

**SECTION 23 05 19**  
**METERS, GAGES and THERMOMETERS for HVAC PIPING**

**PART 1 GENERAL**

1.1 REFERENCES

- A. ASME B40.1 - Pressure Gages and Gauge Attachments
- B. ASTM E1 - Standard Specification for ASTM Liquid in Glass Thermometers
- C. ASTM E77 - Standard Test Method for Inspection and Verification Thermometers
- D. UL 393: Indicating Pressure Gages for Fire and Protection Services
- E. UL 404: Gages, Indicating Pressure for Compressed Gas Service

1.2 SUBMITTALS

- A. Submit under provisions of Section 23 05 00.
- B. Product Data: For each product use in this project, provide catalog data.
- C. Submit sample of plastic, laminated flow chart for venturi flow meter.
- D. Submit sample of metal identification tag for venturi flow meter.

**PART 2 PRODUCTS**

2.1 LIQUID FLOW METERS

- A. Venturi Flow Meter
  - 1. 2" diameter and smaller pipe provide bronze construction with threaded ends, larger than 2" diameter; provide steel construction with welded, grooved, or flanged ends as required for installation.
  - 2. Accessories: Provide nipples, needle valves, push-type quick disconnects, and chained, metal identification tags.
  - 3. Provide appropriate length nipples to coincide with the thickness of the pipe insulation, to insure cutoff valves and test ports are exposed outside of pipe insulation.
  - 4. Metal Identification Tags: Identification tag shall define manufacturer, model number, size, design GPM, and design differential pressure.
    - a. Design GPM shall be from approved shop drawings for AHUs/cooling coils rather than from design drawings.
  - 5. Flow Charts: Provide plastic, laminated flow chart (approximately 8.5" x 11").
    - a. Hang flow chart from flow venturi with 18-gage, Type 304 stainless steel wire.
  - 6. Accuracy: +/- 1%
  - 7. Permanent Head Loss: Not-to-exceed 10% of differential pressure reading.
  - 8. Portable Meter: Not required
- B. Pitot Tube Flow Meter: Not acceptable.
- C. Orifice Plate Flow Meter: Not acceptable
- D. Circuit Setter: Not acceptable

2.2 PRESSURE GAGES

- A. Gage: Per ASME B40.1, UL 393, and UL 404, a rotary brass movement and brass socket with front re-calibration adjustment, white face with black figures and graduations.
  - 1. Case: Cast aluminum with phosphor bronze bourbon tube
  - 2. Size: 4.5" diameter
  - 3. Accuracy: +/- 1%
  - 4. Scale: PSIG

2.3 PRESSURE GAGE TAPS

- A. Gage Cock: Brass construction, lever handle, 150 psig
- B. Nipple: Brass construction, minimum length of 4"

## 2.4 AIR FILTER PRESSURE GAGES

### A. Differential Pressure Gage

1. Type: Diaphragm actuated, dial type, front zero adjustment for pointer, and adjustable signal flag for maximum allowable air-filter pressure drop.
2. Housing, provide aluminum with black enamel finish.
3. Dial 4.5" diameter, white face with black figures and graduations.
4. Range: 0" WG to 1" WG water with minor divisions of 0.02" WG
5. Accuracy, +/- 2% of full scale at 70°F
6. Dwyer Model 2001-AF with ASF option is the base for the performance specifications.
  - a. Other products satisfying the specifications are acceptable.

### B. Accessories

1. Adjustable signal flag for visual indication of maximum pressure drop for air filters.
  - a. Set signal flag at appropriate level for cost effective change out of filters.
2. Vent valves for easy zeroing of pointer.
3. Use right angle static pressure tips and 0.25" diameter aluminum tubing.
4. Provide surface mounting bracket.

## 2.5 STEM TYPE THERMOMETERS AND THERMOWELLS

### A. Thermometer: ASTM E1; adjustable angle, red or blue fluid, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.

1. Size, 12" scale.
2. Window, provide clear non-breakable plastic.
3. Stem: 0.75" NPT brass stem length as noted below
4. Accuracy shall be per ASTM E77 +/- one scale division.
5. Scale: Degrees Fahrenheit

### B. Provide a well type digital thermometer using a standard 3/4" pipe size long brass insert with a temperature range of 45° to 140° F, industrial rated solar powered. (Attached strap type not acceptable.)

### C. Thermowell, use brass construction with or without lagging extensions as noted below.

1. For thermowells without thermometers or temperature sensors, provide caps and chains.

### D. Chilled Water System

1. Range: 0° to 100°F with 1°F scale divisions
2. Thermometer Stem Length: 12"
3. Thermowell: 6" overall length with 2.5" insertion length and 2.5" lagging extension.

### E. Condenser Water System

1. Range: 0° to 120°F with 1°F scale divisions
2. Thermometer Stem Length: 3.5"
3. Thermowell: 3.5" overall length with 2.5" insertion length.

### F. Domestic Hot Water System

1. Range: 30° to 240°F with 2°F scale divisions
2. Thermometer Stem Length: 6"
3. Thermowell: 6" overall length with 2.5" insertion length and 2.5 lagging extension.

## 2.6 AIRFLOW MEASURING STATION

### A. Airflow Measuring Section with Transmitter

1. Factory mounted and piped, multiple pilot-tube airflow elements in a 12" deep galvanized steel casing with flanges for connection to the ductwork.
2. The airflow elements shall be non-corrosive 6063-T5 anodized aluminum.
3. Position the airflow elements on an equal area basis per ASHRAE guidelines for duct traverses.
4. The transmitter output shall be either 4-20 MA or 0-10 VDC.

- B. Airflow Straightening Section: Factory mounted, 0.75" opening x 3" depth honeycomb section of aluminum construction.
- C. Accuracy: Within 2% throughout the velocity range of 600 FPM to 3000 FPM.
- D. Airflow Chart: Attach airflow chart (CFM versus output) to the side of the airflow station.
- E. Paragon Controls Model FE-1500-FX is the base for the performance specifications.
  - 1. Other products satisfying the specifications are acceptable.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- A. Do not install instrumentation when areas are under construction, except for required thermowells and pressure gage taps.
  - B. Install in accordance with manufacturer's instructions.
  - C. Install thermometers and pressure gage taps to allow field maintenance readings in supply and return of chilled water and condenser water lines of each chiller, cooling tower, air handler unit and where required by Division 23 drawings.
    - 1. Install meters and gauge so a 5'-10" person can read the meters and gauges while standing on finished floor.
  - D. For pumps, install pressure gage taps in pump flange taps, pumps shall have flange taps.
  - E. Install pressure gage taps in the chiller's evaporator manifold taps, chillers shall have manifold taps.
  - F. Install pressure gage taps in the chiller's condenser manifold taps, chillers shall have manifold taps.
  - G. Provide 4" min length brass nipples, allow clearance from insulation with gage cocks isolate gages.
  - H. For venturi flow meters, provide minimum lengths (or longer lengths) of straight pipe:
    - 1. Upstream - 5-pipe diameters
    - 2. Downstream - 2-pipe diameters
  - I. For installation of thermowells, enlarge pipes smaller than 2.5" diameter.
  - J. Provide pressure gages with scale ranges selected according to service with largest appropriate scale.
  - K. Install pressure gages and thermometers so that they are easily readable from normal eye level.
    - 1. Install vertical to 45 degrees off vertical.
  - L. Adjust pressure gages and thermometers to final angle, clean windows, lenses, and calibrate to zero.
  - M. For airflow measuring stations, provide minimum lengths (or longer lengths) of straight ductwork in accordance with the manufacturer's recommendation.
    - 1. Locate modulating control dampers downstream of the airflow measuring station.
    - 2. Typical minimum lengths are:
      - a. Upstream: 3 duct diameters.
      - b. Downstream: 1 duct diameter.
- For rectangular ducts, D equals:  
 $D = \text{SQRT} [(4 \times \text{Height} \times \text{Width}) / 3.14]$

END OF SECTION