SECTION 23 22 13 - STEAM AND CONDENSATE PIPING

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Section 23 09 13 – Instrumentation and Control Devices for HVAC. [Note to AE: The requirements for flow meters for steam condensate systems are listed in Section 23 09 13. Insert the flow meter requirements into the appropriate CSI section for inclusion into the Project Specifications.]

PART 2 - PRODUCTS

2.1 VALVES FOR BUILDING STEAM AND CONDENSATE SYSTEMS

A. Shut-Off Valves for Building High Pressure Steam Systems.

Normal Operation: <165 PSIG, <400F

1. Size 2” and Smaller, Socket-Weld Forged Steel Wedge Gate Valve.

   a. ANSI class 800.
   b. Shut-off class IV, bi-directional.
   c. Forged carbon steel body.
   d. Socket-welding connections.
   e. Bolted bonnet.
   f. Outside screw and yoke, rising stem design.
   g. 13% chrome steel wedge.
   h. Alloy 6 (Stellite) hard-faced seats.
   i. Renewable seat rings.
   j. Integral back seat for positive packing chamber isolation.
   k. Stainless steel gasket with graphite filler.
   l. Graphite stem packing.
   m. Spoked hand wheel.
   n. Approved manufacturers: Bonnie Forge, Hancock, Smith

2. Size 2 ½ and 3”, Butt-Weld Cast Steel Wedge Gate Valve.

   a. ANSI class 300.
   b. Shut-off class IV, bi-directional.
   c. Cast carbon steel body.
   d. Butt-welding connections.
   e. Outside screw and yoke, rising stem design.
   f. 13% chrome steel flexible wedge.
   g. Alloy 6 (Stellite) hard-faced seats.
   h. Seal-welded seat rings.
   i. Integral back seat for positive packing chamber isolation.
   j. Stainless steel gasket with graphite filler.
   k. Graphite stem packing.
l. Spoked hand wheel.
m. Approved manufacturers: Kitz, Velan

   a. ANSI class 300.
   b. API 598 zero leakage shutoff rating, bi-directional.
   c. Carbon steel body.
   d. Butt-welding connections to match pipe schedule.
   e. 316 stainless steel disc and seat.
   f. Non-rigid valve-to-shaft connection to accommodate differential thermal expansion of components.
   g. Adjustable graphite shaft packing.
   h. Geared rotary hand-wheel operator sized for maximum rim pull of 100 lb.
   i. Approved Manufacturers: Zwick Series Tri-Con, Xomox Series 9000, FlowSeal MS.

B. Shut-Off Valves for Building Medium Pressure Steam Systems.
   Normal Operation: <60 PSIG, <350F

1. Size 2" and Smaller, Threaded Three-Piece Full-Port Ball Valve.
   a. ANSI class 600.
   b. Shut-off class VI, bi-directional.
   c. Carbon steel three-piece body.
   d. NPT connections.
   e. 316 stainless steel full-port ball and stem.
   f. Vented ball.
   g. Carbon/graphite reinforced TFM seats.
   h. Live-loaded graphite stem packing.
   i. Latch-lock handle.
   j. Extended stem to clear insulation.
   k. Approved manufacturers: Jamesbury Series 4000, KTM Series F180, PBM Series 5, Worcester Series 44.

2. Size 2 1/2" and Larger, Flanged Ball Valve.
   a. ANSI class 150.
   b. Shut-off class VI, bi-directional.
   c. Stainless steel or carbon steel body.
   d. Flanged connections.
   e. 316 stainless steel ball and stem.
   f. Vented ball.
   g. Carbon/graphite reinforced TFM seats.
   h. Live-loaded graphite stem packing.
   i. Extended stem to clear insulation.
   j. Geared rotary hand-wheel operator.
   a. ANSI class 150.
   b. Shut-off class VI, bi-directional.
   c. Stainless steel or carbon steel lug-style body.
   d. 316 stainless steel double-offset disc.
   e. Reinforced TFM seats.
   f. Disc spacers to center disc in seat.
   g. PH-4 stainless steel shaft.
   h. Stainless steel backed polymer shaft bearings.
   i. Adjustable graphite shaft packing.
   j. Geared rotary hand-wheel operator.
   k. Approved manufacturers: Jamesbury, Xomox, Cameron W-K-M.

C. Shut-Off Valves for Building Low Pressure Steam Systems.

Normal Operation: <15 PSIG, <350F

1. Size 2" and Smaller, Threaded Two-Piece Full-Port Ball Valve.
   a. 600 WOG, 150 SWP
   b. Shut-off class VI, bi-directional.
   c. Two-piece cast bronze body. Zinc level in bronze not to exceed 15% (yellow brass not acceptable).
   d. NPT connections.
   e. 316 stainless steel full-port solid tunneled ball (hollow ball not acceptable).
   f. Vented ball.
   g. 316 stainless steel stem and nut.
   h. Reinforced PTFE (RPTFE) seats.
   i. Adjustable stem packing.
   j. Extended stem to clear insulation.
   k. Latch-lock handle.
   l. Approved manufacturers: Apollo, Milwaukee, Nibco, Watts.

2. Size 2 ½" and Larger, Flanged Ball Valve.
   a. ANSI class 150.
   b. Shut-off class VI, bi-directional.
   c. Stainless steel or carbon steel body.
   d. Flanged connections.
   e. 316 stainless steel ball and stem.
   f. Vented ball.
   g. Reinforced PTFE (RPTFE) seats.
   h. Adjustable stem packing.
   i. Extended stem to clear insulation.
   j. Geared rotary hand-wheel operator.
3. Size 2 ½” and Larger, Lug-Style High Performance Butterfly Valve.
   a. ANSI class 150.
   b. Shut-off class VI, bi-directional.
   c. Stainless steel or carbon steel lug-style body.
   d. 316 stainless steel double-offset disc.
   e. Reinforced TFM seats.
   f. Disc spacers to center disc in seat.
   g. PH-4 stainless steel shaft.
   h. Stainless steel backed polymer shaft bearings.
   i. Adjustable graphite shaft packing.
   j. Geared rotary hand-wheel operator.
   k. Approved manufacturers: Jamesbury, Xomox, Cameron W-K-M.

D. Shut-Off Valves for Condensate Piping for Building Medium Pressure Steam Systems.

Normal Operation of Steam System: <60 PSIG, <350F

1. Size 2” and Smaller, Threaded Two-Piece Full-Port Ball Valve.
   a. 1,500 WOG, 150 WSP.
   b. Shut-off class VI, bi-directional.
   c. Carbon steel two-piece body.
   d. NPT connections.
   e. 316 stainless steel full-port ball and stem.
   f. Vented ball.
   g. Carbon/graphite reinforced TFM seats.
   h. Adjustable stem packing.
   i. Extended stem to clear insulation.
   j. Latch-lock handle.

2. Size 2 1/2” and Larger, Flanged Ball Valve.
   a. ANSI class 150.
   b. Shut-off class VI, bi-directional.
   c. Stainless steel or carbon steel body.
   d. Flanged connections.
   e. 316 stainless steel ball and stem.
   f. Vented ball.
   g. Carbon/graphite reinforced TFM seats.
   h. Adjustable stem packing.
   i. Extended stem to clear insulation.
   j. Geared rotary hand-wheel operator or latch-lock handle.

3. Size 2 ½” and Larger, Lug-Style High Performance Butterfly Valve.
   a. ANSI class 150.
   b. Shut-off class VI, bi-directional.
   c. Stainless steel or carbon steel lug-style body.
   d. 316 stainless steel double-offset disc.
   e. Reinforced TFM seats.
   f. Disc spacers to center disc in seat.
   g. PH-4 stainless steel shaft.
   h. Stainless steel backed polymer shaft bearings.
   i. Adjustable graphite shaft packing.
   j. Geared rotary hand-wheel operator.
   k. Approved manufacturers: Jamesbury, Xomox. Cameron W-K-M.

E. Shut-Off Valves for Condensate Piping for Building Low Pressure Steam Systems (Downstream of PRV).

Normal Operation of Steam System: <15 PSIG, <350F

1. Size 3” and Smaller, Threaded Two-Piece Full-Port Ball Valve.
   a. 600 WOG, 150 WSP
   b. Shut-off class VI, bi-directional.
   c. Two-piece cast bronze body. Zinc level in bronze not to exceed 15% (yellow brass not acceptable).
   d. NPT connections.
   e. 316 stainless steel full-port solid tunneled ball (hollow ball not acceptable).
   f. 316 stainless steel stem and nut.
   g. Reinforced PTFE (RPTFE) seats.
   h. Adjustable stem packing.
   i. Extended stem to clear insulation.
   j. Latch-lock handle.
   k. Approved manufacturers: Apollo, Milwaukee, Nibco, Watts.

2. Size 2 ½” and larger, Flanged Two-Piece Full-Port Ball Valve.
   a. 200 WOG.
   b. Shut-off class VI, bi-directional.
   c. Two-piece cast iron or ductile iron body.
   d. Flanged connections.
   e. Stainless steel full-port ball (TFE coated ball not acceptable).
   f. Stainless steel stem.
   g. PTFE seats (Nitrile or EPDM not acceptable).
   h. Adjustable PTFE stem packing.
   i. Geared rotary hand-wheel operator or lever handle.
   j. Approved manufacturers: Apollo, Watts, Kitz.
F. Shut-Off Valves for Pumped Condensate Piping for Building Steam Systems.

Normal Operation: <60 PSIG, < 212F

1. Size 3" and Smaller, Threaded Two-Piece Full-Port Ball Valve.
   a. 1,500 WOG, 150 WSP.
   b. Shut-off class VI, bi-directional.
   c. Carbon steel two-piece body.
   d. NPT connections.
   e. 316 stainless steel full-ball and stem.
   f. Vented ball.
   g. Reinforced PTFE (RPTFE) seats.
   h. Adjustable stem packing.
   i. Extended stem to clear insulation.
   j. Latch-lock handle.
   k. Approved manufacturers: Apollo, Milwaukee, Nibco, Watts.

2. Size 2 1/2" and Larger, Flanged Ball Valve.
   a. ANSI class 150.
   b. Shut-off class VI, bi-directional.
   c. Stainless steel or carbon steel body.
   d. Flanged connections.
   e. 316 stainless steel ball and stem.
   f. Vented ball.
   g. Reinforced PTFE (RPTFE) seats.
   h. Live-loaded stem packing.
   i. Extended stem to clear insulation.
   j. Geared rotary hand-wheel operator or latch-lock handle.

   a. ANSI class 150.
   b. Shut-off class VI, bi-directional.
   c. Stainless steel or carbon steel lug-style body.
   d. 316 stainless steel double-offset disc.
   e. Reinforced TFM seats.
   f. Disc spacers to center disc in seat.
   g. PH-4 stainless steel shaft.
   h. Stainless steel backed polymer shaft bearings.
   i. Adjustable graphite shaft packing.
   j. Geared rotary hand-wheel operator.
   k. Approved manufacturers: Jamesbury, Xomox. Cameron W-K-M.

G. Severe Duty Check Valves for Steam Condensate Pump Applications.
Note to AE: It has been the experience of the University that rebuildable “severe duty” check valves are required for steam condensate pump discharge service. When applied to this demanding application standard duty valves fail quickly. Valve failure results in reverse flow of condensate from the central system back through the associated pump and into the receiver. In some cases, condensate is wasted to drain as the receiver overflows. Reverse flow can also cause meter reading inaccuracy. Some meters are incapable of distinguishing forward flow from reverse flow (e.g. nutating disc meters).

1. Size 2” and Smaller.
   a. Repairable non-slam spring-loaded design.
   b. ANSI class 300.
   c. Steel or stainless steel body.
   d. NPT connections.
   e. 250 degrees F temperature rating.
   f. Body-guided disc.
   g. Stainless steel trim and disc.
   h. Approved manufacturers: CPV catalog #36, 34 or 37, and Durabla model #SCV.

2. Size 2 ½” and Larger.
   a. Repairable non-slam spring-loaded design.
   b. ANSI class 150.
   c. Steel or stainless steel body.
   d. Wafer or lug style body.
   e. 250 degrees F temperature rating.
   f. Center-guided disc.
   g. Stainless steel trim and disc.
   h. Approved manufacturers: CPV catalog #110D, and Durabla model #WLC.

H. Flange Gaskets
   1. Steam Applications
      a. Gasket shall be rated for working pressure and temperature of system.
      b. High pressure/medium pressure steam systems up to and including connection to PRV.
         (a) Spiral wound type.
         (b) Stainless steel with flexible graphite filler material.
         (c) Basis of design: Flexitallic Flexicarb (gray stripe).
      c. Low pressure steam system downstream of PRV.
         (a) Compressed fiber type.
         (b) Basis of design: Flexitallic SF2401.

2.2 STEAM PRESSURE REGULATING VALVES
   A. Pressure Regulating Valves for Medium Pressure Steam (Campus Steam)
      Normal Operation: 20-40 PSIG Inlet, 10-15 PSIG outlet, <350F
      1. 2” and smaller
         a. Self contained, direct acting, spring-loaded, diaphragm type (non-piloted).
b. Failure position, open.
c. Dead-end service, leakage class 4.
d. Bronze body.
e. NPT connections.
f. Pressure class 250.
g. Monel seat, plug and shaft.
h. Exposed springs for easy adjustment.
i. Minimum pressure differential: 5 PSID.
j. Minimum outlet pressure: 5 PSIG.
k. Maximum temperature: 400 degrees F.
l. Basis of design: Boyleston Fig. 90.

2. 2 ½” and larger
   a. Direct acting, spring-loaded, diaphragm type (non-piloted).
   b. Failure position, open.
   c. Dead-end service, leakage class 4.
   d. Semi-steel body.
   e. Pressure class 125.
   f. Flanged connections.
   g. Single seat design, easily renewable.
   h. Exposed springs for easy adjustment.
   i. 3-ply composition diaphragm.
   j. Minimum pressure differential: 5 PSID.
   k. Minimum pressure drop limit: 5 PSID.
   l. Maximum temperature: 400 degrees F.
   m. Basis of design: Boyleston Fig. 390.

2.3 FLOW METERS
   A. Flow Meters for Steam Condensate
      1. Condensate flow meters shall be electromagnet type and shall comply with
         requirements listed in Section 23 09 13 - Instrumentation and Control Devices for
         HVAC.

PART 3 - EXECUTION

3.1 VALVES FOR BUILDING STEAM AND CONDENSATE SYSTEMS
   A. Valve Orientation.
      1. Ball Valve.
         a. Valve may be installed in any position except with stem oriented vertically
            downward (i.e. with handle at bottom).
         b. Valve shall be installed such that the direction of flow indication on the valve body
            and/or product literature, if any, matches the actual direction of fluid flow through
            the valve.
      2. Butterfly Valve.
a. Valve shall be installed such that the shaft is oriented horizontally. In no case shall the valve be installed such that the shaft is oriented vertically downward (i.e. with the actuator at the bottom).

b. Valve shall be installed such that the direction of flow indication on the valve body and/or product literature, if any, matches the actual direction of fluid flow through the valve.

3. Check Valves for Pumped Condensate Applications.
   a. Install center-guided and body-guided valves in vertical upward orientation.

B. Valve Insulation.
   1. Insulated piping applications.
      a. Valves in insulated piping systems shall have the body, flanges, etc., completely insulated. The practice of leaving heating valves and associated unions/flanges un-insulated is not acceptable.
      b. Insulated valves shall be equipped with extended stems and protective shields as required to allow operation without disturbing insulation.
      c. Valves shall be provided with lock-out trim where indicated on the drawings. Extended stems are not required on valves with lock out trim.

C. Flange Gaskets.
   1. Steam and Condensate Applications
      a. Flange gaskets rated for design working pressure and temperature of system shall be provided.
      b. Antiseize compound shall be applied to flange bolt threads.

3.2 PRESSURE REGULATING VALVES
A. Steam Pressure Regulating Valve, Self-Contained.
   1. Accessibility
      a. Pressure regulating valve shall be located for ease of access to facilitate service and removal/replacement.
   2. Strainer
      a. Line-size strainer and eccentric reducer shall be provided in piping system upstream of each regulator.
   3. Unions/Flanges
      a. Pipe union shall be provided on each side of regulating valve to facilitate removal and replacement.
   4. Orientation
      a. Valve shall be installed in vertically upward (preferred) or vertically downward position as indicated in installation instructions.
   5. Accumulator
      a. “Condensate accumulator” (e.g. Boylston #300) shall be provided as indicated in manufacturer’s installation instructions.
   6. Adjustment
      a. Springs shall be adjusted for system pressures according to manufacturer’s installation instructions.

[Note to AE: Installation of an accumulator appears to be unique to Boylston regulators. Its primary purpose is to protect the diaphragm from direct exposure to live steam. Perhaps it has a secondary purpose? The Boylston manual includes the following text. Its logic is not clearly understood by this author.]
"The No. 300 condensate accumulator embodies no moving parts and consequently acts entirely by the action of the steam. The pumping action of the rubber diaphragm will naturally displace the condensate in the diaphragm chamber at times. This will cause a slight variation of reduced pressure. With the accumulator installed, the water held in the vertical pipe connection will never vary more than one or two inches due to the water merely flowing from one chamber to another."

3.3 FLOW METERS

A. Flow Meters for Steam Condensate.

1. Installation of magnetic flow meters for steam condensate applications shall comply with requirements listed in Section 23 09 13 - Instrumentation and Control Devices for HVAC.

END OF SECTION 23 22 13

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