

SECTION 09250

GYPSUM BOARD SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK

- A. Fire-Resistance Rated Gypsum Board
- B. Mold and Moisture Resistant Gypsum Board
- C. Fire-Resistance, Mold and Moisture Resistant Gypsum Board
- D. Abuse Resistant Gypsum Board
- E. Cement Board

1.03 PERFORMANCE CRITERIA

- A. Abuse Resistant Gypsum Board
 - 1. Classification:
 - a. Surface Abrasion: Level 1-3
 - b. Surface Indention: Level 1
 - c. Soft Body Impact: Level 1-2
 - 2. Wall Assembly Fire-Resistance Rating: locations per the drawings.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

Provide in accordance with Article 3.11 of the General Conditions.

1.06 PRODUCT HANDLING

Comply with the requirements of Section 01620.

1.07 CLOSE-OUT: Comply with the requirements of Section 01770 – Contract Closeout.

A. Reports:

None required.

B. As-Builts:

Comply with the requirements of Section 01770 – Contract Closeout.

C. Operation and Maintenance Data:

None required

D. Extra Materials:

None required

E. Extended Warranty:

Comply with the requirements of the General Condition Article 3.5 and Section 01740.

PART 2 - PRODUCTS

2.01 MANUFACTURER / PRODUCTS

Basis of Design: Products of National Gypsum Company

2.02 FIRE-RESISTANCE RATED GYPSUM BOARD

A. Basis of Design: Gold Bond® BRAND Fire-Shield C Gypsum Board.

B. Panel Physical Characteristics:

1. Core: Enhanced fire-resistance rated gypsum core
2. Surface paper: 100% recycled content paper on front, back and long edges
3. Long Edges: [Square] or [Tapered] at Contractor's discretion.
4. Overall thickness: 5/8 inch.
5. Panel complies with Type X requirements of ASTM C 1396 Standard Specification for Gypsum Board

2.03 MOLD AND MOISTURE RESISTANT GYPSUM BOARD

A. Basis of Design: Gold Bond® BRAND XP® Gypsum Board

B. Panel Physical Characteristics

1. Core: Mold and moisture resistant gypsum core.
2. Surface paper: 100% recycled content moisture/mold/mildew resistant paper on front, back, and long edges.
3. Long Edges: Square or Tapered at Contractor's discretion.
4. Overall thickness: 5/8 inch.
5. Panel complies with requirements of ASTM C 1396 Standard Specification for Gypsum Board.
6. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

2.04 FIRE-RESISTANCE RATED GYPSUM BOARD WITH ENHANCED MOLD AND MILDEW RESISTANCE

A. Basis of Design: Gold Bond® BRAND XP® Fire-Shield® C Gypsum Board

B. Type C, Panel Physical Characteristics

1. Core: Mold and moisture resistant, with enhanced fire-resistance rated gypsum core
2. Surface paper: 100% recycled content moisture/mold/mildew paper on front, back and long edges
3. Long Edges: Square or Tapered at Contractor's discretion.
4. Overall thickness: 5/8 inch.
5. Panel complies with requirements Type X of ASTM C 1396 Standard Specification for Gypsum Board
6. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

2.05 ABUSE RESISTANT GYPSUM BOARD

A. Basis of Design: Gold Bond® BRAND Hi-Abuse® XP® Gypsum Board

B. Panel Physical Characteristics

1. Core: Fire resistance rated gypsum core, with additives to enhance, surface indentation resistance and impact resistance.
2. Surface paper: Abrasion resistant, 100% recycled content moisture/mold/mildew resistant paper on front, back and long edges
3. Long Edges: Square or Tapered at Contractor's discretion.
4. Overall thickness: 5/8 inch.
5. Panel complies with Type X requirements ASTM C 1396 Standard Specification for Gypsum Board.
6. Surface Abrasion Resistance: 0.009 inch when tested in accordance with ASTM D 4977 Standard Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion
7. Indentation Resistance: 0.132 inch when tested in accordance with ASTM D 5420 Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
8. Soft Body Impact: 210 ft-lbf when tested in accordance with ASTM E 695 Standard Method for Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading
9. Mold/Mildew Resistance: score of 10 when tested in accordance with ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

2.06 CEMENT BOARD

A. Cement Backerboard

1. Basis of Design: PermaBase® BRAND Cement Board

2. Panel Physical Characteristics

- a. Core: Cementitious, water-durable
- b. Surface: Fiberglass mesh on front and back
- c. Long Edges: Tapered
- d. Overall Thickness: 5/8 inch.
- e. Panel complies with requirements of ASTM C 1325 Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units and ANSI A118.9
- f. Density: 72 lbs. per cu. ft.
- g. Water Absorption: Not greater than 8% when tested for 24 hours in accordance with ASTM C 473 Standard Test Methods for Physical Testing of Gypsum Panel Products

B. Cement Board Underlayment

1. Basis of Design: PermaBase® BRAND Cement Board

2. Panel Physical Characteristics

- a. Core: Cementitious, water-durable

- b. Surface: Fiberglass mesh on front and back
- c. Long Edges: Tapered
- d. Overall Thickness: 1/4 inch
- e. Panel complies with requirements of ASTM C 1325 and ANSI A118.9
- f. Density: 72 lbs per cu. ft.
- g. Water Absorption: Not greater than 8% when tested for 24 hours in accordance with ASTM C 473 Standard Test Methods for Physical Testing of Gypsum Panel Products

2.07 ACCESSORY PRODUCTS

A. Acoustical sealant

- 1. Conform to ASTM C 919 Standard Practice for Use of Sealants in Acoustical Applications
- 2. Products/Manufacturer
 - a. Grabber Acoustical Sealant GSC
 - b. STI SpecSeal Smoke N Sound Caulk
 - c. BOSS 824 Acoustical Sound Sealant

B. Firestopping

- 1. Conform to ASTM E 90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
- 2. Products/Manufacturer
 - a. STI SpecSeal SSP Putty Pads
 - b. BOSS 818 Fire Rated Putty Pads

C. Fasteners for use with 5/8 inch thick tile backer panels: As recommended by Manufacturer.

D. Fasteners for use with Cement Board:

- 1. PermaBase Cement Board Hi-Lo thread screws (No. 8).
- 2. Wafer head, corrosion-resistant.
- 3. Overall Thickness: As recommended by Manufacturer.
- 4. For use with wood framing and complying with ASTM C 1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

E. Joint Treatment

- 1. Tape - As recommended by Manufacturer:
 - a. Paper Tape: 2-1/16 inches wide.
 - b. Paper Tape: 2 inches wide with metal strips laminated along the center crease to form inside and outside corners.
 - c. Fiberglass Tape: Nominal 2 inches wide self adhering tape.
 - d. Alkali-resistant Fiberglass Tape: Nominal 2 inches wide polymer coated alkali-resistant mesh tape.
- 2. Drying Type Compound - As recommended by Manufacturer:
 - a. Ready Mix vinyl base compound.

- b. Ready Mix vinyl base compound formulated for enhanced mold and mildew resistance.
 - c. Ready Mix vinyl base compound formulated to reduce airborne dust during sanding.
 - d. Ready Mix vinyl base topping compound for finish coating.
 - e. Ready Mix vinyl base compound for embedding joint tape, corner beads or other accessories.
 - f. Field Mix vinyl base compound.
- 3. Setting Compound - As recommended by Manufacturer:
 - a. Field mixed hardening compound.
 - b. Field mixed hardening compound for fire resistance rated construction and penetrations.
- 4. Joint Sealant: Conform to ASTM C920 Standard Specification for Elastomeric Joint Sealants.
- 5. Finish Level: Provide a Level 4 Finish, with a light orange-peel texture. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compounds shall be smooth and free from tool marks and ridges. The prepared surface shall be coated with Sheet Rock Brand First Coat Primer, or equal, prior to the application of the light orange-peel texture.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive gypsum products to verify conditions.
- B. Report conditions contrary to contract requirements that would prevent a proper installation.
- C. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- D. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the conditions.
- E. Installation indicates acceptance of the conditions with regard to conditions existing at the time of installation.

3.02 INSTALLATION, ABUSE RESISTANT GYPSUM BOARD

Install in accordance with manufacturer recommendations

3.03 INSTALLATION, CEMENT BOARD

Install in accordance w/manufacturer recommendation and ANSI A108.11

3.04 INSTALLATION, TILE BACKER

A. General:

- 1. Install in accordance with manufacturer recommendations, ASTM C840 and GA-216
- 2. Install with acrylic coated water barrier side facing away from the framing, so that finishes shall be applied to the coated side.
- 3. Caulk or seal penetrations and abutments to dissimilar materials.

B. Tile Backer Installation for walls:

1. Install panels horizontal or vertical to supports spaced a maximum of 16 inches on center without blocking or 24 inches on center with blocking at all joints for ½ inch thick panels and 24 inches on center for 5/8" inch thick panels.
2. Space fasteners 8 inches on center along all support members. Drive fasteners flush with the panel surface, do not countersink.
3. Dry Non-Tile Applications
 - a. Tape joints with fiberglass mesh tape and embed with setting type joint compound.
 - b. Skim the surface with a setting or ready-mix joint compound.
4. Wet Non-Tile Applications
 - a. Finish walls with a direct applied finish systems, or materials suitable for humid environments.
 - b. Seal transitions and abutments to dissimilar materials with flexible joint sealant.

*****END OF SECTION*****

SECTION 09650

RESILIENT FLOORING

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK

Furnish all materials and perform labor required to execute this work as indicated on the drawings, as specified and as necessary to comply with the Contract Documents, including, but not limited to these major items:

- A. Resilient tile flooring.
- B. Floor substrate surface.
- C. Rubber base.

1.03 REGULATORY REQUIREMENTS

Conform to applicable code for flame rating requirements of 75 or less in accordance with ASTM E84.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

- A. Provide in accordance with Article 3.11 of the General Conditions.
- B. Provide product data on specified products, describing physical and performance characteristics.
- C. Submit two samples, illustrating color and pattern for each floor material or base, substituted for those indicated in the Drawings.
- D. Submit manufacturer's installation instructions. When approved by the Architect, will become the basis for accepting or rejecting actual installation procedure used on the Work.

1.06 OPERATION AND MAINTENANCE DATA

Submit cleaning and maintenance data maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

1.08 EXTRA MATERIALS

Provide 5% of each pattern and color of flooring and of base specified.

PART 2 -- PRODUCTS

2.01 VINYL COMPOSITION TILE

Manufacturer(s), Type(s), Location(s), Color(s), and Pattern(s) as indicated on drawings.

2.02 SHEET VINYL

Manufacturer(s), Type(s), Location(s), Color(s), and Pattern(s) as indicated on drawings.

2.03 BASE MATERIALS

Manufacturer(s), Type(s), Location(s), Color(s), and Pattern(s) as indicated on drawings.

2.04 ACCESSORIES

- A. Subfloor Filler: Latex cement underlayment as recommended by flooring material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
- C. Sealer and Wax: Types recommended by flooring manufacturer.
- D. Welding rod: Use same manufacturer as flooring manufacturer and install per manufacturer's instructions. Colors to be selected from standard colors. All flooring in medical procedure rooms and in restrooms shall be heat welded.
- E. Provide other materials, not specifically described but required for a complete and proper installation as selected by the Contractor subject to the approval of the Architect.

2.05 FLOORING TRANSITIONS

Manufacturer(s), Type(s), Location(s), Color(s), and Pattern(s) as indicated on drawings.

PART 3 -- EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the Work.
- C. Do not proceed until unsatisfactory conditions are corrected.
- D. Verify that surfaces are smooth and flat with maximum variation of 1/8 inch in 10 ft. and are ready to receive work.
- E. Verify concrete floors are dry to the maximum moisture content of 2.5% (two and one half percent); and exhibit negative alkalinity, carbonization, or dusting. Provide test results to indicate that the substrate meets moisture requirements prior to starting work. Higher moisture content will be as accepted by manufacturer in their written warranty.
- F. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply, trowel, and float filler to leave smooth, flat, hard surface.
- C. Prohibit traffic from area until filler is cured.
- D. Vacuum clean substrate.
- E. Maintain the temperature of the space to receive the flooring and the materials to be installed at

a minimum of 65 degrees F and maximum of 100 degrees F for at least 48 hours prior to, during, and 48 hours after installation. Maintain a minimum temperature of 55 degrees F thereafter.

F. Install flooring after all other trades, including painting, have been completed.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions, conventional full-spread system.
- B. Spread only enough adhesive to permit installation of materials before initial set.
- C. Set flooring in place; press with heavy roller to attain full adhesion.
- D. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
- E. Install edge strips at unprotected or exposed edges, and where flooring terminates.
- F. Scribe flooring to walls, columns, permanent cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION -- BASE MATERIAL

- A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.
- B. Miter internal corners. At external corners, "V" cut back of base strip to 2/3 of thickness and fold.
- C. Install base on solid backing. Bond tight to wall and floor surfaces.
- D. Scribe and fit to doorframes and other interruptions.

3.05 PROTECTION

Prohibit traffic on floor finish for 48 hours after installation.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean, seal, and wax floor and base surfaces in accordance with manufacturer's instructions.

*** END OF SECTION ***

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SECTION 09900

PAINTING

PARTS 1 -- GENERAL

1.01 SUMMARY

- A. Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.
- B. Section Includes: Painting and finishing of all interior and exterior items and surfaces, unless otherwise indicated or listed under exclusions below:
 - 1. Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated.
 - 2. Include field painting of exposed exterior and interior structural steel, plumbing, mechanical and electrical work, except as indicated below.
 - 3. Paint exterior plaster where indicated on Drawings.
- C. Work Included:
 - 1. The intent and requirements of this section is that all work, items and surfaces which are normally painted and finished in a building of this type and quality, shall be so included in this contract, whether or not said work, item or surface is specifically called out and included in the schedules and notes on the drawings, or is, or is not, specifically mentioned in these specifications.
 - 2. All the requirements of Division Zero and Division One apply to this Section.
- D. The following general categories of work and items that are included under other sections, shall not be a part of this section:
 - 1. Shop prime painting of structural and miscellaneous iron or steel.
 - 2. Shop prime painting of hollow metal work.
 - 3. Shop finished work and items.
 - 4. Any drywall or plaster permanently concealed from view.
 - 5. Any factory finished equipment and other materials with a complete factory applied finish.
 - 6. Finish hardware except where primed for paint finish.
 - 7. Any glass, plastics, floor tiles and sheet vinyl coved or vinyl top set bases.
 - 8. Plumbing fixtures: Toilet room accessories.
 - 9. Lighting fixtures except as noted on drawings or specified.
 - 10. Any acoustical surfaces; unless otherwise specified.
- E. The Room Finish Schedules indicated on the drawings, indicates the location of interior room surfaces to be painted or finished. The schedule indications are general and do not necessarily define the detail requirements. Include all detailed refinements and further instructions as may be given for the required complete finishing of all spaces and rooms.

1.02 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.03 SUBMITTALS

- A. Provide in accordance with Article 3.11 of the General Conditions.
 - 1. Materials List: Submit complete lists of materials proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item when applicable. When required, provide a list of paint and coating materials proposed for use, which equates such materials with the design-basis products specified.
- B. Samples: Submit, on 8-1/2 inch by 11 inch hardboard, samples of each color, gloss, texture and material selected by the Architect from standard colors available for the coatings required.
 - 1. For natural and stained finishes, provide sample on each type and quality of wood used on the project.
- C. Manufacturer's Instructions: Submit the manufacturer's current recommended methods of installation, including relevant limitations, safety and environmental cautions, application rates, and composition analysis.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.

Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to job going out to bid and before start of painting project.

- 1. Comply with the current applicable regulations of the California Air Resources Board (CARB) and the South Coast Air Quality Management District (SCAQMD). Field Sample: When and as directed by the Architect, apply one complete coating system for each color, gloss and texture required. When approved, the sample panel areas will be deemed incorporated into the Work and will serve as the standards by which the subsequent Work of this Section will be judged.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection: Use all means necessary to protect the materials of this Section before, during, and after installation.
- B. Deliver materials to job site in new, original, and unopened containers bearing manufacturer's name and trade name. Store where directed in accordance with manufacturer's instructions.

1.06 PROJECT CONDITIONS

Do not apply exterior materials during fog, rain or mist, or when inclement weather is expected within the dry time specified by the manufacturer. No exterior or interior painting shall be done until the surfaces are thoroughly dry and cured. Do not apply paint when temperature is below 50° F. Avoid painting surfaces when exposed to direct sunlight.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Sherwin-Williams. Architectural representative: John Dumesnil; Phone (619) 665-9341 or Email john.t.dumesnil@sherwin.com.
- B. Acceptable Manufacturers: Frazee Paint Company, Dunn Edwards, and Vista Paint.

2.02 MATERIALS

- A. Paints: Provide Ready-Mixed, except field catalyzed coatings. Pigments shall be fully ground maintaining soft paste consistency, capable of being readily and uniformly dispersed to complete homogeneous mixture. Paints shall have good flowing and brushing properties and be capable of drying or curing free of streaks and sags.
- B. Accessory Materials: Linseed oil, shellac, solvents, and other materials not specified but required to achieve required finishes shall be of high quality and approved by manufacturer.
- C. Colors shall be selected from color chip samples provided by manufacturer of paint system approved for use. Match approved samples for color, texture and coverage.

2.03 MIXES

Mix, prepare, and store painting and finishing materials in accordance with manufacturer's directions.

PART 3 -- EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Examine surfaces to be painted before beginning painting work. Work of other trades that has been left or installed in a condition not suitable to receive paint, stain, other specified finish shall be repaired or corrected by the applicable trade before painting. Painting of defective or unsuitable surface implies acceptance of the surfaces.
- C. Beware of a condition known as "critical lighting". This condition causes shadows that accentuate even the slightest surface variations. A pigmented sealer will provide tooth for succeeding decorative coating, but "does not" equalize smoothness or surface texture. Any corrective action to gypsum board/drywall must be done by the drywall contractor prior to decorating.
- D. Correct conditions detrimental to timely and proper completion of the Work.
- E. Do not proceed until unsatisfactory conditions are corrected.
- F. Beginning of installation means acceptance of conditions.

3.02 PROTECTION

- A. Protect previously installed work and materials, which may be affected by Work of this Section.
 - 1. Protect prefinished surfaces, lawns, shrubbery and adjacent surfaces against paint and damage.
 - 2. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or splatter from fouling surfaces not being painted.
 - 3. Protect surfaces, equipment, and fixtures from damage resulting from use of fixed, movable and hanging scaffolding, planking, and staging.
- B. Provide WET PAINT signs, barricades, and other devices required to protect newly finished surfaces. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.03 PREPARATION

- A. Perform preparation and cleaning procedures in strict accordance with coating manufacturer's instructions for each substrate condition.

- B. Concrete and masonry surfaces shall be dry, clean, and free of dirt, efflorescence, encrustation, and other foreign matter. Glazed surfaces on concrete shall be roughened or etched to uniform texture.
- C. Ferrous metal shall be cleaned per SSPC-SP1. All welds, loosely adhered rust, and debris must be power tool cleaned per SSPC-SP3. Prime within 3 hours after preparation.
- D. Clean per SSPC-SP1 to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, power tool clean per SSPC-SP3 to remove these treatments.
- E. Remove dust, grit and foreign matter from wood surfaces. Sand surfaces and dust clean. Spot coat knots, pitch streaks, and sappy section with pigmented stain sealer when surfaces are to be painted. Fill nail holes, cracks and other defects after priming and spot prime repairs when fully cured.
- F. Remove hardware and accessories, machined surfaces, plates, lighting fixtures and similar items in place and not-to-be-finish painted, or provide surface-applied protection. Reinstall removed items upon completion of work in each area.
- G. Existing surfaces to be recoated shall be thoroughly cleaned and de-glossed by sanding or other means prior to painting. Patched and bare areas shall be spot primed with same primer as specified for new work.
- H. Thoroughly backpaint all surfaces of exterior and interior finish lumber and millwork, including doors and window frames, trim, cabinetwork, etc., which will be concealed after installation. Backpaint items to be painted or enameled with the priming coat. Use a clear sealer for backpriming where transparent finish is required.
- I. Bar and covered pipes, ducts, hangers, exposed steel and ironwork, and primed metal surfaces of equipment installed under mechanical and electrical work shall be cleaned prior to priming.
- J. Preparation of other surfaces shall be performed following specific recommendations of the coatings manufacturer.
- K. Bond breakers and curing agents must be removed and the surface cleaned before primers, sealers or finish paints can be applied.
- L. All drywall surfaces must be completely dry and dust free before painting. Skim coated drywall must be sealed with an alkyd based sealer or a waterborne sealer recommended by the paint manufacturer for this surface. Use the appropriate light or medium tack masking tape.

3.04 APPLICATION

- A. Apply painting and finishing materials in accordance with the manufacturer's submittals, as approved. Use applicators and techniques best suited for the material and surfaces to which applied.
 - 1. The number of coats specified is the minimum that shall be applied. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.
 - 2. All undercoats shall be tinted slightly to approximate the color of the finish coat.
- B. Apply each material at not less than the manufacturer's recommended spreading rate:
 - 1. Provide a total dry film thickness of not less than 1.2 mils for each required coat.
- C. Apply prime coat to surface, which is required to be painted or finished.
- D. Finish exterior doors on tops, bottoms, and edges same as exterior faces, after fitting.
- E. Sand lightly and dust clean between succeeding coats.

3.05 CLEANING, TOUCH-UP AND REFINISHING

- A. Carefully remove all spattering, spots and blemishes caused by work under this section from surfaces throughout the project.
- B. Upon completion of painting work remove all rubbish, paint cans, and accumulated materials resulting from work in each space or room. All areas shall be left in a clean, orderly condition.
- C. Runs, sags, misses, holidays, stains and other defects in the painted surfaces, including inadequate coverage and mil thickness shall be satisfactorily touched up, or refinished, or repainted as necessary.

3.06 FINISH SCHEDULE

- A. Apply the following finishes to the surfaces specified and/or as on the finish schedule on the Drawings. Apply all materials in accordance with manufacturer's instructions on properly prepared surfaces and foundation coats. All intermediate undercoats must be tinted to approximate the final color.

- 1. Architect will issue a color schedule prior to start of painting to designate the various colors and locations required for the work.

- B. Exterior Systems:

- 1. Stucco & Plaster
Flat – 100% Acrylic
First Coat Epoxy Tilt-up Primer B42WW49
Second Coat A-100 Exterior Latex Flat A6 Series
Third Coat A-100 Exterior Latex Flat A6 Series
 - 2. Concrete Tilt-Up
Flat – 100% Acrylic
First Coat Epoxy Tilt-up Primer B42WW49
Second Coat A-100 Exterior Latex Flat A6 Series
Third Coat A-100 Exterior Latex Flat A6 Series
 - 3. Brick Masonry
Flat – 100% Acrylic
First Coat Epoxy Tilt-up Primer B42WW49
Second Coat A-100 Exterior Latex Flat A6 Series
Third Coat A-100 Exterior Latex Flat A6 Series
 - 4. Concrete Block
 - a. Flat – 100% Acrylic
First Coat PrepRite Block Filler B25W25
Second Coat A-100 Exterior Latex Flat A6 Series
Third Coat A-100 Exterior Latex Flat A6 Series
 - b. Satin – 100% Acrylic
First Coat PrepRite Block Filler B25W25
Second Coat A-100 Exterior Latex Satin A82 Series
Third Coat A-100 Exterior Latex Satin A82 Series
 - c. Gloss – 100% Acrylic
First Coat PrepRite Block Filler B25W25
Second Coat A-100 Exterior Latex Gloss A8 Series
Third Coat A-100 Exterior Latex Gloss A8 Series

- d. High Gloss, High Performance – Acrylic/Urethane
 - First Coat Heavy Duty Block Filler B42W46
 - Second Coat Macropoxy 646-100 B58Series
 - Third Coat High Solids Polyurethane 100 B65 Series
 - 5. Ferrous Metal
 - a. Flat – Acrylic
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat A-100 Exterior Latex Flat A6 Series
 - Third Coat A-100 Exterior Latex Flat A6 Series
 - b. Semi-Gloss – Acrylic
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat Solo Acrylic Latex Semigloss A76 Series
 - Third Coat Solo Acrylic Latex Semigloss A76 Series
 - c. Gloss – Acrylic
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat Solo Acrylic Latex Gloss A77 Series
 - Third Coat Solo Acrylic Latex Gloss A77 Series
 - d. Gloss – Rust Preventative Acrylic
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat ProIndustrial Acrylic Gloss B66-600 Series
 - Third Coat ProIndustrial Acrylic Gloss B66-600 Series
 - e. Gloss, Industrial High Performance – Inorganic Zinc/Epoxy/Acrylic
 - First Coat ZincClad III HS-100 B69 Series
 - Second Coat Macropoxy 646-100 B58 Series
 - Third Coat ProIndustrial Acrylic Gloss B66-600 Series
 - f. Matte, Industrial High Performance – Epoxy Primer/Epoxy/Acrylic
(VOC compliant in SCAQMD)
 - First Coat Macropoxy 646-100 B58 Series
 - Second Coat Macropoxy 646-100 B58 Series
 - Third Coat ProIndustrial Acrylic Eg-shel B66-660 Series
 - g. High Gloss, Industrial High Performance – Inorganic Zinc/Epoxy/Urethane
(VOC compliant in SCAQMD)
 - First Coat ZincClad III HS-100 B69 Series
 - Second Coat Macropoxy 646-100 B58 Series
 - Third Coat High Solids Polyurethane 100 Gloss B65 Series
 - h. High Gloss, Industrial High Performance – Epoxy Primer/Epoxy/Urethane
(VOC compliant in SCAQMD)
 - First Coat Macropoxy 646-100 B58 Series
 - Second Coat High Solids Polyurethane 100 Gloss B65 Series
 - Third Coat High Solids Polyurethane 100 Gloss B65 Series
 - 6. Galvanized Metal
 - a. Flat – Acrylic
 - Pretreatment GLL Clean n Etch
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat A-100 Exterior Latex Flat A6 Series
 - Third Coat A-100 Exterior Latex Flat A6 Series

- b. Semi-Gloss – Acrylic
 - Pretreatment GLL Clean n Etch
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat Solo Acrylic Latex Semigloss A76 Series
 - Third Coat Solo Acrylic Latex Semigloss A76 Series
- c. Gloss – Acrylic
 - Pretreatment GLL Clean n Etch
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat Solo Acrylic Latex Gloss A77 Series
 - Third Coat Solo Acrylic Latex Gloss A77 Series
- d. Gloss – Rust Preventative Acrylic
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat ProIndustrial Acrylic Gloss B66-600 Series
 - Third Coat ProIndustrial Acrylic Gloss B66-600 Series
- e. Matte, Industrial High Performance – Epoxy Primer/Acrylic
(VOC compliant in SCAQMD)
 - First Coat Macropoxy 646-100 B58 Series
 - Second Coat ProIndustrial Acrylic Eg-shel B66-660
 - Third Coat ProIndustrial Acrylic Eg-shel B66-660
- f. High Gloss, Industrial High Performance – Epoxy Primer/Urethane
 - First Coat Macropoxy 646-100 B58 Series
 - Second Coat High Solids Polyurethane 100 Gloss B65 Series
 - Third Coat High Solids Polyurethane 100 Gloss B65 Series
- 7. Wood – Paint Finish
 - a. Semi-Gloss – Acrylic
 - First Coat PrepRite ProBlock Primer B51W8020
 - Second Coat Solo Acrylic Latex Semigloss A76 Series
 - Third Coat Solo Acrylic Latex Semigloss A76 Series
 - b. Gloss – Acrylic
 - First Coat PrepRite ProBlock Primer B51W8020
 - Second Coat Solo Acrylic Latex Gloss A77 Series
 - Third Coat Solo Acrylic Latex Gloss A77 Series
- 8. Wood – Stain Finish – Opaque:
 - Two Coats AcryStain Water-based Solid Stain CK6688
- 9. Wood – Stain Finish – Semi-Transparent:
 - One Coat WoodScapes Ext Semi-transparent Stain A15T

C. Interior Systems:

- 1. Gypsum Board
 - a. Flat – Acrylic
 - First Coat ProMar 400 Zero VOC Primer B28W4600
 - Second Coat ProMar 200 Zero VOC Flat B30-2600
 - Third Coat ProMar 200 Zero VOC Flat B30-2600
 - b. Low Sheen – Acrylic
 - First Coat ProMar 400 Zero VOC Primer B28W4600

- | | |
|-------------|--|
| Second Coat | ProMar 200 Zero VOC Low Sheen B24-2600 |
| Third Coat | ProMar 200 Zero VOC Low Sheen B24-2600 |
- c. Eggshell – Acrylic
- | | |
|-------------|--------------------------------------|
| First Coat | ProMar 400 Zero VOC Primer B28W4600 |
| Second Coat | ProMar 200 Zero VOC Eg-shel B20-2600 |
| Third Coat | ProMar 200 Zero VOC Eg-shel B20-2600 |
- d. Semi-Gloss - Acrylic
- | | |
|-------------|--|
| First Coat | ProMar 400 Zero VOC Primer B28W4600 |
| Second Coat | ProMar 200 Zero VOC Semigloss B31-2600 |
| Third Coat | ProMar 200 Zero VOC Semigloss B31-2600 |
- e. Gloss – Acrylic
- | | |
|-------------|--|
| First Coat | ProMar 400 Zero VOC Primer B28W4600 |
| Second Coat | Sologloss Acrylic Latex Gloss A77 Series |
| Third Coat | Sologloss Acrylic Latex Gloss A77 Series |
- f. Gloss– Industrial High Performance – Waterborne Epoxy
- | | |
|-------------|-------------------------------------|
| First Coat | ProMar 200 Zero VOC Primer B28W2600 |
| Second Coat | WB Catalyzed Epoxy Gloss B73 Series |
| Third Coat | WB Catalyzed Epoxy Gloss B73 Series |
- g. High Gloss – Industrial High Performance – Waterborne Epoxy/Urethane
- | | |
|-------------|---|
| First Coat | Macropoxy 646-100 B58 Series |
| Second Coat | High Solids Polyurethane 100 Gloss B65 Series |
| Third Coat | High Solids Polyurethane 100 Gloss B65 Series |
2. Concrete & Plaster:
- a. Flat – Acrylic Copolymer
- | | |
|-------------|-----------------------------------|
| First Coat | Epoxy Masonry Tilt Primer B42WW49 |
| Second Coat | ProMar 200 Zero VOC Flat B30-2600 |
| Third Coat | ProMar 200 Zero VOC Flat B30-2600 |
- b. Low Sheen – Acrylic Copolymer
- | | |
|-------------|--|
| First Coat | Epoxy Masonry Tilt Primer B42WW49 |
| Second Coat | ProMar 200 Zero VOC Low Sheen B24-2600 |
| Third Coat | ProMar 200 Zero VOC Low Sheen B24-2600 |
- c. Eggshell –Acrylic Copolymer
- | | |
|-------------|--------------------------------------|
| First Coat | Epoxy Masonry Tilt Primer B42WW49 |
| Second Coat | ProMar 200 Zero VOC Eg-shel B20-2600 |
| Third Coat | ProMar 200 Zero VOC Eg-shel B20-2600 |
- d. Semi-Gloss –Acrylic Copolymer
- | | |
|-------------|--|
| First Coat | Epoxy Masonry Tilt Primer B42WW49 |
| Second Coat | ProMar 200 Zero VOC Semigloss B31-2600 |
| Third Coat | ProMar 200 Zero VOC Semigloss B31-2600 |
- e. Gloss – 100% Acrylic
- | | |
|-------------|--|
| First Coat | Epoxy Masonry Tilt Primer B42WW49 |
| Second Coat | Sologloss Acrylic Latex Gloss A77 Series |
| Third Coat | Sologloss Acrylic Latex Gloss A77 Series |
- f. Gloss – Industrial High Performance - Waterborne Epoxy

- | | |
|-------------|-------------------------------------|
| First Coat | Epoxy Masonry Tilt Primer B42WW49 |
| Second Coat | WB Catalyzed Epoxy Gloss B73 Series |
| Third Coat | WB Catalyzed Epoxy Gloss B73 Series |
- g. High Gloss- Industrial High Performance - Epoxy/Urethane
- | | |
|-------------|---|
| First Coat | Macropoxy 646-100 B58 Series |
| Second Coat | High Solids Polyurethane 100 Gloss B65 Series |
| Third Coat | High Solids Polyurethane 100 Gloss B65 Series |
3. Brick
- a. Flat – Acrylic Copolymer
- | | |
|-------------|-----------------------------------|
| First Coat | Epoxy Masonry Tilt Primer B42WW49 |
| Second Coat | ProMar 200 Zero VOC Flat B30-2600 |
| Third Coat | ProMar 200 Zero VOC Flat B30-2600 |
- b. Low Sheen – Acrylic Copolymer
- | | |
|-------------|--|
| First Coat | Epoxy Masonry Tilt Primer B42WW49 |
| Second Coat | ProMar 200 Zero VOC Low Sheen B24-2600 |
| Third Coat | ProMar 200 Zero VOC Low Sheen B24-2600 |
- c. Eggshell –Acrylic Copolymer
- | | |
|-------------|--------------------------------------|
| First Coat | Epoxy Masonry Tilt Primer B42WW49 |
| Second Coat | ProMar 200 Zero VOC Eg-shel B20-2600 |
| Third Coat | ProMar 200 Zero VOC Eg-shel B20-2600 |
- d. Semi-Gloss –Acrylic Copolymer
- | | |
|-------------|--|
| First Coat | Epoxy Masonry Tilt Primer B42WW49 |
| Second Coat | ProMar 200 Zero VOC Semigloss B31-2600 |
| Third Coat | ProMar 200 Zero VOC Semigloss B31-2600 |
- e. Gloss – 100% Acrylic
- | | |
|-------------|--|
| First Coat | Epoxy Masonry Tilt Primer B42WW49 |
| Second Coat | Sologloss Acrylic Latex Gloss A77 Series |
| Third Coat | Sologloss Acrylic Latex Gloss A77 Series |
- f. Gloss – Industrial High Performance - Waterborne Epoxy
- | | |
|-------------|-------------------------------------|
| First Coat | Epoxy Masonry Tilt Primer B42WW49 |
| Second Coat | WB Catalyzed Epoxy Gloss B73 Series |
| Third Coat | WB Catalyzed Epoxy Gloss B73 Series |
- g. High Gloss- Industrial High Performance - Epoxy/Urethane
- | | |
|-------------|---|
| First Coat | Macropoxy 646-100 B58 Series |
| Second Coat | High Solids Polyurethane 100 Gloss B65 Series |
| Third Coat | High Solids Polyurethane 100 Gloss B65 Series |
4. Concrete Block
- a. Flat – Acrylic Copolymer
- | | |
|-------------|-----------------------------------|
| First Coat | PrepRite Block Filler B25W25 |
| Second Coat | ProMar 200 Zero VOC Flat B30-2600 |
| Third Coat | ProMar 200 Zero VOC Flat B30-2600 |
- b. Low Sheen – Acrylic Copolymer
- | | |
|-------------|--|
| First Coat | PrepRite Block Filler B25W25 |
| Second Coat | ProMar 200 Zero VOC Low Sheen B24-2600 |
| Third Coat | ProMar 200 Zero VOC Low Sheen B24-2600 |

- c. Eggshell –Acrylic Copolymer
 - First Coat PrepRite Block Filler B25W25
 - Second Coat ProMar 200 Zero VOC Eg-shel B20-2600
 - Third Coat ProMar 200 Zero VOC Eg-shel B20-2600
 - d. Semi-Gloss –Acrylic Copolymer
 - First Coat PrepRite Block Filler B25W25
 - Second Coat ProMar 200 Zero VOC Semigloss B31-2600
 - Third Coat ProMar 200 Zero VOC Semigloss B31-2600
 - e. Gloss – 100% Acrylic
 - First Coat PrepRite Block Filler B25W25
 - Second Coat Sologloss Acrylic Latex Gloss A77 Series
 - Third Coat Sologloss Acrylic Latex Gloss A77 Series
 - f. Gloss – Industrial High Performance - Waterborne Epoxy
 - First Coat PrepRite Block Filler B25W25
 - Second Coat WB Catalyzed Epoxy Gloss B73 Series
 - Third Coat WB Catalyzed Epoxy Gloss B73 Series
 - g. High Gloss- Industrial High Performance – Acrylic/Urethane
 - First Coat Heavy Duty Block Filler B42W46
 - Second Coat Macropoxy 646-100 B58 Series
 - Third Coat High Solids Polyurethane 100 Gloss B65 Series
5. Ferrous Metal
- a. Flat – Acrylic Copolymer
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat ProMar 200 Zero VOC Flat B30-2600
 - Third Coat ProMar 200 Zero VOC Flat B30-2600
 - b. Low Sheen –Acrylic Copolymer
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat ProMar 200 Zero VOC Low Sheen B24-2600
 - Third Coat ProMar 200 Zero VOC Low Sheen B24-2600
 - c. Eggshell –Acrylic Copolymer
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat ProMar 200 Zero VOC Eg-shel B20-2600
 - Third Coat ProMar 200 Zero VOC Eg-shel B20-2600
 - d. Semi-Gloss – Acrylic Primer/ Acrylic Copolymer
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat ProMar 200 Zero VOC Semigloss B31-2600
 - Third Coat ProMar 200 Zero VOC Semigloss B31-2600
 - e. Semi-Gloss –Rust Preventative Acrylic
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat ProIndustrial Acrylic SemiGloss
 - Third Coat ProIndustrial Acrylic SemiGloss
 - f. Gloss – Acrylic Primer /100% Acrylic
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat Solo Acrylic Latex Gloss A77 Series
 - Third Coat Solo Acrylic Latex Gloss A77 Series

- g. Gloss –Rust Preventative Acrylic
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat ProIndustrial Acrylic Gloss
 - Third Coat ProIndustrial Acrylic Gloss
- h. Gloss – Industrial High Performance - Waterborne Epoxy
 - First Coat ProCryl Universal Acrylic Metal Primer B66-310
 - Second Coat WB Catalyzed Epoxy Gloss B73 Series
 - Third Coat WB Catalyzed Epoxy Gloss B73 Series
- i. High Gloss – Industrial High Performance - Epoxy/Urethane
 - First Coat Macropoxy 646-100 B58 Series
 - Second Coat High Solids Polyurethane 100 Gloss B65 Series
 - Third Coat High Solids Polyurethane 100 Gloss B65 Series
- 6. Wood – Paint Finish
 - a. Flat – Acrylic Copolymer
 - First Coat PrepRite ProBlock Primer B51W8020
 - Second Coat ProMar 200 Zero VOC Flat B30-2600
 - Third Coat ProMar 200 Zero VOC Flat B30-2600
 - b. Low Sheen – Acrylic Copolymer
 - First Coat PrepRite ProBlock Primer B51W8020
 - Second Coat ProMar 200 Zero VOC Low Sheen B24-2600
 - Third Coat ProMar 200 Zero VOC Low Sheen B24-2600
 - c. Eggshell – Acrylic Copolymer
 - First Coat PrepRite ProBlock Primer B51W8020
 - Second Coat ProMar 200 Zero VOC Eg-shel B20-2600
 - Third Coat ProMar 200 Zero VOC Eg-shel B20-2600
 - d. Semi-Gloss – 100% Acrylic
 - First Coat PrepRite ProBlock Primer B51W20
 - Second Coat Solo Acrylic Latex Semigloss A76 Series
 - Third Coat Solo Acrylic Latex Semigloss A76 Series
 - e. Semi-Gloss – Alkyd – Class A Fire Retardant
 - First Coat Please contact your Sherwin-Williams representative for
 - Second Coat fire retardant wood finish information.
 - Third Coat
 - f. Gloss – 100% Acrylic
 - First Coat PrepRite ProBlock Primer B51W8020
 - Second Coat Solo Acrylic Latex Gloss A77 Series
 - Third Coat Solo Acrylic Latex Gloss A77 Series
- 7. Wood – Stain & Lacquer
(VOC Rule in SCAQMD is 275 g/L for field-applied coatings)
 - a. Flat
 - First Coat SherWood BAC Wiping Stain S64
 - Filler Jasco Paste Wood Filler
 - Second Coat KemAqua Lacquer Sanding Sealer T65F520
 - Third Coat KemAqua Dull Rub Clear Lacquer T75F528
 - Fourth Coat KemAqua Dull Rub Clear Lacquer T75F528

b. Semi-Gloss

First Coat

Filler

Second Coat

Third Coat

Fourth Coat

SherWood BAC Wiping Stain S64

Jasco Paste Wood Filler

KemAqua Lacquer Sanding Sealer T65F520

KemAqua Semigloss Clear Lacquer T75F526

KemAqua Semigloss Clear Lacquer T75F526

c. Gloss

First Coat

Filler

Second Coat

Third Coat

Fourth Coat

SherWood BAC Wiping Stain S64

Jasco Paste Wood Filler

KemAqua Lacquer Sanding Sealer T65F520

KemAqua Gloss Clear Lacquer T75C525

KemAqua Gloss Clear Lacquer T75C525

END OF SECTION

SECTION 10200

LOUVERS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENT

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 DESCRIPTION

Work included: Provide metal louvers and vents as required by the Drawings, as specified herein, and as needed for a complete and proper installation. All of the requirements of the Contract Documents apply to this Section.

1.03 QUALITY ASSURANCE

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 for proper performance of the work of this Section.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

Provide the following:

1. Provide in accordance with Article 3.11 of the General Conditions.
2. Manufacturer's Specifications and other data needed to prove compliance with the specified requirements.
3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
4. Samples of the proposed products, showing profiles, joining, and finish.
5. Manufacturer's recommended installation procedures which, when accepted by the Architect, will become the basis for accepting or rejecting actual installation procedures for the Work.

PART 2 – PRODUCTS

2.01 METAL LOUVERS

A. Provide metal louvers in the arrangements and dimensions shown on the Drawings, and with the following attributes:

1. High Performance Fixed Drainage Louver, 4" deep. Frames and blades to be 6063-T5 alloy 0.081" (2.06mm) thick. Mullions to be sliding interlock type with integral internal drain. Jamb and mullion drains to be open on front face in order to direct water away from inside of louver. Blades to be one-piece extrusions with gutters designed to catch and direct water to jamb and mullion drains. Fasteners to be aluminum or stainless steel. Louvers to have framed mesh removable mill finish aluminum insect screens.
2. Thin line Louver, 2" deep. Frames and blades to be 6063-T5 alloy 0.050" (1.27mm) thick. Fasteners to be aluminum or stainless steel. Louvers to have framed 18 x 14

aluminum 0.0123" (0.312mm) diameter mesh mill finish aluminum insect screens. All frames to be mitered at corners and reinforced with corner brackets.

3. Finish - Kynar. 500 coating in color selected by the Architect from the manufacturer's color selections.

B. Acceptable products:

1. High Performance Fixed Drainable Louver, Model 4097 & Thinline Louver, Model 2322A, as manufactured by Construction Specialties, Inc.
2. Equal products of other manufacturers when accepted in advance by the Architect.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the Work.
- C. Do not proceed until unsatisfactory conditions are corrected.
- D. Verify all opening dimensions in field prior to fabrication and installation of louvers.
- E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
- B. Install the work of this Section in strict accordance with the original design, the accepted Shop Drawings, and the manufacturer's recommended installation procedures as accepted by the Architect, anchoring all components firmly into position in true alignment within a tolerance of one in 1000 vertically and horizontally.
- C. Dissimilar Materials:
 1. Where aluminum surfaces come in contact with metals other than stainless steel, zinc, or white bronze of small area, isolate the aluminum by one of the following methods:
 - a. Paint the dissimilar metal with a prime coat of zinc-chromate primer, followed by two coats of aluminum metal-and-masonry paint.
 - b. Paint the dissimilar metal with a coating of heavy-bodied bituminous paint.
 - c. Apply a good quality sealant material between the aluminum and the dissimilar metal.
 - d. Isolate the dissimilar metals with non-absorptive tape or gaskets.

3.03 CLEANING

Prior to completion of the Work, Contractor shall thoroughly clean all exposed surfaces of louvers.

1. Use only the cleaning materials and techniques recommended by the manufacturer of the material being cleaned.
2. Do not scratch or otherwise damage the finish.

***** END OF SECTION *****

SECTION 10400

IDENTIFYING DEVICES

PART 1 -- GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SECTION INCLUDES

- A. Molded plastic signs.
- B. Aluminum free-standing signs.
- C. Aluminum channel letters.
- D. Dedication Plaque

1.03 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.04 SUBMITTALS

- A. Provide in accordance with Article 3.11 of the General Conditions.
- B. Submit the following:
 - 1. samples illustrating full size sample sign, of type, style and color specified including method of attachment.
 - 2. manufacturer's installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package signs, labeled in name groups.
- B. Store adhesive tape at ambient room temperatures.

1.06 ENVIRONMENTAL REQUIREMENTS

Do not install signs when ambient temperature is below 70 degrees F. Maintain this minimum during and after installation of signs.

1.07 PRODUCT HANDLING

Adhere to requirements of Section 01770.

1.08 CLOSE-OUT: Comply with the requirements of Section 01770 – Contract Closeout.

A. Reports:

None required.

B. As-Builts:

Comply with the requirements of Section 01770 – Contract Closeout.

C. Operation and Maintenance Data:

None required

D. Extra Materials:

None required

E. Extended Warranty:

Comply with the requirements of the General Condition Article 3.5 and Section 01740.

PART 2 -- PRODUCTS

2.01 MATERIALS -- EXTERIOR BUILDING SIGNAGE

- A. Basis of Design: A.R.K. Ramos Architectural Signage Systems; Aluminum Channel Letter
- B. Letters and/or Numbers -- Font/Size/Finish/Color: as indicated on the Drawings.
- C. Brackets: PPM-1 bracket sleeved stud.
 - 1. Set in adhesive in masonry.
 - 2. Attach to support in framed wall.

2.02 MATERIALS -- ROOM ID SIGNAGE

- A. 1/8" thick ES Plastic. Color to be selected by Architect.
- B. Graphics to be vinyl die-cut. 3/4" Helvetica Medium caps.
- C. Adhesive mounting.
- D. All signs to have 1/2" Radius corners.
- E. See Schedule for types.
- F. All signs installed on glass shall have a full size backing plate adhered to the opposite side of the glass of the same color as the sign.

2.03 MATERIALS -- OTHER INTERIOR SIGNAGE

- A. Products: See Drawings for types.
- B. Material: 1/8" thick ES Plastic. Size and color as indicated on the drawings. All signs to have 1/2" Radius corners.
- C. Graphics: to be vinyl die-cut. Text, Font, size and color as indicated on the drawings.
- D. Mounting: Adhesive mounting.

2.04 MATERIALS -- ALUMINUM FREE-STANDING SIGN

- A. See Drawings for types and locations.
- B. Provide 1/8" thick aluminum sign, on 1-3/4" x 1-3/4" x 1/8" x 7" post; black duranodic aluminum tubing and sign.
- C. Letters are to be vinyl die-cut. Text shall conform to access requirements of the CBC.
- D. Color to be black anodized with white lettering.
- E. Signs are to be sleeve mounted in concrete footings.

2.05 DEDICATION PLAQUE

See Drawings for: location at Flagpole, size, text, and material details.

2.06 ACCESSORIES

- A. Mounting Hardware: Chrome screws; base sleeve and studs per manufacturer's recommendations.
- B. Tape Mount: Double sided tape, permanent adhesive.
- C. Adhesive: Silastic adhesive as recommended by manufacturer.

PART 3 -- EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify adequate support for Building Signs. Coordinate footings with other trades.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install signs after doors and surfaces are finished, in locations indicated.
 - 1. Furnish and install all anchorage devices required to install the item and its appurtenances complete. Provide anchorage in ample time when required to be built in by other trades.
 - 2. All wall-mounted items shall be securely fastened to solid backing or blocking.
- C. Center plastic signs on doors, level.
- D. Anchor all components firmly into position for long life under hard use.
- E. Clean and polish.

*****END OF SECTION*****

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SECTION 10520

FIRE PROTECTION SPECIALTIES

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK

A. Provide and install all Fire extinguishers and Cabinets as shown on the documents and as required by the local Fire Marshall.

B. Accessories as required for a complete and proper project.

1.03 QUALITY ASSURANCE

A. Conform to NFPA 10 requirements for extinguishers.

B. Provide fire extinguishers, cabinets, and accessories by single manufacturer.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions

B. Submit the following:

1. Physical dimensions, operational features, color and finish, wall-mounting brackets with mounted measurements, anchorage details, rough-in measurements, location, and details.
2. Manufacturer's installation instructions.
3. Manufacturer's operation and maintenance data.
4. Include test, refill or recharge schedules, procedure, and re-certification requirements.

1.06 ENVIRONMENTAL REQUIREMENTS

Do not install extinguishers when ambient temperatures may cause freezing.

1.07 PRODUCT HANDLING

Comply with the requirements of Section 01640.

1.08 CLOSE-OUT: Comply with the requirements of Section 01770 – Contract Closeout.

A. Reports:

None required.

B. As-Built:

Comply with the requirements of Section 01770 – Contract Closeout.

C. Operation and Maintenance Data:

None required

D. Extra Materials:

None required

E. Extended Warranty:

Comply with the requirements of the General Condition Article 3.5 and Section 01740.

PART 2 -- PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Larsen's Manufacturing Company or Architect approved equal.

2.02 EXTINGUISHERS

Multi-Purpose Chemical Type: Larsen's Steel tank, Model MP 5, with pressure gage, and UL Rating 2A-10B:C or approved equal.

2.03 CABINETS

Typical Extinguisher Cabinet:

- A. Provide Larsen's 2409-5R Vertical Duo Panel cabinet.
- B. Primer finish.

2.04 ACCESSORIES

- A. Mounting Hardware: Appropriate to cabinet - see manufacturer's installation instructions.
- B. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

2.05 FABRICATION

- A. Form body of cabinet with tight inside corners and seams.
- B. Pre-drill holes for anchorage.
- C. Form perimeter trim and door stiles by welding, filling, and grinding smooth.
- D. Hinge doors for 180 degree opening.
- E. Glaze doors with resilient channel gasket glazing.

2.06 FINISHES

- A. Extinguisher: Red enamel.
- B. Cabinet Trim and Door: Primed to be painted to match adjacent surface.
- C. Cabinet Interior: Enamel white.

PART 3 -- EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that rough openings for cabinet are correctly sized and located.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

- A. Install cabinets plumb and level in wall openings so that there is 54 inches from finished floor to door handle.
- B. Secure rigidly in place in accordance with manufacturer's instructions.

***** END OF SECTION *****

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SECTION 11027

KNOX BOXES

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK

This Section describes the requirements for furnishing and installing lock boxes.

1.03 QUALITY ASSURANCE

Coordinate ordering lock boxes with local Fire District.

1.04 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.05 SUBMITTALS

A. Provide in accordance with Article 3.11 of the General Conditions.

B. Product Data: Manufacturer's descriptive and technical data and installation details.

1.06 CLOSE-OUT: Comply with the requirements of Section 01770 – Contract Closeout.

A. Reports:

None required.

B. As-Builts:

Comply with the requirements of Section 01770 – Contract Closeout.

C. Operation and Maintenance Data:

None required

D. Extra Materials:

None required

E. Extended Warranty:

Comply with the requirements of the General Condition Article 3.5 and Section 01740.

PART 2 – PRODUCTS

2.01 LOCK BOXES

A. Basis of Design: Knox Company

1. Construction: Heavy-duty, high security
2. Door: 5/8-inch solid steel with gasket
3. Size: 9½-inches high x 9½-inches wide x 5-inches deep
4. Mounting: Recessed
5. Finish: Aluminum Finish

B. Model:

1. Model #4400 at Doors
2. Model #3770 at Gates
3. Vehicular Gate Key Control Switch: Knox #3502

C. Fastenings: Non-ferrous, type to suit installation conditions

PART 3 -- EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

- A. Install lock boxes at locations indicated in accordance with manufacturer's instructions.
- B. Securely fasten in place with sides plumb and level.
- C. Exposed surfaces shall be free from scratches, tool marks, and other damage and defects.

***** END OF SECTION *****

SECTION 13850

SECURITY SYSTEM

PART 1 -- GENERAL

- 1.01 Furnish and install a complete intrusion detection monitoring and control system with the performance criteria detailed in this specification; one in each building. The systems shall be inclusive of all necessary functionality, monitoring and control capability as detailed herein and on accompanying shop drawings.
- 1.02 The systems shall be completely programmable from any keypad with programming access determined by level of Personal Identification Number (PIN) code. There shall be no need for a removable programming module or PROM burn to accomplish user programming changes.
- 1.03 The system shall be listed as a Power Limited Device and be listed under the following performance standards.

UL 1610 Central Station Burglar Alarm Units.

UL 1635 Digital Burglar Alarm Communicator System Units.

UL 1023 Household Burglar Alarm System Units.

UL 365 Police Station Connected Burglar Alarm Units and Systems.

UL 609 Local Burglar Alarm Units and Systems.

UL 864 Control Units for Fire Protective Signaling Systems.

UL 985 Household Fire Warning System Units.

NFPA71 Central Station Signaling Systems.

NFPA72A Local Protective Signaling Systems.

NFPA72C Remote Station Protective Signaling Systems.

NFPA72D Proprietary Protective Signaling Systems.

NFPA74 Household Fire Warning Equipment.

CSFM California State Fire Marshal Specifications.

Each system shall be supplied with complete details on all installation criteria necessary to meet all of the above listings.

- 1.04 The system supplier shall be a company specializing in the manufacture and supply of security, fire and access control systems with at least (5) years of experience and shall have local employees available for support during installation and for final hook-up and acceptance testing. The local manufacturer's office shall produce system specific layout and wiring shop drawings for use by the installing contractor.

1.05 WARRANTY

The contractor shall warrant the complete system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one year from the completed and certified test.

The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two inspections and tests per year.

1.06 SUBSTITUTIONS

Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.07 SUBMITTALS

Provide in accordance with Article 3.11 of the General Conditions.

PART 2 – PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Input/Output Capacity

The system shall be capable of monitoring a minimum of 48 individual loops or zones and controlling a minimum of (8) output relays.

B. User/Authorization Level Capacity

The system shall be capable of operation by 100 unique PIN codes with each code being assigned one of 9 User Authorization Levels.

C. Area System

The user of the system shall be capable of selectively arming and disarming any one or more of 8 areas within the system based on the user P.I.N. code used. Each of the 48 loops or zones shall be assignable to any one of the 8 available areas.

D. Keypads

The system shall support a minimum of 8 keypads with Alphanumeric Display. Each keypad shall be capable of arming and disarming any portion of the intrusion detection system based on P.I.N. authorization.

The keypads alphanumeric display shall provide complete prompt messages during all stages of operation and programming of the system and display all relevant operating and test data.

E. Loop Configuration

The system shall have a minimum of 16 Class B loops available in the Command Processor control cabinet and a minimum of 4 Class B loops available at each keypad or loop expander on the system. The system shall have the capacity for a minimum of 8 keypads or loop expanders total but at least one must be a keypad. All Class B loops shall be 2 wire, 22 AWG minimum, supervised by an End-of-Line (EOL) device and shall be able to detect open, normal or short conditions in excess of 200 milliseconds duration.

F. Keypad Communication

Communication between the Command Processor control panel and all keypads and loop expanders shall be multiplexed over a 4 conductor non-shielded cable. This cable shall also provide power to all keypads, loop expanders and other power consuming detection devices.

G. Output Relays

The Command Processor control cabinet shall have, as an integral part of the assembly, (8) output control SPDT form C relays rated 3 amps at 3 ϕ VDC or 120 VAC. Each of these relays shall be capable of activation as outlined in this specification.

H. Primary Power

The Command Processor primary power supply shall be a 16 VAC 40VA Wire-in transformer.

I. Secondary Power

The Command Processor secondary power supply shall be a 12VDC 6AH sealed lead-acid rechargeable battery. The battery shall be protected by an automatic circuit breaker. When

initially connected to battery power alone, the Command Processor control panel shall be protected by a cutoff relay until manually started or primary power is applied. The secondary power shall be float charged at 13.8 VDC at a maximum of 1.2 amps.

J. Battery Supervision

The Command Processor control panel shall supervise the secondary power source by placing a load across the battery. Once every hour while the primary source is available. If the voltage falls below 11.9 VDC a low battery fault shall be detected. If the primary power source is not available, a low battery fault shall be detected any time the voltage falls below 11.9 VDC.

The secondary power supply shall be automatically disconnected from the system when the primary power supply is not available and the secondary power supply drops to 10.0 VDC.

K. Ground Supervision

The Command Processor control panel shall supervise the earth ground connection and annunciate an open circuit condition.

L. Bell Output use during system installation and testing which will silence the bell and when silenced place the bell circuit into a trouble condition. (Requires polarized bell module)

M. Auxiliary Output

The Command Processor control panel shall be capable of supplying a minimum of 1 amp continuous at 10.5 - 15VDC to power keypads, loop expanders, smoke detectors and other power consuming detection devices such as motion detectors. This output shall also be separately fused and the panel shall provide a separate terminal for smoke detectors and disconnect power for 3 seconds during smoke detector reset.

N. Keypad Trouble

If at any time a keypad does not detect polling, the alphanumeric display shall indicate "Service Required". If at any time a keypad detects polling but not its particular address, the alphanumeric display shall indicate "Non-Polled Address".

2.02 LIGHTNING SUPPRESSION

The Command Center control panel primary power source and incoming telephone lines shall be protected from lightning, power surges, voltage spikes and transient or RF interference with a combination of zener overvoltage transient suppressors, R/C filters, ferrite beads and spark gaps. (Requires Lightning Suppressor module.)

2.03 REMOTE COMMUNICATION CAPABILITY

A. Central Station Capability

The system shall be monitored at a Central Monitoring Station using (a Digital Alarm Communicating Transmitter) (dual Digital Alarm Communicating Transmitters) (Multiplex Communication) (Multiplex Communication with Digital Alarm Communicating Transmitter backup). The Digital Alarm Communicating Receiver at the Central Monitoring Station shall be capable of receiving all data as specified in this specification.

NOTE-CONSULT SALES ENGINEERING FOR MULTIPLEX TRANSMISSION.

B. Communicator Program

Single Line Digital Alarm Communicating Transmitter

The system shall be capable of dialing 2 telephone numbers, of 15 digits each using the switched telephone network such that if 2 unsuccessful attempts are made to the first number the system shall automatically switch to the second number and make 2 attempts. If these 2 attempts are unsuccessful the system shall switch between numbers after 2 attempts each, until a successful connection is made or a maximum of 10 try's are attempted. Once 10

unsuccessful attempts are made the system shall stop dialing. Should another event occur which requires a message to be transmitted the dialing process shall be repeated.

(Option B, Dual Line Digital Alarm Communicating Transmitter)

The system shall be capable of dialing 2 telephone numbers of 15 digits each using 2 separate switch telephone network lines such that if 2 unsuccessful attempts are made on the first line to the first number the system shall make 2 attempts on the first line to the second number. If these 2 attempts are unsuccessful the system shall repeat the sequence using the second line. If all 8 attempts are unsuccessful the system shall make 2 further attempts on the first line to the first number. After the tenth unsuccessful attempt dialing will stop. Should another event occur which requires a message to be transmitted the dialing process shall be repeated.

(Option C, Multiplex Communication)

The system shall be capable of being continuously polled by a compatible receiver system over a leased 3002 type telephone line and identifying itself with its unique account number when polled.

The Command Processor control panel shall be capable of supplying a minimum of 2 amps continuous at 10.5-15.0 VDC to power local sounding devices. This output shall be separately fused.

This output shall be supervised and the system shall detect and annunciate an open circuit, a shorted circuit or a ground on either side of the bell circuit. The system shall incorporate a silence switch for

(Option D, Multiplex Communication With Digital Alarm Communicating Transmitter Backup)

The system shall be capable of being continuously polled by a compatible multiplex receiver system over a leased 3002 type telephone line and identifying itself with its unique account number when polled. When the system has a message to Communicate and a polling request is not received for 150 seconds, or 75 seconds when the message is a fire type, the system shall switch to the Digital Alarm Communicating Transmitter backup and proceed as follows.

The Digital Alarm Communicating Transmitter backup shall be capable of dialing 2 telephone numbers using the switched telephone network such that if 2 unsuccessful attempts are made to the first number the system will automatically switch to the second number and make 2 attempts. If these 2 attempts are unsuccessful the system shall switch between numbers after 2 attempts each until a successful connection is made or 10 try's are attempted. Once 10 unsuccessful attempts are made the system shall not try again. After dialing is complete communication shall switch back to multiplex when a poll is received. Should another event occur which requires a message to be transmitted and polling has not been received, the dialing process shall be repeated.

C. (Option) Automatic Recall Time

(Single and Dual Line DACT and Multiplex with DACT Backup).

The system shall transmit an Automatic Recall Message using the Digital Alarm Communicating Transmitter to test communications, each 24 hours.

D. Communication Failure Output

(Option A, DACT Systems)

Should a Digital Alarm Communicating Transmitter fail to communicate with the Central Monitoring Station receiver on 3 successive attempts an output relay shall be activated on the Command Processor control panel. This relay output shall be reset when the system is disarmed.

(Option B, Multiplex Systems)

Should a polling signal not be received by the Command Center control panel for a period of 150 seconds an output relay shall be activated. This relay shall be reset when the system is disarmed.

E. (Option) Opening And Closing Reports

The system shall communicate to a compatible receiver each time an area is armed and disarmed and report the area number and name and the user number of the individual operating the system.

F. (Option) Reports To Operator

(Only Available When Opening & Closing Reports Are Chosen)

The system shall require that when opening and closing reports are communicated to a Central Monitoring Station the compatible receiver operator must acknowledge each communication and record same in log.

G. Close Waiting (Option)

When openings and closings are being monitored at a Central Monitoring Station, the system shall wait for an acknowledgment from the Central Monitoring Station before displaying the "System ON" message during arming of the security areas. During the waiting period the display shall read "One Moment" and the exit delay shall be extended during this period.

H. Closing Check (Option)

After temporary or permanent schedules have expired the system shall at one minute past each hour, check to see that all areas of the system are armed. If any area shall be found to be disarmed past the scheduled time, the system shall emit a steady beep and display "Closing Time" at the keypad displays designated to display System Troubles. If the system is not armed within 4 minutes, then a No Closing Report shall be transmitted to the Central Monitoring Station.

I. (Option) Abort Reports

The system shall communicate an alarm abort report to the Central Monitoring Station any time a burglar alarm has been transmitted and the system disarmed while the alarm bell is still sounding.

J. (Option) Loop Restoral Reports

The system shall communicate all loop restorals to the Central Monitoring Station. The report shall include the loop number, name and condition.

K. (Option) Bypass Reports

The system shall communicate all loop bypasses and resets to the Central Monitoring Station. The report shall include the loop number and name and the user number of the individual operating the system.

L. (Option) Schedule Change Reports

The system shall communicate all permanent and temporary schedule changes to the Central Monitoring Station. The report shall include the day, opening time, closing time and the user number making the change.

M. (Option) Code Change Reports

The system shall communicate all code additions and deletions to the Central Monitoring Station. The report shall include the user number added or deleted and the user number making the change.

N. (Option) Door Access Reports

The system shall allow the selection of a door access report from any combination of the 8 keypads in the system. A door access report shall be communicated to the Central Monitoring Station when a door is accessed from a selected keypad. The report will include the user number and the address of the keypad used to access its associated door.

Doors not selected to be reported shall remain accessible through the associated keypad by authorized users. (Must use key-pads with door strike relays.)

O. Power Failure Delay (Option)

The system shall transmit a Power Failure message to the Central Monitoring Station should primary power fail for (0 to 9) hours.

2.04 SYSTEM CAPABILITY

A. Arm Display (Option)

The system shall display the identity of all armed security areas on keypad alphanumeric displays.

B. Opening Code (Option A)

The system shall require a valid user code to disarm security areas.

Opening Code (Option B)

The system shall require a valid user code to disarm security areas outside of temporary or permanent scheduled periods. No user code shall be required to disarm security areas during scheduled period.

C. Closing Code (Option A)

The system shall require a valid user code to arm security areas.

Closing Code (Option B)

The system shall not require a user code to arm security areas.

D. Any Bypass (Option A)

The system shall permit any security loops to be bypassed without a valid user code during the arming sequence.

Any Bypass (Option B)

The system shall require a valid user code to bypass any security loops during arming.

E. Entry Delay

The system shall permit an entry delay time of (0 to 250) seconds on any loops assigned as exit type loops. When an armed exit type loop is activated, a pre-warn tone shall sound and the entry keypad shall display "Enter Code". If a valid user code is not entered prior to the expiration of the entry delay, an alarm will be transmitted.

F. Exit Delay

The system shall permit an exit delay time of (0 to 250) seconds on any loops assigned as exit type loops. This exit delay shall be displayed and counted down on the exit keypads alphanumeric display. If any loop is in an alarm condition at the expiration of the exit delay, the entry delay sequence will commence immediately.

G. Loop Retard Delay (Option)

The system shall allow a loop retard delay of (0 to 250) seconds to be applied to any loop designated as Fire, Supervisory, Auxiliary 1 or Auxiliary 2. This retard delay shall only function in the short condition.

H. Swinger Bypass (Option)

The system shall be able to automatically bypass any loop which trips more than (0 to 7) times within one hour commencing with the first trip. The system shall also transmit a report of automatic bypass to the Central Monitoring Station if Bypass Reports are included as monitored events.

I. Reset Swinger Bypass (Option)

The system shall also be able to automatically reset the swinger bypass when Swinger Bypass has been in effect for an hour without a further trip on the bypassed loop. The system shall also transmit a report of automatic swinger bypass reset to the Central Monitoring Station if bypass reports are included as monitored events.

2.05 OUTPUT CONTROL CAPABILITY

A. Bell Cutoff (Option)

The system shall automatically reset the Bell Output (0 to 99) minutes after the Bell Output has been activated.

B. Bell Test (Option)

The system shall be able to automatically activate the bell output for one second each time the security system is armed.

C. Bell Action

The system shall be able to activate the bell output in the following manner for the loop type specified.

Fire Type	(None) (Pulsed) (Steady)
Burglary Type	(None) (Pulsed) (Steady)
Supervisory Type	(None) (Pulsed) (Steady)
Panic Type	(None) (Pulsed) (Steady)
Emergency Type	(None) (Pulsed) (Steady)
Auxiliary 1 Type	(None) (Pulsed) (Steady)
Auxiliary 2 Type	(None) (Pulsed) (Steady)

D. Cutoff Output (Option)

The system shall allow a single designated output relay to be automatically reset after a period of (0 to 99) minutes. The system will allow this relay to be manually silenced from the keypad.

E. Area Outputs (Option)

The system shall activate an output relay per security area when any security area is placed in the armed condition. (Requires 16 output relay model control panel)

F. Fire Alarm Output (Option)

The system shall activate a specified output relay whenever a fire type loop is placed in the alarm condition. This relay shall be reset when the Fire Reset function is performed and no fire type loops remain in the alarm condition.

G. Fire Trouble Output (Option)

The system shall activate a specified output relay whenever a fire type loop is placed in the trouble condition or when a supervisory type loop is placed in the alarm or trouble condition. The relay shall be turned off when all fire and supervisory type loops are restored.

2.06 USER CAPABILITY

A. (Option) Arm/Disarm

The system shall allow authorized users to arm and disarm the burglary system and display such on the alphanumeric display.

B. (Option) Alarm Silence

The system shall allow authorized users to silence the bell output and display such on the alphanumeric display.

C. (Option) Fire Reset

The system shall allow authorized users to reset the smoke detectors and display such on the alphanumeric display.

D. (Option) Door Access

The system shall allow authorized users to activate a door strike associated with each keypad and display such on the alphanumeric display. (Requires keypad with door strike relay.)

E. (Option) Armed Areas

The system shall allow authorized users to display a list of armed areas by number and name On the alphanumeric display.

F. (Option) Outputs On/Off

The system shall allow authorized users to individually turn output relays on and off and display the status of each output relay on the alphanumeric keypad.

G. (Option) Loop Status

The system shall allow authorized users to display the armed, bypassed or alarmed loops on the alphanumeric keypad and check the status of individual loops.

H. (Option) Bypass Loops

The system shall allow authorized users to individually bypass any of the burglary loops on the system and display same on the alphanumeric keypad. These users shall also be able to reset any bypassed loops and the system shall display same on the alphanumeric display. Any bypassed loop shall automatically be reset each time the system is disarmed.

I. (Option) System Test

The system shall allow authorized users to test the bell circuit, battery and communications to the central monitoring station and display the results on the alphanumeric display.

J. (Option) User Codes

The system shall allow authorized users to add and delete user codes in the system memory.

K. (Option) Schedules

The system shall allow authorized users to enter, change or delete daily on and off schedules for the output relays, and temporary and permanent opening and closing schedules.

L. (Option) Time

The system shall allow authorized users to display and reset the day of the week and the time of the day in the system memory.

2.07 DISPLAY CAPABILITY

A. (Option) Loop Monitor

The system shall be able to monitor selected burglary loops during disarmed periods and display the loop names when tripped.

B. (Option) System Monitor Trouble

The system shall annunciate and display trouble conditions from the following functions on any or all of the alphanumeric keypads in the system. The functions to be displayed shall be bell circuit, AC power, battery power, bell power fuse, panel tamper, auxiliary power fuse, and ground circuit.

C. (Option) Fire Loops

The system shall annunciate and display fire loop alarms and troubles on any or all of the alphanumeric keypads in the system.

D. (Option) Burglary Loops

The system shall annunciate and display burglary loop alarms and troubles on any or all of the alphanumeric keypads in the system.

E. (Option) Supervisory Loops

The system shall display supervisory loop alarms and troubles on any or all of the alphanumeric keypads in the system.

F. (Option) Panic Loops

The system shall display panic loop alarms and troubles on any or all of the alphanumeric keypads in the system.

G. (Option) Emergency Loops

The system shall display emergency loop alarms and troubles on any or all of the alphanumeric keypads in the system.

H. (Option) Auxiliary 1 Loops

The system shall display auxiliary 1 alarms and troubles on any or all of the alphanumeric keypads in the system.

I. (Option) Auxiliary 2 Loops

The system shall display auxiliary 2 alarms and troubles on any or all of the alphanumeric keypads in the system.

2.08 AREA IDENTIFICATION CAPABILITY

(Area Arming systems Only)

Area Name

Each of the 8 areas within the system shall be identified by a name consisting of up to ten alphanumeric characters. This name shall be used to identify an area when displayed on the alphanumeric keypad.

2.09 LOOP OR ZONE CAPABILITY

A. Loop Name

Each of the loops within the system shall be identified by a name consisting of up to ten alphanumeric characters. This name shall be used to identify a loop when displayed on the alphanumeric keypad.

B. Loop Type

The system shall be able to identify each loop as one of ten different loop types. Each loop type shall have up to eight specifiable characteristics with a default configuration based on loop type.

The system shall allow each individual loop to be configured independently for each of the characteristics related to its selected loop type.

The system shall allow each individual loop to activate one selectable output relay per loop status change and the loop changes that can activate a separate relay each are disarmed opened, disarmed shorted, armed open and armed shorted if available in the selected loop type for that loop. Further, the selected relay shall be either latched activated, pulsed on and off, momentarily activated or follow the status of the loop.

C. Loop Message

The system shall allow the selection of either an alarm, trouble or no message to be displayed on the alphanumeric keypad (and transmitted to the Central Monitoring Station) when a loop condition changes. The selection shall be made separately for disarmed open circuit, disarmed short circuit, armed open circuit and armed short circuit when available for the selected loop type. Each loop shall have a default selection based on the loop type selected.

D. Pre-warn Addresses

The system shall allow the selection of any or all keypads to sound a pre-warning when entry is made through an exit type loop. The system shall at this time also display "Enter Code" on the alphanumeric display on selected keypads.

E. (Option) Retard

The system shall allow any individual fire, supervisory or auxiliary loop to apply a retard period prior to activating an alarm message and if a retard is chosen the system shall allow the annunciation and display of retard activation on any or all alphanumeric keypad displays during the retard period.

2.010 SYSTEM OPERATION

A. User Codes

The system shall allow an authorized user to add a minimum of 100 individual PIN codes to the system and each PIN code shall be assigned to one of 9 authorization levels.

Each PIN code shall be from two to five digits in length (and allow the assigned user to activate and deactivate a predefined combination of the burglary areas within the system)

B. Output Schedules

The system shall allow an authorized user to establish and change a single on-off permanent schedule for each of the output relays for each or the seven days of the week.

C. Burglary System Schedules

The system shall allow an authorized user to establish a permanent opening and closing schedule for each day for the burglar alarm system such that certain users shall not be able to deactivate the alarm system outside of the established schedule. The system shall also allow an authorized user to establish a temporary opening and closing schedule for each day for the burglar alarm system to operate as a permanent schedule except that this schedule shall be automatically canceled after a single use.

(The system shall also use the established schedules as a reference for the Closing Check function when openings and closings are reported to a central monitoring station.)

2.011 MATERIAL

A. Command Processor Control Panel

The Command Processor control panel shall be Simplex Product #
(3002-9001 with 2 output relays.)

(3002-9002 with 8 output relays.)
(3002-9003 with 16 output relays.)

B. Security command Keypads

The Security Command keypads shall be Simplex Product #
(3002-9801 Surface Mount)
(3002-9802 Surface Mount with door strike relay)
(3002-9803 Flush Mount)
(3002-9804 Flush Mount with door strike relay)

C. (Option) Lightning Suppressor

The Lightning Suppressor shall be Simplex Product #
3009-9817

D. (Option) Communication Modules

The Communication Modules shall be Simplex Product #
3002-9813 Single Line DACT
3002-9814 Backup DACT

E. (Option) Polarized Bell Module

The Polarized Bell Module shall be Simplex Part #3002-9820.

F. (Option) Primary Power Supply

1. The Primary Power Supply shall be Simplex Product # 3009-9816 (Required to support 3 or 4 batteries)
2. The Primary Power Supply shall be Simplex Product # 3009-9815 (Required where Class II transformers are not acceptable)

G. Secondary Power Supply

The Secondary Power Supply shall be Simplex Product #3002-9824 (First battery on system) and (1, 2 or 3) Simplex Product # 3002-9821 (2nd, 3rd, & 4th batteries on system).

H. Detection Devices

The various detection devices connected into the protection loops shall be standard Simplex products to ensure compatibility of performance and power consumption with the specified system.

I. Output Devices

The various control devices connected to the system output relays shall be standard Simplex products to ensure compatibility of performance and power consumption with the specified system.

PART 3 -- EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the Work.

- C. Do not proceed until unsatisfactory conditions are corrected.
- D. Beginning of installation means acceptance of conditions.

3.02 CODES

The contractor shall provide and install the system in accordance with the plans and specifications, all national and local codes, and the manufacturer's installation instructions.

3.03 OTHER WORK

Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractor.

3.04 SUPERVISION

The manufacturer shall provide all on-site supervision of the installation, perform a complete functional test of the system and submit a written report to the contractor attesting to the proper operation of the complete system.

3.05 TESTING

The complete system shall be fully tested by the contractor in the presence of the owner's representative, the architect, the consulting engineer, the authority having jurisdiction and the manufacturer. Upon completion of a successful test, the contractor shall so certify in writing to the Owner, architect, manufacturer and general contractor.

3.06 TRAINING

The equipment manufacturer shall provide, as part of this contract, a minimum of (2) hours system programming and operation training to the building owner and consulting engineer.

END OF SECTION

SECTION 22 01 00

BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes general administrative, rules (codes, standards and regulations), and procedural requirements for plumbing installations. The following administrative procedural requirements are included in this Section to expand the requirements of Division-01:

1. Quality Assurance.
2. Submittals.
3. Shop drawings.
4. Coordination drawings.
5. Record documents.
6. Operating and maintenance manuals.
7. Job conditions.
8. Equipment rough-ins.
9. Electrical Requirements.
10. Control Requirements.
11. Excavating, trenching, and backfilling.
12. Cleaning and protecting.
13. Installation of equipment furnished by the Owner and other Divisions.
14. Test Schedule.
15. Start-Up coordination with Commissioning Agent.

- B. Field Quality Control is described in each Section as required.

- C. Related Sections: The following Sections contain requirements and relate to this Section:

1. Division 2 Section, "Demolition."
2. Division 22 Section, "Basic Plumbing Materials and Methods."
3. Division 22 Section, "Plumbing Thermometers, "Gages, "and Test Kits."
4. Division 22 Section, "Plumbing Valves."
5. Division 22 Section, "Hangers and Supports for Plumbing Piping and Equipment."
6. Division 22 Section, "Identification for Plumbing Piping and Equipment."
7. Division 22 Section, "Plumbing Insulation."
8. Division 22 Section, "Domestic Water Piping."
9. Division 22 Section, "Sanitary Waste and Vent Piping."

10. Division 22 Section, "Facility Natural Gas Piping."
 11. Division 23.
 12. Division 25.
 13. Division 26.
 14. Division 31 Section, "Excavation, Backfilling and Compacting for Utilities."
- D. Furnish all labor, materials, tools, equipment, and services for all plumbing Work as specified and indicated, in accord with provisions of Contract Documents complete and ready for intended use. Completely coordinate with Work of all other trades. Although such Work may not be specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation, with no additional cost to the Owner.
- E. Drawings, Use and Interpretation:
1. Plumbing Drawings are diagrammatic and indicate general arrangement of systems except when specifically dimensioned or detailed.
 2. For exact locations of building elements, refer to dimensioned architectural and structural drawings.
- F. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing before starting work.
- G. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- H. UL and CSA Compliance: Provide products which are UL and CSA Listed.
- I. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 Btuh and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.
- J. Provide safety controls required by national Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 Btuh and higher.
- K. Installation of all plumbing systems and equipment is subject to clarification as indicated in reviewed Shop Drawings with field coordination.
1. Generally, layout pipelines requiring gravity drainage first; followed by large pipe mains, ductwork and electrical conduit.
 2. This procedure is intended to promote orderly installation, but not to establish trade precedence.
 3. Do not use equipment exceeding dimensions indicated in the Schedules or on Detail Drawings or arrangements that reduce required clearances or exceed specified maximum dimensions.
 4. Pipe hanger and support installation: As specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- L. Point of Connection with Site Utility Services: Building water, sanitary waste, grease waste, storm water and natural gas Work to a point as indicated on the Plumbing Drawings.
- M. Access: Provide access panels in ceilings (except lay-in and accessible ceilings), walls, partitions, enclosures, etc. as required to permit servicing of plumbing equipment, valves and devices. Show all access panels on the shop drawings and coordination drawings and coordinate with the Reflected Ceiling Plans. Access panel location and sizes are indicated on the plumbing drawings. Minimum size for access panels shall be 24-inches by 24-inches, as specified in Division 08 Section 08 31 13, "Access Doors and Frames."

- N. Point of Connection / Interface with Mechanical Drawings: Cooling coil condensate drain connections; make-up water; steam supply and condensate return and reduced pressure backflow preventors as indicated on the Mechanical and Plumbing Plans, Details and Piping Diagrams and as required by code and per the manufacturer (may not be shown on the drawings and diagrams). Coordinate and review all POC's and any special valves and devices required prior to start of any work. All cooling coil connections by Division 22. All reduced pressure backflow preventors and connections to equipment by Division 22.

1.03 WORK SPECIFIED UNDER OTHER DIVISIONS

- A. Concrete housekeeping pads for plumbing equipment.
- B. Motor controls and power wiring and conduit as specified in Division 26.
- C. Control wiring and interface with existing Energy Management System (EMS)" as specified in Division 25.
- D. Power and control wiring and conduit as specified in Division 26.

1.04 QUALITY ASSURANCE

- A. Perform all work in accord with following rules (codes, standards and regulations):

1. Standards:

- | | |
|---|--------------|
| a. American with Disabilities Act | ADA |
| b. American National Standards Institute | ANSI |
| c. American Society of Heating, Refrigeration, and Air Conditioning Engineers | ASHRAE |
| d. American Society of Heating, Refrigeration, and Air Conditioning Engineers; Guideline 0, the Commissioning Process | ASHRAE-Guide |
| e. American Society of Civil Engineers | ASCE |
| f. American Society of Mechanical Engineers | ASME |
| g. American Society of Plumbing Engineers | ASPE |
| h. American Society of Testing and Materials | ASTM |
| i. American Society of Sanitary Engineering | ASSE |
| j. American Water Works Association | AWWA |
| k. American Welding Society | AWS |
| l. Code of Federal regulations | CFR |
| m. Canadian Gas Association | CGA |
| n. Cast Iron Soil Pipe Institute | CISPI |
| o. CSA International | CSA |
| p. Electrical Testing Laboratories | ETL |
| q. Environmental Protection Agency | EPA |
| r. Food and Drug Administration | FDA |
| s. Factory Mutual Global | FM |
| t. International Association of Plumbing and Mechanical Officials | IAPMO |
| u. Institute of Boiler and Radiator Manufacturers | IBR |
| v. Manufacturer's Standardization Society of the Valves and Fittings Industry | MSS |

- | | |
|---|--------|
| w. Gas Appliance Manufacturers Association | GAMA |
| x. Hydraulic Institute Standards | HI |
| y. International Organization for Standardization | ISO |
| z. Leadership in Energy and Environmental Design | LEED |
| aa. Manufacturers Standardization Society | MSS |
| bb. National Electric Code | NEC |
| cc. National Electrical Manufacturers Association | NEMA |
| dd. National Environmental Balancing Bureau | NEBB |
| ee. National Fire Protection Association | NFPA |
| ff. National Roofing Contractors Association | NRCA |
| gg. National Sanitation Foundation | NSF |
| hh. Occupational Safety and Health Administration | OSHA |
| ii. Plumbing and Piping Industry Council | PPIC |
| jj. Sheet Metal and Air Conditioning Contractors National Association, Inc. | SMACNA |
| kk. Tubular Exchanger Manufacturers Association | TEMA |
| ll. Thermal Insulation Manufacturers Association | TIMA |
| mm. Underwriters' Laboratories | UL |
| nn. United States Department of Agriculture | USDA |
| oo. United States Green Building Council | USGBC |
2. Regulations:
- a. California State Fire Marshal CSFM
 - b. California State Department of Public Health CSDPH
 - c. Safety Orders of Division of Industrial Safety SODIS
 - d. Office of Statewide Health Planning and Development OSHPD
3. Comply with the California Health & Safety Code Section 116875 (known as AB 1953). This Code mandates 100% compliance to low lead content in any and all plumbing products (from faucets to water heater connections, etc.).
 4. Seismic construction and restraints shall be in accordance with requirements of Title 17 and Title 24 of the California Administrative Code.
 5. Comply with the Safety Orders issued by California Occupational Safety and Health Act (COSHA) and any other safety, health, or environmental regulation of the State of California and any districts having jurisdictional authority. Where an omission or conflict appears between COSHA requirements and the Drawings and Specifications, COSHA requirements shall take precedence.
 6. If any of the above standards and regulation requirements are in conflict with one another, or with the requirements of these specifications shall be brought to the attention of the Owner's Representative for resolution prior to commencing start of any Work.

B. Certifications: Provide proof of code compliance (include in submittals) for equipment as follows:

1. Electrical Equipment and Safety Devices: Per applicable standards of NEC; UL listed or classified.
 2. Pressure Vessels and Pressure Safety Devices: Per applicable standards and bear label of ASME.
 3. Energy Conservation: All Equipment and materials shall be certified by manufacturer per California Energy Code as required.
 4. Equipment: All electrically driven equipment shall be UL listed or classified equipment.
- C. See Division 22, Plumbing individual Sections for additional references.
- D. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements. As currently revised and interrupted for equipment manufacturer requirements. Install equipment provided per manufacturer's recommendations.
- E. Whenever this Specification calls for materials, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- F. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.05 DEFINITIONS

- A. "Piping" includes, in addition to pipe, all fittings, flanges, valves, hangers, and other accessories and devices related to such piping.
- B. "Wiring" includes in addition to conductors, all raceway, conduit, fittings, boxes, switches, hangers and other accessories related to such wiring.
- C. Above Finished Floor: Inside building within a zone usually considered at ± 6 -inches above floor finish.
- D. Above Finished Ceiling: Inside building within a zone usually considered at ± 6 -inches above ceiling finish.
- E. Below Slab: Located in ceiling space of floor below or buried in ground or embedded in concrete slab-on-grade.
- F. Concealed: Inside building, above grade and located within walls, furred spaces, service cores, pipe drop enclosures, umbilical risers, above suspended ceilings, shafts, chases or embedded in construction. In general any item not visible or directly accessible.
- G. Connect: Complete hook-up of item with required services, including all adapters, fittings, valves, devices and components.
- H. Exposed: Either visible or subject to mechanical or weather damage, indoors or outdoors, including areas such as mechanical and storage rooms, loading docks and chases. In general any item that is directly accessible without moving panels, walls, ceiling or other parts of the structure commonly used as reference to surface mounted piping, and similar.
- I. Provide: To furnish and install, complete and ready for intended use.
- J. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
- K. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
- L. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or

longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements and approved by the Engineer prior to submitting bids for substituted items.

- M. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's representative and other reviewing entity whose approval is required to obtain systems acceptance.

1.06 SUBMITTALS

- A. See Division 0, General Conditions for Submittal Procedures as well as specific individual Division 22, Plumbing Sections.
- B. Provide product submittals and shop drawings in one copy in paper format with electronic backup; or electronic format only. Electronic format must be submitted via CD-ROM; DVD; portable flash drive; zip file via e-mail or posted to ftp site. For electronic format, provide one zip file per specification division containing a separate file for each specification Section. For paper format, provide one common binder per specification division with tabbed dividers for each specification section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Architect on all transmissions/submissions.
- C. Product Data: Provide manufacturer's descriptive literature for products specified in Division 22, Plumbing Sections.
- D. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
1. Label submittal to match numbering/references as shown in Contract Documents and schedules. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
 2. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference Division 22, Plumbing Sections for specific items required in product data submittal outside of these requirements.
 3. Provide pump curves, operation characteristics, capacities, ambient noise criteria, control narrative and diagram, etc., for equipment.
 4. For vibration isolation of equipment, list make and model selected with operating criteria, etc., for equipment.
 5. See Division 22, Plumbing Sections for additional submittal requirements outside of these requirements.
 6. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineers' hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
- E. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing and support. Indicate manufacturer's installation and support requirements to meet Section 22 05 29, Hangers and Supports for Plumbing Piping and equipment or ASCE 7-05 Chapter 13 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Part 3 of this Section.

- F. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams and connections as required per Division 22, Plumbing Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
- G. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
- H. Substitutions and Variation from Basis of Design:
 - 1. The basis of Design designated product establishes the qualities and characteristics for evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 - 2. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
- I. Resubmission Requirements:
 - 1. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes to the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
 - a. Resubmit for review until review indicates no exceptions taken or "make corrections as noted."
 - b. When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.

1.07 SHOP DRAWINGS

- A. General: Prepare shop drawings, product data and samples per Division 0, General Conditions.

1.08 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements of Division 01 Section 01720, "Project Record Documents." In addition to the requirements of Division 1, indicate the following installed conditions:
 - 1. Mains and branches of all plumbing systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (traps, strainers, expansion compensators, tanks). Valve location diagrams, complete with valve tag chart. Comply with the requirements of Division 22 Section 22 05 53, "Identification for Plumbing Piping and Equipment." Indicate actual inverts and horizontal locations of underground piping.
 - 2. Access door numbering as indicated in Division 22 Section 22 05 53, "Identification for Plumbing Piping and Equipment."

1.09 OPERATING AND MAINTENANCE MANUALS

- A. Prepare Operating and Maintenance Manuals in accordance with the requirements of Division 01, Section 01730.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Pipe: Cap openings of all installed and uninstalled material against entry of foreign matter.

1.11 JOB CONDITIONS

- A. In accordance with Division 0, "General Conditions" and the following.

B. Specifications and Drawings:

1. For purposes of clarity, legibility, Drawings are essentially diagrammatic to the extent that many offsets, bends, unions, special fittings and exact locations of items are not indicated, unless specifically dimensioned. (Especially a number of required duct and pipe offsets to coordinate with structure are not shown.) Coordinate dimensioned conditions, including invert elevations, with other trades prior to installation by any trade.

C. Coordination:

1. Work out all "tight" conditions involving Work under this Division and Work in other Divisions in advance of installation. If necessary, and before Work proceeds in these areas, prepare supplementary Drawings under this Division for review showing all Work in congested area. Provide supplementary Drawings, additional Work necessary to overcome congested conditions, at no increase in Contract Sum.
2. Difference or disputes concerning coordination, interference or extent of Work between Sections shall be decided by the Contractor, his decision, if consistent with Contract Document requirements, shall be final.
3. Coordinate electrical interlocks of Plumbing equipment with Division 26 Electrical.
4. Not all offsets in piping are shown. Contractor shall decide which item to offset or relocate. Maintain required slope in piping.

D. Equipment Rough-In:

1. Rough-in locations shown on Plumbing Drawings for equipment furnished by the Owner and for equipment furnished under other Divisions are approximate only. Obtain exact rough-in locations from following sources:
 - a. From Shop Drawings for Contractor furnished and installed equipment.
2. Verify plumbing characteristics of equipment before starting rough-in. Where conflict exists between equipment and rough-in shown on Drawings obtain clarification from Owner's Representative prior to completing shop drawings.
3. Make final connections.

E. Schedule of Work:

1. In scheduling anticipate means of installing equipment through available openings in structure.

1.12 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 0, Contracting and Procurement Requirements, Division 0, General Requirements, Section 22 01 00 and individual Division 22, Plumbing Sections.

- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty in Division 0, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Provide like items from one manufacturer, including but not limited to fixtures, pumps, drains and equipment.

2.02 MATERIALS

- A. Identify materials, equipment by manufacturer's name, nameplate data. Remove unidentified materials, equipment from Site.
- B. Equipment specified by manufacture's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Furnish optional or additional accessories as specified.
- C. Equipment and/or material damaged during transportation, installation or during start-up is considered as totally damaged and is to be replaced with new at no additional cost to the University.
- D. Equipment shall be as described in the respective Sections of Division 22 Plumbing and as shown and scheduled on the Plumbing Plans, Details and Piping Diagrams.
- E. All items of material in each category of equipment shall be of one manufacturer unless specifically indicated otherwise.
- F. Conform with the conditions shown and specified. Coordinate with other trades for best possible assembly of combined Work. Relocate equipment at no additional cost to the Owner when necessitated by failures to coordinate Work or to advise Owner's Representative of conflicts in writing. Secure approval of new location from Owner's Representative prior to equipment relocation.
- G. Use printed descriptions, specifications and recommendations of manufacturers as a guide for installation of Work.
- H. Material and Equipment – General Requirements:
1. In accordance with Division 0, "General Requirements."
 2. Approved for use by State Fire Marshal and local building inspection department when applicable.
 3. Testing agency labeled or with other identification wherever standards have been established.
 4. Installed fully operating and without objectionable noise or vibration. Comply with the requirements of Division 22 Section 22 05 29, "Hangers and Support for Plumbing Piping and Equipment."
- I. Electrical Requirements:
1. Electrical work shall conform to requirements of Division 26.
 2. All factory built or packaged plumbing equipment with factory mounted control panel shall include main disconnect switch. Control panel shall have contacts for interface with DDC EMS System as specified in Division 25. Equipment shall have a single point power connection where possible.

3. Power Wiring: Factory wire all equipment to a single point of connection, except where shown or specified otherwise. Power wiring shall conform to the requirements of Division 26.
4. All conduit for plumbing controls and power wiring to be provided as Work of Division 26.
5. Factory Wired Assemblies and Panels: Provide pre-wired assemblies with numbered terminal strips for connection to field wiring.
6. Provide complete internal wiring diagrams for all equipment. Provide diagram with field wiring requirements.
7. Motors: Provide premium efficiency motors for all plumbing equipment specified. Motors shall conform to the requirements of Division 22 Section "Basic Plumbing Materials and Methods." Coordinate voltages, wiring and starter requirements with Division 26.
8. Label all wiring including the wiring in control panels provided by the equipment manufacturer. Wiring identification shall match the manufacturer's wiring diagram.
9. Provide controls, controllers, relays, transformers, switches and all other electrical components for complete and functioning systems and equipment.
10. Power for Controls: For equipment with package controls, provide a separate disconnect switch for equipment and controller and control panel. Factory wire to main point of connection ahead of main disconnects so that controls are powered even if main disconnect is open. Disconnects shall conform to the requirements of Division 26 Section 26 28 16, "Enclosed Switches and Circuit Breakers."

PART 3 - EXECUTION

3.01 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 0, General Requirements, and individual Division 22 Sections.
- B. Install equipment requiring access (i.e., drain pans, drains, valves, motors, pumps, cleanouts, water heaters, water treatment equipment, tanks, etc...) so that they may be serviced, reset, recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, corridors, scuttles or crawlspaces which would impact or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

3.02 EXCAVATING, TRENCHING, AND BACKFILLING (EARTHWORK)

- A. Comply with the requirements of Division 31 Section 31 23 00, "Trenching, Backfilling and Compacting for Utilities."
- B. In absence of specific earthwork requirements, comply with individual Division 22 Sections and the following:
 1. Perform excavation, dewatering, shoring, bedding and backfill required for installation of work in this Division in accordance with the provisions of related earthwork sections/divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.

2. Do not excavate under footings, foundation bases or retaining walls.
 3. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- C. In absence of specific requirements for earthwork, comply with individual Division 22 Plumbing Sections and the following:
1. Perform excavation, dewatering, shoring, bedding and backfill required for installation of work in this Division in accordance with the provisions of related earthwork Sections/Divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 2. Excavation: Do not excavate under existing footings, foundations bases or retaining walls.
 3. Install all underground sanitary waste and vent and storm drainage piping per "Cast Iron Soil Pipe and Fittings Handbook, Chapter IV, Installation of Cast Iron Soil Pipe and Fittings."

3.03 FIRESTOPPING

- A. Confirm Firestopping requirements in Division 07, Thermal and Moisture Control. In absence of specific requirements, comply with individual Division 22 Sections and the following:
1. Coordinate location and protection level of fire and/or smoke rated walls, ceilings and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Methods for Fire Tests of Through-Penetration Fire Stops.

3.04 PIPE INSTALLATION

- A. Coordinate work to account for expansion and contraction of piping materials and building as well as anticipated or shrinkage of building. Install work to prevent damage to piping, equipment and building and its contents. Provide piping offsets loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.
1. Include provisions for servicing and removal of equipment without dismantling piping.
- B. Plenums:
1. Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

3.05 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

3.06 INSTALLATION OF EQUIPMENT AND DEVICES

- A. General: Install all plumbing equipment in accord with manufacturer's recommendations and in accordance with the equipment's listing (if applicable). Sequence, coordinate and integrate the various elements of mechanical, plumbing, and fire protection systems, materials and equipment. Comply with the following requirements:
1. Verify all dimensions by field measurement.
 2. Install all equipment and devices to permit easy access for maintenance.

3. Maintain easy access to all equipment and devices installed as part of Division-22 Work, including but not limited to, heat exchangers, water booster pumps, pure water system equipment, valves, mixing centers, and associated items.
4. Install valves, devices, and associated items in accessible locations to avoid the need for access panels.
5. Provide access panels in ceilings, partitions, enclosures, etc. as required in order to achieve easy access to all valves and devices provided or installed under Division 22 Work. Provide additional access panels as required, even though they may not be shown on the Drawings, at no additional cost to the Owner.
6. Coordinate with Architect to achieve acceptable locations of access panels.
7. Coordinate all access panel locations with other trades.
8. Provide all necessary anchoring devices and supports for all equipment and piping systems.
 - a. Use structural supports suitable for equipment, or as specified in Division 22 Sections.
 - b. Comply with Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
9. Verify that equipment will fit where shown on the Plumbing Drawings.
10. Coordinate size and location of roof penetrations, floor penetrations, and wall openings with Work of other Sections prior to start of any work.
11. Install link seals as indicated and as required to make all penetrations of plumbing work through walls and roofs, water and weather-tight. Furnish all clamps, waterproofing material and labor necessary.
12. In Mechanical Rooms, coordinate locations of floor drains, floor sinks, and similar items with locations of equipment, housekeeping pads, Architectural Drawings, laboratory equipment prior to start of any work. Locate floor sinks to properly serve equipment and to result in orderly routing of drain piping, while minimizing tripping hazards, etc.

3.07 INSTALLATION OF EQUIPMENT FURNISHED BY THE OWNER

- A. Provide rough-in and final connections to all equipment as shown on the Plumbing Drawings, Piping Diagrams, and recommended by equipment manufacturer.

3.08 POINTS OF CONNECTION FOR THE INTERFACE OF MECHANICAL & PLUMBING PIPING

- A. Points of connection at which the responsibility of this Section ends ("P" Series Drawings) and to be continued on the "M" Series Drawings. Comply with information on the Plumbing Drawings and as indicated on Plumbing Diagrams and Details.

3.09 TESTING

- A. General: Provide labor and test equipment including test pumps, gages, instruments and other equipment required. Use test quality pressure gages, instruments and other equipment required. Use test quality pressure gages with range of approximately twice test pressure. Use calibrated gages and instruments. Test results and compliance shall be submitted as part of the Operation and Maintenance Manuals.
- B. Piping:
 1. General: Remove from systems, during testing, equipment which would be damaged by test pressure. Replace removed equipment after testing. Systems may be tested in sections as work progresses; however, any previously tested portion shall become a part of any later test of composite system. Correct leaks by remaking joints with

new material; make shift remedies will not be permitted. Test time accrues only while full test pressure is on system. Test before backfilling, concealing, insulating or making connections to potable water system.

2. Test Schedule: Test each section of systems at one and one-half (1-1/2) times the maximum working pressure of that section, but at not less than scheduled test pressure. Obtain maximum working pressures from Architect if not indicated on Drawings. Unless indicated otherwise, scheduled tolerance is "no pressure loss", except that due to temperature change, in 24 hour period.

TEST SCHEDULE			
System	Test Medium	Test Pressure	Tolerance
Domestic Water	Water	150 psig	No leaks--4-hours.
Grease Waste	Water	10-ft head	No leaks--4-hours
Sanitary Waste	Water	10-ft head	No leaks--4-hours.
(Option as approved by the Owner's Representative: Due to the sequence in which the Sanitary waste drain piping is to be installed, it may be required that air testing be used as a method for testing sections or in its entirety per Chapter 7, Section 712.3 of the 2013 California Plumbing Code).			
Sanitary Vents	Water	Top of Vent	No leaks-4-hours.
Grease vent	Water	Top of Vent	No leaks--4-hours
(Option as approved by the Owner's Representative: Due to the sequence in which the sanitary vent piping is to be installed, it may be required that air testing be used as a method for testing sections or in its entirety per Chapter 7, Section 712.3 of the 2013 California Plumbing Code).			
Condensate Drain	Water	150 psig	No leaks- 4-hours.

C. Valves:

1. General Service Valves: Test bonnets for tightness. Test operate from closed-to-open-to-closed position while under test pressure.
2. Automatic Valves: Test solenoid valves, water regulating valves, pressure reducing valves, pressure relief valves, safety valves and temperature and pressure relief valves for proper operation at settings indicated.
3. Safety Valves: Test relief valves, safety relief valves, safety valves and temperature and pressure relief valves 3 times.

D. Piping Specialties: Test thermometers, pressure gages, flow measuring devices, and water meters for accurate indication; automatic water feeders, air vents, trap primers, vacuum breakers, and other specialties for proper performance.

E. Hangers and Supports: With systems in normal operation, test hangers, supports and rods to insure they are plumb and supporting proper share of load. Additionally support systems and equipment that sway, crawl, or vibrate.

F. Other Materials and Equipment:

1. Rotation: Verify.
2. Motor Amperage: Verify operating motor amperage does not exceed motor nameplate rating.
3. Pump Shut-Off Discharge Head: Verify actual head corresponds to submittal data.
4. Test as specified; as recommended by equipment manufacturer; and as otherwise necessary or directed to assure they are complete, operable, and ready for use.

3.10 ADJUSTING AND CLEANING

A. Clean interior and exterior of all piping prior to installation. Remove dirt and debris as work progresses.

B. Protect drains during the entire construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at the end of day and when work stops.

D. Clean all exposed and concealed:

1. Clean all devices, tanks, equipment, to like new condition prior to commissioning.
2. Clean specialties such as traps and strainers.
3. Adjust all domestic water balancing valve assemblies to the gpm's as indicated on the drawings and diagrams.

E. Equipment and Materials: Remove foreign materials including dirt, grease, splashed paint, and plaster, etc. Restore damaged finishes to original condition.

F. Piping: Flush clean interior of domestic water piping. Upon completion of flushing, completely drain systems at low points; remove, clean, and replace strainer baskets and refill systems.

G. Domestic Water Systems:

1. Sterilization: After above flushing, draining, and refilling, sterilize domestic water systems in accordance with requirements of public health agency having jurisdiction.
2. Warning Signs: Provide signs at outlets during chlorination.

H. Adjusting: Adjust equipment and system components as indicated or as otherwise required to result in intended system operation. Thereafter, as a result of system operation, or as

directed, make readjustments as necessary to refine performance and to effect complete system tune-up.

3.11 SPECIAL TOOLS

- A. Furnish to Owner not later than when Owner takes possession of equipment.
- B. Definition of Special Tools: Identified in or otherwise implied by, the manufacturer's operation and maintenance manuals for the furnished equipment, or which are otherwise required for the operation, with the manufacturer's recommended procedures for operation, adjustment and maintenance. Special tools do not include those required for major repairs normally done by factory trained or otherwise specialized service personnel, nor do they include those normally found in the possession of Owner's on site maintenance personnel.

3.12 PUTTING SYSTEMS IN OPERATION - START UP

- A. Where the services of a factory authorized service representative are specified for the start-up of certain pieces of equipment, arrange to have the manufacturer of such equipment perform start-up and check-out service. Manufacturer shall provide a letter which shall be on the manufacturer's letterhead, shall list the equipment, shall certify that the equipment has been examined, that it has been installed in accordance with the manufacturer's installation instructions, started up, adjusted, and checked out in accordance with the manufacturer's instructions, and is operating properly. The letter shall be addressed to the Owner's Representative and shall be signed by an authorized representative of the manufacturer. Service representative to be part of the start-up team in insure equipment and/or system is operating properly.
- B. Submit for review and approval a start-up check list of each system to the Owner's Representative and Commissioning Agent prior to start of any work.
- C. Domestic Water Systems:
 - 1. Inspect each system including piping layout, pipe support, expansion provisions and slope for draining before testing of each system in its entirety.
- D. Domestic Hot Water Systems:
 - 1. Inspect each system including piping layout, pipe support, expansion provisions and slope for draining before testing of each system in its entirety.
 - 2. Start-up each heating system (under supervision of manufacturer's representative) and verify performance. Start-up building circulating pump (under supervision of manufacturer's representative) and vary loads to illustrate start-up and shut-down sequences. Simulate emergency conditions for safety shut downs and equipment failure with automatic and manual reset. Repair and retest defects until satisfactory results are achieved. Make final adjustments to suit building design conditions prior to commissioning.
- E. Perform services in accordance with manufacturer's written start-up instructions. Test control and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- F. Maintenance and Operation Training (refer to Division 01 – Demonstration)

END OF SECTION 22 01 00

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SECTION 220519

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Division 0, Contract requirements and Division 1, General Conditions apply to this section.

1.02 SUMMARY

- A. This Section includes thermometers, gages, test plugs and kits for all plumbing systems:
1. Thermometers (Domestic Cold Water and Domestic Water Heating Systems).
 2. Pressure Gages (Domestic Cold Water, Domestic Water Heating and Natural Gas Systems).
 3. Pressure Gage Tappings (Domestic Cold Water, Domestic Water Heating and Natural Gas Systems).
 4. Stem Type Thermometers and Supports.
 5. Test plugs and kits.
- B. Related Sections include the following:
1. Division 22 Section 22 11 16, "Domestic Water Piping" for thermometers and pressure gauges inside the building.
 2. Division 22 Section 22 11 23, "Facility Natural Gas Piping" for pressure gauges inside the building.

1.03 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.04 SUBMITTALS

- A. General: Provide in accordance with Article 3.11 of the General Conditions.
- B. Product Data: For each type of gage and fitting specified. Provide manufacturers data which indicates use, construction, operating range, total range, accuracy, and dimensions. Submit a gage schedule showing manufacturer's figure number, scale range, location and accessories for each gage.
- C. Provide a Gage Application Table indicating each different use of gages and the gage range to be utilized, including minimum and maximum measurement valves.
- D. Product Certificates: For each type of thermometer and gage, signed by product manufacturer.
- E. Maintenance Data to be included in the "Operating and Maintenance Manuals" specified in Division 01 Section "Operating and Maintenance Manuals." Include data for the following:
1. Test plugs.
 2. Pressure gages.
 3. Thermometers.

1.05 QUALITY ASSURANCE

- A. Comply with applicable portions of American Society of Mechanical Engineers (ASME) and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gages.
- B. Design Criteria: The Plumbing Drawings, Piping Diagrams and Details indicate the location of thermometers, gauges and test ports. Thermometers and gages are based on the specific manufacturer types and models indicated in this Section. Thermometers and gages having equal performance characteristics by other manufacturers may be considered, provided that deviations do not change the design concept or intended performance as judged by the Architect and Engineer. The burden of proof for equality of meters and gages is on the proposer.

1.06 EXTRA MATERIALS

- A. Provide one (1) test plug and kit for the Owner at Project closeout.

PART 2 - PRODUCTS

2.01 DIGITAL THERMOMETERS (DOMESTIC WATER)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Weiss Instruments, Inc. (Basis-of-Design).
 - 2. H.O. Trerice Co.
 - 3. Weksler Instruments Corp.
 - 4. Or equal.
- B. Basis of Design: Weiss Vari-angle Digital Thermometer Model #DVU35 with the following:
 - 1. Accuracy 1% of reading or 1 degree, whichever is greater.
 - 2. Range: -50-to-300 degree F.
 - 3. Case Hi-Impact ABS.
 - 4. Display 1/2-inch LCD digits, wide ambient formula.
 - 5. Resolution 1/10 degree between -19.9/199.9 degrees Fahrenheit.
 - 6. Recalibration internal potentiometer.
 - 7. Lux rating 10 lux (one-foot candles)
 - 8. Update every 10 seconds.
 - 9. Ambient temperature error Zero.
 - 10. Humidity 100%
 - 11. Sensor glass passivated thermister.
- C. Thermometer wells for above: Weiss Instruments, Inc.- Industrial Thermometer Wells (separable socket) as follows:
 - 1. Brass Construction for copper pipe; stainless steel for steel pipe.
 - 2. 2/4" NPT size.
 - 3. 3-1/2" stem size or 6" stem size.
 - 4. Standard or extension neck to suit installation.
 - 5. Schedule:

<u>Model</u>	<u>Stem Size</u>
E-35-75BS	3-1/2-inch
ER6-75BS	6-inch
EN6-75BS	6-inch insertion and 2-1/2-inch extension for insulation.

2.02 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages: METERS AND GAGES FOR PLUMBING PIPING

1. Basis-of-Design Product: Subject to compliance with requirements, H.O. Terice Co or comparable product by one of the following:
 - a. AMETEK, Inc.; U.S. Gauge.
 - b. Ashcroft Inc.
 - c. Ernst Flow Industries.
 - d. Flo Fab Inc.
 - e. Marsh Bellofram.
 - f. Miljoco Corporation.
 - g. Noshok.
 - h. Palmer Wahl Instrumentation Group.
 - i. REOTEMP Instrument Corporation.
 - j. Tel-Tru Manufacturing Company.
 - k. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - l. Weiss Instruments, Inc.
 - m. WIKA Instrument Corporation - USA.
 - n. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 6-inch (152-mm) nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Brass.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.03 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.04 TEST PLUGS AND KITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Texas Fairfax Company (Basis-of-Design).
 2. H.O. Terice Co.
 3. Sisco Co., Spedco, Inc.
 4. Or equal.

- B. Test Plug Basis of Design: Texas Fairfax Company with the following:
 - 1. 1/4-inch or 1/2-inch NPT brass fitting and cap for receiving 1/8-inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 deg F; neoprene core for temperatures up to 350 deg F (domestic hot and cold); lagg extension for pipe insulation.
- C. Test Kit Basis of Design: Texas Fairfax Company with the following:
 - 1. Internally padded and fitted carrying case; two (2) 3-1/2-inch diameter pressure gages-scale range: 0 to 100psi; two gage adapters with 1/8-inch type 316 stainless steel probes; two (2) 1-inch dial thermometers with 5-inch stem and external calibration-scale range: 25 to 125 deg F; two (2) 1" dial thermometers with 5-inch stem and external calibration-scale range: 0 to 220 deg F.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install in complete conformance with the manufacturer's instruction.
- B. Install pressure gages and thermometers in locations where they are easily read from normal operating level (person standing on the floor). Install upright vertical to 45 degrees off vertical.

3.02 THERMOMETERS

- A. Provide thermometers where indicated on the plumbing plans, piping diagrams, and details. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2-inch for installation of thermometer sockets 24-inches on each side of the thermometer. Ensure sockets allow clearance from insulation.
- B. Thermometers:
 - 1. Locations: Install in the following locations:
 - a. At Temporary Mechanical Room.
 - b. At inlet and outlet of each water heater system.
 - c. As indicated on the Plumbing Drawings, Piping Diagrams and Details.
 - 2. Thermometer Wells: Install in piping tee where indicated and insertion thermostats for temperature controls, in vertical upright position. Fill well with oil or graphite, secure cap.

3.03 GAGES

- A. Provide pressure gages where indicated on the plumbing plans, piping diagrams, and details.
- B. Install pressure gages with snubbers. Provide ball valve to isolate each gage. Extend nipples to allow clearance from insulation.
- C. Pressure Gages:
 - 1. General: Install pressure gages in piping tee with pressure gage cock, located on pipe at most readable position.
 - 2. Locations: Install in the following locations:
 - a. At Temporary Mechanical Room.
 - b. At inlet and outlet of each backflow preventer.
 - c. At Main domestic hot and cold water prior to leaving the Temporary Mechanical Room.
 - d. As indicated on the Plumbing Drawings, Piping Diagrams and Details.
 - 3. Pressure Gage Cocks: Install in piping tee with snubber.
 - 4. Gage Connector Plugs: Install in piping tee where indicated, and required for balancing; located on pipe at most readable position. Secure cap.

3.04 TEST PLUGS AND KITS

- A. Provide temperature and pressure test plugs where indicated on the plumbing plans, piping diagrams, and details.
- B. Turn over one (1) test kit to Owner at Project closeout.

3.05 ADJUSTING AND CLEANING

- A. Adjusting: Adjust faces of gages and thermometers to proper angle for best visibility from the floor and clean windows and lenses and calibrate to Zero.
- B. Cleaning: Clean windows of thermometers and gages and factory-finished surfaces. Replace cracked, scratched and broken windows and repair scratched and marred surfaces with manufacturer's touchup paint.

END OF SECTION 220519

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SECTION 220523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Division 0, Contract requirements and Division 1, General Conditions apply to this section.

1.02 SUMMARY

- A. This Section includes valves for incoming building and utility water; domestic hot and cold water and hot water return plumbing piping systems. This Section includes the following plumbing valves:

1. Ball valves.
2. Butterfly valves.
3. Check valves.
4. Strainers.
5. Drain valves.
6. Air Elimination Valve.

- B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and charts.
2. Division 22 Section "Domestic Water Piping."
3. Division 22 Section "Fuel-Fired, Domestic Water Heaters."
4. Division 22 Section "Basic Plumbing Materials and Methods."
5. Division 22 Section "Plumbing Specialties."
6. Division 22 Section "Basic Plumbing Requirements" for compliance with AB 1953.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping, Below Ground: 160 psig.
2. Domestic Water Piping, Above Ground: 125 psig.

1.04 SUBMITTALS

- A. Provide in accordance with Article 3.11 of the General Conditions.

- B. Product Data for each valve type. include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

1. Include list indicating valve and its application. Include pressure drop curve or chart for each type and size of valve.
2. Include compliance with AB 1953 for each valve type and size as required.

3. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing. Submit spare parts list for each type of valve. Include this data in Maintenance Manual.

C. Maintenance Data for the following:

1. Strainers.

1.05 SUBSTITUTIONS

- A. Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.

1.06 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9 for "Building Services Piping" for materials and installation.

- B. ASSE Compliance: Comply with ASSE Standards for mixing valve applications.

- C. MSS Compliance: Comply with the various MSS Standard Practice documents as follows:

1. MSS SP-67- Butterfly valves
2. MSS SP-70- Cast Iron Gate valves, flanged and threaded ends.
3. MSS SP-71- Cast Iron Swing Check valves, flanged and threaded ends.
4. MSS SP-78- Cast Iron Plug valves, flanged and threaded ends.
5. MSS SP-80- Bronze Gate, Globe, Angle, and Check valves.
6. MSS SP-85- Cast Iron Globe and Angle valves, flanged and threaded ends.
7. MSS SP-110- Ball valves threaded, socket-welding, solder joint, grooved and flared ends.

- D. Valves: Manufacturer's name and pressure rating marked on valve body.

- E. Welding Materials and Procedures: Conform to ASME SEC IX and applicable state regulations.

- F. Welders Certification: In accordance with ASME SEC IX.

- G. NSF Compliance:

1. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing valves.

- H. Valve Identification: Comply with MSS SP-25,

- I. Comply with the requirements of California Health & Safety Code, Section 116875 (known as AB1953).

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

- B. Use the following precautions during storage:

1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Provide valves of same manufacturer for all Plumbing Sections, where manufactured, including valves furnished with equipment.
- B. For copper tubing, provide solder-joint valves, or IPS-to-Copper adapter, sized for use with tubing and respective valve.
- C. For flanged valves, provide companion flanges of same PSI rating-class of valve being used.
- D. Provide valves rated not less than 125-lb. steam working pressure/200-lb. WOG for plumbing systems. Provide higher pressure valves where indicated.
- E. Provide valve materials suitable for service and temperature of respective systems, especially with respect to discs, plugs, balls, linings, gaskets, and lubricants of globe valves, plug cocks, ball valves, and associated valves.
- F. Provide valves as specified in valve schedule. Figure numbers listed are given as standard for type and construction.
- G. Provide composition discs for bronze globes, angles or checks. Provide bronze discs for IBBM globes, angles, or checks except where otherwise specified, and only with the recommendation of the manufacturer.
- H. Mark each valve at the factory with the following minimum information, engraved, stamped or cast on each valve or metal tag permanently attached to the valve.
 1. Manufacturer's name.
 2. Catalog or Figure. number
 3. Size and pressure class
 4. Arrows shall indicate direction of flow on check, globe, angle, non-return and eccentric plug valves.
 5. UL listed valves and shall bear the UL label
- I. Provide union ends or flanged connections on all valves with Teflon components, or components with temperature sensitivity.
- J. Valves for pure water system: Comply with requirements of Section 22 67 00, "Pure Water Piping."

2.02 VALVES - BASIC, COMMON FEATURES

- A. General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Valves shall be of same make for all these services.
- B. Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.

- C. Sizes: Same size as upstream pipe, unless otherwise indicated.
- D. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
- E. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.
- F. Threads: ASME B1.20.1.
- G. Flanges: ASME B16.1 for cast iron, ASME 1316.5 for steel, and ASME 1316.24 for bronze valves.
- H. Solder Joint: ASME B16.18.
 - 1. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F for gate, globe, and check valves; below 421 deg F for ball valves.

2.03 BALL VALVES

- A. Ball Valves, 2-Inches and Smaller: MSS SP-110 compliant; ANSI B1.20.1 (threaded end) and ANSI B1.18 (soldered end); Class 150 SWP and 600 psi non-shock CWP, ASTM B 584 bronze body and bonnet, 2-piece construction; machined solid chrome-plated brass ball, full port valves; blowout proof stem design; bronze or brass stem; multi-fill PTFE seats and seals; true adjustable packing; soldered end or threaded connection. (Note: Standard and reduced port and hollow ball design not acceptable). Ball shall be vented to allow relief of any trapped media between body and ball.
 - 1. Operator: Vinyl-covered steel lever handle with lock.
 - 2. Stem Extension: For valves installed in insulated piping provide 2-inch extended handle of non-thermal conductive material. Provide protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation.
- B. Ball Valves, 2-1/2-inches thru 4-inches: MSS SP-110; ANSI B1.20.1; Class 150 SWP and 600 psi non-shock CWP, ASTM B 283 bronze body and bonnet, 3-piece or 2-piece construction; machined solid chrome-plated brass ball, full port valves; blowout proof stem design; bronze or brass stem; multi-fill PTFE seats and seals; adjustable packing; soldered end or threaded connection. (Note: Standard and reduced port and hollow ball design not acceptable).
 - 1. Operator: Vinyl-covered steel lever handle with lock.
 - 2. Stem Extension: For valves installed in insulated piping provide 2-inch extended handle of non-thermal conductive material. Provide protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation.

C. Ball Valves shall be as follows:

Ball Valves: 2-inches and smaller (two-piece):

MANUFACTURER	SOLDER ENDS	THREADED ENDS
Kitz	#869 (Lead Free)	#868 (Lead Free)
Conbraco (Apollo)	77-CLF Series (Lead Free)	77-CLF Series (Lead Free)
Nibco	S-685-80-LF (Lead Free)	T-5685-80-LF (Lead Free)
Or equal.		

Ball Valves: 2-1/2-inch (three piece and two piece):

Note: 2-1/2-inch and larger valves do not have to be AB1953 Compliant.

MANUFACTURER	BRAZED ENDS	THREADED ENDS
Kitz	#69	#68
Conbraco (Apollo)	82-209-01	82-209-01
Nibco	S-595Y	S-595Y
Or equal.		

Ball Valves - 3-inch (three piece and two piece)

Note: 2-1/2-inch and larger valves do not have to be AB1953 Compliant.

MANUFACTURER	BRAZED ENDS	THREADED ENDS
Kitz	#69	#68
Conbraco (Apollo)	82-240-01	82-209-01
Nibco	S-585-70	S-595Y

Or equal.

Ball Valves - 4-Inch (three piece and two piece):

Note: 2-1/2-inch and larger valves do not have to be AB1953 Compliant.

MANUFACTURER	BRAZED ENDS	THREADED ENDS
Kitz	#68 (use threaded with C x MIP adapters)	#68
Conbraco (Apollo)	82-24A-01	82-209-01
Nibco	S-585-70	S-595Y

Or equal.

2.04 BUTTERFLY VALVES

- A. Butterfly Valves: 2-1/2-inches thru 12-inches: MSS SP-67 and API 609, 200-psi CWP, 150-psi maximum pressure differential (except 14-inch through 24-inch which shall be rated at 150-psi), ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, molded-in or bonded-in EPDM or Buna N seat, EPDM or BunaN stem seals, wafer, lug, or grooved style; valve shall be bi-directional and suitable for dead-end service in either direction at the full working pressure of the valve with the downstream flange removed for up to 96 hours.

1. Disc Type: Aluminum bronze.
2. Operator for Sizes 2-inches to 6-inches: Standard lever handle with memory stop.
3. Extended neck for insulation.
4. Lug Type for line shutoff or balance and for equipment isolation shutoff. Lugs drilled and tapped to match ANSI 150 flanges. Use cap screws both sides.

- B. Butterfly Valves shall be as follows:

Butterfly Valves: 2-1/2-inches and larger.

Note: 2-1/2-inch and larger valves do not have to be AB1953 Compliant.

The following are model numbers for wafer-type, with nickel-plated ductile-iron disc;

MANUFACTURER	LEVER	GEAR
Kitz	5112-E-L	5112-E-G
Conbraco (Apollo)	6X13X-01	6W13X-02
Nibco	WD-20103	WD-20105

Or equal.

The following are model numbers for lug-type, with nickel-plated ductile-iron disc:

MANUFACTURER	LEVER	GEAR
Kitz	6112-E-L	6112-E-G
Conbraco (Apollo)	6L13X-01	6L-13X-02
Nibco	LD-20103	LD-20105

Or equal.

The following are model numbers for wafer-type, with aluminum-bronze disc:

MANUFACTURER	LEVER	GEAR
Kitz	5122-E-L	5112-E-G
Conbraco (Apollo)	6W 14X-01	6VW14X-02
Nibco	WD-20003	WD-20005

Or equal.

The following are model numbers for lug-type, with aluminum-bronze disc:

MANUFACTURER	LEVER	GEAR
Kitz	6122-E-L	6122-E-L
Nibco	LD-2000-3	LD-2000-5
Conbraco	6L14X-01	6W14X-02
Or equal.		

2.05 CHECK VALVES (SWING)

- A. Swing Check Valves, 2-Inches and Smaller: MSS SP-80; Class 125, 200-psi CWP and Class 150, 300-psi CWP; horizontal swing, Y-pattern, ASTM B62 cast-bronze body and cap, rotating bronze disc with integral seat or composition seat, threaded or soldered end connections:
- B. Swing Check Valves, 2-1/2-Inches and Larger: MSS SP-71, Class 125, 200-psi CWP, ASTM A 126 cast-iron body and bolted cap, horizontal-swing bronze disc, flanged or grooved end connections.
- C. Check Valves shall be as follows:

Class 150 Bronze Horizontal; Y-Pattern Swing Check Valves - 2 Inch and Smaller - (Lead Free):

	CLASS125	CLASS 125 CLASS 150 CLASS
150	THREADED SOLDER	SOLDER THREADED
MANUFACTURER	ENDS	ENDS ENDS ENDS
Kitz	822T	823T NA NA
Crane	37	1342 137
Nibco	T-413-Y-LF	S-413-Y-LF NA SNA
Or equal.	NA means Not Applicable	

Class 150 Bronze Horizontal; Y-Pattern Swing Check Valves - 2-1/2 Inch and Larger:

Note: 2-1/2-inch and larger valves do not have to be AB1953 Compliant.

	CLASS 150 SOLDERED
MANUFACTURER	ENDS
Kitz	78
Crane	373
Nibco	S-413
Stockham	G-931
Or equal.	NA means Not Applicable

Comply with paragraph 2.6 for valve description and accessories.

Bronze Ring Check Valve 250 lb:

	THREADED	SOLDERED
MANUFACTURER		
Nibco	T-480-Y-LF	S-480-Y-LF
Or equal.		

Class 125/250 Iron Body Silent Check Valve, Wafer Style:

MANUFACTURER	
Nibco	W-910-B125lb.
Or equal.	

2.06 STRAINERS (Y-TYPE)

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch round perforations, unless otherwise indicated.

1. Pressure Rating: 125-psig minimum steam working pressure, unless otherwise indicated.
2. 2-inches and Smaller: Bronze body, with female threaded ends.
3. 2-1/2-inches and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.
4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
 - a. Drain: Factory installed, hose-end drain valve.
5. Basket Strainers: Bolted flange or clamp cover, and basket with lift-out handle.

B. Strainers shall be as follows:

Cast Bronze "Y" Type Strainers: 2-inches and smaller.

MANUFACTURER	THREADED ENDS	SOLDERED ENDS
Kitz	NA	NA
Conbraco (Apollo)	YB-LF (59 Series)	YB-LF (59 Series)
Spirax Sarco	BT/TBT	
Mueller Steam Specialty	351M	3585
Or equal.	NA means Not Applicable	

Strainers: 2-1/2-inches through 4-inches.

Note: 2-1/2-inch and larger valves do not have to be AB1953 Compliant.

MANUFACTURER	THREADED ENDS	Flanged ENDS
Kitz		#15 (2-1/2" & 3")
Or equal.		

2.07 DRAIN VALVES

A. Hose-End Drain Valves: MSS SP-110 compliant; ANSI B1.20.1 (threaded end) and ANSI B1.18 (soldered end); Class 150 SWP and 600 psi non-shock CWP, ASTM B 584 bronze body and bonnet, 2-piece construction; machined solid chrome-plated brass ball, full port valves; blowout proof stem design; bronze or brass stem; multi-fill PTFE seats and seals; adjustable packing; threaded or soldered end connection. (Note: Standard and reduced port and hollow ball design not acceptable).

1. Operator: Vinyl-covered steel fever handle.
2. Operator: Lever operators with lock.
3. Stem Extension: For valves installed in insulated piping provide 2-inch extended handle of non-thermal conductive material. Provide protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation
4. Memory/Balancing Stop: For operator handles.
5. Inlet: Threaded or solder joint.
6. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.
7. Cap: Die cast brass.
8. Chain: Brass.

B. Drain valves shall be as follows:

MANUFACTURER	THREADED ENDS	SOLDER ENDS
Kitz	68C	69C
Conbraco (Apollo)	77-101 thru 109	77-204 thru 209
Nibco	T-585-70-HC	S-585-70-HC
Or equal.		

2.08 AIR ELIMINATION VALVES

- A. Furnish and install where shown on the Drawings or Piping Diagrams on all hot water return systems. Air Eliminators shall be Spirovent Senior models manufactured by Spirotherm, Inc. and be capable of removing 100% of the free air, 100% of the entrained air, and up to 99.6% of the dissolved air in the system fluid.

1. Available Products: TACO, Spirovent, or equal.

- B. Manual Air Vents:

TACO (Basis-of-Design) Model 426 Coin Vent.

- C. Automatic Air Vents:

TACO (Basis-of-Design) Model 426 Hy-Vent.
Model 418 Hy-Vent.
Model 409 Hy-Vent.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

3.02 APPLICATION

- A. Provide unions on both sides of all valves except valves that have flanged connections. Provide unions at piping connections to all equipment or apparatus unless equipment or apparatus have flanged connections. If male adaptors are used at non-flanged valve, then one union is needed.
- B. Provide ball valves for shut-off and to isolate equipment, part of systems, or vertical risers. Note: Ball valves shall be limited to pipe sizes 4 inches and smaller. Valves to be 3-piece for 2-1/2-inches and larger.
- C. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment, for pressure reducing valves as indicated on Drawings.
- D. Provide swing check valves on discharge of water pumps.

- E. Provide hot water return balancing valves in domestic and industrial hot water recirculating systems where indicated on the Plumbing Drawings and Piping Diagrams.
- F. Provide ball valve for main domestic and utility water shutoff.
- G. Provide isolation shutoff valves and unions at inlet and outlet sides of all water pressure reducing valves, reclaim water solenoid valves.
- H. Install piping so that entire systems are drainable. Provide drain valves with hose connections at low points.
- I. Connect branch piping to top of mains.

3.03 INSTALLATION

- A. Provide all equipment with isolation valves.
- B. All hand-controlled line valves are to be ball or butterfly valves, except where throttling control or frequent operation is required, provide globe valves, unless otherwise shown or specified.
- C. Strainers:
 - 1. "Y"-Type Strainers: Ahead of all automatic valves, pumps, coils, pressure regulating valves and similar devices and as shown in systems that are not fully protected by automatic strainer system.
- D. Install strainers in horizontal position,
- E. Provide ball blow-down valves and hose adaptors at strainers, air separators, tanks, pipe traps, equipment drains, and associated items of same size as strainer blow-off connection.
- F. Install swing checks and gravity closing lift checks in vertical position.
- G. Provide discharge pipe to atmosphere from all relief and safety valves, sized with area equal to sum of outlet areas of all valves connected thereto, unless indicated larger.
 - 1. Water System Relief Valves: Extend to over code compliant, suitable drain receptacle with air gap, within 3 inches of drain.
 - 2. Steam System Safety Valves: Discharge through drip pan elbow. Pipe elbow and pan drains same as water system relief valve. Pipe steam vent to above roof as shown on Drawings.
- H. Provide open-ended line valves with plugs or blind flanges.
- I. Provide the type of valves shown on the Plumbing Drawings, Piping Diagrams and Details, and as required for complete isolation of equipment, risers, branches off mains, automatic valves and equipment arranged so as to give complete and regulation control of piping systems throughout the building. Install valves, with neat appearance and grouping, so that all parts are easily accessible for maintenance.

3.04 SOLDERED CONNECTIONS

- A. Cut tube square and to exact lengths.
- B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket.
- C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.
- D. Open ball valves to fully open position.
- E. Remove the cap and disc holder of swing check valves having composition discs.
- F. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.

- G. Apply heat evenly to outside of valve around joint until solder melts on contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.
- H. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
 1. Use soft solders having a maximum melting point of 570 degree F (299 degree C), for example:

95-5 tin-antimony	=	460 degree F (238 degree C).
96-4 tin-silver	=	430 degree F (221 degree C).
 - I. Do not use hard solder with a melting point of 840 degree F (449 degree C) or higher, because resultant crack on a valve surface may cause fluid leakage.
 - J. Prepare copper tubes conforming to ASTM B88, "Seamless Copper Water Tubes."
 - K. The maximum service pressure and temperature of solder jointed valves are limited by the properties of solder and tube materials. Information on typical solder materials are provided below:

Solders	Max. Temp. Degree F	Soldered Joints Maximum Working Pressure				Brazed Joints	
		Size 1/4~1-inch		Size 1-1/4~2-inch		Size 2-1/2-inch and larger	
		MPa	psi	MPa	psi	MPa	psi
95-5 TA	100	3.45	500	2.76	400	2.07	300
(H95 Sb-5A)	150	2.76	400	2.41	350	1.90	275
96-4TA	200	2.07	300	1.72	250	1.38	200
(H96 Ag-3.5A)	250	1.38	200	1.12	175	1.03	150

3.05 THREADED CONNECTIONS

- A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.
- B. Align threads at point of assembly.
- C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.
- D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.
- E. Do not apply an excessive force when threading pipes into valve bores. It will cause seat deformation and operational difficulty. Adequate threading torques are given below:

Valve Size	1/4~1/2-in.	3/4-in.	1-in	1-1/4-in	1-1/2-in	2-in	2-1/2-in	3~4-in
Threading Torque (Nm)	20~ 29	39~ 49	49~ 59	59~ 69	69~ 78	78~ 88	108~ 118	127~ 137

3.06 FLANGED CONNECTIONS

- A. Align flange surfaces parallel.
- B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

- C. For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

3.07 VALVE END SELECTION

- A. Select valves with the following ends or types of pipe/tube connections:
 - 1. Copper Tube Size, 2-1/2 Inches and Smaller: Solder ends.
 - 2. Copper Pipe Sizes, 3 Inches and Larger: Flanged end.

3.08 APPLICATION SCHEDULE

- A. General Application: Use ball and/or butterfly valves for shutoff duty; and ball for throttling duty.
- B. All Potable, Non-Potable, Water Systems: Use the following valve types:
 - 1. Ball Valves: Class 150, 600-psi CWP, with stem extension,
 - 2. Butterfly Valves: Nickel-plated ductile iron, aluminum bronze, or elastomer-coated ductile iron disc; EPDM or Buna N sleeve and stem seals.
 - 3. Bronze Swing Check: Class 125, with rubber seat.

3.09 PROTECTION AND CLEANING

- A. Clean interior and exterior of valves prior to installation. Remove dirt and debris as work progresses.
- B. Protect valves during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted valves at end of day and when work stops.

3.10 ADJUSTING

- A. Adjust valves and correct deficiencies discovered during commissioning.

3.11 PLUMBING VALVES

- A. Provide valves where shown on the Plumbing Drawings, Piping Diagrams and Details, and as required by California Plumbing Code.

END OF SECTION 220523

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SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Division 0, Contract requirements and Division 1, General Conditions apply to this section.

1.02 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

1.03 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.05 ACTION SUBMITTALS

- A. Provide in accordance with Article 3.11 of the General Conditions.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
 2. Metal framing systems.

3. Pipe stands.
 4. Equipment supports.
 - D. Delegated-Design Submittal: For trapeze hangers 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. Detail fabrication and assembly of trapeze hangers.
 2. Design Calculations: Calculate requirements for designing trapeze hangers.
- 1.06 INFORMATIONAL SUBMITTALS
- A. Welding certificates.
- 1.07 SUBSTITUTIONS
- A. Substitutions will be considered per Article 3.3 of the Instruction to Bidders of the Bid Package Section 00003.
- 1.08 QUALITY ASSURANCE
- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

- 2.01 METAL PIPE HANGERS AND SUPPORTS
- A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of **carbon steel**.
- 2.02 TRAPEZE PIPE HANGERS
- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.
- 2.03 METAL FRAMING SYSTEMS
- A. MFMA Manufacturer Metal Framing Systems:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Cooper B-Line, Inc or comparable product by one of the following:
 - a. Allied Tube & Conduit.
 - b. Flex-Strut Inc.
 - c. GS Metals Corp.
 - d. Thomas & Betts Corporation.
 - e. Unistrut Corporation; Tyco International, Ltd.

- f. Wesanco, Inc.
- 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
- 3. Standard: MFMA-4.
- 4. Channels: Continuous slotted steel channel with inturned lips.
- 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
- 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- 7. Metallic Coating: Electroplated zinc.
- 8. Paint Coating: Vinyl alkyd.
- 9. Plastic Coating: PVC.

2.04 THERMAL-HANGER SHIELD INSERTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide National Pipe Hanger Corporation or comparable product by one of the following:
 - 1. Carpenter & Paterson, Inc.
 - 2. Clement Support Services.
 - 3. ERICO International Corporation.
 - 4. PHS Industries, Inc.
 - 5. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 - 6. Piping Technology & Products, Inc.
 - 7. Rilco Manufacturing Co., Inc.
 - 8. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.05 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.06 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
 - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Stainless steel.
 - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 2. Bases: One or more; plastic.
 - 3. Vertical Members: Two or more protective-coated-steel channels.
 - 4. Horizontal Member: Protective-coated-steel channel.
 - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.07 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.08 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.09 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- H. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- I. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- J. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- L. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- M. Install lateral bracing with pipe hangers and supports to prevent swaying.
- N. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- O. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

P. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

Q. Insulated Piping:

1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 09900 "Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use stainless-steel pipe hangers and fiberglass pipe hangers and [fiberglass strut systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.

- c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

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SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Division 0, Contract requirements and Division 1, General Conditions apply to this section.

1.02 SUMMARY

- A. Section Includes identification of plumbing piping and equipment installed under Division 22. All piping concealed or exposed shall have identification markers. All equipment and valves shall have identification markers.
- B. Related Sections:
 - 1. Division 09 Section 09 91 00, "Painting."
 - 2. Division 22 Section 22 11 16, "Domestic Water Piping."
 - 3. Division 22 Section 22 13 16, "Sanitary Waste and Vent Piping."
 - 4. Division 22 Section 22 11-23 "Facility Natural Gas Piping."

1.03 REFERENCES

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

1.04 SUBMITTALS

- A. Provide in accordance with Article 3.11 of the General Conditions.
- B. Product Data: Indicate model, type, and application usage.
- C. Submit list of wording, symbols, letter size, letter style, and color coding for each system.
- D. Submit valve numbering scheme, valve chart and schedule, including valve tag number, location, function type, and valve manufacturer's name and model number. Mark valves which are intended for emergency shutoff and special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals.
- E. Submit access door numbering scheme and schedule, including access door type, location, size and service.
- F. Submit full size nameplates and tag samples. Samples will be returned after approval.

1.05 COORDINATION

- A. Coordinate color coding, as indicated in Article "Plumbing Pipe Service Color Coding," with Owner's Representative for preferred color schemes and service abbreviations and valve and equipment numbering schemes prior to submittal review.
- B. Coordinate installation of identifying devices with completion of covering of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices, pipe identification and flow arrows before installing acoustical ceilings and similar concealment.
- E. Coordinate painting schemes of plumbing piping, if required, with Owner's Representative prior to submittal review.

PART 2 - PRODUCTS

2.01 MANUFACTURER'S IDENTIFICATION

- A. Manufacturer's nameplate, name or trademark shall be permanently affixed to all equipment and material furnished under this Specification. The nameplates of the Subcontractor or Distributor are not acceptable.
- B. Identify model number, size, capacity, electrical characteristics, serial number, etc.
- C. Leave nameplates clean, legible and with unobstructed visibility.

2.02 PIPE MARKERS

- A. Manufacturers:
 - 1. Seton Name Plate Corp.
 - 2. Brimar Industries.
 - 3. Brady.
 - 4. Or equal.
- B. Markers: ANSI A13.1-2007 and ANSI Z535.1.
 - 1. Pressure sensitive vinyl (self sticking) material.
 - 2. Mechanically fastened type: Snap on or strap on.
 - a. For dirty, greasy, or oily pipe where pressure sensitive markers may not perform satisfactorily.
 - 3. All weather film for outdoor exposed piping.
 - 4. Provide 360 degree pipe flow arrows and fluid being conveyed.
 - 5. Size of letters legend:

<u>OUTSIDE DIAMETER OF PIPE OR PIPE COVERING</u>	<u>LENGTH OF COLOR FIELD</u>	<u>SIZE OF LETTERS AND ARROWS</u>
3/4 to 1-1/4 inch	8 inch	1/2 inch
1-1/2 to 2 inch	8 inch	3/4 inch
2-1/2 to 6 inch	12 inch	1-1/4 inch
Over 6 inches	24 inch	2-1/2 inch

C. Plumbing and Pipe Service Color Coding:

<u>ASA Color Service</u>	<u>Color of Background</u>	<u>Color of Letter</u>
Domestic Cold Water:	Green	White
Domestic Hot Water Supply:	Yellow	White
Domestic Hot Water Return:	Yellow	White
Condensate Drain:	Green	White
Steam Supply:	(As indicated Division 23)	
Steam Condensate:	(As indicated Division 23)	
Make-up Water:	Green	White
Sanitary Sewer:	Green	White
Sanitary Sewer Vent:	Green	White
Grease Waste:	Green	White
Grease Vent:	Green	White

ASA Color Service	Color of Background	Color of Letter
Storm Drain:	Green	White
Overflow Drain:	Green	White
Natural Gas:	Green	White

2.03 VALVE TAGS

- A. Attached to stem of each control valve and line shutoff valve installed under Division 22, with No.16 brass chain, color-coded plastic laminate tag. Engrave laminate tags with 1-inch designated numbers, in accordance with typed schedule showing valve size, locations, service, similar to the following form:

RW: 3-inches.
Shutoff, Toilets
3rd Floor
Column F-8

- B. Engrave identification tags "normally open" (green) or "normally closed" (red).

2.04 EQUIPMENT NAME PLATES

- A. Equipment identification shall be engraved plastic securely attached to each piece of equipment. Nameplates shall be a minimum of 1-inch high, 1/8 inch rigid plastic or bakelite with 4 edges beveled, with black background and white border and letters.

1. Two 3/8 inch mounting holes.
2. Minimum 1/2 inch high lettering.
3. Commercial quality, rust resisting nuts and bolts with backwashers, self tapping screws or rivets.

2.05 UNDERGROUND MARKING TAPE (OUTSIDE THE BUILDING)

- A. General: Provide underground pipe marking tape on all sanitary waste, grease waste and vent, storm, potable water, non-potable water and natural gas piping buried beneath the ground outside the building (not required below slab). Provide a continuous length of tape 12-inches below the finished earth surface directly above the buried pipe. Provide a second continuous length of tape 12-inches above the top of the buried pipe if the top of the pipe is lower than 36-inches from the top of the finished earth surface. For all non-metallic provide an electrically continuous corrosion-resistant tracer wire (minimum AWG 14) or tape shall be buried with the plastic pipe to facilitate locating. One end shall be brought above ground at building wall or riser.

- B. Tape: 5 mil inert plastic film for underground use.

- C. Resistant to alkalis, acids and other destructive agents found in soil; information in Civil Engineers Soils Report.

- D. Minimum tensile strength: 120 lb per

- E. Tape Width: 6-inch width.

- F. Minimum elongation: 500 percent.

- G. Provide detectable underground tape above all buried pipes on the Project. Provide a continuous printed message repeated every 16 to 36 inches warning of pipe buried below similar to (i.e. "CAUTION BUILDING WATER LINE BURIED BELOW").

2.06 VALVE AND EQUIPMENT CHARTS AND DIAGRAM FRAMES

- A. Provide five typewritten schedules giving numbers, service and locations, and notations of open or closed, of all tagged valves. Enclose each schedule in separate transparent plastic

binders. List piping systems with symbol and color coding on pipe identification chart. List valve model numbers and symbol for service corresponding to piping symbol on valve identification chart. Provide small "key plan" identifying valves as related to column lines.

- B. Submit drafts of valve schedule for review before preparing final sets.
- C. Provide typewritten list of equipment in triplicate, indicating location, service for each piece of equipment, laminated.

2.07 SAFETY SIGNS

- A. Place safety signs on machines driven by electric motors which are controlled by fully automatic starters, in accordance with Article 3281, General Industry Safety Orders.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 EQUIPMENT IDENTIFICATION

- A. Properly identify each piece of equipment and controls pertaining thereto by nameplates mounted on equipment and controls using round head brass machine screws, pop rivets or contact cement. Cardholders in any form are not acceptable.
- B. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- C. Identify pumps with area served.
- D. Small devices, such as inline pumps, may be identified with tags.
- E. Identify control panels and major control components outside panels with plastic nameplates.
- F. Identify equipment out of view behind access doors in unfinished rooms on face of the access door.

3.03 PIPE IDENTIFICATION

- A. Apply markings after all cleaning of piping and insulation is completed.
- B. Secure each end of marker with 2-1/4-inch wide self-sticking clear tape, wrap entire periphery
- C. Locate pipe markers as follows:
 - 1. Within one foot of each valve, fitting, thermometer or gauge (except on plumbing fixtures).
 - 2. At each branch or riser take off.
 - 3. At each passage through walls, floors and ceiling construction.
 - 4. At each pipe passage to underground.
 - 5. On all horizontal pipe runs every 20 ft, at least twice in each room and each story traversed by piping system.
 - 6. Identify piping contents, flow direction, supply and return.
 - 7. Where capped piping is provided for future connections, provide legible and durable tags indicating symbol identification.
 - 8. At wall and ceiling access panels.
 - 9. Practicable variations or changes in locations and spacing may be made with specific approval of the Owner's Representative to meet specific conditions.

- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers completely around pipe in accordance with manufacturer's instructions.
- F. Locate all markers identifying pipe contents for best visibility from floor.
- G. Paint or use colored insulation covers on all pipe in mechanical rooms. Paint colors and insulation covers shall match background colors as stated in Article 2.2C of this Section.
- H. Install markers with tape color bands over each end of marker, extending around pipe and overlapping a minimum of 30 degrees.

3.04 VALVE IDENTIFICATION

- A. Tag all valves except fixture stops.
- B. Label plumbing valves "Plbg" plus valve identification number.
- C. Number tags to conform to directory listing number, location and use.
- D. Secure tags to valves with corrosion resistant brass chain.

3.05 CONCEALED IDENTIFICATION

- A. Provide color-coded ceiling tracks to locate valves, control devices, etc. or other label on each T-bar suspended ceiling push-out tile. Locate in corner of panel closest to equipment. Submit label to Owner's Representative for review.

3.06 SERVICE ABBREVIATIONS

- A. Coordinate with Owner's Representative for preferred color schemes and service abbreviations as indicated below prior to start of any work and submittal review:

CD	Cooling Coil Condensate Drain Piping (Gravity).
PCD	Pumped Cooling Coil Condensate Drain Piping.
DCW	Domestic Cold Water.
DHW (140 °F)	Domestic Hot Water Supply (indicate temperature).
DHWR 140 °F)	Domestic Hot Water Return (indicate temperature).
DHW (120 °F)	Domestic Hot Water Supply (indicate temperature and associated digital mixing center).
DHWR (120 °F)	Domestic Hot Water Return (indicate temperature and associated digital mixing center).
NPW	Non-Potable Water.
SS	Sanitary Sewer.
GW	Grease Waste
V	Vent.
GV	Grease Vent.
GAS (2.0 psi)	Natural Gas (indicate service pressure, i.e., 2.0 psi or 10"WC)

3.07 INSTALLATION OF UNDERGROUND MARKING TAPE

- A. Install underground marking tape directly above all outside utility lines.
- B. Install tape as stated in Article 2.5/A of this Section.

3.08 CONTROL DIAGRAMS AND INSTRUCTIONS

- A. Diagrams and instructions may be reduced in size provided they are legible and lettering is not smaller than 1/8-inch.

END OF SECTION 220553

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SECTION 220719

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

- B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that product complies 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. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

- D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches (300 mm) long by NPS 2 (DN 50).
2. Jacket Materials for Pipe: 12 inches (300 mm) long by NPS 2 (DN 50).
3. Sheet Jacket Materials: 12 inches (300 mm) square.

4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.
 1. Piping Mockups:
 - a. One 10-foot (3-m) section of NPS 2 (DN 50) straight pipe.
 - b. One each of a 90-degree threaded, welded, and flanged elbow.
 - c. One each of a threaded, welded, and flanged tee fitting.
 - d. One NPS 2 (DN 50) or smaller valve, and one NPS 2-1/2 (DN 65) or larger valve.
 - e. Four support hangers including hanger shield and insert.
 - f. One threaded strainer and one flanged strainer with removable portion of insulation.
 - g. One threaded reducer and one welded reducer.
 - h. One pressure temperature tap.
 - i. One mechanical coupling.
 2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 4. Obtain Architect's approval of mockups before starting insulation application.

5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 7. Demolish and remove mockups when directed.
- D. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Supply and Drain Protective Shielding Guards: ICC A117.1.
- 1.06 DELIVERY, STORAGE, AND HANDLING
- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.
- 1.07 COORDINATION
- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.
- 1.08 SCHEDULING
- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber, Preformed Pipe Insulation:
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.

- b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 ADHESIVES

A. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

- 1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
 - d. Mon-Eco Industries, Inc.; 22-25.
- 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 3. 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."

B. PVC Jacket Adhesive: Compatible with PVC jacket.

- 1. Products: Subject to compliance with requirements, provide the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
- 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 3. 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."

2.03 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

- 1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.

d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. 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."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. 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."

2.04 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.05 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas Number 10.

2.06 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - i. Same material, finish, and thickness as jacket.
 - ii. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - iii. Tee covers.
 - iv. Flange and union covers.
 - v. End caps.
 - vi. Beveled collars.
 - vii. Valve covers.

- viii. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil- (3.2-mm-) thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

1. Products: Subject to compliance with requirements, provide the following:
 - a. Pittsburgh Corning Corporation; Pittwrap.
 - b. Polyguard Products, Inc.; Insulrap No Torch 125.

2.07 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.

- b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
- 2. Width: 2 inches (50 mm).
- 3. Thickness: 6 mils (0.15 mm).
- 4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
- 5. Elongation: 500 percent.
- 6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
 - 2. Width: 2 inches (50 mm).
 - 3. Thickness: 3.7 mils (0.093 mm).
 - 4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
 - 5. Elongation: 5 percent.
 - 6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. 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.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.04 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 07840 "Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07840 "Firestopping."

3.05 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 - 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 - 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 - 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.06 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

- 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
- 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
- 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
- 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

- 1. Install preformed pipe insulation to outer diameter of pipe flange.
- 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
- 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
- 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.07 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.08 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09900 "Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.

- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.09 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. NPS 1 (DN 25) and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
 - 2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
- B. Domestic Hot and Recirculated Hot Water:
 - 1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 - 2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
- C. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.

D. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be the following:

- a. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch (25 mm) thick.

3.12 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

- A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches (50 mm) thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

- B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.
2. PVC: 20 mils (0.5 mm) thick.
3. Aluminum, Corrugated: 0.016 inch (0.41 mm) thick.

D. Piping, Exposed:

1. None.
2. PVC: 30 mils (0.8 mm) thick.
3. Aluminum, Corrugated: 0.020 inch (0.51 mm) thick.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

- B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.
2. PVC: 20 mils (0.5 mm) thick.
3. Aluminum, Corrugated: 0.016 inch (0.41 mm) thick.

D. Piping, Exposed:

1. PVC: 30 mils (0.8 mm) thick.
2. Aluminum, Corrugated with Z-Shaped Locking Seam: 0.020 inch (0.51 mm) thick.

3.15 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220719

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SECTION 221116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Division 0, Contract requirements and Division 1, General Conditions apply to this section.

1.02 SUMMARY

- A. This Section includes domestic water piping systems to all plumbing equipment inside and outside the facility and as indicated on the Plumbing Plans, Piping Diagrams and Details.
- B. Furnish all labor, materials, pipe supports, sleeves, hangers, tools, equipment and perform all work and services necessary for furnishing and installation of a complete domestic water piping system. Although all work is not specifically shown or specified, all valves, appurtenances and devices incidental to or necessary for a sound, secure, complete and compatible installation shall be furnished and installed as part of this work.
- C. Domestic water piping installed below ground and under slab (i.e. trap primer lines, etc) shall be direct burial.
- D. Domestic water piping systems include the following:
1. Under building and aboveground domestic water distribution, including hot and cold water supply and hot water return piping and trap primer piping.
- E. Materials Specified in this Section include the following:
1. Copper pipe and fittings for above and below ground installation.
 2. Grooved joint and fittings for piping 2-1/2-inches and larger.
- F. Related Sections include the following:
1. Division 07 Section "Firestopping" for fire barrier sealers.
 2. Division 22 Section "Basic Plumbing Requirements."
 3. Division 22 Section "Basic Plumbing Materials and Methods."
 4. Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 5. Division 22 Section "Plumbing Valves."
 6. Division 22 Section "Identification for Plumbing Piping and Equipment."
 7. Division 22 Section "Plumbing Insulation."
 8. Division 31 Section "Excavation, Backfilling and Compacting for Utilities."

1.03 REFERENCED STANDARDS

- A. American Society for Testing and Materials (ASTM): Standard Specification for:

- | | | |
|----|------------|-----------------------------------|
| 1. | ASTM A 47 | Ferritic Malleable Iron Castings. |
| 2. | ASTM A 536 | Ductile Iron Castings. |
| 3. | ASTM B 32 | Solder Metal. |
| 4. | ASTM B 75 | Seamless Copper Tube |
| 5. | ASTM B 88 | Seamless Copper Water Tube |

6. ASTM B 584 Copper Alloy Sand Castings for General Applications.
7. ASTM B 813 Liquid Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube.
8. ASTM B 828 Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

B. American National Standards Institute (ANSI) / American Welding Society (AWS):

1. ANSI/AWS A5.8 Specification for Filler Metals for Brazing.
2. ANSI/AWS A5.31 Specification for Fluxes for Brazing and Braze Welding.
3. ANSI/AWS B2.2 Standard for Brazing Procedure and Performance Qualification.
4. ANSI/AWS C3.4 Specification for Torch Brazing.

C. American Society of Mechanical Engineers (ASME):

1. ASME B1.20.1 Pipe Threads, General Purpose (Inch).
2. ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.21 Nonmetallic Flat Gaskets for Pipe Flanges.
4. ASME B16.22 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
5. ASME B16.24 Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500, and 2500.
6. ASME B16.26 Cast Copper Alloy Fittings for Flared Copper Tubes.
7. ASME B16.29 Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings - DWV.
8. ASME B16.50 Wrought Copper and Wrought Copper Alloy Braze-Joint Pressure Fittings.
9. ASME B31.9 Building Services Piping.
10. ASME Section IX Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.

D. Manufacturers' Standardization Society (MSS):

1. MSS-SP-58 Pipe Hangers and Supports – Materials, Design and Manufacture.
2. MSS-SP-69 Pipe Hangers and Supports – Selection and Application.
3. MSS-SP-73 Silver Brazing Joints for Wrought and Cast Solder-Joint Fittings.
4. MSS-SP-89 Pipe Hangers and Supports – Fabrication and Installation Practices.

1.04 DEFINITIONS

- A. Water Service Piping: Water piping outside the building that conveys water to the building.
- B. Service Entrance Piping: Water piping outside the building, between water service piping and water distribution piping.
- C. Domestic Water Distribution Piping: Water piping from a point downstream of the domestic water booster pump that conveys water to fixtures and equipment throughout the building.

1.05 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
1. Domestic Water Service Piping, Below Ground: 160 psig.
 2. Domestic Water Distribution Piping, Above Ground: 125 psig.

1.06 SUBMITTALS

- A. Provide in accordance with Article 3.11 of the General Conditions, and Division 22 Section "Basic Plumbing Requirements."
1. Product Data for below and above ground pipe, fittings, and couplings. Provide manufacturer's catalog information.
 2. Grooved joint couplings and fittings for above ground pipe shall be shown on product submittals and be specifically identified with the applicable style or series designation.
 3. Provide recycled certification from manufacturer as specified in Article 2.1 B.

1.07 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with the provisions of ASME B31.9 "Building Services Piping," for materials, products, and installation.
- C. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.
- D. Comply with ASME SEC IX; Welding and Brazing Qualifications.
- E. Comply with ASTM E814; Fire Tests of Through-Penetration Fire Stops.
- F. Comply with AWWA C651; Disinfecting Domestic and Industrial Water Mains, comply with requirements of Division 33 Section.
- G. Comply with NCPWB; Procedure Specifications for Pipe Welding.
- H. Qualify soldering processes, procedures and solderers for copper and copper alloy pipe and tube in accordance with ASTM B 828.
- I. Qualify brazing processes for copper and copper alloy pipe and tube according to ANSI/AWS C3.4.
1. Qualify brazing procedures and brazer performance in accordance with either Section IX of the ASME Boiler and Pressure Vessel Code, or AWS B2.2.
- J. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be of a single manufacturer as the grooved components.

1.08 DRAWINGS AND SCHEDULES

- A. Comply with the requirements of Sheet Notes on the Drawings and the Schedules, Piping Diagrams and Details which indicate model numbers, symbols, and contain additional information concerning products specified in this Section.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Comply with requirements in Division 31 for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are 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. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves.
- H. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install seismic restraints on piping as required.
- K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- L. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping to permit valve servicing.
- O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- P. Install piping free of sags and bends.
- Q. Install fittings for changes in direction and branch connections.
- R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."
- T. Install thermostats in hot-water circulation piping.\

- U. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
- V. Install sleeves for piping penetrations of walls, ceilings, and floors.
- W. Install sleeve seals for piping penetrations of concrete walls and slabs.
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.03 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. 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.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- H. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- I. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- J. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- K. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.04 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.

2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.05 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.06 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint.
- B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.

2. Individual, Straight, Horizontal Piping Runs:

- a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
- c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

- C. Support vertical piping and tubing at base and at each floor.

- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

- E. Install supports for vertical copper tubing every 10 feet.

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- F. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.

2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 3. NPS 2:: 10 feet with 3/8-inch rod.
 4. NPS 2-1/2): 11 feet with 1/2-inch rod.
 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 7. NPS 6 (DN 150): 12 feet with 3/4-inch rod.
- G. Install supports for vertical stainless-steel piping every 15 feet.
- H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.08 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.09 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - i. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - ii. Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

- 1. Close drain valves, hydrants, and hose bibbs.
- 2. Open shutoff valves to fully open position.
- 3. Open throttling valves to proper setting.
- 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
- 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
- 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
- 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
- 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

- 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.