

SECTION 10 14 00 - INTERIOR SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior panel signs
- B. ADA Accessibility Signage.

1.02 RELATED SECTIONS

- A. Section 08 14 16 – Wood Doors: Attachment to doors.
- B. Section 09 29 00 - Gypsum Wallboard Systems: Wall sign substrate.
- C. Division 23 - For mechanical identification.
- D. Division 26 - For electrical identification.

1.03 REFERENCES

- A. ASTM E 84 - Surface Burning Characteristics of Building Materials.
- B. ADA (Americans with Disabilities Act) Accessibility Guidelines.

1.04 SUBMITTALS

- A. Product Data: Manufacturer's product data, specifications and installation instructions specifically identifying each type of sign required.
- B. Samples
 - 1. Identify samples with label on the back, showing designating number, name of manufacturer, name of project, specific sign location, letter style, etc.
 - 2. Submit the following:
 - a. Material for each sign type, with specified finish.
 - b. Color Samples (minimum size 5 x 5 inches) of colors scheduled.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Package separately or in like groups labeled to indicate contents. Include installation templates, installation hardware, adhesives and installation instructions.
- B. Store and protect assemblies from injury at the shop, in transit to the job and until erected in place, completed, inspected and accepted.

1.06 WARRANTY

- A. Warrant products in this section against defective materials for a minimum period of 1 year.
- B. Correct defects in material and workmanship which may appear during the correction period by repairing to the Owner's satisfaction or by replacing with new materials.
- C. Defects subject to corrections include, but are not limited to:
 - 1. Bubbling, crazing, peeling, chalking, rusting, delamination or other disintegration of sign face, messages or edge finish of sign inserts or panels.
 - 2. Corrosion developing beneath paint surfaces of the support systems (except when it is the result of obvious vandalism or other external damage to the paint surfaces).
 - 3. Corrosion of fastenings.
 - 4. Sign or letters not remaining true and plumb on supports.
 - 5. Fading of color when matched against sample of original color and material.
- D. Correct defects in material and workmanship which may appear during the correction period by repairing to the Owner's satisfaction or by replacing with new materials.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Interior Signage
 - 1. Basis of Design: ASI Sign Systems, Inc.
 - 2. Other Acceptable Manufacturers include, but are not limited to the following:
 - a. Andco Industries Corp.
 - b. Best Sign Systems, Inc.
 - c. HB Sign Co.

2.02 MATERIALS

- A. Acrylic: Plexiglas as manufactured by Rohm and Haas, or equal.
 - 1. Integral Color Acrylic: Plexiglas; colors as indicated.
- B. Miscellaneous Other Materials
 - 1. Adhesive Tape: Closed-cell black foam type with adhesive surfaces on both faces. Provide thicknesses and widths of tapes as required to safely secure signs to various wall finishes, but in no case less than 1/16 inch thick and 1/2 inch wide. Basis of Design: Sealant Tape Normount V2862, manufactured by Norton Performance Plastics Corp., Granville, New York.
 - 2. Liquid Adhesive: Silicone Silastic 732 RTV adhesive/sealant as manufactured by Dow-Corning Corporation.
 - 3. Hangers, Brackets and Accessories: Where such items are not otherwise indicated, provide hangers, brackets and accessories as required for the proper execution of the work.

2.03 COMPONENTS

A. Sign Panels

1. Flat panel with square corners.
2. Surface Finish: Provide surface finishes free from lines, ridges, variations in color, orange peel, bubbles, pinholes, mottling, crazing, grit and coarse particles.
3. Acrylic Sheet Thickness: Shall be from 1/16 inch to 1/2 inch as indicated or as recommended by manufacturer for the intended application. At fastening points, thicknesses greater than 1/4 inch may be made up of laminations or reduced to 1/4 inch if the fabricator can guarantee structural soundness consistent with details shown.
4. Opacity: Except for internally illuminated assemblies, signs shall have opaque background and opaque graphics.
Note: Whites, in particular, but all colors, especially in the acrylic signs, are to be clear and match references exactly.

B. Identification of Permanent Spaces

1. Raised characters shall be accompanied by Braille, Grade 2.

2.04 (NOT USED)

2.05 FABRICATION

- A. Field Conditions: Before starting work, examine adjoining work on which work of this Section is dependent for workmanship and fit. Verify measurements in field as required for fabricated work to fit job conditions.
- B. Changeability: Fabricate signs in such a manner that each major mounting component may be replaced with similar components by maintenance personnel, but not readily be removed by unauthorized persons.
- C. Construction: Fabricate joints, corners, miters, etc., with work accurately machined, fitted and rigidly framed together. Match work to provide continuity of lines and design, with parts in contact having hairline joints. Make joints as strong and as rigid as adjoining sections. Locate exposed joints where least conspicuous.
- D. Connections and Accessories
 1. General: Provide connections and accessories adequate to withstand stresses and strains to which they will be normally subjected.
 2. Fastenings
 - a. Surface Finish: Do not expose fastenings on sign face surface of sign panels. Do not deform, distort or discolor sign face surfaces by attachment or concealed fastenings.
 - b. Corrosion Resistance: Provide noncorrosive fastenings, resistant to oxidation or other corrosive action, of same composition throughout cross section.
 - c. Color: Secure work with fastenings of same color and finish as components they secure, where exposed to view.

2.06 MESSAGES

- A. Follow layouts shown on Drawings. Center messages unless noted otherwise.
- B. Provide letter forms that are true and clean. Rounded corners, or chipped, nicked, cut or ragged edges, will not be accepted.
 - 1. Surface and Subsurface-Applied Messages
 - a. Reflectivity and Specular Gloss - Nonreflecting Message: 60° specular in accordance with ASTM Test D 523.
 - b. Thickness: For tactile lettering, use 1/16 inch minimum thickness and provide as otherwise required for ADA compliance.
 - c. Color and Color Fastness: Ensure that signs with subsurface color areas and surface-applied messages have colors matching those of surface-applied messages. Exposed surfaces and finishes shall show no discernible color change nor chalking when exposed for 1,000 hours in an Atlas Twin Arc Weathermeter Model HCDL-X, or equivalent, when tested in accordance with ASTM D 822.
- C. Letter Arrangement
 - 1. Form: Ensure that letter form matches specimens above.
 - 2. Size: Letter height is based on height of a capital letter.
 - 3. Placement: When setting type or installing letters, ensure that letters are straight and even.
 - 4. Comply with ADA Accessibility Guidelines for contrast, character proportion, mounting height, and for tactile signs where identifying permanent rooms or spaces and where providing direction or information about functional spaces.
 - 5. Visual Justification: Show sample interletter and interword spacing on sample sign panels submitted to the Architect for approval before fabrication is initiated.

2.07 (NOT USED)

PART 3 EXECUTION

3.01 INSPECTION

- A. Examine the substrates and conditions under which signs are to be installed and notify Architect in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install signs and components securely mounted with concealed fasteners, unless otherwise shown. Attach signs to substrates in accordance with manufacturer's instructions.
- B. Install level, plumb and at proper height. Cooperate with other trades for installation of signs to finish surfaces. Repair or replace damage as directed by the Architect.
- C. Verify each surface in field to determine specific, appropriate hardware.
- D. Install signs and letters centered and level, in line, in accordance with manufacturer's recommendations.

3.03 CLEANUP

- A. Periodically and upon completion of installation, remove waste, dirt, wrappings and excess materials, tools and equipment.
- B. Clean and polish surfaces. Remove excess adhesive.

END OF SECTION 10 14 00

THIS SHEET INTENTIONALLY LEFT BLANK

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Corner guards
 - 2. Impact-resistant wall coverings
 - 3. Door-protection systems
- B. Low Emitting Materials
 - 1. Products listed shall have a minimum VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - a. Adhesive: 70 g/L or less.
- C. Related Sections include the following:
 - 1. Division 01 Section "Product Requirements."
 - 2. Division 08 Section "Door Hardware" for metal armor, kick, mop, and push plates.

1.3 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall-protection unit.
- B. Shop Drawings: For each impact-resistant wall-protection unit showing locations and extent. Include sections, details, and attachments to other work.
 - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Include dimensions for all products.
- C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated.
 - 1. Include similar Samples of accent strips and accessories involving color selection.

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

1. Corner Guards: 12 inches long. Include examples of joinery, corners, top caps, and field splices.
2. Impact-Resistant Wall Covering: 6 by 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: For each impact-resistant plastic material.
- B. Material Certificates: For each impact-resistant plastic material, signed by manufacturer.
- C. Warranty: Sample of warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each impact-resistant wall-protection unit to include in maintenance manuals.
 1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.
- B. Executed warranty

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain impact-resistant wall-protection units through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall-protection units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Fire-Test-Response Characteristics: Provide impact-resistant, plastic wall-protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall-protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 - 2. Keep plastic sheet material out of direct sunlight.
 - 3. Store plastic wall-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall-protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.
- B. Field Measurements: Verify actual locations of walls, columns, and other construction contiguous with impact-resistant wall-protection units by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Deterioration of plastic and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

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

2.2 MATERIALS

- A. Plastic Sheet Wall Covering Material: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, semirigid, high-impact-resistant acrylic-modified vinyl plastic sheet with integral color throughout; thickness as indicated.
 - 1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
 - 2. Chemical and Stain Resistance: Tested according to ASTM D 543.
 - 3. Self-extinguishing when tested according to ASTM D 635.
 - 4. Flame-Spread Index: 25 or less.
 - 5. Smoke-Developed Index: 450 or less.
- B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- C. Adhesive: Type recommended by manufacturer for use with material being adhered to substrate indicated.
 - 1. Use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Gypsum Board and Panel Adhesives: 50 g/L.
 - b. Multipurpose Construction Adhesives: 70 g/L.
 - c. Contact Adhesive: 250 g/L.

2.3 CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards: Fabricated from 1-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
 - 1. Basis of Design: Construction Specialties, Inc.
 - 2. Other Acceptable Manufacturers subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of the manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitutions":
 - a. American Floor Products Co., Inc.
 - b. IPC Door and Wall Protection Systems; Division of InPro Corporation
 - c. Pawling Corporation
 - 3. Material: Stainless steel, Type 304.
 - a. Thickness: Minimum 0.0500 inch.
 - b. Finish: Directional satin, No. 4.
 - 4. Length: 4 foot – 0 inches.
 - 5. Wing Size: Nominal 2-1/2 by 2-1/2 inches.
 - 6. Corner Radius: 1/8 inch.
 - 7. Mounting: Double-faced, adhesive foam tape.

2.4 END-WALL GUARDS

- A. Surface-Mounted, Metal, End-Wall Guards: Fabricated from one-piece, formed or extruded metal that covers entire end of wall; with formed edges.
1. Basis of Design: American Floor Products Co., Inc.
 2. Other Acceptable Manufacturers subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of the manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitutions":
 - a. ARDEN Architectural Specialties, Inc.
 3. Material: Stainless steel, Type 304.
 - a. Thickness: Minimum 0.0500 inch.
 - b. Finish: Directional satin, No. 4.
 4. Length: 4 foot – 0 inches.
 5. Wing Size: Nominal 2-1/2 by 2-1/2 inches.
 6. Corner Radius: 1/8 inch.
 7. Mounting: Double-faced, adhesive foam tape.

2.5 IMPACT-RESISTANT WALL COVERINGS

- A. Semirigid, Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall covering material.
1. Basis of Design: Construction Specialties, Inc.
 2. Other Acceptable Manufacturers subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of the manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitutions":
 - a. IPC Door and Wall Protection Systems; Division of InPro Corporation
 - b. Korogard Wall Protection Systems; Division of RJF International Corporation
 - c. Pawling Corporation
 3. Size: 48 by 96 inches for sheet.
 4. Sheet Thickness: 0.060 inch.
 5. Color and Texture: Reference finish schedule. Successful bidder must match color and pattern.
 6. Height: 4 foot – 0 inches wainscot.
 7. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
 8. Mounting: Adhesive.

2.6 FABRICATION

- A. Fabricate impact-resistant wall-protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

- B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.7 METAL FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Remove tool and die marks and stretch lines or blend into finish.
 - 2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- B. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of work.
 - 1. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 2. For impact-resistant wall-protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall-protection system components.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. General: Install impact-resistant wall-protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
 - 1. Install impact-resistant wall-protection units in locations and at mounting heights indicated on Drawings or, if not indicated, at heights indicated below:
 - a. Wall Guards: 4 foot – 0 inches above finished floor
 - b. Corner Guards: 4 foot – 0 inch units installed directly above wall base.
 - 2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
 - a. Provide anchoring devices to withstand imposed loads.
 - b. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches.
 - c. Adjust top caps as required to ensure tight seams.
- B. Impact-Resistant Wall Covering: Provide top and edge moldings, corners, and divider bars by wall covering manufacturer, as required for a complete installation.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00

THIS SHEET INTENTIONALLY LEFT BLANK

SECTION 10 28 00 - TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Toilet and bath accessories listed herein.
- B. Rough-in frames supplied to other sections.
- C. Attachment hardware.
- D. All toilet and bath accessories shall match existing.

1.02 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry: Installation of accessories.
- B. Section 09 29 00 - Gypsum Wallboard System: Anchor reinforcement in walls.

1.03 REFERENCES

- A. ASTM A 167 - Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- B. ASTM A 269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- C. ASTM A 366 - Cold Rolled Carbon Steel Sheets, Commercial Quality.
- D. Federal ADA

1.04 SUBMITTALS

- A. Product Data
 - 1. Submit in accordance with Section 01 33 00.
 - 2. Data to illustrate each accessory at large scale and show installation method.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.
- B. Pack accessories individually in a manner to protect accessory and its finish.
- C. Protect adjacent or adjoining finished surfaces and work from damage during installation of work of this section.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Basis of Design

1. Bobrick Washroom Equipment Inc.

B. Other Acceptable Manufacturers subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of the manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitutions".

1. American Specialties, Inc.
2. Bradley Corp.
3. General Accessory Manufacturing Co.
4. McKinney/Parker

2.02 MATERIALS

- A. Sheet Steel: ASTM A 366, cold rolled stretcher leveled; 1.25 oz./sq. ft. (3808/m²) galvanized coating.
- B. Stainless Steel Sheet: ASTM A 167, commercial grade, 22 gauge.
- C. Stainless Steel Tubing: ASTM A 269, commercial grade, seamless welded.
- D. Adhesive: Epoxy type contact cement.
- E. Fasteners, Screws and Bolts: Concealed hot dip galvanized. Exposed stainless steel. Expansion Shields: Fiber, lead or rubber as recommended by accessory manufacturer for component and substrate.
- F. Keyed (tumbler lock) accessories shall be keyed alike with the exception of coin receiving boxes on dispensing machines.
- G. All accessories shall be products of a single manufacturer.
- H. Lettering for identification of accessories and operation instructions shall be silk screened using international symbols unless otherwise specified.
- I. Accessories.

2.03 EXPOSED FINISHES

- A. Stainless Steel: No. 4 satin luster finish.

2.04 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from 1 sheet of stock, free of joints.
- C. Provide steel anchor plates and anchor components for installation of accessories herein

specified.

- D. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- E. Back paint components where contact is made with building finishes to prevent electrolysis.
- F. Hot dip galvanized ferrous metal anchors and fastening devices.
- G. Shop assemble components and package complete with anchors and fittings.

PART 3 EXECUTION

3.01 PREPARATION

- A. Deliver inserts, anchor plates, rough-in frames, etc., to job site at appropriate time for building in. Provide templates for blocking and rough-in measurements as required.
- B. Before starting work notify Architect in writing of any conflicts detrimental to installation or operation of units.
- C. Verify with Architect exact location of accessories.

3.02 INSTALLATION

- A. Install fixtures, accessories and items in accordance with manufacturer's printed instructions.
- B. Install true, plumb and level, securely and rigidly anchored to substrate.

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE EXTINGUISHER CABINETS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguisher cabinets, semi-recessed application.
- B. Attachment hardware.
- C. Fire extinguisher.

1.02 RELATED SECTIONS

- A. Section 09 29 00 - Gypsum Wallboard Systems: Rough wall openings.

1.03 REFERENCES

- A. ASTM A 167 - Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- B. ASTM A 336 - Cold Rolled Carbon Steel Sheets, Commercial Quality.

1.04 SUBMITTALS

- A. Submit manufacturer's product data in accordance with Section 01 33 00.
- B. Submit data to illustrate cabinets and show installation method.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver to site until rooms in which they are to be installed are ready to receive them.
- B. Pack individually in a manner to protect cabinet and its finish.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Basis of Design: J. L. Industries
- B. Other Acceptable Manufacturers
 - 1. Larsen's Manufacturing Company
 - 2. Potter-Roemer, Inc. Division of Smith Industries Inc.
- C. Cabinet: Series 1525F25
- D. General Extinguisher: Cosmic 10E

2.02 CABINETS

- A. General: Provide fire extinguisher cabinets suitable for housing one standard 10 lb. ABC (UL rating 4A-60BC) size fire extinguisher, as follows:
 - 1. Semirecessed: 2-1/2 inch (65 mm) rolled edge trim, for shallow wall installation.
 - 2. Cabinet in rated partitions shall have fire rating the same as the partition.
- B. Metal Gauge: Provide cabinets fabricated of the following minimum equivalent steel gauges.
 - 1. Box: 20 gauge.
 - 2. Trim Frame: 18 gauge.
 - 3. Tubular Door Perimeter Frame: 20 gauge.
 - 4. Door Panel: 16 gauge.
- C. Construction: One-piece metal trim frame, to suit cabinet style required. Weld all joints and grind smooth. Provide manufacturer's standard interior finish and exterior finish.
- D. Aluminum Doors and Trim: Manufacturer's standard, flush aluminum door frame and trim, satin etch and clear anodized finish, style as indicated.
- E. Doors: Of the following type:
 - 1. Vertical Duo-Panel: DSA glass, with catch.
- F. Door Hardware: Continuous type hinge permitting door to open 180°. Provide either lever handle with cam action latch or door pull and friction latch.
- G. Cabinet shall abide with ADA requirements.

2.03 EXTINGUISHER

- A. Multipurpose dry chemical type with a UL rating of 4A-60BC.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in locations and at mounting height to comply with governing authorities. Prepare recesses in walls as required. Securely fasten to structure with galvanized buttonhead screws driven square and plumb, in accordance with manufacturer's instructions. Wherever exact location of surface-mounted units is not shown, locate as directed by Architect.

END OF SECTION 10 44 13

SECTION 10 51 13 - WARDROBE LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal locker body and hinged door.
- B. End panels, trim pieces.
- C. Base.
- D. Sloping tops.
- E. Hooks, Latches and Hardware.
- F. Attachment hardware.
- G. All architectural components shall be in accordance with the seismic requirements of the governing codes; refer to specification Section 01 10 00.

1.02 RELATED SECTIONS

- A. Section 01 10 00 - Summary of Work.
- B. Section 06 10 00 - Rough Carpentry: Blocking.
- C. Section 09 29 00 - Gypsum Wallboard Systems: Furred down bulkheads.

1.03 NOT USED

1.04 SUBMITTALS

- A. Shop Drawings and Product Data
 - 1. Submit in accordance with Section 01 33 00.
 - 2. Indicate locker types, sizes, configurations, installation details, layout of groups of lockers, accessories, color and finish, and numbering.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Protect locker finishes and adjacent surfaces and materials from damage or marring during installation.

1.06 GUARANTEE/WARRANTY

- A. Furnish a 10 year material and labor warranty from the manufacturer, against defects in materials and workmanship.

1.07 (NOT USED)

1.08 PROJECT/SITE CONDITIONS

- A. Field Measurements: Prior to submittal of shop drawings, verify dimensions for exact placement/fit/location of lockers.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Metal Lockers

- 1. Basis of Design: Lyon Workspace Products
- 2. Other Acceptable Manufacturers
 - a. List Industries Inc.
 - b. Penco Products
 - c. Republic Storage Company, Inc.

2.02 TYPES

- A. Metal lockers shall be in quantities as shown on the drawings.
- B. All lockers to be provided with sloped tops, 20-gauge for individual lockers, 16-gauge for continuous.

2.03 METAL LOCKER MATERIALS

- A. Sheet Steel: Mild cold-rolled domestic furniture steel; free of surface imperfections; capable of taking a high grade baked enamel finish; of the following minimum thicknesses:
 - 1. Body and Shelf: 24 gauge.
 - 2. Base, Top, Trim: 22 gauge.
 - 3. Doors: 16 gauge for 12 inches and up, 18 gauge for under 12 inches and box lockers.
 - 4. Door Inner Faces: 24 gauge.
 - 5. Door Frames: 16 gauge.
 - 6. Hinges: 14 gauge.
- B. Fittings: Recessed locking handle, coat hooks, rod, shelf, door numbers, rubber bumpers as required by the type and size of locker specified below.

2.05 HARDWARE

- A. Hinges shall be heavy-duty, two (2) on doors less than 36 inches, three (3) on doors greater than 36 inches; nameplates: 1-1/2 inch brass disk with black numbers, routed in flush with door surface.
- B. Locks: Padlock furnished by Owner.
- C. Miscellaneous: Two (2) side-mounted, single prong coat hooks, and one double-pronged back mounted coat hook, coat hanger bar, metal number plate.

2.06 (NOT USED)

2.07 METAL LOCKER FABRICATION

- A. Locker sizes as shown in the drawings.
- B. Bodies: Formed and flanged with stiffener ribs.
- C. Door Frame: Formed channel shape, welded together and ground flush.
- D. Doors: Doors shall be one piece with lock and hinge edges being channel shaped. Top and bottom edges shall be flanged at a 90% angle.
- E. Provide ventilation openings at top and bottom of each locker.
- F. Finish edges smooth without burrs.
- G. Prepare locking handle for padlock furnished by Owner.
- H. Locker shall be bolted or riveted together with zinc-plated fasteners or fasteners subjected to other similar retardant treatment.

2.08 (NOT USED)

2.09 LOCKER FINISHING

- A. Metal
 - 1. Prior to assembly, the surface of the steel shall be thoroughly cleaned and phosphatized in a seven stage process. All parts shall then be finished with a heavy coat of enamel baked at a minimum 300° F. for a minimum of 30 minutes.
 - 2. Colors to be selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 PREPARATION

- A. Take site dimensions affecting this work.
- B. Ensure that bases are properly sized and located.

3.02 INSTALLATION

- A. Install lockers secure, plumb, square, and in line in accordance with manufacturer's written instructions.
- B. Anchor lockers to wall with anchor devices.
- C. Bolt adjoining locker units together to provide rigid installation.
- D. Install end panels and filler panels to close off openings.

SECTION 11 70 00 - MEDICAL EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabrication, furnishing and installation of items listed as Contractor-furnished and Contractor-installed (CFCI)
- B. Coordination and installation of items listed as Owner-furnished and Contractor-installed (OFCI) and Vendor-furnished and Contractor-installed (VFCI)
- C. Coordination of items listed as Vendor-furnished and Vendor-installed (VFVI) and Owner-furnished and Owner-installed (OFOI)
- D. Electrical and mechanical services fitting to and mounting on the equipment.
- E. Furnishing of mechanical electrical fixtures to trades of Divisions 15 and 16 for installation.
- F. Connections, fasteners and anchors required for proper attachment of equipment.
- G. All architectural components shall be in accordance with the seismic requirements of the governing codes; refer to specification Section 01 10 00.

1.02 RELATED SECTIONS

- A. Division 01 Section "Summary of Work."
- B. Division 15 - Mechanical: Supply and hookup to equipment.
- C. Division 16 - Electrical: Supply and hookup to equipment.

1.03 REFERENCES

- A. All electric operated and/or heated equipment, fabricated or otherwise, shall conform to the latest standards of the National Electric Manufacturers' Association and of Underwriters' Laboratories, Inc.
- B. All standard steam heated equipment shall be manufactured in accordance with ASME code requirements and carry the ASME stamp.
- C. All pressure tanks and vessels shall meet State Code Requirements and shall be code stamped, where required.
- D. Cooler and freezer units shall be listed by Underwriters' Laboratories. Electrical wiring and components, including self-contained refrigeration systems, shall meet UL standards.
- E. ASTM A 240 - Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Fusion-Welded Unfired Pressure Vessels.

- F. ASTM A 366 - Steel, Carbon, Cold Rolled Sheet, Commercial Quality.
- G. ASTM B 88 - Seamless Copper Water Tube.
- H. ASTM B 43 - Seamless Red Brass Pipe, Standard Sizes.
- I. ASTM B 135 - Seamless Brass Tube.
- J. Federal Specification GG-S-1340 - Sterilizer, Surgical Instrument and Supply Gravity Air Removal, Nonportable (Heat and Moisture Stable).

1.04 SUBMITTALS

- A. Submit Shop Drawings and Product Data in accordance with Section 01 33 00.
- B. Samples: Submit samples in accordance with Section 01 33 00.
- C. Brochure of Purchased Items
 - 1. Furnish purchased equipment brochures, with manufacturer's catalogue sheets complete with descriptive data, capacities, special modifications, door swings, utility requirements, and accessories.
 - 2. Mark plainly with the specification item number and quantity of units required. Where the catalogue sheets illustrate accessories which are not being supplied, such accessories shall be marked out, as should all data which is not relative to the specified unit.
 - 3. Bind catalogue sheets in a ring type binder. Include a typewritten index sheet, with a list of the equipment being included and the item number for same.
 - 4. Furnish a minimum of 6 brochures for distribution after final approval.
- D. Shop Drawings: Furnish Shop Drawings of fabricated equipment, including item number, amount of units required, gauges of material, methods of fastening, dimensions, hardware model numbers, locations and size of utility connections, and other pertinent data. Show typical details illustrating essential construction methods.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Wrap and crate finished components and assemblies at the factory in a manner to prevent damage or marring of assemblies or surfaces during shipping and handling.
- B. Deliver materials to site, unload and store. Lay panels and flat sections flat and blocked clear of floor in a manner to prevent warping, twisting or sagging.

1.06 GUARANTEE/WARRANTY

- A. Provide written warranties from manufacturers in accordance with Section 01 77 00.

1.07 MAINTENANCE

- A. Submit operation and maintenance data in accordance with Section 01 77 00.
- B. At completion of work, provide a qualified and trained manufacturer's representative to demonstrate the operation of each item of equipment and instruct Owner in the operating

procedure and maintenance.

1.08 PROJECT/SITE CONDITIONS

- A. Before installation, check building dimensions, and services rough-in, including means of access, for conditions affecting delivery and installation of equipment.
- B. Where dimensions are not available before fabrication is commenced, confirm dimensions in writing to Architect.
- C. Visit jobsite prior to equipment installation to verify all ventilation outlets, utility and electrical service connections, and instruction to all parties with regard to shop drawings.
- D. Starting work indicates acceptance of other in-place work.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers are listed with each item of equipment.

PART 3 EXECUTION

3.01 EXISTING EQUIPMENT

- A. Move and install equipment, ready for connection by mechanical and electrical trades. Work shall be done in cooperation with the Owner so that normal function of services is minimally interrupted. Balance of existing equipment not used will be removed by Others and disposed of.
- B. Existing equipment may be seen at the site at a time convenient to the Owner.
- C. Thoroughly clean existing equipment to be reused.
- D. Existing equipment which must be removed from site for repairs or alterations shall be handled carefully and returned in as good condition as when originally removed, apart from repairs or alterations necessitating removal.
- E. Refer to the drawing schedule for identity of reused equipment.

3.02 INSTALLATION

- A. Install all items in strict accordance with manufacturer's instructions.

END OF SECTION 11 70 00

THIS SHEET INTENTIONALLY LEFT BLANK

SECTION 12 32 00 - PLASTIC LAMINATE CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fixed plastic laminate cabinets and casework including:
- B. Laminated plastic counter tops, backsplash and edges;
- C. Solid surface countertops.
- D. Cutouts for electrical, mechanical equipment;
- E. Coordinate installation of appliances;
- F. Shelf standards, brackets, and other accessories;
- G. Metal wall bracket supports for cabinets;
- H. Drilling, tapping, cutting, rough hardware as necessary for installation of work;
- I. Fillers, trim and fascias;
- J. Shelving;
- K. All architectural components shall be in accordance with the seismic requirements of the governing codes; refer to specification Section 01 10 00.

1.02 RELATED SECTIONS

- A. Section 01 10 00 - Summary of Work.
- B. Section 01 10 00 - Rough Carpentry: Blocking within walls.
- C. Section 09 65 16 - Resilient Flooring: Base material.
- D. Division 23: Plumbing and Mechanical.
- E. Division 26: Electrical Hookup to Utilities.

1.03 REFERENCES

- A. ASTM A 264 - Stainless Chromium Nickel Steel Clad Plate, Sheet and Strip.
- B. ASTM C 1036 - Flat Glass.
- C. ASTM C 1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.

- D. ASTM C 1172 - Laminate Architectural Flat Glass.
- E. AWI Quality Standards, latest edition.
- F. N.S.F. Standards

1.04 SUBMITTALS

A. Samples

- 1. Submit in accordance with Section 01 33 00.
- 2. Provide representative samples of accessories.
- 3. Provide actual color samples of laminated plastic.

B. Certification

- 1. Submit printed catalog information documenting the fact that all casework shall be pre-engineered and cataloged to rigid modular-matrix sizing, allowing for future (a minimum of 10 years) interchange of components, or entire units.
- 2. That casework is in compliance with NSF Standards
- 3. That casework is in compliance with ANSI A161.1 - 1995 accompanied by independent testing laboratory reports.
- 4. From manufacturer stating the particleboard/MDF/agri-fiber particleboard has NO formaldehyde emissions.

C. Shop Drawings

- 1. Submit Shop Drawings in accordance with Section 01 33 00.
- 2. Detail casework; include elevations, and plans, with large scale sections and details. Note finishes, and show installation details.

D. Product data.

1.05 DELIVERY, STORAGE AND HANDLING

A. Wrap or crate casework in a manner to prevent damage during shipping and installation.

B. Do not deliver casework to site until spaces in which it is to be installed are ready to receive it.

C. Store completed laminate clad casework and countertops in a ventilated place, protected from the weather, with relative humidity range of 20% to 50%.

D. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with a protective covering.

E. Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least 1 week.

- 1. Manufacturer/Supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
- 2. After installation, control temperature and humidity to maintain relative to maintain relative humidity between 25 percent and 55 percent.

1.06 GUARANTEE/WARRANTY

- A. Submit in accordance with Section 01 77 00. Furnish written warranty from manufacturer and Subcontractor covering the satisfactory repair and/or replacement of all defective equipment or workmanship included in this section for a period of three years.

1.07 MAINTENANCE

- A. Provide catalog binder depicting installed systems and identifying manufacturer and local representative.

1.08 PROJECT/SITE CONDITIONS

- A. Field Measurements: Prior to submittal of shop drawings, field verify dimensions for exact fit/placement/location of casework.

1.09 QUALITY ASSURANCE

- A. Casework shall meet W.I.C. Standards.
- B. Equipment shall meet with state, local and federal codes and Underwriters' approval and inspections as applicable.
- C. Provide manufactured casework system, counter tops and related items specified in this section, furnished by the same supplier.
- D. Manufactured casework systems must conform to design, quality of materials, workmanship and function, as shown on drawing and specified herein or in conformance with the quality standards set forth in AWI Section 1600 custom grade and Section 400 premium grade for counter tops, whichever is more stringent.
- E. Certified independent testing laboratory achieving the following minimum results:
 - 1. Base Cabinet Racking Test - 850 lbs. psi. (5861 kPa)
 - 2. Base Cabinet Front Joint Load Test - 450 lbs. psi. (3103 kPa)
 - 3. Wall Cabinet Static Load Test - 185 lbs. psi. (1276 kPa)
 - 4. Shelf Clip Load Test - 1200 lbs. psi/330 lbs. psi per clip (8273 kPa/2275 kPa).
 - 5. Edging Impact Test - 1467 Force of Newtons.
 - 6. Particleboard Screw Holding Strength - 330 lbs. Psi (2275 kPa).
 - 7. Countertop Support Bracket - 500 lbs. (227 kg)
- F. Minimum of 5 years experience in providing manufactured casework systems for similar type projects.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Laminated Plastic
 - 1. As listed on the drawings.

B. Solid Surface Countertops

1. As listed in the drawings

2.02 DEFINITIONS AND MATERIALS

A. Definitions: Identification of casework parts by surface visibility.

1. Open Interiors: Any open storage unit without solid door or drawer fronts and units with full glass doors or insert doors.
2. Closed Interiors: Any closed storage unit behind solid door or drawer fronts, sliding solid doors.
3. Exposed Ends: Any storage unit exterior side surface that is visible after installation.
4. Other Exposed Surfaces: Faces of doors and drawers when closed, tops of cabinets less than 72 inches (1830 mm) above finished floor.
5. Semiexposed Surfaces: Interior surfaces which are visible, bottoms of wall cabinets and tops of cabinets 72 inches (1830 mm) or more above finished floor.
6. Concealed Surfaces: Any surface not visible after installation.

B. Core Materials

1. Particleboard up to 7/8 inch (22 mm) thick: Industrial grade average 47 pound (750 kg/m³) density particleboard, ANSI A208.1-1999, M-3.
2. Particleboard 1 inch (25 mm) thick and thicker: Industrial grade average 47 pound (750 kg/m³) density particleboard, ANSI A208.1-1999, M-2.
3. MR Moisture Resistant Particleboard: Average 47 pound (750 kg/m³) density particleboard, ANSI A208.1-1999, M-3.
4. Medium Density Fiberboard 1/4 inch (6 mm) thick: Average 54 pound (860 kg/m³) density grade, ANSI A208.2.
5. Medium Density Fiberboard 3/4 inch (19 mm) thick: Average 48 pound (770 kg/m³) density grade, ANSI A208.2.
6. Hardboard: Prefinished hardboard in 1/4 inch (6 mm) thickness meeting or exceeding commercial standards CS-251.
7. All particleboard/MDF/agri-fiber particleboard shall be formaldehyde-free.
8. At Contractor's option, formaldehyde-free MDF or Wheat Sheet may be used in lieu of particleboard, except where sinks occur.
 - a. Medium Density Fiberboard (MDF): ANSI A208.2, Grade MD-Exterior Glue, FSC certified.
 - b. Wheat-Straw or Straw Based Particleboard: Recycled wheat chaff with MDI Rubinate binder. Formaldehyde and emission-free (EFB) board meeting ANSI A208.1, PrimeBoard as manufactured by United Board Group or Wheatboard or Wheatstalk as manufactured by Dow BioProducts/Dow Chemical Canada. Performance shall be in accordance with the following:

Density (pcf)	40
Modulus of Elasticity	3000+
Modulus of Rupture	400+
Internal Bond (psi)	80+
Face Screw Holding (lbs.)	300+
Edge Screw Holding (lbs.)	250+
Average Thickness	±.006

Hardness
Formaldehyde Emissions

600+
0 - Contains no Urea
Formaldehyde

C. Decorative Laminates/Veneer Where Applicable

1. High pressure decorative laminate VGS (.028), NEMA Test LD3 -1995.
2. High pressure decorative laminate HGS (.048), NEMA Test LD3 - 1995.
3. High pressure decorative laminate HGP (.039), NEMA Test LD3 - 1995.
4. High Pressure cabinet liner CLS (.020), NEMA Test LD3 - 1995.
5. High pressure backer BKH (.048), (.048), (.039), (.028), NEMA Test LD3 - 1995.
6. Thermally fused melamine laminate NEMA Test LD3 - 1995.
7. Chemical-resistant decorative laminate, NEMA Test LD3 - 1995.

D. Laminate Color Selection

1. Basic Cabinet Body Color (semiexposed surfaces)
 - a. To include surfaces of all components, including drawer boxes, to be covered with melamine laminate as a minimum requirement.
 - b. Melamine laminate shall be available in manufacturer's standard neutral colors. One color only per project.
2. Laminate Color Selection: Maximum 1 color per unit face and 5 colors per project.

2.03 SPECIALTY ITEMS

- A. Metal Parts: Countertop support brackets, undercounter support frames, legs and miscellaneous metal parts shall be furniture steel, welded, degreased, cleaned, treated and epoxy powder painted.
- B. Articulating Computer Keyboard Tray: Undercounter mount with slide, tilt and rotation mechanism and mouse tray, black molded polymer.

2.04 CABINET HARDWARE

A. Hinges

1. Shall be Blum concealed clip-on style No. 77M5580 with 125 degree swing and shall be self-closing. Each door will have a bumper to prevent laminate-to-laminate contact. Hinge shall have a lifetime warranty as offered by the hinge manufacturer. The number of hinges per door shall be as follows:

<u>Door Height</u>	<u>Hinges per Door</u>
0 - 34 inches (864 mm)	2
35 (889 mm) - 62 inches (1575 mm)	3
63 (1600 mm) - 80 inches (2032 mm)	4

B. Pulls

1. Door and drawer front pull shall be metal wire style, 96mm spacing on fasteners. Pull design shall be ADA compatible.

C. Drawer and Shelf Slides: Regular, knee space, pencil and file shall be Blum Style No.

BS430E full extension with epoxy steel, bottom corner mounted with smooth and quiet nylon rollers. Slides will have a 150 pound load rating at full extension and a built-in, positive stop both directions, with self-closing feature. Slides shall have a life time warranty as offered by the slide manufacturer.

- D. Adjustable Shelf Supports: Shall be injection molded polycarbonate, clear color to blend with selected interior finish, friction fit into cabinet end panels and vertical dividers, readily adjustable on 32mm (approximately 1-1/4 inch) centers. Each shelf support shall have two (2) integral support pins, 5mm diameter, to interface with predrilled holes, and to prevent accidental rotation of support. The supports shall be automatically adaptable to 3/4 inch (19 mm) or 1 inch (25 mm) thick shelving and shall provide nontip feature for shelving. Supports shall be designed to readily permit field fixing of shelf if desired. Structural load testing shall show loading to 1,200 pounds (300 pounds per support) without failure.

E. Locks

1. Locks shall be National Lock #M49054, removable core, disc tumbler, cam style lock with strike. Each lock shall be furnished with two (2) keys. Locks for sliding 3/4 inch (19 mm) doors shall be a disc type plunger lock, sliding door type with strike. Locks for sliding glass/acrylic doors shall be a ratchet type sliding showcase lock.
2. Automatic door bolt, Hafele #530-1604 used to secure inactive door on all locked cabinets.

- F. File Suspension Rails: All file drawers shall include a pair of 14 gauge steel pendaflex file suspension rails, epoxy powder coated to match basic cabinet color. File followers, or other split bottom hardware, shall not be acceptable.

- G. All doors shall have rubber bumpers.

2.05 FABRICATION

- A. Preparation for Other Trades: All casework shall be drilled, tapped and cut, as required, for the proper installation of all equipment, computers, plumbing, electrical and mechanical work attached thereto.

- B. Fabricate casework to dimensions, profiles and details shown.

C. Cabinet Body Construction

1. Tops and bottoms shall be joined to cabinet ends and internal cabinet components such as fixed horizontals, rails and verticals shall be joined using hardwood dowels, laterally fluted with chamfered ends, securely glued and clamped under pressure during assembly to secure joints and cabinet squareness. Use minimum of six (6) dowels at each joint for 24 inch (610 mm) deep cabinets and minimum of four (4) dowels at each joint for 12 inch (300 mm) deep cabinets.
 - a. Tops, bottoms and sides of all cabinets except sink base units shall be particleboard core.
 - b. Tops, bottoms and sides of sink base units shall be moisture resistant particleboard core.
2. Unless specifically indicated, core shall be 3/4 inch (19 mm) thick particleboard. Edging and surface finishes as indicated herein.

3. Unit backs shall be 1/4 inch (6 mm) thick prefinished MDF. Exposed back to be 3/4 inch particleboard, color matched to cabinet interior, exterior surface VGS laminate as selected.
 - a. Exposed back on fixed or movable cabinets, except sink base units: 3/4 inch particleboard with the exterior surface finished in VGS laminate as selected.
 - b. Exposed back on fixed or movable sink base cabinets: 3/4 inch (19 mm) moisture resistant particleboard with the exterior surface finished in VGS laminate as selected.
 - c. Flexible rail mounted cabinet backs: 3/4 inch (19 mm) thick particleboard structurally doweled into cabinet sides and top panels.
4. All undercounter units except sink base units, shall be provided with full subtop. Sink base units shall be provided with open top, front welded steel/epoxy painted sink rail full width at top front edge concealed behind face rail/doors, split back removable access panels.
5. All end panels and vertical dividers, except sink base units, shall be prepared to receive adjustable shelf hardware at 32 mm (approximately 1-1/4 inch) centers. Door hinges, drawer slides and pull-out shelves shall mount on line boring to maintain vertical alignment of components and provide for future relocation of doors, drawers, shelves and/or pull-out shelves.
6. Set case back in, to conceal piping and heating units, provide removable back for plumbing access where shown.
7. Provide adjustable leveling feet on all cases more than 18 inches wide or deep.
8. Adjustable shelf core shall be 3/4 inch (19 mm) thick particleboard up to 30 inches (760 mm) wide, 1 inch (25 mm) thick particleboard over 30 inches (760 mm) wide. Shelves over 36 inches (900 mm) wide and over 18 inches (460 mm) deep shall receive an epoxy powder coated 6061-T6 aluminum alloy webbed stiffener for additional support. All four (4) edges shall have factory applied 1 mm PVC.
9. Interior Finish, Units with Open Interiors: Sides, top, bottom, horizontal and vertical members, and adjustable shelving faced with VGS high pressure decorative laminate, color from casework manufacturer's full range offering of at least 120 colors.
10. Interior Finish, Units with Closed Interiors: Sides, top, bottom, horizontal and vertical members, faced with melamine laminate with matching prefinished back.
11. Exposed Ends: Shall be faced with VGS high pressure decorative laminate.
12. Fixed base and tall units shall have an individual factory-applied base, constructed of 3/4 inch (19 mm) exterior grade plywood. Base shall be nominal 4 inches high unless otherwise indicated on the drawings.
13. Wall Unit Bottom: For bottoms at 52 inches (1320 mm) AFF or higher, shall be faced with VGS high pressure decorative laminate.
14. Wall and Tall Unit Tops
 - a. The top edge of all wall and tall unit end panels shall be factory edged with 1mm PVC to match basic cabinet body color; raw edges at top of wall and tall end panels will not be permitted.
 - b. Top surface will be laminated with melamine to match basic cabinet body color.
15. Balanced construction of all laminated panels is mandatory. Edges of particleboard shall be sealed. Unfinished core stock, even on concealed surfaces, will not be permitted. No exceptions.

D. Drawers

1. Sides, back and subfront shall be particleboard, 1/2 inch (13 mm) thick, laminated with thermally fused melamine. The back and subfront shall be doweled and glued into the sides. Dowels shall be fluted, with chamfered ends and a minimum diameter of 8mm. Top edge shall be banded with 1mm PVC edging.
2. Drawer bottom shall be particleboard, 1/2 inch (13 mm) thick, laminated with thermally fused melamine, screwed directly to the bottom edges of the drawer box. Drawer bottom less than 1/2 inch (13 mm) thick will not be permitted.
3. Paper Storage Drawers: Minimum 1/2 inch (13 mm) thick particleboard sides, back and subfront laminated with thermally fused melamine. Minimum 1/2 inch thick particleboard drawer bottoms screwed directly to the bottom edges of the drawer box. Provide PVC angle retaining bar at the rear of the drawer.
4. Painted finishes on drawer sides and/or bottom will not be permitted.

E. Door/Drawer Fronts

1. Core for all doors and applied drawer fronts shall be 3/4 inch (19 mm) thick particleboard (moisture resistant at sink units). All edges shall be finished as indicated herein.
2. Double doors shall be used on all cabinets in excess of 24 inches (610 mm) wide.

F. Miscellaneous Shelving

1. Core Material: 3/4 inch (19 mm) or 1 inch (25 mm) particleboard.
2. Exterior: VGS high-pressure decorative laminate.
3. Edges: 1mm PVC.

2.06 DECORATIVE LAMINATE COUNTER TOPS

- A. All laminate clad counter tops shown on drawings shall be constructed with 1-3/16 (30 mm) phenolic resin particleboard core laminated top face with HGS/HGP high pressure decorative laminate, with balanced backer underside. Counter tops with sinks shall be AB marine plywood with no joints occurring within 2 feet (610 mm) of the sink. Provide tight joint fasteners where needed. All exposed edges, including edges of backsplash where used, shall be plastic laminate self-edged. All edges shall be sealed. Construction shall be in accordance with AWI Premium.
- B. Edges, Including Applied Backsplash: 3mm PVC, exposed edges and corners machine profiled to 1/8 inch (3 mm) radius. Edges shall be machine applied with moisture curing polyurethane (PUR) hotmelt for fast setting, high strength adhesion.

2.07 MISCELLANEOUS

- A. Fascia Panels: Provide plastic laminate surfaced 1/2 inch (13 mm) particleboard fascia panels of finish to match that of cabinet and necessary furring from top of cabinets to a line 3 inches (75 mm) above ceilings.
- B. Fillers and Trim: Provide fillers, strips, trim, etc., as required at recessed installation and proper fitting of work; to be of same material and finish of adjacent work. Where casework is installed between walls, or where one end abuts a wall, construct to allow 1/2 inch (13 mm) clearance at each side so that filler strip or scribe piece is substantially large enough for proper workmanship.

2.08 COLOR SELECTION

- A. Laminate Color: As noted on drawings or as selected by Architect. WilsonArt®, Nevamar®, Pionite® and Formica® stock colors for cabinet faces, exposed ends, open interiors and counter tops. Thermally fused melamine laminates shall be Frosty White, color (matched to WilsonArt®).
- B. Hinge and Pull Color (matched to WilsonArt®): Chrome.
- C. Miscellaneous Hardware Color (support brackets, table frames, rail): Frosty White, (matched to WilsonArt®).
- D. 1mm PVC Edge Banding Color: 1mm PVC stock colors available to the industry, matching laminate colors.
- E. 3mm PVC Edge Banding Color: 3mm PVC stock colors available to the industry, matching laminate colors.

PART 3 EXECUTION

3.01 PREPARATION

- A. Obtain dimensions affecting work of this section from the site.
- B. Ensure that roughed-in openings, built-in anchorage and reinforcing required for proper installation of work of this section are correctly sized, installed and located.
- C. Obtain electrical and mechanical service characteristics and rough-in locations from site.
- D. Notify Architect in writing of defects in work of other sections which will affect proper installation and operation of work of this section. Installation operations shall not commence until defects are corrected.
- E. Condition casework to average prevailing humidity conditions in installation areas prior to installing.

3.02 INSTALLATION

- A. All casework items to be set plumb, square and true, securely anchored to building structure.
- B. Install items in accordance with manufacturers' instructions and shop drawings, by workers skilled and familiar with casework installation.
- C. Install wall cabinets utilizing a 3/4 inch (19 mm) thick wood cleat anchored to cabinet set on a 3/4 inch (19 mm) thick wood wall cleat; physically anchor cabinet to substantial substrate.
- D. Scribe to walls and columns, shim level and rigid, use proper type anchoring devices for materials encountered and usage expected.
- E. Cut, fit and patch; coordinate work with other trades involved.
- F. Cut and drill tops, backs, sides or bottoms for service outlets and fixtures. Connections to

services shall be by mechanical and electrical trades, Divisions 15 and 16 respectively.

- G. Sequence installation and erection to ensure that mechanical and electrical connections are effected by trades concerned.
- H. Install casework with factory-trained supervision authorized by manufacturer. Erect casework, plumb, level, true and straight with no distortions. Shim as required. Where laminate clad casework abuts other finished work, scribe and cut to accurate fit.
- I. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.03 ADJUSTING AND CLEANING

- A. Adjust doors, drawers, hardware fixtures, and other moving or operating parts to function smoothly and correctly.
- B. Clean casework, counters, shelves, glass, legs, hardware, fittings and fixtures.

END OF SECTION 12 32 00

SECTION 22 05 00 – COMMON MATERIALS AND METHODS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section is intended to describe the common materials and installation methods of the mechanical work and it applies in general to all other Sections under Division 22.
- B. Due to the small scale of the drawings, all work required is not shown on the floor plans and certain work is shown on flow diagrams, riser diagrams and details. Work of Division 22 shall include all required work shown on plans, riser diagrams, flow diagrams and details.
- C. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems
 - 2. Transition fittings
 - 3. Dielectric fittings
 - 4. Mechanical sleeve seals
 - 5. Sleeves
 - 6. Escutcheons
 - 7. Grout
 - 8. Plumbing demolition
 - 9. Equipment installation requirements common to equipment sections
 - 10. Painting and finishing
 - 11. Concrete bases
 - 12. Hangers and supports for plumbing system piping and equipment
 - 13. Identification for plumbing piping and equipment

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 REFERENCES

- A. Provide work in accordance with all applicable international, state and local, codes, rules, regulations, and standards, including but not limited to, requirements of the following:
 - 1. ASME/ANSI B31: Code for Pressure Piping
 - 2. ASME Boiler and Pressure Vessel Codes
 - 3. AWS D1.1: Structural Welding Code-Steel
 - 4. MSS SP58: Pipe Hangers and Supports – Materials, Design, and Manufacturers
 - 5. MSS SP69: Pipe Hangers and Supports – Selection and Application except spacing for hangers
 - 6. ANSI A13.1: Scheme for Identification of Piping Systems
 - 7. Applicable NFPA Codes and Standards
 - 8. NSF/ANSI 61: Drinking Water System Components

1.5 SUBMITTALS

- A. Provide Product List of factory fabricated items, in accordance with Section 01 60 00 “Product Requirements”, including name of proposed manufacturer, for all products specified in various sections of Division 22.
- B. Provide submittals in accordance with Section 01 33 00 “Submittal Procedures” in sufficient detail to verify full compliance with the requirements of the Contract Documents.
- C. Product Data: Provide for each type of factory-fabricated product indicated.
- D. Welding certificates.

1.6 WARRANTY AND CONTRACT CLOSEOUT

- A. Comply with warranty and contract closeout requirements specified in Division 01.
- B. Provide Special Warranties and/or warranty service in accordance with Section 01 60 00 “Product Requirements” where specified in the various sections of Division 22.
- C. Provide manufacturer’s certificates of supervision and startup service as specified in the various sections of Division 22.
- D. Provide testing and cleaning reports. Indicate dates of testing and cleaning operations, procedures used and results obtained for each system. Reports shall be certified as complete.

- E. Provide instructions and demonstration to the Owner's representative for all equipment and systems installed under Division 22. Instruction and demonstration shall be appropriate for the size and complexity of the installed system.
- F. Include information for all products specified in the operation and maintenance manual.

1.7 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
 - 3. Use welders fully qualified and licensed by the state authorities.
- C. The specifications for certain products and alternative materials may appear in more than one section of Division 22. Work of Division 22 shall be coordinated for all sections of Division 22 to assure that where two or more items of any given product are furnished under Division 22 that they are of the same manufacturer and type and that alternative materials is consistent throughout the work of Division 22.
- D. Except for spacing of hangers, provide hangers and supports in accordance with the latest issue of Manufacturer's Standardization Society (MSS) Specifications SP 58 and 69.
- E. All pipe, valves, fittings, stops, faucets, and domestic water pumps shall comply with the Federal "Reduction of Lead in Drinking Water Act" NSF/ANSI 61 and NSF/ANSI 372 for lead content of 0.25%.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle all material and equipment in accordance with manufacturer's instructions and recommendations. Such instructions and recommendations are hereby made part of these specifications.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Deliver products and equipment properly labeled and tagged. Maintain products in original shipping containers and store in a dry area until ready for installation.
- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.9 COORDINATION

- A. The Mechanical systems are indicated on the Plumbing Drawings. Certain pertinent information and details involving the installation of plumbing work appear on Architectural, Structural, Mechanical and Electrical Drawings. Become familiar with all Drawings and incorporate all pertinent requirements.
- B. Drawings are diagrammatic and indicate general arrangement of systems and requirements of the plumbing work. Do not scale the Drawings to obtain dimensional requirements. Exact locations of equipment must be coordinated and obtained prior to starting the work.
- C. Arrange for pipe spaces, chases, slots, duct shafts and openings in building structure during progress of construction, to allow for plumbing installations.
- D. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- E. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Coordinate installation of identification labels with locations of access panels and doors.
- F. Coordinate scheduling, sequencing, movement and positioning of large equipment into the building during construction.
- G. Coordinate installation of identification devices with completion of covering and painting of surfaces where identification devices are to be applied.
- H. Install identification devices prior to installation of ceilings and similar concealment.

1.10 SEISMIC REQUIREMENTS

- A. Seismic Design
 - 1. All **new** plumbing systems (equipment and piping) shall be provided with seismic restraints in accordance with the requirements of ASCE as modified by the 2013 California Building Code, and Division 22 Section "Vibration Isolation and Seismic Restraints for Plumbing Systems".
 - 2. Refer to **Structural Drawings** for seismic criteria to be used for this project.
 - 3. Use a component Importance Factor, I_p , of 1.5 for all life safety systems required to function during and after an earthquake; including, but not limited to:
 - a. Hospital medical gas systems
 - 4. Use a component Importance Factor, I_p , of 1.5 for all systems and components required for continuous operation of the facility or whose failure could impair the continued operation of the building, including:
 - a. Piping
 - b. Suspended equipment

5. Except as noted otherwise herein, use an Importance Factor, I_p , of 1.0 for all other components.
6. Employ a Professional Engineer registered in the jurisdiction for which the project is located to design all restraints necessary to meet the seismic requirements. Said Engineer shall sign and seal all drawings and calculations prepared for this purpose.
7. Prior to first Application for Payment, provide a complete listing of all components and elements that are to be seismically restrained and/or braced.
8. It is the entire responsibility of the equipment manufacturer to design their equipment so that the strength and anchorage of the components of the equipment exceeds the force level used to restrain and anchor equipment itself to the supporting structure. Factory manufactured and/or field or shop fabricated equipment shall be designed to safely accept and resist, at its points of anchorage or suspension without failure or permanent displacement of the equipment, earthquake generated external forces required by the code.
9. The preparation and submittal of product data and shop drawings to the Architect for review shall constitute a representation by the manufacturer, contractor and vendor that all components comply with the above requirements.
10. The functional and physical interrelationship of components and their effect on each other shall be installed so that failure of an essential or nonessential architectural, mechanical, electrical component shall not cause the failure of nearby essential architectural, mechanical, or electrical components.

1.11 ENERGY PERFORMANCE CRITERIA

- A. All equipment provided under Division 22 shall meet the requirements of the International, or State, Energy Code, ASHRAE Standard 90 or the latest issue of the Standards for Equipment in the National Energy Policy Act (NEPA), whichever is more stringent.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. In other Part 2 articles of various sections of Division 22 where subparagraph titles below introduce lists, the following requirements apply for product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 2. Unless otherwise noted, substitutions of specified manufacturers shall comply with the requirements of Division 01.
 3. Only lead-free plumbing components shall be installed complying with 2013 CPC.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F 493
 - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 3. ABS Piping: ASTM D 2235
 - 4. PVC to ABS Piping Transition ASTM D 3138
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.
 - 2. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve type coupling.
 - 3. Aboveground Pressure Piping: Pipe fitting.

- B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end. Fernco, Mission or equal.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Steel, zinc, dichromate for fire protection reinforced nylon polymer elsewhere. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

4. Thunderline link seal or equal.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239 inch (0.6 mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings; Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PE: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

- A. General: Manufactured wall and ceiling escutcheons and floor plates, with an inside diameter to closely fit around pipe, tube, and insulation of insulated piping and an outside diameter that completely covers opening.
- B. One piece construction on exposed piping in finished areas. Elsewhere, split pattern with setscrew. Provide deep pattern type where required to conceal protruding fittings and sleeve.
- C. Provide polished chromium plated escutcheons on pipes passing through walls, floors or ceilings wherever such pipes are exposed to view.

2.9 HANGERS AND SUPPORTS

- A. Acceptable Manufacturers
 1. Other Than Roof Supports
 - a. B-Line Systems, Inc.
 - b. Grinnell Company
 - c. National Pipe Hangers
 - d. Penn Construction Industries
 - e. Other approved United States manufacturer whose products comply with the referenced standards.
- B. Reference Standards
 1. ASTM A 36 - Specification for Structural Steel

2. ASTM A 123 - Zinc (Hot-Dip Galvanized Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Bars, and Strip)
3. ASTM A 653 G90 - Specification for Steel Sheet, Zinc Coated by the Hot-Dip Process
4. ASTM B 633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel
5. AWS D1.1 - Structural Welding Code - Steel
6. MSS SP58 - Manufacturer's Standardization Society: Pipe Hangers and Supports - Materials, Design and Manufacture
7. MSS SP69 - Manufacturer's Standardization Society: Pipe Hangers and Supports - Selection and Application
8. NFPA 13 - Standard for the Installation of sprinkler Systems

C. Quality Assurance

1. Steel pipe hangers and supports shall have the manufacturer's name, part number and applicable size stamped in the part itself for identification.
2. Hangers and supports shall be designed and manufactured in conformance with MSS SP58.

D. General

1. Except for spacing of the hangers, design and fabrication of pipe hangers, supports and welding attachments shall conform to ANSI B31.9 or B31.1 as applicable.
2. Except for spacing of the hangers, hanger types and supports for bare and covered pipe shall conform to MSS SP69 for the temperature range except that only flat wide band hangers shall be used for hangers installed outside of insulation and plastic pipe.
3. Except for spacing of pipe hangers and elsewhere as otherwise indicated, horizontal and vertical piping attachment shall conform to the more stringent of this specification or MSS SP58 or MSS SP69. Continuous inserts and expansion bolts may be used.
4. All ferrous hangers, supports and hardware located outdoors shall be hot dip galvanized after fabrication per ASTM A 123.
5. Hangers and clamps for support of bare copper piping shall be coated with copper colored (for identification) baked on epoxy paint. Use additional PVC coating of the epoxy painted hangers where necessary.
6. Provide suitable chromium plated brass supports for chromium plated pipe with exposed heads of bolts and screws chromium plated.
7. Hangers other than described above shall be zinc plated in accordance with ASTM B 633 or shall have an electrodeposited epoxy finish.
8. Strut channels shall be pregalvanized in accordance with ASTM A 653 G90 or shall have an electrodeposited finish.
9. All hangers and supports shall have some form of adjustment available after installation.

E. Pipe Hangers and Supports: Provide hangers as follows:

1. Hangers for Pipe Sizes to 1-1/2 Inch: Adjustable carbon steel ring or clevis.
2. Hangers for Hot or Cold Pipe Sizes 2 Inches to 4 Inches and Cold Pipe Sizes 6 Inches and Over: Adjustable carbon steel clevis.
3. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke and cast iron roll.
4. Multiple or Trapeze Hangers: Factory-enameled steel channels with welded spacers and hanger rods or 12 gauge rolled formed ASTM A 570 Grade 33 structural quality steel channels (strut), cast iron roll and stand for hot pipe sizes 6 inches and over. Cross

section suitable for span and loading. Suspension by outside hanger rods sized for total load on trapeze.

5. Wall Support for Pipe Sizes to 3 Inches: Carbon steel hook.
 6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and steel clamp, adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over.
 7. Vertical Support: Steel riser clamp.
 8. Floor Support for Hot Pipe Sizes to 4 Inches and All Cold Pipe Sizes: Adjustable pipe saddle and pipe nipple attached to steel base stand, and concrete pier or steel support.
 9. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws and concrete pier or steel support.
 10. Design hangers to impede disengagement by the movement of supported pipe. Provide spring and neoprene hangers as required.
- F. Beam Clamps: Forged steel C-clamps shall include retaining strap, locking nut or other device for nonslip attachment, except LOCKING NUT NOT ALLOWED for project requiring seismic restraints.
- G. Hanger Rod: Steel hanger rod zinc plated per ASTM B 633.

2.10 THERMOMETERS

A. Acceptable Manufacturers

1. Terice
2. Taylor Instrument Company
3. U.S. Gauge
4. Weksler
5. Weiss

- B. ASTM E 1, liquid in place thermometer. Cast aluminum case, black baked epoxy enamel finish, 9 inch minimum liquid filled tube, brass stem, adjustable angle type with locking device and with brass union type separable socket. Socket length to suit installation. Mercury filled thermometer not allowed.
- C. Select range of thermometer to indicate normal operating temperatures at midpoint of scale. Scale division of 1 degree F for cold service and 2 degree F for hot service.
- D. Install wells with stem extending to center of pipe. Fill wells with oil or graphite and secure caps.

2.11 PRESSURE GAUGES

A. Acceptable Manufacturers

1. Terice
2. Taylor Instrument Company
3. U.S. Gauge
4. Weksler
5. Weiss
6. Ashcroft

- B. ASTM B 40.1, Grade A phosphor bronze seamless Bourdon spring type with white face, black numerals, 4-1/2 inch cast aluminum case, black baked epoxy enamel finish, brass bronze bushed movement and brass socket. Select range of gauge to indicate normal operating pressure of system at midpoint of scale.
- C. Provide brass snubber of material suitable for system fluid. Provide with needle valve.

2.12 IDENTIFICATION DEVICES AND LABELS

A. General

- 1. Products specified are manufacturer's standard products of categories and types required for each application as referenced in Part 3 of this section and elsewhere on the drawings or in Division 22 specifications. Where more than single type is specified for listed application, selection is Contractor's option, but provide single selection for each product category.
- 2. Products shall comply with requirements of ANSI A13.1 and OSHA where applicable.

- B. Stencils: Standard stencils, prepared with letter sizes conforming to recommendations of ANSI A13.1. Minimum letter height is 1-1/4 inches for piping and 3/4 inch for access door signs and similar operational instructions.

- 1. Stencil Paint: Exterior, oil-based alkyd gloss black enamel, except as otherwise indicated. Paint may be in pressurized spray-can form.
- 2. Identification Paint: Exterior, oil-based alkyd enamel in colors according to ANSI A13.1, except as otherwise indicated.

- C. Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid snap-on, color-coded pipe markers conforming to ANSI A13.1.

- D. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive vinyl pipe markers, with permanent adhesive conforming to ANSI A13.1.

- E. Pipes/Insulation Smaller Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe/insulation at each location.

- F. Pipes/Insulation 6 Inches And Larger: Either full-band or strip type pipe markers, at least 3 times the letter height and of length required for label.

- G. Arrows: Either integrally with piping system service lettering (to accommodate both directions), or as separate unit, on each pipe marker to indicate direction of flow.

- H. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive, vinyl tape, at least 3 mils thick. Width 1-1/2 inches wide on pipes with outside diameters (including insulation) less than 6 inches; 2-1/2 inches wide for larger pipes. Color shall comply with ANSI A13.1 unless otherwise indicated.

- I. Valve Tags: Stamped or engraved brass with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Provide a hole for fastener. Brass wire-link chain, beaded chain, or S-hook fasteners.

- J. Access Panel Markers: 1/16 inch thick engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed device. Provide center hole for attachment.
- K. Valve Schedule Frames: Glazed display frame, with screws for removable mounting on masonry walls for each page of valve schedule. Polished hardwood or extruded aluminum frame.
- L. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white (letter color) melamine subcore, except when other colors are indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening. 1/16 inch thick for units up to 20 square inches or 8 inch length, 1/8 inch thick for larger units. Self-tapping stainless steel screws or contact-type permanent adhesive.
- M. Plasticized Tags: Preprinted accident-prevention tags, of plasticized card stock. Size approximately 3-1/4 by 5-5/8 inches. Brass grommets and wire fasteners.
- N. Nomenclature: Large-size wording such as "DANGER," "CAUTION," or "DO NOT OPERATE", or as noted on the drawings in the specification.
- O. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.
- P. Multiple Systems: Where multiple systems of same name are indicated, identify individual system number as well as service.

2.13 VALVES

A. General

- 1. Valves are specified by Valve Type and, for some services, several valve types are grouped by "Valve Class" in various sections of Division 22. Application is stated in the "Piping System Requirements". Where more than one Valve Type or Valve Class is listed for a service, use any of the listed Types or Classes, unless otherwise specified or indicated, but selection must be consistent throughout the work.
- 2. It shall be Contractor's responsibility to coordinate the work for all sections of Division 22 to assure that all general service valves throughout the work of Division 22 are of the same manufacture and type and that all valves of the same type number/identification throughout the work of Division 22 are of the same manufacture.
- 3. Valve packing shall not contain asbestos.
- 4. Bronze Valves: Construct body of ASTM B 62 for Classes 125 and 150, ASTM B 61 for Classes 200 and 300, copper-silicon bronze stem.
- 5. Iron Valves: Construct body of ASTM A 126, Class B copper-silicon bronze stem.
- 6. Domestic water system valve construction shall comply with NSF 61, 372 and Federal law 111-380 and shall be certified as lead free compliant.

- B. Types V1 through V5 General Service Valves: Industrial valve construction. Handwheel operator, except where specified to be provided with chain-wheel operator. Figure numbers listed are those of Stockham Valve Co. Valves shall be products of a single manufacturer.

1. Type V1: Class 125 bronze, solder-end, for soldered copper piping 2 inch and smaller in size; 150 psig water or oil working pressure at 250° F. with high temperature nonlead solder joint (95-5 or equivalent as specified in the "Solder" article of this section); 125 psig saturated steam working pressure:

		Swing	
	Ball	Check	Globe
	See Type V9	B309	B14T
*Use B104 where space prevents full extension of rising steam.			

2. Type V2: Class 125 bronze, for screwed piping 2 inch and smaller in size; 125 psig steam working pressure; 200 psig cold water, oil or gas working pressure:

		Swing	Lift		
	Ball	Check	Check	Globe	Angle
	See Type V9	B319	B316	B22T	B222T
*Use B103 where space prevents full extension of rising steam.					

3. Type V3: Class 300 bronze, for screwed piping 2 inch and smaller in size; 300 psig steam working pressure; 600 psig cold water, oil or gas working pressure:

	Swing	Lift		
Ball	Check	Check	Globe	Angle
See Type V9	B375	B367	B74	B266

4. Type V4: Class 125 flanged, iron body, bronze mounted (IBBM) - for copper and steel piping 2-1/2 inch and over in size; 125 psig saturated steam working pressure; 200 psig cold water, oil or gas working pressure:

Gate	Swing		
OS&Y	Check	Globe	Angle
G623	G931	G512	G515

5. Type V5: Class 250 flanged, iron body, bronze mounted (IBBM) - for copper and steel piping 2-1/2 inch and over in size; 250 psig steam working pressure 450° F.; 500 psig cold water, oil or gas working pressure:

Gate	Swing	
OS&Y	Check	Globe
F667	F947	F532

6. Approved Manufacturers:

- a. Crane
- b. Nibco

- c. Stockham
- d. Hammond
- e. Jomar

C. Type V8 Shutoff Valves

1. Type V8a, 10 Inches and Larger (10 Inches and Larger for Shutoff Service: 150 psig WOG, bubbletight shutoff, 250° F continuous: Butterfly type with 1 piece semisteel body (split body design not acceptable), threaded lugs (same number of lugs as connecting flange), extended neck to suit insulation thickness, bronze disc, bronze bearings, stainless steel shaft and continuous retained EPDM resilient seat to provide dead end or isolation service without use of downstream flanges. DeZurik Industrial Type BGS for sizes 12 inches and smaller.

D. Type V9 and V10, Ball Valves

1. Type V9, General Service, 3 Inches and Smaller: Cast bronze body, two piece type with full or conventional port, chrome plated brass ball, RPTFE seats and packing with adjustable stem packing gland, lever handle. 600 psi CWP. Extended stem to suit insulation thickness. Apollo 70 LF series. Valves in copper piping constructed with thermal barrier suitable for installation with nonlead solder joint (95-5 or equivalent as specified in the "Solder" article of this section). Include verification of suitability for high temperature solder with submittal. Where press type fittings and joining system is used, sizes 4 inches and smaller, provide Apollo 77VLF series. Where stainless steel piping systems are used, provide Apollo 76F series. Natural gas and propane system valves shall be Apollo 77G-UL series with NPT ends.
2. Approved Manufacturers:
 - a. Apollo
 - b. Nibco
 - c. Crane
 - d. Stockhom
 - e. Watts
 - f. Hammond
 - g. Victaulic
 - h. Jomar
3. Type V10, General Service: 4 inches and larger ductile iron epoxy coated full port Class 125 ball valve, flanged or grooved ends. FDA epoxy grade coating, PTFE seats and seals, stainless steel ball and stem. CWP rating 200 psig. Apollo 1BV-125-6Q series.
4. Approved Manufacturers:
 - a. Apollo
 - b. American Valve Co.
 - c. Watts
 - d. Victaulic
 - e. Jomar

- E. Type V11, Nonslam (Silent) Check Valve: Combination Pump Valve Co. figure numbers are indicated.

1. 1/2 Inch Through 2 Inch in Size: Model 36, 300 psi, with union end. Bronze body and trim and stainless steel spring.
 2. 2-1/2 Inch Through 8 Inch, Styles 10D and 11D Wafer Type; 10 Inch and Larger in Size, Styles 20D and 21D Globe Body: Cast iron body, bronze trim and stainless steel spring. Pressure classification to suit application.
- F. Type CPBV, Chrome Plated Brass Valves: Similar to Type V2 and V3, except chrome plated brass finish and black composition wheel handle.
- G. Balancing Valves
1. Balancing valves shall be calibrated type with bronze body, Class 125, soldered or screwed ends as required. Valves shall have Venturi flow measuring ports.
 2. Approved Manufacturers:
 - a. Bell and Gossett Circuit Setter
 - b. Taco
 - c. Armstrong
 - d. Victaulic
- H. Drain Valves
1. Valves 3/4 Inch and Smaller in Size: Interior hose bibb, brass, compression type, with renewable seat and male threads for attachment of hose and fitted with wheel handle and cap when not piped to drain. Valves exposed in finished spaces chromium plated.
 2. Valves 1 Inch and Larger in Size: Hose end gate valves fitted with cap except that valves indicated as piped to drain shall be standard shutoff type for system.
- I. Refer to other sections of Division 22 for additional valve requirements.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. General

1. Furnish, deliver, erect, connect, and finish in every detail all materials, equipment and accessories required for the Work.
2. Include in the work and in the bid minor details not usually shown or specified, but manifestly necessary for the proper installation and operation of the various systems, the same as if specified or shown.
3. If any departures from the Contract Documents are deemed necessary, submit details of such departure and the reasons therefore to the Architect for approval.
4. Be responsible to request clarification from the Architect on any conflicts represented between the drawings and specifications.
5. Adequately guard all exposed moving parts of equipment, such that contact by operating personnel will not cause personal damage or injury.

B. Layout and Coordination With Other Trades

1. Layout Work from building and property lines and benchmarks provided, verify, and be responsible for the correctness of all measurements in connection with the Work. Any change made in major overall dimensions shown which affect the physical size, shape, or location of any part of the Work, whether due to field check or changes due to use of equipment of a manufacturer other than that used as basis of design shall cause no interference with other Work.
2. Examine the Drawings of other trades, cooperate and coordinate with other trades to insure that the Work can be installed properly as designed and planned without interference with other work or delay. Where interferences may occur and departures from the arrangements shown are required, consult with other trade involved. Come to agreement as to changed locations and elevations. Furnish all necessary templates, patterns, measurements, etc., for installation and for the purpose of making adjoining work conform. Furnish setting plans and shop drawings to other trades as required.
3. Investigate the structural and finish conditions affecting the Work. Offsets, bends or other items required may not be shown on the drawings; provide such offsets or bends as required to meet structural or finish conditions.
4. Coordinate layout with architectural ceilings and lighting layouts and similar work.
5. Coordinate and be responsible for the required clearances in shafts, chases, furred partitions and suspended ceilings. Coordinate and cooperate with the trades responsible for constructing such spaces, together with other trades sharing such spaces, and advise other trades of the requirements of the Work. Immediately submit for review large scale composite Drawings showing space requirements that exceed those shown.
6. Install systems so that they do not interfere with any openings, doors or windows, or with other work, and so as to permit proper access.
7. Install material and equipment as high as possible; at minimum, to clear the top of all doors, windows and other structural openings. Maintain maximum headroom and space conditions in every case. Where headroom or space conditions appear inadequate, notify the Architect before proceeding with the installation.
8. Except where greater clearance is specified or required by applicable codes, rules or regulations, install piping, fittings, valves, etc., to provide not less than 1 inch between their finished covering and the structure or adjacent work of any kind. The minimum space between finished hot piping of any kind and adjacent electrical conduit shall be 6 inches.
9. Make reasonable modifications in the layout to provide proper clearances or accessibility, or to prevent conflict with the work of other trades, at no increase in the Contract sum.
10. Prepare large scale composite working drawings, including such section views and details as are necessary to clearly show how the systems are to be installed in relation to the work of other trades. Issue such Drawings to the other trades for coordination of their work. Where such drawings show deviations from the Contract Drawings or conflict with other trades such that reasonable modifications cannot be made, detail and submit such deviation or conflict to the Architect for review.
11. If work is installed before coordinating with other trades so as to cause interference with the work of other trades, or as not to provide proper access for maintenance or repair, make necessary changes to correct the condition at no increase in the Contract sum.
12. For alterations to existing facilities, be fully responsible for coordinating work with all existing conditions. Verify location of existing piping, and equipment in the field. Relocate or offset new piping, and make reasonable modifications to existing piping, as required to fit in available space whether or not such relocation of offset is shown on the Drawings.

C. Manufacturer's Instructions and Recommendations

1. Perform the installation, cleaning, testing, calibration and start up of all material and equipment in accordance with the manufacturer's instructions and recommendations. Such instructions and recommendations are hereby made part of the specifications.
2. Should a conflict exist between specifications and manufacturer's instructions, consult with the Architect.

D. Electrical Rooms

1. Do not install any piping, or equipment in or through an electrical room or similar room containing electrical equipment, other than piping, or equipment exclusively serving the room or equipment in the room.
2. If there is a conflict between the above requirement and the Drawings, the above shall govern. If reasonable modifications cannot be made to accommodate this requirement, obtain instructions from the Architect before proceeding with the work.

E. Painting

1. Except where specified otherwise in Division 22, Work of Division 09 will provide painting of plumbing systems, equipment and components.
2. Protect all equipment from rust, corrosion, and similar damage by either factory applied or field applied protective coatings.
3. Repair marred and damaged factory painted finishes with manufacturer's touch up paint and application procedures to match original factory finish.

F. Wall and Ceiling Access Doors

1. Access Doors shown on Architectural Drawings will be provided under Division 05.
2. Furnish access doors required for access to concealed valves, air vents, traps, cleanouts, unions, expansion joints, and other equipment where no other means of access is available. Access doors shall be of adequate size for the service requirements, minimum clear opening of 14 inches by 16 inches.
3. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors shall be specified in Division 08 Section "Access Doors and Frames."

3.2 PENETRATIONS

A. General

1. Coordinate with other trades as to the size and location of openings to be provided in new floors, walls, roofs and ceilings as construction progresses.
2. Do not cut openings in new or existing floors and walls without proper structural reinforcement.
3. Install both piping and seals so as to maintain integrity of seals with expansion and contraction of piping.
4. Hospital Room Sealing Requirements (Full Height Non-Fire Rated Walls):
 - a. Seal completely all penetrations of piping through any surface.
 - b. Seal completely all penetrations of piping through above ceiling full height partitions.
 - c. Seal completely the perimeter of all access doors or panels in any surface.

B. Sleeves

1. Provide each pipe, passing through a masonry or concrete wall, floor or partition, and elsewhere as indicated, with a sleeve made from standard weight galvanized steel pipe for pipe or conduit.
2. Select sleeves two pipe sizes larger than any pipe to accommodate pipe, insulation, and jacketing without touching the sleeve and shall provide minimum of 3/8 clearance.
3. Be responsible for the proper location and alignment of all sleeves.
4. Extend wall and partition sleeves through and cut flush with each surface unless otherwise indicated or specified.
5. Place sleeves imbedded in concrete floors or walls in the forms before concrete is poured; sleeves shall have integral water stop flanges, where they are to receive either water tight or hydrostatic seals.

C. Fire Rated Penetrations

1. Provide through-penetration fire-stop sealing system for pipe penetrations through fire or smoke rated construction. Refer to Division 07 for through-penetration fire stop sealing system.
2. Coordinate with Division 07 to determine requirements for sleeves and clearances.

D. Interior Non-Rated Wall Pipe Penetrations

1. For acoustically treated partitions, and walls between mechanical equipment rooms and occupied spaces, fill annular void at penetration with acoustical sealant.

E. Resilient Penetration Sleeve/Seal

1. Provide resilient penetration sleeve seal for piping subject to vibration to prevent transmission to the building structure.
2. Maintain an airtight seal around the penetrating element and prevent rigid contact of the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.

F. Floor Pipe Penetrations

1. Provide water stops for new cored openings for piping where such openings are above grade in mechanical rooms (such as the Storage Room).
2. Provide water stops for existing pipe floor openings that do not have sleeves extended above the floor.
3. Provide either a sleeve or angle water stop. Sleeve may be used if the fire-stop sealing method selected by Division 07 allows the use of a sleeve, otherwise provide angle water stop.
4. Sleeve Water Stop: Construct of Schedule 40 galvanized steel pipe, length as required for 1 inch above floor and 1 inch below underside of floor. Provide 1 inch by 1 inch by 1/8 inch galvanized angle clips welded to sleeve at 90 degree intervals and securely fastened to underside of floor. Caulk space between floor opening and sleeve water tight with soft setting waterproof silicone sealant.
5. Angle Water Stop: Construct of standard weight pipe 1 inch long welded to a 1/4 inch circular steel base plate ring fastened to floor with expansion anchors. Base plate ring

- width as required for anchor clearance from edge of cored opening. Seal between base ring and floor and caulk all edges of base ring with waterproof silicone sealant.
6. Floor penetrations through concrete slabs on grade shall be sleeved as required by the plumbing code. For hydrostatic floor slab penetrations provide Link Seal as specified under exterior wall pipe penetrations.

3.3 ALTERATIONS AND CONNECTIONS TO EXISTING FACILITIES

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Make all necessary alterations to existing Division 22 systems as required for removing or for connecting or extending these systems to new work and for revisions in existing work as indicated and as required, whether indicated or not. Match new materials in altered systems with existing materials unless otherwise indicated.
- C. Continuity of Existing Services
1. Perform alterations and connections to existing facilities with a minimum of interruption. Where interruption is necessary, prepare a time schedule for shutdown activities, coordinate with Architect, Owner and other trades, and obtain written approval from Owner prior to proceeding with the work. Include work scheduled for off hours, when Owner requires that shutdown and interruption of facilities occur during unoccupied times.
 2. Prepare and set notices on services and equipment that are temporarily shut off or disconnected.
- D. Provide shutoff valves to isolate new work from existing and temporary or permanent connections to new work as required for proper testing and cleaning of new work.
- E. All relocations of existing work shall be accomplished using new materials and accessories unless specifically noted otherwise.
- F. Where equipment, and/or piping is removed or disconnected under Division 22, perform the work in such a manner that no damage is done to the structure or remaining portions of the existing systems. Do not under any circumstance place stress on existing pipe and fittings that are to be reused. Be fully responsible for and repair, at no additional expense to the Owner, any leaks developing in existing piping due to failure to take proper precautions when making alterations.
- G. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 2. Piping to Be Abandoned in Place: Do not abandon any piping in place unless specifically noted to do so. Drain piping and cap or plug piping with same or compatible piping material.
 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.

4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 6. All materials and equipment removed or disconnected by Division 22, which is not to be reused or delivered to Owner, shall be removed from the premises.
- H. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- I. Remove all piping, and equipment hangers and supports.
- J. Cap tight unused connection at mains and risers behind finished surfaces.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install all piping in accordance with best practices of trade and latest code requirements. Locate groups of pipes parallel to each other, spaced to permit valve servicing. Use uniform system materials throughout building.
- D. Install components having pressure rating equal to or greater than system operating pressure.
- E. Keep all piping as high as possible, consistent with proper pitch, to maintain maximum headroom. Cut piping accurately to measurements established at building, work into place without springing, forcing or cutting of the building structure, and install as directly as possible without sags between connecting points parallel with or at right angles to building construction, except as required to obtain pitch.
- F. Pitch all systems for proper venting at high points and to drain at low points where the systems can be completely emptied. Install vents at all high points and drains at all low points, including where offsets and bends in horizontal pipe runs create a low point. Provide drain points with bronze hose end drain valves.
- G. Do not install piping above or through electrical rooms, telecommunication rooms, or similar room having a large collection of electrical equipment.
- H. Keep pipe and fittings clean from cutting burrs, foreign matter and defects in structure and threading. Make all cuts square. Ream after cutting. Bevel plain ends of steel pipe. Clean off scale and dirt inside and outside before assembly. Remove welding slag or other foreign matter inside and outside.

- I. Install piping within building concealed in walls, furred spaces, pipe spaces or above suspended ceilings. Do not build in or bury horizontal piping within partitions. Install exposed piping as closely as possible to walls, ceilings and columns, allowing space for installation of insulation and access for valve operation.
- J. Install piping sections using greatest length possible in all cases. The use of short lengths socketed together will not be allowed.
- K. The use of lampwick or other material for packing threads, caulking or wrapping of joints to stop or prevent leaks or correct faults is not permitted. The use of long screws having right and left hand threads or couplings is not permitted.
- L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- M. Install piping to permit valve servicing and application of insulation.
- N. Provide offsets and loops as required for piping crossing a building expansion joint to accommodate building movement, whether or not shown on the drawings. Provide seismic joints for piping crossing building seismic joints to accommodate building movement, whether or not shown on the drawings. Piping seismic joints shall be designed to accommodate maximum building seismic joint movement. Piping seismic joints shall be Metraflex or equal.
- O. Changes in Pipe Size and Direction
 - 1. Make reduction or increase in pipe size with fittings. Use eccentric reducing fittings in horizontal piping. Use reducing tees in pressure piping for side outlet reduction only, not on run. Bushed fittings, notched or straight runs to form tees, or any similar fabrication method will not be permitted.
 - 2. Make changes in direction with standard fittings. Mitering of pipe to form elbows or similar fabrication method will not be allowed. Bending of piping will not be permitted.
- P. Chromium Plated and Stainless Steel Piping: Friction wrenches and clamps must be used exclusively in the installation of chromium plated and stainless steel pipe and fittings. Pipe which is cut, dented or otherwise damaged shall be replaced with new pipe.
- Q. Drain Pans
 - 1. Provide drain pans under entire length of any piping, joints or fittings for soil, waste, rainwater or drain piping system which is installed over operating and delivery rooms, nurseries, ICU, food preparation centers, food serving facilities, food storage areas, central services areas and electronic data processing areas.
 - 2. Fabricate each drain pan not less than 2 inches deep and provide 3/4 inch drain pipe to discharge at nearest convenient drain line, floor drain or other approved drain point. Construct of not less than 18 gauge galvanized steel.
- R. Electrolysis Control
 - 1. Install copper or brass piping or tubing in such a way as not to touch or come in contact with ferrous metals.
 - 2. Where ferrous piping or equipment is connected to copper or brass piping, make connection with insulating or dielectric union to prevent electrolytic action between the

ferrous and nonferrous metals. At branch connections off mains, provide shut off valve upstream of dielectric union in order to isolate downstream union.

3. Where copper or brass piping, tubing or fittings are anchored to, supported by, or come in contact with ferrous metal construction, provide an insulating nonconductor spacer of rubber, plastic or equivalent material to assure prevention of electrolysis.

S. Equipment Piping

1. Verify final locations of equipment for rough in of piping connections.
2. Provide shut off valves in the supply and return to each item of equipment. Suitably locate equipment isolation valves to facilitate removal of equipment.
3. Provide piping from pump glands, drain pans, relief valves or other drainage to spill over open sight drains, floor drains, or other trapped acceptable discharge, terminating with plain end cut at a 45 degree angle.

T. Expansion and Contraction of Piping

1. The piping installation shall be free of stress. Run all piping with full allowance for expansion or contraction. Base expansion calculations on 50 degree F. installation temperature to 140 degree F. for hot water systems.
2. Evaluate the complete piping layout and notify Architect of additional anchors or expansion joints and any deviations required to compensate for expansion.
3. Make connections to equipment in such a manner as to eliminate undue strains in piping and equipment. Install sufficient number of elbow swings to allow for proper expansion and contraction of piping at the point of connection to mains and equipment.
4. Fabricate expansion loops with long radius welded fittings in steel piping and with long radius copper sweat fittings in copper piping.
5. Provide adequate pipe guides as close as possible on each end of the expansion device to preserve alignment and pitch.
6. Install pipe hangers and supports in such a manner as to not cause an anchor condition in any direction.

U. Pipe Anchors

1. Install anchors where required to direct pipe expansion properly into expansion joints, loops or offsets and to prevent transfer of loading and stresses to connected equipment.
2. Pipe anchors may consist of heavy steel clamps bolted or welded to piping and provided with lugs and bolts for clamping and attaching anchor braces. Design anchors to restrict pipe movement and fasten to main members of building structure in most effective manner to secure desired results.
3. Do not attach supports, anchors or stays in places or in such a manner that will damage construction or integrity of the structure, either during installation, by weight of the pipe, or by expansion and contraction of the pipe.

V. Pipe Insulation Inserts and Shields

1. Refer to Section of Division 22, "Plumbing Insulation" to coordinate specific insulation thicknesses and requirements. At hanger locations for insulated piping 1-1/2 inches and larger where hanger support is outside the insulation, provide inserts of exploded silica pipe insulation between pipe and hanger. Density and compression strength suitable for pipe size and support spacing as required by MSS SP-58, Paragraph 9 and MSS SP-69,

Table 3. Provide inserts as required for smaller piping to prevent deformation of insulation. Inserts of equal thickness to adjoining insulation, provided with vapor retardant seals, and of proper length to fully support pipe at each hanger location. Manufactured by Value Engineered Products Max Span; or equivalent.

2. At all hanger locations for insulated piping where hanger is outside of insulation, provide galvanized sheet steel shield formed to fit insert/insulation, extending up to pipe centerline. Length 12 inch minimum when insert is not required. Where inserts are provided, length of shield 4 inches less than insert length. Provide shields 16 gauge for piping up to 4 inches, 12 gauge for piping 6 inches and larger.
3. Preformed insulated pipe saddles may be used in lieu of insert and shield where appropriate. Thickness of insert or pipe saddle same thickness as pipe insulation.

3.5 VALVES

A. General

1. Provide valves at locations shown, where specified and where required to properly control piping systems. Provide valves recommended or required by equipment manufacturers and codes for proper operation of equipment and shutoff valves to allow isolation of each main and branch service line, whether or not indicated or specified.
 2. 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.
 3. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.
 4. Examine threads on valve and mating pipe for form and cleanliness.
 5. 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.
 6. Do not attempt to repair defective valves; replace with new valves.
 7. Install valves in horizontal piping with stem at or above the center of the pipe.
 8. Install valves in a position to allow full stem movement.
- B. Check Valves: Provide lift check type in steam, air, gas or vapor service lines and after globe valves, install with stem upright and plumb. Provide nonslam type in vertical piping on discharge side of pumps and elsewhere as indicated or specified. Provide horizontal swing check type elsewhere unless otherwise indicated or required for service intended, install in horizontal position with hinge pin level. Install check valves, including those that are spring loaded, so that force of gravity will operate to close valves.
- C. Provide valve ends to suit character of pipe in which installed. Provide valves designed for working pressure of at least 125% of maximum operating pressure of system in which installed, but not less than 250 psig on high pressure systems, and 125 psig on low pressure systems.
- D. Provide chromium plated valves in chromium plated piping. Provide steam valves in chromium plated piping with composition hand wheels which shall remain reasonably cool in service.

3.6 WELDING, SOLDERING AND BRAZING

- A. Do not employ workers who have not been fully qualified and certified for the specified procedures.
- B. Pipe Welding, Black or Galvanized Steel Pipe: Perform all welding of black or galvanized steel pipe by shielded metallic arc method of fusion welding, in accordance with welding procedures of AWS (American Welding Society) D10.12 recommended procedures for welding low carbon steel pipe, or other approved procedure, conforming to requirements of ASME/ANSI B31.1 for high pressure steam boiler piping and B31.9 elsewhere.
- C. Pipe Welding Stainless Steel Pipe: Refer to other Sections of Division 22 for welding requirements.
- D. Structural Steel Field Welding: Comply with AWS D1.1 procedures for manual shielded metal-arc welding, appearance and quality of welds, methods used in correcting welding work, and 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 that no roughness shows after finishing, and so that contours of welded surfaces match adjacent contours.
- E. Soldering: Comply with the requirements of the AWS Soldering Manual.
- F. Brazing: Comply with the requirements of the AWS Brazing Manual and AWS A5.8 specification for filler materials for brazing.

3.7 UNIONS

- A. In Screwed Steel Pipe, 2 inches and smaller: Screwed, Class 250 malleable iron, brass to iron seat, ground joint union with brass seat ring pressed into head piece. Provide galvanized unions in galvanized pipe.
- B. In Welded Steel Pipe, 2 inches and smaller: Class 3000 carbon steel socket welded union, steel to steel seat and ground joint. Provide stainless steel in stainless steel piping.
- C. In Copper tubing, 2 inches and smaller: Class 200 wrought copper, solder type, brass ground joint union.
- D. In Brass Piping, 2 inches and smaller: Class 250 cast bronze, screwed ends, brass ground joint unions. Provide chromium plated unions in chromium plated piping.
- E. Provide companion flanges in piping 2-1/2 inch and larger.

3.8 PIPING CONNECTIONS

- A. Refer to other Sections of Division 22 for additional requirements.

- B. Flanged Connections: Make with nonasbestos gaskets of 1/8 inch thick best quality material as recommended by manufacturer for the service application. For steam piping, factory manufactured for flange/connection size/type as manufactured by Flexitallic. For other piping services either Flexitallic or gaskets factory cut for flange size as manufactured by Garlock Packing Division, Colt Industries, or equal. Align flange surfaces parallel. Install gasket concentrically positioned. 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 using torque wrench.
- C. Mechanical Couplings: Prepare pipe and install in accordance with manufacturer's instructions. Standard wall steel pipe either roll or cut grooved at Contractor's option, all sizes, except provide cut grooved as required to accommodate thermal expansion and contraction. Heavy wall steel pipe cut grooved all sizes. Light wall steel pipe roll grooved all sizes. Copper tubing roll grooved.
- D. Soldered Joints: Unless noted otherwise, make with appropriate flux and solder. Clean tubing ends and fittings before assembly. For piping 2 inch and larger tin tubing and fittings before assembly. For tubing 2-1/2 inch and larger use circular flame torch for soldering. The use of lead flux or solder and finishing with 50-50 solder is prohibited.
- E. Threaded Pipe: Make full, clean-cut standard ANSI/ASME B1.20.1 taper pipe threads using sharp dies. Carefully cut, ream or file out to size or bore, removing all chips. Use Schedule 80 pipe for all screwed close and shoulder nipples. Do not use all thread nipples. Provide teflon tape or other approved nontoxic joint compound, applied to male thread only.
- F. Welding Connections: Use only factory made welding fittings, same weight as piping, on welded pipe, except that Bonney Forge WELDOLET or THREADOLET, or Allied Type 1 Branchlet fittings, of same weight as connecting piping, may be used for branch takeoffs two or more commercial pipe sizes smaller than main. All elbows long radius.
- G. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- H. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- I. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- J. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657. Plain-End Pipe and Fittings: Use butt fusion. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.9 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.10 PROTECTION OF WORK

- A. Clean pipe, tubing, fittings, valves, piping specialties, ductwork and equipment before installation and keep clean while the work is in progress.
- B. Securely close open ends of pipe and tubing and openings in other material and equipment until installed, during installation, and until finally connected or otherwise finished, with caps, plugs or other approved closure devices designed for such service.
- C. Protect factory finished equipment, fixtures and devices with approved temporary covering material where those items are installed so as to be subject to accidental damage or abuse. Contractor shall remove all temporary covering material at the conclusion of the work or as directed.
- D. Protect the work of other trades and property of Owner from damage and assume full responsibility for the cost of repairing or replacing any damage to such work or property caused by the performance of the work under Division 22.

3.11 CLEANING OF SYSTEMS

- A. Refer to other sections of Division 22 for additional cleaning and system flushing requirements.
- B. Following completion of system testing, thoroughly clean all piping systems by flushing with water or other approved method, or as otherwise specified. Completely remove all dirt, scale, oil, grease and other foreign substances that may have accumulated in systems during installation.
- C. Carefully wipe out, wire brush, or if necessary, sand blast sections of pipe lines between temporary or permanent strainers and equipment they are to protect. Replace all permanent strainer screens with temporary screens during cleaning process. Remove temporary screens and reinstall permanent screens after cleaning is completed.
- D. Disconnect automatic devices that can become clogged during cleaning process and do not connect permanently until cleaning process is complete.

- E. Clean all piping and equipment of dirt, scale, plaster, concrete, splattered paint and other foreign matter.
- F. Clean all grease and cuttings from stainless steel piping and trim.
- G. Clean all strainers, dirt pockets, drip legs, traps and other accessories that may collect foreign matter.

3.12 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.13 HANGERS AND SUPPORTS

A. General

1. Support major piping (3 inch and above), tanks and other equipment to the structure above (beams and girders) or by means of struts or brackets to columns. Do not support from floor or roof decks. Do not overload structural members to which supports are attached. Hanger spacing not to exceed MSS SP69.
 - a. Provide hangers, rollers, threaded rods, turnbuckles, deflection guides, deflection provisions, inserts, beam clamps and all miscellaneous specialties for attachment of hangers and supports to structure.
 - b. Provide all rods, angles, rails, struts, brace plates, structural steel, platforms and other items required for suspension or support of piping, tanks and equipment.
 - c. Provide supplemental angles, channels, plates or other reinforcement where supports are required between building structural members. Size supports for weight of pipe, pipe contents, equipment fittings and other items, plus a 200 pound live load. Attach supplemental supports in a manner that will not weaken or overload structural members. Weld steel according to AWS D-1.1.
 - d. Attach by welding, clamping, concrete inserts, drilled in mechanical type anchors (Hilti or equal) and other approved means. Adhesive type anchors are not approved.
 - e. Place grout under supports for equipment, and make a smooth bearing surface.
 - f. For seismic restraint, provide double-sided beam clamp loaded perpendicularly to beam for seismic anchor point.
2. No lead shield anchors, powder or power fasteners permitted for attachments.
3. Do not use perforated strap hangers. Do not use steel strap hangers on piping.
4. Wherever possible, support shall be provided directly to main steel or concrete framing beams. If spacing of structure exceeds spacing required to support the mechanical work, supplemental channel or unistrut framing shall be designed and provided by the Contractor. Refer to Structural Drawings for attachment requirements.

5. Support all mechanical work independently of other trades. Under no circumstances shall work be supported or suspended from ceiling grids, piping or other supports by other trades.

B. Pipe Hangers and Supports

1. Unless otherwise required to avoid overloading of structural members or for seismic restraint, support horizontal steel and copper piping as follows:

Nominal Pipe Size (inch)	(a) Maximum Distance Between Support (feet)		Hanger Rod Diameter (inch)
	Steel Pipe	Copper Tubing	
up to 3/4	6	5	3/8
up to 2	6	6	3/8
2-1/2 to 3-1/2	10	8	1/2
4 and 5	12	10	5/8
6	12	10	3/4
8 to 12	14	14	7/8
14 and over	14	-	1
Trapeze Hanger Rod	(b)		

- a. Provide additional supports as required to avoid overloading of supporting structure. Reduce distance where so required by applicable codes.
 - b. As required to carry weight of trapeze channel, span of piping with contents, insulation and supports, plus a 200 pound live load.
2. Install hangers to provide minimum 1/2 inch clear space between finished covering and adjacent work.
 3. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers and expansion joints/loops.
 4. Place a hanger within one foot of each horizontal elbow.
 5. Use hangers that are vertically adjustable 1-1/2 inch minimum after piping is erected.
 6. Unless otherwise required to avoid overloading, of structural members or for seismic restraint, support vertical piping with clamps spaced appropriately as to type and weight of piping, minimum spacing at every other floor and below roof. Support vertical soil pipe at each floor at hub. For exposed piping in stairs, walkways and finished areas, locate clamps below floor and secure to structure below floor as required.
 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers. Space hangers for smallest pipe size or provide intermediate supports for smaller pipe as specified above for individual pipes.
 8. Where practical, support riser piping independently of connected horizontal piping.
 9. Support pipe runs in a manner to minimize stress in the pipe or tubing and on bodies of valves and fittings.
 10. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units, and so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
 11. Install hangers and supports to provide indicated pipe slopes and so that maximum pipe deflections allowed by ASME B31.9 "Building Services Piping" is not exceeded.

12. For piping subject to sweating (e.g.: domestic cold water), and for insulated piping requiring roller supports, install hangers outside insulation and provide pipe insulation protection shields as specified in this section. For all other piping, hanger may be attached to the piping before insulation is applied or may be installed outside the insulation with insulation protection shields.
13. Do not support nonferrous piping with ferrous materials even on a temporary basis.
14. Do not support piping from other piping or ductwork.
15. Install hanger rods subjected to tension only. Accomplish lateral and axial movements by proper linkage in rod assembly. Secure hanger to hanger rod with two bottom lock nuts.

3.14 IDENTIFICATION

- A. Identify all new and altered equipment, and new and altered exposed and concealed pipe with legible lettering, applied after finish painting, in a color to contrast with basic color in accordance with ANSI A13.1 and OSHA.
- B. Identify piping by name of pipe content and direction of flow near major equipment items, adjacent to valves or flanges, adjacent to gauges or thermometers, at each tee, at changes in direction, on each side of a penetration of a wall or floor, at each access door or panel and then at maximum 20 foot centers in congested areas and 50 foot intervals elsewhere; indicate flow direction with arrows. Identification shall be by means of plastic markers or tape or painted on the finished pipe surface by using stencils. Lettering shall not be smaller than one third of the pipe diameter and directional arrows not less than 1/2 inch wide and 12 inches long.
- C. Identify equipment and operating devices such as switches, starters and similar equipment, by the equipment numbers shown on Drawings or by the Owner's numbering system, if so directed.
 1. Include the type of service or the name of areas served.
 2. Lettering minimum 1 inch high.
 3. Nameplates shall be two tone plastic, or printed white paper enclosed in a transparent, laminated plastic case with permanently sealed edges.
 4. Attach securely to equipment, or where this is not practicable attach by brass link chains.
 5. Do not stencil surfaces exposed in public areas.
- D. Furnish for each valve, except those immediately adjacent to apparatus, a 2 inch diameter nonferrous metal tag with figures stamped on the tag.
 1. Number tags for Plumbing P-1, P-2, etc.; Use Owner's numbering system if so directed.
 2. Fasten tags to valves with nonferrous S hooks and nonferrous chains.
 3. Where valves are located above removable acoustical tile ceilings, identify the tile section below the valves by an approved color pin system.
 4. Furnish duplicate framed schedules showing the location of each valve, system or equipment it serves, manufacturer, and figure number.

3.15 TESTING OF PIPING SYSTEMS – COMMON REQUIREMENTS

- A. Refer to various sections of Division 22 for additional piping system testing requirements.
- B. Provide materials and equipment required for testing. Test and make tight all new piping systems and alterations and connections to existing piping system.

- C. Take precautions during testing to insure safety of personnel and equipment. Provide systems to be pressurized with appropriate gauges and blowouts or relief valve set at a pressure no more than one third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test. Make good at no increase in Contract sum damage to work or work of other trades caused by failure to observe proper precautions.
 - D. Test piping systems prior to application of insulation. Testing as stipulated herein shall be considered minimum, and where tests stipulated by lawful jurisdictional authorities exceed these requirements, such more stringent tests shall be performed. Tests shall be witnessed and approved by the authorities having jurisdiction over the work.
 - E. Concealed work shall remain uncovered until required tests have been completed. Provide proper sectionalizing devices so that portions of a system may be tested as appropriate.
 - F. Isolate and exclude from tests all in line equipment, instruments, gauge glasses, flow meters and all other devices not capable of withstanding test pressure.
 - G. Use ambient temperature water as testing medium, except where otherwise specified and except where there is a risk of damage due to freezing.
 - H. Apply soap solution to all joints of pneumatically tested systems while system is being subjected to test pressure.
 - I. Maintain test pressures sufficient length of time to permit thorough inspection of all joints. Where leaks are observed, replace defective work or material. Caulking of screw joints or holes is not acceptable. Repeat entire test as many times as necessary, until successful completion of test with no leaks.
 - J. Prepare written report of testing.
- 3.16 BALANCING, ADJUSTING AND PERFORMANCE TESTING OF PLUMBING SYSTEMS
- A. Testing, adjusting and balancing of water systems will be provided by the Installing Contractor.
 - B. Installing Contractor(s) responsible for the work specified in Division 22 shall perform all work necessary to place systems in full operation prior to start of testing, adjusting and balancing work. In addition, Installing Contractor shall perform certain additional preparatory work required for testing, adjusting and balancing as specified in various Sections of Division 22.
 - C. Provide notice upon completion of all preparatory work and all initial operational testing required as part the Work. Perform additional operational testing on equipment, or systems, as directed and to extent and for duration deemed necessary, to demonstrate that systems are performing properly and delivering quantities in accordance with the requirements of the Contract Documents.
 - D. Furnish approved manufacturer's technical data and shop drawings for equipment, including pump performance curves.

3.17 INSTRUCTION AND DEMONSTRATION

- A. Upon completion of all work and all tests, and at a time mutually agreed on by Contractor, Architect and Owner, Installing Contractor shall operate systems in all parts and at their expense for sufficient length of time to demonstrate the mode of operation and definitively determine whether the systems as a whole are in first class working condition. Immediately correct, at no cost to Owner, any defects that may develop during this period of operation and place systems in first class working condition before being finally turned over to Owner.
- B. Provide experienced operating personnel to instruct Owner's authorized employees in the operation, adjustment and maintenance of systems and equipment installed under this Contract. Provide instructions for the period of time appropriate for the size and complexity of the system, or as requested by Owner.

3.18 MANUFACTURER'S SUPERVISIONS AND STARTUP SERVICE

- A. Include manufacturer's supervision/startup/certification and special instruction service for equipment as specified in various Sections of Division 22. Be responsible for properly making arrangements for and coordinating with the manufacturer to provide the specified work. Make any corrections/modifications to the installation as required by the manufacturer at no additional cost to Owner.
- B. The manufacturer's engineer or authorized service personnel shall check the equipment for its conformance to the Specifications, for proper installation and run the system in all modes of operation to ascertain that the unit will function properly. Make necessary adjustments to insure optimum efficiency and trouble free service.
- C. After completion of the startup procedures, the manufacturer shall certify, in writing, that the equipment is installed in accordance with their requirements and is operating in accordance with the intent of the Specifications.

3.19 COMMISSIONING

- A. Commissioning will be provided as specified in Division 01 Section "Commissioning". All contractors and subcontractors of the various sections of this specification shall cooperate and participate in the commissioning work in accordance with requirements of Division 01 Section "Commissioning".
- B. Ensure participation of major equipment manufacturers or their representatives.
- C. Equipment and systems/subsystems installed under this section are expected to be in full compliance with the design intent by the commissioning phase. Notify the Commissioning Agent when any specific piece of equipment or specific system/subsystem is ready for commissioning. Be prepared to demonstrate system readiness.
- D. Equipment or systems/subsystems having incomplete work or exhibiting problems related to noncompliance with the design intent shall require commissioning. The contractor for this section shall be fully responsible to make all necessary corrections to incomplete or non-complying work at their own expense and shall pay the Commissioning Agent per diem rate for recommissioning such incomplete or non-complying work.

SECTION 22 05 13 - ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes extent of electrical equipment and electrical wiring that is responsibility of Division 22.
- B. Section includes general requirements for motors installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
- C. Related Sections
 - 1. Section 22 05 00, Common Materials and Methods for Plumbing Systems.

1.3 REFERENCE STANDARDS

- A. ANSI/IEEE 112 (C50.20): Test Procedure for single Phase Induction Motors
- B. ANSI/IEEE 114 (C50.21): Test Procedure for Polyphase Induction Motors and Generators
- C. NFPA 70: National Electric Code (NEC)
- D. UL: Underwriters Laboratories

1.4 SUBMITTALS

- A. Product Data: Include with equipment submittals, data pertinent to electrical characteristics, motor size, type, power requirements, wiring requirements.

1.5 QUALITY ASSURANCE

- A. Provide electrical products, including those factory mounted or factory furnished, which have been tested, listed and labeled with Underwriters' Laboratory (UL) or Electrical Testing Laboratory (ETL).
- B. There shall be no field modifications made to any materials, equipment and systems that would violate the listing and labeling.

- C. Comply with Division 26, NEC and NEMA as applicable to wiring methods, materials and equipment and equipment, construction and installation.

1.6 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.
- B. Wiring Under Division 26 "Electrical"
 - 1. Power wiring under Division 26 will include power feeders from source of building power to wiring terminals on the equipment; unit mounted disconnects, or control panels.
 - 2. Where disconnect switches for equipment are provided by Division 26, power wiring under Division 26 will include wiring from disconnect to wiring terminals on the equipment.
- C. Wiring Under Division 25 "Integrated Automation "
 - 1. Except on factory packaged equipment, wiring under Division 25 shall include all connections to control devices, wiring of pressure and flow control switches, flow meters and similar plumbing-electrical devices for plumbing systems to control panels, interlock wiring, control relays, and minor power wiring to auxiliary components for major pieces of apparatus such as solenoid valves and control valve motors.
 - 2. Wiring under Division 25 shall include all signal wiring from plumbing equipment to building automation system.
- D. Provide all other power and control wiring for Division 22 systems and equipment in accordance with the requirements of Division 26, required for complete operation, including wiring that is specified for factory prewired equipment, but not so provided.

PART 2 - PRODUCTS

2.1 ELECTRICAL WIRING

- A. Electrical wiring provided by Division 22 shall be in accordance with the requirements of Division 26.

2.2 CONTROL PANELS

- A. Include in control panels provided as a part of apparatus specified in Division 22, fused disconnect, circuit breaker or motor circuit protector combination starter with overload protection for each motor, contactors, and electric heaters, if required. Provide 120 volt control circuit and other required circuit protection. Where remote controls are required, they shall

operate at 120 volt maximum, with properly fused control transformer provided for that purpose.

PART 3 - EXECUTION

3.1 ELECTRICAL WIRING

- A. Power wiring will be provided under Division 26 and control wiring will be provided under Division 22. Provide power and control wiring for Division 22 systems and equipment for interconnecting wiring on apparatus that has not been factory installed.

END OF SECTION 22 05 13

THIS SHEET INTENTIONALLY LEFT BLANK

SECTION 22 05 48 - VIBRATION ISOLATION AND SEISMIC RESTRAINTS
FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Seismic control devices, accessories, materials and related items for new and altered equipment, and piping as may be required to keep all components in place during a seismic event and operational where this specification so requires.
 - 2. Requirements for Certification of seismic analysis, design and installation.

1.3 REFERENCES

- A. ASCE: American Society of Civil Engineers, ASCE 7, latest edition.
- B. ASHRAE: American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc., Applications Handbook, latest edition.
- C. ASTM: American Society for Testing and Materials.
- D. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association, Duct Construction Standards – Metal and Flexible, latest version.
- E. SMACNA: Seismic Restraint Manual Guidelines for Mechanical Systems, latest version.
- F. CBC: California Building Code 2013.
- G. OSHPD: Office of Statewide Health Planning and Development

1.4 DEFINITIONS

- A. Failure: For the purpose of this project, is defined as the discontinuance of any attachment point between equipment and structure, vertical permanent deformation greater than 0.125 inch and/or horizontal permanent deformation greater than 0.250 inch.
- B. Isolation Manufacturer: For the purpose of this project, manufacturer of vibration isolation and seismic restraint equipment.

- C. Longitudinal Bracing: Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or conduit.
- D. Positive Attachment: A cast-in anchor, a drill-in wedge anchor, a double sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps and power shots for support rods of piping, ductwork, or any other equipment are not acceptable on this project as positive attachment.
- E. Restraint: Device(s) intended to keep component in place during a seismic event.
- F. Transverse Bracing: Restraint(s) applied to limit motion perpendicular to the centerline of the pipe, duct or conduit.
- G. High Hazard Systems
 - 1. Systems conveying material that is either toxic or potentially explosive and in significant quantity could pose a threat to the general public.
 - 2. Nitrous oxide, natural gas, oxygen, compressed air, high pressure steam or any piping containing flammable, combustible, toxic oxidizing or corrosive material.
- H. Life Safety Systems:
 - 1. Hospital heating and air-conditioning systems required to maintain normal ambient temperature including domestic water make up.
 - 2. Plumbing systems that support the operation of or are connected to emergency power generation equipment.
- I. Refer to CBC and ASCE 7 for additional definitions of items related to seismic restraints.

1.5 SUBMITTALS

- A. Product Data: Annotate to indicate application of each product submitted and compliance with the specifications.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style material, strength, fastening provision, and finish for each type and size of seismic restraint component used.
- B. Product Schedule or List: Provide schedule of all vibration isolated and restrained equipment and all restrained but not vibration isolated equipment, all vibration isolated and restrained piping systems and all restrained, but not vibration isolated piping and ductwork systems. Submit separate schedules for "Vibration Isolated and Restrained" and for "Restrained but Not Vibration Isolated". Include the following for each piece of equipment and, as applicable, for each piping and ductwork system:
 - 1. Identification. Include equipment ID where applicable
 - 2. Isolator type(s) with identification reference numbers of applicable product data and shop drawings.
 - 3. Actual load for each isolator type.

4. Actual static deflection expected under actual load for each isolator type.
5. Specified minimum static deflection under actual load for each isolator type.
6. Seismic restraint(s) with identification number(s) of applicable product data and shop drawings. Include overstressed condition information, if any, as required by the Article titled "Seismic Engineer's Responsibilities" in Part 1 of this section.

- a. Initial and final deflection, anticipated movement and final floor loading for spring riser system.

C. Shop Drawings:

1. Fabrication details of steel rails, steel base frames and concrete inertia bases showing all steel work, reinforcing, vibration isolator mounting attachment method and location of equipment bolts.
2. Drawings showing methods of suspension, support guides for piping.
3. Drawings showing methods for isolation of pipes piercing walls and slabs.
4. Drawings showing number and location of seismic restraints and anchors for each piece of equipment and each piping system.
5. Specific details of restraints including anchor bolts for mounting at each location, for each piece of equipment and for pipe locations.
6. Methods and details for vertical restraints.
7. Details of housekeeping pad(s) showing reinforcement, method of attachment to structure and method of attachment of equipment restraint(s).
8. All other special details necessary to convey complete understanding of work to be performed.

D. Certification of Seismic Analysis and Design: Statement on seismic engineer's letterhead stationary with original signature of an authorized representative of the manufacturer certifying that, as required by the Article "Seismic Engineer Responsibilities" in Part 1 of this section:

1. Seismic calculations have been completed and stamped by a registered engineer in the same state as the project, including name, license number and state of registration of responsible engineer.
2. All overstressed conditions have been included in the submittal.
3. Seismic restraints and attachments are capable of safely accepting loads resulting from the specified seismic forces when installed in accordance with manufacturer's instructions.

E. Certification of Component Manufacturer Seismic Compliance:

1. For life safety and high hazard components and systems, provide component manufacturer's Approved Agency Certificate of Compliance for their equipment when used on project with Seismic Design Category C through F, including testing certification.
2. All other components, equipment manufacturer must provide certification product has been tested or analyzed to withstand the expected loads. Seismic engineer shall review products for capability to withstand project design loads.
3. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

- a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will remain fully operational after the seismic event."
 - 4. Dimensioned Outline Drawings of Unit Equipment: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 5. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
- F. Certificates: All seismic components to be used in association with OSHPD projects must be submitted with OSHPD pre-approval certification stamp.

1.6 QUALITY ASSURANCE

- A. It is the objective of this specification to provide the design and installation of vibration isolation equipment and devices for the avoidance of excessive noise and vibration in the building(s) due to the operation of machinery or equipment and/or due to interconnected piping, or conduit, and to provide the design and installation of restraint equipment and devices for seismic restraint for the plumbing systems.
- B. All vibration isolation equipment and devices and all seismic restraint equipment and devices shall be the products of a single manufacturer, hereinafter called the isolation manufacturer, unless otherwise allowed in writing by the Architect, shall be certified by the isolation manufacturer and shall be furnished by the isolation manufacturer or his authorized representative, who shall be responsible for performing all work specified in this section to be performed by the isolation manufacturer or his representative and for coordination of all phases of the work.
- C. This specification represents the minimum requirements for seismic consideration. All systems must be installed in strict accordance with seismic codes and component manufacturer's standards and instructions. Whenever a conflict occurs between codes, manufacturer's standards and requirements in this Section, the most stringent shall apply.
- D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel.
- E. Quality Assurance Program: The quality assurance plan shall be included when required by the applicable building codes. The design of each seismic system shall include a quality assurance plan prepared by a professional engineer registered in the same state as the project. The quality assurance plan shall identify the following:
 - 1. Seismic systems that are subject to quality assurance:
 - a. Medical gas systems
 - 2. Special inspections and testing to be provided as per applicable code requirements.
 - 3. The type and frequency of testing and special inspections.
 - 4. The frequency and distribution of testing and special inspection reports.
 - 5. The structural observations to be performed.
 - 6. The required frequency and distribution of structural observation reports.

- F. Contractor Responsibility Statement: When a quality assurance plan is required by the applicable building code, the Contractor responsibility statement is required. Contractor shall submit a written statement with copies to the building official and Owner indicating acknowledgement of the requirements of the quality assurance plan and identification qualifications and position of individual(s) responsible for maintaining conformance to quality assurance plan within the Contractor's organization.
- G. Owner will retain and pay for services of a qualified structural/seismic engineering consultant to inspect and certify seismic restraint installation where special inspections are required by the applicable codes. The Contractor shall notify the Owner of all special inspection requirements included in the quality assurance plan. Special inspection reports shall be submitted to the Architect, seismic engineer, Owner and Contractor for record purposes.

1.7 DESIGN REQUIREMENTS

- A. Refer to Section 22 05 00 Article titled "Seismic Requirements."
- B. Design seismic restraints to safely accept and resist earthquake generated external horizontal forces in any direction at the center of mass without failure or permanent displacement. Refer to Structural Design Criteria and CBC.
- C. Design of seismic restraints shall be in compliance with ASCE 7 as modified by the 2013 California Building Code.
- D. Expected noise levels in various parts of the building shall conform to room criteria (RC) recommendations as set forth in the latest edition of the ASHRAE HVAC Applications Handbook. The midpoint range of the NC criteria curves shall apply.

1.8 SEISMIC RESTRAINT AND VIBRATION ISOLATION MANUFACTURER'S RESPONSIBILITIES

- A. Seismic Restraint and Vibration Isolation manufacturer shall have the following responsibilities:
 - 1. Determine vibration isolation and seismic restraint sizes and locations to meet the CBC requirements for OSHPD.
 - 2. Furnish vibration isolation systems and seismic restraints as scheduled or specified.
 - 3. Guarantee specified isolation system deflection.
 - 4. Provide design and application of seismic restraints in accordance with the more stringent of the requirements of the referenced building code, ASCE 7, SMACNA standards and the requirements of latest version ASHRAE Applications Handbook.
 - 5. Provide installation instructions, drawings and field supervision to assure proper installation and performance. The installation of all vibration isolation units and seismic restraints, and associated hangers and bases, shall be under the direct supervision of the manufacturer's representative. Upon completion of installation and after system is put into operation, representative shall make a final inspection and submit his report to Architect in writing certifying correctness of installation and compliance with reviewed submittal data.
 - 6. Provide component certification of seismic restraints and attachments capability to safely accept loads resulting from seismic forces determined by methods defined above.

Certification must be substantiated by calculations or test reports verified by a licensed engineer.

7. Provide approved resilient restraining devices as required to limit equipment and piping motion in excess of 3/8 inch.
8. Advise Contractor of special size and anchor bolt requirements for foundations and housekeeping pads to develop strength equal to that for which the seismic restraints are designed to resist and certify same.

1.9 SEISMIC ENGINEER'S RESPONSIBILITIES

- A. Seismic Engineer retained by the Plumbing Contractor as required shall have the following responsibilities:
 1. Seismic calculations, seismic analysis and design certification.
 2. Development of a seismic restraint quality assurance plan when required by the applicable building code.
 3. Registered Professional Engineer in the state where the project is located.
 4. Identification of any overstressed conditions and notification to Architect of overstressed conditions.
 5. Review of seismic restraint manufacturer's component certifications.
 6. Development of special inspection requirements for this project as required by applicable codes and standards.
 7. Shop drawing review and certification of compliance with seismic analysis and design.
 8. Provide calculations to determine restraint loads resulting from seismic forces presented in governing codes and project seismic requirements; with a minimum seismic acceleration applied at the equipment center of mass as specified in the "Design Requirements" Article in Part 1 of this section. Seismic calculations shall be certified by a licensed engineer, experienced in the design of seismic restraints. Submit calculations with professional engineer's stamp and signature to Owner for record purposes.
 9. Check the structural members of the building for localized stress at points of attachment for seismic restraint. The engineer shall provide to the architect the magnitude of seismic restraint force and include direction on shop drawings, together with computation of stress conditions at localized attachments only in the event that an overstressed condition is determined by the engineer. The engineer shall certify that the architect has been advised of all overstressed condition information. The architect will review only such identified locations for additional bracing or reinforcing at these localized conditions.

1.10 COORDINATION

- A. Coordinate work with other trades to avoid having isolated systems coming in contact with the building. Inform other trades following this work to avoid causing any contact which would reduce the vibration isolation.
- B. Coordinate size, location and special requirements of vibration isolation equipment and systems with other trades. Coordinate plan dimensions with size of housekeeping pad.
- C. Bring to the Architect's attention prior to installation any conflicts with other trades which will result in unavoidable contact to the equipment, piping, etc., described herein, due to inadequate

space, etc. Corrective work necessitated by conflicts after installation shall be at the Contractor's expense.

- D. Bring to the Architect's attention any discrepancies between the specifications and field conditions, changes required due to specific equipment selection, etc., prior to installation. Corrective work necessitated by discrepancies after installation shall be at the Contractor's expense.

1.11 INSPECTION AND INSTRUCTION

- A. Notify the isolation manufacturer's representative prior to the general installation of vibration isolation devices and seismic restraints so that the isolation manufacturer's representative can instruct and demonstrate the proper installation procedures with the Contractor's foremen.
- B. Obtain written and/or oral instructions from the isolation manufacturer's representative as to the proper installation and adjustment of vibration isolation devices and seismic restraints.
- C. Obtain inspection and approval from the isolation manufacturer's representative of the completed installation. Perform all work and make all adjustments as directed by the isolation manufacturer's representative as a result of the inspection.
- D. Obtain inspection and approval from the isolation manufacturer's representative, and perform all directed work and adjustments, of any installation to be covered or enclosed prior to such closure.
- E. Where special inspection and periodic special inspection of seismic restraints is required by the referenced building code, Contractor must submit a written statement of responsibility as part of the Quality Assurance Program including, identification of components, control procedures for all inspection and testing including frequency and method of reporting, and list of qualified personnel responsible for certifying seismic restraints.
- F. The following systems require special inspection and periodic special inspection for anchorage during the course of construction:
 - 1. All flammable combustible and highly toxic and associated systems: Periodic.
 - 2. Equipment Using Toxic or Combustible Energy Sources: Special.
 - 3. Reciprocating and Rotary Machinery: Special.
 - 4. Pipe Larger Than 3 Inches: Special.
 - 5. Tanks, Heat Exchangers, Pressure Vessels: Special.
 - 6. Isolator Units for Seismic Isolation System: Periodic.

PART 2 - PRODUCTS

2.1 SEISMIC-RESTRAINT DEVICES

- A. Acceptable Manufacturers:
 - 1. Mason Industries
 - 2. M. W. Sausse

B. General Requirements for Restraint Components:

1. Restraints shall be capable of safely accepting external forces specified in the DESIGN REQUIREMENTS article in Part I of this section, without failure, shall maintain mechanical systems, and accessories in a captive position, and shall not short circuit vibration isolation systems or transmit objectionable vibration or noise.
2. EXCEPT FOR TYPE I RESTRAINT, systems that incorporate vibration isolation support within seismic restraint housing are not permitted – seismic restraints must be separate from isolation mounts.
3. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Type I Restraint: Type FSNTL-SR, Type FN-SR.

D. Type II Restraint

1. All directional, double acting seismic snubber consisting of interlocking steel members restrained by shock absorbent elastomeric material compounded to bridge bearing specifications as indicated elsewhere in this section. Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
2. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
3. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
4. Elastomeric bushing shall be replaceable and a minimum of 1/4-inch-thick. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8-inch or more than 1/4-inch.
5. The snubber shall be constructed to allow easy inspection of snubber internal clearances.

E. Type III Restraint

1. Cable type system consisting of ASTM A 492 stainless steel cable designed for a minimum safety factor of 2, and end fastening devices, arranged to provide all-directional restraint. End fastening devices, steel assemblies with thimbles, brackets, swivel and bolts designed to swivel and clamp cable with 2 clamping bolts. All parts of system including cables and clamps, but excluding fastenings, to be furnished by a single vendor to assure seismic compliance.
2. The cable size and attachment to the restrained item and structure shall be designed and signed by a licensed engineer.
3. Submittal drawing shall indicate method of vertical restraint.

F. Type IV Restraint: Nonisolated equipment to be positively attached to structure (powder shots not acceptable) to resist seismic forces.

G. Type V Restraint: Seismic solid brace consisting of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all direction (compression, tension and torsion) restraint. Solid brace end connectors shall be assemblies that swivel to the final installation and utilize minimum 2 bolts to provide proper attachment to structure. Provide corrosion resistant coating.

- H. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
- I. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- J. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- K. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- L. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Provide vibration isolators of appropriate sizes and proper loading. Select in accordance with the weight distribution to provide reasonably uniform deflection.
- B. Supply and install any incidental materials such as mounting brackets, attachments and other accessories as may be needed to meet requirements stated herein, even if not expressly specified or shown on Drawings, without claim for additional payment.
- C. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specifications.
- D. Should any rotating equipment cause excessive noise or vibration when properly installed on the vibration isolators, the Contractor shall be responsible for rebalancing, realignment or other remedial work required to reduce noise and vibration levels. Excessive is defined as exceeding the manufacturer's specifications for unit in question.

- E. Make certain that seismic restraints do not short circuit the isolation system and that isolation system is unrestrained.
- F. Adjust isolators after piping system is at operating weight.
- G. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- H. Adjust active height of spring isolators.
- I. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.3 SEISMIC RESTRAINT, APPLICATION

A. General

- 1. Seismically restrain all specified work in all directions.
- 2. Install hanger rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.

B. Piping

- 1. Piping restraints shall comply with requirements in MSS SP-127.
- 2. Provide Type III restraints for isolated piping in mechanical rooms. Type III or Type V seismic restraints for non-isolated piping. All other piping 2-1/2 inch diameter and larger, provide Type III restraints for isolated piping and Type III or Type V restraints for non-isolated piping. Provide up-stop snubbers for vibration isolators and suspension rod stiffeners as required.
- 3. Transverse bracing on runs of piping not to exceed a spacing of 10 feet on no-hub piping; transverse bracing on runs of other piping up to size 16 inches not to exceed 40 feet.
- 4. Longitudinal bracing at 20 feet intervals on no-hub piping; longitudinal bracing of other piping at intervals of 80 feet on piping size up to 16 inches.
- 5. Bracing distances for multiple pipe runs on the same support must be calculated by isolation manufacturer.
- 6. Hold-down clamps must be used to attach pipe to all trapeze hangers prior to installing restraint. Clamps or restraints must not impede thermal expansion or contraction of piping system.
- 7. Branch piping is not an acceptable means for restraining main piping.
- 8. All high hazard and life safety systems regardless of size such as fuel oil or gas shall be seismically restrained. Provide Type III restraints for isolated piping and Type III or Type V restraints for non-isolated piping.

C. Electrical Equipment and Conduit: Restrain electrical equipment and conduit provided under Division 22 as specified for plumbing equipment and piping.

D. Exclusions to Seismic Restraints

- a. As allowed by the CBC.

3.4 SEISMIC RESTRAINTS, INSTALLATION

A. General

1. Install restraints in strict accordance with seismic codes, building construction standards, the isolation manufacturer's written instructions and the verbal instructions of his authorized representative. Whenever a conflict occurs, the most stringent shall apply.
2. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
3. Positively attach restraints to the supporting structure and to the equipment, and piping.
4. Install seismic snubbers on equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
5. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

B. Where restraints are attached to clevis hangers, provide cross bolt reinforcement.

C. Shim snubbers as required to achieve and maintain clearance.

D. Positively attach restraints to structure by field bolting or welding. Overstress of the building structure must not occur. Do not support overhead supported equipment from slab diaphragms between beams unless specifically approved. Support can occur from:

1. Flanges of structural steel beams
2. Cast-in-place inserts or drilled in mechanical type anchor, Hilti or equal, in concrete. Shot pins and adhesive type anchors are not allowed.

E. Install Type III restraints with slack as required, 1/2 inch maximum, to prevent excessive seismic motion for vibration isolated systems and equipment and to allow for thermal movement where applicable. Install Type III restraints taut elsewhere. Provide two sided beam clamps when securing to steel structural members.

F. Contractor shall notify special inspection agency/engineering consultant 48 hours in advance of work being completed for required special inspections. Contractor shall cooperate with and shall provide free access to work for the special inspection agency/engineering consultant.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 for piping flexible connections.

3.6 FIELD QUALITY CONTROL

- A. Upon completion of installation of all vibration isolation devices, the isolation manufacturer's representative shall inspect the installation and certify in writing to the Contractor that all isolation devices are installed properly, or require correction.
- B. All independent Special and Periodic Inspections must be performed and submitted on components as outlined in Part 1 of this Section.

END OF SECTION 22 05 48

SECTION 22 10 00 - PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the following plumbing materials and equipment for domestic water, fuel gas and drainage systems:

1. Pipe and fittings
2. Valves
3. Drains
4. Backflow preventers
5. Trap primers
6. Cleanouts

- B. Related Sections include the following:

1. Section 22 11 00: Disinfection of Domestic Water Lines
2. Section 22 05 00: Basic Materials and Methods
3. Section 22 07 00: Plumbing Insulation
4. Section 22 05 13: Electrical Equipment and Wiring for Plumbing Systems
5. Section 22 05 48: Vibration Isolation and Seismic Restraints for Plumbing Equipment
6. Section 22 60 00: Special Systems
7. Section 22 40 00: Plumbing Fixtures and Trim
8. Division 26: Electrical

1.3 REFERENCES

- A. ASSE 1018 - Trap Seal Primer Valves, Water Supply Fed
- B. ASCE/SEI 7 - Seismic Performance Criteria
- C. NSF 61 - Standard for Potable Domestic Water Piping and Components
- D. NFPA 99 - Healthcare Facilities

1.4 SUBMITTALS

- A. Product data for the following:

1. Pipe, valves and fittings
2. Drains, cleanouts and trap primers
3. Backflow preventers

B. Welding certificates.

1.5 WARRANTY AND CONTRACT CLOSEOUT

A. Warranty

1. Refer to BIDDING AND CONTRACT REQUIREMENTS and to warranty and contract closeout requirements specified in DIVISION 00.

B. Contract Closeout

1. Comply with requirements of Division 1, Contract Closeout.
2. Include information for all products specified in this section, in the operating and maintenance manual.
3. Provide the following as specified in this section or Section 22 05 00.
 - a. Testing and cleaning reports certified by contractor for each system.

1.6 PRODUCTS FURNISHED BY OTHERS

A. Provide rough-in, traps and final drain and water connections for following equipment set in place by others.

1. Humidifier system provided under Division 23.

1.7 SEISMIC DESIGN

A. Refer to Section 22 05 00, Article 1.10.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products of the following manufacture:

1. Automatic Trap Primer
 - a. Precision Plumbing Products, Inc.
 - b. Josam Mfg. Co.
 - c. Jay R. Smith Mfg. Co.
 - d. Wade Div. Tyler Pipe Industries, Inc.
 - e. Zurn Industries, Inc.
 - f. Watts Drainage

- g. Mifab
- 2. Backflow Preventer
 - a. Hersey Products, Inc.
 - b. ITT Lawler
 - c. Watts Regulator Co.
 - d. Zurn Wilkins Division
 - e. Ames
 - f. Febco
- 3. Cleanouts, Carriers, Drains, Interceptors
 - a. Watts Drainage
 - b. Enfield
 - c. Jay R. Smith Mfg. Co.
 - d. Josam Mfg. Co.
 - e. Precision Plumbing Products, Inc.
 - f. R & G Sloane
 - g. Wade Div. Tyler Pipe Industries, Inc.
 - h. Zurn Industries, Inc.
 - i. Mifab
 - j. Blucher
- 4. Pipe and Fittings
 - a. General Pipe and Fitting Materials, No Specified Manufacturer
 - 1) Any manufacturer whose products are manufactured in the United States and comply with the reference standards.
 - b. Basic Pipe and Fitting Materials and Accessories not Specified in this Section: Refer to Section 22 05 00.
 - c. Ductile Iron Retainer Glands
 - 1) American Cast Iron Pipe Co.
 - 2) Fire Protection Equipment Co.
 - 3) U. S. Pipe.
 - d. High Silicon Cast Iron Pipe and Fittings (Submittal Code A)
 - 1) Duriron Company.
- 5. Valves
 - a. Basic Valve Types not Specified in this Section: Refer to Section 22 05 00.
 - b. Type V14, Ball Check Valve
 - 1) Flygt

2.2 AUTOMATIC TRAP PRIMER

- A. ASSE 1018, water-supply-fed type, with the following characteristics: 125-psig minimum working pressure; bronze body with atmospheric-vented drain chamber; 1/2-inch NPS threaded, union, or solder joint inlet and outlet connections; 1/2-inch NPS threaded or solder joint gravity drain outlet connection; chrome plated finish except rough bronze for units used with pipe or tube that is not chrome finished.
- B. Electronic solenoid actuated trap priming manifold assembly mounted in surface cabinet with stainless steel door and cylinder lock. Provide 5/8 inch compression fittings for the quantity of primed traps as indicated on plans. Unit shall be Precision Plumbing Products Prime-Time #PT-4 wired for 120 volt power supply.

2.3 BACKFLOW PREVENTER

- A. Complete factory assembly including resilient seated shutoff valves before and after device, resilient seated test cocks and protected by strainer having a resilient sealed blowdown valve. Provide pressure differential relief valve located between two positive seating check valves. All bronze body. All internal parts stainless steel. Meet requirements of American Society of Sanitary Engineering Standard 1013 and University of Southern California Foundation for Cross Connection Control and Hydraulic Research, and so certify. Meet local code requirements. Include solenoid shut down where flooding potential exists.

2.4 CLEANOUT AND CLEANOUT ACCESS COVER

- A. Provide cleanouts with brass, screw-in type plugs as listed below.
 - 1. Finished Floors: Duco cast iron body with bronze plug, gasket seal, internally threaded extension with adjustable head, round scoriated nickel bronze top secured with vandalproof screws, Jay R. Smith 4020 Series.
 - 2. Vinyl or Composition Tile Floors: Same as above, except square top with 1/8 inch recess to receive flooring material, Jay R. Smith 4160 Series.
 - 3. Terrazzo or Ceramic Tile Floors: Same as 1. above, except square top with recess of sufficient depth to receive flooring material, Jay R. Smith 4200 Series.
 - 4. Carpeted Floors: Same as 1. above with adjustable carpet clamping frame, Jay R. Smith 4020X Series.
 - 5. Finished Walls: Cast iron cleanout plug or cleanout tee, bronze hex head plug, round nickel-bronze frame and secured cover with vandalproof screws, Jay R. Smith 4720.
 - 6. Exposed Piping in Unfinished Areas: For cast iron pipe, provide a ferrule caulked into the hub of fitting and a heavy rough brass plug screwed into ferrule. For screwed piping, provide heavy rough brass plug screwed into pipe fitting.
 - 7. Unfinished Floors: Duco cast iron body with round adjustable scoriated cast iron top secured with vandalproof screws, bronze plug. Jay R. Smith 4220 Series.
- B. Provide flashing clamp for cleanout installed in waterproof construction.

2.5 PIPE AND FITTINGS

- A. General

1. Pipe and fitting materials and joint types are specified in the following "Piping Class" paragraphs. Application material and joint type which will be permitted for specific services are specified hereinafter in the Article titled "Piping System Requirements". Where more than one Piping Class is listed under "Piping System Requirements" for a service, use any of listed classes, unless otherwise specified or indicated, but systems' materials must be consistent throughout the work.
2. Pipe and fittings shall conform to the latest issue of the standards referred to hereinafter. Each length of pipe and each fitting shall be marked with the manufacturer's name brand and specification code designation to which it belongs.

B. Piping Class BR1

ITEM	LIMITS	DESCRIPTION
PIPE		Brass pipe Schedule 40, Nipples Schedule 80, Chromium Plated
JOINTS		Screwed
FITTINGS		Class 125 cast bronze threaded, Chromium Plated
UNIONS		Class 250, chromium plated

Reference Standards

1. Brass Pipe: ASTM B 43 Grade A red brass, ANSI H27.1. Chromium plated. All pipe must be marked with trademark of manufacturer and with grade letter "A".
2. Cast Bronze Threaded Fittings: ANSI B16.15, Classes 125 and 250. Chromium plated.

C. Piping Class CI1

ITEM	LIMITS	DESCRIPTION
PIPE & FITTINGS	2 inch thru 15 inch	Cast iron bell and spigot soil pipe and fittings, service weight
	16 inch thru 54 inch	Ductile iron water pipe and fittings
JOINTS	2 inch thru 15 inch	Caulked with lead and oakum. For underground service only, rubber gasket push-on type ASTM C 564 and C 1563 may be used if allowed by codes.
JOINTS	16 inch thru 54 inch	Rubber gasket push on or mechanical

Reference Standards

1. Cast Iron Soil Pipe and Fittings, Hub and Spigot: ASTM A 74, Commercial Standard CS-188. Pipe shall bear Commercial Standard symbol. Piping shall bear CISPI collective trademark and NSF international listing.

2. Ductile Iron Water Pipe and Fittings: Pipe - Class 52 ANSI A21.51; Fittings - Class 250 rated cast iron or ductile iron, ANSI C110; Joints - either rubber gasket push-on type or mechanical type, ANSI 21.11.

D. *Piping Class CI2

ITEM	LIMITS	DESCRIPTION
PIPE & FITTINGS	2 inch thru 12 inch	Cast iron no hub soil pipe and fittings
JOINTS	2 inch thru 12 inch	Compression type couplings shall be Heavy-duty couplings ASTM C 1540 Clamp All Hi Torq 125, Mission, Husky or equal

* For use only above ground where allowed by codes.

Reference Standards

1. Cast Iron Soil Pipe and Fittings, No Hub: ASTM A 888, CISPI 301. Joints, ASTM C 564. Piping shall bear CISPI collective trademark and NSF international listing.

E. Piping Class CU1 & CU1S

ITEM	LIMITS	DESCRIPTION
PIPE	All sizes	Copper tubing Type L. Hard temper for Class CU1 and soft temper for Class CU1S
JOINTS	All sizes	Soldered
FITTINGS	All sizes	Wrought copper, except cast brass only in sizes where wrought copper is not available
UNIONS	2 inch and smaller	Class 200
	2-1/2 inch and larger	Companion flanges
FLANGES	2-1/2 inch and larger	Class 150 cast bronze

Reference Standards

1. Copper Tubing: ASTM B 88, ANSI H23.1
2. Soldered Fittings for Copper Tubing: Wrought copper, ANSI B16.22 for pressure fittings and B16.29 for drainage fittings; Cast brass for larger sizes where wrought copper is not available, ANSI B16.18 for pressure fittings and B16.23 for drainage fittings.
3. Flanges for Copper Tubing: Cast bronze, ANSI B11.24, Classes 150 and 300, solder joint.

F. Piping Class CU1M

ITEM	LIMITS	DESCRIPTION
PIPE	2-6 inch	Copper tubing Type L. Hard temper
JOINTS	2-6 inch	Soldered
FITTINGS	2-6 inch	Wrought copper, except cast brass only in sizes where wrought copper is not available
UNIONS	2-6 inch and larger	Companion flanges
FLANGES	2-6 inch	Class 150 cast bronze

Reference Standards

1. Copper Tubing: ASTM B 88, ANSI H23.1
2. Soldered Fittings for Copper Tubing: Wrought copper ANSI B16.22; Cast brass for larger sizes where wrought copper is not available, ANSI B16.18.
3. Copper Grooved-End Fittings: ASTM B 75 or ASTM b 584.
4. Flanges for Copper Tubing: Cast bronze, ANSI B11.24, Classes 150 and 300, solder joint.
5. Refer to Section 22 05 00 for mechanical couplings.

G. Piping Class CU3

ITEM	LIMITS	DESCRIPTION
PIPE	Less than 1-1/4 inch	Copper tubing, Type L, Hard
	1-1/4 inch & larger	Urinals (2") copper tubing Type K, hard; elsewhere DWV copper drainage tubing and fittings, hard.
JOINTS	All sizes	Soldered
FITTINGS	All sizes	DWV Pattern wrought copper except cast brass only in sizes where wrought copper is not available
FLANGES		Class 150 cast bronze

Reference Standards

1. Copper Tubing: ASTM B 88, ANSI H23.1
2. DWV Copper Drainage Tube: ASTM B 306, ANSI H23.6.
3. Flanges for Copper Tubing: Cast bronze, ANSI B11.24, Classes 150 and 300, solder joint.
4. Soldered Drainage Fittings (DWV): Cast bronze, ANSI B16.23.
5. Soldered Fittings for Copper Tubing: Wrought copper ANSI B16.29; Cast brass, for larger sizes where wrought copper is not available, ANSI B16.23.

2.6 PIPING SYSTEM REQUIREMENTS

Service	Valve Type/Class	Pipe Class
Domestic Water Above Ground and Industrial Cold Water		
1) General Service 6 inches and smaller	VC-4	CU1, CU1M
8 inches and larger	VC-4	CU1, SG2
2) Exposed at Plumbing Fixtures and in Hospital and Similar Equipment	CPBV	BR1
Sanitary Gravity Drainage and Vent Above Ground		
1) Piping, General		CI1, CI2
2) Branch Waste & Vents for Fixtures other than Water Closets and Urinals		CI1, CI2
3) Branch Waste & Vents for Water Closets		CI1, CI2
4) Branch Waste & Vents for Urinals (2 inch)		CU3
5) Indirect drainage		CU1**, CU3
6) Exposed Piping at Fixtures & Equipment		BR1
**Piping less than 1-1/4 inch in size		

2.7 VALVES

A. General

- Valves are specified by Valve Type and, for some services, several valve types are grouped by "Valve Class" in various sections of Division 22. Application is stated in the "Piping System Requirements". Where more than one Valve Type or Valve Class is listed for a service, use any of the listed Types or Classes, unless otherwise specified or indicated, but selection must be consistent throughout the work.
- It shall be Contractor's responsibility to coordinate the work for all sections of Division 22 to assure that all general service valves throughout the work of Division 22 are of the same manufacture and type and that all valves of the same type number/identification throughout the work of Division 22 are of the same manufacture.
- Valve packing shall not contain asbestos.

4. Bronze Valves: Construct body of ASTM B 62 for Classes 125 and 150, ASTM B 61 for Classes 200 and 300, copper-silicon bronze stem.
5. Iron Valves: Construct body of ASTM A 126, Class B copper-silicon bronze stem.
6. All valves used in domestic water applications shall comply with NSF/ANSI 61 for lead free construction.

- B. Refer to Section 22 05 00 for specifications for basic valve types not specified in this section.
- C. Type V14 Ball Check Valve: Nonclog, unobstructed, free flow type. Ball shall be out of the flow in the open position, directed to and from the body seat by guide rails integral with the valve body. Function satisfactorily in a vertical, horizontal or inverted position. Capable of direct burial without the use of a vault or other enclosure. Ball actuated by the flowing medium, system pressure, or gravity without the use of springs, levers, weights or external power source. Body of gray cast iron construction for sizes 2-1/2 inch and larger, flange ends integral with the body casting, flat faced and drilled to ANSI B16.1, Class 125 cast iron, standard. Body shall be cast bronze with threaded connections conforming to N.P.T. for 2 inch size. Ball shall be a hollow steel sphere with a smooth covering of nitril rubber. Valve shall be suitable for 150 psig working pressure and a temperature of 185°F. Flygt HDL ball check valves.
- D. Type CPBV, Chrome Plated Brass Valves: Similar to Type V2 and V3 except chrome plated brass finish and black composition wheel handle.
- E. Valve Classes
1. Valve Class VC-4

SERVICE	LIMITS	ALLOWABLE VALVE TYPES
SHUTOFF	Copper Tubing	V8a, V9\V10
	Steel Pipe	V8a, V9, V10
THROTTLING (BYPASS)	Copper Tubing	V1 & V4 globe, V9, V10
	Steel Pipe	V2 & V4 globe, V9, V10
BALANCING		Calibrated type Class 125 bronze body. Bell & Gossett circuit setter or equal. See Section 20 05 00.
CHECK	Copper Tubing	V1 swing check or V14 at storm water or sanitary pump discharge, V1 & V4 elsewhere
	Steel Pipe	V2 swing check or V14 at storm water or sanitary pump discharge, V2 & V4 elsewhere
*Not allowed for pump discharge balancing service.		

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Refer to and comply with Section 22 05 00 for basic requirements.
- B. Refer to Section 22 05 48 for vibration isolation and seismic restraints, penetration seals and the like.

3.2 BACKFLOW PREVENTERS

- A. Install backflow preventers on makeup water connections to mechanical equipment (humidifiers, boilers, cooling towers, hot water and chilled water systems). See detail on Drawings.

3.3 CLEANING OF SYSTEMS

- A. Refer to Section 22 05 00 for basic requirements.
- B. Refer to Section 22 11 00 for Disinfection of Water Lines.

3.4 CLEANOUTS

- A. Provide cleanouts on all drainage piping at 50 foot intervals on piping 4 inches and smaller and at not more than 100 foot intervals on larger pipe sizes, at each change in direction of more than 45°, at the base of drainage stacks and at other locations shown. Cleanouts full size for pipes up to 4 inches and not less than 4 inches for larger pipes except where code requires cleanouts larger than 4 inches. Cleanout sizes shall comply with applicable plumbing code.
- B. Lubricate non-plastic cleanout plugs with mixture of graphite and linseed oil or provide Teflon tape on threads. Sealants for plastic cleanout plugs shall be compatible with plastic piping materials. Prior to building turnover remove cleanout plugs, relubricate and reinstall using only enough force to ensure permanent leakproof joint.

3.5 DOMESTIC WATER PIPING

- A. Install inside domestic water distribution piping with sufficient pitch and in a manner that entire system may be drained at a central point, if possible. Otherwise provide drainage points for each portion of system.
- B. Support risers and stacks by metal brackets attached to building construction or by other approved methods.
- C. Provide a riser shutoff valve at all water supply risers in nearest accessible location.
- D. Provide isolation valve in new piping where new piping and existing piping interconnect. Provide 3/4 inch tap with hose end valve for pipe disinfection downstream of isolation valve.

3.6 DRAINS

- A. Flash drains installed in waterproofed floor or in toilet rooms and mechanical equipment room above grade with 2 foot, 6 inch square, sheet membrane clamped into clamping device of the drain and mopped into waterproofing or cast into concrete. Membrane shall be thermoplastic elastomeric, ASTM D 4068, Chloraloy 240, as manufactured by the Noble Company. Installation shall be in strict accordance with the manufacturer's recommendations.

3.7 ELECTRICAL WORK

- A. Refer to Section 22 05 13 for general requirements.
- B. Power wiring will be provided under Division 26, Electrical, to the following:
 - 1. Electronic automatic trap primer.

3.8 PIPING CONNECTIONS

- A. Refer to Section 22 05 00 for basic requirements.
- B. Bell and Spigot, Cast Iron Pipe Joints: Caulk firmly with oakum or hemp and fill with molten lead not less than 1 inch deep and not to extend more than 1/8 inch below rim of hub; no paint, varnish or other coatings permitted on jointing material until after joint has been tested and approved. Neoprene gasketing system or gasket and clamp type mechanical fastener where specified.

3.9 TESTING OF PIPING SYSTEMS

- A. Refer to Testing of Piping Systems, General in Section 22 05 00.
- B. Field Quality Control
 - 1. Do not enclose, cover, or put into operation water distribution piping system and drainage and vent piping system until each has been inspected and approved by the authority having jurisdiction.
 - 2. Reinspections: When the representative of the authority having jurisdiction finds that piping system will not pass test or inspection, make required corrections and arrange for reinspection by authority having jurisdiction.
 - 3. Reports: Prepare inspection reports signed by the representative of the authority having jurisdiction.
 - 4. Test in accordance with the more stringent of the requirements of the authority having jurisdiction or the following:
- C. Gravity Drainage Systems
 - 1. Combination Water/Air Test
 - a. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open-jointed drain tile, test new and/or altered piping of plumbing drainage and venting

systems on completion of roughing in piping installation. Tightly close all openings in piping system and fill with water to point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before inspection starts through 15 minutes after completion of inspection. Inspect all joints for leaks.

- b. Finished Plumbing Test Procedure: After plumbing fixtures have been set and their traps filled with water, test connections and prove gastight and watertight. Plug stack openings on roof and building drain where it leaves the building and introduce air into the system equal to pressure of 1 inch water column. Use a U tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without introducing additional air throughout period beginning 15 minutes before inspection starts and 15 minutes after completion of inspection. Inspect plumbing fixture connections for gas, air and water leaks.

2. Air test only

- a. Rough Plumbing Test Procedure: If tests are made with air, apply a pressure of not less than 5 psig with a force pump and test as specified above. Use mercury-column gauge registering 10 inches in height in air test. Use air tests only when air temperatures around tested system are 32° F. or below and temporary heat is not available.
- b. Finished Plumbing Test Procedure: Test as specified above.

- D. Domestic Hot and Cold Water: Test hydrostatically upon completion of the rough-in and before insulating or setting fixtures. Maintain pressure for not less than 4 hours without leakage.

3.10 VALVES

- A. Refer to Section 22 05 00 for basic requirements.

END OF SECTION 22 10 00

SECTION 22 11 00 - DISINFECTION OF DOMESTIC WATER LINES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SUMMARY

- A. This section includes the disinfection and laboratory testing of domestic water piping systems to certify disinfection of system.
- B. Related Sections: Division 22.

1.3 DEFINITIONS

- A. Disinfectant Residual means the quantity of disinfectant in treated water.
- B. pH Factor means the measure of alkalinity and acidity in water.
- C. Ppm means parts per million.
- D. CFU/mL means colony forming units per milliliter.

1.4 QUALITY ASSURANCE

- A. Water Treatment Contractor: At least 5 years experience performing Work specified herein.
- B. Bacteriological Laboratory: Certified by State of California and by federal and local authorities having jurisdiction.

1.5 REFERENCE STANDARDS

- A. Comply with State of California and local Health Department requirements.
- B. AWWA Specification C-651 - Disinfecting Water Mains.
- C. Centers for Disease Control and Prevention (CDC) Standard Methods #9260J.

1.6 SUBMITTALS

- A. Water Treatment Contractor's evidence of certification: Submit four copies.

- B. Water Treatment Contractor's evidence of experience: Submit four copies.
- C. Bacteriological Laboratory's evidence of certification: Submit four copies.
- D. Tests Reports: Submit four copies as follows:
 - 1. Disinfection Report, include:
 - a. Date issued
 - b. Project name and location
 - c. Treatment Contractor's name, address, and phone number and name of person executing disinfection
 - d. Type and form of Disinfectant used
 - e. Time and date of Disinfectant injection start and completion
 - f. Test Locations
 - g. Initial and 24 hour Disinfectant Residuals in ppm for each outlet tested
 - h. Time and date of flushing start and completion
 - i. Disinfectant Residual after flushing in ppm for each outlet tested
 - 2. Bacteriological Report; include:
 - a. Date issued
 - b. Project name and location
 - c. Laboratory's name, certification number, address and phone number
 - d. Time and date of water sample collection
 - e. Name of person collecting samples
 - f. Test locations
 - g. Time and date of laboratory test start
 - h. Coliform bacteria test results for each outlet tested
 - i. Certification that water conforms or fails to conform to bacterial standards or fails to conform to bacterial standards of Federal Safe Drinking Water Act.
 - j. Bacteriologist's signature
 - 3. Legionella Report; include:
 - a. Date issued
 - b. Project name and location
 - c. Laboratory's name, certification number, address and phone number
 - d. Time and date of water sample collection
 - e. Name of person collecting samples
 - f. Test sample point location
 - g. Initial flow temperature of sample
 - h. Stabilized flow temperature of sample
 - i. Time and date of laboratory test start
 - j. Legionella test results for each test sample
 - k. Test method used
 - l. Bacteriologist's signature
 - 4. Include in report test procedures and results as required by Office of Statewide Health Planning and Development (OSHPD)

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protect against damage and contamination.
- B. Maintain caution labels on hazardous materials.
- C. Maintain storage room dry and with temperatures as uniform as possible between 60 deg F. and 80 deg F.

1.8 PROTECTION

- A. Provide necessary signs, barricades and notices to prevent any person from accidentally consuming water or disturbing system being treated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. DISINFECTANT

- 1. Sodium Hypochlorite; liquid, powder, tablet, or gas.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Prior to starting Work verify that domestic water system is completed and cleaned.
- B. Notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.
- D. Follow procedures as indicated in the California Plumbing Code Section 609.9(1) through 609.9(4).

3.2 SYSTEM TREATMENT

- A. Inject Disinfectant to obtain 200 ppm residual throughout the system.
- B. Starting at outlet closest to water source, bleed water from each outlet until water produces odor of disinfectant. Repeat process at each outlet throughout system.
- C. Maintain disinfectant in system for 3 hours.
- D. At the end of retention period, test for Disinfectant Residual at each of the following locations:

1. Ends of piping runs
2. Remote outlets

E. If Disinfectant Residual is less than 10 ppm, repeat system treatment.

3.3 FLUSHING

- A. Remove disinfectant by flushing system with clean water until residual rate is reduced to less than 1.0 ppm.

3.4 BACTERIOLOGICAL TEST

- A. Instruct Bacteriological Laboratory to take water samples no sooner than 24 hours after flushing system.
- B. Consult local sewage treatment facility and insure that pH levels of disinfectant to be disposed is satisfactory prior to disposal. Provide all means and methods necessary to meet disposal requirements of authorities having jurisdiction.
- C. Take water samples at each of the following locations:
1. Where water enters system
 2. Ends of piping runs
 3. Remote outlets
- D. Analyze water samples in accordance with AWWA Standard Methods for the Examination of Water & Waste Water, 14th edition.
- E. If bacteriological test proves water quality to be unacceptable, repeat disinfection of system until satisfactory bacteriological results have been obtained.

3.5 LEGIONELLA TEST

- A. Instruct bacteriological laboratory to take water samples no sooner than 24 hours after flushing system.
- B. Take water samples at each of the following locations:
1. Incoming water supply
 2. Ends of piping runs
 3. Remote outlets
- C. Analyze water samples in accordance with CDC Standard Method #9260J, or other internationally recognized test method as recommended by groups such as Special Pathogens Laboratory of the VA Medical Center, Pittsburgh, Pennsylvania.
- D. Samples shall be delivered to the laboratory and analyzed within 48 hours of collection. Samples shall be protected from extreme temperature variations during transport.