vertical louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

A. Clean vertical louver blind surfaces after installation according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer and that ensures that vertical louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged vertical louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

END OF SECTION 122116

SECTION 21 0000 - FIRE SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 23 0000, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

A. General: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The entire building shall be fire sprinklered.

B. Design/Calculations: The sprinkler system has been designed and sized by hydraulic calculations in accordance with 2016 NFPA No. 13, NFPA 14 and fire authority requirements. Calculations have been included in submittals. Provide current fire flow information from flow test at nearest fire hydrant. Fire flow test shall be done within 6 months of installation of sprinkler system.

C. Preparation of Drawings and Material Data Sheets: A complete fire sprinkler submittal (drawings, specifications, materials and hydraulic calculations) has been prepared. Hydraulic calculations shall conform to 2016 NFPA 13, paragraph 23.3.5 & NFPA 14 in all respects.

D. Coordination Drawings: Contractor shall submit coordination drawings with Contractor title block to Engineer for review, in addition to materials submittals. Deviations between bid documents and coordination drawings shall be specifically noted on drawings (highlighted, clouded, etc.). Any contractor requested design changes to these documents, including layout, materials, or calculations, may be considered a substitution and shall comply with paragraph 1.4 below.

1.3 WORK SPECIFIED ELSEWHERE:

A. Electrical wiring.

B. Fire alarm system.

C. Painting of exposed piping.

1.4 DESIGN CHANGES/SUBSTITUTIONS:

A. General: Design changes or substitutions of fire sprinkler system shall be submitted to Engineer for review.

B. Significant changes in design or substitution of materials may require a construction change document, requiring resubmission to DSA/FLS, as determined by the Engineer and/or DSA District Engineer. Contractor shall bear all expenses incurred due to preparation and processing of design substitutions, up to and including submission to, and obtaining approval from, DSA/FLS. Refer to Section 23 0000, 1.11, B, and DSA Policy PL 10-01 and Interpretation of Regulations IR A-6, available from http://www.dsa.dgs.ca.gov.

PART 2 - PRODUCTS

2.1 STANDARDS:

A. All materials shall be in accordance with 2016 NFPA No.13 "Standard for the Installation of Sprinkler Systems". Underground mains shall be in accordance with 2016 NFPA No. 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances".

2.2 PIPING MATERIALS:

A. General: The pressure rating of all piping, valves, flanges and other piping accessories shall be in accordance with code and fire authority requirements. Pressure ratings shall exceed the highest possible working pressure.

B. Piping:

1. Underground: Polyvinyl chloride, Class 200, DR 14, AWWA C900, with rubber ring joints, ASTM D1869. Cast or ductile iron fittings, AWWA C110 or C153, Class 250 or higher, with rubber ring joints, ASTM D1869.
2. Above Grade:

a. 1-1/4" and Smaller: Threaded black steel pipe, ASTM A53, schedule 40. 175 psi WOG (min.) black cast iron threaded fittings, ANSI B16.4, UL listed. Unions shall be Class 150 malleable iron threaded, ANSI B16.3.
b. 1-1/2" and Larger: Welded black steel pipe, ASTM A53, EddyFlow. Standard weight carbon steel welding fittings, ANSI B16.9. Flanges shall be steel, ANSI B16.5. Roll grooved pipe couplings may be used for assembling welded sections, Victaulic, Grinnell, Gruvlok.

C. Gate Valve:

1. 2" and Smaller: All bronze, rising stem. UL listed.
2. 2-1/2" and Larger: Iron body, bronze mounted, outside screw and yoke. UL listed. (UL listed butterfly valves may be substituted for 4" and larger gate valves above grade.)

D. Check Valve:
1. 2" and Smaller: All bronze swing check. UL listed.
2. 2-1/2" and Larger: Iron body, bronze mounted swing check. UL listed.

E. Drain Valve: All bronze angle globe valve. UL listed.

F. Anchors and Hangers: Shall comply with 2016 NFPA No. 13.

2.3 SPRINKLER HEAD:

A. Automatic sprinkler head, concealed type in areas with finished ceilings and recessed or suspended lighting, concealed type in areas with finished ceilings and surface lighting, upright or pendent heads elsewhere (as allowed by NFPA 13). Heads shall be quick response, Tyco, Model TY-FRB. UL listed. Temperature ratings shall be in accordance with NFPA No. 13. Provide extra heads (of each type installed) in accordance with code requirements. Exposed heads installed with deflector lower than 7'-6" above floor shall have wire guards.

2.4 ALARM VALVE ASSEMBLY:

A. Standard wet type alarm valve assembly and electric bell complete with trim as required by the authority having jurisdiction. Provide flow switch for connection to alarm system. Provide tamper switch. UL listed. Coordinate electric bell with Division 28.

PART 3: - EXECUTION

3.1 PIPING INSTALLATION:

A. General: Piping shall be concealed in walls, above the ceilings or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location shall be approved by the Architect. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. Depth of cover in traffic areas shall be 36 inches (minimum).

1. Installer Certification: Installation shall be performed by certified fire sprinkler fitter(s) as required by CCR, Title 19, Divisions 1, Chapter 5.5. See CAL FIRE – Office of the State Fire Marshall Information Bulletin 17-002 for more information. The Bulletin can be downloaded from the following: http://osfm.fire.ca.gov/informationbulletin/pdf/2017/IB_AESCert_final_05_25_17.pdf

B. Standards: All piping shall be installed in accordance with NFPA No. 13 "Standard for the Installation of Sprinkler Systems". Underground mains shall be installed in accordance with NFPA No. 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances".

C. Miscellaneous:

1. Escutcheons: Provide chrome plated metal escutcheons where piping penetrates walls, ceilings or floors in finished areas.
2. Pattern: Sprinklers shall be installed in a symmetrical pattern with lighting fixtures and with ceiling pattern. Heads located in lay-in ceilings shall be centered in panel.
3. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe for piping 3" and smaller and 2" annular clearance for piping 4" and larger.
4. Access: Provide access doors as required for all valves, devices, etc.
5. Pipes Passing through Fire Rated Surfaces: Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe, or pipe insulation sealed with fire rated materials in accordance with the requirements of 2019 CBC Section 714.
6. Concrete Thrust Blocks: Shall be constructed at all valves, tees, elbows, bends, crosses, reducers and dead ends in loose-joint pipe. Blocks shall cure a minimum of 7 days before pressure is applied. Concrete shall be 3000 psi mix.
7. Electrical Equipment: Piping shall not be run over electrical panels, motor control centers or switchboards, except where specifically allowed by CEC.

3.2 IDENTIFICATION:

A. All controls, piping, valves and equipment shall be labeled for function and service in accordance with NFPA No. 13.

3.3 TESTS AND ADJUSTMENTS:

A. Unless otherwise directed, tests shall be witnessed by a representative of the Architect and an inspector of the authority having jurisdiction. Contractor shall notify fire authority at least 48 hours prior to testing. At various stages and upon completion, the system must be tested in the presence of the enforcing agency. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and the entire work retested. Test all systems in accordance with fire authority requirements and NFPA No. 13, No.14 and No. 24.

B. Backflow Preventer: All backflow preventers shall be tested according to manufacturer's recommendations and the USC Cross Connection Control and Hydraulic Research Manual (8th Edition). Testing shall be performed by an AWWA Certified Backflow Prevention Assembly Tester. Contractor shall certify in writing to the Architect the date which backflow preventers were tested and by whom test was witnessed.

3.4 CERTIFICATION:

A. At completion of the project, Contractor’s Material and Test Certificates for Underground Piping and for Above Ground Piping, indicating installation and testing in accordance with referenced standards, shall be completed. Copies shall be prepared by Contractor for the local fire authority, Architect, Owner (School District) and DSA. Deliver certificates to Owner through Architect.

END OF SECTION 21 0000

SECTION 211100 – FACILITY FIRE SUPPRESSION WATER PIPING SYSTEM

PART 1: GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

A. Included: Provide all labor, materials, and services necessary for complete, lawful, and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Perform excavation and backfill required for work of this section.
2. Complete installation of fire suppression water distribution piping and related components outside the building(s), including all related piping, fittings, valves, etc.
3. Post indicator valve.
4. Fire department connection.
5. All material and equipment as shown or noted on the drawings or as specified.
6. Fire hydrant flow test and report.
7. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, braces, housekeeping pads, supports and related items no longer required.

B. Design/Calculations: The fire suppression system has been designed in accordance with fire authority requirements.

C. Preparation of Drawings and Material Data Sheets: Any contractor requested changes to these documents, including layout, materials or calculations shall be considered a substitution and shall comply with paragraph 1.4 below

D. Work Specified Elsewhere:

1. Division 21 for Fire Sprinkler System
2. Division 26 Electrical
3. Fire detection and alarm system.
4. Painting unless specifically called for in the drawings or specifications.

1.3 QUALITY ASSURANCE:

A. Contractor Qualifications: The installing contractor shall have a minimum of five years of experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.

B. Welder Qualifications: Welders shall be certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9. Certified welder shall bear evidence of valid certification thirty (30) days before commencing work on project.

C. Underwriters Laboratories (UL) Listed: Equipment, pipes, fittings, and valves must be UL Listed for fire protection service.

D. California State Fire Marshal (CSFM) Listed/Approved: Equipment, pipes, fittings, and valves must meet the requirements of the California State Fire Marshal for fire protection service.

E. Piping materials shall bear label, stamp, or other markings of specified testing agency.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

G. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.

1.4 SUBSTITUTIONS:

A. General: Substitutions of fire suppression system shall be treated as a change order. Contractor shall bear all expenses incurred due to preparation and processing of substitution. Refer to Section 230010 General Mechanical Provisions and DSA Policy PL 09-01.

PART 2: PRODUCTS

2.1 STANDARDS:

A. All materials shall be in accordance with NFPA 24 “Standard for the Installation of Private Fire Service Mains and Their Appurtenances”, latest edition.

2.2 PIPE AND FITTINGS:

A. General: The pressure rating of all piping, valves, flanges, and other piping accessories shall be in accordance with code and fire authority requirements. Pressure ratings shall exceed the highest possible working pressure.

B. Outside Building, Below Grade, to Five Feet Outside of Building Face:

1. 4” to 8”: Polyvinyl Chloride (PVC), AWWA C900, DR14 pressure class 305 psi, UL 1285 Listed for fire protection service. PVC fabricated or molded fittings of same class as pipe, gasket joints. JM Eagle, North American Pipe Corporation.

C. Outside Building, Above Grade:

1. 4” to 8”: AWWA C151. Grooved end ductile iron pipe with grooved joints. Cement mortar lining, AWWA C104. Ductile iron fittings in accordance with AWWA C153. Gaskets in accordance with AWWA C111.

D. Lead-In to Building System Riser: Single, extended 90 degree fitting, constructed of corrosion resistant 304 stainless steel tubing, 200 psi working pressure. UL listed. Ames In-Building Riser, Wilkins.

E. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

F. Restraints and Thrust Blocks: Shall comply with NFPA 24.

2.3 VALVES:

A. General: UL Listed for fire protection service. Manufacturer's model numbers are listed to complete description. Equivalent models of Muller or Tyco are acceptable.

B. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

C. All valves of a particular type or for a particular service shall be by the same manufacturer.

D. Gate Valve: UL 262 Listed for fire protection service.

1. 2" and Smaller: All bronze, rising stem.
2. 2-1/2" and Larger, Below Grade: Iron body, bronze mounted, non-rising stem, resilient wedge type. Fusion bonded epoxy coated interior and exterior. Underground valves shall have square operating nut or indicator post flange. Provide operating "T" handles for underground valves. Mueller A-2361.

E. Check Valve: UL 312 Listed for fire protection service.

1. 2-1/2" and Larger, Above Grade: Iron body, bronze mounted swing check.

F. Valve Box: Precast reinforced concrete. Cast iron lid marked with “FIRE” lettering. Christy G05T.

G. “T” Handles for Underground Valves: Provide a minimum of two operating “T” handles for underground valves. The lengths of the handles are dependent upon the depth of the valves and the ability of the handles to fully open and/or close the valves. At least one “T” handle shall be on site at the beginning of the installation of a particular system for emergencies, and the Construction Manager shall have access to these “T” handles and valves.

H. Restraints and Thrust Blocks: Shall comply with NFPA 24.

2.4 POST INDICATOR VALVE:

A. Indicator Post Underground Service Valve: Iron body, non-rising stem, resilient wedge type gate valves with indicator post flange. UL 262 Listed. Mueller P-2361.

B. Indicator Post, Adjustable: Cast or ductile iron base and extension barrels, adjustable length, target visible through a glass covered post reading either “OPEN” or “SHUT”, lockable operating handle. UL 789 Listed. Mueller A-20806.

C. Supervisory Switches: Tamper proof supervisory switch, two single-pole double throw (SPDT) microswitches; designed to signal valve in other than fully open position. CSFM Listed. System Sensor PIBV2.

2.5 FIRE DEPARTMENT CONNECTION:

A. Freestanding Type: Cast bronze body, threaded inlets according to NFPA 1963 and matching local fire department hose threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers. UL Listed. Potter Roemer 5731-C.

1. Connection Sizes: one 4" inlet and two 2-1/2" outlets with dust cap and chain of matching material and finish.

B. Identification Plate/Sign: Brass, round plate for 4" pipe. Lettering minimum 1" high. NFPA 24 compliant.

2.6 MISCELLANEOUS PIPING ITEMS:

A. Pipe Identification:

1. Detectable Warning Tape, Below Grade Piping: Preprinted with a description of underground utility, color coded, a minimum of 6" wide and 4 mils thick, metallic ribbon marker capable of being located with a metal detector. Christy, Seton.

B. Protection for Underground Piping:

1. Ferrous Pipe and Fittings, Below Grade: Polyethylene encasement, minimum 8 mils thick, ANSI/AWWA C105/A21.5. Polywrap.

–or–

2. Ferrous Pipe, Below Grade: Factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness. Scotchkote, X-Tru-Coat.
3. Ferrous Pipe Fittings, Below Grade: Polyvinyl tape, 10 mils thickness. Johns-Manville.

C. Tracer Wire: Minimum 14 AWG copper, corrosion resistant polyethylene insulated for direct burial. Color per APWA Uniform Color Code. Agave Wire, Southwire.

D. Concrete Thrust Blocks: Shall be constructed at all valves, tees, elbows, bends, crosses, reducers and dead ends in loose-joint pipe. Blocks shall cure a minimum of 7 days before pressure is applied. Concrete shall have compressive strength after 28 days of 3000 psi minimum.

PART 3: EXECUTION

3.1 PREPARATION:

A. Perform fire hydrant flow test according to NFPA 291, latest edition.

B. Report test results promptly and in writing to the Engineer through the Architect.

3.2 PIPING INSTALLATION:

A. Standards: All piping shall be installed in accordance with NFPA 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances", latest edition.

B. Piping layouts indicated on plans are diagrammatic only. Some work may be shown offset for clarity. Exact location of equipment and pipes shall be coordinated with other trades.

C. Piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment.

D. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Minimum pipe size shall be 4", unless otherwise noted. Pipe size reduction shall be made with bell reducer fittings.

E. All joints, changes in direction, and branch connections shall be made with standard fittings.

F. Plastic pipe and fittings shall be joined in accordance with manufacturer's recommendations. Metal to plastic transition fittings shall be installed at all transitions.

G. Open ends of piping shall be capped during progress of work to preclude foreign matter.

H. Protection For Underground Piping:

1. All ferrous piping below grade shall be encased in polyethylene tube.

–or–

2. All ferrous piping below grade shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness. Protective coating shall be extended 6" above surrounding grade.
3. All ferrous piping rises above grade shall be covered with two layers double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Pipe wrap shall be extended 6" above surrounding grade.
4. All ferrous pipe fittings and areas of damaged coating shall be covered with two layers double wrap of 10 mil polyvinyl tape to total thickness of 40 mils.

J. Outside Building, Below Grade:

1. Install underground, fire suppression water piping buried at least 36 inches below finished grade.
2. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
3. PVC Piping: Use joining materials according to AWWA C900.

    a. Fire suppression water piping that rises up from below grade shall be ductile iron pipe, wrapped with 40 mils of pipe wrap tape. Female PVC adapters shall not be used.
    b. Secure insulated tracer wire to underground pipe with nylon ties at maximum 10 feet interval. Tracer wire shall terminate 6" above grade at both ends of piping. Tracer Wire is in addition to preprinted metallic detectable warning tape.

4. Bury a continuous, preprinted, color coded, metallic detectable warning tape capable of being located with a metal detector with each underground pipe. Locate directly over buried pipe, 6" to 8" below finished grade.

3.3 VALVE INSTALLATION:

A. All valves shall be full line size.

B. Use gate valves for shutoff service only.

C. Install check valves for proper direction of flow.

D. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

E. Install each underground valve with stem point up and with valve box or vertical cast iron indicator post. Wrap valve and fittings in 8 mil polyethylene.

3.4 PIPING JOINT CONSTRUCTION:

A. Ream ends of pipes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900.

D. Threaded Joints: Pipe shall be cut square and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.

E. Welded Joints: Filler rod shall be of suitable or the same alloy as pipe. Welding shall be performed by a Certified Welder as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for water service. Install gasket concentrically positioned.

G. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.5 POST INDICATOR VALVE INSTALLATION:

A. General: Install post indicator valve and any required protective devices per local fire authority and NFPA standards.

B. Install tamper proof supervisory switch and conduit with wires and connect to alarm panel.

C. Install a sign for each indicator post that indicates function and service per NFPA standards.

D. Paint Indicator Post: Paint with one coat of primer and two coats of OSHA safety red enamel.

3.6 FIRE DEPARTMENT CONNECTION INSTALLATION:

A. General: Install fire department connection and any required protective devices per local fire authority and NFPA standards.

B. Fire department connection shall be located with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

C. Install a listed check valve in each fire department connection per NFPA standards.

D. Install a sign for each connection that indicate function and service per NFPA standards.

E. Paint Fire Department Connection: Paint with one coat of primer and two coats of OSHA safety red enamel.

3.7 CONNECTIONS:

A. Connect fire water piping to existing site fire water main.

B. Extend fire suppression water piping to inside the building, terminate at 6" above finish floor for connection to fire riser. Terminate piping with caps, plugs, or flanges as required for piping material. Coordinate with fire sprinkler system installer.

3.8 IDENTIFICATION:

A. All controls, piping, valves and equipment shall be labeled for function and service in accordance with NFPA 24.

3.9 TESTS AND ADJUSTMENTS:

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect and an inspector of the authority having jurisdiction. Contractor shall notify fire authority at least 48 hours prior to testing. At various stages and upon completion, the system must be tested in the presence of the enforcing agency. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Test all systems in accordance with fire authority requirements and NFPA 24.

B. Fire Main Pipe Flushing: All portions of underground piping, from the water supply to the system riser, and lead-in connections to the system riser, including all hydrants, shall be completely flushed before the connection is made to downstream fire protection system piping in accordance with NFPA standards. The flushing operation shall continue until water flow is verified to be clear of debris.

C. Fire Main Piping, Hydrostatic Test: All portions of fire main water piping system, in sections or in entirety, shall maintain the greater of 200 psig or 50 psig in excess of the system working pressure, and shall maintain that pressure for 4 hours. There shall be no drop in pressure during test except that due to ambient temperature changes.

3.10 CERTIFICATION:

A. At completion of the project, a Contractor's Material and Test Certificate, indicating installation and testing in accordance with referenced standards, shall be completed. Copies shall be prepared by Installing Contractor for the approving authorities, Owner, and General Contractor. Deliver certificates to the Owner through the Architect.

END OF SECTION

SECTION 220719 – PLUMBING PIPING INSULATION

PART 1: GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Complete installation of piping insulation for plumbing piping services, including domestic cold water exposed to weather, domestic hot water piping, and supplies and drains for handicap accessible lavatories and sinks, including all related fittings, valves, etc.

B. Work Specified Elsewhere:

1. Section 221113 “Domestic Water Piping System”
2. Section 221316 “Sewer, Waste and Vent Piping System”
3. Section 224200 “Plumbing Fixtures and Equipment”
4. Section 230010 “General Mechanical Provisions”
5. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
6. Painting unless specifically called for in the drawings or specifications.

1.3 QUALITY ASSURANCE:

A. Installer Qualifications: The installing contractor shall have a minimum of five years experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.

B. Source Limitations: Materials of a given type shall be by the same manufacturer.

PART 2: PRODUCTS

2.1 INSULATION MATERIALS:

A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

B. Pre-Molded Fiberglass: Heavy density sectional pre-molded fiberglass with vapor barrier laminated all service jacket and pressure sealing vapor barrier lap. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft2-F at a mean temperature of 75 degrees F. Water vapor permeance rating of 0.02 perms maximum per ASTM E96. Insulation shall be minimum 1-1/2" thickness for pipes 1-1/2" and smaller, otherwise 2" thickness. Provide 3" minimum wide tape of same material as lap for butt joints. Johns-Manville, Knauf, Owens-Corning.

C. Fiberglass Blanket: Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft2-F at a mean temperature of 75 degrees F. Minimum 1-1/2" thickness. Johns Manville, Knauf, Owens-Corning.

D. Stretchable Fabric Reinforcing Mesh: Polyester or fiberglass fabric mesh with a minimum thread count of 8 strands by 8 strands per square inch weave design. Childers Chil Glas #10, Foster 42-24, Mast-A-Fab, Vimasco Elastafab 894.

E. Lagging Adhesive: Childers Chil-Seal CP-50A MV1, Foster 30-36 Sealfas Coating, Vimasco 714.

F. Fiberglass Adhesive: Water based, shall meet ASTM C916 Type II requirements. Childers Chil-Quik CP-127, Foster 85-60, Vimasco 795.

G. PVC Jacket (for pipe, fittings and valves): Pre-molded polyvinyl chloride (PVC) jackets, 0.020" thickness. Size to match application. Provide solvent weld adhesive and PVC vapor barrier pressure sealing tape by same manufacturer. Johns Manville Zeston.

H. Aluminum Jacketing: Aluminum pipe and fitting jacketing. 0.016" thickness for straight pipe. 0.024" thickness for fittings. Stucco-embossed finish. Integral moisture barrier. Provide pre-fabricated aluminum strapping and seals by same manufacturer. ITW Pabco/Childers, RPR Products.

J. Metal Jacketing/Flashing Sealant: Childers Chil-Byl CP-76, Foster 95-44 Elastolar, Pittsburgh Corning Pittseal 727. Gallon container quantities only; no tubes.

K. Insulating Tape: Ground virgin cork and synthetic elastomeric, 1/8" thickness. Black, odorless, and non-toxic. Thermal conductivity shall not exceed 0.43 Btu-in/hr-ft2-F at a mean temperature of 75F. Non-shrinking. For outdoor use, provide protective finish by same manufacturer. Sealers 1401.

L. Molded Closed Cell Vinyl (Piping Insulation Under ADA Accessible Lavatories and Sinks): Fully molded closed cell vinyl, minimum 1/8" thick. Thermal conductivity shall not exceed 1.17 Btu-in/hr-ft2-F at an average temperature of 73 degrees F. Weep hole in cleanout nut enclosure. Hinged cap over valve to allow access for servicing. Out of sight nylon fastening system and internal ribs on drain insulation to provide air gap (Truebro Lav-Guard only). Truebro Lav-Guard, McGuire Pro Wrap, Plumberex.

PART 3: EXECUTION

3.1 GENERAL INSULATION REQUIREMENTS:

A. Install insulation materials, accessories, and finished with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

C. Install insulation with longitudinal seams at top and bottom of horizontal runs.

D. Apply adhesives, mastics, and sealants at manufacturers' recommended coverage rate and wet and dry film thicknesses.

E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

F. Install jacketing over insulation material. Cover with PVC jacketing where exposed to view, aluminum jacketing where exposed to weather. Do not field paint aluminum jackets.

3.2 PIPE INSULATION INSTALLATION:

A. Domestic Hot Water:

1. General: All domestic hot water piping, fittings and accessories shall be insulated.

   a. 1-1/2" and Smaller: 1-1/2" thickness, minimum.
   b. 2" and Larger: 2" thickness, minimum.

2. Pipe: Apply pre-molded fiberglass sections to pipe using integral pressure sealing lap adhesive in accordance with manufacturer's recommendations. Stagger longitudinal joints. Seal butt joints with factory supplied pressure sealing tape.
3. Fittings and Valves:

   a. Wrap all fittings and valves with pre-cut fiberglass blanket to thickness matching adjoining insulation. Cover blanket with PVC jacket in accordance with manufacturer's recommendations. Solvent weld. Seal all joints with factory supplied pressure sealing vapor barrier tape with minimum 1-1/2" overlap on both sides of joint. Insulate valves to stem. Do not insulate unions, flanges or valves unless water temperature exceeds 140 degrees F or the piping is exposed to weather.
   b. For miscellaneous fittings and accessories for which PVC jackets are not available or where proximity of fittings precludes a neat appearing installation, the Contractor may cover the fiberglass blanket with stretchable reinforcing mesh, one coat of lagging adhesive and a final coat of vapor barrier coating. All exposed ends of insulation shall be adequately sealed.

4. Piping Exposed to Weather:

    a. All piping and fittings exposed to weather shall have, in addition to the above described insulation, an aluminum jacketing. Secure in place with factory supplied straps. Install all joints to prevent water entry. All joints shall be sealed with outdoor mastic.
    b. For miscellaneous fittings for which aluminum jackets are not available or where proximity of fittings precludes a neat-appearing installation, the Contractor may cover the insulation with stretchable reinforcing mesh and at least two coats of outdoor mastic.

5. Additional Finish for Exposed Piping and Equipment: All piping and equipment exposed to view but protected from the weather shall be given an additional finish of PVC jackets.

B. Freeze Protection of Cold Water, Soil, and Waste Piping: All cold water, soil, and waste piping exposed to weather or other areas subject to freezing (i.e. ventilated attics, uninsulated exterior soffits, exterior walls, etc.) shall be insulated same as hot water piping, except with 1" thickness. Cover with PVC jacketing where exposed to view, aluminum jacketing where exposed to weather. Short lengths of pipe (i.e. less than 12" in length) and valves may be wrapped with insulating tape, 50% overlap. Cover valves to stem. Apply at least two coats of protective finish where exposed to weather.

C. Piping Insulation Under ADA Accessible Lavatories and Sinks: Cold and hot water piping, cold and hot water stops, and drain piping under ADA accessible lavatories and sinks shall be insulated with 1/8" thick molded closed cell vinyl. Installation shall be in accordance with manufacturer's instructions.

END OF SECTION

SECTION 221113 – DOMESTIC WATER PIPING SYSTEM

PART 1: GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Perform excavation and backfill required for work of this section.
2. Complete installation of domestic water distribution system inside the building and within five feet of building walls, including all related piping, fittings, valves, etc.
3. Perform connection to plumbing fixtures and equipment as shown or noted on the drawings or as specified.
4. All equipment as shown or noted on the drawings or as specified.

B. Work Specified Elsewhere:

1. Section 220719 “Plumbing Piping Insulation”
2. Section 224200 “Plumbing Fixtures and Equipment”
3. Section 230010 “General Mechanical Provisions”
4. Section 237000 “HVAC Equipment”
5. Division 33 for Site Domestic Water Piping System
6. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
7. Painting unless specifically called for in the drawings or specifications.

1.3 QUALITY ASSURANCE:

A. Contractor Qualifications: The installing contractor shall have a minimum of five years of experience and shall submit a list of at least five projects which are similar in size, scope, and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with ASTM F645 for selection, design, and installation of thermoplastic water piping.

D. Comply with NSF 14 for plastic potable water service piping.

E. Comply with NSF 61 Annex G for materials for water service piping and specialties for domestic water.

F. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.

PART 2: PRODUCTS

2.1 PIPE AND FITTINGS:

A. Cold Water:

1. Inside Building, Within Five Feet of Building Walls, and All Above Grade:

a. Hard temper seamless copper, ASTM B88. Wrought copper fittings, ANSI B16.22. Type L with brazed joints (1100F minimum). 1-1/2" and smaller above grade may be soldered, 95-5 tin-antimony solder. All nipples shall be red brass (85% copper). Above grade fittings may be copper (1/2" to 2") or "Lead Free" bronze (2-1/2" to 4") press fittings, ASME B16.18 or ASME B16.22. EPDM O-rings. Installation shall be in accordance with the manufacturer's installation instructions. ProPress.

2. Inside Building, Below Grade 1" and Smaller: Soft copper tube, ASTM B88, Type K.

B. Hot Water:

1. Inside Building, Above Grade: Same as Cold Water Piping, Inside Building.

2.2 VALVES:

A. General: All valves shall meet the California "Lead Free" standard for domestic water service. Manufacturer's model numbers are listed to complete description. Equivalent models of Crane, Milwaukee, Nibco, Stockham, or Walworth are acceptable.

B. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

C. All valves of a particular type or for a particular service shall be by the same manufacturer.

1. Gate Valve:

a. 2" and Smaller: All bronze. Threaded bonnet. Non-rising stem. Wedge disk. Malleable iron handwheel. 200 psi WOG rating. Nibco T-113-LF.
b. 2-1/2" and Larger: Iron body. Non-rising stem. Wedge disk, resilient seated. 300 psi WOG rating. Flanged or AWWA hub end as applicable. Nibco F-619-RWS. Underground valves shall have square operating nut. Provide operating "T" handles for underground valves.

2. Ball Valve, 2" and Smaller: Full port. Bronze or brass body, cap, stem, disk and ball. Threaded connection. Lever handle. PTFE seats. O-ring seals. Pressure rated 600 psi non-shock CWP, maximum 100 psi at 300F. Apollo, Nibco T-685-80-LF, Watts.
3. Check Valve:

a. 2" and Smaller: Lead free all bronze swing check type, regrinding. 200 psi WOG rating. Nibco T-413-Y-LF.
b. 2-1/2" and Larger: Iron body, bronze mounted, swing check. 200 psi WOG rating. Flanged end.

4. Temperature and Pressure Relief Valve: ASME rated fully automatic, reseating combination pressure and temperature relief valve sized in accordance with energy input. Sensing element immersed within upper 6" of tank. Watts.

D. Valve Box: Precast reinforced concrete. Cast iron lid marked with "WATER" lettering. Christy G05T.

E. "T" Handles for Underground Valves: Provide a minimum of two operating "T" handles for underground valves for each underground system where valves are required. The lengths of the handles are dependent upon the depth of the valves and the ability of the handles to fully open and/or close the valves. At least one "T" handle for each system shall be on site at the beginning of the installation of a particular system for emergencies, and the Construction Manager shall have access to these "T" handles and valves.

2.3 PIPING SPECIALTIES:

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Instruments:

1. Thermometer: 3" dial, stainless steel case. Back or bottom connected as required. 1/2" NPT. 20F to 240F in 2F division for hot water, 25F to 125F in 2F division for chilled water. 2" insertion length. Allowance to be made for insulation thickness. Marshalltown, Moeller, Taylor, Tel Tru, Winters.

a. For installations over 7 feet above finish floor, provide digital thermometer with remote reader.

2. Thermometer Well: Brass well suitable for thermometer above. Provide 2" extension at insulated pipes.
3. Pressure Gages: Liquid filled bourdon tube type, 4" diameter face. The gage shall be liquid filled and have copper alloy internal parts in a stainless steel case. Gage accuracy shall be 2.5%.

C. Union:

1. 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi. Unions for copper piping shall be copper or lead free cast bronze. Anvil.
2. 2-1/2" and Larger: Grooved pipe, synthetic gasket, malleable iron housing. EPDM gasket UL classified in accordance with ANSI/NSF 61. Victaulic Style 77 Grade E gasket, Gruvlok 7001 Grade EP gasket.

D. Dielectric Coupling: Insulating union or flange rated for 250 psig. EPCO, Zurn Wilkins Series DUXL.

E. Shock Absorber: Multiple bellows. Stainless steel or copper construction. Designed and applied in accordance with PDI WH201. Amtrol, Sioux Chief, Smith, Wade, Zurn.

F. Flexible Connection: Corrugated stainless steel core covered with high tensile stainless steel tubular braid. 150 psi working pressure. 2" and smaller shall have threaded connections. 2-1/2" and larger shall have flanged connections. Senior Flexonics, Keflex.

G. Escutcheons: Chrome plated, metal type with fasteners.

2.6 MISCELLANEOUS PIPING ITEMS:

A. Pipe Identification:

1. Pipe Labels, Above Grade Piping: Preprinted, color coded, with lettering indicating service, and arrow showing flow direction. Contact type, permanent adhesive backing. Brady Corp, Champion America, Seton.
2. Detectable Warning Tape, Below Grade Piping: Preprinted with a description of underground utility, color coded, a minimum of 6” wide and 4 mils thick, metallic ribbon marker capable of being located with a metal detector. Christy, Seton.

B. Pipe Support: Finish shall be galvanized, unless noted otherwise.

1. Pipe Hanger: Galvanized steel "J" hanger with side bolt for piping 4" and smaller; galvanized steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendation. Felt liner for copper piping. Anvil, B-Line, Tolco, Unistrut.
2. Insulation Support: Calcium silicate insulation, 100 PSI, or heavy density fiber glass, 100 PSI. Insulation thickness equal to adjoining pipe insulation. Galvanized steel support shield or saddle. Provide vapor barrier for chilled water piping. Insulation and/or vapor barrier shall extend 1” beyond steel support. Pipe hanger in accordance with paragraph “1” above. Increase hanger size per manufacturer’s recommendation. B-Line, Insulated Pipe Shields, Inc., Uni-Grip.
3. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph “1” above. Increase hanger size per manufacturer's recommendation. B-Line B3195, Semco, Superstrut.
4. Hanger Rod: All thread rod with galvanized finish. Anvil, B-Line, Tolco, Unistrut.
5. Construction Channel: 12 gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. Anvil, B-Line B22, Tolco A-12, Unistrut P1000.

    a. Copper Pipe System: Pipe clamp with locknut and thermoplastic elastomer cushion. Cush-A-Clamp.

6. Pipe Riser Clamp: Galvanized finish. Anvil, B-Line, Tolco, Unistrut.
7. Pipe Block: 100% recycled rubber pad with reflective strips on each side, UV resistant, 1” gap between multiple block systems, 12 gage galvanized strut channel bolted to block, adjustable hinge fitting for sloped roofs. B-Line DB6 series.

C. Flashing: Provide clamp-on storm collar and seal water tight with mastic. Maintain dielectric separation between copper and galvanized materials.

1. Pipe Through Roof: Flashing shall be prefabricated galvanized steel roof jacks with 18 inch square base flange, minimum 24 gage. Oatey All-Flash.

    a. Cold Process Built-Up Roof: Flashing shall be 4 lb/sq. ft. lead instead of galvanized steel. Mayco, Santa Rosa Lead Products.
    b. Single-Ply Roof: Flashing material per roofing manufacturer’s recommendation.

D. Protection for Underground Piping:

1. Ferrous Pipe and Fittings, Below Grade: Polyethylene encasement, minimum 8 mils thick, ANSI/AWWA C105/A21.5. Polywrap.

–or–

2. Ferrous Pipe, Below Grade: Factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness. Scotchkote, X-Tru-Coat.
3. Ferrous Pipe Fittings, Below Grade: Polyvinyl tape, 10 mils thickness. Johns-Manville.

E. Tracer Wire: Minimum 14 AWG copper, corrosion resistant polyethylene insulated for direct burial, blue color for potable water piping per APWA Uniform Color Code. Agave Wire, Southwire.

F. Access Doors: Access doors shall match the wall or ceiling finish and fire rating as indicated on the Architectural drawings. 16 gage steel frame and 14 gage steel door with paintable finish, except in ceramic tile, where door shall be 16 gage stainless steel with satin finish. Continuous hinge. Key and cylinder lock. Milcor.

Unless otherwise noted, the minimum sizes shall be as follows:

1. 1 valve up to 1-1/2": 12" x 12"
2. 1 valve up to 3": 16" x 16"

PART 3: EXECUTION

3.1 PIPING INSTALLATION:

A. Plumbing layouts indicated on plans are diagrammatic only. Some work may be shown offset for clarity. Exact location of equipment and pipes shall be coordinated with other trades.

B. Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run at right angles or parallel to building walls; location to be approved by Architect.

C. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed.

D. Piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment.

E. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Minimum pipe size shall be 3/4”, unless otherwise noted. Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.

F. All joints, changes in direction, and branch connections shall be made with standard fittings. Close nipples shall not be used. Connect branch piping and risers from top of horizontal piping.

G. Plastic pipe and fittings shall be joined in accordance with manufacturer's recommendations. Metal to plastic transition fittings shall be installed at all transitions.

H. A union shall be installed on the leaving side of each valve, at all sides of automatic valves, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.

J. Dielectric couplings shall be installed wherever piping of dissimilar metals are joined, except that bronze valves may be installed in ferrous piping without dielectric couplings.

K. Install thermometers on inlet and outlet piping from each water heater. Provide tee for instrument well. Minimum size of pipe surrounding well shall be 1-1/2".

L. Install thermostats in hot water circulation piping.

M. Open ends of piping shall be capped during progress of work to preclude foreign matter.

N. Protection For Underground Piping:

1. All ferrous piping below grade shall be encased in polyethylene tube.

–or–

2. All ferrous piping below grade shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness. Protective coating shall be extended 6" above surrounding grade.
3. All ferrous piping rises above grade shall be covered with two layers double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Pipe wrap shall be extended 6" above surrounding grade.
4. All ferrous pipe fittings and areas of damaged coating shall be covered with two layers double wrap of 10 mil polyvinyl tape to total thickness of 40 mils.

P. Outside Building, Below Grade:

1. Install underground, water piping buried at least 24 inches below finished grade.
2. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
3. Plastic Piping: Shall be cut square and assembled prior to solvent weld. Apply primer per manufacturer's recommendations. Coat male joint fully with solvent, make joint before solvent dries and wipe exterior clean.

    a. Water piping that rises up from below grade shall be Type L copper with brazed joints, wrapped with 40 mils of pipe wrap tape. Female PVC adapters shall not be used.
    b. Secure insulated tracer wire to underground pipe with nylon ties at maximum 10 feet interval. Tracer wire shall terminate 6" above grade at both ends of piping. Tracer wire is in addition to pre-printed metallic detectable warning tape.

4. Bury a continuous, pre-printed, color coded, metallic detectable warning tape capable of being located with a metal detector with each underground pipe. Locate directly over buried pipe, 6" to 8" below finished grade.

Q. Inside Building:

1. Vertical lines shall be installed to allow for building settlement without damage to piping.
2. Provide shutoff at each equipment connection.

3. Provide access doors as required where equipment, piping, valves, etc. are not otherwise accessible. Deliver doors to the General Contractor for installation.
4. Supply header in fixture battery shall be full size to last fixture, reducing in size only on individual connections to each fixture in battery.
5. All stub outs, including exposed fixture stops and flush valves shall be installed with brass nipples or Type K copper for copper piping. Nipples are to extend from outside of wall to fitting at header or drop behind finish wall surfaces. Pipe nipples shall be same size as stop or flush valve.
6. Water hammer arrestors shall be installed in a vertical position as indicated on plans.
7. Only equipment mounted on vibration isolators shall be connected with flexible connectors.
8. Underground cold water and hot water piping which run parallel to each other shall be installed 3 feet apart, minimum.
9. Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe or pipe insulation sealed with fire rated materials in accordance with the requirements of CBC Section 714 and the fire authority having jurisdiction.
10. Pipes passing through concrete or concrete block wall shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe or pipe insulation for piping 3" and smaller, otherwise 2" annular clearance.
11. Provide chrome plated metal escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
12. Copper piping systems which protrude through a surface for connection to a fixture stop or other outlet shall be secured with a drop ell, Nibco 707-3-5, to a Holdrite SB1 bracket. Nipple through surface shall be threaded brass.
13. Piping shall not pass above electrical panels, motor control centers or switchboards.
14. Pipe Label Locations: Locate pipe labels and directional flow arrows where piping is exposed or above accessible ceiling in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

    a. Near each valve.
    b. Near each branch connection, excluding short takeoffs for fixtures. Where flow pattern is not obvious, mark each pipe at branch.
    c. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
    d. At access doors and similar access points that permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.
    f. Space at maximum intervals of 20 feet along each run.

3.2 VALVE INSTALLATION:

A. All valves shall be full line size.

B. Provide shutoff valve at each point of connection to existing piping.

C. Provide shutoff valve for each building and each equipment connection. At equipment connections, valves shall be full size of upstream piping.

D. Use gate valves for shutoff service only.

E. Ball valves shall not be installed below grade.

F. Install check valves for proper direction of flow.

G. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

H. Install pressure reducing valve, as shown on plans, in a vault or above ground between shutoff valves.

J. Install relief valve with shutoff valve on inlet.

K. Install underground valves with valve boxes. Provided minimum 6” diameter pipe extended from 12” below valve to 6” of top of valve box.

L. Install valves in horizontal piping with stem at or above center of pipe.

M. Install valves in position to allow full stem movement.

N. Locate above ground valves for easy access.

P. Valves located above ceilings shall be installed within 24" of the ceiling. For situations where this is not practical or where valves are greater than 10 feet above the floor, chain wheel operators shall be provided. Chain shall extend down to 7 feet above the floor. All such installations must have prior review by the Engineer.

3.3 PIPING JOINT CONSTRUCTION:

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Copper Tubing, Pressure Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure seal fitting manufacturer.

D. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900.

E. Threaded Joints: Pipe shall be cut square and reamed to full size. Threads shall be in accordance with ASME B1.20.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.

F. Welded or Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100F. Welding or brazing shall be performed by a Certified Welder or Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.

G. Flanged Joints: Install gasket material, size, type, and thickness appropriate for water service. Install gasket concentrically positioned.

H. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.4 HANGER AND SUPPORT INSTALLATION:

A. Install seismic restraints on piping in compliance with CBC Chapter 16A.

B. Support individual pipes with pipe hanger. Provide hangers, supports, clamps, and necessary attachments as required to properly support piping from the building structure. Hangers shall be placed to support piping without strain on joints or fittings.

C. All cold and hot water piping shall have isolating shield; no portion of this piping shall touch the structure without an isolating shield except at anchor points for fixture rough-in.

D. Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.

E. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam.

F. Vertical piping shall be supported with riser clamp at base and at each floor, maximum 10' on center.

G. Provide additional supports for equipment, valves or other fittings.

H. Support pipe within 12" of all changes in direction.

J. Install hangers for horizontal copper piping with the following maximum spacing and minimum rod sizes. Maximum spacing is based on straight lengths of pipe with couplings only. Actual spacing requirements will depend on structural system. Seismic requirements may reduce maximum spacing.

1. 1/2" to 1-1/2”: Maximum span, 6 feet; minimum rod size, 3/8”.
2. 2”: Maximum span, 10 feet; minimum rod size, 3/8”.
3. 2-1/2" to 3”: Maximum span, 10 feet; minimum rod size, 1/2”.

K. Install support for vertical copper piping at each floor, not to exceed 10 feet.

3.5 CONNECTIONS:

A. Connect building domestic water piping to site domestic water piping. Use transition fitting to join dissimilar piping materials.

B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

C. Connect piping to equipment using manual shutoff valve and union. Install union between valve and equipment.

D. Connect water piping to plumbing fixtures and equipment.

3.6 TESTS:

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.

B. Domestic Cold and Hot Water Piping: All portions of water piping system, in sections or in entirety, shall maintain 100 psig water pressure for 4 hours. There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made.

3.7 DISINFECTION:

A. Disinfect all domestic water piping systems in accordance with AWWA Standard C651 "AWWA Standard for Disinfecting Water Mains", latest edition, and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and witnessed by a representative of the Architect. During procedure, signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, water samples shall be collected for bacteriological analysis and tested for bacteriological purity. Sample cold water and hot water where applicable. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner through the Architect before project completion.

END OF SECTION

SECTION 221316 – SEWER, WASTE, AND VENT PIPING SYSTEM

PART 1: GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

A. Included: Provide all labor, materials, and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Perform excavation and backfill required for work of this section.
2. Complete installation of sanitary drainage and vent system, including sewer, waste, vent, and condensate drain inside the building and within five feet of building walls, including all related piping, fittings, etc.
3. Perform connection to plumbing fixtures and equipment as shown or noted on the drawings or as specified.
4. Perform connection to HVAC equipment.
5. All equipment as shown or noted on the drawings or as specified.

B. Work Specified Elsewhere:

1. Section 220719 “Plumbing Piping Insulation”
2. Section 224200 “Plumbing Fixtures and Equipment”
3. Section 230010 “General Mechanical Provisions”
4. Section 237000 “HVAC Equipment”
5. Division 33 for Site Sanitary Sewer Piping System
6. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
7. Painting unless specifically called for in the drawings or specifications.

1.3 QUALITY ASSURANCE:

A. Contractor Qualifications: The installing contractor shall have a minimum of five years of experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with NSF 14 “Plastics Piping Systems Components and Related Materials” for plastic sanitary piping specialty components.

D. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.

PART 2: PRODUCTS

2.1 PIPE AND FITTINGS:

A. Soil, Waste and Vent Piping (Non-Pressure), Inside Building and Within Five Feet of Building Walls:

1. Standard weight coated cast iron pipe and fittings. Plain end, CISPI 301, ASTM A888, or hub end with rubber gaskets, ASTM A74, ASTM C564. ABI, Tyler, JC Cast Iron, Star Pipe Products.

a. Hubless Pipe Couplings: Heavy-duty shielded couplings with neoprene gasket, Type 304 stainless steel shield with stainless steel bands and tightening devices, ASTM C1540. Husky HD 2000, Clamp-All 80, Mission HeavyWeight.
b. Hubless Pipe Couplings for Above Grade Vent System may be standard-duty shielded couplings with neoprene gasket, Type 304 stainless steel shield with stainless steel bands and tightening devices, ASTM C1540.

2. Size 2" and smaller above grade may be schedule 40 galvanized steel pipe, ASTM A53, with coated cast iron recessed drainage fittings, ANSI B16.12.
3. Size 2" and smaller exposed to view shall be schedule 40 galvanized steel pipe, ASTM A53, with coated cast iron recessed drainage fittings, ANSI B16.12.

B. Drain Piping, Including Condensate:

1. Schedule 40 galvanized steel pipe, ASTM A53. 150 psi galvanized malleable iron threaded fittings, ANSI B16.3.

-or-

2. Hard temper seamless copper, ASTM B88. Wrought copper fittings, ANSI B16.22. Type L with brazed joints (1100F, min.). 1-1/2" and smaller above grade may be soldered, 95-5 tin-antimony solder. All nipples shall be red brass (85% copper). Above grade fittings may be copper (1/2” to 2”) or “Lead Free” bronze (2-1/2” to 4”) press fittings, ASME B16.18 or ASME B16.22. EPDM O-rings. Installation shall be in accordance with the manufacturer’s installation instructions. ProPress.
3. Inside Building, Exposed to View: Brass with polished chrome plate finish.

2.2 CLEANOUTS:

A. Comparable models of Josam, Mifab, Wade or Zurn are acceptable. Grease plug prior to installation.

B. Floor Cleanouts: Round, cast iron adjustable housing, taper threaded bronze closure plug. Same size as connected drainage piping. Smith 4023 with nickel bronze top in finished areas; Smith 4223 with extra heavy duty cast iron top in utility areas.

C. Wall Cleanouts: Cast iron cleanout tee with taper threaded bronze plug and stainless steel wall access. Same size as connected drainage piping. Smith 4532 with stainless steel round cover and screw; Smith 4558 with stainless steel square cover and screw in tile wall.

D. Pipe Cleanouts: Iron body ferrule with threaded, raised head brass closure plug.

E. Cleanout Box: Precast reinforced concrete. Cast iron lid marked with “SEWER” lettering. Christy G05T.

2.3 PIPING SPECIALTIES:

A. Transition Fittings: Manufactured fitting or coupling same size as and compatible with piping to be joined.

B. Dielectric Coupling: Insulating union or flange rated for 250 psig. EPCO, Zurn Wilkins.

C. Escutcheons: Chrome plated, metal type with fasteners.

2.4 MISCELLANEOUS PIPING ITEMS:

A. Pipe Identification:

1. Pipe Labels, Above Grade Piping: Preprinted, color coded, with lettering indicating service, and arrow showing flow direction. Contact type, permanent adhesive backing. Brady Corp, Champion America, Seton.
2. Detectable Warning Tape, Below Grade Piping: Preprinted with a description of underground utility, color coded, a minimum of 6” wide and 4 mils thick, metallic ribbon marker capable of being located with a metal detector. Christy, Seton.

B. Pipe Support: Finish shall be galvanized, unless noted otherwise.

1. Pipe Hanger: Galvanized steel "J" hanger with side bolt for piping 4" and smaller; galvanized steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendation. Felt liner for copper piping. Anvil, B-Line, Tolco, Unistrut.
2. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph “1” above. Increase hanger size per manufacturer's recommendation. B-Line B3195, Semco, Superstrut.
3. Hanger Rod: All thread rod with galvanized finish. Anvil, B-Line, Tolco, Unistrut.
4. Construction Channel: 12 gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. Anvil, B-Line B22, Tolco A-12, Unistrut P1000.

    a. Copper Pipe System: Pipe clamp with locknut and thermoplastic elastomer cushion. Cush-A-Clamp.

5. Pipe Riser Clamp : Galvanized finish. Anvil, B-Line, Tolco, Unistrut.
6. Pipe Block: 100% recycled rubber pad with reflective strips on each side, UV resistant, 1” gap between multiple block systems, 12 gage galvanized strut channel bolted to block, adjustable hinge fitting for sloped roofs. B-Line DB6 series.

C. Flashing: Provide clamp-on storm collar and seal water tight with mastic. Maintain dielectric separation between copper and galvanized materials.

1. Vent Through Roof: Flashing shall be 4 lb/sq. ft., 0.0625” thick lead, 18 inch square base flange, length sufficient to be turned down 2" into vent. Mayco, Santa Rosa Lead Products.

2. Pipe Through Roof: Flashing shall be prefabricated galvanized steel roof jacks with 18 inch square base flange, minimum 24 gage. Oatey All-Flash.

   a. Cold Process Built-Up Roof: Flashing shall be 4 lb/sq. ft., 0.0625" thick lead instead of galvanized steel. Mayco, Santa Rosa Lead Products.
   b. Single-Ply Roof: Flashing material per roofing manufacturer's recommendation.

D. Protection for Underground Piping:

1. Ferrous Pipe and Fittings, Below Grade: Polyethylene encasement, minimum 8 mils thick, ANSI/AWWA C105/A21.5. Polywrap.

–or–

2. Ferrous Pipe, Below Grade: Factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness. Scotchkote, X-Tru-Coat.
3. Ferrous Pipe Fittings, Below Grade: Polyvinyl tape, 10 mils thickness. Johns-Manville.

PART 3: EXECUTION

3.1 PIPING INSTALLATION:

A. Plumbing layouts indicated on plans are diagrammatic only. Some work may be shown offset for clarity. Exact location of equipment and pipes shall be coordinated with other trades.

B. Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run at right angles or parallel to building walls; location to be approved by Architect.

C. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed.

D. Piping shall be installed in a manner to ensure unrestricted flow, free of sags and bends, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment.

E. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Minimum pipe size shall be 3/4", unless otherwise noted. Reducing size of piping in direction of flow is prohibited.

F. All joints, changes in direction, and branch connections shall be made with standard fittings.

G. Where inverts are not indicated, sanitary sewer piping shall be installed at 1/4" per foot pitch. Piping 4" and larger may be installed at 1/8" per foot pitch where structural or other limitations prevent installation at a greater pitch. Bell and spigot piping shall be installed with barrel on sand bed; excavate hole for bell.

H. Vents: Vents shall terminate not less than 6 inch above the roof, nor less than 12 inch from any vertical surface, nor within 10 feet of any outside air intake. Install horizontal vent lines at 1/4" per foot pitch. Offset vents 2 feet minimum from gutters, parapets, ridges and roof flashing.

J. Drain Piping, Including Condensate: Install with constant pitch to receptacle, 1/4" per foot pitch where possible, otherwise 1/8" per foot minimum. Provide tee with cleanout plug at all changes of direction. Provide trap at each air handling unit to prevent air leakage. Only equipment mounted on vibration isolators shall be connected with flexible connectors. Piping not concealed in wall structure, above ceilings or below floors shall be chrome plated brass, except in equipment rooms, piping shall be galvanized steel. P&T relief and water heater drain piping shall be galvanized steel. Provide secondary drain piping where required.

K. Plastic pipe and fittings shall be joined in accordance with manufacturer's recommendations. Metal to plastic transition fittings shall be installed at all transitions.

L. Dielectric couplings shall be installed wherever piping of dissimilar metals are joined.

M. Open ends of piping shall be capped during progress of work to preclude foreign matter.

N. Protection For Underground Piping:

1. All ferrous piping below grade shall be encased in polyethylene tube.

–or–

2. All ferrous piping below grade shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness. Protective coating shall be extended 6” above surrounding grade.
3. All ferrous piping rises above grade shall be covered with two layers double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Pipe wrap shall be extended 6” above surrounding grade.
4. All ferrous pipe fittings and areas of damaged coating shall be covered with two layers double wrap of 10 mil polyvinyl tape to total thickness of 40 mils.

P. Below Grade:

1. Install underground piping buried at least 24 inches below finished grade.
2. Detectable Warning Tape: Bury a continuous, preprinted, color coded, metallic detectable warning tape capable of being located with a metal detector with each underground pipe. Locate directly over buried pipe, 6" to 8" below finished grade.

Q. Above Grade:

1. Vertical lines shall be installed to allow for building settlement without damage to piping.
2. Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe or pipe insulation sealed with fire rated materials in accordance with the requirements of CBC Section 714 and the fire authority having jurisdiction.
3. Pipes passing through concrete or concrete block wall shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe for piping 3" and smaller, otherwise 2" annular clearance.
4. Provide chrome plated metal escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
5. Piping shall not pass above electrical panels, motor control centers or switchboards.

6. Pipe Label Locations: Locate pipe labels and directional flow arrows where piping is exposed or above accessible ceiling in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

    a. Near each branch connection, excluding short takeoffs for fixtures. Where flow pattern is not obvious, mark each pipe at branch.
    b. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
    c. At access doors, manholes, and similar access points that permit view of concealed piping.
    d. Near major equipment items and other points of origination and termination.
    e. Space at maximum intervals of 20 feet along each run.

7. Provide access doors as required where equipment, piping, valves, etc. are not otherwise accessible. Deliver doors to the General Contractor for installation.

3.2 CLEANOUT INSTALLATION:

A. Provide cleanouts at ends of lines, at changes of direction greater than 45 degrees, and at not greater than 100 foot intervals. Locate interior cleanouts in accessible locations and bring flush to finished surface.

B. Install cleanouts with PVC riser extensions from sewer pipes to cleanouts at grade. Use cast iron soil piping fittings in sewer pipes at branches for cleanouts, and use cast iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

C. Cleanouts shall be installed with a wye 1/8 bend combination. End of line cleanouts and cleanouts at change of direction shall be installed with two 1/8 bends or long sweep 1/4 bend.

D. Size shall be same as drainage piping up to 4". Use 4" for larger drainage piping unless otherwise indicated.

E. Provide cleanout at base of each vertical soil and waste stack.

F. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

G. Set cleanout frames and covers in earth in cast-in-place concrete pad.

3.3 PIPING JOINT CONSTRUCTION:

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Copper Tubing, Pressure Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure seal fitting manufacturer.

D. Threaded Joints: Pipe shall be cut square and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.

E. Welded or Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100F. Welding or brazing shall be performed by a Certified Welder or Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.

F. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.4 HANGER AND SUPPORT INSTALLATION:

A. Install seismic restraints on piping in compliance with CBC Chapter 16A.

B. Support individual pipes with pipe hanger. Provide hangers, supports, clamps, and necessary attachments as required to properly support piping from the building structure. Hangers shall be placed to support piping without strain on joints or fittings.

C. All drainage piping shall have isolating shield; no portion of this piping shall touch the structure without an isolating shield except at anchor points for fixture rough-in.

D. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam.

E. Vertical piping shall be supported with riser clamp at base and at each floor, maximum 10' on center.

F. Provide additional supports for fittings and couplings.

G. Support pipe within 12" of all changes in direction.

H. Gravity drain piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated below.

J. Install pipe support for horizontal cast iron piping with the following maximum spacing and minimum rod sizes. Maximum spacing is based on straight lengths of pipe with couplings only. Actual spacing requirements will depend on structural system. Seismic requirements may reduce maximum spacing.

1. 1-1/2" to 2”: Maximum span, 5 feet; minimum rod size, 3/8”.
2. 3": Maximum span, 5 feet; minimum rod size, 1/2”.
3. 4": Maximum span, 5 feet; minimum rod size, 5/8”.
4. Spacing for 10-foot lengths may be increased to 10 feet.

K. Install support for vertical cast iron piping at base and each floor, not to exceed 10 feet.

L. Install pipe support for horizontal steel piping with the following maximum spacing and minimum rod sizes. Maximum spacing is based on straight lengths of pipe with couplings only. Actual spacing requirements will depend on structural system. Seismic requirements may reduce maximum spacing.

1. 3/4" to 1-1/4”: Maximum span, 7 feet; minimum rod size, 3/8”.

2. 1-1/2” to 2”: Maximum span, 9 feet; minimum rod size, 3/8”.

M. Install support for vertical steel piping at each floor, not to exceed 10 feet.

N. Install pipe support for horizontal copper piping with the following maximum spacing and minimum rod sizes. Maximum spacing is based on straight lengths of pipe with couplings only. Actual spacing requirements will depend on structural system. Seismic requirements may reduce maximum spacing.

1. 1/2" to 1-1/4”: Maximum span, 6 feet; minimum rod size, 3/8”.
2. 1-1/2” to 2”: Maximum span, 8 feet; minimum rod size, 3/8”.

P. Install support for vertical copper piping at each floor, not to exceed 10 feet.

3.5 CONNECTIONS:

A. Connect building sewer drainage piping to site sewer piping. Use transition fitting to join dissimilar piping materials.

B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

C. Connect waste and/or vent piping to plumbing fixtures and equipment.

D. Connect drain piping to HVAC equipment.

3.6 TESTS:

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.

B. Sanitary Sewer: All ends of the sanitary sewer system shall be capped and lines filled with water to the top of the highest vent, 10 feet above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.

C. Drains, Including Condensate: Similar to Sanitary Sewer.

END OF SECTION

SECTION 221413 – STORM DRAINAGE PIPING SYSTEM

PART 1: GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Perform excavation and backfill required for work of this section.
2. Complete installation of storm water drainage system, including rain water leader, inside the building and within five feet of building walls, including all related piping, fittings, etc.
3. Perform connection to plumbing fixtures and equipment as shown or noted on the drawings or as specified.
4. All equipment as shown or noted on the drawings or as specified.

B. Work Specified Elsewhere:

1. Section 224200 “Plumbing Fixtures and Equipment”
2. Section 230010 “General Mechanical Provisions”
3. Division 33 for Site Storm Water Piping System
4. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
5. Painting unless specifically called for in the drawings or specifications.

1.3 QUALITY ASSURANCE:

A. Contractor Qualifications: The installing contractor shall have a minimum of five years experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.

PART 2: PRODUCTS

2.1 PIPE AND FITTINGS:

A. Storm Drain, Including Rain Water Leader (RWL), Inside Building and Within Five Feet of Building Walls:

1. Standard weight coated cast iron pipe and fittings. Plain end, CISPI 301, ASTM A888, or hub end with rubber gaskets, ASTM A74, ASTM C564. ABI, Tyler, JC Cast Iron, Star Pipe Products.

a. Hubless Pipe Couplings: Heavy-duty shielded couplings with neoprene gasket, Type 304 stainless steel shield with stainless steel bands and tightening devices, ASTM C1540. Husky HD 2000, Clamp-All 80, Mission HeavyWeight.

2.2 CLEANOUTS:

A. Pipe Cleanouts: Iron body ferrule with threaded, raised head brass closure plug.

B. Cleanout Box: Precast reinforced concrete. Cast iron lid marked with “STORM” lettering. Christy G05T.

2.3 DRAINS:

A. Refer to Plumbing Schedule on the plans for list of fixtures and equipment. Manufacturer's model numbers are listed to complete description. Equivalent models of JR Smith, Josam, Mifab, Wade or Zurn are acceptable.

B. Combination Roof and Overflow Drains: Cast iron body with flashing clamps and gravel stops. Cast iron domes for roof drain and overflow drain.

2.4 PIPING SPECIALTIES:

A. Transition Fittings: Manufactured fitting or coupling same size as and compatible with piping to be joined.

B. Dielectric Coupling: Insulating union or flange rated for 250 psig. EPCO, Zurn Wilkin.

C. Escutcheons: Chrome plated, metal type with fasteners.

2.5 MISCELLANEOUS PIPING ITEMS:

A. Pipe Identification:

1. Pipe Labels, Above Grade Piping: Preprinted, color coded, with lettering indicating service, and arrow showing flow direction. Contact type, permanent adhesive backing. Brady Corp, Champion America, Seton.
2. Detectable Warning Tape, Below Grade Piping: Preprinted with a description of underground utility, color coded, a minimum of 6” wide and 4 mils thick, metallic ribbon marker capable of being located with a metal detector. Christy, Seton.

B. Pipe Support: Finish shall be galvanized, unless noted otherwise.

1. Pipe Hanger: Galvanized steel "J" hanger with side bolt for piping 4" and smaller; galvanized steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendation. Anvil, B-Line, Tolco, Unistrut.
2. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph "1" above. Increase hanger size per manufacturer's recommendation. B-Line B3195, Semco, Superstrut.
3. Hanger Rod: All thread rod with galvanized finish. Anvil, B-Line, Tolco, Unistrut.
4. Construction Channel: 12 gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. Anvil, B-Line B22, Tolco A-12, Unistrut P1000.
5. Pipe Riser Clamp: Galvanized finish. Anvil, B-Line, Tolco, Unistrut.

C. Protection for Underground Piping:

1. Ferrous Pipe and Fittings, Below Grade: Polyethylene encasement, minimum 8 mils thick, ANSI/AWWA C105/A21.5. Polywrap.

–or–

2. Ferrous Pipe, Below Grade: Factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness. Scotchkote, X-Tru-Coat.
3. Ferrous Pipe Fittings, Below Grade: Polyvinyl tape, 10 mils thickness. Johns-Manville.

PART 3: EXECUTION

3.1 PIPING INSTALLATION:

A. Plumbing layouts indicated on plans are diagrammatic only. Some work may be shown offset for clarity. Exact location of equipment and pipes shall be coordinated with other trades.

B. Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run at right angles or parallel to building walls; location to be approved by Architect.

C. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed.

D. Piping shall be installed in a manner to ensure unrestricted flow, free of sags and bends, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment.

E. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Minimum pipe size shall be 3", unless otherwise noted. Reducing size of piping in direction of flow is prohibited.

F. All joints, changes in direction, and branch connections shall be made with standard fittings.

G. Where inverts are not indicated, sanitary storm piping shall be installed at 1/4" per foot pitch. Piping 4" and larger may be installed at 1/8" per foot pitch where structural or other limitations prevent installation at a greater pitch. Bell and spigot piping shall be installed with barrel on sand bed; excavate hole for bell.

H. Dielectric couplings shall be installed wherever piping of dissimilar metals are joined.

J. Open ends of piping shall be capped during progress of work to preclude foreign matter.

K. Protection For Underground Piping:

1. All ferrous piping below grade shall be encased in polyethylene tube.

–or–

2. All ferrous piping below grade shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness. Protective coating shall be extended 6” above surrounding grade.
3. All ferrous piping rises above grade shall be covered with two layers double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Pipe wrap shall be extended 6” above surrounding grade.
4. All ferrous pipe fittings and areas of damaged coating shall be covered with two layers double wrap of 10 mil polyvinyl tape to total thickness of 40 mils.

L. Below Grade:

1. Install underground piping buried at least 24 inches below finished grade.
2. Install underground piping 6” and larger with restrained joints at horizontal and vertical changes in direction. Use restrained joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
3. Bury a continuous, preprinted, color coded, metallic detectable warning tape capable of being located with a metal detector with each underground pipe. Locate directly over buried pipe, 6" to 8" below finished grade.

M. Above Grade:

1. Vertical lines shall be installed to allow for building settlement without damage to piping.
2. Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe sealed with fire rated materials in accordance with the requirements of CBC Section 714 and the fire authority having jurisdiction.
3. Pipes passing through concrete or concrete block wall shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe for piping 3" and smaller, otherwise 2" annular clearance.
4. Provide chrome plated metal escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
5. Piping shall not pass above electrical panels, motor control centers or switchboards.
6. Pipe Label Locations: Locate pipe labels and directional flow arrows where piping is exposed or above accessible ceiling in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

    a. Near each branch connection. Where flow pattern is not obvious, mark each pipe at branch.
    b. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
    c. Space at maximum intervals of 20 feet along each run.

3.2 CLEANOUT INSTALLATION:

A. Provide cleanouts in above ground piping, at ends of lines, at each change of direction greater than 45 degrees, and at not greater than 100 foot intervals. Locate interior cleanouts in accessible locations.

B. Provide cleanouts at grade and extend to where building storm drains connect to site storm drain.

C. Install cleanouts with PVC riser extensions from storm drain pipes to cleanouts at grade. Use cast iron piping fittings in storm drain pipes at branches for cleanouts, and use cast iron pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in storm drain pipe.

D. Cleanouts shall be installed with a wye 1/8 bend combination. End of line cleanouts and cleanouts at change of direction shall be installed with two 1/8 bends or long sweep 1/4 bend.

E. Size shall be same as storm drain piping up to 4". Use 4" for larger storm drain piping unless otherwise indicated.

F. Provide cleanout at base of each vertical rain leader/conductor before it connects to the horizontal storm drain pipe.

G. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

H. Set cleanout frames and covers in earth in cast-in-place concrete pad.

3.3 DRAIN INSTALLATION:

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Install flashing collar or flange to prevent leakage between drain and adjoining roof. Maintain integrity of waterproof membranes where penetrated.

B. Set drain frames and grate with tops flush with finish surface.

3.4 PIPING JOINT CONSTRUCTION:

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.5 HANGER AND SUPPORT INSTALLATION:

A. Install seismic restraints on piping in compliance with CBC Chapter 16A.

B. Support individual pipes with pipe hanger. Provide hangers, supports, clamps, and necessary attachments as required to properly support piping from the building structure. Hangers shall be placed to support piping without strain on joints or fittings.

C. All storm water drainage piping shall have isolating shield; no portion of this piping shall touch the structure without an isolating shield except at anchor points for fixture rough-in.

D. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam.

E. Vertical piping shall be supported with riser clamp at base and at each floor, maximum 10' on center.

F. Provide additional supports for fittings and couplings.

G. Support pipe within 12" of all changes in direction.

H. Install hangers for horizontal cast iron piping with the following maximum spacing and minimum rod sizes. Maximum spacing is based on straight lengths of pipe with couplings only. Actual spacing requirements will depend on structural system. Seismic requirements may reduce maximum spacing.

1. 3": Maximum span, 5 feet; minimum rod size, 1/2".
2. 4": Maximum span, 5 feet; minimum rod size, 5/8".
3. Spacing for 10-foot lengths may be increased to 10 feet.

J. Install support for vertical cast iron piping at base and each floor, not to exceed 10 feet.

3.6 CONNECTIONS:

A. Connect building storm drainage piping to site storm piping. Use transition fitting to join dissimilar piping materials.

B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

C. Connect storm drain piping to roof drains, area drains, deck drains, trench drains.

3.7 TESTS:

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.

B. Storm Drain, Including RWL: All ends of the storm drainage system shall be capped and lines filled with water to the top of the highest vent, 10 feet above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.

END OF SECTION

SECTION 224200 – PLUMBING FIXTURES AND EQUIPMENT

PART 1: GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

A. Included: Provide all labor, materials, and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Perform excavation and backfill required for work of this section.
2. Perform connection to plumbing fixtures and equipment with water supplies, stops, and risers, and with soil, waste, drain, trap, and vent piping as shown or noted on the drawings or as specified.
3. All fixtures and equipment as shown or noted on the drawings or as specified.

B. Work Specified Elsewhere:

1. Section 220719 “Plumbing Piping Insulation”
2. Section 221113 “Domestic Water Piping System”
3. Section 221316 “Sewer, Waste and Vent Piping System”
4. Section 221413 “Storm Drainage Piping System”
5. Section 23010 “General Mechanical Provisions”
6. Line voltage power wiring, motor starters in motor control centers, disconnect switches and installation of all starters are included in Division 26 Electrical, unless otherwise noted.
7. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
8. Painting unless specifically called for in the drawings or specifications.

1.3 QUALITY ASSURANCE:

A. Contractor Qualifications: The installing contractor shall have a minimum of five years of experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with NSF 61 Annex G for materials in contact with domestic water service.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC by a qualified testing agency and marked for intended location and application.

E. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.

PART 2: PRODUCTS

2.1 FIXTURES:

A. General: Provide rough-in for and install all plumbing fixtures shown on drawings. Except in equipment rooms, all trim, valves and piping not concealed in wall structure, above ceiling or below floors, shall be brass with polished chrome plate finish, unless noted otherwise. All enameled fixtures shall be acid resisting. Standard color is white unless otherwise noted.

B. Schedule: Refer to Plumbing Schedule on the drawings for list of fixtures and trim. Manufacturer's model numbers are listed to complete description. Equivalent models of American Standard, Elkay, Haws, Just, Kohler, Sloan, T&S Brass, Willoughby or Zurn are acceptable. For drainage fixtures, equivalent models of Josam, Mifab, JR Smith, Wade or Zurn are acceptable.

C. Operating Handle or Valve for ADA Accessible Fixtures: Operating handle or valve for accessible water closets, urinals, lavatories, sinks, and showers shall operate with less than 5 pounds force.

D. Stops and P-Traps: All fixtures shall be provided with stops and P-Traps as applicable. Wall mounted faucets, valves, etc. shall have integral stops or wall mounted stops.

1. Stops: All cold and hot water supplies shall be 1/2" IPS inlet angle stops with stuffing box, loose key lock shield, and brass riser (3/8" for 2.5 gpm and less, otherwise 1/2"). McGuire, Speedway.

a. Check Stops: Check valve type, integral with or attached to body. For cold and hot water supply connections.

2. P-Traps: Semi-cast brass, ground joint. 17 gage. Cleanout plug. Unobstructed waterway. California Tubular, McGuire.

E. Caulking: White silicone sealant, mildew resistant. Dow DOWSIL 786, GE Sanitary SCS1700, Pecora 898NST.

1. Caulking against concrete or masonry: Dow Corning 790.

2.2 EQUIPMENT:

A. General Requirements:

1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
3. Ratings:

a. Electrical: Electrical equipment shall be in accordance with NEMA standards and UL or ETL listed where applicable standards have been established.

4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
5. Electrical:

    a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, and shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
    b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts and other devices shall be in ungrounded conductors.
    c. Motors: Shall be rated, constructed and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip-proof (ODP), NEMA B design on pumps, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction, unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B, unless otherwise noted. Motors exposed to weather shall be totally enclosed fan cooled (TEFC). Vertical motors with exposed fans shall have rain caps.
    d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.
    e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
    f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.

B. Water Heater, Electric: Fully insulated, glass lined tank with magnesium anode protection, 150 psi working pressure, automatic temperature control, high limit control. Provide ASME rated pressure and temperature relief valve sized in accordance with energy input, dielectric couplings, and drain valve. UL listed. A.O. Smith, State Water Heaters.

C. Circulating Pump:

1. In-line centrifugal, 3-speed motor. Stainless steel housing. All parts exposed to fluid shall be stainless steel. Water lubricated, ceramic shaft and radial bearings. Provide factory removable check valve, aquastat. UL Listed. Grundfos UPS.

2.3 EQUIPMENT IDENTIFICATION:

A. Equipment Labels: Plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. WH-1). 1/2" high lettering, white on black background. Contact type permanent adhesive, compatible with label and with substrate. Seton.

PART 3: EXECUTION

3.1 FIXTURE INSTALLATION:

A. Fixture Height: Shall be as indicated on Architectural drawings.

B. Floor Drains or Floor Sinks: Shall be placed parallel to room surfaces, set level, flush with floor, and adjusted to proper height to drain. Cover openings during construction to keep all foreign matter out of drain line.

C. Wall Hung Fixtures: Shall be provided with proper backing and hanger plates secured to wall. Fixtures mounted on carriers shall bear against stop nuts, clear of wall surface. Caulk fixtures against walls with white silicone sealant, GE Sanitary SCS1700 or equal. Caulking shall be smooth and flush with fixture surface, not concave.

D. Floor Mounted Fixtures: Shall be provided with proper support plates. Caulk floor mounted fixtures with white silicone sealant, GE Sanitary SCS1700 or equal. Caulking shall be smooth and flush with fixture surface, not concave.

E. Other Connections: Rough-in and connection for trim or fixtures supplied by others shall be included in this specification section.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep pattern escutcheons if required to conceal protruding fittings.

G. Where installing piping adjacent to fixtures, allow space for service and maintenance of fixtures.

3.2 EQUIPMENT INSTALLATION:

A. General: It shall be the responsibility of the equipment installer to ensure that no work done under other specification sections shall in any way block, or otherwise hinder the equipment. All equipment shall be securely anchored in place. All equipment shall be installed level. Maintain manufacturer's recommended clearances for service and maintenance.

B. Connections to Equipment: Where size changes are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.

C. Pumps: Install pumps with a minimum of 8 diameters of straight pipe at the pump suction.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment. Arrange piping for easy removal of equipment.

E. Equipment Identification: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. WH-1).

3.3 CLEANING AND PROTECTION:

A. Clean fixtures and fittings in accordance with manufacturers' recommended cleaning methods and materials.

B. Fixtures and equipment shall be covered or otherwise protected during construction as required to maintain the material and equipment in new factory condition until project acceptance.

C. Do not allow use of fixtures and equipment for temporary facilities unless approved in writing by Owner.

3.4 TESTS:

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Defects shown by tests shall be repaired and entire work retested.

3.5 DEMONSTRATION:

A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water heaters.

END OF SECTION

SECTION 230010 – GENERAL MECHANICAL PROVISIONS

PART 1: GENERAL

1.1 GENERAL CONDITIONS:

A. The preceding General and Special Conditions and Divisions 00 and 01 requirements shall form a part of this Section with the same force and effect as though repeated here. The provisions of this Section shall apply to all of the Sections of Divisions 21, 22, and 23 of these Specifications and shall be considered a part of these sections.

1.2 CODES AND REGULATIONS:

A. All work and materials shall be in full accordance with current rules and regulations of all applicable codes. Nothing in these Drawings or Specifications is to be construed to permit work not conforming to these codes. Should the Drawings or Specifications call for material or methods of construction of a higher quality or standard than required by these codes, the Drawings and Specifications shall govern. Applicable codes and regulations include, but are not necessarily limited to, the following:

1. California Code of Regulations (CCR):

    a. Title 8, Industrial Relations
    b. Title 17, Public Health
    c. Title 20, Section 1601 et seq., Appliance Efficiency Regulations
    d. Title 24, Part 1, Administrative Code

2. California Building Code – CBC – 2019
3. California Electrical Code – CEC – 2019
4. California Mechanical Code – CMC – 2019
5. California Plumbing Code – CPC – 2019
6. California Energy Code – CEEC – 2019
7. California Fire Code – CFC – 2019
8. California Green Building Standards Code – CAL Green – 2019
9. Air Diffusion Council – ADC
10. American Gas Association – AGA
11. Air Conditioning, Heating and Refrigeration Institute – AHRI
12. Air Movement and Control Association – AMCA
13. American National Standards Institute – ANSI
14. American Society of Heating, Refrigerating, and Air Conditioning Engineers – ASHRAE
15. American Society of Mechanical Engineers – ASME
16. American Society for Testing and Materials – ASTM
17. American Water Works Association – AWWA
18. Cast Iron Soil Pipe Institute – CISPI
19. National Electrical Manufacturers Association – NEMA
20. National Fire Protection Association – NFPA
21. National Sanitation Foundation – NSF
22. Occupational Safety and Health Act – OSHA
23. Plumbing and Drainage Institute – PDI
24. Sheet Metal and Air Conditioning Contractors National Association – SMACNA
25. Underwriters' Laboratory – UL

26. Local Codes
27. Bakersfield City School District Standards

1.3 PERMITS AND FEES:

A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required. All charges are to be included in the work.

1.4 COORDINATION OF WORK:

A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. Some work may be shown offset for clarity. The actual locations of all materials, piping, ductwork, fixtures, equipment, supports, etc. shall be carefully planned prior to installation of any work in order to avoid all interference with each other, or with structural, electrical, architectural or other elements. Verify the proper voltage and phase of all equipment with the electrical plans. If discrepancies are discovered between drawing and specification requirements, the more stringent requirement shall apply. All conflicts shall be called to the attention of the Architect and the Engineer prior to the installation of any work or the ordering of any equipment. No work shall be prefabricated or installed prior to this coordination. No costs will be allowed to the Contractor for any prefabrication or installation performed prior to this coordination.

1.5 GUARANTEE:

A. Guarantee shall be in accordance with the General Conditions. These Specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the certificate of guarantee shall be furnished to the Owner through the Architect. Equipment that is started and operated prior to acceptance shall have the guarantee extended to cover that period. Owner guarantee shall start at acceptance.

1.6 QUIETNESS:

A. Piping, ductwork and equipment shall be arranged and supported so that vibration is a minimum and is not transmitted to the structure.

1.7 DAMAGES BY LEAKS:

A. The Contractor shall be responsible for damages caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

1.8 EXAMINATION OF SITE:

A. The Contractor shall examine the site, compare it with Plans and Specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.9 COMPATIBILITY WITH EXISTING SYSTEMS:

A. Any work which is done as an addition, expansion or remodel of an existing system shall be compatible with that system.

1.10 MATERIALS AND EQUIPMENT:

A. Materials and equipment shall be new unless otherwise noted. Materials and equipment of a given type shall be by the same manufacturer. Materials and equipment shall be free of dents, scratches, marks, shipping tags and all defacing features at time of project acceptance. Materials and equipment shall be covered or otherwise protected during construction as required to maintain the material and equipment in new factory condition until project acceptance.

B. All duct and other related air distribution openings shall be covered, during installation, with tape, plastic, sheet metal or other metals acceptable to the enforcement agency to reduce the amount of dust, water and debris which may enter the system.

1.11 SUBMITTALS:

A. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material or equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution.

Each specification section shall be submitted separately. All shop drawings must comply with the following:

1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Include manufacturer’s catalog data of each manufactured item. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory. FAX submittals are not acceptable.
2. All shop drawings shall be submitted in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor, table of contents, and indexed tabs dividing each group of materials or item of equipment. All items shall be identified by the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on drawings.
3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled or detailed.
4. Electronic submittals, where allowed by Division 01, are acceptable provided the following requirements are met. Electronic submittals which do not comply with these requirements will be rejected.

    a. Submittal shall be in PDF format, with bookmarks for table of contents and each tab, and sub-bookmarks for each item.
    b. All text shall be searchable, except for text that is part of a graphic.

c. Submittal shall include all items noted in paragraphs 1 through 3 above, except a binder is not required.
d. Electronic submittals shall be processed through normal channels. Do not submit directly to the Engineer.
e. Contractor shall provide Owner and Owner's Representative with hard copies of the final submittal. Coordinate exact number required with Owner through Architect/Engineer.

B. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and features desired. Where equipment is scheduled on the drawings, any equipment submitted other than scheduled equipment is considered a substitution. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. A completed and signed Substitution Request form shall be included. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items. At the Engineer's request, furnish locations where equipment similar to the substituted equipment is installed and operating along with the user's phone numbers and contact person. Satisfactory operation and service history will be considered in the acceptance or rejection of the proposed substitution.

C. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed. If a resubmittal is required, submit a complete copy of the Engineer's review letter requiring such with the resubmittal.

1.12 DELIVERY, STORAGE, AND HANDLING:

A. Proper implements, tools and facilities shall be provided and used for unloading and distributing materials along the line of the work. Any pipe, fitting, etc. damaged in transportation or handling, shall be rejected and immediately removed from the job site.

B. Contractor shall be responsible for the safe storage of all material intended for the work. Contractor shall take all necessary precautions to prevent damage to materials, equipment and work.

C. Any pipe joint compound, liquid or cementitious materials, etc. shall be stored in their manufacturer's original containers and shall be kept free from moisture and protected from damage.

D. All pipe, fittings, valves, etc. shall be delivered in their original shipping containers with labels in place, and shall be stored in such a manner as to protect them from snow, ice, mud, and water intrusion.

1.13 MANUFACTURER'S RECOMMENDATIONS:

A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of the particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

1.14 SCHEDULING OF WORK:

A. All work shall be scheduled subject to the review of the Architect, Engineer and the Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work, and shall cause no delay to other Contractors engaged upon this project or to the Owner.

1.15 OPENINGS, CUTTING AND PATCHING:

A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. Except as noted below, the actual openings and the required cutting and patching shall be provided by other Divisions. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall be provided by other Divisions. Cutting or coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Architect.

1.16 EXCAVATION AND BACKFILL:

A. General: Barrel of pipe shall have uniform support on sand bed. Sand shall be free from clay or organic material, suitable for the purpose intended and shall be of such size that 90 percent to 100 percent will pass a No. 4 sieve and not more than 5 percent will pass a No. 200 sieve. Unless otherwise noted, minimum earth cover above top of pipe or tubing outside building walls shall be 24", not including base and paving in paved areas.

B. Excavation: Width of trenches at top of pipe shall be minimum of 16", plus the outside diameter of the pipe or pipe insulation. Provide all shoring required by site conditions. Where over excavation occurs, provide compacted sand backfill to pipe bottom. Where groundwater is encountered, remove to keep excavation dry, using well points and pumps as required.

C. Backfill:

1. 6" Below, Around, and to 12" Above Pipe: Material shall be sand. Place carefully around and on top of pipe, taking care not to disturb piping, consolidate with vibrator. Native soil may be used where allowed by Geotechnical (Soils) Report. Where native soil is used, trenching for gravity drain pipe shall be done using a laser-level and trencher.
2. One Foot Above Pipe to Grade: Material shall be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to review by Engineer.

D. Compaction: Compact to density of 95% within building and under walkways, driveways, traffic areas, paved areas, etc. and to 90% elsewhere. Demonstrate proper compaction by testing at top, bottom and one-half of the trench depth. Perform these tests at three locations per 100 feet of trench.

1.17 PROTECTION FOR UNDERGROUND PIPING:

A. All ferrous piping below grade (except cast iron) shall be encased in polyethylene tube, minimum 8 mil thick, ANSI/AWWA C105/A21.5. Polywrap.

–or–

B. All ferrous piping below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness. Protective coating shall be extended 6” above surrounding grade. Scotchkote, X-Tru-Coat.

C. All ferrous piping rises above grade shall be covered with two layers double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Pipe wrap shall be extended 6” above surrounding grade. Johns-Manville.

D. All fittings and areas of damaged coating shall be covered with two layers, double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Johns-Manville.

1.18 ACCESS DOORS:

A. Provide access doors as required where equipment, piping, valves, ductwork, etc. are not otherwise accessible. Access doors shall match the wall or ceiling finish and fire rating as indicated on the Architectural drawings. 16-gage steel frame and 14-gage steel door with paintable finish, except in ceramic tile, where door shall be 16-gage stainless steel with satin finish. Continuous hinge. Key and cylinder lock, except quick opening type for Emergency Gas Shutoff Valve. Deliver doors to the General Contractor for installation. Milcor. Unless otherwise noted, the minimum sizes shall be as follows:

1 valve up to 1-1/2"	12" x 12"
1 valve up to 3"	16" x 16"
Fire/smoke damper (FSD)	20” x 24”

1.19 HOUSEKEEPING PAD:

A. Housekeeping pads shall be minimum 6" high concrete, 3000 PSI compressive strength, unless otherwise noted. Pad shall extend 6" beyond the largest dimensions of the equipment, unless otherwise noted. The top edge of the pad shall have a 3/4" chamfer. The pad shall have #4 reinforcing bars at 12" on center, each way, located at the mid-depth of the pad. If not poured at the same time as the floor slab with pad rebar tied to floor rebar, the pad shall be anchored as follows: Drill 1" diameter, 4" deep hole in floor. Fill hole with "Por-Rok", then insert 8" long, #4 rebar into hole. Provide a minimum of 4 of these anchors per pad, but no more than 4 feet apart in either direction. Anchor points shall be 12" from the edge of the pad.

1.20 CONCRETE ANCHORS:

A. Steel bolt with expansion anchor requiring a drilled hole - powder driven anchors, adhesive anchors and concrete screws are not acceptable. Reuse of screw anchor holes shall not be permitted. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 12 diameters center to center and 6 diameters center to edge of concrete. Post-installed anchors in concrete used for component anchorage shall be prequalified for seismic application in accordance with ACI 355.2 and ICC-ES AC193. Post-installed anchors in masonry used for component anchorage shall be prequalified for seismic applications in accordance with ICC-ES AC01. Maximum allowable stresses for tension and shear shall be 80% of the ICC-ES test report values. Hilti, ITW Red Head.

1.21 EQUIPMENT ANCHORING:

A. All equipment shall be securely anchored in accordance with ASCE 7-16, Chapter 13, as amended by CBC Section 1617A.1. All equipment mounted on concrete shall be secured with a concrete anchor as specified above at each mounting point.

1.22 SUPPORTS AND SEISMIC RESTRAINTS:

A. All mechanical systems (equipment, ductwork, piping, etc.) shall be provided with supports and seismic restraints in accordance with the "Seismic Restraint Guidelines for Suspended Distribution Systems" latest edition, as published by Mason West, OPM-0043-13, or other HCAI pre-approved system, and in accordance with ASCE 7-16, Chapter 13, as amended by CBC Section 1617A.1. Brace spacing shall be reduced by 50% for cast iron, plastic, no-hub, or other non-ductile piping. A copy of this manual shall be kept on site at all times during construction.

1.23 ASBESTOS CONTAINING MATERIALS AND ASBESTOS REMOVAL:

A. No materials or material coatings containing asbestos shall be allowed on this project.

B. All asbestos removal shall be by Owner. Asbestos is to be removed before the work is started. If the Contractor discovers asbestos which has not been removed, the Contractor shall immediately cease work in that area and promptly notify the Owner.

1.24 SYSTEM IDENTIFICATION:

A. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 2" high lettering minimum, white on black background. Contact type permanent adhesive, compatible with label and with substrate. Nameplates shall be permanently secured to the exterior of the unit. Seton.

B. Below Grade Piping:

1. Detectable Warning Tape: Bury a continuous, pre-printed with a description of underground utility, bright-colored, metallic ribbon marker capable of being located with a metal detector with each underground pipe. The detectable warning tape shall be a minimum of 6” wide and 4 mils thick. Locate directly over buried pipe, 6" to 8" below finished grade. Christy, Seton.

2. Tracer Wire: Secure 14 AWG minimum, corrosion resistant insulated tracer wire, to underground PVC/plastic pipe with nylon ties at maximum 10 feet interval. Terminate tracer wire 6" above grade at each end of piping.

C. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, indicate the fluid conveyed or its abbreviation, by pre-printed markers, and include arrows to show direction of flow. Pre-printed markers shall be the type that wrap completely around the pipe, requiring no other means of fastening such as tape, adhesive, etc. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 20 feet maximum intervals along exposed portions of lines.

1.25 CLEANING:

A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work. This includes but is not limited to building surfaces, piping, equipment and ductwork, inside and out. Surfaces shall be free of dirt, grease, labels, tags, tape, rust, and all foreign material.

B. At end of each work day, the Contractor shall cover all open ends of piping and ductwork with protective plastic.

1.26 ACCEPTANCE TESTING:

A. The Contractor shall perform, document and submit all acceptance testing as required by California Code of Regulations, Title 24, and as noted on the Certificate of Compliance form, where applicable. Submit a copy of the documentation to the Engineer for review, prior to submitting to Administrative Authority.

1.27 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Printed: Three copies of Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts list for all faucets, trim, valves, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-1). All Wiring Diagrams shall agree with reviewed Shop Drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Pumps, Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included with factory support contact names and phone numbers.

B. USB Flash Drive: The Contractor shall provide three copies of USB flash drives containing the Operations and Maintenance Instructions and Wiring Diagrams as instructed per above requirements in PDF format.

C. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation, maintenance, and troubleshooting of all equipment and systems. The controls contractor shall present that portion of the instructions that apply to the control system, including but not limited to, programming and setup of any control systems. The Engineer's office shall be notified 48 hours prior to this meeting.

D. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, compact discs, and verbal) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.28 RECORD DRAWINGS:

A. The Contractor shall obtain one set of prints for the project, upon which a record of all construction changes shall be made. As the work progresses, the Contractor shall maintain a record of all deviations in the work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. building, curbs, sidewalks. In addition, the water, gas, sewer, underfloor duct, etc. within the building shall be recorded by offset distances from building walls. The Contractor shall have a set of reproducible drawings made from the original drawings as part of his overhead expense. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings, marked-up prints, and reproducible drawings shall be submitted to the Engineer for review.

PART 2: PRODUCTS (not used)

PART 3: EXECUTION (not used)

END OF SECTION

SECTION 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1: GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

A. Provide the services of an independent test and balance agency to test, adjust and balance, retest and record performance of the system(s) to obtain design quantities as specified. The agency must prove that they have no affiliation with any equipment manufacturer, design engineer, installing contractor, or any other party which might lead to a conflict of interest, in order to provide an unbiased, third party system balance and report. The work includes, but is not necessarily limited to, the following:

1. Balance air systems.
2. Testing, adjusting, and balancing equipment.
3. Control system verification.

B. Work Specified Elsewhere:

1. Section 230010 “General Mechanical Provisions”
2. Section 230700 “HVAC Insulation”
3. Section 232300 “Refrigerant Piping System”
4. Section 233113 “Air Distribution”
5. Section 237000 “HVAC Equipment”

1.3 DEFINITIONS:

A. Adjusting: Varying of system flow by modifying settings of dampers, in combination with varying fan speeds to obtain optimum operating conditions for the entire system.

B. Balancing: Proportioning of air flows through system mains, branches, and terminal devices using standardized procedures to obtain specified air flow while imposing the least amount of restriction on the HVAC system.

C. Testing: Use of specialized and calibrated instruments to measure temperatures, pressures, rotational speeds, electrical characteristic, air flow in velocities or quantities used in evaluating the performance of a HVAC system.

1.4 QUALITY ASSURANCE:

A. Contractor Qualifications:

1. Prior to commencing work, the agency shall be reviewed by the Engineer and shall be certified by the Associated Air Balance Council (AABC), National Environmental Balancing Bureau (NEBB), or Testing Adjusting and Balancing Bureau (TABB). Certification shall be current for the duration of the project.
2. The Testing, Adjusting, and Balancing (TAB) Contractor shall be an independent agency specializing in the testing, adjusting, and balancing of HVAC systems and associated equipment. The agency must prove that they have no affiliation with any equipment manufacturer, design engineer, installing contractor, or any other party which might lead to a conflict of interest, in order to provide an unbiased, third party system balance and report.
3. The TAB Contractor shall have a minimum of five years experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.

1.5 SUBMITTALS:

A. Include in shop drawings copies of forms to be used for testing and balancing showing all data which is to be recorded.

B. Three copies of completed balance report shall be submitted to and reviewed by the Mechanical Engineer prior to the final mechanical construction review.

1.6 WARRANTY:

A. Provide warranty for period of 120 days following submission of completed report, during which time the Engineer, at his discretion, may request a recheck or resetting of any item(s) in test report. The agency shall provide technicians to assist the Engineer in making any tests he may require during this period of time.

PART 2: PRODUCTS

2.1 INSTRUMENTS AND TOOLS:

A. TAB Contractor shall furnish all labor, tools, and instruments as required to achieve a full and effective balance of the HVAC systems.

B. All instruments used for measurements shall be accurate, and calibration histories for each instrument shall be available for examination. Application of instrumentation shall be in accordance with AABC, NEBB, or TABB standards.

C. Instruments that require calibration shall have unexpired calibration dates. Instruments shall be calibrated against certified equipment having a known valid relationship to nationally recognized standards. If no national standard exists, the basis for calibration shall be documented and submitted in the final report.

D. Certified documentation of all instrument calibrations shall be submitted in the final report.

2.2 BELTS, SHEAVES, IMPELLERS:

A. TAB Contractor shall coordinate with the HVAC Contractor to supply correctly sized drive belts and sheaves. HVAC Contractor shall make any changes in pulleys, belts, and dampers or the addition of dampers required for correct balance as recommended by TAB Contractor, at no additional cost to Owner. Impellers shall be trimmed or replaced by the HVAC Contractor and shall be correctly re-sized and coordinated by the TAB Contractor.

B. TAB Contractor shall determine the fan belt and sheave replacement necessary for final balance condition for specified air quantity when the VFD is operating in the bypass mode for final field conditions, without placing the motor over its nameplate amp rating.

PART 3: EXECUTION

3.1 EXAMINATION:

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purposes and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201 “Fans and Systems”, or in SMACNA’s “HVAC Systems – Duct Design”. Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. Examine and verify proper diffusion pattern for all ceiling grilles and that all sidewall grilles are set for 5 degrees upward deflection, unless noted otherwise. Make a notation of any that are not set properly.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated valves.

3.2 PREPARATION:

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Duct systems are complete with terminal devices installed.
b. Volume, smoke, and fire dampers are open and functional.
c. Clean filters are installed.
d. Fans are operating, free of vibration, and rotating in correct direction.
e. Automatic temperature control systems are operational.
f. Ceilings are installed.
g. Windows and doors are installed.
h. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING:

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Field Measurements and Instrumentation - Total System Balance", Volume Two, No. 12173, or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems – Testing Adjusting, and Balancing", and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233113 "Air Distribution".
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230700 "HVAC Insulation".

C. Mark equipment and balancing devices, including damper control positions, valve position indicators, fan speed control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Measure and report testing and balancing measurements in inch-pound units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS:

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of equipment showing exactly where all pressure readings were taken.

C. Prepare schematic diagrams of systems' "as-built" duct layouts. Identify each grille, diffuser, and register as to its location.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check airflow patterns from the outdoor air louvers and dampers and the return and exhaust air dampers through the supply fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

J. Check for airflow blockages.

K. Check condensate drains for proper connections and functioning.

L. Check for proper sealing of air handling unit components.

H. Verify that air duct system is sealed as specified in Section 233113 "Air Distribution".

3.5 PROCEDURES FOR CONSTANT VOLUME AIR SYSTEMS:

A. Adjust fan(s) to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside air, return air, and relief air dampers for proper position that simulates minimum outdoor air conditions.
b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain airflow.
c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.
    c. Measure static pressure across each component that makes up the air handling system.
    d. Report artificial loading of filters at the time static pressures are measured.

3. Do not make fan speed adjustments that result in motor overload. Consult equipment manufacturers about fan speed safety factors. Modulate dampers and measure fan motor amperage to ensure that no overload occurs. Measure amperage in full cooling, full heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, sub-main ducts, and major branch ducts to indicated airflows.

1. Measure airflow of sub-main and branch ducts.
2. Adjust sub-main and branch duct volume dampers for specified airflow.
3. Re-measure each sub-main and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Re-adjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record minimum and maximum outside and exhaust airflows.
6. Measure and record all operating data.
7. Record final fan performance data.
8. Measure and record final pressure drop across filter(s) at each filter bank. Record filter quantity and size(s) at each filter bank.
9. Measure and record unit entering and leaving air temperatures: DB heating, DB and WB cooling.

3.6 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer’s name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.

4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Full load amperes.
8. Starter size and thermal protection element rating.
9. Service factor and frame size.

B. Motors Driven by Variable Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure and record entering and leaving air temperatures.

C. Record fan and motor operating data.

3.8 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Set, test and adjust packaged air conditioning unit economizer and demand control ventilation operation in cooperation with Controls Contractor. Record minimum and maximum outside and exhaust airflows.

C. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.9 TOLERANCES

A. Set HVAC system’s airflow rates within the following tolerances:

1. Supply, return, and exhaust fans and equipment with fans: Plus 10%, minus 0% of design requirements.
2. Air outlets and inlets: Plus 10%, minus 0% of design requirements.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.10 PROGRESS REPORTING

A. Initial Construction Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare bi-weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field report data, include the following:

1. Fan curves.
2. Pump curves.
3. Manufacturer's test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB Contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.

13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor, return, and exhaust air dampers.
    b. Conditions of filters.
    c. Cooling coils, wet and dry bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable air volume systems.
    g. Settings for supply air, static pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Balancing stations.
4. Position of balancing devices.

E. Air Handling Unit Test Reports: For air handling units with coils, include the following:

1. Unit Data:

    a. Unit Identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center to center dimensions of sheave and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center to center dimensions of sheave and amount of adjustments in inches.

3. Test Data, Indicated and Actual Values:

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.

e. Filter static pressure differential in inches wg.
f. Preheat coil static pressure differential in inches wg.
g. Cooling coil static pressure differential in inches wg.
h. Heating coil static pressure differential in inches wg.
i. Outdoor airflow cfm.
j. Return airflow cfm.
k. Outdoor air damper position.
l. Return air damper position.
m. Vortex damper position.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center to center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center to center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data, Indicated and Actual Values:

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

G. Round, Flat Oval, and Rectangular Duct Traverse Reports: Include a diagram with grid representing the duct cross section and record the following:

1. Report Data:

a. System and air handling unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in square feet.

g. Indicated airflow in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

H. Air Terminal Device Reports:

1. Size, type and manufacturer of diffusers, grilles, registers and all tested items shall be identified and listed. Manufacturer's ratings shall be used to make required calculations on all items.
2. Unit Data:

a. System and air handling unit identification.
b. Location and size.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in square feet.

3. Test Data, Indicated and Actual Values:

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

J. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.12 VERIFICATION OF TAB REPORT

A. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of a representative of the Architect.

B. Prepare test and inspection reports.

END OF SECTION

SECTION 230700 – HVAC INSULATION

PART 1: GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 23 0010, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Ductwork insulation system.
2. Refrigerant piping insulation system.
3. All material and equipment as shown or noted on the drawings or as specified.

B. Work Specified Elsewhere:

1. Section 230010 “General Mechanical Provisions”
2. Section 230593 “Testing, Adjusting, and Balancing for HVAC”
3. Section 232300 “Refrigerant Piping System”
4. Section 233113 “Air Distribution”
5. Section 237000 “HVAC Equipment”
6. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
7. Painting unless specifically called for in the drawings or specifications.

1.3 QUALITY ASSURANCE:

A. Contractor Qualifications: The installing contractor shall have a minimum of five years experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.

B. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.

PART 2: PRODUCTS

2.1 DUCTWORK INSULATION MATERIALS:

A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

B. Fiberglass Blanket: Installed thermal resistance at a mean temperature of 75F shall meet or exceed indicated R-value. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft2-F at a mean temperature of 75F. 1-1/2 pound per cubic foot density. 1-1/2" thickness, R-6 where ductwork is within the building thermal insulation envelope. 2" thickness, R-8 where ductwork is outside the building thermal insulation envelope and/or above the roof. Faced with glass reinforced foil laminated to Kraft paper. CertainTeed SoftTouch, Johns Manville Microlite XG, Knauf, Owens Corning SOFTR.

2.2 PIPING INSULATION MATERIALS:

A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

B. PVC Jacket (for pipe, fittings and valves): Pre-molded polyvinyl chloride (PVC) jackets, 0.020" thickness. Size to match application. Provide solvent weld adhesive and PVC vapor barrier pressure sealing tape by same manufacturer. Johns Manville Zeston.

C. Aluminum Jacketing: Aluminum pipe and fitting jacketing, 0.016" thickness for straight pipe. 0.024" thickness for fittings. Integral moisture barrier. Stucco-Embossed finish. Provide prefabricated aluminum strapping and seals by same manufacturer. ITW Pabco/Childers, RPR Products.

D. Metal Jacketing/Flashing Sealant: Childers Chil-Byl CP-76, Foster 95-44 Elastolar, Pittsburgh Corning Pittseal 727. Gallon container quantities only; no tubes.

E. Insulating Tape: Ground virgin cork and synthetic elastomeric, 1/8" thickness. Black, odorless, and non-toxic. Thermal conductivity shall not exceed 0.43 Btu-in/hr-ft2-F at a mean temperature of 75F. Non-shrinking. For outdoor use, provide protective finish by same manufacturer. Sealers 1401.

F. Foamed Plastic: Closed cell or rubber based, preformed flexible elastomeric pipe insulation, ASTM C534 Type I. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft2-F at a mean temperature of 75F. Provide adhesive by same manufacturer. Armacell AP/Armaflex.

PART 3: EXECUTION

3.1 DUCTWORK INSULATION INSTALLATION:

A. General: Insulate all sheet metal supply, return, and outside air intake ductwork except as noted below. Insulation shall be continuous through walls and floors except at fire dampers.

B. Where Insulation Is Not Required: Do not insulate factory-insulated ducts or casings, acoustic lined ducts, fibrous glass ducts, underground ductwork, supply or return ductwork exposed to view in the space that it serves, or exhaust ductwork.

C. Concealed Ductwork: Wrap concealed ductwork with fiberglass blanket lapped 2" minimum. Secure with staples 4" on centers maximum on straight runs and 3" maximum at elbows and fittings. Insulation on bottom of ducts wider than 36" shall also be secured with mechanical fasteners at 24" on center.

3.2 PIPING INSULATION INSTALLATION:

A. Refrigerant Piping: Cover piping, suction and liquid lines, with foamed plastic insulation. Longitudinal and end seams shall be thoroughly cemented with adhesive in accordance with manufacturer's recommendations. Cover all fittings, unions, valves and connections. Piping exposed to view shall be covered with PVC jacketing. Piping exposed to weather shall be covered with aluminum jacketing, seal all joints and seams with gray outdoor mastic or silver silicone sealant.

1. Less Than 1-1/2": 1/2" thickness, minimum.
2. 1-1/2" and Larger: 1" thickness, minimum.

END OF SECTION

SECTION 232300 – REFRIGERANT PIPING SYSTEM

PART 1: GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 23 0010, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

A. Included: Provide all labor, materials, and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Refrigeration system.
2. All material and equipment as shown or noted on the drawings or as specified.

B. Work Specified Elsewhere:

1. Section 230010 “General Mechanical Provisions”
2. Section 230593 “Testing, Adjusting, and Balancing for HVAC”
3. Section 230700 “HVAC Insulation”
4. Section 237000 “HVAC Equipment”
5. Connection of condensate drain(s) to equipment.
6. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
7. Painting unless specifically called for in the drawings or specifications.

1.3 QUALITY ASSURANCE:

A. Contractor Qualifications: The installing contractor shall have a minimum of five years experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.

B. Brazer Qualifications: Brazers shall be certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9. Certified brazer shall bear evidence of current certification thirty (30) days before commencing work on project.

C. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.

PART 2: PRODUCTS

2.1 PIPE AND FITTINGS:

A. Refrigerant Piping: Hard drawn Type ACR copper, dried and capped. Wrought copper fittings, silver alloy brazed, 1100F, Silfos. Size 3/8" and smaller shall be refrigerant tube, ASTM B280.

2.2 VALVES:

A. General: Valves shall meet the standard for refrigerant service. Manufacturer's model numbers are listed to complete description. All valves of a particular type or for a particular service shall be by the same manufacturer.

B. Line Valves: Bronze body construction, full port ball type for refrigerant service, TFE locked in seals. Back seated valve stem.

C. Solenoid Valve: Full line size. Sporlan.

2.3 PIPING SPECIALTIES:

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Unions, 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi. Anvil.

C. Filter Drier: Replaceable core. Capacity in accordance with AHRI Standard 710. Sporlan Catch-All.

D. Moisture Indicator Sight Glass: Double port. Sporlan See-All, Henry.

E. Vibration Isolating Connection: Seamless flexible bronze tubing, braid covered, suitable for system pressure. US Hose, Senior Flexonics.

F. Escutcheons: Chrome plated, metal type with fasteners.

2.4 MISCELLANEOUS PIPING ITEMS:

A. Piping Identification:

1. Pipe Labels, Above Grade Piping: Preprinted, color coded, with lettering indicating service, and arrow showing flow direction. Contact type, permanent adhesive backing. Brady Corp, Champion America, Seton.

B. Pipe Support: Finish shall be galvanized, unless noted otherwise.

1. Pipe Hanger: Galvanized steel "J" hanger with side bolt for piping 4" and smaller; galvanized steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendation. Felt liner for copper piping. Anvil, B-Line, Tolco, Unistrut.
2. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph “1” above. Increase hanger size per manufacturer's recommendation. B-Line B3195, Semco, Superstrut.
3. Hanger Rod: All thread rod with galvanized finish. Anvil, B-Line, Tolco, Unistrut.
4. Construction Channel: 12 gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. Anvil, B-Line B22, Tolco A-12, Unistrut P1000.

    a. Copper Pipe System: Pipe clamp with locknut and thermoplastic elastomer cushion. Cush-A-Clamp.

5. Pipe Riser Clamp: Galvanized finish. Anvil, B-Line, Tolco, Unistrut.
6. Pipe Block: 100% recycled rubber pad with reflective strips on each side, UV resistant, 1" gap between multiple block systems, 12 gage galvanized strut channel bolted to block, adjustable hinge fitting for sloped roofs. B-Line DB6 series.

C. Flashing: Provide clamp-on storm collar and seal water tight with mastic. Maintain dielectric separation between copper and galvanized materials.

1. Pipe Through Roof: Flashing shall be prefabricated galvanized steel roof jacks with 18 inch square base flange, minimum 24 gage. Oatey All-Flash.

a. Cold Process Built-Up Roof: Flashing shall be 4 lb/sq. ft., 0.0625" thick lead instead of galvanized steel. Mayco, Santa Rosa Lead Products.
b. Single-Ply Roof: Flashing material per roofing manufacturer's recommendation.

PART 3: EXECUTION

3.1 PIPING INSTALLATION:

A. Plumbing layouts indicated on plans are diagrammatic only. Some work may be shown offset for clarity. Exact location of equipment and pipes shall be coordinated with other trades.

B. Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run at right angles or parallel to building walls; location to be approved by Architect.

C. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed.

D. Piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment.

E. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.

F. All joints, changes in direction, and branch connections shall be made with standard fittings. Close nipples shall not be used. When using pre-charged tubing, all changes of direction shall be made with bending tools producing neat uniform bends. Free hand bends will not be accepted.

G. Install liquid line filter drier on each refrigerant circuit.

H. Install a moisture indicator sight glass, full line size, downstream of all filter dryers.

J. A union shall be installed on the leaving side of each valve, at all sides of automatic valves, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.

K. Dielectric couplings shall be installed wherever piping of dissimilar metals are joined, except that bronze valves may be installed in ferrous piping without dielectric couplings.

L. Open ends of piping shall be capped during progress of work to preclude foreign matter.

M. Inside Building:

1. Vertical lines shall be installed to allow for building settlement without damage to piping.
2. Install strainer on inlet of each line pressure regulator and automatic or electrically operated valve.
3. Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe sealed with fire rated materials in accordance with the requirements of CBC Section 714 and the fire authority having jurisdiction.
4. Pipe Sleeves: Pipes passing through concrete or concrete block wall shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe for piping 3" and smaller, otherwise 2" annular clearance.
5. Escutcheons: Provide chrome plated metal escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
6. Piping shall not pass above electrical panels, motor control centers or switchboards.
7. Pipe Label Locations: Locate pipe labels and directional flow arrows where piping is exposed or above accessible ceiling in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

    a. Near each valve.
    b. Near each branch connection, excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
    c. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
    d. At access doors and similar access points that permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.
    f. Space at maximum intervals of 20 feet along each run.

3.2 VALVE INSTALLATION:

A. All valves shall be full line size.

B. Install valves with unions at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate above ground valves for easy access.

3.3 PIPING JOINT CONSTRUCTION:

A. Pipe shall be cut square. Ream ends of pipes and tubes and remove burrs.

B. Joint surfaces shall be thoroughly cleaned, fitted and erected before brazing. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100F. Brazing shall be performed by a Certified Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.

3.4 HANGER AND SUPPORT INSTALLATION:

A. Install seismic restraints on piping in compliance with CBC Chapter 16A.

B. Support individual pipes with pipe hanger. Provide hangers, supports, clamps, and necessary attachments as required to properly support piping from the building structure. Hangers shall be placed to support piping without strain on joints or fittings.

C. All piping shall have isolating shield; no portion of this piping shall touch the structure without an isolating shield.

D. Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.

E. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam.

F. Vertical piping shall be supported with riser clamp at base and at each floor, maximum 10' on center.

G. Provide additional supports for equipment, valves or other fittings.

H. Support pipe within 12" of all changes in direction.

I. Install hangers for horizontal copper piping with the following maximum spacing and minimum rod sizes. Maximum spacing is based on straight lengths of pipe with couplings only. Actual spacing requirements will depend on structural system. Seismic requirements may reduce maximum spacing.

1. 1/2" to 1-1/2”: Maximum span, 5 feet; minimum rod size, 3/8”.

J. Install support for vertical copper piping every 10 feet.

3.5 CONNECTIONS:

A. Connect piping to HVAC equipment.

B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.6 TESTS:

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.

B. Procedures for charging and purging of systems and for disposal of refrigerant shall be in accordance with ASHRAE 15 “Safety Standard for Refrigeration Systems”, latest edition. Test refrigeration system in accordance with ASME B31.5.

C. After installation, evacuate to 29 inches of mercury, ambient temperature during evacuation shall not be less than 70F.

D. After evacuation, fill with dry nitrogen to 250 psi and maintain for two-hour period without additional charge.

G. After nitrogen test, purge with refrigerant charged through dryer and maintain holding charge in system and equipment.

H. System Charging and Startup Test: Charge the system after satisfactory completion of the evacuation test. The entire system shall then be tested for leaks with electronic leak detectors. Test to no leakage.

END OF SECTION

SECTION 233113 – AIR DISTRIBUTION

PART 1: GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Air distribution system.
2. All material and equipment as shown or noted on the drawings or as specified.
3. Acceptance testing as required to comply with Title 24 energy code. If a HERS rater is required to witness the test, the HERS rater shall be paid for under this specification section.

B. Work Specified Elsewhere:

1. Section 230010 “General Mechanical Provisions”
2. Section 230593 “Testing, Adjusting, and Balancing for HVAC”
3. Section 230700 “HVAC Insulation”
4. Section 237000 “HVAC Equipment”
5. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
6. Painting unless specifically called for in the drawings or specifications.
7. Carpentry.
8. Undercutting of doors and door louvers.

1.3 QUALITY ASSURANCE:

A. Contractor Qualifications: The installing contractor shall have a minimum of five years of experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.

B. Comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible”, latest edition, for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

C. Comply with NFPA 90A “Installation of Air Conditioning and Ventilating Systems” and with NFPA 90B “Installation of Warm Air Heating and Air Conditioning Systems”, latest editions.

D. Welder Qualifications: Welders shall be certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9. Certified welder shall bear evidence of current certification thirty (30) days before commencing work on project.

E. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.

PART 2: PRODUCTS

2.1 DUCTWORK MATERIALS:

A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50. Minimum 26 gauge unless noted otherwise. Shall comply with CMC Chapter 6 Duct Systems.

1. All duct sizes shown on the Drawings are clear inside dimensions. Allowance shall be made for internal lining, where specified, to provide the required free area.
2. All ductwork shall be constructed for a minimum pressure class as listed below, unless stated otherwise, for the following systems:

    a. Typical low pressure supply ductwork: 2” wg positive.
    b. Typical return ductwork: 2” wg negative.
    c. Typical low pressure exhaust ductwork: 2” wg negative.

B. Rectangular Ductwork: Metal ductwork shall be G90 coated galvanized sheet steel of lock forming quality, ASTM A653, with gauge and construction to match SMACNA Standard for pressure required, 26 gauge minimum. Pittsburgh lock shall be used on all longitudinal seams. SMACNA Seal Class A.

C. Round Ductwork, Concealed: Ductwork shall be galvanized steel, spiral lockseam duct, ASTM A653, with gauge and construction to match SMACNA Standard for pressure required, 26 gauge minimum. Slip joint or pipe coupling connectors. Snap lock shall not be allowed due to sealing problems. McGill Airflow Uni-Seal.

D. Flexible Ductwork, Insulated: Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft2-F at a mean temperature of 75F. One pound per cubic foot minimum density glass fiber insulation. 1-1/2" thickness, R-6 where ductwork is within the building thermal insulation envelope. 2” thickness, R-8 where ductwork is outside the building thermal insulation envelope. Seamless metalized reinforced polyester vapor barrier jacket. Continuous internal liner bonded to galvanized steel wire helix. Duct shall be capable of continuous operation at 1.5" of water static pressure and 4,000 FPM air velocity. Duct shall comply with NFPA 90A. Casco HP-25, JP Lamborn MHP, Thermaflex M-KC.

1. Duct Joint: Sheet metal collar to which flexible duct is attached shall be 2” minimum in length. Sheet metal sleeves of 4” minimum in length shall be used to join two sections of flexible duct. Flexible duct joints shall be secured to collar or sleeve with stainless steel or nylon draw bands. DuroDyne Dyn-O-Ties.

E. Moisture Bearing Exhaust Ductwork: Exhaust ductwork bearing moisture such as exhaust ducts from showers, dishwashers, clothes driers, etc. shall be constructed of aluminum sheets (unless shown otherwise on drawings), with gauge and construction to match SMACNA Standard for pressure required, 26 gauge minimum. All duct system appurtenances are to be the same material as ductwork including turning vanes, volume dampers and access doors.

F. Acoustic Duct Liner: Glass fiber duct liner, comply with ASTM C1071. Installed thermal resistance at a mean temperature of 75 degrees F shall meet or exceed indicated R-value. Maximum thermal conductivity shall not exceed 0.24 Btu-in/hr-ft2-F at a mean temperature of 75 degrees F. One side coated to prevent fiber erosion up to 6,000 FPM. Average noise reduction coefficient of 0.70 for 1" thickness and 0.95 for 2" thickness. 1-1/2 pound per cubic foot minimum density. 1" thickness, R-4.2 where ductwork is within the building thermal insulation envelope. 2" thickness, R-8 where ductwork is outside the building thermal insulation envelope and/or above the roof. CertainTeed ToughGard R, Johns Manville Linacoustic RC, Knauf Sonic XP, Owens Corning QuietR.

G. Duct Liner Adhesive: Water based, shall meet ASTM C916 Type II requirements. Childers Chil-Quik CP-127, Design Polymerics DP2501, Foster 85-60, Vimasco 795.

H. Duct Sealants:

1. Joints Exposed to Weather: UV resistant, water resistant. Sealant shall be GE SilPruf SCS2000 or SilGlaze II SCS2800, without substitution.
2. Joints Not Exposed to Weather: Fiber reinforced. White in color. Childers Chil-Duct CP-148, Design Polymerics DP1030, Foster 32-17, Hardcast Versa-Grip 181, Hardcast CCWI-181.

2.2 AIR TERMINALS AND DUCT FITTINGS:

A. Grilles (Including Diffusers, Registers, and Louvers):

1. Information on Drawings: Refer to Grille Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description. Titus. Equivalent models of Anemostat and Krueger are acceptable. Refer to the floor plans for neck size, CFM, air diffusion pattern and fire damper, if required.
2. Performance: Submit complete performance data (throw, pressure drop, noise level, etc.) for all grilles proposed, other than those scheduled. Testing shall be in accordance with ANSI/ASHRAE Standard 70 "Method of Testing the Performance of Air Outlets and Air Inlets", latest edition. If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be reselected by the Contractor for the proper diffusion, spread, pressure drop, throw and noise level.
3. Frame and Accessories: All supply, return, and exhaust grilles shall not have an opposed blade volume control damper unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawings. Key or screwdriver operated, no slide bars.
4. Finish: All ceiling and wall grilles and all louvers shall have a paintable white finish unless otherwise noted. Interior components, everything behind the face plate, shall be painted flat black. Floor grilles shall have an anodized aluminum finish unless otherwise noted.

B. Spin-In Fittings: Same material and gauge as ductwork with die-formed mounting groove. Sheet Metal Connectors.

C. Branch Duct Volume Control Damper (VCD):

1. VCD in Rectangular Ducts: Opposed blade, 8" maximum blade width, 16 gauge galvanized steel blade, 48" maximum length, nylon or oil impregnated bronze bearings, 1/2" diameter pin shaft, 16 gauge galvanized channel frame, actuating rod and linkage out of air stream. Ruskin MD35.
2. VCD in Round Duct: Single blade damper, minimum 20 gauge galvanized frame and blade. Ruskin MDRS25.
3. All branch dampers shall have regulator with stamped steel handle, spring loaded shaft nut, cast body and serrated self-locking die cast core. Regulator for horizontal ducts overhead shall be mounted on sides or bottom of ducts. Secure a 12" length of brightly colored plastic ribbon to handle for ease of location. Where rectangular or round ductwork is insulated, provide stand-off platform at least 1/4" higher than the insulation thickness and slit insulation to allow handle to protrude. Ventlok 641 (with 607 open end bearing for round ducts).

D. Flexible Connection: UL listed, fire retardant neoprene coated fiberglass cloth. Minimum density of 30 ounces per square yard, rated to 200 degrees F. Overall length of 9 inches consists of 3" metal, 3" fabric, 3" metal. Duro Dyne Metal-Fab Neoprene, Ventfabrics Metaledge Ventglas.

E. Duct Access Door:

1. Rectangular: Insulated double wall door. Full piano hinge. Cam latch. Pressure rating to match application. Air Balance, Ductmate.
2. Round: Three layers of stamped steel. Inside panel shall consist of two layers of metal which are spot welded together along the rim, encapsulating high density fiberglass insulation (25/50 rated). Closed cell neoprene gasket bonded to the inside of the door. Zinc plated conical springs installed between the inner and outer door. Polypropylene molded knobs with threaded metal inserts. Knobs shall be easily turned by hand and shall be UL94HB listed. Zinc plated carriage bolts, clinched and sealed to the inner door. Provide self adhesive template for the exact size of duct opening. Pressure rating to match application. Ductmate.

F. Bird Screen: Screen shall be 1/2" 16 gauge galvanized steel mesh, unless otherwise noted.

2.3 HANGER AND SUPPORT:

A. Hanger Strap: Galvanized sheet metal strap, 1-1/2" wide x 18 gauge minimum.

B. Hanger Rod: All threaded rod with galvanized finish, 3/8" diameter minimum. Anvil, B-Line, Tolco, Unistrut.

C. Cables: Aircraft cable, 1/4" diameter minimum.

D. Construction Channel: 12 gauge, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. Anvil, B-Line B22, Tolco A-12, Unistrut P1000.

E. Flexible Duct Supports: Galvanized sheet metal straps, 4" wide with 6" wide fiberglass pad between duct and hanging strap.

PART 3: EXECUTION

3.1 DUCTWORK INSTALLATION:

A. General:

1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA Standards. Ductwork shall be built to a pressure classification equal to or greater than the maximum operating pressure at that point in the ductwork. Duct and fittings shall be sealed to SMACNA Seal Class A. A copy of these standards shall be maintained at the job site at all times. Ductwork and accessories shall be installed in a manner to prevent vibration and rattling.
2. Access: Provide duct access doors as required to adjust equipment and dampers. Provide wall or ceiling access panels, or remote actuators as required where equipment and dampers are not otherwise accessible. Ventlok 666 concealed remote actuator with zinc finish on cover.
3. Flanges and Escutcheon: Where ductwork penetrates walls, ceilings, or floors, furnish and install flange or escutcheon of same material as duct.
4. Flexible Connections: Connection of ductwork to any vibrating equipment shall be with 3" minimum flexible connection. Install with ample slack and uniform gap. There shall be no metal to metal contact across flexible connection. Flexible connections exposed to weather shall have a protective sheet metal cover. Connectors shall be attached in such a manner to provide an airtight and waterproof seal.
5. Ducted Returns: All air handling equipment that is not directly located in the space that it serves shall have ducted returns.
6. Acoustic Lining: Unless otherwise indicated, all supply and return ductwork in equipment rooms including outside air intakes, all ductwork exposed to weather and other ducts as indicated on drawings, shall have acoustic lining. Where acoustic lining is installed, increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and also secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.
7. Duct Fire Caulking: All ductwork passing through rated assemblies that do not have a fire or fire/smoke damper shall be installed with a UL listed fire caulking assembly. Exact details of UL listed assembly shall be followed. Provide Inspector of Record and project engineer submittal showing UL listed fire caulking detail that the contractor intends to use for each condition. In lieu of fire caulking, at contractor's option, provide fire damper installed in accordance with UL listing.

B. Low Velocity-Low Pressure, up to 2,000 FPM and up to 2" Water Gauge:

1. Sheet Metal Ductwork:

a. Elbows: Elbows shall be standard radius type with centerline radius to duct diameter of 1.0 (R/D ratio). Elbows with less than standard radius and square elbows shall be fitted with turning vanes.
b. Tees: Tees in supply ductwork shall be straight tap-in with extractor or 45 degree take-off. Grilles or branches in supply ductwork shall be a minimum of eight duct diameters downstream of tees.

c. Duct Joints and Seams: All joints and seams which are not exposed to weather shall be sealed airtight with duct sealant. All joints and seams exposed to weather shall be sealed air and watertight with silicone sealant. All joints on spiral wound metal ductwork not exposed to weather shall be sealed airtight with gray duct sealant.

d. Dampers: Install volume control damper and damper regulator in all branch ducts.

2. Flexible Ductwork, Insulated: The use of insulated flexible duct is limited to the last 5 feet of each branch duct. Example: one 5 foot section of flexible duct may be used to connect the grille to the sheet metal branch duct. No joints are permitted in this 5 foot length. Hangers shall be 4" wide metal straps spaced to prevent sagging, 42" maximum spacing. Insert 6" wide fiberglass pad between duct and hanging strap. Duct joints shall be secured to collar or sleeve with stainless steel or nylon draw bands. Ducts shall be sealed using approved mastics and/or tapes. Minimum turn radius shall be in accordance with SMACNA Standards: turn radius of duct centerline not less than 1.5 times the duct diameter.

3. Moisture Bearing Exhaust Ductwork: Joints shall be sealed watertight with mastic. Unless otherwise indicated, the ducts shall slope down towards the source of the moisture (grille, hood, clothes drier, etc.). Sheet metal screws or any other device that protrudes into the duct shall not be used for clothes drier exhaust ducts.

3.2 AIR TERMINALS AND DUCT FITTINGS INSTALLATION:

A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA Standards. Terminals and fittings shall be installed in a manner to prevent vibration and rattling.

B. All grilles, diffusers, and registers shall be adjusted for required air patterns and to minimize drafts. Sidewall grilles shall be adjusted for 5 degrees upward deflection, unless noted otherwise.

C. Paint interior of metal ducts that are visible through grilles and registers and that do not have duct liner. Apple one coat of flat, black, latex paint over a compatible galvanized steel primer.

D. Duct Access Door: Install access doors with permanent label identifying the concealed components. Provide duct access doors at the following locations:

1. Balancing dampers and backdraft dampers.

3.3 HANGER AND SUPPORT INSTALLATION:

A. Install seismic restraints on ductwork in compliance with CBC Chapter 16A.

B. Support individual ducts with hanger strap or rod. Provide hangers, supports, clamps, and necessary attachments as required to properly support ductwork from the building structure. Hangers shall be placed to support ductwork without strain on joints or fittings.

C. Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.

D. Hangers exposed to view shall be all threaded rod and angle or channel supports.

E. Vertical ductwork shall be supported with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets at base and at each floor, maximum 10 feet on center.

F. Support duct within 12" of all changes in direction.

G. Install supports for low pressure horizontal rectangular duct with the following maximum spacing. Maximum spacing is based on straight lengths of duct only. Actual spacing requirements will depend on structural system. Seismic requirements may reduce maximum spacing.

1. 12” and Smaller in Largest Dimension: Maximum span, 8 feet.
2. 13” to 48” in Largest Dimension: Maximum span, 5 feet.

H. Install supports for low pressure horizontal round duct with the following maximum spacing. Maximum spacing is based on straight lengths of duct only. Actual spacing requirements will depend on structural system. Seismic requirements may reduce maximum spacing.

1. 18” and Smaller: Maximum span, 8 feet.
2. 19” to 48”: Maximum span, 5 feet.

3.4 CONNECTIONS:

A. Connect ductwork to HVAC equipment with flexible duct connectors.

3.5 TESTS AND ADJUSTMENTS:

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.

B. Acceptance of duct systems shall be contingent upon conformance with the requirements specified in Section 230593 “Testing, Adjusting and Balancing for HVAC”.

END OF SECTION

SECTION 237000 – HVAC EQUIPMENT

PART 1: GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 230010, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. All material and equipment as shown or noted on the drawings or as specified.
2. Temperature control system. Provide Pelican Wireless system to match existing Bakersfield City School District HVAC control system. The HVAC control system strategies and graphics shall be consistent with existing format. The control system includes control panels, control devices, line and low voltage control and interlock wiring, conduit and related equipment as required for proper operation of all controlled systems. Control and interlock wiring includes wiring to controllers, switches, timers, relays, etc. Power wiring and disconnect switches are included in the Electrical Specifications except that power wiring required for control devices such as thermostats, valves, etc., is included in the control system.
3. Assist the Testing, Adjusting, and Balancing (TAB) Contractor by execute starting of equipment and operate equipment for the duration of TAB work. As a part of the work of this contract, THE AIR CONDITIONING CONTRACTOR shall make any changes in pulleys, belts and dampers or the addition of dampers required for correct balance as recommended by TAB Contractor, at no additional cost to Owner.

B. Work Specified Elsewhere:

1. Section 230010 “General Mechanical Provisions”
2. Section 230593 “Testing, Adjusting, and Balancing for HVAC”
3. Section 232300 “Refrigerant Piping System”
4. Section 233113 “Air Distribution”
5. Division 22 for connection of domestic water and condensate drains to equipment.
6. Line voltage power wiring, motor starters in motor control centers, disconnect switches and installation of all starters are included in Division 26 Electrical, unless otherwise noted.
7. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
8. Painting unless specifically called for in the drawings or specifications.
9. Undercutting of doors and door louvers.

1.3 QUALITY ASSURANCE:

A. Contractor Qualifications: The installing contractor shall have a minimum of five years experience and shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number, and contract value.

B. Motors shall comply with NEMA MG-1.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

D. Fans shall have AMCA certified performance ratings and shall bear the AMCA Certified ratings seal.

E. Power ventilators shall comply with UL 705.

F. Source Limitations: Materials and equipment of a given type shall be by the same manufacturer.

G. Warranty: Temperature Controls Contractor shall provide a one year parts and labor warranty on the entire HVAC control system.

1.4 COORDINATION:

A. Coordinate sizes and locations of structural steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2: PRODUCTS

2.1 EQUIPMENT:

A. General Requirements:

1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities and efficiencies are to be considered minimum.
2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment, different than scheduled units, showing actual job conditions, required clearances for proper operation, maintenance, etc.
3. Ratings:

    a. Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.

4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.

5. Electrical:

   a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
   b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts, and other devices shall be in ungrounded conductors.
   c. Motors: Continuous duty at ambient temperature of 104 degrees F, at altitude of 3300 feet, and for temperature rise in accordance with ANSI/NEMA MG-1 limits for insulation class, service factor, and motor enclosure type. Motor shall be rated, constructed, and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip proof (ODP), NEMA Design B on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be totally enclosed fan cooled (TEFC). Motors in a fan air stream shall be TEFC or totally enclosed air over (TEAO). Vertical motors outdoors shall be ODP or TEFC and shall have rain caps.
   d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.
   e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
   f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.

6. Fan Selection:

   a. Fan Curves: Performance curves shall be submitted for all units of 3,000 CFM or greater. Operating point for forward curved fans shall be from point of maximum efficiency toward increased CFM limited by horsepower scheduled. Operating point for backward inclined fans shall be selected near point of maximum efficiency. Curves shall plot CFM verses static pressure with constant brake horsepower, RPM, and efficiency lines.

b. Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure (TSP) includes all ductwork, filter, coil, cabinet, damper, and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.30 inches of water column, unless otherwise noted. Submit itemized static pressure losses for all components.

7. Filters:

   a. General: Tested and rated in accordance with ASHRAE Standard 52.2, UL 900, and SFM 12-71-1, Part 12, Title 24, CCR. Furnish and install one complete change of all filters after air balance is completed and prior to acceptance. Provide pressure differential gage across all filter banks.
   b. Filter Media: 2" media. Pleated panel filter, MERV of 13 or better when tested in accordance with ASHRAE Standard 52.2. Initial clean filter resistance 0.30 inches of water gage maximum at 500 FPM face velocity. Throw-away frame. UL 900 listed. AAF Flanders PREpleat M13, Columbus Industries, Koch Multi-Pleat Green13.

8. Screens: All duct or louver openings to the outside shall be covered with 1/2", 16 gage, galvanized wire mesh screen.
9. Mixing Dampers: Opposed blade, 6” maximum blade width, 16 gage blade, 48" maximum length, nylon or oil impregnated bronze bearings, 1/2” diameter pin shaft, 16 gage channel frame, 1% maximum leakage at 4 inches of water column in accordance with AMCA 500 for outside air dampers, actuating rod out of air stream. Arrow.
10. Sound Ratings: Shall be in accordance with ASHRAE 36-72. Sound ratings shall not exceed scheduled values.
11. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/- 10%, selected at mid range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.
12. Coils:

    a. Construction: Copper tube. Copper or aluminum 0.0075” minimum thickness fins hydraulically or mechanically bonded to tube. 16 gage galvanized steel rigid channel coil casing. Rated 750 psig minimum working pressure. All coils shall have connections at same end. Wherever two or more coils are being controlled by a single valve, each coil shall be installed with a separate balancing cock and a Pete’s Plug at each outlet.
    b. Capacity: Ratings certified by AHRI in accordance with AHRI Standard 410. Cooling coil face velocity shall not exceed manufacturer’s published ratings or 600 FPM. Include coil selection calculations in shop drawings.
    c. Direct Expansion (DX) Coils: Copper suction header silver brazed to tubes, distributing tubes and expansion valve. Working pressure 400 psig minimum. 10 fins per inch maximum.

B. Air Conditioning Unit, Heat Pump:

1. General: Self-contained heat pump unit designed for outdoor installation. Factory assembled and tested. Refer to Paragraph 2.1,A for General Requirements. Provide all starters and relays required for operation. 24-volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Outside air inlet. Drain pan. Vane axial supply fan with direct drive electrically commutated variable speed motor. Integrated defrost system to prevent excessive frost accumulation during heating duty. AHRI certified. Carrier 50GCQ, JCI/York.
2. Refrigeration: Fully hermetic, heat pump duty 2-stage scroll compressor with internal vibration isolating mount. High pressure switch, low pressure switch, expansion valve, filter drier, suction line accumulator. Service gage connections on suction and discharge lines. Air-cooled condenser with totally enclosed motor and direct drive propeller fan. Non-ferrous finned coil. Low ambient cooling operation down to 35 degree F. 5 year extended warranty on compressor(s).
3. Outside Air Damper and Hood: Damper shall be modulating type. Provide rain hood with filter. MicroMetl.
4. Economizer and Fault Detection and Diagnostics (FDD) System: Air-side, dry-bulb, integrated economizer and Energy Commission certified FDD system in compliance with Title 24 Energy Code. Provide with barometric relief. Dampers shall be modulating type where the unit will exhaust at the minimum outside air setpoint and exhaust 100% during economizer mode. Provide sensors, direct drive actuators, and PEARL economizer logic module controller to monitor system operation including system status, detect failures/faults and annunciate locally on thermostat. The PEARL economizer controller shall communicate with Pelican Wireless System. Provide rain hood with filter. 5 year warranty on economizer assembly. MicroMetl, Pelican PEARL.
5. Accessories: Time guard control circuit, condenser coil guard, hinged access panels, condensate overflow switch, fan/filter status indicator, filter maintenance indicator air, phase monitor protection, electric resistance heater, roof curb to match roof slope, UL listed NPBI type ion generator, controller interface for communication to Pelican Wireless thermostat.

C. Split System, Heat Pump:

1. General: Refer to Paragraph 2.1,A for General Requirements. Completely assembled and factory tested. Provide all starters and relays required for operation. All components by same manufacturer. Carrier, Mitsubishi Electric.
2. Outdoor Unit:

    a. Compressor: Variable speed inverter driven hermetic rotary compressor with vibration isolator mountings. Expansion valve, accumulator, recycling timer to prevent compressor short cycling. High temperature protection. Motor overload protection. Crankcase heater, base pan heater. Low ambient cooling operation down to 22 degree F. High and low side service valves. Single phase start assist kit. 7 year extended warranty.
    b. Fan and Coil: Finned tube non-ferrous coil (condenser coil with copper tubing and aluminum fins). Air-cooled unit with totally enclosed motor and direct drive propeller fan. Non-ferrous finned coil. Motor overload protected, permanently lubricated ball bearings, resiliently mounted.
    c. Cabinet: Weatherproof constructed from galvanized steel plate, factory paint.

3. Indoor Unit:

    a. Supply Fan: Direct drive, multi-speed centrifugal fan. Motor overload protected, permanently lubricated ball bearings.
    b. Indoor Coil: Copper tube, aluminum fin, DX coil.
    c. Condensate Pan: Install under complete coil area with factory installed condensate lift pump and drain connection.
    d. Filter: Factory supplied washable media.
    e. Ceiling Cassette Cabinet: Cabinet is constructed of zinc-coated steel, factory paint. Fully insulated discharge and inlet grilles. Filter access thru ceiling panel/grille. Mounting brackets. Factory knock-out provision for outside air intake connection.

4. Controls: Microprocessor control system with integral temperature sensing, temperature selection, room temperature indication, self-diagnostics. Automatic cooling/heating changeover, power failure automatic restart safety. Provide controller interface for communication to Pelican Wireless thermostat.

D. Exhaust Fans:

1. General: All exhaust fans shall be tested according to AMCA Standard 210 in an AMCA registered laboratory and shall bear certified ratings seal for sound and air performance. Fans exposed to weather shall have ventilated weatherproof housing over motor and drive assembly. Refer to Paragraph 2.1,A for General Requirements. All direct drive fans shall be provided with unit mounted speed controllers, unless otherwise noted. All motors 1 HP and larger shall be the premium efficiency type.
2. Ceiling Fan: Direct driven, centrifugal exhaust fan. Fan shall bear the AMCA certified ratings seal for sound and air performance. Fan wheel housing constructed of heavy gage galvanized steel with acoustic insulation. Integral outlet duct collar shall have a backdraft damper. Inlet grille shall be constructed of non-yellowing high-impact polystyrene. Motor shall be isolation mounted and have thermal overload protection. Provide a field wiring compartment with disconnect receptacle. Provide an adjustable pre-punched mounting bracket to accommodate different ceiling thickness. Wheel shall be centrifugal forward curved type and dynamically balanced. Manufacturer's standard roof jack, wall cap, or louvered grille eave vent, and transition fittings. Solid state speed controller. UL Listed. Cook, Greenheck SP.

2.2 EQUIPMENT SUPPORT:

A. Roof Curbs: Double wall insulated galvanized steel curb with mounting flange, mitered and welded corners, 1-1/2" thick rigid fiberglass insulation adhered to inside walls, galvanized metal liner, 1-1/2" wood nailer, curb height shall provide 8" minimum clearance between finish roof and bottom of HVAC equipment and accessories, pitched to match roof slope. Size as required to suit roof opening and equipment base.

2.3 EQUIPMENT IDENTIFICATION:

A. Equipment Labels: Plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). 2" high lettering minimum, white on black background. Contact type permanent adhesive, compatible with label and with substrate. All equipment shall be labeled. Seton.

2.4 TEMPERATURE CONTROL SYSTEM:

A. Scope: Provide all labor, materials and services necessary for a complete installation and operable system utilizing wireless communication with cloud based servers. The wireless, HVAC control system includes gateways, repeaters, control panels, control devices, line and low voltage control and interlock wiring, conduit and related equipment as required for proper operation of all controlled systems. Control and interlock wiring includes wiring to controllers, switches, timers, relays, etc. Power wiring and disconnect switches are included in the Electrical Specifications except that power wiring required for control devices such as thermostats, valves, etc., is included in the control system. The Controls Contractor shall have the responsibility as the expert in the proper application of his control components and system. The final design, installation, and operation of the control system are the responsibilities of this Contractor. The Controls Contractor is responsible to assure that all field control devices are compatible with HVAC control system hardware and software. The Controls Contractor shall make additions and/or modifications to the design as required at no additional cost.

B. Type of system: The control system shall be wireless electric/electronic, Pelican Wireless Systems, to match existing. The HVAC control system shall include a network of internet programmable thermostats which use IEEE 802.15.4 mesh wireless communication protocol to reach a wireless gateway. The wireless gateway shall connect to the District's wide area network over a TCP/IP connection. Access and control of the HVAC control system is through a web based management tool which sits on a cloud server and shall be accessible either locally or remotely via the Internet.

C. HVAC Equipment Interface: It shall be the responsibility of the Controls Contractor to obtain factory wiring diagrams of all HVAC equipment provided on this project to insure proper controls interface without jeopardizing factory internal safeties of the equipment.

D. System Components:

1. Wireless Gateway (WG), GW400: Provide wireless gateway(s) to facilitate the communication link between the entire system and a cloud based server. Communication with Cloud servers shall be secured using Advanced Encryption Standard (AES). WG shall be able to communicate with up to 2000 devices and have the following features as a minimum:

    a. One Ethernet port
    b. CAT5 Ethernet cable, 10 feet minimum.
    c. One micro-USB 5VDC power input
    d. 115VAC power adapter
    e. 2.4 GHz IEEE 802.15.4 built-in communication processor

2. Wireless Repeater, GR400: Provides extended wireless range to bridge long distances and/or in areas where wireless is weak. 115VAC power adapter.
3. Internet Programmable Thermostat (IPT), TC1: IPT shall be a wireless communicating commercial programmable thermostat that uses IEEE 802.15.4 for networking communication and a wiring terminal block for controlling a single zone HVAC unit.

    a. The IPT shall provide a touchscreen LCD display and function selectors for setting temperature setpoints, system mode (Heat, Cool, Auto, Off), fan mode (Auto, On), and light button.

b. The IPT shall be configurable using a web based app (WBA). No thermostat configuration, other than setting the IPT to Conventional, Heat Pump - O, or Heat Pump - B, shall be done at the thermostat. The web based user customizable configuration setting options shall include: naming the thermostat and grouping multiple thermostats; conventional or heat pump system setting; up to 6 compressor cycles per hour for short cycle protection; up to 2 stages for heating and 2 stages for cooling; up to 2 stages for fan; temperature display in Fahrenheit or Celsius; temperature range setting limitation for heating and cooling; ability to disable and enable keypad lockout control; display energy consumption units in kilowatt, btu, ton or watt; notification sensitivity settings of High, Medium, and Low; enable fault alarm when temperature exceed user defined safe range.

c. IPT settings and control through the web base app shall be in real-time and include space temperature, system mode (Heat, Cool, Auto, Off), fan mode (Auto, On), current setpoint, relay status (Heat/Cool and Fan), historical trend graphs, scheduling, lock and unlock entire thermostat's keypad, and lock and unlock the thermostat's fan mode setting.

4. Power Control Module, PM5: Consist of a low voltage wireless antenna and a line voltage power relay module. The antenna shall communicate with the wireless mesh network. Five independent dry contact relays, rated 120VAC up to 15 amps or 240/277VAC up to 10 amps, can be scheduled to start/stop units (fans, pumps, etc.) with manual override function. The relays can also be synchronized with a thermostat. Each relay shall have a green status light to indicate when it is energized. The module can be powered by 120VAC or 208-240 VAC.

5. Input Temperature Sensor (ITS), TA1:

   a. The ITS shall connect to the IPT over 3-wires, provide at least one external 10K Type II thermistor temperature sensor input, and shall be accurate to +/- 1^{o}F. ITS shall be able to be installed up to 500 feet away from IPT using standard thermostat wiring.

   b. WBA shall be able to record and provide at least two years of past temperature data for ITS. The trend data shall be viewable on the WBA.

6. Wireless Proximity Sensors (WPS), PRX1: Battery operated, the WPS shall communicate with the IPT over the IEEE 802.15.4 wireless mesh network.

   a. WPS shall be able to be used for either:

      (1) Accepting a motion sensor's 2-wire dry contact output.

         (aa) The WPS shall be able to notify an IPT if a motion sensor's dry contact is in either the open or closed position. Open position will indicate that the space is occupied and the IPT shall be able to automatically setback its temperature setting by a range of 0^{o}F to 10^{o}F or OFF. Closed position will indicate that the space is unoccupied and set the temperature to a comfort setting when the space is occupied.

         (bb) Setback settings and comfort settings must be settable through the IPT's schedule through the WBA; cannot be settable at thermostat. WBA shall be able to display when a space is unoccupied.

      (2) Occupancy Sensor Input: 2-wire connection to a dry contact occupancy sensor.

b. WBA shall be able to notify via email and/or text message when the WPS batteries are low and record and provide at least two years of past history on occupancy and/or door/window status for each space a WPS is installed in. The trend data shall be viewable on the WBA.
c. IPT shall be able to connect with at least eight WPS. Each WPS shall have a unique serial number and each WPS shall be settable, through the WBA, as a motion sensor input.

7. Internet Enable Economizer (IEE) Controller, PEARL: The IEE shall connect to the ITS with only 3-wires. No additional wiring shall be required between the IEE and the ITS to gain complete Title 24 compliant economization control and demand control ventilation. IEE shall be able to send California Title 24 fault and diagnostics codes to the WBA, email addresses, and/or text messages. IEE shall be able to be installed up to 500 feet away from IPT using standard thermostat wiring.

a. IEE shall provide three 10K Type II external thermistor temperature sensor inputs for supply air, return air, and outside air.
b. WBA shall be able to record and provide at least two years of past data for IEE. The trend data shall be viewable on the WBA. Data shall represent historical representations of supply and outside air temperatures, outside air damper position, and calls for economization.
c. IEE shall have a 0-10VDC input for outside air damper position feedback and shall have a settable 0-10VDC output for outside air damper actuator control.
d. IEE shall have a settable 0-10VDC output for variable frequency drive (VFD) control. IEE shall be configurable for different VFD speeds based on calls for cool, heat, and ventilation.

8. Relays: 24 VAC single pole, single throw (SPST).
9. Electric Actuators:

a. General: Fully modulating, UL listed. Visual position indicator, manual override and clear weather shield where exposed to weather. 24 volt. Belimo.
b. Damper Actuators: Positive position feed back and spring return. Actuators shall be direct mounted onto the damper control shaft without linkage. Damper actuators shall be sized to provide a minimum of 5 in-lbs torque per square foot of damper face area.

10. Wall Switches: Plates for all wall switches and timers shall match those specified in Electrical Specification Sections.
11. Labels: All labels, signs, etc. shall be engraved, laminated plastic, white on black background, 1/8" high lettering, minimum.
12. Temperature Control Panels: Hinged, lockable front panel. Each panel and each control device or readout on the front of the panel shall be identified with an engraved plastic label with 1/4” high lettering, white on black background. Pilot lights shall be the push-to-test type.

E. Web Based Graphical User Interface:

1. The web based app (WBA) shall be able to run on any personal computer that uses Safari, Chrome, Firefox, or any other web browser that meets these browsers’ functionality. The WBA platform shall be able to run on any internet accessible smartphone and/or tablet that have a web browser compatible with HTML5.

2. The WBA shall allow up to a minimum of 100 simultaneous users to access the system.
3. The web based client shall support at a minimum, the following functions:

    a. User log-on identification and password shall be required. Users shall have administrator and user definable access privileges.
    b. HTML programming shall not be required to display any graphics or data on the web page.
    c. Storage of data shall reside within the cloud server and shall not sit within the client's computer or device. The controls system that requires data storage on a client computer or an on-site server is not acceptable.
    d. Open application programming interface (API) with XML data output.

4. Schedules: The WBA shall provide user with access to setting IPT schedules. Up to 12 schedule periods per day shall be available for each IPT. Schedules shall be available as weekly (7-day), daily, or weekday/weekend (5-2). The WBA shall provide the user the ability to view schedules, add/modify schedules, assign thermostat to a group schedule, and be able to delete schedules.
5. Trending:

    a. The WBA shall provide real-time trend information on each IEE's call for economization and on each IPT's space temperature, temperature setpoints, and current call (Heat, Cool, and/or Fan).
    b. The WBA shall be able to record and provide at least two years of past trend data for every thermostat in the wireless network. Trend data shall be viewable on the WBA. Trend data shall include space temperature with resolution of every 1/10th of a degree Fahrenheit, IPT's temperature setpoints, and indicate whether the thermostat was calling for Heat, Cool, and/or Fan.

6. Alarm Notifications:

    a. The WBA shall provide automatic alarming functionally based on real-time monitoring of space temperature and temperature change, IPT's temperature setpoints, and IPT's current call (Heat, Cool, and/or Fan).
    b. The WBA shall be able to provide user with the ability to view alarms, delete alarms, and set alarm notification sensitivity level to High, Medium, or Low.
    c. Alarms shall be able to be sent via email and/or text message to up to 100 or more users.

7. Consumption Usage:

    a. The WBA shall be able to calculate and graphically display the consumption of running a single zone HVAC unit based on a user defined HVAC unit heat and/or cool consumption rate multiplied by the thermostat heat/cool call time.
    b. The WBA shall be able to calculate and graphically display the cost of consumption of running a single zone HVAC unit based on taking a user defined HVAC unit heat and/or cool consumption and multiplying that by the client defined cost per kilowatt and/or therm.
    c. The WBA shall be able to display consumption usage for a single thermostat, multiple thermostats at a single time, or all the thermostats in the controls system.
    d. The WBA shall be able to record and display up to at least two years of consumption usage information.

2.5 EXTRA MATERIALS:

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

B. Filters, Temporary: Provide temporary filters for all fans that are operated during construction. In addition to temporary filters at filter location, provide temporary filters on all duct openings which will operate under a negative pressure. After all construction dirt has been removed from the building, install new filters at no additional cost to Owner.

1. Filters used for temporary operation shall be the same as permanent filters for the application.
2. Filters used for duct openings may be 1" thick pleated media, disposable type.

C. Filters, Extra:

1. Furnish and install one set of filters in each air handling system prior to TAB work.
2. Furnish and install one complete change of all filters for each unit after air balance is completed and prior to acceptance.
3. Furnish one spare set of filters for each air unit to Owner prior to acceptance.

PART 3: EXECUTION

3.1 EQUIPMENT INSTALLATION:

A. General: It shall be the responsibility of the equipment installer to ensure that no work done under other specification sections shall in any way block or otherwise hinder the equipment. All equipment shall be securely anchored in place. All equipment shall be installed level. Maintain manufacturer's recommended clearances for service and maintenance.

1. Roof Mounted Units: Secure roof mounted equipment to roof curbs with cadium-plated hardware.
2. Ceiling Units: Suspend units from structure; use hanger rods, steel wire, or metal straps.

B. Connections to Equipment: Where size changes are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.

C. Equipment Platforms: Shall be as shown on drawings and as follows: Flashing and platform cover shall be minimum 22 gage sheet metal. All joints and seams shall be soldered with minimum 2" overlaps. Extend drip lip down minimum 3". Provide 30 lb felt under platform cover.

D. Equipment Identification: All equipment shall be identified with permanent label.

3.2 TEMPERATURE CONTROL SYSTEM INSTALLATION:

A. General: The internet enabled wireless thermostat shall start/stop all equipment. Controls Contractor shall coordinate HVAC control system program schedule with Owner.

B. Examination:

1. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.
2. Notify the owner's representative in writing of conditions detrimental to the proper and timely completion of the work.
3. Do not begin work until all unsatisfactory conditions are resolved.

C. Installation, General:

1. Install in accordance with manufacturer's instructions.
2. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation.
3. All control wiring and conduit for temperature control system that is not shown or described on the electrical drawings will be installed by Temperature Control Contractor under this Section. All control wiring will in installed in EMT conduit in dry locations and EMT with weather-tight fittings or rigid IMC conduit with seal tight connections in exposed locations. Control wiring installed above accessible ceilings will be allowed in plenum rated cable is installed in a neat and professional manner.

D. Location and Installation Components:

1. Locate and install components for easy accessibility; in general, space sensors are to be mounted 48 inches above finished floor with a minimum of 3'-0" clear access space in front of sensors. Obtain approval on locations from owner's representative prior to installation.
2. All instruments, switches, transmitters, etc. shall be suitably wired and mounted to protect them from vibration, moisture, and high or low temperatures.
3. Identify all equipment and panels.
4. Mount all space sensors/thermostats with button or levers at 48 inches above finished floor in accordance with ADA requirements.

E. Interlocking and Control Wiring:

1. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 26 and all national, state, and local electrical codes. All 120VAC interlock wiring will be in conduit.
2. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with owner's representative prior to rough-in.
3. Provide auxiliary pilot duty relays on motor starters as required for control function.
4. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings, coordinated with Electrical Contractor.
5. All control wiring in the mechanical, electrical, telephone rooms to be installed in EMT conduit. All other wiring to be installed neatly and inconspicuously per local code requirements.

F. Sequence of Operations:

1. General: Connect the new campus to the existing District's web based, wireless HVAC control system.
2. System Operation Schedule: Coordinate with Owner.
3. Heating/Cooling Units: Heating setpoint 70ºF and cooling setpoint 75ºF. The unit shall run per the system operation schedule through the HVAC control system. Room thermostat shall be wall mounted. The unit setpoint shall be adjustable +/- 2ºF from a switch located on the thermostat. The HVAC control system shall control the heating/cooling unit to maintain setpoints. The system shall monitor the unit status with a current sensor and the supply air temperature. The unit shall be capable of integrated economizer operation. Economizer fault alert shall be displayed on the thermostat. System fan shall run during occupied hours to provide minimum outside air. Coordinate with Div 26 and 28.
4. Exhaust Fans: See Schedule for control. Status sensor shall report fan to the HVAC control system. The system shall alarm if the fan is energized and the sensor indicates that the fan is not running.
5. IDU/ODU, Server Room: Cooling setpoint 75ºF. System shall be enabled continuously. Room thermostat shall be wall mounted. The unit setpoint shall be adjustable +/- 2ºF from a switch located on the thermostat. The HVAC control system shall control the cooling unit to maintain setpoint. Controls Contractor shall provide the interlock wiring between the controller and the indoor unit, and the interlock wiring between the indoor and outdoor unit. The HVAC control system shall monitor room temperature and shall alarm the system if room temperature rises above 85ºF, adjustable. The HVAC control system shall monitor system status with current sensors (one each for IDU and ODU).
6. Domestic Hot Water Circulating Pumps: Shall run per the system operation schedule (individual start/stop for each pump). A current sensor shall monitor each pump's status to the HVAC control system. If a pump is scheduled to be running and the current sensor indicates that the pump is not running, the system shall signal a pump failure.

G. Installation, Programming, Training, Testing and Acceptance, O&M's:

1. General: All electrical work shall be in accordance with the California Electrical Code and this Section. All electric/electronic systems shall be hardwired in conduit or using plenum rated cable as previously noted. Wiring shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed wiring shall run parallel to room surfaces; the Construction Manager shall approve location. No structural member shall be weakened by cutting, notching, boring, or otherwise modified. Provide a 120 volt circuit for each device requiring external power. Dedicated circuits shall be provided where required. Any devices or wiring exposed to the weather shall be protected in weatherproof enclosures such as NEMA 3R and weatherproof conduit. Penetrations of fire rated walls, floors, or ceilings shall be firestopped.
2. Labeling of System: Controls Contractor shall provide complete labeling of all terminals at all panels or equipment terminal strips and wiring. Equal to Brady marking on wires and number on terminals in sequence corresponding to control diagram.
3. Programming: The web based HVAC control system operational program shall be provided by manufacturer. The Controls Contractor shall be responsible for programming the system and shall coordinate the scheduling, on/off times, with the Owner. Prior to commissioning, the Controls Contractor shall provide any testing program he feels necessary to fully test the operation of the various components. The Controls Contractor shall provide to the Owner programming functions that will allow for future addition and deletion of operating HVAC systems and zones by the Owner.

4. Training: Prior to final acceptance, the Controls Contractor shall provide operational training to the Owner's personnel. The training sessions shall include a complete demonstration of the system. Dates and times of the training sessions shall be coordinated through the Architect not less than one week prior to session. A total of 8 hours of instruction shall be provided. The Controls Contractor shall maintain a log of training sessions including dates, times and names/titles of those attending. The Controls Contractor shall submit a copy of this log on request.
5. Testing and Acceptance: The Controls Contractor shall furnish a complete and operating system. The Controls Contractor shall also verify, in the presence of the Architect/Engineer, the system accuracy and proper function of each controlled device and sensor. The following items shall be successfully demonstrated prior to acceptance by Owner:

    a. All system outputs including controllers, relays, and other control devices shall be addressed and start/stop functions demonstrated.
    b. All inputs shall be displayed and all event-initiated functions shall be demonstrated.
    c. Demonstrate program integrity and power restore sequence during and after a power failure and restoration.
    d. Deliver all Record Drawings, wiring diagrams, equipment specifications, Installation and Operation Manuals and other documentation as required to describe the system.
    e. Complete operator training in the use, programming, and operation of the system.

6. Verification: A written testing and commissioning report must be submitted for approval before acceptance. In addition to the Controls Contractor's testing and commissioning report, the Owner may independently verify the test results. The report on test results shall include setpoints and operating ranges of all components.
7. Operation and Maintenance Manuals: Furnish Operating and Maintenance Manuals for all components. These manuals shall contain full documentation which shall include, without being limited to, the following:

    a. General description and specifications.
    b. Installation and initial checkout procedures.
    c. Principles and theory of operation.
    d. Complete trouble-shooting procedures and diagrams.
    e. Complete alignment and calibration procedures for all components.
    f. Preventative maintenance requirements.
    g. Detailed schematics and assembly drawings.
    h. Complete recommended spare parts list including unit prices.

3.3 TESTS AND ADJUSTMENTS:

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.

3.4 INDOOR ENVIRONMENTAL QUALITY AND BUILDING FLUSH OUT:

A. General: The requirements of ASHRAE Standard 62-1, Section 7 shall apply during construction and system startup. This includes protection of materials, air balancing, and testing of drain pans. If HVAC systems are operated during construction, they shall have filters in place. These filters shall be replaced by contractor prior to building occupancy. Contractor shall maintain a copy of this Standard onsite during construction. Equipment that is started and operated prior to acceptance shall have the guarantee extended to cover that period. Owner guarantee shall start at acceptance.

B. Temporary Construction Ventilation: Continuously ventilate during installation of materials that emit volatile organic compounds (VOC) and after installation until emissions dissipate. Ventilate areas directly to outside areas; do not ventilate to other enclosed spaces. Replace all filtration media immediately prior to occupancy except for unspent filters used to filter outside air. If continuous ventilation is not possible via the building's HVAC system(s), then ventilate via open windows and temporary fans that sufficiently provide no less than three air changes per hour.

C. Duct Protection: Turn the ventilation system off, and protect HVAC supply and return openings from dust infiltration during dust producing activities. These activities include but not limited to drywall installation and finishing. Provide temporary ventilation as required.

D. Duct Cleaning: On-site, inspect ducts to confirm that no oil film is present. Remove any oil. If ducts contain dust and dirt, clean them immediately, prior to substantial completion and prior to using the ducts to circulate air. HVAC system components or ductwork may only be cleaned, coated, or have applied to its surface, disinfectants, pesticides, or biocides that are registered and labeled for use in HVAC systems by state and federal EPA.

E. Building Flush Out: Flush out the building with 100% outside air to help remove indoor pollutants prior to occupancy. After construction ends, and with all interior finishes installed, flush out the building by supplying continuous ventilation with all air handling units at their maximum outdoor air rate for at least 14 days. During the flush out, maintain a relative humidity no higher than 60%. Every attempt shall be made to maintain an internal temperature between 60ºF and 78ºF, but it is understood that this may not be feasible during seasonal temperature extremes. Occupancy may start after 7 days, provided flush out continues for the full 14 days and the above temperatures can be maintained. Do not "bake out" the building by increasing the temperature of the space. If continuous ventilation is not possible, flush out must total the equivalent of 14 days of maximum outdoor air. Coordinate scheduling with General Contractor to ensure time for flush out is included in project timeline.

F. Post Occupancy Ventilation: When the contractor is required to perform touch-up work involving products with chemical emissions, provide temporary construction ventilation during installation and extend the building flush out by a minimum of 4 days after touch up installation, with 100% tempered outside air for 24 hours each day.

END OF SECTION

SECTION 260000 - ELECTRICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

Work in general includes, but is not limited to, the following:

A. Disconnect HVAC units to be removed.

B. Connect new HVAC units to be installed.

C. New lighting in Multipurpose Room.

D. New fire alarm devices.

E. New IT and AV devices.

F. Complete lighting and power system as shown on Drawings and specified herein, including conduit, wiring, panelboards, circuit breakers, relays, switches, receptacles, and other items necessary for complete and operable systems.

G. Electrical connection of equipment furnished by others as shown on the Drawings.

H. Control wiring and installation and connections of control devices as specified herein.

1.03 SITE VISITS, COORDINATION OF CONTRACT DOCUMENTS, VERIFICATION OF DIMENSIONS

A. Examine existing conditions as applicable. Become acquainted with Specifications and Drawings for all portions of the Project. Notify Project Manager of apparent discrepancies and of inconsistency between the Specifications and the existing conditions. Secure and follow Project Manager's instructions. The Drawings serve as working drawings only, indicating diagrammatically the general layout of the systems and their various components and equipment.

B. Scaled and figured dimensions are approximate and are given for estimate purposes only. Carefully check and verify dimensions and sizes in order to determine if equipment and materials will fit together and if the dimensions of the assembly are compatible with the space provided. Where equipment is furnished by others, verify that dimensions and requirements for assembly are compatible with the space provided before proceeding with the roughing-in connections. Field verifications of locations shown on Drawings are necessary since actual locations, distances, mounting heights, etc., may be affected by field conditions. The right is reserved to make reasonable changes in locations of equipment or other features shown on Drawings prior to rough-in without additional cost to the Owner.

C. Where apparatus and equipment have been indicated on the Drawings, dimensions have been taken from typical equipment of the class indicated. Carefully check the Drawings to see that the contemplated equipment will fit into the spaces provided, regardless of whether or not it may have been approved for quality and utility as an equal.

D. Rough in all equipment, fixtures, etc., as designated on the Drawings and as specified herein. The Drawings indicate only the approximate location of rough-ins. The exact rough-in locations must be determined from large-scale certified Drawings. The Contractor shall obtain all certified rough-in information before progressing with any Work for rough-in connections.

E. Be responsible for providing outlets and services of proper size at the required locations.

F. Coordinate requirements of equipment furnished by others, prior to ordering and installation.

G. No allowance will be made for extra expense due to failure or neglect to follow foregoing directives.

1.04 RULES AND REGULATIONS

A. Materials and installation shall be in accordance with current rules and requirements of California Code of Regulations and local codes and ordinances including, but not necessarily limited to, the current editions of the following:

1. The California Electrical Code (CEC).
2. Title 8, Chapter 4, California Code of Regulations (Low Voltage Electrical Safety Orders).
3. California State Fire Marshal.
4. California Statewide Qualified Product List (QPL), Title 20.
5. Design Lights Consortium (DLC).
6. NEMA (National Electrical Manufacturers Assoc.).
7. IEEE (Institute of Electrical and Electronic Engineers).
8. California Green Building Code.
9. ANSI (American National Standards Institute).
10. ASTM (American Society for Testing and Materials).
11. UL (Underwriters Laboratories).
12. OSHA (Occupational Safety & Health Act) Federal.
13. Title 24, California Code of Regulations, California Building Code.
14. NFPA (National Fire Protection Association).
15. NESC (National Electrical Safety Code).
16. NECA Standards of Installation.

    a. NECA 400-2018, Standard for Installing and Maintaining Switchboards (ANSI).
    b. NECA 402-2018, Standard for Installing and Maintaining Motor Control Centers (ANSI).
    c. NECA 408-2002, Recommended Practice for Installing and Maintaining Busways (ANSI).
    d. NECA 409-2018, Recommended Practice for Installing and Maintaining Dry-Type Transformers (ANSI).
    e. NECA 410-2005 Standard for Installing and Maintaining Liquid-Filled Transformers (ANSI).
    f. NECA 411-2006 Standard for Installing and Maintaining Uninterruptible Power Supplies (UPS) (ANSI).
    g. NECA 420-2018 Standard for Fuse Applications (ANSI).

h. NECA 430-2006, Standard for Installing Medium-Voltage Metal-Clad Switchgear (ANSI).
i. NECA/EGSA 404-2007 Standard for Installing Generator Sets (ANSI).
j. NECA/IESNA 500-2006, Standard for Installing Indoor Lighting Systems.
k. NECA/IESNA 501-2006 Standard for Installing Exterior Lighting Systems.
l. NECA 331-2018, Standard for Building and Service Entrance Grounding and Bonding

B. Where these Specifications call for a higher standard than the above-mentioned rules, the Specifications shall govern.

C. Should there be any direct conflict between the above-mentioned rules and these Specifications, the rules shall govern.

D. Nothing in the Drawings or Specifications is to be construed to permit Work not conforming to the rules, codes, and regulations.

E. All materials utilized shall be new and the best of their respective grades or kinds.

1.05 DEFINITIONS

A. Article 100 of the California Electrical Code shall serve as a guide for definitions.

B. Industry standard definitions.

C. Specific Definitions:

1. Concealed: Hidden from sight, as in trenches, chases, hollow construction, above furred spaces, suspended ceilings (acoustical or plastic type), or exposed to view only in tunnels, attics, shafts, crawl spaces, unfinished spaces, or other areas solely for maintenance and repair.
2. Exposed: Not concealed.
3. Unfinished Space: A room or space that is ordinarily accessible only to building maintenance personnel, a room noted on the "Finish Schedule" with exposed and unpainted construction for walls, floor or ceilings, or specifically mentioned as "unfinished".
4. Finished Spaces: Any space ordinarily visible to the visiting public, including exterior areas.

1.06 RULES OF LOCAL UTILITY COMPANIES

A. Comply with rules and regulations of the serving utility companies, and before submitting bid, check and include applicable service costs for the Project.

1.07 RECOGNIZED TEST LAB

A. All equipment specified or installed under this project shall be listed by a recognized test lab and bear that label of approval.

1.08 PERMITS AND FEES

A. Procure licenses and permits necessary for the completion of the Work, and inspection and other applicable fees. Before final payment, deliver to the Owner certificates and permits, approved and signed by the authorities having jurisdiction.

1.09 RECORD DRAWINGS

A. Include under this Work complete and accurate record information both during construction and before final acceptance by the Owner, and costs associated therewith shall be included under this Work.

B. Obtain from the Project Manager, at cost, a complete, full size set of prints. On these prints, systematically and accurately keep an up-to-date and legible dimensional record of Work installed differently from the location or manner indicated by the Drawings, as well as exact locations of stub-outs and hidden or underground features. Have these Drawings readily available for reference and review. When job status permits, submit them to the Project Manager and amend or correct and re-submit if requested.

C. When the above information is complete and acceptable, deliver Record Drawings to the Project Manager.

1.10 SUBMITTALS - SUBSTITUTIONS

A. Bids shall be based on Drawings and Specifications and references exactly as shown except as substitutions are permitted under terms of the Instructions to Bidders. Acceptance by the Project Manager of a variation or alternate shall not of itself waive other requirements of the Drawings and Specifications.

B. Before a substitute is used, it shall be equal in quality and utility to the material or make of equipment specified, and furthermore, shall be suitable for the particular application. The decision of the Project Manager as to the quality and utility of the substitute offered shall be final.

C. When submitting a substitute to a specified item, provide complete data for both the specified item and the substitute. Complete data includes:

1. Catalog cuts with complete dimensions, characteristics, electrical properties, Underwriter's Laboratory listing, harmonics, light output, mounting and support requirements.
2. Calculations, photometrics, system load data, energy effect on system, etc.

If the substitute is not deemed equal in both utility and quality to the specified item, the specified item will be approved and it shall be provided by the Contractor.

D. Submit in one package complete systematized lists of equipment and Drawings, catalog cuts, brochures, capacity tables and curves, descriptive information, performance data and guarantees and warranties referenced either to applicable Specification paragraphs or to item numbers as shown on the Drawings, or both. Submit six (6) copies.

E. Do not order or install equipment until submittals have been reviewed and approved.

F. Where accepted materials or equipment other than is specified or shown on the Drawings require redesign of structural, architectural, electrical or mechanical features or layouts, such changes shall be made by, or at the expense of the Contractor - all subject to complete review by the Project Manager.

G. Because of the contingencies involved, review and general acceptance of proposed substitutes shall not relieve the Contractor's responsibility under this Work for ensuring in all respects the suitability of such materials and equipment for the particular Project requirements.

1.11 SHOP DRAWINGS

A. Prepare shop Drawings of items as required by the Project Manager or by Drawings and Specifications; submit six (6) copies of each to the Project Manager as part of the submittal package, sufficiently in advance of construction, if necessary.

B. The shop drawings shall be submitted sufficiently in advance of construction to allow time for review and for resubmission, if necessary.

C. Submit all shop drawings and data at one time for equipment provided under this Section. The complete electrical shop drawings shall be bound in one pamphlet or binder indexed to this Section.

D. Shop drawing submittals processed are not change orders. The purpose of shop drawing submittals by the Contractor is to demonstrate that the Contractor understands the design concept; he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. If deviations, discrepancies or conflicts between shop Drawings and Specifications are discovered, either prior to or after shop drawing submittals are processed, the design Drawings and Specifications shall control and shall be followed.

E. Manufacturers' data and dimension sheets shall be submitted giving all pertinent physical and engineering data including weights, cross-sections and maintenance instructions. Standard items of equipment such as receptacles, switches, plates, etc., which are cataloged items, shall be listed by manufacturer.

F. Index all submittals and reference to these Specifications.

1.12 COMPLETION DATA

A. Submit completion data to the Project Manager in acceptable quantity and form before requesting a final inspection. Such submittal shall be corrected, amended, or completed before final acceptance of the Work.

B. Include Record Drawings, maintenance manuals, and data; test results; control and wiring diagrams.

1.13 CUTTING, PATCHING, AND REPAIRING

A. Cutting, patching, and framing of wood members to accommodate this Work shall be done by the Contractor and shall be in conformance with Sections 613 and 617 (F) and (K), Title 24, California Code of Regulations. All such cutting, patching and framing shall be approved by the Project Manager.

B. Do minor miscellaneous cutting, drilling, and patching necessary and normally required at the time of actually installing this Work. Patching shall be of the same materials, workmanship, and finish as the original or surrounding Work to the complete satisfaction of the Project Manager. Comply with Division-1 CUTTING AND PATCHING Section.

C. Adequately inform other trades of openings and framing requirements for this Work and provide suitable instructions for establishing locations and sizes of openings or sleeves so that these may be provided in the proper location at the proper time. Concrete shall not be cut, except where approved by the Project Manager.

1.14 SIMILARITY OF MATERIALS

A. Unless specified otherwise, fixtures, fittings, hangers, and respective type features and equipment, of a similar type or having similar operative or functional features, shall be of the same manufacturer throughout the Project.

1.15 MANUFACTURERS' DIRECTIONS

A. Follow manufacturers' directions and recommendations in all cases where the manufacturers' equipment or articles are used for this Work. Compliance with the manufacturer's direction is a requirement for that product's listing with a recognized test lab.

1.16 VERIFICATION OF DIMENSIONS

A. Scaled and figured dimensions are approximate only. Before proceeding with Work, carefully check and verify dimensions, etc., on architectural Drawings, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

B. Drawings are essentially diagrammatic, and many offsets, bends, pull boxes, special fittings, and exact locations are not indicated. Carefully study Drawings and premises in order to determine best methods, exact locations, routes, building obstructions, etc., and install apparatus and equipment in available locations. Install apparatus and equipment in manner and locations to avoid obstructions, preserve headroom, and keep openings and passageways clear.

1.17 IDENTIFICATION OF EQUIPMENT

A. All electrical equipment shall be labeled, tagged, stamped, or otherwise identified in accordance with the following schedule:

1. Branch Circuit Panelboards:

a. Panel identification shall be P-Touch ¾” label.
b. Circuit directory shall be a two-column, 8-1/2 x 11” sheet attached to the inside of the door. Each odd numbered circuit shall be in sequence in the left column and the even numbered circuit in the right column (e.g., 1, 3, 5..., 2, 4, 6...). Each circuit shall be identified as to the use and room name(s) or area(s). Confirm room names and/or room numbers with the Project Manager prior to project completion. Circuit breaker identification shall be by permanently installed metal numbers or plastic numbers under acrylic plastic. "Paste-on" numbers will not be accepted. Refer to "Panelboards" section for additional requirements.

2. Distribution Panelboards: Identification shall be with 1" x 4" laminated, white on black, micarta nameplates on each major component, each with name and/or number of unit and other pertinent data as required. Emergency power distribution panels shall be identified with white on red micarta nameplates. Letters shall be no less than 3/8" high.
3. Circuit breakers shall be identified by number and name with 3/4" x 1-1/2" laminated micarta nameplates with 3/16" high letters mounted adjacent to circuit breaker or switch.
4. Miscellaneous equipment (electrical), such as individually mounted safety switches, starters, step-down transformers, pull boxes, junction boxes, etc., shall be identified by the use of such equipment with P-Touch labels as required.
5. In general, the installed nameplates, as herein called for shall also clearly indicate its use, area served, circuit identification, voltage and any other useful data.
6. All auxiliary systems, including communications, shall be labeled to indicate function.
7. Motor control and motor control centers shall be labeled with the identification given on drawing schedules.

1.18 CLOSING IN OF UNREVIEWED WORK

A. Do not allow or cause any of this Work to be covered up or enclosed until it has been reviewed by the Project Manager. Should any of this Work be enclosed or covered up before such review, uncover the Work and make repairs with such materials as may be necessary to restore the Work and that of the other trades to its original and proper condition at no additional cost to the Owner.

1.19 SAFETY PRECAUTIONS

A. It is intended that within the scope of this Work during construction and until final acceptance, strict attention be given to matters pertaining to public safety and to safety of the construction workers and complementing personnel; and to other health and building safety requirements as specified and indicated including, but not limited to: Protection of openings in fire-rated construction; clearances from and/or protection of combustibles; proper securement for fixtures, equipment materials; method of performing the Work, operational and safety check of electrical devices, etc.; erection and maintenance of suitable barriers, protective devices, lights and warning signs and adequate provisions for storage and protection of Work, materials and equipment.

B. It is understood that the responsibility for the proper attention to the above stipulations is included under this Work.

1.20 WIRING OF EQUIPMENT FURNISHED UNDER OTHER SECTIONS

A. All electrical wiring including power wiring and control wiring (except as specified under Automatic Temperature Control), including raceways, wiring, outlet and junction boxes, and labor for installation of the wiring and equipment shall be included in this section of the Specifications.

B. All control devices, and starters not in motor control centers, for equipment furnished under the Air Conditioning section (except as specified under Automatic Temperature Control paragraph), Plumbing section, Fire Sprinkler or Lawn Sprinkler section are to be furnished under that particular section and installed under this section.

C. Wiring diagrams complete with all connection details shall be furnished under each respective section.

D. Coordinate requirements and locations for all equipment prior to ordering and installation.

E. Comply with requirements of Article 430 of the California Electrical Code.

1.21 MOUNTING

A. Provide materials and accessories necessary to properly mount and secure equipment furnished and/or installed under the electrical Work. This includes but is not limited to such items as conduit, outlets, junction boxes, switches, relays, disconnect switches, lighting fixtures, cabinets, and transformers.

B. Inserts and Anchors shall be:

1. Furnished and installed for support of Work under this Division.
2. Adjustable concrete hanger inserts installed in new concrete work as manufactured by Hilti or as approved.
3. Installed in locations as approved by Project Manager.
4. Expandable lead type anchors installed in existing concrete with minimum surface damage, as manufactured by Hilti.
5. Toggle bolts, or "molly anchors", where installed in concrete block walls.
6. Complete with 3/16" or heavier steel backup plate where used to support heavy items. Through-bolts or backup plate shall be concealed from view, except as otherwise indicated.

C. Mounting of equipment that is of such size as to be freestanding and that equipment which cannot conveniently be located on walls, such as motor starters, etc., shall be rigidly supported on a framework of galvanized steel angle, Unistrut or as approved.

D. Furnish and install sleeves for the installation of Work under all sections of this Division. Sleeves through floors, roof and walls shall be as described in conduit section.

1.22 FLASHING

A. Flash and counterflash all conduits penetrating roofing membrane.

1.23 TESTS

A. Perform electrical tests as required or directed. Provide materials, labor, and equipment necessary for performances of these tests, and at completion of the Work perform a complete "in-service" operation of the entire electrical and power system to show compliance with the Drawings and Specifications. Replace Work showing faults under tests without additional cost to the Owner. Test system voltage at switchboards at completion of Work and provide a written report to the Project Manager.

1.24 EQUIPMENT LISTS AND MAINTENANCE MANUALS

A. Prior to completion of job, Contractor shall compile a complete equipment list and maintenance manual. The equipment list shall include the following items for every piece of material and equipment supplied under this section of the Specifications.

1. Name, model and manufacturer.
2. Complete parts Drawings and list.
3. Local supply for parts and replacement and telephone number.
4. All tags, inspection slips, instruction packages, etc. removed from equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from.

B. Maintenance manuals shall be furnished for each applicable section of the Specifications, shall be suitably bound with hard covers, and shall include all available manufacturers' operation and maintenance instructions, together with as-built Drawings and lists hereinbefore specified and other diagrams and instructions necessary to properly operate and maintain the equipment. The equipment lists and maintenance manuals shall be submitted in duplicate to Architect for approval not less than 10 days prior to the completion of the job. The maintenance manuals shall also include the name, address and phone number of the General Contractor and all subcontractors involved in any of the Work specified herein. The maintenance manuals shall be finally provided in four copies.

1.25 CLEANING

A. During construction on a daily basis, and upon completion of the Work, remove from the site all debris and excess materials, tools, and removed items, resulting from this Work. Clean equipment, including lighting fixtures, free of dust, dirt, grease, paint, etc.

1.26 SALVAGE

A. Deliver salvaged equipment and material deemed salvageable by Project Manager to location designated by Project Manager. Remove other removed material and equipment from site.

1.27 GUARANTEE

A. Leave the entire installation in complete working order, free from defects in materials, workmanship or finish. Guarantee to repair or replace parts that may develop defects due to faulty materials, equipment, or workmanship within a period of one year after the Work is accepted by the Owner. Also, guarantee to repair or replace with like materials, other existing Work in the building damaged from or during the repair of any such defective equipment, materials, or workmanship.

1.28 INSTALLERS QUALIFICATIONS

A. Installer must have electrical certification per California Labor Code Section 3099.2.

B. All work described in the Electrical Specifications and shown on Electrical Drawings shall be performed by California State Certified Electricians.

C. All electrical foremen shall have a minimum of 500 hours of documented classroom training.

D. All electrical foremen shall have a minimum of 3,000 hours of documented on-the-job training.

E. At the time equipment submittals are made, provide copies of State Certification and training documents for electricians working on this project

F.

PART 2 – PRODUCTS AND EXECUTION

2.01 GROUNDING

A. Grounding shall be executed in accordance with applicable codes and regulations of the State of California, California Electrical Code and local authorities having jurisdiction as well as any additional provisions specified or shown on Drawings.

B. Grounding bushings shall be used wherever conduits are grounded. Feeder conduits to panels and air conditioners shall have grounding bushings.

C. Grounding conductors should be located to permit, the shortest and most direct path to ground. Connections shall be readily accessible for inspection and connections shall not be permanently concealed in floors or walls.

D. Non-current carrying metallic parts of electrical equipment and raceways shall be securely grounded to the common system ground. In all locations, ground conductors shall be run through conduits and shall be securely bonded to the conduit at the entrance and exit. The conduit for the grounding conductors shall be continuous from the point of attachment to cabinets or equipment to the grounding electrode, and shall be securely fastened to the ground clamp fittings.

E. Ground connections to equipment shall be made with an approved type of exothermic weld or shall be bolted or clamped to equipment or conduit. Sheet metal strap types of ground clamps shall not be used. Contact surfaces shall be thoroughly cleaned and bright before connection is made so as to ensure a good metal to metal contact.

F. Where nonmetallic conduit is used, ground shall be achieved through use of a separate, green-insulated, copper, code-size, ground conductor included in the conduit.

G. Bonding of cold water piping system shall be achieved at the service entrance. A copper saddle shall be installed over the copper pipe at the location of the clamp to avoid damage to the pipe.

2.02 CONDUIT

A. Rigid Steel Conduit:

1. Rigid steel conduit shall have zinc coated exterior, zinc or enamel interior, standard weight, zinc coated couplings, locknuts and bushings and shall bear the U.L. label. Rigid conduit shall not be installed underground.
2. Use rigid conduit only for exposed exterior conduit runs, wherever subject to physical damage, or where specifically called for on the Drawings or required by a serving utility.
3. Intermediate metallic conduit (I.M.C.) may be used in lieu of rigid steel conduit.

B. Electrical Metallic Tubing:

1. Electrical metallic tubing (E.M.T.) shall bear the U.L. label and shall be zinc coated thinwall conduit with zinc-coated couplings and connections. "Indent" type fittings shall not be used.
2. E.M.T. may be used where rigid, flexible or non-metallic conduit is not required.
3. E.M.T. shall be used for interior dry locations. EMT shall be used where no specified conduit type is called for on the Drawings.

C. Flexible Metallic Conduit:

1. Flexible metallic conduit shall be galvanized steel and bear the U.L. label. Fittings for flexible conduit shall be squeeze type. Screw-in connectors and other connectors that decrease the interior diameter of the conduit shall not be used unless specifically approved by the Project Manager.
2. Liquid-tight flexible conduit shall bear the U.L. label and be plastic jacketed moisture and oil resistant with oil and vapor tight connectors.

3. Use flexible conduit for final connection to equipment where vibration may injure direct conduit connection. It may be used for indoor dry locations, for fixture whips not to exceed 72 inches and in other locations where structural conditions will not permit the use of EMT not to exceed six feet, only if approved by the Project Manager.
4. Use liquid-tight flexible conduit in lieu of flexible conduit for wet, damp, or outdoor areas or where weatherproof flexible conduit is called for on the Drawings or by code.

D. Plastic Conduit:

1. Plastic conduit shall not be used on this project.
2. Exposed/Concealed Conduit:

a. Provide secure mounting facilities for conduits. Wire or plumbers tape shall not be used for hanging conduit. Strap shall be factory made of the one hole malleable iron or two-hole galvanized clamp type.
b. Provide expansion couplings wherever conduits cross expansion joints.
c. Run conduit at right angles or parallel to structural members, walls, floors and ceilings. Where several conduits are run together or suspended, they shall be hung on Unistrut trapezes with minimum 3/8-inch rod hangers.
d. Cut ends of conduit square and ream to remove burrs or sharp edges. Terminate conduits properly with bushings, locknuts, etc. Terminate one (1) inch and larger conduits with insulated bushings.
e. Render conduits projecting through the roofing watertight by proper flashings. Securely fasten a sheet metal cap and tighten bank or storm collar to the conduits. Extend flashing a minimum of six (6) inches in all directions. Coordinate and install roof flashing for conduits to the satisfaction of the Project Manager.
f. All conduit runs shall have a code size insulated grounding conductor.
g. Pull wires shall be installed in empty conduits including telephone conduits and stub-outs, No. 12 AWG, type "THWN" insulated copper wire or 1/8-inch polyethylene rope shall be used.
h. Flexible conduit connections shall comply with NEC Section 350-22.
i. Provide Dura Block or similar support for roof-mounted conduits.

2.03 OUTLET, JUNCTION AND PULL BOXES

A. Outlet boxes and junction boxes shall be galvanized one-piece pressed steel, knockout type. The size of each box shall be determined by the number of wires or conduits or size of conduits entering the box, but shall not be less than 4" square and 1-1/2" deep unless otherwise noted. All boxes shall be UL listed.

B. Locknuts shall be used on both sides of conduit connections to box or panel, in addition to bushing. Where a larger size opening occurs than size of conduit, use reducing washers.

C. Exposed boxes shall be weatherproof, threaded or hub condulet with gasketed condulet cover suitable for device installed or with blank cover plate when condulet is used as a junction box. Condulet wire fill capacity shall not be exceeded.

D. Large size junction or pull boxes shall be fabricated from code gauge sheet steel. Where located indoors, finish shall be gray enamel and covers shall be secured with screws. Where exposed to weather, they shall be weatherproof, NEMA 3R, and rain-tight and hot-dip galvanized after fabrication; also, they shall have weatherproof gaskets, flat covers and galvanized iron screws. Provide knockouts and/or threaded hubs as required for the conduit used. Boxes in finished areas shall be prime painted.

E. Any unused, removed knockouts shall be filled with a K.O. cover.

F. Provide bonding or grounding from metal conduit terminating in junction with concentric KO's.

2.04 WIRE AND CABLE

A. 600 Volt Conductors:

1. Conductors shall be copper and delivered to the site in their original, unbroken packages plainly marked or tagged with U.L. label, size, kind, insulation, name of manufacturer and trade name of the wire.
2. Type "THWN/THHN", 600-volt insulation shall be used for all locations.
3. Minimum size conductor shall be #12.
4. Conductors shall be stranded.
5. Ground conductors shall be bare copper or have green insulation.
6. 120 volt and 277 volt circuits shall have separate neutrals.

B. Installation:

1. Conductors shall be continuous between outlets or junction boxes and no splices shall be made except in outlet boxes, pull boxes, panelboard gutters or handholes.
2. Joints, splices and taps No. l0 or smaller (including fixture pigtails) shall be connected with "floating spring" type connectors. No. 8 and larger shall be connected with solderless connectors of 100% electrolytic copper. Split-bolt connectors are not acceptable.
3. Tighten pressure type lugs on panels and equipment, and then retighten 24 hours or more later after energizing. Provide written report of torque values on lugs.
4. Oil or grease shall not be used when pulling conductors. Use U.L. approved cable lubrication only.
5. Lace or train conductors neatly in panels, cabinets and equipment. Use plastic wire ties to route conductors at edge of enclosure away from overcurrent devices.
6. Branch circuits shall be color coded in compliance with Section 210-5 of the California Electrical Code. Colored tape is not acceptable.
7. All wiring, both line and low voltage, shall be installed in conduit unless otherwise noted.
8. Conductors from different panels or from different power sources shall not be installed in the same conduit, junction box, gutter, or raceway.

C. Tag:

1. Branch circuits shall be left tagged with circuit numbers in gutters and junction boxes where unused circuits terminate.
2. Feeder conductors shall be tagged as phase "A" or "B" or "C".
3. The method of tagging shall be with adhesive preprinted tape numbered or lettered wrap around tags. Colored tape is not acceptable.
4. Tagging shall be applied after wire is installed in conduit.
5. Feeders in panel or equipment shall be tagged by phase letter in each panel or equipment.
6. Where it is impractical to use printed markers on certain wires or cables, use blank tape with identification marked thereon with indelible pen or pencil.

D. Color Coding for Phase Identification: Color code secondary service, feeder, and branch circuit conductors with factory applied color as follows:

208y/120Volts	Phase	480y/277Volts
Black	A	Yellow
Red	B	Brown
Blue	C	Orange
White	Neutral	Gray
Green	Ground	Green

2.05 DISCONNECT SWITCHES

A. Non-fusible or fusible as shown on the Drawings, heavy duty, 250 or 600 volts as required, NEMA Type 1 enclosure, except where WP is indicated or required by code, use NEMA Type 3R enclosure.

END OF SECTION

SECTION 267000 - ASSISTIVE LISTENING DEVICES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

B. Refer to other sections of these specifications for electrical service to transmitter for the assistive listening system.

1.02 SUMMARY

A. Extent of the assistive listening system work is indicated on drawings and by provisions of this section; and is defined to include the entire and complete system necessary to provide a personal assistive listening system.

B. Components of the assistive listening system are listed below. Contractor is required to provide all necessary components of the system even if not listed.

C. The system must operate in the radio frequency band and be able to accept line level or microphone level inputs. Personal receivers with earphones and batteries must be included and the quantity provided must satisfy the A.D.A. requirement of 4% of the total number of seats. The receivers should be stored in a location readily accessible for distribution to the public.

1.03 QUALITY INSURANCE

A. Installer Qualifications: Manufacturer representative or authorized agent of assistive listening system manufacturer for minimum of three years.

1. Minimum of three years experience installing assistive listening systems.
2. The Integrated Systems Contractor (Factory Authorized Dealer) must certify that it maintains on staff the services of Certified Electronic Systems Technicians (C-EST) trained technicians. At least 50% of all installers and technicians who work on this project must be a Certified Electronic Systems Technician. The lead foreman (C-EST) shall have a minimum of five (5) years experience in installation of these types of systems and shall be factory authorized to work on the specified systems.
3. The Integrated Systems Contractor (Factory Authorized Dealer) shall also maintain on staff or provide the services of a Registered Communications Distribution Designer (RCDD). The RCDD shall have a minimum of five (5) years experience in infrastructure design. The RCDD shall review, approve, and stamp all infrastructure design documents to insure compliance with National Communications Standards and Practices as outlines by BICSI (Building Industry Consulting Service International), CEC (California Electrical Code), and any state and local requirements. The name, address, and telephone number of the RCDD assigned to this project must be included in the Contractor’s documents and subsequent submittal package.

B. Manufacturer Qualifications: Regularly engaged for the past three years in the manufacture of assistive listening systems.

1. Regularly have maintained for a minimum of three years a service facility within 100 miles of the building site.

C. Regulatory Requirements and Permits:

1. The contractor shall apply and pay for all necessary permits and inspections as required for the installation.
2. Electrical Code: Comply with "National Electrical Code" (NFPA 70/ANSI C1) NFPA.

D. U.L. Listing: All equipment shall be U.L. listed.

E. Applicable Standards: Unit shall be designed and manufactured in accordance with the following standards:

1. California Building Code, Title 24.
2. Underwriters Laboratories (U.L.)
3. National Electric Code (N.E.C.)
4. American Society for Testing Materials (A.S.T.M.)
5. American Welding Society (A.W.S.)

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's complete technical product data and installation instructions, indicating capacities, sizes, performances, operations, controls, finishes and similar information.

B. Samples: Submit samples of finishes.

C. Maintenance Manuals: Submit bound manuals for the assistive listening system with operating and maintenance instructions, parts listing with sources indicated, recommended parts inventory listing, emergency instructions and similar information.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacture's original, unopened protective packaging.

B. Store materials in original protective packaging. Protect equipment and exposed finishes during transportation and erection against damage and stains by other trades.

1.06 INSTRUCTION AND MAINTENANCE

A. Instruct Owner's personnel in proper operation and maintenance of the assistive listening system. Train Owner's personnel in procedures to follow in identifying sources of operations failures or malfunctions.

1.07 WARRANTY

A. Special Project Warranty: Submit a written warranty, executed by the Contractor, Installer and wheelchair lift manufacturer, agreeing to repair or replace system components which fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to, operation or control system failure, performances below required minimums, unusual deterioration or aging of materials or finishes. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

B. Warranty period: 1 year after the date of the Notice of Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering, assistive listening systems, which may be incorporated in the work, include, but are not limited to, the following:

B. Listen Technologies- 7-Person Portable FM System – LS-06.

2.02 MATERIALS AND COMPONENTS

A. General: Provide manufacturer's standard pre-engineered assistive listening systems, which will comply with or fulfill requirements of schedule sheets and drawings. Where not otherwise indicated, provide manufacturer's products as indicated in published product literature. Complete system shall include the following:

1. LT-700 Portable FM Display Transmitter
2. LA-278 Behind the Head Microphone
3. LR-400 Portable Display FM Receiver
4. LA-164 Ear Speaker
5. LA-322 8 Unit Portable FM Product Carrying Case
6. LA-361 High Capacity AA Alkaline Batteries

B. All materials, appliances, and equipment except that furnished by the Owner shall be new bear U.L. Label and of the make, brand, or quality specified or as accepted by the Architect as herein provided. This shall also apply to all parts of the work whether or not number refers to this particular paragraph.

C. All apparatus, conduit systems, etc. shall be installed and interconnected so as to form complete systems, as herein, specified and/or shown on all the accompanying drawings. This Contractor shall include wire, cable, electronics, and all other incidental items required providing a complete functional system.

D. Transmitter:

1. The portable FM transmitter shall be capable of broadcasting on 57 channels. The unit shall incorporate a microphone sensitivity switch. The device shall broadcast on both wide and narrow band channels with a SNR of 80dB or greater. The device shall have an audio frequency response of 50Hz to 15KHz, +/- 3dB at 72MHz, or of 50Hz to 10kHz, +/-3dB at 216MHz. The device will incorporate a mute switch. The battery door shall be capable of being mechanically locked. The device shall incorporate an LCD display that indicates channel, battery level, low battery, battery charging, and RF signal strength. The portable transmitter shall incorporate automatic battery charging circuitry for recharging of NiMH batteries. The Listen LT-700 is specified.

LT-700 Specifications

	Specification	LT-700-072	LT-700-216
RF	RF Frequency Range	72.025 - 75.975 MHz	216.025 - 216.987 MHz

	Number of Channels	57 (17 wide, 40 narrow)	57 (19 wide, 38 narrow)
	Sensitivity	.6uV typical, 1 uV maximum for 12dB SINAD	
	Frequency Accuracy	±.005% stability 0° to 50°C (32° to 122° F)	
	Transmitter Stability	50 PPM	
	Transmission Range	0 -150 ft (45.7m)	
	Output Power	Less than 10mW	Less than 100mW
	Antenna	Uses microphone cable	
	Antenna Connector	3.5mm connector	
	Compliance	FCC Part 15, Industry Canada	
Audio	** All system specifications are wireless end-to-end		
	System Frequency Response	63Hz - 15kHz (± 3dB)	63Hz - 10kHz (±3dB)
	System Signal to Noise Ratio (A-weighted)	SQ enabled: 80dB; SQ disabled 60dB	SQ enabled: 80dB; SQ disabled 50dB
	System Distortion	<2% total harmonic distortion (THD) at 80% deviation	
	Microphone Input	Unbalanced, tip of 3.5mm connector, (55 dBu nominal, -32dBu maximum, impedance 21 Ohms)	
	Microphone Sensitivity	Three position switch: high, middle and low; 6dB increments	
	Line Input	Unbalanced, ring of 3.5mm connector, (-10dB nominal input level adjustable, +4dBu maximum, impedance 10k Ohms)	
	Phantom Power	3VDC	
Controls	Set-up Controls, behind the door	Mic sensitivity, NiMH/alkaline battery, SQ enable/disable	
	User Controls	Power, mute, channel UP and DOWN	

	Programming	Unit can be programmed so that only desired channels are displayed to the user; channel selection can be locked by holding the UP or DOWN button 5 seconds.
Indicators	LED	Red, illuminates when unit is on. Flashes when batteries are low, or to indicate charging. Flashes 2x when muted
	LCD Display	Channel, lock status, programming
Power	Battery Type	Two AA batteries, alkaline or NiMH
	Battery Life (Listen batteries)	20 hours alkaline (LA-361), 10 hours NiMH rechargeable (LA-362)
	Battery Charging (NiMH only)	Fully automatic, 14 hours
	Power Supply Connector	2.3mm OD by 0.7mm ID, barrel type connector. 7.5VDC, center positive 300mA. Drop in contact points for use with Listen charging cases.
	Compliance	UL Listed
Physical	Dimensions	3.0 in x 1.0 in x 5 in WxDxH (7.6cm x 2.5cm x 13.cm)
	Unit Weight	3.9oz (111g)
	Unit Weight with batteries	5.8 oz (164.4g)
	Shipping Weight	1.0 lbs (0.45kg)
	Door	Manually lockable. UP, DOWN and power through door, other controls behind door (see Controls above)
Environmental	Temperature - Operation	-10° to 40°C (14° to 104° F)
	Temperature - Storage	-20° to 50°C (-4° to 122° F)
	Humidity	0 to 95% relative humidity, non-condensing

E. Receiver: The FM receiver shall be capable of receiving on 57 wide and narrow band channels with a SNR of 80dB or greater. The receiver shall be programmable to electronically lock out unneeded channels. The receiver shall be capable of seeking channels. The device shall have an adjustable squelch. The device shall have an audio frequency response of 50Hz to 15KHz, ±3dB at 72MHz, or of 50Hz to 10kHz, ±3dB at 216MHz. The device will incorporate a stereo headset jack that allows the user to plug in either a mono or stereo headset. The device shall incorporate an LCD display that indicates channel, battery level, low battery, battery charging, and RF signal strength. The receiver shall incorporate automatic battery charging circuitry for recharging of NiMH batteries. The Listen LR-500 is specified.

LR-400 Specifications

	Specification	LR-400-072	LR-400-216
RF	RF Frequency Range	72.025 - 75.950 MHz	216.025 - 216.975 MHz
	Number of Channels	57 (17 wide, 40 narrow)	57 (19 wide, 38 narrow)
	Sensitivity	.6uV typical, 1 uV maximum for 12dB SINAD	
	Frequency Accuracy	± .005% stability 0° to 50°C (32° to 122° F)	
	Antenna	Uses earphone cable	
	Antenna Connector	3.5mm connector	
	Squelch	Programmable in 20 steps	
	Compliance	FCC Part 15, Industry Canada	
Audio	** All system specifications are wireless end-to-end		
	System Frequency Response	50Hz - 15kHz (±3dB)	50Hz - 10kHz (±3dB)
	System Signal to Noise Ratio (A-weighted)	SQ enabled: 80dB; SQ disabled 60dB	SQ enabled: 80dB; SQ disabled 50dB
	System Distortion	<2% total harmonic distortion (THD) at 80% deviation	

	Output	3.5mm connectors, unbalanced, 0dBu nominal output level, 16mW maximum, impedance 32 Ohms
Controls	Set Up Controls	Programmable channel selection (see below), alkaline/NiMH batteries and squelch, SQ enable/disable
	User Controls	Channel UP/DOWN, SEEK, volume.
	Programming	Unit can be programmed so that only desired channels are displayed. Squelch can be adjusted for sensitivity and signal capture control. Channel selection can be locked by holding the SEEK button 5 seconds.
Indicators	LCD Display	Channel designation,battery level, battery charging, RF signal strength and channel lock
	LED	Red, illuminated when unit is on, flashes when batteries are low or to indicate charging, flashes when locked and SEEK is pushed.
Power	Battery Type	Two AA batteries, alkaline or NiMH
	Battery Life (Listen batteries)	30 hours alkaline (LA-361), 15 hours NiMH rechargeable (LA-362)
	Battery Charging (NiMH only)	Fully automatic, 14 hours
	Power Supply Connector	2.3mm OD by 0.7mm ID, barrel type connector. 7.5VDC, center positive <250mA. Drop in contact points for use with Listen charging cases.
	Compliance	UL Listed
Physical	Dimensions	3.0 in x 1.0 in x 5 in WxDxH (7.6cm x 2.5cm x 13.cm)
	Unit Weight	3.9oz (111g)
	Unit Weight with batteries	5.8 oz (164.4g)
	Shipping Weight	1.0 lbs (453.6kg)
	Door	Manually lockable. UP, DOWN and SEEK through door, other controls behind door (see Controls above).
Environmental	Temperature - Operation	-10° to 40°C (14° to 104° F)
	Temperature - Storage	-20° to 50°C (-4° to 122° F)

	Humidity	0 to 95% relative humidity, non-condensing

F. Earplug: Provide Listen LA-164 Single earplugs to match the quantity of receivers provided.

G. Charging Case: Provide one Listen LA-322 8- Unit Charging/Carrying Case with Removable Lid.

H. Hearing Assistance System:

1. Transmitter to be Portable.
2. Operates with radio frequency.
3. Personal receivers included with earphones.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's instructions and recommendations for work during installation.

END OF SECTION 267000

SECTION 283100 - FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled and intelligent network fire alarm systems components required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, auxiliary control devices, annunciators, and wiring as shown on the Drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification and/or the AHJ. The system shall be electrically supervised and monitor the integrity of all conductors.

C. The fire alarm system shall be manufactured by FCI/Gamewell.

D. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm systems and the installation shall be in compliance with the UL 864 9th Edition listing.

E. The installing company shall employ FCI trained technicians on site to guide the project commissioning, ensure the system integrity, and to prepare the system for inspection and turn over to the District. The installing company shall employ FCI trained project management to ensure the above.

1. Upon completion of the changed (added, deleted, etc.) fire alarm system appliances, devices or system, that portion of the Fire Alarm system in the scope of work shall be inspected and tested as required by NFPA 72. Upon successful completion of the acceptance or reacceptance inspection and testing, an NFPA 72 Inspection and Testing form shall be completed by the installer. A copy of the form, with signatures, shall be submitted to the Architect of Record, the DSA Project Inspector, the School District and the Local Fire Authority.

1.02 SCOPE

A. General: New fire alarm system components shall be provided in the Administration/ Lobby remodel in accordance to the project specifications and drawings.

B. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be employed on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
2. Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style B) as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y) as part of an addressable device connected by the SLC Circuit or as a direct panel NAC output.
4. On Style 6 (Class A) configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

5. On Style 7 (Class A) configurations a single ground fault, open circuit, or short circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm. Style 7 configurations shall employ Short Circuit Isolation (SCI) technology.
6. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.

C. Basic System Functional Operation: When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system alarm LED on the system display shall flash.
2. A local panel buzzer in the control panel shall sound with a distinct sound separate from the trouble indication sound.
3. A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
4. Printing and history storage equipment shall log the information associated with each new fire alarm control panel condition, along with time and date of occurrence.
5. All system output programs assigned via CAUSE AND EFFECT interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

1.03 SUBMITTALS

A. General:

1. Eight copies of all submittals shall be submitted to the Architect/Engineer for review.
2. All references to manufacturers part numbers and other pertinent information herein is intended to establish the standards of performance, function and quality of the FCI/Gamewell UL-listed system and equipment. Equipment from other manufacturers may be not be substituted for the specified equipment.

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include manufacturer's name(s), model numbers, ratings, power requirements, battery calculations, equipment layout, device arrangement, complete wiring point-to-point diagrams, riser diagrams, conduit layouts, and sequence of operations.
3. Show system layout, configurations, and terminations.

C. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Software Modifications:

1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for all system points. The system structure and software shall place no limit on the type or extent of software modifications on-site.

E. Certifications: Together with the shop drawing submittal, submit a letter of certification from FCI/Gamewell indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized FCI/Gamewell representative. Include names and addresses in the certification.

1.04 GUARANTEE

A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance.

1.05 APPLICABLE CODES AND STANDARDS

A. The codes and standards below form a part of this specification. The system shall fully comply with the current or latest editions of these codes and standards as applicable.

1. National Fire Protection Association (NFPA) - USA:

a. No. 13 Sprinkler Systems
b. No. 72 National Fire Alarm Code
c. No. 70 National Electric Code - Article 760
d. No. 101 Life Safety Code

2. Underwriters Laboratories Inc. (UL) - USA:

a. No. 268 Smoke Detectors for Fire Protective Signaling Systems
b. No. 864 Control Units for Fire Protective Signaling Systems (9th Edition)
c. No. 268A Smoke Detectors for Duct Applications
d. No. 521 Heat Detectors for Fire Protective Signaling Systems
e. No. 464 Audible Signaling Appliances
f. No. 38 Manually Actuated Signaling Boxes
g. No. 346 Water-flow Indicators for Fire Protective Signaling Systems
h. No. 1971 ADA Visual Notification Appliances
i. No. 1481 Power supplies for Fire Protective Signaling Systems

B. California State Fire Marshall.

C. Local, Municipal, and State Building/Fire Codes.

D. Requirements of the Authority Having Jurisdiction (AHJ).

1.06 APPROVALS AND LISTINGS

A. The system shall have proper listing and/or approval from the following recognized agencies:

1. UL – Underwriters Laboratories Inc
2. FM – Factory Mutual Inc.
3. CSFM – California State Fire Marshall

B. The fire alarm system shall meet the requirements of the UL 864 9th Edition standard (Control Units) for the following types of listed service:

1. Local commercial protected premise: Automatic, manual, water-flow, sprinkler supervisory, Auxiliary Service (local energy), and Central Station Service (DACT).

PART 2 – PRODUCTS

2.01 EQUIPMENT AND MATERIAL, GENERAL

A. All fire alarm equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code and appropriate UL listing categories identified in this document.

B. All fire alarm equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.02 CONDUIT AND WIRE

A. Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
4. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or back-boxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4-inch (19.1 mm) minimum.

B. Wire:

1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NFPA70-NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a fire protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
5. Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 10,000 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
6. Wiring used for the network communications shall be twisted shielded pair, minimum 20ga., sized as necessary to support the extended fire alarm network.
7. All field wiring shall be electrically supervised for open circuit and ground fault.
8. The fire alarm control panel shall be capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems that do not allow or have restrictions in, for example, the amount of t-taps, length of t-taps etc., are not acceptable.
9. Existing wiring may be used for SLC or NAC circuit use provided this meets the minimum requirements of the manufacturer, local code requirements and the site location Authority Having Jurisdiction.

C. Terminal Boxes, Junction Boxes and Cabinets:

1. All boxes and cabinets shall be UL listed for their intended use and purpose.
2. All terminal, junction boxes and cabinets not marked with the fire alarm manufacturers name shall have the box covers painted red, or shall be designated with “F/A” or “Fire Alarm” in bold permanent lettering.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke, water-flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe, proper building grounding point, or grounding rod to the designated ground point on the fire control equipment.

2.03 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE

A. General: Main FACP shall be a FCI/Gamewell E3 fire alarm control panel and shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, annunciators, expansion accessories, and other system controlled devices.

B. Operator Control:

1. Panel Sounder Silence:

    a. Activation of the control Panel Sounder Silence button in response to new alarms and/or troubles shall silence the local panel sounder signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of the "More Alarms", or "More Events" buttons shall advance the LCD display to the next alarm or trouble condition.
    b. Depression of the Panel Sounder Silence button shall also silence all Remote Annunciator panel sounders if so programmed per network node configuration.

2. Alarm Silence Button: Activation of the Alarm Silence button shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition.

    a. The selection of notification circuits and relays that are silence-able by this button shall be fully field programmable within the confines of all applicable standards. The FACP software shall include optional auto-silence timers.
    b. The fire alarm panel display will continue to show two red LED's indicated "Fire", and the Panel Sounder Silence yellow LED will indicate steadily until the fire alarm panel is RESET and the conditions are clear. Should other types of alarm or trouble conditions be present, the system shall respond accordingly and the appropriate LED's associated with this category of alarm or trouble will indicate until the panel has been restored to normal condition. Subsequent alarms, if any will activate the alarm notification appliances and relays again.

3. Fire Drill Button: The Fire Drill button shall activate all notification appliance circuits and addressable modules/sounders that are programmed for General Alarm operation. The drill function shall latch these circuits and devices "on" until the panel is silenced or reset. The two red "Fire" LED's shall flash, the yellow "On Test" LED shall indicate steadily on the panel display and the LCD display shall display "Fire Drill". Pressing the Fire Drill or Reset button shall silence and reset all related circuits and devices.
4. ReSound Alarm Button: Pressing the "ReSound Alarm" button on the front display, at any time after the FACP has been silenced, but not Reset, will re-activate the notification appliance circuits and addressable modules/sounders that are programmed for General Alarm operation back into the appropriate alarm condition.
5. System Reset Button: Activation of the System Reset button shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, and annunciator displays to return to their normal condition. Addressable duct detector relays will also return to normal condition provided the auxiliary relays have been configured to interrupt power to the duct detectors.
6. Lamp Test: The Lamp Test button shall activate all local system LEDs and illuminate each segment of the liquid crystal display (LCD) while the Lamp Test button is depressed.
7. Programmable Function: The Programmable Function button shall be user programmable and shall activate any programmed action or output, or group of actions or outputs associated with programmed Cause and Effect software control to function with the operation of this button. Associated LED's or display codes will appear on the FACP display as needed to indicate the category of the programmed function. The programmed function button will only activate while the button is pressed during Level 2 password access or front panel "Enable" key switch access.
8. Enter: The Enter button shall be used as necessary in association with the keypad to enter various commands, menus, or system modes.

9. Exit: The Exit button shall be used to exit any level of access, various commands, menus, or system modes and return display to its original condition.
10. More Events: The More Events button shall be used by the system operator to view additional alarm, trouble, supervisory or other event category conditions as they occur or have occurred on the FACP. The most current events shall be displayed first. Older event shall display last. The system will automatically continue to organize and display events as they occur in real time. The events displayed in this menu are active and current events (current event buffer). For viewing historical events that have already been restored, the user must view the event history log.
11. More Fire Events: The More Fire Events button shall be used to display all high priority "Fire" alarm conditions on the panel. The LCD display will display two fire alarm events at a time. The first (original) and last (latest) fire alarm events will be displayed by default. When the More Fire Events button is used, the system will cycle the last fire alarm event entry through all currently active fire alarm events, keeping the originating event concurrently displayed. The system will automatically continue to categorize and display alarm events as they occur in real time.
12. Numeric/Arrow Navigation Buttons: The numeric arrow buttons shall be used by the system technician and/or other appropriate personnel to enter the Access Level 2 or 3 menu structures. From these menus personnel can perform programming functions, disablements, set system time, device parameters, printers, maintenance alerts, etc. The Access Level 2 menu functions are for standard user functions and system operation. The Access Level 3 menu functions are for system programming and higher-level administrator operations.
13. Question Button (?): The Question button shall be used by the system operator or technician to provide help to describe the particular menu or level the operator is currently in. Example, by pressing the help button when the panel is in alarm mode will explain to the operator what is occurring and suggest appropriate action. Fire alarm systems that do not provide dynamic onboard front panel help via menu function shall not be acceptable.

C. System Capacity and General Operation:

1. The control panel or network node shall provide, or be capable of, SLC input/output capacity of 800 addresses and sub-addresses at full panel expansion.
2. The control panel or network node shall support (2) or (4) SLC loop configurations.
3. The control panel or network node shall support (127) sensors/detectors/modules and (127) addressable sounder bases per loop totaling up to 254 addressable points per SLC loop. Systems that are not capable of this SLC capacity shall not be acceptable.
4. The control panel or network node shall include five (5) onboard programmable Form-C relays with default operation for Common Fire 1, Common Fire 2, Common Trouble, Common Supervisory, and Auxiliary functions rated at a minimum of 1.0 amp @ 30VDC.
5. The control panel or network node shall include four (4) onboard Class B (NFPA Style Y) programmable Notification Appliance Circuits rated at 2.5 amps @ 24VDC.
6. The control panel or network node shall include three (3) onboard additional programmable supervised reverse polarity voltage outputs (common fire, common trouble, and programmable) rated at 500mA @ 24VDC.
7. Each FACP NAC, voltage, and relay output (except for Supervisory) may be individually programmed to operate on any pre-defined condition via Cause and Effect programming.
8. The control panel or network node shall include (500) network-wide zones. Systems that do not employ this type of zoning shall not be acceptable.
9. Protection: All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with the requirements of the UL864 9th edition standard.

10. Field Wiring Terminal Blocks: For ease of installation and service all panel I/O wiring terminal blocks shall have sufficient capacity for #18 to #12 AWG wire.
11. The control panel or network node shall include and employ (2) RS485 network ports configured in a Class A “ring” topology for high integrity operation. Systems that employ a single RS485 port or Class B 2-wire network operation shall not be acceptable.
12. The control panel or network node shall include a slave RS485 port for remote expansion accessories. This expansion port shall support up to (32) optional remote expansion accessories with a capacity of up to (512) secondary inputs and outputs or (15) local serial LCD annunciators and (17) expansion accessories. Systems that do not employ a slave RS485 port for expansion accessories shall not be acceptable.
13. The control panel or network node shall include (1) onboard RS232 port for PC programming.
14. The control panel or network node shall include (1) onboard RS232 port for 3rd party serial fire printer support.
15. The control panel or network node shall include (8) onboard digital logic inputs without the need for expansion modules. These inputs shall be capable of PLC style logic and secondary input operation. Systems that do not employ onboard digital inputs shall not be acceptable.
16. Protection: the control panel or network node shall incorporate surge and lightning protection devices as required to meet the UL 864 9th Edition criteria.
17. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit (320) character (8 lines x 40 characters) Liquid Crystal Display (LCD), with individual color coded system status LEDs, and a keypad with easy touch rubber keys for the field programming and control of the fire alarm system.
18. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes. The memory storage of the system shall be Flash memory type, EPROM type shall not be acceptable.
19. The system shall allow the programming of any input to activate any output or group of outputs via advanced Cause & Effect software programming. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or have only basic logic programming are not considered suitable substitutes.
20. The FACP shall support up to 500 Cause & Effect logic statements involving up to 2000 inputs, 2000 outputs, and 500 zones. The logic shall support "AND," "OR," and "COINCIDENCE” operators to be used for advanced programming. The logic statements shall support special macro operations to perform advanced automated system bypass disablements and multi-zone One Man Walk Test functions. Systems that do not employ this Cause & Effect capability, capacity, or special logic macros shall not be acceptable.
21. The FACP or network node shall include the following features:

    a. Automatic drift compensation employed per UL864 9th Edition criteria where each smoke sensor/detector automatically adjust its zero-point, fire-point, and alarm threshold sensitivity to adjusted ambient environmental conditions (“clean-air” samples) taken within each (24) hour period. This operation adjusts each smoke sensor/detector automatically to suit ongoing subtle changes in the ambient air conditions. The adjusted values and operation insure smoke sensors/detectors are always optimally tuned to their environment and do not fail to operate or false alarm as the smoke chambers slowly become dirty or obscured. Systems that do not employ automatic drift compensation to the UL864 9th Edition criteria shall not be acceptable.

b. Integral detector sensitivity test method between the control unit and the smoke sensor/detector that meets the requirements of NFPA 72-2002, Chapter 10 section 10.4.3.2.4. Systems that do not employ integral detector sensitivity test method shall not be acceptable.
c. Early warning maintenance alert to warn of increasing dirt, dust, or other obscuration accumulation in the smoke sensor/detector chamber, or if the device drifts out of factory nominal ranges indicating a potential maintenance trouble condition. Systems that do not employ an early warning maintenance alert function shall not be acceptable.
d. Two individual variable sensitivity levels of alarm for each sensor/detector in the system, one for Day mode, and another for Night mode. The alarm level range shall be .88 to 3.57 of obscuration percent per foot for analog /addressable photoelectric sensors/detectors and 0.88 to 2.57 percent per foot for analog/addressable duct detectors. Analog/addressable ionization detectors shall have sensitivity assigned according to fixed values set to low, medium, or high. Analog/addressable thermal heat sensors/detectors shall have an alarm level range of 32-158 degrees Fahrenheit, but are UL listed for fire when set between 135-150 degrees Fahrenheit.
e. The system shall also include an automatic dynamic pre-alarm function assigned as a fixed relationship to the adjustable alarm threshold or sensitivity of a given sensor/detector. The dynamic pre-alarm value varies automatically with each sensor's/detector's sensitivity setting and is adjusted across the sensor/detector range. This allows for a continuously variable multi-step pre-alarm operation. Pre-alarm function can be turned on and off manually via programming option.
f. The ability to display or print system reports, loop/zone configurations, and history events.
g. Alarm verification of smoke sensor/detector zones per UL864 9th Edition criteria. Alarm verification time value shall be programmable from (5) to (60) seconds in (5) second intervals.
h. The ability to link inputs to outputs and/or to group inputs and outputs. Systems that use DOS commands, machine language commands, executable statements, or #,+ -, or other non-standard unique programming styles are not acceptable.
i. Rapid alarm reporting with digital fire detection protocol supporting 1.5 second alarm response reporting worst case on any given SLC. All system nodes shall meet NFPA 72-2002 requirements for alarm activation from initiation to notification within 10 seconds. Systems that do not meet this requirement and ability shall not be acceptable.
j. Automatic daily sensor/detector calibration and test function conducted by the control panel. This system shall automatically test and calibrate every sensor/detector in the system every (24) hours and perform drift compensation during each calibration event. Systems that do not employ automatic daily calibration and self test function shall not be acceptable.
k. Cross zoning (Coincidence operator) function: Any two objects of a subset applied in the "Cause" section of Cause & Effect using the "Coincidence" operator, will activate the output action subset outlined in the "Effect" section of Cause &Effect from any two objects defined in the "Cause" section of Cause & Effect. This function allows any two "Cause" input objects such as two detectors, two software zones, one detector and one software zone, one smoke detector and one thermal detector, or any combination of two inputs and/or zones to operate in a cross-zoned fashion. One Man Walk test mode with optional Cause & Effect driven macros for automated multi-zone One Man Walk Test mode operation.
l. Automatic day/night mode adjustment of sensor/detector sensitivities based on unique daily time schedules on a weekly basis.

m. Advanced auto-learn feature that learns all SLC loop devices and addresses, internal control panel and expansion structure, and network relationship to other nodes. The default learned configuration assumes safest UL864 and NFPA 72 compliant settings and attributes for all system components such that the system will not need further programming to operate in General Alarm mode. This allows the system to operate "out-of-the-box" after an auto-learn is performed. Systems that do not employ an advanced auto-learn function in this manner shall not be acceptable.

22. The FACP shall be capable of coding control panel notification appliance circuits in March Time, Temporal 3 (per NFPA 72/ANSI), and Continuous patterns for notification appliance devices.
23. Network Communication:

a. The network architecture shall be based on a communications package that utilizes a peer-to-peer, inherently regenerative highly secure format and protocol. A node may be an intelligent Fire Alarm Control Panel (FACP) or Network Remote Annunciator/ Control Station (RNA). The network shall be capable of expansion to at least (64) panels and/or nodes.
b. Each network node address shall be capable of storing up to (500) events. Any network node can serve as a reporting or control node for another node if necessary by programming the necessary network routing attributes.
c. The network shall be capable of communicating via wire. A wire network shall include a fail-safe means of isolating the nodes in the unlikely event of complete power loss to a node. Loss of a network node, cable short-circuit, cable open-circuit, or fault of network communications shall activate a trouble signal on the network nodes (panels and network annunciators) programmed with the necessary network routing attributes. The wire network shall include and employ (2) RS485 network ports configured in a Class A "ring" topology for high integrity operation. The Class A "ring" topology network operation shall communicate in both directions over both ports and not be degraded by a single break anywhere on the network. The network wiring shall be a minimum (20) gauge twisted shielded pairs suitable for RS485 style communications. The network transmission shall be capable of (4000) feet between each node. The overall network wire length shall be capable of (256,000) feet in the maximum network configuration. Systems that employ a single RS485 port or Class B 2-wire network or that do not perform in the above manner shall not be acceptable.
d. Network Fire alarm panels or nodes shall be capable of up to (500) software zones that may be assigned network-wide. Panels and network nodes shall not be restricted to unique zones. Any zone may be used by any combination of panels and network nodes. Systems that do not employ network-wide zoning or have zoning restrictions shall not be acceptable.
e. Network process and event handling shall be capable of independently and separately routing each system event type and/or control from any network node to and from any other network node. The network shall be capable of routing the following individual types of event categories:

1) Fire
2) Supervisory
3) Trouble
4) Pre-Alarm
5) Emergency
6) Auxiliary
7) Security

8) Disablements (Bypass events)
9) Test (Walk Test events)
10) Status & Control (system status/panel controls)

f. The network shall be capable of individually handling each of the above types of event categories as follows:

1) Process (act on the network event)
2) Display (display the network event)
3) Log (record the network event)
4) Print (print the network event)
5) Buzz (activate the buzzer from the network event)
6) Each network node (panel or network annunciator) shall be capable of having unique network routing assignments. Each network node shall be capable of receiving any and all network events from any and all other network nodes. Each network node shall be capable of receiving all events from a maximum size network of (64) nodes, which supports (51,200) addresses/sub-addresses within the (85,000) total system points possible. Systems that do support these network capabilities shall not be acceptable.

D. Central Microprocessor:

1. The microprocessor shall be a state-of-the-art, and it shall communicate with, monitor and control all external interfaces. It shall include Flash memory for system program and site-specific configuration storage, and shall include a supervised "watch dog" circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event operations shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time/date annotation of system displays, printer, and history log. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real-time clock shall have an option for Daylight Savings Time. The real time clock shall also control panel functions such as Day/Night mode, Calibration, Alarm Verification, AC Failure Delay, Sounder Timeout, and I/O timer functions per their respective programmed settings.
4. Microprocessor shall utilize FCI/Gamewell system protocol for efficient reliable communications with addressable analog addressable devices.
5. An auto-program (auto-learn) function shall be provided to quickly install initial default functions, SLC devices, and network attributes and make the system operational.
6. For flexibility and to ensure program validity, all system programs and functions shall be configured with the System Configuration Software Utility. This program shall be used to off-line program the system with batch upload/download functions, and have the ability to upgrade the manufacturers (FLASH) operating system firmware code.

E. System Display and User Interface:

1. The system shall support the following Liquid Crystal Display (LCD) properties:

    a. Panel and annunciator displays shall include a (320) character backlit alphanumeric LCD display. The LCD display shall arrange the (320) characters in (8) lines of (40) characters. Each display shall be capable of duplicating the display of any other panel or network annunciator display if so programmed via network routing attributes.
    b. The LCD display shall have a contrast adjustment to set to contrast intensity of the display.
    c. The LCD display shall include a ¼" plexi-glass clear protector cover to prevent field damage and to provide security protection from vandalism.
    d. The LCD display shall provide comprehensive information for system events, menus, and devices. At a minimum the following shall be displayed: date, time, node#, loop#, zone#, address#, sub-address#, device type, event category, specific event type, action message, and (40) character location text. Menu text shall display complete and unabbreviated verbiage. Systems that support less than (320) characters total, (8) lines total, (40) characters of location text, or employ abbreviated text shall not be acceptable.

2. The system shall provide indications and controls on the front panel or annunciator user interface as follows:

    a. Control buttons: Panel Sounder Silence, Alarm Silence, Fire Drill, Reset, Re-Sound Alarm, Fire Drill, Programmable Function and Lamp Test.
    b. Light-Emitting Diodes (LED) indicators: AC Power On, (2)-Fire Alarm, Pre-Alarm, Fire Output Active, On Test, Panel Sounder Silenced, Delay Active, More Events, Point Bypassed, General Trouble, Power Trouble, System Trouble, NAC Trouble, and Supervisory Alarm. Systems that do not include these indications are not acceptable.
    c. Menu navigation and programming buttons: Exit, Enter, More Events, More Fire Events, numeric/navigation, and help (?) buttons.
    d. The system user interface shall feature an easy (5) point navigation system with built in "help" button with the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels (three Access Levels total, Level 1 being no password used) shall be provided to prevent unauthorized system control or programming.
    e. The system shall support easy entry of password codes via navigation system or key switch to easily access level 2 or level 3 command menus.

F. Signaling Line Circuits (SLC):

1. Each FACP or FACP network node shall support up to (4) SLC loops. Each SLC loop shall provide power to and communicate with up to (127) analog addressable sensors/detectors (ionization, photoelectric, duct, and/or thermal) and addressable modules (input monitor, addressable pull-station, output relay, conventional zone, and/or supervised output), along with (127) addressable sounder bases for a loop capacity of up to (254) SLC devices. The (2) loop panel shall be capable of supporting (508) SLC devices and when the two-loop expander is used the (4) loop panel shall potentially be capable of (1016) devices by loop architecture, however the panel memory maximum will limit this total to (800) addresses and sub-addresses for the (4) loop panel.

2. Individual FireNET panels can be networked up to (64) nodes to provide a maximum of (51,200) addresses/sub-addresses within the (85,000) total system points possible. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
3. FACP shall receive analog information from all analog addressable sensors/detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each sensor/detector. The software shall automatically maintain the sensor/detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each sensor/detector. The panel will assess the sensor/detector analog data to determine when the fire condition is reached and the alarm must be generated. The analog information shall also be used for automatic detector testing/calibration and for the automatic determination of detector maintenance requirements. See Drift Compensation and Calibration portions of this document for additional details.
4. Point monitor modules shall be programmable for (13) different types of event categories depending on the module type: fire, trouble, pre-alarm, supervisory, emergency, auxiliary, security, silence, reset, fire drill, transparent, disablement, and test mode. In addition, each point shall be capable of being assigned an action message. There shall be (20) action messages total (11 preset and 9 custom with up to 15 characters each). Each point shall have the capacity for up to (40) alphanumeric characters. In addition any monitor module can via its selected program, individually override alarm output delays, set an input delay time, and support advanced programming options. NFPA, UL, AHJ, and local, state, and federal codes must be observed. Systems without this capability shall not be acceptable.

G. Serial Interfaces:

1. The system shall include five serial interfaces. Each interface shall comply with EIA standards for RS232 and RS485. Systems that do not include these integral serial interfaces and their supported operation shall not be acceptable.

    a. The system shall include (1) slave Class B multi-drop RS-485 serial port for optional expansion accessories such as I/O boards and local serial annunciators.
    b. The system shall include (2) peer-to-peer RS-485 serial ports arranged in a Class A “ring” topology for the primary fire system network connecting multiple fire control panels and/or remote network annunciators.
    c. The system shall include (1) RS-232 serial port for connection to fire or ancillary serial printers.
    d. The system shall include (1) RS-232 serial port for connection to laptop, desktop, or handheld computer systems. This port shall also support a proprietary high-level protocol for optional integration and interface to third party building automation platforms, graphics software, and other enterprise building software suites.

H. Notification Appliance Circuit (NAC) Output:

1. The Notification Appliance Circuit outputs shall provide four fully supervised Class B (NFPA Style Y) notification circuits.
2. The notification circuit capacity shall be 2.5 amperes maximum per circuit not to exceed 4 amperes maximum per panel based on battery and voltage drop calculations.
3. The notification circuits shall not affect other portions of panel operations in any way during a short circuit condition.
4. The notification circuit terminal of the panel shall be UL Listed for use with up to 12ga. AWG wiring.

5. Notification circuits shall be fully programmable for variable use. The outputs may be activated by common alarm, general event categories, zoned, point, or logic triggered operation. NAC shall support silence-able and strobe output options, as well as audible patterns for horns. NAC shall have optional settings for non-NAC operation such as continuous, door holder, and reset-able power functions.

I. Auxiliary Programmable Inputs and Outputs:

1. The panel shall provide eight (8) auxiliary programmable logic input circuits. The inputs may be programmed to any type of secondary ancillary logic operation.
2. The panel shall include five (5) programmable relay outputs and three (3) programmable 24vdc voltage outputs. The voltage outputs shall be rated at 500mA each.
3. Each input or output shall be capable of fully independent operation.
4. Each input or output shall be capable of independent enable/disable conditions via timed and un-timed settings via menu commands when front panel controls are in Access Level 2 or in key-switch enabled mode.

J. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and door shall be corrosion, rust, and vandal resistant.
2. The cabinet and door shall be constructed of 16 gauge or thicker steel with provisions for ½" and ¾" electrical conduit connections into the sides, top, and bottom of the cabinet.
3. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all LCD indications. The opening shall be protected by a ¼" plexi-glass or acrylic transparent cover. For convenience, the door may be removed to facilitate installation of system wiring or ease of use. The removable door shall have a hinge pins to facilitate quick removal without damage to system electronics. The bottom hinge pin shall be longer to allow easy guided re-installation of the door after removal.
4. The cabinet shall include a designated earth ground stud identified with a label containing appropriate earth ground symbol per UL864 9th edition, NFPA-70, and applicable building and safety electrical codes.
5. The cabinet shall include a grounding block to receive shielded drain wires and other low-voltage grounding needs.
6. The cabinet shall include a removable back-plane for mounted electronics allowing quick and easy removal to facilitate installation of system wiring or ease of use without damage to system electronics.

K. FACP Power Supply:

1. The panel power supply output shall be rated at 4.0 Amps for internal panel power and external SLC, NAC, and other auxiliary power needs. The battery charger shall be rated at 1.5 Amps and shall not detract from the 4.0 Amp total output current.
2. Positive-Temperature-Coefficient (PTC) fuses or other over-current protection shall be provided on primary AC input, DC power output, and battery input.
3. The primary AC input power shall have dual operating voltage capability at 120/240 VAC, 50/60 Hz, and shall provide all necessary primary power for the panel.
4. The power supply shall provide an integral battery charger for use with batteries up to 60 AH. Battery arrangement may be configured in the field per the manufacturer's recommended methods.

5. The power supply shall meet new UL864 9th edition requirements introduced in 2005/2006 per the updated control panel standard. The power supply shall be capable of handling NAC and surge transients outlined in the new standard. DC power outputs shall be UL listed for "Regulated" use.

L. Other Specific System Operations:

1. Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all analog/addressable intelligent detectors and sensors in the system from the system keypad. Sensitivity ranges shall be within the allowed UL window.
2. Alarm Verification: The analog/addressable smoke detectors and sensors in the system may be enabled for verification per zone.
3. Point Disable: Individual inputs, outputs, SLC, NAC, zones, or all audible devices in the system may be enabled or disabled on a timed or un-timed basis through the panel user interface.
4. Point Status: The system shall be able to display or print the following point status diagnostic functions:

    a. Device status
    b. Device type
    c. Custom device label
    d. View analog detector values
    e. Device zone assignments
    f. All program parameters

5. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 500 events. The buffer shall be prioritized such that higher priority events (example: fire) are retained as lower priority events are dropped, keeping the highest priority items present in the 500 event buffer. Systems that do not have this capability are not suitable substitutes. Each of the system events shall be stored with a date/time stamp that includes actual time of the activations and restores. The contents of the history buffer may be manually viewed or printed, one event at a time, by event category, or in its entirety.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector or sensor and shall analyze the detector responses over a period of time. If any intelligent detector or sensor in the system responds with a reading that is above or below normal limits, the system will generate one of two maintenance troubles, and the particular detector or sensor will be annunciated on the system display and/or printed on the optional printer. There shall be two maintenance trouble types. 1: early warning; service unit. 2: outside limits, service or replace unit. When trouble 1 occurs units will continue to operate, when trouble 2 occurs they units may no longer function properly. The automatic early warning feature (trouble 1) shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
7. The fire alarm control panel shall include a one man walk test feature. It shall include the ability to test initiating devices and notification appliance circuits from the field without returning to the panel to operate the system. Operation shall be as follows:

    a. Alarming an initiating device shall activate notification and other outputs that are programmed for General Alarm when placed in walk test mode.
    b. Walk Test mode shall be recorded in the history buffer.

c. Walk Test mode shall automatically time out after 15 minutes from the last device tested. The system will automatically return to normal detection and alarm operation after this timeout.
d. Walk Test mode shall have the option to have audible or silent operation of system notification outputs during test modes.

8. Water-flow Operation: An alarm from a water-flow detection device shall activate the appropriate alarm message on the system display and turn on all programmed notification appliance circuits. Water-flow inputs shall have the option of not being affected by the alarm silence switch.
9. Supervisory Operation: An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory alarm LED, but will not cause the system to enter the trouble or fire alarm mode.
10. Alarm Silence Operation: The panel shall have the ability to program each output circuit (notification, relay, voltage, module, etc) to deactivate upon depression of the alarm silence switch. The alarm silence operation shall only operate when the system is placed in Access Level 2.
11. Non-Alarm Input Operation: Any input in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices. The following optional secondary input event types shall be available:

a. Emergency
b. Auxiliary
c. Trouble
d. Pre-Alarm
e. Security
f. Test
g. Disable
h. Transparent

M. System Configuration Software Utility:

1. The software shall be by FCI/Gamewell.
2. The software shall support standard Microsoft Windows programming styles such as drag & drop, cut & paste, hot keys/short cuts, auto-fill, etc. Systems that do not support this style programming shall not be accepted.
3. Zone Manager: Allows quick drag & drop or cut & paste style programming of system input/output to any of (500) zones.
4. Quick Config: Allows each SLC loop to be placed in spreadsheet format to allow quick and easy programming of location text and zones. Feature must support cut & paste style programming.
5. System Print/Pre-view: Allow all programming attributes to be viewed and saved as a Microsoft Word document for “as-built” programming records.
6. Advanced Cause & Effect logic: Supports up to 500 Cause & Effect logic statements involving up to 2000 inputs, 2000 outputs, and 500 zones. The logic shall support "AND," "OR," and "COINCIDENCE” operators to be used for advanced programming. Supports three styles of logic: actions, disablements, and test zones. The Cause and Effect logic shall operate network-wide and shall not be restricted to a single panel or network node.

7. Advanced configuration download/upload: Allows configuration loads via a single connection to a single panel or node on the network. Any and all panels or nodes may be loaded from a single point. Eliminates the need to go to each panel or node to perform configuration loading. Systems that do not have this feature shall not be acceptable.
8. Virtual Panel mode: Allows virtual control of any panel or node as if standing at the control unit from a single panel or node connection on the network. Any panel or node may be accessed from any other single panel or node connection. Systems that do not have this feature shall not be acceptable.
9. Event Log: Allows event logs from any panel or node on the network to be viewed and extracted to the software utility and saved as a Microsoft Excel spreadsheet.
10. Analog Values: Allows last calibrated and drift compensated sensor/detector values to be viewed on a SLC loop basis and saved as a Microsoft Excel spreadsheet.
11. Monitor Mode: Allows real-time event monitoring of any panel or node directly connected to the software utility to be viewed and saved as a Microsoft Word document. This document can be a record of inspection or test activity and provided to the AHJ as an electronic or printed test record. This eliminates the need for hand written records.
12. Advanced Help Functions: Software utility shall include embedded help library with components from the installation and programming manual. An embedded online help function shall be included that links to the manufacturers product and support website. A built-in email link to the manufacturers Tech Support department shall also be included.

2.04 SYSTEM COMPONENTS – EXPANSION AND ACCESSORIES

A. Local Serial Annunciator (LSA):

1. The LSA shall be capable of displaying all information for all (85,000) possible system points on a maximum size network of (64) nodes. Same as the main FACP.
2. The LSA shall include a (320) character backlit alphanumeric LCD display. The LCD display shall arrange the (320) characters in (8) lines of (40) characters. Each display shall be capable of duplicating the display of the panel it is connected to. The LCD display shall operate exactly the same as described in this document for the main FACP. The LCD display shall have the same contrast adjustment and plex-glass protection as described in this document for the main FACP.
3. Control buttons: Panel Sounder Silence, Alarm Silence, Fire Drill, Reset, Re-Sound Alarm, Fire Drill, Programmable Function and Lamp Test. Same as the main FACP.
4. Light-Emitting Diodes (LED) indicators: AC Power On, (2)-Fire Alarm, Pre-Alarm, Fire Output Active, On Test, Panel Sounder Silenced, Delay Active, More Events, Point Bypassed, General Trouble, Power Trouble, System Trouble, NAC Trouble, and Supervisory Alarm. Systems that do not include these indications shall not be acceptable. Same as the main FACP.
5. Menu navigation and programming buttons: Exit, Enter, More Events, More Fire Events, numeric/navigation, and help (?) buttons. Same as the main FACP.
6. The LSA user interface shall feature an easy (5) point navigation system with built in "help" button with the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels (three Access Levels total, Level 1 being no password used) shall be provided to prevent unauthorized system control or programming. Same as the main FACP.
7. The LSA shall support easy entry of password codes via navigation system or key-switch to easily access level 2 or level 3 command menus. Same as the main FACP.

8. The LSA shall mount in its own steel enclosure and shall support either surface or flush mounting. The enclosure shall be corrosion, rust, and vandal resistant. The enclosure shall be constructed of 16 gauge or thicker steel with provisions for ½" and ¾" electrical conduit connections into the back of the enclosure and ½" electrical conduit connections into the sides of the enclosure. The enclosure shall also support 2-gang, 3-gang, and 4-gang holes for standard electrical back-box and switch-box mounting styles.
9. The LSA shall have 24VDC power input that can be supplied via the control panel or an auxiliary UL864 or UL1481 listed power supply.
10. It shall be possible to connect up to (15) LSA units to a single panel or network annunciator.
11. The LSA shall connect to the dedicated multi-drop RS-485 slave port of the panel. This port shall be a Class B two-wire serial connection and shall be capable of distances up to 4000 feet.
12. The LSA shall have throughput wiring provisions for 24VDC power and serial connections.
13. Each LSA shall mimic the main controls, LED indicators, and LCD display of the panel it is connected to.

B. Input/Output Expansion Module (IOM):

1. The IOM shall have 16 channels of input/output points.
2. Each channel shall be configurable as an input or output point.
3. Inputs shall be an opto-isolated, non-supervised, and pull-down type triggered from a "dry" contact input source.
4. Outputs shall be open collector transistor pull-down type that provides a "wet" voltage output (100mA max each).
5. There shall be 32 IOM modules possible per panel (512 channels of input/output points).
6. The IOM shall have simple 4 wire connection to the control panel (2 for power, 2 for data).
7. All inputs/outputs shall be assignable to global functions, any event category, and used in network wide Cause & Effect logic.
8. The IOM can be mounted locally within control panel enclosure or remotely via FN-ACC accessory enclosure up to 4000ft. from the panel.
9. Input/Outputs shall be for secondary use, not for primary fire initiation inputs or notification outputs.
10. Two LED's shall be provided for communication and power status.
11. The IOM shall be rated at 24VDC. Quiescent Current: 20mA. Current per input: 3mA max. Current per output: 100mA max. (within overall limits). Current per bank is 500mA max. (for banks 1-8 & 9-16) for 8 outputs: Total current per I/O board: 1A max.
12. The IOM shall communicate via two wire Class B multi-drop RS485 capable of distances up to 4,000 ft. The IOM shall connect to the panel or network annunciator slave RS485 port.
13. The IOM shall have terminals capable of receiving 12 AWG wire.

C. City-Tie Module [Local Energy type] (CTM):

1. The CTM terminal blocks shall be capable of accepting up to 14 AWG wire.
2. The CTM shall be configured such that the NAC EOL (end of line) device of the panel will connect directly to the CTM to ensure that supervision of NAC interface wiring is performed. This integrates the panel NAC EOL device into the CTM operation to provide full supervision of the circuit.
3. The CTM shall fit into a standard 4" electrical back box.

4. The CTM interfaces the panel to a Local Energy type City Tie monitoring circuit.
5. The CTM shall be Underwriters Laboratories Listed for the intended purpose.
6. The CTM shall have a wide operating voltage range: 12 ~ 30 VDC. The current consumption shall be 0mA in standby and 1 Amp for 0.5 seconds during alarm to operate the Master Box Trip Coil.
7. The CTM shall provide power limited operation and include transient protection.

D. Accessory/Battery Extension Enclosure (ACC):

1. The ACC shall be a UL-listed cabinet suitable for surface mounting. The cabinet and door shall be corrosion, rust, and vandal resistant.
2. The cabinet and door shall be constructed of 16 gauge or thicker steel with provisions for ½" and ¾" electrical conduit connections into the sides, top, and bottom of the cabinet.
3. The ACC shall have mounting provisions to support remote I/O expansion accessories and power supplies when the unit is used as an accessory enclosure.
4. The ACC shall support batteries sizes above 17AH that exceed the standard panel enclosure dimensions. The ACC shall be a battery extension cabinet when used in this fashion and shall include provisions for extended wiring harness and connectors for this purpose.

E. Enclosure Trim Ring (ETR):

1. The ETR shall be a UL-listed trim ring suitable to support semi-flush mounting of the control panel. The ETR shall be corrosion, rust, and vandal resistant.
2. The ETR shall be constructed of 16 gauge or thicker steel.

F. Dialer (DACT):

1. The Digital Alarm Communicator Transmitter (DACT) is an interface for communicating digital information between a protected premise fire alarm control panel and an UL-Listed central station.
2. Five (5) reporting formats shall be supported: Modem IIIa2, Contact ID, SIA110, SIA300, and 4/2.
3. The DACT shall have LED indicators for Heartbeat, System Trouble and Phone Line Trouble (one per line).
4. The input power shall support either 12VDC or 24 VDC voltages.
5. Internal supervision of the DACT shall be accomplished with a hardware watch-dog circuit. Failure of the control program in the unit will result in a hardware reset within two seconds. The onboard trouble relay will be released for the duration of the reset (the relay is normally held energized). The following items shall be automatically tested periodically: EEPROM memory, input points, and phone lines. The EEPROM checksum is verified every 10 minutes. If the EEPROM checksum fails, a trouble condition is locally annunciated and a trouble report is sent.
6. The DACT shall support five (5) user programmable inputs that may be triggered by dry contact relays or open collector outputs. Each of these inputs can be configured for one of seven types of conditions: Fire Alarm, Water-flow Alarm, Supervisory, Monitor Alarm, System Fault, AC Failure and Low Battery. The inputs shall be supervised via Class B (Style B) wiring.
7. There shall be six different report groups that can be routed to one of four phone settings. These report groups consist of non-supervisory alarms, supervisory alarms, alarm restorals, resets, supervisory restorals, tests, troubles, and trouble restorals.
8. Programming shall be accomplished via the HD7033 optional LCD remote keypad and programmer. All DACT settings shall be adjusted via the HD7033.

9. The DACT shall include connections for dual telephone lines per UL/NFPA/FCC requirements. Phone lines shall be supervised.
10. For lightning and static suppression, the DACT shall include MOV and spark gap suppressors for inputs and telephone line interface.
11. The DACT shall also include the following features:

    a. Onboard Form C Trouble Relay (normally energized). The trouble relay shall operate from the following conditions: Any onboard dialer trouble condition, internal diagnostic faults, phone line supervision faults, input point supervision faults, and communication failure/faults.
    b. 100 Event History Buffer
    c. Real Time Clock

2.05 SYSTEM COMPONENTS – ADDRESSABLE DEVICES

A. Addressable Devices – General:

1. Addressable devices shall be the following FCI/Gamewell models:

    a. ASD-PL2F Addressable Photoelectric Smoke Detector
    b. ATD-RL2F Addressable Heat Detector

2. Addressable devices shall be simple to install and not require mechanical DIP or rotary address switches. Devices shall be digital and able to be addressed electronically via a hand held programmer.
3. Addressable devices, which use a mechanical address setting method, such as a DIP-switch, or decade dial (rotary) switches shall not be acceptable.
4. Addressable detectors/sensors shall be intelligent, analog, addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
5. Addressable detectors/sensors shall provide dual alarm and polling LED indicators. The indicators shall flash red under normal conditions, indicating that the detector/sensor is operational and in regular communication with the control panel. The indicators shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED indicator.
6. The fire alarm control panel shall permit addressable detector/sensor sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust and alternate sensitivity between Day and Night modes.
7. The addressable detectors/sensors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance via intelligence and control from the panel per calibration and drift compensation functions. The detectors/sensors and control panel shall meet the calibrated sensitivity test requirements of NFPA Standard 72-2002, Chapter 10, section 10.4.3.2.4.
8. Addressable detectors/sensors shall include a separate twist-lock base. The bases shall permit direct interchange with the ionization type smoke sensor, photoelectric smoke sensor, and the heat sensor. The vandal-resistant, security locking feature shall be used in those areas required by the application and implemented per the manufacturer's instructions.
9. Addressable detectors/sensors shall provide an integral test means whereby an internal fire test of the chamber or sensor shall be performed by the control panel automatically during each 24 hour calibration cycle. This operation shall guarantee every detector /sensor in the system is operational with each calibration cycle and any detectors/sensors that do not pass this test method shall indicate a trouble and maintenance alert on the control panel.

10. Addressable devices shall also store an internal identifying type code that the control panel shall use to identify the type of device specifically. The panel shall identify the exact type of detector/sensor, module, etc. Addressable devices of different types or variant models shall not use the same type code.
11. Addressable detectors/sensors shall operate in an analog fashion, where the detector measures its environment variable and transmits an analog value to the control panel based on real-time measured values of the ambient conditions. The control panel, not the detector/sensor, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector/sensor to be set and monitored by the control panel. The system operator shall have the ability to view the current analog value of each detector/sensor.
12. Addressable modules shall mount in a standard 4-inch square electrical construction box. Mini-Modules shall fit inside a standard 4-inch square or single-gang box.
13. Addressable devices shall be capable of accepting up to 14-gauge wire sizes.
14. Addressable devices shall be UL listed and compatible with the FCI/Gamewell analog/addressable control panel.
15. Addressable device addresses shall be electrically programmable and stored in EEPROM.
16. Addressable device shall use Digital Communication Protocol (DCP) which is noise immune and utilizes alarm interrupts for fast response to fires.
17. Addressable devices shall be programmed/addressed by using the hand-held device programmer.
18. Addressable detectors, sensors, and modules shall operate on SLC addresses 1 – 127. Addressable sounder bases shall operate on SLC addresses 128-254. The SLC shall support 254 addresses total.

B. Analog Photoelectric Smoke Detector – (ALG):

1. Analog photo smoke sensors shall have a UL listed operating range from .88%/ft. to 3.57%/ft. obscuration graduated across an air velocity range up to 4000 fpm. Analog photo smoke sensors that do not support this operating range or velocity capability shall not be acceptable.
2. Analog photo smoke sensors shall have a low profile design, only 1.97" high, including base.
3. Optical fire test feature shall be built-in.
4. The plastics shall be a PC/ABS blend and shall be resistant to yellowing from prolonged UV exposure. The color shall be bone.
5. The smoke chamber shall be removable to allow ease of maintenance and cleaning.

C. Analog Ionization Smoke Detector – (AIE):

1. Analog ion smoke sensors shall have a UL listed operating range from .55%/ft. to 1.15%/ft. obscuration.
2. Analog ion smoke sensors shall have a low profile design, only 2.22" high, including base.
3. Fire test feature shall be built-in.
4. The plastics shall be a PC/ABS blend and shall be resistant to yellowing from prolonged UV exposure. The color shall be bone.

D. Analog Thermal/Heat Detector – (ATG):

1. Analog heat sensors shall have a UL listed operating range from 135 to 150 degrees Fahrenheit when used as a fire detection device. The analog heat sensor shall support an increased operating range from 32 to 158 degrees Fahrenheit when used as a supervisory device.
2. Analog heat sensors shall have a low profile design, only 2.0" high, including base.

3. Fire test feature shall be built-in.
4. The plastics shall be a PC/ABS blend and shall be resistant to yellowing from prolonged UV exposure. The color shall be bone.

E. Analog Photoelectric Duct Smoke Detector – (DH-98A/R):

1. Analog photo duct smoke sensors shall have a UL listed operating range from .88%/ft. to 2.75%/ft. obscuration across an air velocity range from 300 to 4000 fpm. Analog photo duct smoke sensors that do not support this operating range or velocity capability shall not be acceptable.
2. Optical Fire test feature shall be built-in.
3. The plastics shall be a PC/ABS blend and shall be resistant to yellowing from prolonged UV exposure. The color shall be bone.
4. Analog photo duct smoke sensors shall include two (2) built-in programmable Form C relays, rated at 10 Amps @ 250VAC. An alternate non-relay two-wire model shall also be available that does not require 24VDC input power. The relay model operates on four-wires and requires 24VDC input power.
5. The duct detector housings shall be of metal construction and complete mechanical installation may be performed without removal of detector cover. The duct detector shall not require additional filters or screens which must be maintained. The housing shall contain a base which will accept an analog photoelectric duct sensor head. The housing cover shall be clear for easy inspection. Terminal connections shall be of the screw type and be a minimum of a #6 size screw. For installations requiring relay function (DH98-AR), terminals shall be provided for remote pilot, remote alarm indication, strobe/ horn and remote key switch. A manual reset switch shall be located on front of the device. For installations not requiring relay function (DH98A), visual indication of alarm and power must be provided.
6. The smoke chamber and head shall be removable to allow ease of maintenance and cleaning.

F. Addressable Sounder Base – (ASB):

1. The addressable sounder base shall be fully programmable and operate on an independent SLC address. The ASB shall not require extra control wiring, DIP switches, decade dial (rotary) switches, etc. to link multiple, independent sounder bases, or groups of sounder bases together. The ASB shall accommodate all analog sensors, such as photo, ion, or heat.
2. The addressable sounder base shall be UL listed as an indication device that provides 85 decibels of sound level output at 10 feet and shall have programmable audible patterns for temporal, continuous, or march time.
3. The ASB shall be programmable to operate from any global event category, zone, point, or Cause & Effect logic. The flexible programming and operation shall allow multiple trigger sources for fire alarm, supervisory, and other logic to support hotel and high-rise apartment style applications, all from intelligent addressable output control from the panel.
4. The sounder base shall include support for a remote alarm LED indicator as an option.
5. The ASB shall be self addressing based on the host sensor address it is attached to, not requiring any special device address programming. The ASB shall automatically add 127 plus the detector address to obtain its independent address. The addressable sounder base shall operate in the higher SLC address range from 128 to 254. Systems which cannot automatically address the sounder base, sounder bases that are not fully programmable, or SLC that do not support 254 addresses shall not be accepted.
6. The plastics shall be a PC/ABS blend and shall be resistant to yellowing from prolonged UV exposure. The color shall be bone.

G. Addressable Manual Pull-Station – (AMS):

1. Manual pull stations shall be addressable AMS-series single or dual action models, DCP-AMS, DCP-AMS-KL, DCP-AMS-LP, or DCP-AMS-KL-LP. Models shall be made of 14 AWG CRS and painted with Red enamel. The words Fire Alarm shall be in a contrasting color and be embossed text 1/2" tall. The electronics shall be fully integrated into the manual pull station requiring only connection to the SLC loop of the control panel. Programming of the manual pull station address must be possible with the manual pull station fully installed.
2. Manual pull stations shall be Underwriters Laboratories Inc. Listed, CSFM Approved, and be installed within the limits defined in the American Disabilities Act.
3. The AMS shall have the following features and options:

    a. Addressable integrated design
    b. All metal construction
    c. Single and dual action models available
    d. Extremely easy to operate
    e. Bi-colored status LED indicates Standby and Alarm conditions
    f. Address is programmable in EEPROM
    g. Address can be programmed when installed
    h. Key lock or hex key lock models available
    i. Terminals accept up to 14AWG wire
    j. Surface mount back box available
    k. ADA compliant

H. Addressable Conventional Zone Module – (CZM)

1. Addressable Conventional Zone Module (CZM) shall provide one supervised IDC initiating zone for conventional alarm initiating devices and will connect to the SLC.
2. The CZM shall be suitable for Style D (Class A) or Style B (Class B) operation.
3. The CZM shall provide an address point for a conventional initiating zone (IDC) of up to (25) conventional smoke detectors depending on the model and brand. Conventional devices with a N.O. dry contact output may also be used and do not have a restriction of (25) devices. UL 2-wire compatibility is required on all conventional zone powered devices used on the IDC of the CZM module. Devices with N.O. dry contact output shall not require UL 2-wire compatibility.
4. The CZM shall have a bi-colored LED indicator that flashes green when polled and latches on red (controlled by panel) when activated for alarms.
5. The CZM shall require a 24VDC auxiliary power source to provide IDC power for the conventional zone of detectors.

I. Addressable Dual Input Monitor Module – (DIMM):

1. The DIMM shall provide two (2) independently monitored inputs to connect N.O. dry contact type initiating devices to the SLC. Each input shall be capable of independent operation, such as one input for water-flow (Fire), and the other for valve tamper (Supervisory). The two inputs shall not interfere with each other or require common function and shall be capable of programmable operation, such as water-flow (Fire), valve tamper (Supervisory), manual pull-station (Fire), and other general event categories.
2. The DIMM shall only occupy one (1) SLC address. The two (2) inputs shall be sub-addresses that operate under the single SLC address of the module. An SLC using DIMM shall be capable of (254) inputs when all (127) SLC addresses are used.

3. The DIMM shall operate on Style 4, 6, or 7 SLC. The inputs shall be capable of being programmed for N.O. or N.C contacts, with an option for non-supervised N.C. (no EOL) operation.
4. The DIMM shall have a bi-colored LED indicator for displaying device polling and alarm status.

J. Addressable Single Input/Mini Monitor Modules – (FRCME-4/S/P):

1. Addressable single input modules (FRCME) shall provide a monitored input to connect N.O. dry contact type initiating devices to the SLC. The input shall be capable of programmable operation, such as water-flow (Fire), valve tamper (Supervisory), manual pull-station (Fire), and other general event categories.
2. The FRCME shall operate on Style 4, 6, or 7 SLC. The input shall be capable of being programmed for a N.O. or N.C contact, with an option for non-supervised N.C. (no EOL) operation.
3. The FRCME shall have a bi-colored LED indicator for displaying device polling and alarm status.

K. Addressable Supervised Output Module – (SOM):

1. The SOM shall provide supervision and controlled activation of polarized 24VDC audio/visual notification appliances and other 24VDC powered devices.
2. The SOM shall provide a voltage output rated at 24VDC @ 2.0 Amps. The output shall be wired for Style Y (Class B) operation. The output shall provide reverse polarity operation for supervision of the device circuit. Outputs patterns shall be Temporal, Continuous, and March. There shall be a silence-able option.
3. Audio/visual load power for the SOM shall be provided by a separate supervised 24VDC auxiliary power circuit from the control panel.
4. The SOM shall have 16 different control states and modulation patterns for multi-state programming. The operating parameters for the SOM shall be maintained in the module after device initialization and will not require individual control commands from the control panel during fire conditions to operate. The control panel shall instead broadcast system-wide commands on the SLC and the SOM or group of SOMs will respond based on individual programming allowing simultaneous group device activations from a single control panel command. Systems that do not meet this requirement shall not be acceptable.
5. The SOM shall be programmable to operate from any global event category, zone, point, or Cause & Effect logic. The flexible programming and operation shall allow multiple trigger source options for fire alarm, supervisory, and other logic to support hotel and high-rise apartment style applications, all from intelligent addressable output control from the panel.
6. The SOM shall have a bi-colored LED indicator for displaying device polling and control status.
7. Systems that do not meet the SOM performance criteria shall not be acceptable.

L. Addressable Relay Module:

1. The addressable relay module shall provide controlled relay outputs to connect devices requiring control from the fire system to the SLC. Each output shall be capable of independent operation. The two outputs shall not interfere with each other or require common function and shall be capable of programmable operation such as general event categories, zone control, point control, silence-able option, two output delay options, and Cause & Effect logic control.

2. The module shall only occupy one (1) SLC address. The two (2) outputs shall be sub-addresses that operate under the single SLC address of the module. An SLC using module shall be capable of (254) outputs when all (127) SLC addresses are used.
3. The module shall operate on Style 4, 6, or 7 SLC. The outputs shall be two (2) Form C relay contacts rated at .5 Amps @ 125VAC or 1 Amp 30VDC. The module shall not require a 24VDC auxiliary power supply source.
4. The module shall have 16 different control states for multi-state programming. The operating parameters for the module shall be maintained in the module after device initialization and will not require individual control commands from the control panel during fire conditions to operate. The control panel shall instead broadcast system-wide commands on the SLC and the module or group of modules will respond based on individual programming allowing simultaneous group device activations from a single control panel command. The module shall also have the ability to receive individual commands (non-group commands) from the control panel along with the group command broadcasts. Systems that do not meet this requirement shall not be acceptable.
5. The module shall be programmable to operate from any global event category, zone, point, or Cause & Effect logic. The flexible programming and operation shall allow multiple trigger source options for fire alarm, supervisory, and other logic to support elevator recall, fan/damper control, door holder/lock control, and other building control functions, all from intelligent addressable output control from the panel.
6. The module shall have a bi-colored LED indicator for displaying device polling and control status.
7. Systems that do not meet the module performance criteria shall not be acceptable.

M. Short Circuit Isolator Module – (SCI):

1. The SCI shall be provide automatic isolation of wire-to-wire short circuits on a Class A (Style 6 or 7) SLC or Class B (Style 4) SLC trunk and/or branch circuits. The isolator module shall prevent addressable devices from being rendered inoperative by a short circuit fault on the SLC when used in a NFPA 72-2002 Style 7 configuration. When used in Style 4 or 6 hybrid configurations (i.e. not fully Style 7 compliant), the isolator module shall limit the number of addressable devices from being rendered inoperative by a short circuit fault on the SLC.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the segment of the SLC that is shorted. When the short circuit condition is corrected, the SCI shall automatically reconnect the isolated segment.
3. The SCI shall not require address-setting or an SLC address. The SCI operation shall be completely automatic. It shall not be necessary to replace or reset an SCI after its normal operation. The SCI shall have the ability to be placed anywhere on the SLC and shall not have a limit of how many can placed on a given SLC.
4. The SCI shall provide a single yellow LED that shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.06 SYSTEM COMPONENTS – OTHER DEVICES

A. Audible/Visual Notification Appliances: Audible/visual notification appliances shall meet the applicable requirements of UL464 and UL1971 respectively, and shall be compliant with NFPA72 & ADA guidelines accordingly. All A/V notification appliances shall be UL listed.

2.07 BATTERIES

A. The fire system standby batteries shall have sufficient capacity to provide power to the fire alarm system for not less than twenty-four (24) hours in standby and five (5) minutes of alarm upon a failure of normal AC power and shall comply with UL864 9th Edition and NFPA72-2002 criteria.

B. Batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

C. Battery sizes up to 60AH shall be acceptable and sized per fire alarm system demands and capacities of the individual control panels, network nodes, NAC boosters, auxiliary power supplies, and/or external battery chargers and supplies.

D. If necessary to meet standby requirements system wide, external battery and charger systems may be used. All power supplies and chargers must comply with UL864 9th Edition and/or UL1481 standards, as applicable.

E. All loading for batteries, standby power, and alarm power for the fire alarm system shall be calculated and provided for compliance to this specification. Appropriate battery calculators for applicable control panels, network nodes, NAC boosters, auxiliary power supplies, external battery chargers and supplies, and/or other power sources shall be included with this submittal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be in accordance with the Codes and Standards outlined earlier in this specification, as well as with all local and state codes, per AHJ requirements, as shown on the drawings, and as recommended by the equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system commissioning, programming, and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage, including using the manufacturer’s device dust covers.

C. All fire detection and system devices, control panels, network nodes, remote annunciators, etc. shall be flush mounted where possible when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual pull-stations shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor. Manual pull-station installation shall comply with ADA requirements and all local building codes.

3.02 TEST

A. The service of a competent, factory-certified/trained engineer or technician authorized by FCI/Gamewell for the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system, during initial commissioning, as well as with post installation service and maintenance testing, as applicable. All testing shall be in accordance with NFPA 72-2002, Chapter 10.

B. Before energizing the system, cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation failures.

C. Close each sprinkler system monitor valve and verify proper supervisory operation at the control panel.

D. Verify activation of all water-flow switches and verify proper fire alarm operation at the control panel.

E. Verify all trouble signals for SLC, NAC, system network, system devices and accessories to ensure proper trouble signal actuation and operation.

F. Verify operation of system ground fault detection to ensure proper trouble operation and to prove the fire alarm system is clear of all grounds.

G. Check all notification appliance device operation by performing fire drill tests. Verify proper audibility, synchronization, and tone patterns. Check and confirm proper strobe operation, synchronization, and light intensity. Audible/visual notification appliance installation and operation shall comply with UL864 9th Edition, UL464, UL1971, NFPA72, local codes, and AHJ requirements.

H. Check installation, supervision, and operation of all alarm zones using the walk test function.

I. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the control panel and the correct activation of the control points. The system sequence of operations and logic supplied with the submittal of the fire alarm system per this specification and as required by the local plan check division of the AHJ, shall be tested and verified during final commissioning of the system.

J. When the system is equipped with optional features, the manufacturer's documentation shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar. In general, test methods shall comply with the manufactures instructions and recommendations for the equipment under this specification.

3.03 FINAL INSPECTION

A. At the final inspection, a factory-certified/trained representative for the equipment shall demonstrate that the system functions properly in every respect.

B. The system shall be demonstrated satisfactorily and comply with local AHJ requirements for Temporary Certificate of Occupancy (T.C.O.) and/or Permanent Certificate of Occupancy (C.O.).

C. The final inspection performance and documentation shall comply with local AHJ and NFPA 72 requirements.

1. Upon successful completion of the acceptance or reacceptance inspection and testing, an NFPA 72 Inspection and Testing form shall be completed by the installer. A copy of the form, with signatures, shall be submitted to the Architect of Record, the DSA Project Inspector, the School District and the Local Fire Authority.

D. System operating instructions placard or signage shall be installed at AHJ designated locations for the control panels and annunciators in the system per UL864 9th Edition and NFPA72. The manufacturers system operating instructions shall be used for this purpose.

E. As-built drawings and programming shall be provided upon completion.

3.04 INSTRUCTION

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

C. Appropriate quantities of installation and operation manuals shall be provided and used for instructional purposes.

END OF SECTION

SECTION 311000 - SITE CLEARING

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. Removing existing vegetation.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Removing above and below-grade rock.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Capping existing water wells.
8. Temporary erosion- and sedimentation-control measures.

B. Related Sections:

1. Section 015000 "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities, and temporary erosion- and sedimentation-control measures.
2. Section 017300 "Execution" for field engineering and surveying.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Rock stockpiling program.

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

E. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

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

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

E. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

F. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PRODUCTS

1.7 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 2 - EXECUTION

2.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

2.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

2.3 EXISTING UTILITIES

A. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than **two** days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

2.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of below exposed subgrade.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

2.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

2.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

2.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

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. Preparing subgrades for slabs-on-grade walks, pavements, turf and grasses, and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subbase course and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities.
8. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:

1. Section 013200 "Construction Progress Documentation for recording preexcavation and earth-moving progress.Section 015000 "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
2. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
3. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
4. Section 312319 "Dewatering" for lowering and disposing of ground water during construction.
5. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
6. Section 329300 "Landscape Planting" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Aggregate Base: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Controlled low-strength material, including design mixture.
2. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Warning Tape: 12 inches long; of each color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 1557.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

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

B. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 015000 "Temporary Facilities and Controls," are in place.

C. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

D. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve. Engineered Fill shall be predominately non-expansive with a Plasticity Index less than 10 and an Expansion Index less than 15. Imported Fill material shall be submitted to the Soils Engineer for approval.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of **washed** crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type I or Type II.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
4. Water: ASTM C 94.
5. Air-Entraining Admixture: ASTM C 260.

B. Produce conventional-weight, controlled low-strength material with 140-psi compressive strength when tested according to ASTM C 495.

2.3 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. 12 inches beneath bottom of concrete slabs-on-grade.
    e. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

B. Excavate all loose fill materials up to 6 feet deep identified in the Soils Report

3.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Place on engineered fill. Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.7 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, and waterproofing.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide [4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use engineered fill and class 2 aggregate base.
3. Under building slabs, use engineered fill and class 2 aggregate base.
4. Under footings and foundations, use engineered fill and class 2 aggregate base.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, foundations, and building slabs, overexcavate and recompact top 24 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent. Limits shall extend a minimum of 5 feet beyond proposed footing lines.
2. Under asphalt concrete pavement, concrete flatwork, and other concrete walkways, overexcavate and recompact top 12 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent. Limits shall extend a minimum of 2 feet beyond proposed edges of pavements or concrete work.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 92 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Place base course material over subbase course under hot-mix asphalt pavement.
2. Shape subbase course and base course to required crown elevations and cross-slope grades.
3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according toASTM D 1557.

3.17 DRAINAGE COURSE (AGGERGATE BASE) UNDER CONCRETE SLABS-ON-GRADE

A. Place aggregate base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact aggregate base course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course 6 inches or less in compacted thickness in a single layer.
2. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

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. Cold-applied joint sealants.
2. Hot-applied joint sealants.

B. Related Sections:

1. Section 079200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.
2. Section 321216 "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
3. Section 321313 "Concrete Paving" for constructing joints in concrete pavement.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, Samples of materials that will contact or affect joint sealants.

1. Use manufacturer's standard test method to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit no fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint-preparation data that are based on previous testing, not older than 24 months, of sealant products for compatibility with and adhesion to joint substrates and other materials matching those submitted.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. 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.

C. Pavement-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of joint sealant and accessory, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.

D. Preconstruction Compatibility and Adhesion Test Reports: From joint-sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility with and adhesion to joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.6 QUALITY ASSURANCE

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

B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

D. Preinstallation Conference: Conduct conference at Project site.

1.7 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.
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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide joint sealants, backing materials, 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. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.

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. Crafco Inc., an ERGON company; RoadSaver Silicone.
b. Dow Corning Corporation; 888.
c. Pecora Corporation; 301 NS.

B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.

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. Crafco Inc., an ERGON company; RoadSaver Silicone SL.
b. Dow Corning Corporation; 890-SL.
c. Pecora Corporation; 300 SL.

C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, 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. Pecora Corporation; Urexpan NR-200.

2.3 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant for Concrete: ASTM D 3406.

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. Crafco Inc., an ERGON company; Superseal 444/777.

B. Hot-Applied, Single-Component Joint Sealant for Concrete and Asphalt: ASTM D 6690, Types I, II, and III.

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. Meadows, W. R., Inc.; Sealtight Hi-Spec Sealtight 3405.
b. Right Pointe; D-3405 Hot Applied Sealant.

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.5 PRIMERS

A. Primers: Product 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.

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.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

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. Joint-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 joint-sealant backings of kind indicated to support joint 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 joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place joint sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements 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 joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING

A. Clean off excess joint 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 and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.6 PAVEMENT-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within cement concrete pavement.

1. Joint Location:

    a. Expansion and isolation joints in cast-in-place concrete pavement.
    b. Contraction joints in cast-in-place concrete slabs.
    c. Other joints as indicated.

2. Silicone Joint Sealant for Concrete: Single component, self-leveling.
3. Urethane Joint Sealant for Concrete: Multicomponent, pourable, traffic-grade.
4. Hot-Applied Joint Sealant for Concrete: Single component.
5. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

B. Joint-Sealant Application: Joints between cement concrete and asphalt pavement.

1. Joint Location:

    a. Joints between concrete and asphalt pavement.
    b. Joints between concrete curbs and asphalt pavement.
    c. Other joints as indicated.

2. Hot-Applied Joint Sealant for Concrete and Asphalt: Single component.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 321373

SECTION 323113 - CHAIN LINK FENCES AND GATES

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. Chain-link fences.

a. Galvanized chain link fencing and gates.

2. Gates:

a. Manual swing.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete for concrete fence post setting..

1.3 ACTION SUBMITTALS

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

1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Gates and hardware.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware and operational clearances.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain-link fence, and gate, from manufacturer.

B. Product Test Reports: For framing strength according to ASTM F 1043.

C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:

1. Gate hardware.

1.6 PROJECT CONDITIONS

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

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

1.8 ACCESSIBILITY REQUIREMENTS

A. For door/gate hardware on doors/gates in an 2010 ADA standards accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's, “ICC/ANSI A117.1 HUD's "Fair Housing Accessibility Guidelines" and 2016 Title 24 CBC.

1. Provide operating devices that are operable with one hand and do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

   a. Interior and Exterior, Non-Fire-Rated Hinged Doors and Gates: 5 lbf applied perpendicular to door.
   b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Accessible door handles, pulls, latches, locks and other operable parts on doors and gates shall be operable with one hand and shall not require tight grasping, tight pinching, or twisting of the wrist.
4. Operable parts of such hardware shall be 34 inches minimum to 44 inches maximum above the finished floor or ground.
5. Door and gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum. Door and gate spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed poition in 1.5 seconds minimum.

6. The force for pushing or pulling open a door or gate shall be 5 pounds maximum for interior and exterior hinged doors and gates; and shall not exceed 15 pounds for required fire doors.
7. Floor-mounted door stops and similar obstructions shall be installed at a maximum of 4 inches from the face of a wall, partition, or fence.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire Fabric: Wire with a diameter of 0.192 inch.
    a. Mesh Size: .
    b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied after weaving.
3. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:

1. Fence Height: As indicated on Drawings.
2. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.
    a. Line Post: 2.875 inches.
    b. End, Corner and Pull Post: 2.875 inches.
3. Horizontal Framework Members: Intermediate, top, and bottom rails complying with ASTM F 1043.
    a. Top Rail: 1.66 inches.
    b. Intermediate Rail: 1.66 inches.
    c. Bottom Rail: 1.66 inches.
4. Metallic Coating for Steel Framing:
    a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123 or 4.0-oz./sq. ft. zinc coating per ASTM A 653.

2.3 SWING GATES

A. General: Comply with ASTM F 900 for gate posts and single swing gate types. Provide automated vehicular gates that comply with ASTM F 2200.

1. Gate Leaf Width: As indicated.
2. Gate Fabric Height: As indicated.

B. Pipe and Tubing:

1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence.
2. Gate Posts: Round tubular steel.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

D. Hardware:

1. Hinges: 180-degree outward swing.
2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate. There shall be no padlocking on accessible gates.
3. Provide operating devices that are operable with one hand and do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
4. Comply with the following maximum opening-force requirements:

    a. Interior and Exterior, Non-Fire-Rated Hinged Doors and Gates: 5 lbf applied perpendicular to door.

5. Accessible door handles, pulls, latches, locks and other operable parts on doors and gates shall be operable with one hand and shall not require tight grasping, tight pinching, or twisting of the wrist.
6. Operable parts of such hardware shall be 34 inches minimum to 44 inches maximum above the finished floor or ground.
7. Door and gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum. Door and gate spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed poition in 1.5 seconds minimum.
8. The force for pushing or pulling open a door or gate shall be 5 pounds maximum for interior and exterior hinged doors and gates; and shall not exceed 15 pounds for required fire doors.
9. Floor-mounted door stops and similar obstructions shall be installed at a maximum of 4 inches from the face of a wall, partition, or fence.

2.4 FITTINGS

A. General: Comply with ASTM F 626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

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

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

2.5 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

1. Install fencing on established boundary lines.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

D. Line Posts: Space line posts uniformly at 10 feet o.c.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
2. Extended along top of barbed wire arms and top of fence fabric for supporting barbed tape.

F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

G. Intermediate and Bottom Rails: Install and secure to posts with fittings.

H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.4 GATE INSTALLATION

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

3.5 ADJUSTING

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

B. Lubricate hardware and other moving parts.

END OF SECTION 323113

SECTION 323113 - CHAIN LINK FENCES AND GATES

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. Chain-link fences.

a. Galvanized chain link fencing and gates.

2. Gates:

a. Manual swing.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete for concrete fence post setting..

1.3 ACTION SUBMITTALS

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

1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Gates and hardware.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware and operational clearances.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain-link fence, and gate, from manufacturer.

B. Product Test Reports: For framing strength according to ASTM F 1043.

C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:

1. Gate hardware.

1.6 PROJECT CONDITIONS

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

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

1.8 ACCESSIBILITY REQUIREMENTS

A. Door and gate hardware shall comply with the 2019 CBC and 2019 Title 24 CBC.

1. Provide operating devices that are operable with one hand and do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

a. Interior and Exterior, Non-Fire-Rated Hinged Doors and Gates: 5 lbf applied perpendicular to door.
b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Accessible door handles, pulls, latches, locks and other operable parts on doors and gates shall be operable with one hand and shall not require tight grasping, tight pinching, or twisting of the wrist.
4. Operable parts of such hardware shall be 34 inches minimum to 44 inches maximum above the finished floor or ground.
5. Door and gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum. Door and gate spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed poition in 1.5 seconds minimum.
6. The force for pushing or pulling open a door or gate shall be 5 pounds maximum for interior and exterior hinged doors and gates; and shall not exceed 15 pounds for required fire doors.

7. Floor-mounted door stops and similar obstructions shall be installed at a maximum of 4 inches from the face of a wall, partition, or fence.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire Fabric: Wire with a diameter of 0.192 inch.
    a. Mesh Size: .
    b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied after weaving.
3. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:

1. Fence Height: As indicated on Drawings.
2. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.
    a. Line Post: 2.875 inches.
    b. End, Corner and Pull Post: 2.875 inches.
3. Horizontal Framework Members: Intermediate, top, and bottom rails complying with ASTM F 1043.
    a. Top Rail: 1.66 inches.
    b. Intermediate Rail: 1.66 inches.
    c. Bottom Rail: 1.66 inches.
4. Metallic Coating for Steel Framing:
    a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123 or 4.0-oz./sq. ft. zinc coating per ASTM A 653.

2.3 SWING GATES

A. General: Comply with ASTM F 900 for gate posts and single swing gate types. Provide automated vehicular gates that comply with ASTM F 2200.

1. Gate Leaf Width: As indicated.
2. Gate Fabric Height: As indicated.

B. Pipe and Tubing:

1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence.
2. Gate Posts: Round tubular steel.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

D. Hardware:

1. Hinges: 180-degree outward swing.
2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate. There shall be no padlocking on accessible gates.
3. Provide operating devices that are operable with one hand and do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
4. Comply with the following maximum opening-force requirements:

    a. Interior and Exterior, Non-Fire-Rated Hinged Doors and Gates: 5 lbf applied perpendicular to door.

5. Accessible door handles, pulls, latches, locks and other operable parts on doors and gates shall be operable with one hand and shall not require tight grasping, tight pinching, or twisting of the wrist.
6. Operable parts of such hardware shall be 34 inches minimum to 44 inches maximum above the finished floor or ground.
7. Door and gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum. Door and gate spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed poition in 1.5 seconds minimum.
8. The force for pushing or pulling open a door or gate shall be 5 pounds maximum for interior and exterior hinged doors and gates; and shall not exceed 15 pounds for required fire doors.
9. Floor-mounted door stops and similar obstructions shall be installed at a maximum of 4 inches from the face of a wall, partition, or fence.

2.4 FITTINGS

A. General: Comply with ASTM F 626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

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

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

2.5 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

1. Install fencing on established boundary lines.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

D. Line Posts: Space line posts uniformly at 10 feet o.c.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
2. Extended along top of barbed wire arms and top of fence fabric for supporting barbed tape.

F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

G. Intermediate and Bottom Rails: Install and secure to posts with fittings.

H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.4 GATE INSTALLATION

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

3.5 ADJUSTING

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

B. Lubricate hardware and other moving parts.

END OF SECTION 323113

SECTION 328400 - PLANTING IRRIGATION

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 irrigation system for city water. Provide trenching , backfill and compaction in accordance with Division 31, section “Earth Moving” and Geotechnical Report recommendations. Provide piping and components rated and colored for connecting to municipal recycled water supply:

1. Piping.
2. Encasement for piping.
3. Manual valves.
4. Pressure-reducing valves.
5. Automatic control valves.
6. Automatic drain valves.
7. Transition fittings.
8. Dielectric fittings.
9. Miscellaneous piping specialties.
10. Sprinklers.
11. Quick couplers.
12. Controllers.
13. Boxes for automatic control valves.

B. Related Sections:

1. Section 329200 "Turf and Grasses" for water turf preparation and planting of grasses.
2. Section 329300 “Plants” for plants, soils and tree stabilization.

1.3 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.

C. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 PERFORMANCE REQUIREMENTS

A. Irrigation zone control shall be automatic operation with controller and automatic control valves.

B. Delegated Design: Design 100 percent coverage irrigation system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Available land records indicate the following native soil conditions:

a. Type: Silty sands and sandy silts.
b. Structure: Stiff Soil.

C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:

1. Irrigation Main Piping: 200 psig.
2. Circuit Piping: 150 psig.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For irrigation systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Irrigation systems, drawn to scale, on which components are shown and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions such as signs and light standards.

B. Qualification Data: For qualified Installer.

C. Zoning Chart: Show each irrigation zone and its control valve.

D. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

E. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sprinklers controllers and automatic control valves to include in operation and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

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

1. Spray Sprinklers: Equal to 5 percent of amount installed for each type and size indicated, but no fewer than 25 units.
2. Bubblers: Equal to 5 percent of amount installed for each type indicated, but no fewer than 15 units.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers that include a Professional Technical Class member of the American Society of Irrigation Consultants

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Provide piping and components designed for recycled water system.

B. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

C. Steel Pipe: Where steel materials are used in contact with soil provide polyethylene encasement for corrosion protection.

D. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedules 40 and 80.

1. PVC Socket Fittings: ASTM D 2466, Schedules 40 and 80.
2. PVC Threaded Fittings: ASTM D 2464, Schedule 80.
3. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.

E. PVC Pipe, Pressure Rated: ASTM D 2241, PVC 1120 compound, SDR 21 and SDR 26.

1. PVC Socket Fittings: ASTM D 2467, Schedule 80.
2. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.

2.2 PIPING JOINING MATERIALS

A. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.3 MANUAL VALVES

A. Curb Valves:

1. Description:

a. Standard: AWWA C800.
b. NPS 1 and Smaller Pressure Rating: 100 psig minimum.
c. NPS 1-1/4 to NPS 2 Pressure Rating: 80 psig minimum.
d. Body Material: Brass or bronze with ball or ground-key plug.
e. End Connections: Matching piping.
f. Stem: With wide-tee head.

B. Curb-Valve Casing:

1. Standard: Similar to AWWA M44 for cast-iron valve casings.
2. Top Section: Telescoping, of length required for depth of burial of curb valve.
3. Barrel: Approximately 3-inch diameter.
4. Plug: With lettering "WATER."
5. Bottom Section: With base of size to fit over valve.
6. Base Support: Concrete collar.

C. Shutoff Rods for Curb-Valve Casings: Furnish **two** steel, tee-handle shutoff rod(s) with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve for Project.

D. Bronze Ball Valves:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded or solder joint if indicated.
f. Seats: PTFE or TFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Full or regular, but not reduced.

E. Bronze Gate Valves:

1. Description:

a. Standard: MSS SP-80, Type 2.
b. Class: 125.
c. CWP Rating: 200 psig/
d. Body Material: ASTM B 62 bronze with integral seat and screw-in bonnet.
e. Ends: Threaded or solder joint.
f. Stem: Bronze, nonrising.
g. Disc: Solid wedge; bronze.
h. Packing: Asbestos free.
i. Handwheel: Malleable iron, bronze, or aluminum.

F. Operating Wrenches for Iron Gate Valve Casings: Furnish two steel, tee-handle operating wrench(es) with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut for Project.

2.4 PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Description:

a. Standard: ASSE 1003.
b. Body Material: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
c. Pressure Rating: Initial pressure of 150 psig.
d. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.5 AUTOMATIC CONTROL VALVES

A. Bronze, Automatic Control Valves:

1. Description: Cast-bronze body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.

2.6 AUTOMATIC DRAIN VALVES

A. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig

2.7 TRANSITION FITTINGS

A. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings:

1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

C. Plastic-to-Metal Transition Fittings:

1. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-socket or threaded end.

D. Plastic-to-Metal Transition Unions:

1. Description: MSS SP-107, PVC four-part union. Include one brass or stainless-steel threaded end, one solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Description: Factory-fabricated union, NPS 2 and smaller.

a. Pressure Rating: 150 psig minimum at 180 deg F.
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.

a. Pressure Rating: 150 psig.
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.

a. Pressure Rating: 150 psig.
b. Gasket: Neoprene or phenolic.
c. Bolt Sleeves: Phenolic or polyethylene.
d. Washers: Phenolic with steel backing washers.

2.9 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI WH 201, with bellows or piston-type pressurized cushioning chamber and in sizes complying with PDI WH 201, Sizes A to F.

B. Pressure Gages: ASME B40.1. Include 4-1/2-inch-diameter dial, dial range of two times system operating pressure, and bottom outlet.

2.10 SPRINKLERS

A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

B. Plastic, Pop-up, Gear-Drive Rotary Sprinklers:

1. Description:

a. Body Material: ABS.
b. Nozzle: Brass.
c. Retraction Spring: Stainless steel.
d. Internal Parts: Corrosion resistant.

2. Capacities and Characteristics:

a. Flow: As required by sprinkler system design.
b. Pop-up Height: 4 inches aboveground to nozzle.
c. Arc: As required.
d. Radius: As required.
e. Inlet: NPS 1/2 or NPS 3/4.

C. Plastic, Surface Spray Sprinklers:

1. Description:

a. Body Material and Flange: ABS.
b. Pattern: Fixed, with flow adjustment.

D. Plastic, Pop-up Spray Sprinklers:

1. Description:

a. Body Material: ABS.
b. Nozzle: Brass.
c. Retraction Spring: Stainless steel.
d. Internal Parts: Corrosion resistant.
e. Pattern: Fixed, with flow adjustment.

2. Characteristics:

a. Nozzle: Brass.
b. Pop-up Height: 4 inches aboveground to nozzle.
c. Arc: As required.

E. Plastic Shrub Sprinklers:

1. Description:

a. Body Material: ABS or other plastic.
b. Pattern: Fixed, with flow adjustment.

2.11 QUICK COUPLERS

A. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.

1. Locking-Top Option: Vandal-resistant locking feature. Include two.

2.12 CONTROLLERS

A. Description:

1. Controller Stations for Automatic Control Valves: Each station is variable from approximately 5 to 60 minutes. Include switch for manual or automatic operation of each station.
2. Exterior Control Enclosures: NEMA 250, Type 4, weatherproof, with locking cover and two matching keys; include provision for grounding.

a. Body Material: Stainless-steel sheet metal.
b. Mounting: Surface type for wall.

3. Control Transformer: 24-V secondary, with primary fuse.
4. Timing Device: Adjustable, 24-hour, 14-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, or to operate two or more times daily.

a. Manual or Semiautomatic Operation: Allows this mode without disturbing preset automatic operation.
b. Nickel-Cadmium Battery and Trickle Charger: Automatically powers timing device during power outages.
c. Surge Protection: Metal-oxide-varistor type on each station and primary power.

5. Moisture Sensor: Adjustable from one to seven days, to shut off water flow during rain.
6. Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial.

a. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
b. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
c. Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.

7. Concrete Base: Reinforced precast concrete not less than 36 by 24 by 4 inches thick, and 6 inches greater in each direction than overall dimensions of controller. Include opening for wiring.

2.13 BOXES FOR AUTOMATIC CONTROL VALVES

A. Polymer-Concrete Boxes:

1. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.

   a. Size: As required for valves and service.
   b. Shape: Rectangular.
   c. Sidewall Material: Polymer concrete with lateral and vertical sidewall design loading of 5000 lb minimum over 10 by 10 inches square.
   d. Cover Material: Polymer concrete with cover design loading of 5000 lb minimum over 10 by 10 inches square.

      1) Lettering: "IRRIGATION.

B. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch minimum to 3 inches maximum.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

B. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.

C. Provide minimum cover over top of underground piping according to the following:

1. Irrigation Main Piping: Minimum depth of 36 inches below finished grade, or not less than 18 inches below average local frost depth, whichever is deeper.
2. Circuit Piping: 12 inches.
3. Drain Piping: 12 inches.
4. Sleeves24 inches.

3.2 PREPARATION

A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.

3.3 PIPING INSTALLATION

A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.

C. Install piping free of sags and bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

E. Install fittings for changes in direction and branch connections.

F. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.

G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.

H. Install underground thermoplastic piping according to ASTM D 2774.

I. Install expansion loops in control-valve boxes for plastic piping.

J. Lay piping on solid subbase, uniformly sloped without humps or depressions.

K. Install PVC piping in dry weather when temperature is above 40 deg F Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.

L. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.

M. Install piping in sleeves under parking lots, roadways, and sidewalks.

N. Install sleeves made of Schedule 80 PVC pipe and socket fittings, and solvent-cemented joints.

O. Install transition fittings for plastic-to-metal pipe connections according to the following:

1. Underground Piping:

    a. NPS 1-1/2 and Smaller: Plastic-to-metal transition fittings.
    b. NPS 2 and Larger: AWWA transition couplings.

2. Aboveground Piping:

    a. NPS 2 and Smaller: Plastic-to-metal transition fittings.
    b. NPS 2 and Larger: Use dielectric flange kits with one plastic flange.

P. Install dielectric fittings for dissimilar-metal pipe connections according to the following:

1. Underground Piping:

    a. NPS 2 and Smaller: Dielectric coupling or dielectric nipple.
    b. NPS 2-1/2 and Larger: Prohibited except in control-valve box.

2. Aboveground Piping:

    a. NPS 2 and Smaller: Dielectric union.
    b. NPS 2-1/2 to NPS 4: Dielectric flange.
    c. NPS 5 and Larger: Dielectric flange kit.

3. Piping in Control-Valve Boxes:

    a. NPS 2 and Smaller: Dielectric union.
    b. NPS 2-1/2 to NPS 4: Dielectric flange.
    c. NPS 5 and Larger: Dielectric flange kit.

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Flanged Joints: Select rubber gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
3. PVC Nonpressure Piping: Join according to ASTM D 2855.

3.5 VALVE INSTALLATION

A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.

B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.

1. Install valves and PVC pipe with restrained, gasketed joints.

C. Aboveground Valves: Install as components of connected piping system.

D. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves.

E. Throttling Valves: Install in underground piping in boxes for automatic control valves.

F. Drain Valves: Install in underground piping in boxes for automatic control valves.

3.6 SPRINKLER INSTALLATION

A. Install sprinklers after hydrostatic test is completed.

B. Install sprinklers at manufacturer's recommended heights.

C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries unless otherwise indicated.

3.7 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

A. Equipment Mounting: Install exterior freestanding controllers on precast concrete bases.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Install control cable in same trench as irrigation piping and at least 2 inches below piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.

3.8 CONNECTIONS

A. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.

B. Connect wiring between controllers and automatic control valves.

3.9 IDENTIFICATION

A. Identify system components. Identify plumbing piping and and equipment.

B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.

1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Section 312000 "Earth Moving" for warning tapes.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Any irrigation product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that controllers are installed and connected according to the Contract Documents.
3. Verify that electrical wiring installation complies with manufacturer's submittal.

3.12 ADJUSTING

A. Adjust settings of controllers.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

3.13 CLEANING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

3.14 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic control valves and controllers.

3.15 PIPING SCHEDULE

A. Design all piping for a recycled water system, color shall be purple to identify recycled water piping.

B. Install components having pressure rating equal to or greater than system operating pressure.

C. Piping in control-valve boxes and aboveground may be joined with flanges or unions instead of joints indicated.

D. Underground irrigation main piping, NPS 4 and smaller, shall be one of the following:

1. Schedule 40, PVC pipe and socket fittings, and solvent-cemented joints.
2. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.
3. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.

E. Underground irrigation main piping, NPS 5 and larger, shall be[one of] the following:

1. Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.
2. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.

F. Circuit piping, NPS 2 and smaller, shall be one of the following:

1. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
2. SDR 26, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

G. Circuit piping, NPS 2-1/2 to NPS 4 (, shall be one of the following:

1. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
2. SDR 26, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

H. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.

1. Option: Plastic swing-joint assemblies, with offsets for flexible joints, manufactured for this application.

I. Risers to Aboveground Sprinklers and Specialties: Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.

J. Drain piping shall be one of the following:

1. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
2. SDR 21, 26, or 32.5, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

3.16 VALVE SCHEDULE

A. Underground, Shutoff-Duty Valves: Use the following:

1. NPS 2 and Smaller: Curb valve, curb-valve casing, and shutoff rod.
2. NPS 3 and Larger: Iron gate valve, resilient seated; iron gate valve casing; and operating wrench(es).

B. Aboveground, Shutoff-Duty Valves:

1. NPS 2 and Smaller: Brass or bronzeball valve.
2. NPS 2 and Smaller: Bronze gate valve.

C. Throttling-Duty Valves:

1. NPS 2 (DN 50) and Smaller: Bronzeautomatic control valve.
2. NPS 2-1/2 and NPS 3: Bronze automatic control valve.

D. Drain Valves:

1. NPS 1/2 and NPS 3/4: Automatic drain valve.
2. NPS 1 to NPS 2: Brass or bronze ball valve.

END OF SECTION 328400

SECTION 329200 - TURF AND GRASSES

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. Turf preparation.
2. Grass seeding and maintenance.
3. Erosion control.

B. Related Requirements:

1. Section 312000 "Earthmoving" for excavating, filling, rough grading, subsurface aggregate drainage and drainage backfill.
2. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and root/weed barriers.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329115 "Soil Preparation (Performance Specification)" and drawing designations for planting soils.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 INFORMATIONAL SUBMITTALS

A. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of artificial grass

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Pesticide Applicator: State licensed, commercial..

1.7 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.8 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

1. Full Sun: Bermudagrass (Cynodon dactylon).

2.2 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.3 MULCHES

A. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

B. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.4 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.5 EROSION-CONTROL MATERIALS

A. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. Uniformly amend the topsoil in turf grass and planting areas per the following and per the approved modifications as a result of the soils analysis recommendations:

1. Turf and Non-Sloped Planting Area Soil Conditioning (per 1,000 square feet).

a. Compost at a rate of six (6) cubic yards.
b. Gypsum shall be applied at a rate of 200 pounds. The Gypsum shall be applied prior to finish grading.
c. Tri-C Premium Humate soil conditioner at a rate of fifteen (15) pounds.
d. Apply pre-planting fertilizer at a rate of 1 pound of actual N.
e. Apply Tri-C Endo 120 per Subsection 3.6, Mycorrhizae Application.

B. Till soil amendments into the planting soil to a minimum depth of six (6) inches. Perform the cultivation in at least one pass in each perpendicular direction so that the amendments are homogeneously incorporated into the topsoil. All cultivation inside the drip line of existing trees shall be preformed manually.

C. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade.

1. Reduce elevation of planting soil to allow for soil thickness of sod.

D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 HYDROSEEDING

A. Hydroseeding: Mix specified seed, commercial fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.6 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third 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. Schedule initial and subsequent mowings to maintain the following grass height:
1. Mow Bermuda grass to a height of 1/2 to 1 inch.

D. Turf Post fertilization: Apply commercial fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.7 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.8 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.9 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.10 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Seeded Turf: 60 days from date of Substantial Completion.

a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

END OF SECTION 329200

SECTION 329300 - PLANTS

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. Plants and planting.
2. Planting soils.
3. Tree stabilization.
4. Root and weed barriers.

B. Related Sections:

1. Section 311000 "Site Clearing" for protection of existing trees and plantings, topsoil stripping and stockpiling, and site clearing.
2. Section 312000 "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
3. Section 329300 “Turf and Grasses” for turf preparation and planting of grasses.

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by the American Nursery & Landscape Association (ANSI Z60.1) for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

F. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

G. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

H. Finish Grade: Elevation of finished surface of planting soil.

I. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

J. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

K. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

L. Planting Area: Areas to be planted.

M. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

N. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

O. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

P. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

Q. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

R. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

S. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including soils.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
3. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph.

B. Samples for Verification: For each of the following:

1. Trees and Shrubs: When requested by the Architect or Owner’s Representative, maintain approved samples on-site as a standard for comparison.
2. Mulch: 1-pint volume of each mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
3. Weed Control Barrier: 12 by 12 inches.
4. Root Barrier: Width of panel by 12 inches.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Material Test Reports: For existing in-place surface soil and imported or manufactured topsoil.

D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

E. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants with a current California Contractor’s A or C27 License.

B. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Fertility Analysis: The Contractor shall provide an pay for a fertility analysis of the existing topsoil and any proposed import planting topsoil. The samples shall be collected for the fertility analysis by collecting a minimum of 5 representative samples of the soil throughout the area of work. Each sample shall be a minimum of one pint each, and shall be thoroughly mixed together to prepare a homogenous sample. A one quart sample shall be submitted to the soil testing laboratory as a representative sample for fertility analysis. For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
2. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
3. Report suitability of tested soil for plant growth.

    a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

D. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1. Selection of plants purchased under allowances will be made by Architect, who will tag plants at their place of growth before they are prepared for transplanting.

E. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

F. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

G. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

C. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

E. Handle planting stock by root ball.

F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

G. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.

3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of each service or utility.
2. Do not proceed with interruption of services or utilities without Owner's written permission.

C. Planting Restrictions: Warm-season turfgrass seed/stolon planting shall be performed between May 1st and August 1st , or as recommended by the turfgrass supplier. Any turfgrass seed application outside of the above period shall be an approved cool-season turfgrass variety, blend or mix.

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.9 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
b. Structural failures including plantings falling or blowing over.
c. Faulty performance of tree stabilization.

2. Warranty Periods from Date of Planting Completion:

    a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
    b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
    c. Annuals: Three months.

3. Include the following remedial actions as a minimum:

    a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
    b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
    c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
    d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.10 MAINTENANCE SERVICE

A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

    1. Maintenance Period: Six months from date of planting completion.

B. Initial Maintenance Service for Turfgrass, Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

    1. Maintenance Period: Six months from date of planting completion.

C. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

E. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

F. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

2.3 SOIL AMENDMENTS

A. "Blended Compost" as supplied by Earthwise Organics (559) 275-3300; "WonderGrow Compost" by Grover, Inc. (866) 764-5765, or equivalent and conforming to the following minimums:

1. Certified as "Mature" or better per the California Compost Quality Council Maturity Index.
2. Pass EPA Class A standards for pathogens and heavy metals.
3. Particle size: "114" maximum.

4. pH: 6.5-8.0.
5. Macro-nutrients: Minimum of 1.0% Nitrogen, 0.5% Phosphorus, 0.5% Potassium.
6. Organic content greater than 25% dry weight.
7. AdIndex ratio greater than 2.
8. Carbon/Nitrogen ratio: less than or equal to 25.
9. Salinity (ECe): less than 5.0 dS/m.

B. Gypsum shall be mined agricultural grade gypsum composed of no less than 75% pure CAS042H20 hydrated calcium sulfate. Elemental Sulfur shall be 95% pure agricultural grade.

C. Terra C Dry Humate organic soil conditioner comprised of 70% humic acid from Leonardite by Superior Soil Supplements, (559) 584-7695- or equivalent.

D. Tri-C Endo 120 Mycorrhizae containing a minimum 60,000 living propagules per pound of glomus intraradices by Tri-C Enterprises, (800) 927-3311, or equivalent.

2.4 FERTILIZER

A. Trees and Shrubs: Fertilizer for all trees and shrubs to be BEST PAKS (20-10-5) controlled release fertilizer in a biodegradable 10 oz. packet. The BEST P AKS shall be applied at the following rate:

1 Gallon Can	1 Best-Pak
5 Gallon Can	5 Best-Paks
15 Gallon Can	10 Best-Paks
Boxed sizes	4 Best-Paks per 1/2" of trunk caliper

B. The pre-plant fertilizer shall be a commercial homogeneous, granular pellet:

1. Pre-plant fertilizer for turf grass shall be:
   a. Best 6-24-24-5S XB+ with Avail
2. Pre-plant fertilizer for mixed plantings shall be:
   a. Best Landscape Color 14-14-14 (14-6-11.6-3S and micronutrients) with 9.9% slow release N, or equal.

C. The maintenance fertilizer shall be a commercial homogeneous, granular pellet:

1. Maintenance fertilizer for general turf grass shall be Best Nitex 19-3-5-7S-3.4Fe, or equal.
2. Maintenance fertilizer for mixed plantings shall be the pre-planting fertilizer.

D. Fertilizer material type and analysis may be subject to change based on the recommendations from the horticultural soil testing lab.

2.5 PLANTING SOILS

G. Planting Soil: Imported topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from, agricultural lands, bogs, or marshes.

1. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes; grubs; or other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled pore space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.
2. Mix imported topsoil or manufactured topsoil with the following soil amendments and fertilizers to produce planting soil:

2.6 MULCH

A. Shredded and aged greenwaste material without leaves, green wood, sticks, dirt, dust and other debris as accepted by the Landscape Architect. Particle size 112" to 1" in general size.

2.7 WEED-CONTROL BARRIERS

A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.

B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd.

2.8 PESTICIDES

A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.9 STAKING & GUYING MATERIALS

A. Stakes: 2" Diameter lodgepole pine, pressure treated and pointed one end.

B. Ties: V.LT. Cinch Tie, 32 inches long, V.LT. Products, Inc. (619) 673-1760, or equivalent.

2.10 MISCELLANEOUS PRODUCTS

A. Root Barrier: A ribbed polyethylene panel of minimum 0.080" thickness equal to Deep Root Partners #UB 24-2 PANEL, (800) 458-7668.

B. Tree Trunk Protector: ArborGard+ Polyenthylene Tree Guard by Dimex (800) 334-3776.

C. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

D. Burlap: Non-synthetic, biodegradable.

E. Planter Drainage Gravel: Washed, sound crushed stone or gravel complying with ASTM D 448 for Size No. 8.

F. Planter Filter Fabric: Woven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.

G. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 WEED CONTROL

A. The Contractor shall treat all proposed new turf and planting areas with a post-emergent contact weed killer at manufacturer's approved rates prior to any commencement of work at the site including any irrigation work. Areas planned for seed planting shall receive "grow and kill" weed removal as outlined below.

B. Weed eradication shall be ongoing throughout the course of the landscape installation. The Contractor shall apply a post-emergent contact weed killer to eradicate all weeds that are existing or have germinated up to and throughout the maintenance period. At no time will weeds be allowed to become established. Contractor shall provide all weed control operations as directed by the Owner's Representative.

C. All weed control operations and chemical usage shall comply with the State and Owner Standards as well as AB2260 "Healthy Schools Act of 2000" for the California School Integrated Pest Management Program. All products provided and installed by the Contractor shall comply with the "Healthy Schools Act of2000".

D. Perform clearing and weed control for non-sloping areas planned to receive planting as follows:

1. Apply irrigation to encourage weed growth prior to clearing, and to maintain moisture in the soil.
2. Apply a contact herbicide to weed foliage. Remove weeds and expose bare soil.
3. Lightly disk/till to a depth of three-inches, followed by a light roller.
4. Perform one "grow and kill" operation after the first disking/tillage:

    a. Water and lightly fertilize to encourage weed germination.
    b. Follow with a second application of a contact herbicide.
    c. Remove weeds and perform a light harrowing or disking.

5. Apply irrigation to encourage weed growth. If additional weeds germinate, perform a second "grow and kill" operation.
6. Once existing weeds are completely removed, obtain authorization from the Owner's Representative to proceed with finish grading and soil conditioning operations.

E. Just prior to turf grass stolon application, and/or after the shrub/ground cover planting is complete and prior to mulch installation, apply a pre-emergent herbicide per the manufacturer's recommended rates.

3.3 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.4 SOIL CONDITIONING

A. Before commencement of any soil conditioning, weed removal shall be completed as outlined above.

B. Uniformly amend the topsoil in turf grass and planting areas per the following and per the approved modifications as a result of the soils analysis recommendations:

1. Turf and Non-Sloped Planting Area Soil Conditioning (per 1,000 square feet).

a. Compost at a rate of six (6) cubic yards.
b. Gypsum shall be applied at a rate of 200 pounds. The Gypsum shall be applied prior to finish grading.
c. Tri-C Premium Humate soil conditioner at a rate of fifteen (15) pounds.
d. Apply pre-planting fertilizer at a rate of 1 pound of actual N.
e. Apply Tri-C Endo 120 per Subsection 3.6, Mycorrhizae Application.

C. Till soil amendments into the planting soil to a minimum depth of six (6) inches. Perform the cultivation in at least one pass in each perpendicular direction so that the amendments are homogeneously incorporated into the topsoil. All cultivation inside the drip line of existing trees shall be preformed manually.

D. Planting backfill for trees and shrubs shall be a mix of two-thirds native soil and onethird Compost by volume. Add Tri-C Premium Humate and Endo 120 Mycorrhizae at 5 pounds each.

3.5 PLANTING AREA ESTABLISHMENT

B. Loosen subgrade of planting areas to a minimum depth of 12 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Spread planting soil to a depth of 6 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

a. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches. Spread remainder of planting soil.

C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.6 MYCORRHIZAE APPLICATION

A. After fine grading is completed, broadcast Tri-C Endo 120 Mycorrhizae at a rate of one and one half (1-112) pound per 1,000 square feet (60 lbs per acre). Lightly rake into the top one inch (1") of topsoil immediately prior to turf grass sod/seed installation.

B. In shrub and/or ground cover planting areas, the Mycorrhizae inocculant may be incorporated into the soil with the other soil amendments per Subsection 3.4, Soil Conditioning.

3.7 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

1. Excavate approximately three times as wide as ball diameter.
2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
5. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected after working hours.
8. If drain tile is shown on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Subsoil and topsoil removed from excavations may be used as planting soil.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.8 TREE, SHRUB, AND VINE PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Use planting soil for backfill.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Set stock plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Use planting soil for backfill.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Set fabric bag-grown stock plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Use planting soil for backfill.
2. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

F. Set and support bare-root stock in center of planting pit or trench with root flare 1 inch above adjacent finish grade.

1. Use planting soil for backfill.
2. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots.
3. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside soil-covered roots about 1 inch from root tips; do not place tablets in bottom of the hole or touching the roots.
4. Continue backfilling process. Water again after placing and tamping final layer of soil.

G. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.9 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.10 TREE STABILIZATION

A. Install trunk stabilization as follows unless otherwise indicated:

1. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
2. Use two stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; three stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.
3. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
4. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

B. Staking and Guying: Stake and guy trees more than 14 feet in height and more than 3 inches in caliper unless otherwise indicated. Securely attach no fewer than three guys to stakes 30 inches long, driven to grade.

1. Site-Fabricated Staking-and-Guying Method:

    a. For trees more than 6 inches in caliper, anchor guys to wood deadmen buried at least 36 inches below grade. Provide turnbuckle for each guy wire and tighten securely.
    b. Support trees with bands of flexible ties at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.
    c. Support trees with strands of cable or multiple strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.
    d. Attach flags to each guy wire, 30 inches above finish grade.
    e. Paint turnbuckles with luminescent white paint.

2. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

C. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.

1. Wood Hold-Down Method: Place vertical stakes against side of root ball and drive them into subsoil; place horizontal wood hold-down stake across top of root ball and screw at each end to one of the vertical stakes.

    a. Install stakes of length required to penetrate at least to the dimension shown on Drawings below bottom of backfilled excavation. Saw stakes off at horizontal stake.
    b. Install screws through horizontal hold-down and penetrating at least 1 inch (25 mm) into stakes. Predrill holes if necessary to prevent splitting wood.

c. Install second set of stakes on other side of root trunk for larger trees as indicated.

2. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

3.12 ROOT-BARRIER INSTALLATION

A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways unless otherwise shown on Drawings.

B. Align root barrier vertically and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.

C. Install root barrier continuously for a distance of 60 inches in each direction from the tree trunk, for a total distance of 10 feet per tree. If trees are spaced closer, use a single continuous piece of root barrier.

1. Position top of root barrier flush with finish grade or per manufacturer's recommendations.
2. Overlap root barrier a minimum of 12 inches at joints.
3. Do not distort or bend root barrier during construction activities.
4. Do not install root barrier surrounding the root ball of tree.

3.13 PLANTING IN PLANTERS

A. Place a layer of drainage gravel at least 4 inches thick in bottom of planter. Cover bottom with filter fabric and wrap filter fabric 6 inches up on all sides. Duct tape along the entire top edge of the filter fabric, to secure the filter fabric against the sides during the soil-filling process.

B. Fill planter with planting soil. Place soil in lightly compacted layers to an elevation of 1-1/2 inches below top of planter, allowing natural settlement.

3.14 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated in even rows with triangular spacing.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.15 PLANTING AREA MULCH

A. Install a minimum 3” layer of mulch in all planting areas, except for slopes greater than 3:1 and seeded areas. Install a minimum 2” layer of mulch in all areas receiving flatted plants, and in the watering basin of trees and shrubs.

B. Install a minimum 2” layer of wood mulch at a 3’ radius from the tree trunk of existing trees located in new turfgrass areas.

3.16 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated past management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.17 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.18 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.19 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 329300

SECTION 331116 - SITE WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Domestic water line(s), valves and boxes, fittings, fire hydrants, meters and appurtenances, anchorages, yard hydrants.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General Supplementary Conditions and Division 00 and 01 Sections, apply to this work.

B. Section 31 20 00 - Excavation.

C. Section 31 20 00 – Trenching and Backfilling.

D. Section 32 13 13 – Site Concrete Improvements.

E. County of Madera Public Works Standard Plans and Specifications for Offsite Water Improvements

1.3 REFERENCES

A. ANSI/ASTM D1557 – Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

B. ANSI/ASTM D2466 – Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

C. ANSI/AWWA C500 – Gate Valves, 3 through 48 in NPS, for Water and Sewage Systems.

D. ANSI/AWWA C900 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.

E. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipes, Schedule 40, 80, and Class 200.

F. ASTM D2855 – Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.

G. ASTM D3139 – Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

C. Manufacturer’s Certificate: Certify that products meet or exceed specified requirements.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 33 00 – Submittal Procedures.

B. Accurately record actual locations of piping mains, valves, connections, and appurtenances.

C. Identify and describe unexpected variations to subsoil conditions and discovery of uncharted utilities or utilities found at locations different that indicated on plans.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with product manufacturer's recommendations and these Contract Documents.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle all products required.

PART 2 PRODUCTS

2.1 WATER PIPE

A. PVC Pipe (4" and larger, underground): ANSI/AWWA C900 Class 305, 1120 high impact.

1. Fittings: ANSI/AWWA C111, cast iron.
2. Joints: ASTM D3139 compression gasket ring.

B. PVC Pipe (3" and smaller, underground) : ASTM D1785 Schedule 40 with solvent welded joints. Pipe shall be installed in conformance with manufacturer's recommendations.

1. PVC Molded Fittings: ASTM D2466

2.2 GATE VALVES – UP TO 2 INCHES (50mm)

A. Use full port ball valves for 2" and smaller and gate valves for 2-1/2" and larger size.

B. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends.

2.3 GATE VALVES –2-1/2 INCHES (63mm) AND OVER

A. ANSI/AWWA C500, Iron body, bronze trim, non-rising stem with square nut or control handle wheel, single wedge, threaded or flanged.

2.4 VALVE BOXES

A. Precast Reinforced Concrete. Cast iron lid marked for service. Christy G5 or approved equal.

2.5 ACCESSORIES

A. Concrete for Thrust Blocks and Valve Box Surface Collars: Concrete type specified in Section 033000.

B. Valve Boxes and Covers: Christy No. G5 traffic box, or approved equal. Cover marking shall read “Water”. A one piece PVC riser extension shall be provided as necessary to allow unobstructed access to valve operating nut.

C. Solvent Cement and Primer for PVC Pipe and Fittings: Per ASTM F656 and ASTM D2564.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions. All plot dimensions are approximate. Before proceeding with any work, carefully check and verify all dimensions and report any variations to the Engineer.

B. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. Carefully investigate the structural and finished conditions affecting all work, and plan work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Drawings are diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner, so that conflicts between water systems, planting, and architectural features will be minimized.

C. Do not install the facilities as indicated on the drawings when it is obvious in the field that unknown obstructions might not have been considered in the engineering. Such obstructions or differences should be brought to the attention of the Engineer.

D. Verify that trench cut and excavation base are ready to receive Work, and excavations, dimensions, and elevations are as shown on Shop Drawings and as indicated on the Drawings.

E. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Prepare for pipe installation by assembling all needed materials.

B. Cover all PVC pipe during storage.

C. Excavate trench, pit or hole in accordance with Section 312000 for work of this Section.

D. Hand trim excavations to required elevations. Correct over excavation by placing bedding material at bottom of excavations, level soil materials in continuous layers not exceeding 6 inches uncompacted depth.

E. Backfill around sides and to a level six inches above the top of pipe with bedding sand, tamped in place.

F. Maintain optimum moisture content of bedding material to attain required compaction density.

G. Remove large stones or other hard matter which could damage waterline or impede consistent backfilling or compaction.

3.3 INSTALLATION – PIPE AND FITTINGS

A. Install pipe at locations and depths indicated on plans.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions.

C. Route pipe in straight line, whenever possible. All changes in direction of pipes shall be made with fittings, not by bending.

D. Install pipe to allow for expansion and contraction without stressing pipe or joints.

E. Form and place concrete for thrust blocks at each elbow, tee, angle or other significant change in direction in loose-joint pipe, per detail on plans.

F. Establish elevations of buried piping to ensure not less than 30 inches of cover, except at connections to existing lines, which may be shallower or deeper, or where shown otherwise on plans.

G. When two water pipes are to be installed in same trench, maintain 4 inch horizontal clearance between pipes.

H. Place pipe on minimum 4-inch deep bed of compacted granular material.

I. Pipe shall be laid, assembled, and pipe connections shall be made in full conformance with AWWA C900 and the pipe manufacturer's requirements and recommendations.

J. Backfill trench or other excavation in accordance with Section 312000.

K. Install granular material at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches.

L. Place select backfill material in maximum 6-inch lifts, consolidating each lift. Jetting of backfill material shall not be permitted.

3.4 INSTALLATION – VALVES

A. Set valves on solid bearing.

B. A valve box shall be provided for every gate valve. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished pavement, ground surface or such other level as may be directed.

C. Pour concrete collar around top of valve box per detail on plans.

D. Furnish and install valves and valve boxes in addition to those shown on plans as required for isolation of lines for construction and disinfection, while minimizing disruption of service to buildings, at no additional cost to Owner.

3.5 INSTALLATION – THREADED CONNECTIONS

A. Assemble all plastic and galvanized steel threaded pipe and fittings using an approved Teflon tape applied to the male threads only. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved Teflon tape will be required.

B. At all plastic (PVC) pipe connections, work the ductile iron connections first. Connections shall always be plastic into steel, never steel to plastic.

C. A non-hardening sealant and lubricant similar to Permatex #51 or LASCO blue pipe sealant may be used in lieu of Teflon tape. Apply sealant to clean male threads brushing into grooves and to the first three threads of the female threads.

D. The cutting of the pipe for inserting of valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or to any lining, with the ends left reasonably smooth and at right angles to the axis of the pipe.

3.6 DISINFECTION OF DOMESTIC WATER PIPING

A. Prior to acceptance of the waterline improvements, the water mains and appurtenances shall be disinfected.

B. The Contractor shall perform the disinfection procedure in strict accordance with AWWA Standard C601, " AWWA Standard for Disinfecting Water Mains", and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and witnesses by a representative of the Architect. During the procedure signs shall be posted at each water outlet stating, "Chlorination – Do not Drink".

D. Following chlorination, all treated water shall be thoroughly flushed from the disinfected pipe at its extremity until the replacement water throughout its length shall, upon test, be proved comparable to the quality of water served from the existing water supply system.

F. The Contractor shall furnish and install all equipment, pipe, valves, fittings, and appurtenances necessary to disinfect and flush the water mains and service line by the method approved by the Architect. The flushing schedule utilized by the contractor shall be designed to prevent damage to the water distribution system. Care must also be taken to obtain proper flushing velocities and also to properly dispose of the flushing water. The main is to be flushed until the water is clear and the chlorine residual is equal to the residual in the flushing water. The flushing schedule shall be submitted by the Contractor to the Architect.

G. Following disinfection and flushing of the water main, a representative water sample shall be collected and submitted by the Contractor to a certified laboratory for analysis. The water shall not be used as potable water until it has been determined to be safe. If the water is found to be unsafe, the flushing and disinfection procedures must be repeated by the Contractor until a satisfactory result is obtained. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner through the Architect.

3.7 SALVAGE OF MATERIALS

A. Salvage and deliver to location specified by Owner all materials desired by Owner. Dispose of all materials not desired by Owner.

3.8 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 014000.

B. Compaction testing will be performed in accordance with ASTM D-1557.

C. If compaction tests indicate Work does not meet specified requirements, recompact and retest at no additional cost to the Owner.

D. If tests indicate Work does not meet specified requirements, remove work, replace and retest at no additional cost to the Owner.

3.9 PROTECTION

A. Protect finished installation under provisions of Section 015000.

B. Protect pipe and filter aggregate from damage or displacement until backfilling operation is in progress.

END OF SECTION 331116

SECTION 331119 - SITE FIRE PROTECTION WATER DISTRIBUTION

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 site distribution piping outside buildings for fire protection water service, and the following components:

1. Valves.
2. Backflow preventers.
3. Concrete thrust blocks.

B. The following is to be performed by utility company's separate contractor, and is not included in contract:

1. Connection to water main in street and underground piping to water meters.
2. Installation of water meters and accompanying utility boxes.

C. Related Sections include:

1. Division 21 Section for fire protection lines below and within buildings.
2. Section 312000 "Earthwork" for trenching and backfilling for underground water lines, and detectable warning tapes.
3. Section 331116 "Site Water Distribution" for underground site domestic water lines.

1.3 DEFINITIONS

A. Water Main: Utility's water piping.

B. Fire Protection Water Service: Site fire protection water piping.

C. Point of Delivery: Piping outlet from water meter.

D. DN: Dimension Nominal.

E. NPS: Nominal Pipe Size.

F. PVC: Polyvinyl chloride plastic.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure Ratings: Except where indicated otherwise, minimum pressure requirements for fire protection water system piping is 200 psig.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated, including the following:

1. Piping and related specialties.

2. Valves and accessories.
3. Valve boxes.
4. Hydrants.
5. Backflow preventers and accessories.

B. Shop Drawings: For the following:

1. Precast concrete utility boxes, including frames and covers.

C. Coordination Drawings: For piping and specialties including relationship to other services in same area. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field Quality-Control Test Reports: From Contractor.

E. Operation and Maintenance Data: For specialties to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Sections for closeout procedures and operation and maintenance data, include the following:

1. Valves.
2. Backflow preventers.
3. Hydrants.

F. Record drawings of installed fire protection water service lines and appurtenances in accordance Division 1 Section for project closeout requirements.

1. Locate and dimension work with reference to permanent landmarks. Indicate materials and sizes of all components.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of piping and specialties and are based on the specific system indicated. Refer to Division 1 Section for product requirements.

B. All work and materials to be in accordance with NFPA 24 “Standard for the Installation of Private Fire Service Mains and Their Appurtenances.”

1.7 REGULATORY REQUIREMENTS

A. Comply with all requirements of local Fire Department, including the following:

1. Arrangement of required tests, inspections, and approvals.
2. Configuration and sizes of connections and hose threads.

B. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.

3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.9 PROJECT CONDITIONS

A. Do not interrupt existing utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than five working days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

B. Information shown regarding locations of existing utilities is based upon available records and data, but shall be regarded as approximate, only. Make minor deviations necessary to conform with actual locations and conditions without extra cost. Verify location and elevation of utilities prior to commencement of excavation.

1. Exercise extreme care in excavating near existing utilities. Contractor is responsible for damage to existing utilities.

1.10 COORDINATION

A. Coordinate connection to water main with utility company.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate placement of valve boxes with layout of paving joints and patterns. Refer to Drawings for layout.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC (Cast Iron Pipe Size (CIPS)): AWWA C900, Class 200, with bell end with gasket and spigot end; gaskets meeting requirements of ASTM F 477.

1. PVC Molded Fittings: AWWA C907, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.2 JOINING MATERIALS

A. AWWA Transition Couplings:

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

a. Cascade Waterworks Manufacturing Company.
b. Dresser Industries, Inc.; DMD Division.
c. JCM Industries.
d. Viking Johnson.
e. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.

2. Underground Piping, NPS 2 (DN 50) and Larger: AWWA C219, metal, sleeve-type coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

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

a. Eslon Thermoplastics.
b. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.

C. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

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

a. NIBCO Inc.
b. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.

D. Pipe Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. AWWA C110, rubber, flat face, 1/8-inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

E. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

F. Plastic Pipe Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

G. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.3 SLEEVES

A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.4 GATE VALVES

A. Bronze Gate Valves:

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

a. Crane Co.; Crane Valve Group; Stockham Division
b. NIBCO INC.
c. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.

2. Non-rising Stem Gate Valves:

a. Description: 200 psi working pressure, bronze with solid wedge, threaded ends, and malleable-iron handwheel.

i) Standard: MSS SP-80.

2.5 VALVE ACCESSORIES AND SPECIALTIES

A. Tapping Sleeve Assemblies: Comply with MSS SP-60. Include sleeve and valve compatible with drilling machine.

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

a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
b. Grinnell Corporation; Mueller Company; Water Products Division
c. United States Pipe and Foundry Company.
d. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.

2. Tapping Sleeve: Cast iron or ductile iron or stainless steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
3. Valve: AWWA, cast-iron, non-rising-stem, metal seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Non-Traffic Rated Valve Boxes: Precast reinforced concrete box with etched polyethylene face and cast iron lid; beveled shoulder profile to prevent settling; extension pieces of quantity required for depth of burial of valve.

1. Products: Subject to compliance with requirements, provide the following:

a. Christy Concrete Products, Inc.:

i) 9-3/8-inch by 15-1/2-inch size: Christy #B3.
ii) 10-1/4-inch by 17-1/4-inch size: Christy #B9.
iii) 12-inch by 20-inch size: Christy #B12.

2. Size: As indicated, or if not indicated, as required to accommodate size and number of valves.
3. Provide threaded fasteners to secure lid to box.
4. Lid to be inscribed with the word “FIRE PROTECTION.”

C. Traffic-Rated Valve Boxes: Comply with Caltrans requirements for traffic-rated utility boxes; precast reinforced concrete box with steel checkerplate lid and beveled shoulder profile to prevent settling; include top section, extension pieces of quantity required for depth of burial of valve, bottom section with base of size to fit over valve.

1. Products: Subject to compliance with requirements, provide the following:

a. Christy Concrete Products, Inc.:

i) 10-inch by 17-inch size: Christy #B1017.
ii) 13-inch by 24-inch size: Christy #B1324.
iii) 17-inch by 30-inch size: Christy #B1730.

2. Size: As indicated, or if not indicated, as required to accommodate size and number of valves.
3. Designed for H20-44 wheel loading requirements according to AASHTO.
4. Provide threaded fasteners to secure lid to box.
5. Lid to be inscribed with the word “FIRE PROTECTION.”

2.6 HYDRANTS

A. Fire Hydrants: Wet barrel type, meeting all requirements and specifications of NFPA 24 and local Fire Department.

1. Provide sizes and number of threaded connections as per requirements of local Fire Department.

2.7 WATER METERS

A. Water meters will be furnished and installed by utility company.

2.8 BACKFLOW PREVENTERS

A. Manufacturer:

1. As specified on plans

B. General: AWWA standard, backflow preventers; as approved for use by local water utility and fire department.

1. Working Pressure: 200 psig minimum, unless otherwise indicated.
2. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
3. NPS 2-1/2 (DN 65) and Larger: Bronze, cast iron, steel, or stainless steel body with flanged ends.

a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast Iron or steel body.

4. Interior Components: Corrosion-resistant materials.
5. Strainer: On inlet, if indicated.

C. Reduced Pressure Principle Backflow Preventers: AWWA C511, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure differential relief valve with ASME A112.1.2, air-gap fitting located between two positive seating check valves.

1. Maximum Pressure Loss: 12 psig through middle 1/3 of flow range.

2.9 MISCELLANEOUS MATERIALS

A. Portland Cement Concrete: Minimum compressive strength of 3000 psi, minimum of four sacks of cement per cubic yard of concrete, one-Inch maximum aggregate size, three-inch maximum slump, two to four percent entrained air.

1. Cement: ASTM C 150, Type I.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C33, crushed gravel.
4. Water: Potable.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 “Earthwork” for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

B. Do not use flanges, unions, or keyed couplings for underground piping.

C. Flanges, unions, keyed couplings, and special fittings may be used, instead of joints indicated, on piping in utility boxes and vaults.

3.3 VALVE APPLICATIONS

A. General Application: Use threaded or flanged end valves for underground installation, as suitable for piping in which valve is installed. Install AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.

3.4 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of water-service piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

C. Install ductile iron, water-service piping according to AWWA C600 and AWWA C105.

D. Install PVC pipe according to AWWA M23 and ASTM F 645.

E. Select system components with pressure rating equal to or greater than system operating pressure.

F. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

G. Install piping to permit valve servicing.

H. Install water service piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install sleeves for pipes passing through concrete and masonry walls and foundations.

K. Unless indicated otherwise, bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:

1. Under Driveways and Other Vehicular Traffic Areas: With at least 36 inches cover over top.
2. In Loose Gravelly Soil and Rock: With at least 12 inches additional cover.

L. Install piping by tunneling, jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

M. Restrained Joints: Install underground gasketed-joint fire protection water service piping with restrained joints at horizontal and vertical changes in direction in accordance with NFPA 24. Use concrete thrust blocks or, if indicated, other supports including restrained-joint piping, anchors, and tie rods and clamps.

1. Install concrete thrust blocks at all pipe tees, wyes, bends, crosses, elbows, and risers.
2. Thrust blocks to bear against undisturbed soil, and sized as indicated.
3. Place thrust blocks so that pipe joints are accessible for inspection and repair.

N. Install water-supply piping with shutoff valve in water supply to each building. Use gate valve and valve box.

3.5 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. PVC Piping Gasketed Joints: Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
2. PVC Piping Solvent-Cement Joints: Ream ends of pipe and remove burrs. Clean and dry joining surfaces. Join pipe and fittings according to ASTM D 2672.

    a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

3. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.6 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. Center valve box on valve, setting plumb and level.

1. Use traffic-rated valve box where occurring in areas subject to vehicular traffic, and as indicated on Drawings. Use non-traffic-rated valve boxes in all other areas.
2. Install valve box extensions as required to extend down to level of piping
3. Compact soil backfill around valve box to a distance of 4 feet on all sides.

3.7 FIRE HYDRANT INSTALLATION

A. Install fire hydrant in conformance with NFPA 24 and manufacturer's written instructions.

1. Meet all requirements of local Fire Department.

3.8 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of utility company, plumbing and health departments, and authorities having jurisdiction.

B. Install backflow preventer to facilitate service, maintenance, and repair or replacement of components.

C. Do not install backflow preventers with relief drain in area subject to flooding.

D. Support NPS 2-1/2 (DN 65) and larger backflow preventers, valves, and piping near floor and on concrete piers.

3.9 CONNECTIONS

A. Connect fire protection water service piping at water supply source and extend to point of connection to building water piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water service piping at building wall until building water piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water piping systems when those systems are installed.
2. Refer to Division 15 Section for fire protection piping within buildings.

B. Connections to Valves and Equipment: Except as otherwise indicated, make piping connections as follows:

1. Install unions adjacent to each valve and at final connection to each piece of equipment having threaded pipe connection.
2. Install flanges adjacent to each valve and at final connection to each piece of equipment having flanged pipe connection.

3.10 IDENTIFICATION

A. Refer to Section 312000 “Earthwork” for continuous underground warning tape installed over underground water-distribution piping.

3.11 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Pressure Test:

1. After piping is laid, joints completed, and trench partially backfilled, leaving the joints exposed for examination, subject newly laid piping and valved sections of water distribution and service piping to a hydrostatic pressure of 200 psi.
2. Open and close each valve several times during the test.
3. Carefully examine exposed pipe, joints, fittings, and valves.
4. Replace or remake joints showing visible leakage.
5. Remove cracked pipe, defective pipe, and defective or cracked joints, fittings, and valves. Replace with sound material and repeat the test until results are satisfactory.
6. Make repair or replacement without additional cost to Owner.

C. Leakage Test:

1. Conduct leakage test in accordance with requirements of NFPA 24 after the pressure test has been completed satisfactorily, and 24 hours after lines have been filled with water in a manner to remove all air.
2. Duration of leakage test: Two hours minimum.
3. Subject lines to a pressure of 200 psi during test.
4. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

5. The amount of leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage shall not exceed two quarts per hour per 100 joints irrespective of pipe diameter.
6. Should any testing of pipe disclose leakage greater than that specified above, locate and repair, at no additional cost to Owner, the defective joint or joints until the leakage is within the specified allowance.
7. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

D. Prepare reports of testing activities:

1. Prior to final acceptance of work, furnish a "Contractor's Material and Test Certificate for Private Fire Service Mains," as found in NFPA 24, countersigned by Owner's representative and Project Inspector.

3.12 CLEANING

A. Flush all lines clear of debris, following procedures specified in NFPA 24.

END OF SECTION

SECTION 333113 - SANITARY SEWER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install site sanitary sewer collection systems and associated accessory items as shown on the drawings and as specified herein. Items include, but are not necessarily limited, to the following :

1. Sanitary Sewer Pipelines, Manholes and Services.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General Supplementary Conditions and Division 00 and 01 Sections, apply to this work.

B. Section 312000 - Excavation.

C. Section 312000 – Trenching and Backfilling.

D. Section 031313 – Site Concrete Improvements.

E. County of Madera Public Works Standard Plans and Specifications

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies

1. Safety Regulations : Work shall comply with all Federal, State and Municipal regulations regarding safety, including the requirements of the following :

a. William-Steiger Occupational Safety and Health Act of 1970.
b. State of California, California Administrative Code, Title 8 Industrial Relations, Chapter 4, Subchapter 4, “Construction of Safety Orders” and other State and local agencies having jurisdiction.
c. All trenching work shall conform to Trench Construction Safety Orders of California State Industrial Accident Commission.

1.4 REFERENCES

A. American Water Works Association (AWWA)

B. American Society for Testing Materials (ASTM):

1. Designation D3034 – Polyvinyl Chloride (PVC) pipe.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – Submittal Procedures.

B. Certificates of compliance for material.

C. Product Data: Provide data indicating pipe materials, accessories and associated equipment to be furnished.

D. Submit Manufacturer's data and/or fabrication drawings for all pipes, and appurtenances installed under this section. No items shall be incorporated into the work until submittals are approved by the Architect.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 33 00 – Submittal Procedures.

B. Accurately record location of pipe runs, connections, manholes, and invert elevations. Submittal of this information shall be made to the Construction Manager.

C. Identify and describe unexpected variations to subsoil conditions and discovery of uncharted utilities or utilities found at locations different that indicated on plans.

1.7 COORDINATION

A. Coordinate work with other project work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle all products required.

1.9 EXISTING UTILITIES

A. The Engineer has made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the work. The location of said facilities shall be considered approximate only, until exposed by the Contractor.

B. Maintain all existing utility mains and service lines in constant service during construction of the Work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sanitary sewer pipelines shall be polyvinyl chloride (PVC) pipe for sanitary sewers conforming to ASTM Designation : D3034, SDR35 for 4" and larger with bell and spigot ends for gasketed joints with ASTM F477 elastomeric seals and be Schedule 40 PVC pipe, ASTM D1785, 1120 high impact, for 3" and smaller.

B. Concrete for structures shall conform to Section 033000.

C. Surface cleanouts to be furnished and installed per plans and Plumbing Code.

D. Precast Reinforced Concrete Manhole Sections: Per ANSI/ASTM C478. Elliptical single line reinforcement is not allowed and as shown on detail drawing.

E. Manhole Frames, Covers and Grates: Cast Iron per ASTM A48, Class 25.

F. Mortar: Composed of one part, by weight, Portland cement (Type II low alkali per ASTM C150), 2 parts, by weight, sand and water.

G. Concrete collar shall be constructed as per detailed drawing.

H. Soil Fill for Concrete Pipe Bedding Envelope: Backfill or Sandfill per Section 312000 and Section 312300.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions. All plot dimensions are approximate. Before proceeding with any work, carefully check and verify all dimensions and report any variations to the Engineer.

B. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. Carefully investigate the structural and finished conditions affecting all work, and plan work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Drawings are diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner, so that conflicts between sewer systems, planting, and architectural features will be minimized.

C. Do not install the facilities as indicated on the drawings when it is obvious in the field that unknown obstructions might not have been considered in the engineering. Such obstructions or differences should be brought to the attention of the Engineer.

D. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Prepare for pipe installation by assembling all needed materials.

B. Clean and dry pipes and fittings before installation.

C. Cover all PVC pipe during storage.

3.3 TRENCHING

A. Trench excavation and backfilling shall be in accordance with Section 312000.

B. Hand trim excavations to required elevations. Correct over excavation by placing bedding material at bottom of excavations, level soil materials in continuous layers not exceeding 6 inches uncompacted depth.

C. Backfill around sides and to a level six inches above the top of pipe with bedding sand, tamped in place.

D. Maintain optimum moisture content of bedding material to attain required compaction density.

E. Remove large stones or other hard matter which could damage waterline or impede consistent backfilling or compaction.

3.4 PIPE INSTALLATION

A. Lay and join pipes in accordance with manufacturer's recommendations.

B. Sewer pipe shall be laid in strict conformity to the prescribed line and grade, with grade bars set and each pipe length checked to the grade line. Three consecutive points on the same rate of slope shall be used at all times to detect any variation from a straight grade. In case any discrepancy exists, the work shall be stopped and the discrepancy immediately reported to the Architect. In addition, when requested by the Architect, a string line shall be used in the bottom of the trench to insure a straight alignment of the sewer pipe between manholes. The elevation of the pipe invert shall not deviate from the design elevation by more than +2 percent to the pipe size concerned, or 1 inch, whichever is greater. The rate of deviation from grade or returning grade shall be limited to 1/16 inch per foot or pipe.

C. Lay pipes on prepared bed with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

D. Commence laying at outlet and proceed in upstream direction with the bell ends of bell and spigot pipe placed upstream. Do not exceed maximum joint deflection recommended by pipe manufacturer. Each section of pipe shall be laid to line and grade as herein specified and in such a manner as to form a watertight, concentric joint with the adjoining pipe. Complete each joint before laying next length of pipe. The interior of the pipe shall be cleared of all dirt and debris and excess joint sealing material as the work progresses. Pipes shall not be laid when the condition of the trench or weather is unsuitable. All open ends of pipe and fittings shall be adequately and securely closed whenever the work is discontinued for more than one-half hour. Minimize joint deflection after joint has been made to avoid joint damage. Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

E. Make watertight connections to manholes. Use shrinkage compensating grout when suitable gaskets are not available.

F. Sewer Systems Plugs: Temporary plugs of brick or mortar shall be installed on all sewer projects at points of connection to existing facilities. These plugs shall remain in place until completion of the balling and flushing operation. The plugs, intended to prevent water from the balling and flushing operation, drainage, or any other condition from entering the existing system, shall be installed or removed in the presence of and under the direct supervision of the Engineer. Until the system has been pumped clear of accumulated water, the plugs shall not be removed. This water must not be allowed to enter the adjacent sewer or drainage systems.

G. Internal Inspection: Upon completion of construction and prior to final inspection, the Contractor shall clean the entire new pipeline of all dirt and debris. Any dirt or debris in previously existing pipes or ditches in the area, which in the opinion of the Architect resulted from the new installation, shall be removed by the Contractor. Sewer pipes shall be cleaned by the controlled balling method. Temporary plugs shall be installed and maintained during cleaning operations at points of connection to existing facilities to prevent water, dirt and debris from entering the existing facility. Temporary plugs for sewer systems shall also conform to Subsection F, above. Water from the drainage system operations shall be routed through a suitable trap to collect any dirt and debris prior to discharging into any downstream facility. The Contractor shall notify the Architect immediately after completion of the pipe cleaning operations. Cleaning of drainage pipes by the controlled balling method will not be required.

As soon as possible after the completion of the pipe cleaning, and prior to final acceptance, the Architect may make a visual internal inspection of the new pipeline either manually or with televisions equipment.

3.5 TESTING OF SANITARY SEWERS

A. After cleaning per Section 3.04 C, each section of sewer constructed shall be tested in accordance with acceptable “Low Pressure Air Test for Sanitary Sewers” methods such as presented in the Journal of Sanitary Engineering, Division ASCE, April 1964.

3.6 ADJUSTMENT

A. Adjustment of existing sewer manhole for finish grade shall be as per detail drawing.

3.7 CLEAN-UP

A. Remove from the site all rubbish, debris, etc. resulting from Work in this Section. The clean up shall include the replacement and repair of any damaged or disturbed property.

END OF SECTION 333113

SECTION 334100 - STORM DRAINAGE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide all materials, labor, equipment and services necessary to furnish and install Storm Drainage System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and 01 sections, apply to this work.

B. Section 312000 - Excavation.

C. Section 312000 – Trenching and Backfilling

D. Section 321313 – Site Concrete Improvements

1.3 REFERENCES

A. ANSI/ASTM C76 – Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

B. ANSI/ASTM C443 – Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

C. ANSI/ASTM C478 – Precast Reinforced Concrete Manhole Sections.

D. California Test Method No. 216 (Dry Method)

1.4 DEFINITIONS

A. Bedding: Fill placed under, around, beside and directly over pipe, prior to subsequent backfill operations.

B. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

A. Submit under provisions of Division 0 – Contract General Requirements.

B. Certificates of compliance for material.

C. Product Data: Provide data indicating pipe materials, accessories and associated equipment to be furnished.

D. Submit Manufacturer’s data and/or fabrication drawings for all pipes, and appurtenances installed under this section. No items shall be incorporated into the work until submittals are approved by the Architect.

1.5.1 COORDINATIONThe Engineer has made a diligent attempt to indicate on the plans the location of all main and trunk line utility facilities which may affect the work. The location of said facilities shall be considered approximate only, until exposed by the Contractor.

B. Maintain all existing utility mains and service lines in constant service during construction of the Work.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 017839.

B. Accurately record actual locations of utilities encountered.

C. Identify and describe unexpected variations to subsoil conditions and discovery of uncharted utilities or utilities found at locations different that indicated on plans.

PART 2 - PRODUCTS

2.1 MATERIALS

A. High Density Polyethylene for pipe larger than fifteen (15) inches conforming to ASTM F894 with rubber gasketed joints complying with ASTM D3212 as manufactured by Hancor “Sure Lok” or Equal

B. Storm Drainage pipeline shall be polyvinyl chloride (PVC) pipe for storm drain conforming to ASTM designation 3034, SDR 35 for pipe twelve (15) inches or less.

C. Precast Reinforced Concrete Manhole Sections: Per ANSI/ASTM C478. Elliptical single line reinforcement is not allowed as shown on detail drawing.

D. Manhole Frames, Covers and Grates: Cast Iron per ASTM A48, Class 25.

E. Concrete collar shall be constructed as per detailed drawing.

F. Soil Fill for Concrete Pipe Bedding Envelope: Backfill or Sandfill per Section 312000 and Section 312300.

G. Poured in Place Concrete : Per Section 033000

H. Reinforcement : Per Section 033000

I. Mortar: Composed of Mortar: Composed of one part, by weight, Portland cement (Type II low alkali per ASTM C150), 2 parts, by weight, sand and water.

J. Storm drainage outfall shall be constructed as per detailed drawing.

K. Surface cleanouts to be furnished and installed per plans and Plumbing Code.

L. Storm drain inlets shall be Christy U-21, Christy V-12, and Christy V-1 drain inlet with precast extension required. Contractor shall also construct concrete bottom as shown on detailed draw-

ings. Christy U-21 catch basin grates shall be U21-HT, ADA approved and for H20 loading. Christy V-12 drain box grates shall be V12-71W bolt down grates, ADA approved. Christy V-1 drain box grates shall be V1-71C bolt down grates, ADA approved.

M. Gray-Iron Area Drains: ASME A112.21.1M, round body with anchor flange and round secured grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.

Available Manufacturers:

a) Josam Company.
b) Smith, Jay R. Mfg. Co.
c) Zurn Industries, Inc.; Zurn Specification Drainage Operation.

Top-Loading Classification(s): Medium duty

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions.

3.2 PREPARATION

A. Identify location of proposed storm drainage facilities to be constructed.

B. Protect other improvements from damage from excavation equipment and vehicular traffic.

C. Employ equipment and methods appropriate to the work site.

D. Protect excavated areas from drainage inflow, and provide drainage to all excavated areas.

E. Comply with safety requirements as they pertain to excavations, per Section 31 20 00.

F. Remove all interfering surface and subsurface improvements authorized for removal.

3.3 EXCAVATION

A. Excavate trenches and pits per Section 312000.

B. Excavate trenches and pits to allow installation and construction of the storm drainage facilities to the alignment, grades, depths and cross-sections as indicated on the construction plans.

C. Excavate trench to depth which is 4 inches below the outside bottom of the pipe barrel to be placed therein.

D. Cut trenches just wide enough to allow the installation of the pipe and pipe bedding as indicated on the plans. Minimize trench width above the pipe.

E. Provide protection to public per Section 01 50 00/1.6.

3.4 INSTALLATION AND BEDDING STORM DRAIN PIPE

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Excavate suitable bell (or socket) holes in the bedding material, so that the bells do not bear on the subgrade or bedding. Provide uniform bearing of pipe barrel on bedding material.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited

E. Ensure that all joints are properly “homed” and are watertight.

F. Bed concrete pipe in backfill or sandfill soil envelope, and compact to a minimum of 85% relative compaction. Place and compact the bedding material under, around and over the pipe, filling the trench cavity and extending from the bottom of the trench (4-inches below the outside bottom of the pipe barrel) to level 12-inches above the outside top of the pipe barrel.

3.5 INSTALLATION OF STORM DRAINAGE STRUCTURES AND APPURTENANCES

A. Install storm drainage structures as indicated on the construction plans, in accordance with the manufacturer’s recommendations, and as specified herein.

B. Construct poured-in place concrete per Section 03 30 00.

C. Key top of poured-in-place concrete bases for structures to receive the tongue of precast riser sections.

D. Joint precast manhole and structure riser sections with a minimum thickness of ½-inch of mortar per Section 03 30 00 to a watertight joint. Neatly point the inside and outside of the joint. Set sections plumb.

E. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

F. Construct cleanout, outfall structure per detail drawing.

3.6 TOLERANCES

A. Pipe laying tolerances :

1. Above grade: Not to exceed ¼-inch above planned grade.
2. Below grade: Not to exceed 1/2-inch below planned grade.
3. Alignment: Not to exceed 2-inches from planned alignment, if gradual and regular over a distance of 20-feet.

B. Structure finish grade tolerance: Within ¼-inch of planned grade, but must match adjacent improvements.

3.7 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.

B. Field inspection and testing will be performed under provisions of 01 40 00.

C. Compaction testing of bedding and backfill will be performed in accordance with ASTM D 1557.

D. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest.

3.8 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334100