

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Light-activated thermometers.
5. Thermowells.
6. Pressure gages.
7. Gage attachments.
8. Test plugs.
9. Test-plug kits.
10. Sight flow indicators.

B. Related Requirements:

1. Section 221119 "Domestic Water Piping Specialties" for water meters.
2. Section 221513 "General-Service Compressed-Air Piping" for compressed air gages.
3. Section 331415 "Site Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- ##### A. Product Certificates: For each type of meter and gage.

1.4 CLOSEOUT SUBMITTALS

- ##### A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- ##### A. Standard: ASME B40.200.

- B. Case: stainless steel with 3-inch nominal diameter.
- C. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- D. Connector Type(s): Union joint, with unified-inch screw threads.
- E. Connector Size: ASME B1.1 screw threads.
- F. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- G. Window: Plain glass or plastic.
- H. Ring: Stainless steel.
- I. Element: Bimetal coil.
- J. Pointer: Dark-colored metal.
- K. Accuracy: Plus or minus 1 percent of scale range.

2.2 FILLED-SYSTEM THERMOMETERS

- A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:
 - 1. Standard: ASME B40.200.
 - 2. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
 - 3. Element: Bourdon tube or other type of pressure element.
 - 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 5. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
 - 6. Pointer: Dark-colored metal.
 - 7. Window: Glass or plastic.
 - 8. Ring: Metal.
 - 9. Connector Type(s): Union joint, with ASME B1.1 screw threads.
 - 10. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 - 11. Accuracy: Plus or minus 1 percent of scale range.
- B. Direct-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
 - 1. Standard: ASME B40.200.
 - 2. Case: Sealed type, plastic; 4-1/2-inch nominal diameter.
 - 3. Element: Bourdon tube or other type of pressure element.
 - 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 5. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
 - 6. Pointer: Dark-colored metal.
 - 7. Window: Glass or plastic.

8. Ring: Metal or plastic.
 9. Connector Type(s): Union joint, with ASME B1.1 screw threads.
 10. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 11. Accuracy: Plus or minus 1 percent of scale range.
- C. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:
1. Standard: ASME B40.200.
 2. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter with flange and holes for panel mounting.
 3. Element: Bourdon tube or other type of pressure element.
 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 5. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
 6. Pointer: Dark-colored metal.
 7. Window: Glass or plastic.
 8. Ring: Metal.
 9. Connector Type(s): Union joint, with ASME B1.1 screw threads.
 10. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 11. Accuracy: Plus or minus 1 percent of scale range.
- D. Remote-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
1. Standard: ASME B40.200.
 2. Case: Sealed type, plastic; 4-1/2-inch nominal diameter with flange and holes for panel mounting.
 3. Element: Bourdon tube or other type of pressure element.
 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 5. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
 6. Pointer: Dark-colored metal.
 7. Window: Glass or plastic.
 8. Ring: Metal or plastic.
 9. Connector Type(s): Union joint, threaded, with ASME B1.1 screw threads.
 10. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 11. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Cast aluminum; 6-inch nominal size.
3. Tube: Glass with magnifying lens and blue or red organic liquid.
4. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
5. Window: Glass or plastic.
6. Stem: Aluminum or brass and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
7. Connector: 3/4 inch, with ASME B1.1 screw threads.
8. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Plastic; 6-inch nominal size.
3. Tube: Glass with magnifying lens and blue or red organic liquid.
4. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F.
5. Window: Glass or plastic.
6. Stem: Aluminum or brass and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
7. Connector: 3/4 inch, with ASME B1.1 screw threads.
8. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

C. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
3. Tube: Glass with magnifying lens and blue or red organic liquid.
4. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
5. Window: Glass or plastic.
6. Stem: Aluminum and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
7. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
8. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

D. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Plastic; 7-inch nominal size unless otherwise indicated.
3. Tube: Glass with magnifying lens and blue or red organic liquid.
4. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
5. Window: Glass or plastic.
6. Stem: Aluminum, brass, or stainless steel and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
7. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
8. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.4 LIGHT-ACTIVATED THERMOMETERS

A. Direct-Mounted, Light-Activated Thermometers:

1. Case: Plastic or Metal; 7-inch nominal size unless otherwise indicated.
2. Scale(s): Deg F
3. Connector: ASME B1.1 screw threads.
4. Stem: Aluminum and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
5. Display: Digital.
6. Accuracy: Plus or minus 2 deg F.

B. Remote-Mounted, Light-Activated Thermometers:

1. Case: Plastic, for wall mounting.
2. Scale(s): Deg F.
3. Sensor: Bulb and thermister wire.
 - a. Design for Thermowell Installation: Bare stem.
4. Display: Digital.
5. Accuracy: Plus or minus 2 deg F.

2.5 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES or CSA.

5. Type: Stepped shank unless straight or tapered shank is indicated.
 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
 7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
 8. Bore: Diameter required to match thermometer bulb or stem.
 9. Insertion Length: Length required to match thermometer bulb or stem.
 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
 11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.6 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Standard: ASME B40.100.
 2. Case: cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
 3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 5. Movement: Mechanical, with link to pressure element and connection to pointer.
 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
 7. Pointer: Dark-colored metal.
 8. Window: Glass or plastic.
 9. Ring: Metal.
 10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
- B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:
1. Standard: ASME B40.100.
 2. Case: plastic; 4-1/2-inch nominal diameter.
 3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 5. Movement: Mechanical, with link to pressure element and connection to pointer.
 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
 7. Pointer: Dark-colored metal.
 8. Window: Glass or plastic.
 9. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
- C. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Standard: ASME B40.100.
 2. Case: metal, 4-1/2-inch nominal diameter with flange and holes for panel mounting.
 3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 5. Movement: Mechanical, with link to pressure element and connection to pointer.
 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
 7. Pointer: Dark-colored metal.

8. Window: Glass or plastic.
 9. Ring: Metal.
 10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
- D. Remote-Mounted, Plastic-Case, Dial-Type Pressure Gages:
1. Standard: ASME B40.100.
 2. Case: plastic; 4-1/2-inch nominal diameter with flange and holes for panel mounting.
 3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 5. Movement: Mechanical, with link to pressure element and connection to pointer.
 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
 7. Pointer: Dark-colored metal.
 8. Window: Glass or plastic.
 9. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.7 GAGE ATTACHMENTS

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

2.8 TEST PLUGS

- A. Description: Test-station fitting made for insertion into piping tee fitting.
- B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- C. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- E. Core Inserts: Chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber.

2.9 TEST-PLUG KITS

- A. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- B. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.
- C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

- D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch-diameter dial and probe. Dial range shall be at least 0 to 200 psig.
- E. Carrying Case: Metal or plastic, with formed instrument padding.

2.10 SIGHT FLOW INDICATORS

- A. Description: Piping inline-installation device for visual verification of flow.
- B. Construction: Bronze or stainless steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.
- C. Minimum Pressure Rating: 125 psig.
- D. Minimum Temperature Rating: 200 deg F.
- E. End Connections for NPS 2 and Smaller: Threaded.
- F. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.

L. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Liquid-filled or Sealed, bimetallic-actuated type.
2. Direct-mounted, metal or plastic-case, vapor-actuated type.
3. Metal Plastic case, liquid-in-glass type.
4. Direct-mounted, light-activated type.
5. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be one of the following:

1. Liquid-filled or Sealed, bimetallic-actuated type.
2. Direct-mounted, metal or plastic-case, vapor-actuated type.
3. Metal Plastic case, liquid-in-glass type.
4. Direct-mounted, light-activated type.
5. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:

1. Liquid-filled or Sealed, bimetallic-actuated type.
2. Direct-mounted, metal or plastic-case, vapor-actuated type.

3. Metal Plastic case, liquid-in-glass type.
 4. Direct-mounted, light-activated type.
 5. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.
- D. Thermometers at inlet and outlet of each remote domestic water chiller shall be one of the following:
1. Liquid-filled or Sealed, bimetallic-actuated type.
 2. Direct-mounted, metal or plastic-case, vapor-actuated type.
 3. Metal Plastic case, liquid-in-glass type.
 4. Direct-mounted, light-activated type.
 5. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.
- E. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping:
1. 0 to 100 deg F.
- B. Scale Range for Domestic Hot-Water Piping:
1. 30 to 240 deg F.

3.6 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at discharge of each water service into building shall be the following:
1. Liquid-filled Sealed Open-front, pressure-relief or Solid-front, pressure-relief, direct-mounted, metal case.
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:
1. Liquid-filled Sealed Open-front, pressure-relief or Solid-front, pressure-relief, direct-mounted, metal case.
- C. Pressure gages at suction and discharge of each domestic water pump shall be the following:
1. Liquid-filled Sealed Open-front, pressure-relief or Solid-front, pressure-relief, direct-mounted, metal case.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping:
1. 0 to 160 psi.

B. Scale Range for Domestic Water Piping:

1. 0 to 160 psi.

END OF SECTION 220519