SECTION 23 05 19 - METERS AND GAUGES FOR HVAC PIPING

PART I – GENERAL

1.1 SECTION INCLUDES

A. Thermometers

B. Pressure Gauges

C. Pressure/Temperature (P/T) Plugs

D. Venturi Flow Elements

1.2 RELATED SECTIONS

A. *Section 23 09 13 – Instrumentation and Control Devices for HVAC*

B. *Section 23 20 13 – Hydronic Piping*

C. *Section 23 22 13 – Steam and Condensate Piping*

1.3 REFERENCES

A. *ASME Standard B40.100 – Pressure Gauges and Gauge Attachments*

B. *ASME Standard B40.200 – Thermometers, Direct Reading and Remote Reading*

1.4 QUALITY ASSSURANCE

A. Products and execution shall be in compliance with applicable codes and standards including those referenced above in paragraph entitled *REFERENCES*

B. Installation and operation shall be in compliance with Manufacturer's recommendations, requirements, and Installation and Operation Manual (IOM).

C. SUBMITTALS

1. Manufacturer's data
2. Detailed specifications
3. Dimensioned drawings
4. Selection guide
5. Project application schedule
6. Installation, operation and maintenance manual

PART 2 - PRODUCTS

2.1 STEM TYPE THERMOMETERS FOR PIPELINE AND TANK MOUNTING

*[Note to PSC: Thermometers shall be provided only where truly needed. For example, thermometers are needed at heat transfer devices such as heat exchangers and coils but not at pressure devices such as pumps. Thermometers as specified below shall be provided at central station equipment but typically not at small unitary and terminal units such as terminal reheat coils, finned tube units, fan coil units and cabinet unit heaters. PT plugs are typically adequate to serve these smaller units.]*

*[Note to PSC: It has been the experience of the University that thermometers typically used in the HVAC industry are often inaccurate "out of the box" or lose their accuracy over the life of the instrument. It is the general <u>opinion</u> of the University that, although easier to read, bimetallic dial thermometers do not hold their accuracy as well as liquid-in-glass types. The obvious downside of liquid-in-glass thermometers is that they are difficult to read. So which do we want, thermometers that hold their accuracy or thermometers that we can read? Until such*

*time, the liquid-in-glass thermometer remains the thermometer of preference for standard HVAC applications. Yet, in locations where visibility is challenging, bimetallic dial type may be the better choice. Good engineering judgment is required in making such determination. If more than one thermometer type is specified for a given project it will be necessary to provide clear direction to the Contractor regarding the application and location of each type.]*

A. Liquid-in-Glass Thermometer

1. Case: Cast aluminum
2. Lens
    a. Acrylic, polycarbonate or glass for ranges to 300 degrees F
    b. Glass for ranges over 300 degrees F
3. Scale: 9”
4. Accuracy: 1 scale division
5. Stem configuration
    a. Fully adjustable in multiple planes
    b. Extended as required to clear insulation
6. Stem length
    a. Pipe application: Insertion to approximate midpoint of pipe but no less than 1/3 pipe diameter
    b. Tank application: Minimum insertion length of 5”
7. Thermowell
    a. Brass or stainless steel construction as appropriate for process fluid. Rated for 27 FPS fluid velocity
    b. With “lagging extension” for insulated piping
    c. With flange for duct mounting
8. Temperature range: Selected for normal reading near center of scale, for example...
    a. Chilled water: 0-100 degrees F
    b. Condenser water: 0-160 degrees F
    c. Heating hot water: 30-240 degrees F
    d. Steam condensate: 30-300 degrees F
    e. Steam, low pressure: 50-300 degrees F
    f. Steam, medium-high pressure: 50-500 degrees F
9. Manufacturers
    a. Ashcroft
    b. Trerice
    c. Reotemp
    d. Wika
    e. Wexler

B. Bimetallic Dial Thermometer

1. Case and ring: Hermetically sealed stainless steel, 5”
2. Lens: Anti-parallax glass

3. Dial face:  Aluminum
4. Accuracy:  1 scale division, field recalibratable
5. Connection:  ½” NPT stainless steel
6. Stem:  ¼” stainless steel
7. Bracket
    a. Fully adjustable in multiple planes
8. Extended as required to clear insulation
9. Stem length
    a. Pipe application:  Insertion to approximate midpoint of pipe but no less than 1/3 diameter of pipe
10. Tank application:  Minimum insertion length of 5”
11. Thermowell
    a. Brass or stainless steel construction as appropriate for process fluid.  Rated for 27 FPS fluid velocity
    b. With “lagging extension” for insulated piping
    c. With flange for duct mounting
12. Temperature range: Selected for normal reading near center of scale, for example...
    a. Chilled water:  0-100 degrees F
    b. Condenser water:  0-160 degrees F
    c. Heating hot water:  30-240 degrees F
    d. Steam condensate:  30-300 degrees F
    e. Steam, low pressure:  50-300 degrees F
    f. Steam, medium-high pressure:  50-500 degrees F
13. Manufacturers
    a. Ashcroft
    b. Trerice
    c. Reotemp
    d. Wika
    e. Wexler

2.2 PRESSURE GAUGES FOR HVAC APPLICATIONS

*[Note to AE – Commercial grade “contractor gauges” are typically specified for HVAC applications.  It has been the experience of the University that these gauges rarely maintain proper calibration and typically fail prematurely.  Because personnel learn not to trust them, the gauges become essentially worthless.  Actually, they become worse than worthless given that provide false information.  Thus, the University requires that higher quality gauges be specified. These come at a higher price.  To offset this cost, the University recommends that gauges be installed only where they are truly needed.  For example, pressure gauges are needed at pressure devices such as pumps and pressure regulators but not at heat transfer devices such as heat exchangers and coils.]*

A. Pressure Gauge for Hydronic and Steam Applications
    1. ANSI Grade 1A ( ±1% of span)

2. 4 ½” dial
3. ¼” NPT lower connection
4. Weather-proof stainless steel or polypropylene case
5. Stainless steel or polypropylene ring
6. Laminated safety glass or acrylic window
7. Stainless steel movement
8. Bronze tube and brass socket
9. Micro-adjustable knife edge pointer
10. Glycerin liquid filled
    a. Hydronic, compressed air and gas applications, 0-250 degrees F
11. Dry type
    a. Applications above or below this temperature range
    b. All steam applications
12. Pressure range: Selected for reading near center of scale, for example...
    a. Chilled water, central: 0-160 PSIG
    b. Chilled water, dedicated: 0-100 psig
    c. Condenser water: 0-100 PSIG
    d. Heating hot water: 0-100 PSIG
    e. Steam, high pressure: 0-300 PSIG
    f. Steam, medium pressure: 0-100 PSIG
    g. Steam, low pressure: 0-30 PSIG degrees
    h. Steam pumped condensate: 0-100 PSIG
13. Manufacturers
    a. Ashcroft
    b. Trerice
    c. Reotemp
    d. Wika
    e. Wexler

B. Pressure Gauge for Air Applications
1. Die cast aluminum case and bezel with acrylic cover
2. 4” dial face
3. Accuracy: $\underline{+}$2% full scale
4. 1/8" female NPT duplicate high and low pressure taps
5. Adjustable signal pointer
6. Pressure range: Selected for reading near center of scale
7. Stand-off mounting bracket as required to accommodate insulation
8. Duct connector and tubing kit
9. Basis of Design

a. Dwyer Series 2000 Magnehelic

2.3 PRESSURE/TEMPERATURE TEST PLUGS

A. P/T Test Plug

1. ¼” or ½” brass body and cap

2. Body length:

a. 1 ½” for uninsulated piping applications

b. 3” for insulated piping applications

3. Nordel core for receiving 1/8” diameter pressure and temperature probes. Nordel shall be used for all temperature ranges.

4. Rated for 500 PSIG / 275 degrees F

5. Rated for zero leakage over published range

2.4 VENTURI FLOW ELEMENT

*[Note to PSC: As stated elsewhere within these Standards, the University discourages the use of balancing valves in most hydronic system applications. Exceptions exist, such as provision of a balancing valve in each circuit of a multi-section coil. In some cases flow balancing is not required but flow rate measurement is still desired. In such cases a simple venturi flow element can be provided in lieu of a balancing valve to address this need. Use of a static flow meter of this type yields improved accuracy while reducing system pressure drop as well as installed cost.]*

A. 2” and Smaller

1. Forged brass body

2. NPT connections

3. 400 PSIG / 250 degrees rating

4. 250 degrees F temperature rating

5. Venturi inner flow nozzle

6. Temperature Rating: 250 degrees F

7. Pressure test ports with Nordel cores (per Paragraph *2.3 P/T Test Plug* specification above

8. Accuracy: 1%

9. Straight-run pipe requirement shall not exceed 5 diameters upstream and 2 ½ diameters downstream.

10. Manufacturers: Griswold, Macon, Presso, Badger

B. 2 ½” and Large

1. Carbon steel body

2. Flanged connections

3. 240 PSIG / 250 degrees F rating

4. Venturi internal flow nozzle

5. Piezo ring dual chamber design for signal averaging

6. Pressure test ports with Nordel cores (per PT test plug specification found elsewhere in documents)

7. Accuracy: 1%

8. Straight-run pipe requirement shall not exceed 5 diameters upstream and 2 ½ diameters downstream.

9. Manufacturers

   a. Griswold

   b. Macon

   c. Presso

   d. IMI Flow Design

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Thermometers

1. Provide thermometers as shown on drawings. Selection of thermometer type may be based upon location or application.

2. Locate and position thermometer for ease of viewing.

3. Specific orientation requirements:

   a. Large pipe applications (10" diameter and larger): Orient stem 45 degrees from bottom of pipe.

   b. Small pipe applications: Install thermometer at 90 degree elbow location. Orient stem collinear with centerline of pipe.

4. Provide separable thermowell unless otherwise indicated in project documents.

5. Coat last two inches of stem with non-hardening heat-conducting compound suitable for measured temperature range.

6. Trim and seal surrounding insulation. Ensure vapor barrier integrity. Apply approved mastic as required to maintain vapor barrier.

B. Pressure Gauges

1. Provide pressure gauges as shown on drawings.

2. Position gauge for ease of viewing.

3. Provide pulsation dampener (aka "snubber") at pump discharge locations. Avoid dampeners at other locations (they are prone to stopping up).

4. Provide siphon (aka "pigtail") at each steam pressure indicating gauge.

5. Provide shut-off valve for each gauge. Use ball valve for hydronic or steam service as specified in *23 21 13 – Hydronic Piping* or *23 22 13 - Steam and Condensate Piping*. Valve may be standard port or full port design. Locate valve as near system main as practical.

6. Use ½" schedule 80 steel pipe nipple from pipe connection to valve.

7. Where gauge piping is connected to equipment (e.g. pump, suction diffuser, etc.) use "connection size" schedule 80 steel pipe from equipment connection to valve. Use 1/2" copper or stainless steel tubing from valve(s) to gauge.

C. Pressure Temperature Test Ports (P/T Plugs)

1. Provide P/T plug in supply and return piping at each terminal unit throughout hydronic system in addition to P/T plugs shown on drawings.

   a. "Terminal unit" shall include but not be limited to reheat coil, finned tube element, unit heater, convector, fan coil unit, water cooled condenser, laboratory and process equipment, etc.

2. Additionally, provide P/T plugs at all other locations shown on drawings.
3. Locate and orient P/T plug for ease of access.
4. Avoid orienting P/T plug downward (to prevent fouling with sediment).

D. Venturi Flow Elements

1. Provide flow elements as shown on drawings.
2. Locate and orient flow element for ease of access.
3. Provide manufacturer's required straight-run piping at a minimum.

END OF SECTION 23 05 19

. This section of the *U of I Facilities Standards* establishes minimum requirements only.
It should not be used as a complete specification.