



DIVISION 00 - SPECIAL SECTIONS

00 01 15 List of Drawings

DIVISION 01 - GENERAL REQUIREMENTS

01 00 00 General Requirements
01 01 10 Fire Safety Section
01 01 20 Infection Control
01 33 23 Shop Drawings, Product Data, And Samples
01 42 19 Reference Standards

DIVISION 02 - EXISTING CONDITIONS

02 41 00 Demolition
02 82 11 Traditional Asbestos Abatement (Class I Negative Pressure Enclosure Asbestos Abatement Specifications)
02 83 33.13 Lead-Based Paint Removal and Disposal

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 10 00 Rough Carpentry
06 40 23 Interior Architectural Woodwork
06 61 00 Solid Surface Materials

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 84 00 Firestopping
07 92 00 Joint Sealants

DIVISION 08 - OPENINGS

08 11 13 Hollow Metal Doors And Frames
08 14 00 Interior Wood Doors
08 71 00 Door Hardware

DIVISION 09 - FINISHES

09 22 16 Non-Structural Metal Framing
09 29 00 Gypsum Board
09 51 00 Acoustical Ceilings
09 65 13 Resilient Base and Accessories
09 65 16 Resilient Sheet Flooring
09 91 00 Painting

DIVISION 10 - SPECIALTIES

- 10 14 00 Signage
- 10 21 13 Toilet Compartments
- 10 26 00 Wall And Door Protection
- 10 28 00 Toilet, Bath, And Laundry Accessories
- 10 51 16 Phenolic Lockers

DIVISION 21 - FIRE SUPPRESSION

- 21 13 13 Wet-Pipe Sprinkler System

DIVISION 22 - PLUMBING

- 22 05 11 Common Work Results for Plumbing
- 22 05 12 General Motor Requirements For Plumbing Equipment
- 22 05 19 Meters and Gages for Plumbing Piping
- 22 05 23 General-Duty Valves for Plumbing Piping
- 22 05 53 Identification For Plumbing Piping And Equipment
- 22 07 11 *Plumbing Insulation (ADM 02)*
- 22 11 00 Facility Water Distribution
- 22 13 00 Facility Sanitary Sewerage
- 22 14 00 Family Storm Drainage
- 22 40 00 Plumbing Fixtures

DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING

- 23 05 11 Common Work Results for HVAC
- 23 05 93 Testing, Adjusting, And Balancing (TAB) For HVAC
- 23 09 23 Instrumentation and Control for HVAC
- 23 31 00 HVAC Ducts And Casings
- 23 37 00 Air Outlets And Inlets

DIVISION 26 - ELECTRICAL

- 26 05 11 Requirements For Electrical Installations
- 26 05 21 Low-voltage Electrical Power Conductors And Cables (600 Volts and Below)
- 26 05 26 Grounding And Bonding For Electrical Systems
- 26 05 33 Raceway And Boxes For Electrical Systems
- 26 09 23 Lighting Controls
- 26 27 26 Wiring Devices
- 26 51 00 Interior Lighting



DIVISION 27 - COMMUNICATIONS

27 05 11 Requirements For Communications Installations

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 05 11 Requirements For Electronic Safety And Security Installations

END OF TABLE OF CONTENTS

THIS PAGE WAS INTENTIONALLY LEFT BLANK



SECTION 00 01 15 - LIST OF DRAWINGS

The drawings listed below accompanying this specification form a part of the contract.

DOMESTIC WATER REPLACEMENT BUILDING 1 VA PROJECT NO. 655-10-107

<u>Drawing No.</u>	<u>Title</u>
	GENERAL
G-101	Title Sheet
	PLUMBING
PD-100	Basement Sanitary And Storm Demolition Units A, B, & C
PD-101	Basement Sanitary And Storm Demolition Units D, E, & F
PD-102	Basement Domestic Demolition Units A, B, & C
PD-103	Basement Domestic Demolition Units D, E, & F
PD-110	First Floor Sanitary And Storm Demolition Units A, B, & C
PD-111	First Floor Sanitary And Storm Demolition Units D, E, & F
PD-120	Second Floor Sanitary And Storm Demolition Units A, B, & C
PD-121	Second Floor Sanitary And Storm Demolition Units D, E, & F
PD-130	Third Floor sanitary And Storm Demolition Units A, B, & C
PD-131	Third Floor Sanitary And Storm Demolition Unit D
PD-140	Fourth Floor Sanitary And Storm Demolition Units A, B, & C
PD-150	Fifth Floor Sanitary And Storm Demolition Units A, B, & C
PD-160	Penthouse Sanitary And Storm Demolition (ADM 02)
PL-100	Basement Sanitary And Storm Piping Units A, B, & C
PL-101	Basement Sanitary And Storm Piping Units D, E, & F
PL-102	Basement Domestic Plumbing Units A, B, & C
PL-103	Basement Domestic Plumbing Units D, E, & F
PL-110	First Floor Sanitary And Storm Piping Units A, B, & C
PL-111	First Floor Sanitary And Storm Piping Units D, E, & F
PL-112	First Floor Domestic Plumbing Units A, B, & C
PL-113	First Floor Domestic Plumbing Units D, E, & F
PL-120	Second Floor Sanitary And Storm Piping Units A, B, & C
PL-121	Second Floor Sanitary And Storm Piping Units D, E, & F
PL-122	Second Floor Domestic Plumbing Units A, B, & C
PL-123	Second Floor Domestic Plumbing Units D, E, & F
PL-130	Third Floor Sanitary And Storm Piping Units A, B, & C
PL-131	Third Floor Sanitary And Storm Piping Unit D
PL-132	Third Floor Domestic Plumbing Units A, B, & C
PL-133	Third Floor Domestic Plumbing Unit D
PL-140	Fourth Floor Sanitary And Storm Piping Units A, B, & C
PL-141	Fourth Floor Domestic Plumbing Units A, B, & C
PL-150	Fifth Floor Sanitary And Storm Piping Units A, B, & C
PL-151	Fifth Floor Domestic Plumbing Units A, B, & C

PL-160	Penthouse Sanitary Piping (ADM 02)
PL-300	Plumbing Enlargements
PL-301	Building 1 Domestic Water Isometric
PL-302	Building 1 Sanitary Isometric
PL-500	Details

RESTROOM RENOVATIONS VA PROJECT NO. 665-11-102

<u>Drawing No.</u>	<u>Title</u>
GENERAL	
G-001	Title Sheet
G-002	Partition Types & Mounting Heights
BUILDING 1 ARCHITECTURAL	
1- AD100	Bldg 1 – Basement Demolition Plans
1- AD110	Bldg 1 – First Floor Demolition Plans
1- AD120	Bldg 1 – Second Floor Demolition Plans
1- AD130	Bldg 1 – Third Floor Demolition Plans
1- AD140	Bldg 1 – Fourth Floor Demolition Plans
1- AD150	Bldg 1 – Fifth Floor Demolition Plans
1- A100	Bldg 1 – Basement Plans
1- A101	Bldg 1 – Basement RCP Plans
1- A110	Bldg 1 – First Floor Plans
1- A111	Bldg 1 – First Floor RCP Plans
1- A120	Bldg 1 – Second Floor Plans
1- A121	Bldg 1 – Second Floor RCP Plans
1- A130	Bldg 1 – Third Floor Plans
1- A131	Bldg 1 – Third Floor RCP Plans
1- A140	Bldg 1 – Fourth Floor Plans
1- A141	Bldg 1 – Fourth Floor RCP Plans
1- A150	Bldg 1 – Fifth Floor Plans
1- A151	Bldg 1 – Fifth Floor RCP Plans
1- A600	Door Schedule, Types & Details
BUILDING 1 INTERIORS	
1-I400	Bldg 1 – Interior Elevations
1-I600	Bldg 1 – Room Finish & Materials Schedule
BUILDING 1 PLUMBING	
1-PD100	Bldg 1 – Basement Plumbing Demolition Plans
1-P100	Bldg 1 – Basement Fixture Plans
1-P101	Bldg 1 – Basement Plumbing Plans
1-P110	Bldg 1 – First Floor Fixture Plans
1-P120	Bldg 1 – Second Floor Fixture Plans
1-P130	Bldg 1 – Third Floor Fixture Plans



1-P140	Bldg 1 – Fourth Floor Fixture Plans
1-P150	Bldg 1 – Fifth Floor Fixture Plans
1-P500	Bldg 1 – Plumbing Details

BUILDING 1 ELECTRICAL

1-ED100	Bldg 1 – Basement Electrical Demolition Plans
1-ED110	Bldg 1 – First Floor Electrical Demolition Plans
1-ED120	Bldg 1 – Second Floor Electrical Demolition Plans
1-ED130	Bldg 1 – Third Floor Electrical Demolition Plans
1-ED140	Bldg 1 – Fourth Floor Electrical Demolition Plans
1-ED150	Bldg 1 – Fifth Floor Electrical Demolition Plans
1-E100	Bldg 1 – Basement Electrical Plans
1-E110	Bldg 1 – First Floor Electrical Plans
1-E120	Bldg 1 – Second Floor Electrical Plans
1-E130	Bldg 1 – Third Floor Electrical Plans
1-E140	Bldg 1 – Fourth Floor Electrical Plans
1-E150	Bldg 1 – Fifth Floor Electrical Plans

BUILDING 2 ARCHITECTURAL

2- A100	Bldg 2 – Demolition Plans, Floor Plans & RCP
---------	--

BUILDING 2 INTERIORS

2-I600	Bldg 2 – Schedules, Finish Plans, Interior Elevations & Details
--------	---

BUILDING 2 PLUMBING

2-P110	Bldg 2 – First Floor Plumbing Plans
2-P120	Bldg 2 – Second Floor Plumbing Plans

BUILDING 2 ELECTRICAL

2-E110	Bldg 2 – First Floor Electrical Plans
--------	---------------------------------------

BUILDING 3 ARCHITECTURAL

3- A100	Bldg 3 – Demolition Plans, Floor Plans & RCP
---------	--

BUILDING 3 INTERIORS

3-I600	Bldg 3 – Schedules, Finish Plans, Interior Elevations & Details
--------	---

BUILDING 3 PLUMBING

3-P110	Bldg 3 – First Floor Plumbing Plans
--------	-------------------------------------

BUILDING 3 ELECTRICAL

3-E110	Bldg 3 – First Floor Electrical Plans
--------	---------------------------------------

BUILDING 4 ARCHITECTURAL

4- A100	Bldg 4 – Demolition Plans, Floor Plans & RCP
---------	--

BUILDING 4 INTERIORS

4-I600 Bldg 4 – Schedules, Finish Plans, Interior Elevations & Details

BUILDING 4 PLUMBING

4-P110 Bldg 4 – First Floor Plumbing Plans
4-P120 Bldg 4 – Second Floor Plumbing Plans

BUILDING 4 ELECTRICAL

4-E110 Bldg 4 – Electrical Plans

END OF SECTION 00 01 15



SECTION 22 07 11 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Field applied insulation for thermal efficiency and condensation control for
 - 1. Plumbing piping and equipment.
 - 2. Re-insulation of plumbing piping and equipment after asbestos abatement.
- B. Definitions
 - 1. ASJ: All service jacket, white finish facing or jacket.
 - 2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
 - 3. Cold: Equipment or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
 - 4. Concealed: Piping above ceilings and in chases, and pipe spaces.
 - 5. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
 - 6. FSK: Foil-scrim-kraft facing.
 - 7. Hot: Plumbing equipment or piping handling media above 41 degrees C (105 degrees F).
 - 8. Density: kg/m³ - kilograms per cubic meter (Pcf - pounds per cubic foot).
 - 9. Thermal conductance: Heat flow rate through materials.
 - a. Flat surface: Watts per square meter (BTU per hour per square foot).
 - b. Pipe or Cylinder: Watts per square meter (BTU per hour per linear foot).
 - 10. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
 - 11. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.
 - 12. R: Pump recirculation.
 - 13. CW: Cold water.
 - 14. HW: Hot water.

1.2 RELATED WORK

- A. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT: Insulation containing asbestos material.
- B. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: General mechanical requirements and items, which are common to more than one section of Division 22.
- D. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water piping.

1.3 QUALITY ASSURANCE

- A. Refer to article QUALITY ASSURANCE, in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- B. Criteria:

- 1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4, parts of which are quoted as follows:

4.3.3.1 Pipe insulation and coverings, vapor retarder facings, adhesives, fasteners, tapes, unless otherwise provided for in 4.3.3.1.12 or 4.3.3.1.2, shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.

4.3.3.1.1 Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)

4.3.3.3 Pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service.

4.3.3.3.1 In no case shall the test temperature be below 121°C (250°F).



4.3.10.2.6.3 Nonferrous fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

4.3.10.2.6.7 Smoke detectors shall not be required to meet the provisions of this section.

2. Test methods: ASTM E84, UL 723, or NFPA 255.
 3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
 4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.
- C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
 - a. Insulation materials: Specify each type used and state surface burning characteristics.
 - b. Insulation facings and jackets: Each type used.
 - c. Insulation accessory materials: Each type used.
 - d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
 - e. Make reference to applicable specification paragraph numbers for coordination.

C. Samples:

1. Each type of insulation: Minimum size 100 mm (4 inches) square for board/block/blanket; 150 mm (6 inches) long, full diameter for round types.
2. Each type of facing and jacket: Minimum size 100 mm (4 inches square).
3. Each accessory material: Minimum 120 ML (4 ounce) liquid container or 120 gram (4 ounce) dry weight for adhesives / cement / mastic.

1.5 STORAGE AND HANDLING OF MATERIAL

- A. Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

B. Federal Specifications (Fed. Spec.):

L-P-535E (2)-91 Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

C. Military Specifications (Mil. Spec.):

MIL-A-3316C (2)-90 Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A (1)-87 Adhesive, Flexible Unicellular-Plastic
Thermal Insulation

MIL-C-19565C (1)-88 Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier

MIL-C-20079H-87 Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass

D. American Society for Testing and Materials (ASTM):

A167-04 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

B209-07 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C411-05 Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation

C449-07 Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement



-
- C533-09 Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
- C534-08 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
- C547-07 Standard Specification for Mineral Fiber pipe Insulation
- C552-07 Standard Specification for Cellular Glass Thermal Insulation
- C553-08 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
- C585-09 Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System) R (1998)
- C612-10 Standard Specification for Mineral Fiber Block and Board Thermal Insulation
- C1126-10 Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
- C1136-10 Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
- D1668-97a (2006) Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
- E84-10 Standard Test Method for Surface Burning Characteristics of Building Materials
- E119-09C Standard Test Method for Fire Tests of Building Construction and Materials
- E136-09 b Standard Test Methods for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C (1380 F)
- E. National Fire Protection Association (NFPA):
- 101-09 Life Safety Code
- 251-06 Standard methods of Tests of Fire Endurance of Building Construction Materials
- 255-06 Standard Method of tests of Surface Burning Characteristics of Building Materials
- F. Underwriters Laboratories, Inc (UL):
- 723 UL Standard for Safety Test for Surface Burning Characteristics of Building Materials with Revision of 08/03
- G. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS):
- SP58-2002 Pipe Hangers and Supports Materials, Design, and Manufacture

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

- A. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, $k = 0.037$ (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride pre-molded fitting covering.
- B. Comply with Standard ASTM C612, Class 3, 450 degrees C (850 degrees F).

2.2 RIGID CELLULAR PHENOLIC FOAM

- A. Preformed (molded) pipe insulation, ASTM C1126, type III, grade 1, $k = 0.021$ (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with vapor retarder and all service vapor retarder jacket with polyvinyl chloride pre-molded fitting covering.

2.3 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

- A. ASTM C177, C518, $k = 0.039$ (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

2.4 INSULATION FACINGS AND JACKETS

- A. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.
- B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK) or PVDC vapor retarder jacketing type for concealed ductwork and equipment.



- D. Field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping as well as on interior piping conveying fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.
- E. Factory composite materials may be used provided
- F. Pipe fitting insulation covering (jackets): Fitting covering shall be pre-molded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.

2.5 PIPE COVERING PROTECTION SADDLES

- A. Cold pipe support: Pre-molded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass of the same thickness as adjacent insulation.
- B. Warm or hot pipe supports: Pre-molded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density calcium silicate. Insulation at supports shall have same thickness as adjacent insulation.

2.6 ADHESIVE, MASTIC, CEMENT

- A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.
- B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.
- C. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
- D. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.
- E. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.
- F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
- G. Other: Insulation manufacturers' published recommendations.

2.7 MECHANICAL FASTENERS

- A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- B. Staples: Outward clinching galvanized steel
- C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
- D. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.8 REINFORCEMENT AND FINISHES

- A. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.
- B. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.
- C. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.
- D. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

2.9 FIRESTOPPING MATERIAL

- A. Other than pipe insulation, refer to Section 07 84 00 FIRESTOPPING.

2.10 FLAME AND SMOKE

- A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".



PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Required pressure tests of piping joints and connections shall be completed and the work approved by the COTR for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- B. Except for specific exceptions, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.
- C. Where removal of insulation of piping and equipment is required to comply with Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT, such areas shall be reinsulated to comply with this specification.
- D. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).
- E. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.
- F. Construct insulation on parts of equipment such as cold water pumps and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.
- G. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- H. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.
- I. Plumbing work not to be insulated:
 - 1. Piping and valves of fire protection system.
 - 2. Chromium plated brass piping.
 - 3. Water piping in contact with earth.

4. Small horizontal cold water branch runs in partitions to individual fixtures may be without insulation for maximum distance of 900 mm (3 feet).
- J. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.
- K. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.
- L. Firestop Pipe insulation:
 1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 07 84 00, FIRESTOPPING.
 2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
 - a. Pipe risers through floors
 - b. Pipe chase walls and floors
 - c. Smoke partitions
 - d. Fire partitions
 3. All interior piping conveying fluids below ambient air temperature in high humidity areas.

3.2 INSULATION INSTALLATION

- A. Molded Mineral Fiber Pipe and Tubing Covering:
 1. Fit insulation to pipe, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
 2. Contractor's options for fitting, flange and valve insulation:
 - a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
 - b. Factory pre-molded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 degrees C (40 degrees F), or above 121 degrees C (250 degrees F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.



- c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
 - d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
 - 3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.
- B. Rigid Cellular Phenolic Foam:
 - 1. Rigid closed cell phenolic insulation may be provided for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).
 - 2. Note the NFPA 90A burning characteristics requirements of 25/50 in paragraph 1.3.B
 - 3. Provide secure attachment facilities such as welding pins.
 - 4. Apply insulation with joints tightly drawn together
 - 5. Apply adhesives, coverings, neatly finished at fittings, and valves.
 - 6. Final installation shall be smooth, tight, neatly finished at all edges.
 - 7. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.
 - 8. Condensation control insulation: Minimum 25 mm (1.0 inch) thick for all pipe sizes.
 - a. Plumbing piping as follows:
 - 1) Cold water piping.
- C. Flexible Elastomeric Cellular Thermal Insulation:
 - 1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer.
 - 2. Pipe and tubing insulation:
 - a. Use proper size material. Do not stretch or strain insulation.
 - b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
 - c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.

3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.

3.3 PIPE INSULATION SCHEDULE

- A. Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	Insulation Material	Less than 25 (1)	25 – 32 (1 – 1¼)	38 – 75 (1½ - 3)	100 (4) and Above
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Rigid Cellular Phenolic Foam (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	----	----
4-16 degrees C (40-60 degrees F) (Domestic Cold Water)	Rigid Cellular Phenolic Foam (Above ground piping only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
(4-16 degrees C (40-60 degrees F) (Domestic Cold Water)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)

END OF SECTION 22 07 11



SECTION 22 11 00 - FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

- A. Penetrations in rated enclosures: Section 07 84 00, FIRESTOPPING.
- B. Preparation and finish painting and identification of piping systems: Section 09 91 00, PAINTING.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Piping.
 - 2. Strainers.
 - 3. All items listed in Part 2 - Products.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - A-A-1427C..... Sodium Hypochlorite Solution
 - A-A-59617 Unions, Brass or Bronze Threaded, Pipe Connections and Solder-Joint Tube Connections

C. American National Standards Institute (ANSI):

American Society of Mechanical Engineers (ASME): (Copyrighted Society)

A13.1-96.....	Scheme for Identification of Piping Systems
B16.3-98.....	Malleable Iron Threaded Fittings ANSI/ASME
B16.9-01.....	Factory-Made Wrought Steel Butt welding Fittings ANSI/ASME
B16.11-01.....	Forged Steel Fittings, Socket-Welding and Threaded ANSI/ASME
B16.15-85(R 1994).....	Cast Bronze Threaded Fittings ANSI/ASME
B16.18-01.....	Cast Copper Alloy Solder-Joint Pressure Fittings ANSI/ASME
B16.22-01.....	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings ANSI/ASME Element ANSI/ASME

D. American Society for Testing and Materials (ASTM):

A47-99.....	Ferritic Malleable Iron Castings Revision 1989
A536-84(R1999) E1.....	Ductile Iron Castings
B32-03.....	Solder Metal
B75-99(Rev A).....	Seamless Copper Tube
B88-03.....	Seamless Copper Water Tube
B584-00.....	Copper Alloy Sand Castings for General Applications Revision A
B687-99.....	Brass, Copper, and Chromium-Plated Pipe Nipples

E. American Water Works Association (AWWA):

C110-03/ A21.10-03.....	Ductile Iron and Gray Iron Fittings - 75 mm thru 1200 mm (3 inch thru 48 inches) for Water and other liquids AWWA/ ANSI
C151-00/ A21.51-02.....	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids AWWA/ ANSI
C651-99.....	Disinfecting Water Mains

F. American Welding Society (AWS):

A5.8-92.....	Filler Metals for Brazing
--------------	---------------------------

G. National Association of Plumbing - Heating - Cooling Contractors (PHCC):

National Standard Plumbing Code - 1996



- H. International Association of Plumbing and Mechanical Officials (IAPMO):
 - Uniform Plumbing Code - 2000
 - IS6-93..... Installation Standard
- I. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
 - SP-72-99..... Ball Valves With Flanged or Butt Welding For General Purpose
 - SP-110-96..... Ball Valve Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends
- J. American Society of Sanitary Engineers (ASSE):
 - 1001-02..... Pipe Applied Atmospheric Type Vacuum Breakers
 - 1018-01..... Performance for trap seal primer valve-water supply fed
 - 1020-04..... Vacuum Breakers, Anti-Siphon, Pressure Type
- K. Plumbing and Drainage Institute (PDI):
 - PDI WH-201..... Water Hammer Arrestor

PART 2 - PRODUCTS

2.1 WATER SERVICE CONNECTIONS TO BUILDINGS

- A. From inside face of exterior wall to a distance of approximately 1500 mm (5 feet) outside of building and underground inside building, material selected shall be the same for the size specified.
- B. Seventy five millimeters (3 inch) Diameter and Over: Ductile iron, AWWA C151, 850 kPa (125 pounds) water steam pressure (WSP), exterior bituminous coating, cement lined. Provide flanged and anchored connection to interior piping.
- C. Under 75 mm (3 inch) Diameter: Copper tubing, ASTM B88, Type K, seamless, annealed. Fittings as specified under Article, INTERIOR DOMESTIC WATER PIPING. Use brazing alloys, AWS A5.8, Classification BCuP.

2.2 INTERIOR DOMESTIC WATER PIPING

- A. Pipe: Copper tube, ASTM B88, Type K or L, drawn. For pipe 75 mm (3 inches) and larger, stainless, steel ASTM A312, schedule 10 may be used.

B. Fittings for Copper Tube:

1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, MSS SP72 & SP 110, Solder or braze joints.
2. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper ASTM B75 C12200, 125 to 150 mm (5 to 6 inch) bronze casting ASTM B584, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
3. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints.

C. Fittings for Stainless Steel:

1. *Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ANSI B16.9.*
2. *Grooved fittings, stainless steel, Type 316, Schedule 10, conforming to ASTM A403. Segmentally fabricated fittings are not allowed. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or Malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel. (ADM 02)*

2.3 EXPOSED WATER PIPING

- A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
1. Pipe: Fed. Spec. WW-P-351, standard weight.
 2. Fittings: ANSI B16.15 cast bronze threaded fittings with chrome finish, (125 and 250).
 3. Nipples: ASTM B 687, Chromium-plated.
 4. Unions: Mss SP-72, SP-110, Brass or Bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.
- B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09 91 00, PAINTING.



2.5 TRAP PRIMER WATER PIPING

- A. Pipe: Copper tube, ASTM B88, type K, hard drawn.
- B. Fittings: Bronze castings conforming to ANSI B16.18 Solder joints.
- C. Solder: ASTM B32 composition Sb5. Provide non-corrosive flux.

2.6 WATERPROOFING

- A. Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.
- B. Floors: Provide cast iron stack sleeve with flashing device and a underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.
- C. Walls: See detail shown on drawings.

2.7 STRAINERS

- A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.
- B. Water: Basket or "Y" type with easily removable cover and brass strainer basket.
- C. Body: Smaller than 80 mm (3 inches), brass or bronze; 80 mm (3 inches) and larger, cast iron or semi-steel.

2.8 DIELECTRIC FITTINGS

- A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

2.9 STERILIZATION CHEMICALS

- A. Liquid Chlorine: ASTM E1120.
- B. Hypochlorite: ASTM E1229, or Fed. Spec. AA-1427C, grade B.

2.10 WATER HAMMER ARRESTER

- A. Closed copper tube chamber with permanently sealed 410 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N O-rings pressure packed and lubricated with FDA approved Dow Corning No. 11 silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Plumbing and Drainage Institute requirements (PDI WH 201). Provide water hammer arrestors at all solenoid valves, at all groups of two or more flush valves, at all quick opening or closing valves, and at all medical washing equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with the PHCC National Standard Plumbing Code and the following:
1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
 2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.
 3. All pipe runs shall be laid out to avoid interference with other work.
 4. Install union and shut-off valve on pressure piping at connections to equipment.
 5. Pipe Hangers, Supports and Accessories:
 - a. All piping shall be supported per of the National Standard Plumbing Code, Chapter No. 8.
 - b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with red lead or zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
 - c. Floor, Wall and Ceiling Plates, Supports, Hangers:
 - 1) Solid or split unplated cast iron.
 - 2) All plates shall be provided with set screws.
 - 3) Pipe Hangers: Height adjustable clevis type.
 - 4) Adjustable Floor Rests and Base Flanges: Steel.
 - 5) Concrete Inserts: "Universal" or continuous slotted type.
 - 6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
 - 7) Riser Clamps: Malleable iron or steel.
 - 8) Rollers: Cast iron.



- 9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
 - 10) Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gauge steel. The shield shall be sized for the insulation.
 - 11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
- 6. Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
 - 7. Penetrations:
 - a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the fire stopping materials.
 - b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.
- B. Piping shall conform to the following:
- 1. Domestic Water:
 - a. Where possible, grade all lines to facilitate drainage. Provide drain valves at bottom of risers. All unnecessary traps in circulating lines shall be avoided.
 - b. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

3.2 TESTS

- A. General: Test system either in its entirety or in sections.
- B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 690 kPa (100 psi) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested.

- C. Reagent Grade Water Systems: Fill system with water and maintain hydrostatic pressure of 690 kPa (100 psi) gage during inspection and prove tight.
- D. All Other Piping Tests: Test new installed piping under 1 1/2 times actual operating conditions and prove tight.

3.3 STERILIZATION

- A. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.
- B. Use either liquid chlorine or hypochlorite for sterilization.

END OF SECTION 22 11 00