PART 1 GENERAL

1.1 SUMMARY
A. Related Sections:
   1. 15090 - Supports, Anchors, and Seals.
   2. 15047 - Identification
   3. 15410 - Piping (Plumbing).
   4. 15510 - Piping (HVAC).
   5. 15540 - Pumping Equipment (HVAC).
   6. 15855 - Air Handling Units.
   7. 15970 - HVAC Control System.
   8. 15990 - Tests (HVAC).

1.2 REFERENCES

1.3 SUBMITTALS
A. Submit the following:
   1. Thermometers and Pressure Gages: Catalog cuts, proposed range, and calibrated accuracy.
   2. Strainers: Catalog cuts, pressure drop curves.
   3. Pressure Relief and Reducing Valves: Catalog cuts; pressure range, and settings.
   4. Air Vents: Catalog cuts.
   5. Flexible Connectors: Catalog cuts.
   6. All Valves: Catalog cuts, schedule of proposed installation locations, pressure ratings, and materials of construction.
   7. Inserts: Catalog cuts and load tables.
   8. Supports: Catalog cuts or drawings.
   9. Anchors: Drawings and details of installation.
   10. Water Flow Tube Station: Catalog cuts, pressure drop charts, and engineering information.
   11. Expansion Tank: Shop drawings, catalog cuts of accessories and shop drawings of tank support.
   12. Shop Drawings of support equipment.

PART 2 PRODUCTS
2.1 MANUFACTURERS

A. Valves:

1. DeZurik.
2. Grinnell.
3. Homestead.
4. Hammond.
5. Kennedy
7. Milwaukee.
8. Nibco.

B. Expansion Tanks:

1. Taco.
2. Bell & Gossett.
3. Accepted equivalent.

2.2 VALVES.

A. General:

1. Gate and globe valves shall not be installed with the stem pointing downwards. Valves may be installed with the stem at or above a horizontal plane. Provide adequate clearance for stem rise.
2. Check valves may be installed either in the horizontal or vertical position. Non-spring-loaded check valves shall only be installed in the vertical position when the flow is upwards.
3. Butterfly valves may be installed with the stem in any position. Whenever possible the stem shall be installed as outlined for gate and globe valves.
4. Valves: Provide all valves with a 1-1/2" diameter brass tag having 1/2" high black filled numbers and 1/4" high letters, as manufactured by Seton or accepted equivalent.
   a. Service shall be identified by abbreviations such as: CHW (Chilled Water), CW (Condenser Water), HW (Hot Water), DW (Domestic Water), GAS, etc.
   b. Valve tag fasteners shall consist of No.6 brass beaded chain. The use of color-coded one-piece nylon ties is acceptable instead of beaded chain fasteners.
   c. Prepare schematic piping diagrams of systems controlled by valves with a schedule identifying all valves. Diagram and Valve Schedule shall be posted in the mechanical room where system depicted is located. All diagrams shall be printed on non-fading media and framed under a plastic laminate surface.
5. Provide ease of access to valve handwheel or lever to maintenance personnel.
   a. Valves installed above a ceiling shall have the stem placed 15 degrees above the horizontal position whenever possible.
   b. Provide colored thumbtack indexes at all ceiling tiles where valves are installed directly above.
   c. Index all colored thumbtacks in the as-built drawings.
6. Provide chain actuators for all valves in mechanical equipment rooms installed at a centerline height at or above 7 feet above the floor.
   a. Actuators shall consist of a cast iron sprocket rim attached to the valve, malleable iron chain guide, and chain of sufficient length to descend to a floor height of not more than 3'-6".
   b. Valves larger than 12 inches and valves not suitable for chain actuators shall be provided with electrical actuators, motors, and switches.
   c. Install switches where directed.

B. Gate Valves:
   1. Up to 2": Class 150, bronze, union bonnet rising stem, inside screw, solid wedge disc, non-asbestos packing, soldered ends.
   2. 2-1/2" and above: Class 125, outside screw and yoke, iron body, bronze trim, (IBBM), rising stem, solid bronze wedge disc up to size 3-1/2" and cast iron with bronze wedge face rings in larger sizes, non-asbestos packing, flanged ends.

C. Globe and Angle Valves:
   1. Up to 2": Class 150, bronze, union bonnet rising stem, inside screw, integral seat, renewable Teflon discs, non-asbestos packing, soldered or threaded ends.
   2. 2-1/2" & above: Class 125, bolted bonnet, outside screw, iron body, bronze trim, (IBBM), rising stem, renewable bronze seat ring and disc up to 3" or 4" size and iron disc with bronze disc face rings in larger sizes, non-asbestos body gasket, flanged ends.

D. Check Valves:
   1. Up to 2": Class 125 or Class 200, bronze, screwed bonnet, Y pattern, renewable Teflon discs, non-asbestos packing, soldered or threaded ends.
   2. 2-1/2" & above: Class 125, silent, non-slam type spring loaded, iron body, bronze seat and plug, single disc, stainless steel spring, guided disc top and bottom, wafer or lug type.

E. Butterfly Valves:
   1. 2-1/2" to 6": 200 psi WOG, cast iron body with extended neck for insulated piping, lugged, with lugs drilled and tapped according to ANSI B-16, silicon bronze or aluminum bronze disc, EPDM seat, and 416 stainless steel stem.
      a. Valve shall comply with API-609 and MSS-SP-67.
      b. Provide valves with lever-lock operator having position lock and 10-degree balancing notches.
      c. Provide a memory stop capable of allowing valve closing and reopening to previously balanced position.
   2. 8" and above: 200 psi WOG, sizes 2"-12" and 150 psi WOG for larger sizes. Cast iron body with extended neck for insulated piping, lugged, with lugs drilled and tapped according to ANSI B-16, silicon bronze or aluminum bronze disc, EPDM seat, and 416 stainless steel stem. Valve shall comply with API-609 and MSS-SP-67. Provide valves with hand cranked heavy-duty weatherproof gear operator with indicator and adjustable stops at all locations.
F. Balancing Valves: Up to 2": 175 lb. WOG, non-lubricated, eccentric plug type, nickel seat, semi-steel body, neoprene or Teflon coated resilient plug, Buna filled Teflon U-ring seal or Buna (Vee) packing. Provide memory stop and lever handle.

G. Ball Valves:
   1. Plumbing: Allowed for all plumbing systems.
   2. HVAC: Allowed only for shut-off, not for balancing service. Provide 3-inch stem extensions for insulated line.
   3. Porting: No reduced ports shall be acceptable in any ball valve.
   4. Up to 2": Class 150, 400/600 psi WOG, full port, three-piece construction, blowout-proof stem, non-asbestos packing, bronze body, silicone bronze stem, bronze/brass/chrome plated ball, Teflon resilient seat, and EPDM O-ring seal.

H. Hose Bibb (Wall Hydrant):
   1. Quarter-turn wall hydrant with 3/4” hose connection. Full flow with integral vacuum breaker and removable "T" handle key.
   2. Flush-type 304 stainless steel frame, cover, and housing, with cylinder locking hinged cover that opens 180°.
   3. Provide isolation valve in branch.
   4. Jay R. Smith Model #5509QT or other A/E approved equal.

2.3 Piping Accessories

A. Strainers:
   1. Design Flow Rate: Clean strainer shall not exceed 2 psi at the design flow rate.
   2. Drain Valve and Reducer: Furnish each strainer for use in equipment rooms and at each AHU with a drain valve and reducer to 3/4” hose thread, capped.
   3. Up to 2": "Y" type, cast iron body with 20 mesh stainless steel screen, 250 lb. w.s.p. with blow-off outlet and plug, threaded ends. Mueller #11M, or accepted equivalent.
   4. 2-1/2” to 4": "Y" type, cast iron flanged body, 125 lb. w.s.p. with blow-off tapping and plug and stainless steel screen with 1/16” perforations, Mueller #758 or accepted equivalent.
   5. 4” and above: "Basket" type, heavy gage perforated brass basket, 0.057" diameter perforations in sizes to 4 inches and 0.125" diameter perforations in sizes larger than 4 inches. Muessco #165 or accepted equivalent.

B. Flexible Connectors: All sizes - Full line size with floating flanges. Rated 150 psi at 180 degrees F., wire reinforced, double arched, and with control rods and rubber washers. Mason Industries or accepted equivalent.

C. Pressure Relief Valves: 3/4", Brass body, micro finished bevel for seats, cadmium plated springs, manual chilled lift ring, ASME Std. Bell and Gossett or accepted equivalent.

D. Pressure Reducing Valves: 3/4", Brass body and brass working parts with built-in strainer, 125 W.S.P. Bell and Gossett or accepted equivalent.

E. Air Vents:
   1. Provide manual air vents at high points in chilled water systems.
2. Manual air vents shall be bronze needle or ball valves.

F. Thermometers:
   1. Industrial, mercury filled, glass thermometers with 9-inch scale, "V" shape, and adjustable angle separable socket well.
   2. Operating temperature shall display at midpoint of thermometer range.
   3. Accuracy shall be ±0.5 degrees F.
   4. Casings shall be brass or aluminum.

G. Thermometer Wells:
   1. Brass construction with cap and chain.
   3. Provide extended neck wells in insulated piping.
   4. Provide tees at lines 3 inches or smaller for thermometer wells.

H. Pressure Gages:
   1. Standard depth, cast aluminum, black finished, chrome plated close type ring, clear glass window, bronze bourdon tube, precision movement and ±0.5 percent accuracy.
   2. Gage shall have a minimum 4-1/2 inch diameter face and with the operating pressure displaying at the middle range of the scale. Bottom connection shall be at least 1/4” diameter.

I. Gage valves:
   1. Brass, 1/4” needle valve type.
   2. Manufacturers: H.O. Trerice, or accepted equivalent.

J. Dielectric Pipe Fittings:
   1. Dielectric pipe fittings shall consist of insulators, insulating gasket, pipe connector and nut or flange as required.
   2. Pipe connectors shall be suitable for soldered, screwed, or welded joints as required.
   3. Dielectric unions shall be rated at 250 psi and cast-iron flange unions at 175 psi.
   4. Dielectric fitting shall be plated according to Federal Specifications of 0.005”.
   5. Fittings shall be as manufactured by Epco.

K. Water Flow Sensors:
   1. As manufactured by Annubar ANR-75, stainless steel.
   2. Instrument connections shall be No.C-22.
   3. 1/4” valves on 1-3/8” square head.
   4. Valve rating shall be maximum 5,000 psi at 100 degrees F.
   5. Flow sensor in steel pipe shall be weld nipple mounted.
   6. Flow sensor in PVC pipe shall be saddle mounted.
   7. Manufacturers: Dietrich Standard Corp or accepted equivalent.
L. In-line type air purger with tappings for an air vent and a makeup water line, as indicated, shall be Amtrol, 125 psi, flanged, cast iron.

M. Provide and install immersion wells and pressure taps as required for automatic control system.

N. Venturi Flow Meters:
   1. Provide with quick disconnect valves, safety shut-off valves, and metal identification tags on chain giving pipe size, Venturi series, station identification, and meter reading at specified flow rate at locations where shown on Construction Documents.
   2. Sizes:
      a. 2-1/2" Through 8 Inches: Plated cast iron with slip on flanges.
      b. 10 Inches and Above: Fabricated steel plate with welding ends.
   3. Venturi Size: Same as pipe size
   4. Manufacturers: Amity industries, Robertson or accepted equivalent.

2.4 EXPANSION TANKS
A. Size, capacity, and arrangement as shown on Construction Documents.
B. Designed, constructed and stamped according to ASME Code for 125 psig.
C. Welded black steel construction, rustproof coated, with base mount for vertical installation.
D. Provided with lifting ring and connection tappings.
E. Sealed in elastomer diaphragm suitable for 240 degrees.
F. Built-in air charger valve. Precharge tank to 20 psi.

2.5 PIPE HANGERS AND SUPPORTS
A. Provide hangers, supports, and supplementary steel as required for the different applications.
B. Support spacing shall be as required by the appropriate Tables found in the FBC – Mechanical, Plumbing and Gas.
C. Inserts, Hangers, Rods, and Clamps: Fee and Mason, or Michigan Hanger Co. Fig. numbers used refer to Grinnell.
   1. Inserts: (Galvanized or stainless steel, except as noted.)
      a. Universal concrete insert, Fig.282.
      b. Wedge type concrete insert, Fig.281.
      c. Expansion case, Fig.117.
   2. Clamps:
      a. UFS beam clamp with weldless eye nut, Fig.292, clamp size 1, rod size 3/4".
b. C-clamp with retaining clip, Fig.87.
c. I beam clamp, Fig.131.
d. Universal side I beam clamp, Fig.225.
e. C-clamp, copper finish, Fig.CT-88.

3. Hangers: Use adjustable clevis type hangers as specified. Hangers for insulated pipes shall have a diameter large enough to include insulation and a protection shield shall be installed with each hanger.
   a. Copper tubing: Fig.CT-65.
   b. Insulated steel pipe: Fig.300.
   c. Uninsulated steel pipe: Fig.260.
   d. Trapeze.

4. Rods: Continuous thread, Fig.146. Sizes shall be as specified.
5. Riser Clamps:
   a. Black steel, Fig.261.
   b. Plastic coated, Fig.261C.
   c. Copper finish, Fig.CT121.

D. Diameter of Hanging Rods shall be as listed below:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Rod Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 2&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; &amp; 3&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>4&quot; &amp; 5&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>8&quot; &amp; 12&quot;</td>
<td>7/8&quot;</td>
</tr>
<tr>
<td>14&quot; &amp; 16&quot;</td>
<td>1&quot;</td>
</tr>
</tbody>
</table>

E. Insulation Protection Shield: Fig.167.

F. Access Panels: As specified in Division 8.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide shut-off valves at inlets and outlets of equipment and branch connections to mains and as shown on Construction Documents.

B. Final connections to apparatus, equipment, automatic control valves, and pressure reducing valves shall be made with flanges or unions between shut-off valve and connection.

C. Connections to cooling coils and refrigeration machines shall have flanges or unions next to equipment to allow tube removal without extensive dismantling of piping.
D. Strainers shall be full line size and shall be full size valved for servicing. Strainers shall be installed upstream of automatic control valves and other locations as shown on Construction Documents.

E. Pressure Relief Valves: Provide at cooling coil side of shut-off valves and where shown on Construction Documents.

F. Flexible Connectors: Provide between vibrating equipment and piping.

G. Location of Valves and Chain Operators:
   1. Install valves to be accessible for operation and free from interferences when operated.
   2. Position so leakage will not contact any electrical equipment located below.
   3. Provide valve chain operators for valves 4 inches and larger if the valve handle is more than 6 feet above the operating equipment room floor level.

H. Thermometer Wells: Provide for thermometers and at the inlet and outlet of each cooling coil, next to sensing bulbs of controllers and remote temperature indicators, and as shown on Construction Documents.

I. Thermometers: Provide at the inlet and outlet of each air handling unit coil bank and as shown on Construction Documents.

J. Pressure Gages: Provide as shown on Construction Documents and at following locations:
   1. At suction and discharge of circulating pumps.
   2. At inlet and outlet of evaporator and condenser.
   3. At makeup water inlet to expansion tanks and equipment.

K. Pipe Hangers and Supports:
   1. Provide adjustable hangers, inserts, brackets, rolls, clamps, and supplementary steel as required for proper support of pipes.
   2. Design hangers to allow for expansion and contraction of pipes and of adequate size to allow covering to run continuously through hangers.
   3. Support piping independently of equipment.
   4. Coordinate location of hangers with light fixtures.
   5. Wire brush steel or iron supports and prepare surfaces under this section for painting.
   6. Install plastic pipe loose to allow for contraction and expansion.
   7. Hangers for PVC piping in storage tanks do not need rollers and hangers can be shop fabricated from stainless steel strap and anchor bolts.
   8. Pipes supported by trapeze hangers and not mounted on pipe rollers shall be secured to the trapeze with pipe clamps or "U" bolts.
   9. Hangers shall be placed at each change of direction, within 1 foot of valves and other appurtenances installed in horizontal piping and not more than 3 feet from end of each branch runout.
   10. Special Supports: Provide clamps, hangers, and supports according to equipment manufacturer's recommendations.
   11. Supports of wire, rope, wood, chain, strap, perforated bar, or any other makeshift devices are not allowed.
12. Where overhead construction does not allow fastening hanger rods in required locations, provide additional steel framing as required.
13. Refer to "Vibration Isolation" Section for supports requiring vibration isolators.
14. Maximum loading on inserts shall not exceed 75 percent of catalog rating.
15. Floor supports, wall brackets, and expansion tank supports as shown on Construction Documents or as required to support equipment. Submit shop drawings.
16. Buckling of piping due to inadequate provision for expansion shall be Contractor's responsibility. Piping shall be properly guided between expansion joints and anchor points.

L. Expansion Tanks:

1. Suspended from structure (horizontal type).
2. Connect to makeup water piping provided under plumbing work.
3. Pipe relief valve to nearest drain.

M. Water Flow Sensors: Install water flow tube stations according to manufacturer's published recommendations and as shown on Contract Documents.

N. Dielectric Fittings: Provide dielectric fittings between piping of dissimilar metals.

END OF SECTION