SECTION 23 05 19
METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.01 REFERENCE STANDARDS

A. ASME B1.1 - Unified Inch Screw Threads (UN, UNR, and UNJ Thread Forms); 2024.

B. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

C. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section Includes:
   1. Liquid-in-glass thermometers.
   2. Thermowells.
   3. Dial-type pressure gauges.
   4. Gage attachments.
   5. Test plugs.
   6. Test-plug kits.

B. Related Requirements:
   1. Section 232216 "Steam and Condensate Piping Specialties" for steam and condensate meters.
   2. Section 239000 “BAS General Requirements”
   3. Section 239010 “BAS Instrumentation”

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Include diagrams for power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

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

1.06 CLOSEOUT SUBMITTALS

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

PART 2 - PRODUCTS

2.01 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by the following:
      a. Trerice, H. O. Co.
      b. Weiss Instruments, Inc.
      c. Flo Fab Inc.
      d. Approved equal
   2. Standard: ASME B40.200.
   3. Case: Cast aluminum; 7-inch nominal size.
   4. Case Form: Adjustable angle unless otherwise indicated.
   5. Tube: Glass with magnifying lens and red organic liquid.
   6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.

7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.
    a. Design for Thermowell Installation: Bare stem.
9. Connector: 3/4 inch, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range.

2.02 THERMOWELLS

A. Thermowells:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Trerice, H.O. Co
    b. Weiss Instruments, Inc
    c. Weksler Glass Thermometer Corp.
    d. Winters Instruments – U.S.
2. Standard: ASME B40.200.
3. Description: Pressure-tight, socket-type fitting made for insertion in piping tee fitting.
4. Material for Use with Copper Tubing: Brass.
5. Material for Use with Steel Piping: Stainless steel.
6. Type: Stepped shank unless straight or tapered shank is indicated.
7. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
8. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
9. Bore: Diameter required to match thermometer bulb or stem.
10. Insertion Length: Length required to match thermometer bulb or stem.
11. Lagging Extension: Include on thermowells for insulated piping and tubing.
12. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.03 PRESSURE GAUGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gauges:
1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
    a. Trerice, H.O. Co
    b. Weiss Instruments, Inc
    c. Weksler Glass Thermometer Corp.
    d. Winters Instruments – U.S.
    e. Approve equal.
2. Standard: ASME B40.100.
3. Case: Liquid-filled Sealed types; cast aluminum 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.04 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS ¼ or NPS 1/2, ASME B1.20.1 pipe threads and piston type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of stainless-steel pipe with NPS 1/4 or NPS 1/2 pipe threads.

C. Valves: Stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.05 TEST PLUGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
   1. Flow Design, Inc.
   2. Trerice, H. O. Co.
   3. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS ¼ or NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 degrees Fahrenheit.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.06 TEST-PLUG KITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
   1. Flow Design, Inc.
   2. Trerice, H. O. Co.
   3. Weiss Instruments, Inc.

B. Furnish one test-plug kit, for each building in the project, containing two thermometers, 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.

C. 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 degrees Fahrenheit.

D. 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 degrees Fahrenheit.

E. 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.

F. Carrying Case: Metal, with formed instrument padding.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connector. 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 direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and syphon fitting in piping for each pressure gage for steam.

H. Install test plugs in piping tees.

I. Install flow indicators in piping systems in accessible positions for easy viewing.

J. Install permanent indicators on walls or brackets in accessible and readable positions.

K. Install thermometers in the following locations:

1. Inlet and outlet of each heat exchanger.
2. Outlet of boiler feedwater tank.

L. Install pressure gages in the following locations:
1. Steam headers.
2. Suction and discharge of each condensate pump.

3.02 CONNECTIONS

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

3.03 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

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

3.04 THERMOMETER SCHEDULE

A. Thermometers shall be the following:
1. Compact-style, liquid-in-glass type.
2. Test plug with chlorosulfonated polyethylene synthetic EPDM self-sealing rubber inserts.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.05 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Steam and Steam-Condensate Piping: 0 to 250 degrees Fahrenheit and 0 to 302 degrees Fahrenheit.

B. Scale Range for Heating Hot Water Piping: 0 to 250 degrees Fahrenheit and 0 to 302 degrees Fahrenheit.

3.06 PRESSURE-GAUGE SCHEDULE

A. Pressure gauges shall be the following:
1. Liquid-filled Sealed, direct-mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic EPDM self-sealing rubber inserts.

3.07 PRESSURE-GAUGE SCALE-RANGE SCHEDULE

A. Scale Range for Steam Piping: 0 to 100 psi and 0 to 87 psi.

B. Scale Range for Hydronic Piping: 0 to 100 psi and 0 to 87 psi.

END OF SECTION 23 05 19