

SECTION 230923.11 – CONTROL VALVES

1.1 GENERAL

Control valves assemblies shall be provided and delivered from a single manufacturer as a complete assembly. The manufacturer shall warrant all components for a period of 5 years from the date of production with the first two years unconditional.

1.2 PRESSURE INDEPENDENT CONTROL VALVES

- A. Manufactured, brand labeled or distributed by Belimo.
- B. Piping Package Option **NPS 2 (DN 50)** and smaller: Furnish a piping package with the control valve assembly, package to be supplied by the valve manufacturer, components as follows: the supply side of the coil shall contain a strainer/shut-off ball valve/drain [an integrated isolation ball valve/manual air vent] with P/T port; the return side of the coil shall contain a union fitting with a P/T port, ball-style control valve, an integrated manual balancing valve/union/isolation ball valve/manual air vent with P/T port. Isolation valves furnished as an integrated part of the ball-style control valve shall not be permitted. **[For ball valves with two ports, supply an integrated 100% port isolation valve/manual air vent with P/T port for field installation in the bypass of the circuit.]** **[A [12"] [24"] flexible hose set shall be provided for each coil supply and return connection.]**
- C. Pressure Independent Ball Valves **NPS ¾ (DN 20)** and Smaller:
 - 1. Materials:
 - a. Body:
 - 1) Forged brass.
 - b. Ball:
 - 1) Stainless steel.
 - c. Seats/Seals:
 - 1) PTFE (Teflon™), (2) EPDM O-rings.
 - d. Stem/Extension/Seals:
 - 1) Stainless steel, blowout-proof design.
 - e. Characterizing Disc:
 - 1) PTFE (Tefzel™);
 - 2. Piping Connections: (2), female NPT.
 - 3. Media: Water (maximum 60% monoethylene or polypropylene glycol solution).
 - 4. Performance:
 - a. Media Temperature: **36°F** to **212 °F (2°C to 100°C)**.
 - b. Pressure:
 - 1) Body: **360 psig (2482 kPa)**;
 - 2) Maximum Operating Differential: **50 psid (345 kPa)**;
 - 3) Close-off (valve and actuation assembly): **75 psig (517 kPa)**;
 - c. Leakage (A-AB): 0%.
 - d. Flow Characteristic: Equal percentage.
 - 5. Integral Pressure Regulator: Located upstream of characterized ball to regulate pressure, to maintain a constant pressure differential over the operating pressure differential range maintain the flow with an accuracy of +/- 5% due to system pressure fluctuations. Two

internal P/T ports shall be incorporated for differential pressure verification. Replaceable cartridges are not permitted.

6. **Labeling:** Valve body shall be furnished with a label containing the following data:
 - a. Manufacturer's name and model number;
 - b. Nominal size.

D. Pressure Independent Control Valve **NPS 6 (DN 150)** and Smaller:

1. **Materials:**
 - a. Body:
 - 1) **NPS 2 (DN 50)** and smaller: Forged brass;
 - 2) **NPS 2-1/2 (DN 65)** through **NPS 6 (DN 150)**: Cast iron GG25.
 - b. Ball:
 - 1) Stainless steel;
 - c. Seats/Seals:
 - 1) PTFE (Teflon™), (2) EPDM O-rings.
 - d. Stem/Extension/Seals:
 - 1) Stainless steel to match ball;
 - 2) Lubricated EPDM O-Rings (2).
 - e. Characterizing Disc:
 - 1) **NPS 2 (DN 50)** and smaller: Tefzel™;
 - 2) **NPS 2-1/2 (DN 65)** through **NPS 6 (DN 150)**: Stainless steel.
2. **Piping Connections:**
 - a. **NPS 2 (DN 50)** and smaller: (2), female NPT.
 - b. **NPS 2-1/2 (DN 65)** through **NPS 6 (DN 150)**: (2), flanged, [ANSI Class 125B] or [ANSI Class 250]
3. **Media:** Water (maximum 60% aqueous propylene glycol solution).
4. **Performance:**
 - a. Media Temperature: **14°F** to **250 °F** (Minus **10°C** to plus **150°C**).
 - b. Pressure:
 - 1) Body:
 - a) **NPS 1/2**, through **NPS 2 (DN 15 to DN 50)**: **360 psig (2758 kPa)**;
 - b) **NPS 2-1/2** through **NPS 6 (DN 65 to DN 150)**: In accordance with [ANSI Class 125B] or [ANSI Class 250].
 - 2) Maximum Operating Differential: **50 psid (345 kPa)**;
 - 3) Close-off (valve and actuation assembly):
 - a) **NPS 1/2**, through **NPS 2 (DN 15 to DN 50)**: **200 psig (1378 kPa)**;
 - b) **NPS 2-1/2**, through **NPS 6 (DN 65 to DN 150)**: ANSI Class 125B: **175 psid (1206 kPa)**; ANSI Class 250: **310 psid (2137 kPa)**.
 - c. Leakage (A-AB): 0%.
 - d. Flow Characteristic: Equal percentage.
5. **Flow Meter:** An ultrasonic flow meter (accuracy +/- 2%) shall be integrated with a characterized control valve providing analog flow feedback. The valve shall reposition to maintain the required flow with a +/- 5% accuracy over a pressure differential range of nominal 5 to 50 psig (34 to 350 kPa). The flow meter shall incorporate an algorithm to automatically compensate for the glycol concentration.
6. **Coil Optimization:** Two immersion temperature sensors for supply and return coil water temperatures shall be incorporated into the valve assembly. Software shall control the valve to avoid the coil differential temperature from falling below a programmed setpoint. Real-time data and configuration of valve operating parameters shall be available by BTL listed BACnet MS/TP, BACnet/IP, MODBUS or HTTP. Monitored points shall include inlet and outlet coil water temperatures,

absolute flow, absolute valve position, absolute coil power and total heating/cooling energy in BTU/hr. Configuration points shall include valve, flow and power settings. Historical trend data shall be stored for up to 13 months and be retrievable in a standard date-time stamped format.]

a. **[Cloud Technology: Owner provided internet connection for valve connection to cloud based analytics providing coil and system optimization. Manufacturer shall provide quarterly performance reports, automatic or manual coil optimization setpoint determination and software updates. A minimum connection time to the cloud for lifetime data access including Delta T and flow shall be required. Warranty shall be extended to 7 years with the first two years unconditional.]**

7. Labeling: Valve body shall be furnished with a label containing the following data:
- Manufacturer's name and model number;
 - Nominal size.

E. 6-way Pressure Independent Control Valve **NPS ¾ (DN 20)** and Smaller:

- Materials:
 - Body:
 - Forged brass.
 - Ball:
 - Chrome plated brass.
 - Seats/Seals:
 - PTFE (Teflon™), (4) EPDM O-rings.
 - Stem/Extension/Seals:
 - Nickel plated brass;
 - Lubricated EPDM O-Rings (4).
 - Characterizing Disc:
 - Chrome plated steel.
- Piping Connections: (6), female NPT.
- Media: Water (maximum 60% aqueous propylene glycol solution).
- Performance:
 - Media Temperature: **43°F to 180 °F (6°C to plus 82°C)**.
 - Pressure:
 - Body: **232 psig (1599 kPa)**;
 - Maximum Operating Differential: **15 psid (103 kPa)**;
 - Close-off (valve and actuation assembly): **50 psig (344 kPa)**.
 - Leakage (A-AB): 0%.
 - Flow Characteristic: Linear.
- Controllable Flow Range: Sequence 1 is 0 to 30 degree angle; Dead zone is 30 to 60 degree angle; Sequence 2 is 60 to 90 degree angle.
- Flow Meter: An ultrasonic flow meter (accuracy +/- 2%) shall be integrated with a 6-way characterized control valve providing analog flow feedback. The valve shall reposition to maintain the required flow with a +/- 6% accuracy over a pressure differential range of nominal **7 to 35 psig (34 to 241 kPa)**. The flow meter shall incorporate an algorithm to automatically compensate for the glycol concentration.
- Labeling: Valve body shall be furnished with a label containing the following data:
 - Manufacturer's name and model number;
 - Nominal size.

1.3 ELECTRIC AND ELECTRONIC CONTROL VALVE ACTUATORS

- A. Manufactured, brand labeled or distributed by Belimo.
- B. Agency Listings: ISO 9001, UL 873 or UL 60730, CE, and CSA.
- C. The valve assembly (control valve and actuator) shall be provided and delivered from a single manufacturer.
- D. The manufacturer shall warrant all components for a period of 5 years from the date of production with the first two years unconditional.
- E. Type: Motor operated, with gears, electric and electronic.
- F. Actuators for Hydronic Control Valves: Capable of closing valve against system pump shutoff head.
- G. Actuators for Steam Control Valves: Shutoff against [1.2] [1.5] <Insert number> times steam design pressure.
- H. Voltage:
 - 1. [See Drawings] [Voltage selection is delegated to professional designing control system] [24 V] [120 V] [230 V] <Insert requirement>.
 - 2. Actuator shall deliver torque required for continuous uniform movement of controlled device from limit to limit when operated at rated voltage and temperatures.
- I. Two-Position Actuators: Single direction, spring return or reversing type.
 - 1. Low voltage actuators [24 V] or wide range line voltage [120-230 V] or Universal voltage [24-230 V]
- J. Modulating Actuators:
 - 1. Capable of stopping at numerous points across full movement range, and starting in either direction from any point in range.
 - 2. Control Input Signal (Y):
 - a. Three Point, Tristate, or Floating Point: One input drives actuator towards open position, and other input drives actuator towards closed position. No signal to either input actuator remains in last position.
 - b. Proportional: Actuator drives proportional to input signal and modulates throughout its angle of rotation. Suitable for [zero- to 10] [or] [2- to 10] VDC [and] [4- to 20-mA] signals.
 - c. Pulse Width Modulation (PWM): Actuator drives to a commanded position according to a pulse duration (length) of signal from a dry-contact closure, triac sink or source controller.
 - d. Programmable:
 - 1) Control Input, Position Feedback, Mechanical Travel, and Running Time: Factory or field software programmable without the use of actuator mounted switches.

- 2) Adaptation: Upon adjustment of operating parameters, adaptation shall be available to initiate adaption of the input, feedback and run time, to the actual mechanical angle of rotation or travel.
 - 3) Diagnostic: Feedback of hunting or oscillation, mechanical overload, mechanical travel, and mechanical load limit.
 - 4) Service Data: Include, at a minimum, the ratio of the number of hours in motion and the number of hours powered.
- e. Digital control:
- 1) Valve actuators with built-in digital control for BACnet [MS/TP] or Modbus [RTU].
 - 2) Valve actuators with built-in digital control for BACnet [IP] or Modbus [TCP].

K. Position Feedback:

1. [Equip] [Where indicated, equip] two-position actuators with auxiliary switches or other positive means of a position indication signal for remote monitoring of [open] [and] [close] position.
2. [Equip] [Where indicated, equip] modulating actuators with analog position feedback through [voltage] signal for remote monitoring.
3. [Equip] [Where indicated, equip] digitally controlled [BACnet MS/TP] or [Modbus RTU] actuators with position feedback data point.
4. Provide a position indicator and graduated scale on each actuator indicating open and closed travel limits.

L. Fail-Safe:

1. Where indicated, provide actuator to fail to an end position.
2. Mechanical spring return mechanism to drive controlled device to an end position (open or close) on loss of power.
3. Electronic fail-safe shall incorporate an active balancing circuit to maintain equal charging rates among the Super Capacitors. The power fail position shall be proportionally adjustable between 0 to 100% in 10 degree increments with a 2 second [Insert timing between 0-10 seconds] operational delay.

M. Integral Overload Protection:

1. Provide electronic overload protection throughout the entire operating range in both directions.

N. Valve Attachment:

1. Attach actuator to valve drive shaft in a way that ensure maximum transfer of power and torque without slippage.
2. Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
3. V-bolt dual nut clamp with a V-shaped toothed cradle; directly couple and mount to the valve bonnet stem; or ISO-style direct-coupled mounting pad.

O. Temperature and Humidity:

1. Temperature: Suitable for operating temperature range encountered by application with minimum operating temperature range of [**minus 22 to plus 122 deg F ((minus 30 to plus 50 deg C))**].
2. Humidity: Suitable for humidity range encountered by application; minimum operating range shall be from 5 to 95 percent relative humidity, non-condensing.

P. Enclosure:

1. Suitable for ambient conditions encountered by application.
2. NEMA Type 1 for indoor installation in an equipment enclosure.
3. NEMA Type 2 for indoor and protected applications.
4. NEMA Type 4 or Type 4X for outdoor and unprotected applications.
5. Provide actuator enclosure with a heater and controller where required by application.

Q. Stroke Time:

1. Operate damper from fully closed to fully open within [**15**] [**60**] [**75**] [**90**] [**150**] <Insert number> seconds.
2. Operate damper from fully open to fully closed within [**15**] [**60**] [**75**] [**90**] [**150**] <Insert number> seconds.
3. Move damper to fail-safe position within [**5**] [**15**] [**30**] <Insert number> seconds.
4. Select operating speed to be compatible with equipment and system operation.
5. Actuators operating in smoke control systems comply with governing code and NFPA requirements.

R. **Optional Addressable Actuator**

1. **Controlled via BACnet MS/TP or Modbus RTU.**
 - a. Internal converter for one (optional) sensor (active sensor or switching contact) for transmission of the sensor signal to a higher-level system.
2. **Controlled via the Cloud, BACnet IP or Modbus TCP.**
 - a. Internal converter for two (optional) sensors (passive sensor, active sensor or switching contact) for transmission of the sensor signal to a higher-level system.

SPECIFYING PRESSURE INDEPENDENT CONTROL VALVES REQUIRE THE FOLLOWING ADDITIONS TO SECTIONS 232113 AND 230593.

To be inserted into Section 232113 – HYDRONIC PIPING

2.6 CONTROL VALVES

- K. Calibrated Balancing Valves and Automatic Flow-Control Valves shall not be used on equipment where pressure independent control valves are installed.

To be inserted into Section 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

3.11 PROCEDURE FOR HYDRONIC SYSTEMS

- H. Systems installed with pressure independent control valves shall not require terminal level hydronic system balancing. **[Field verify installation and operating differential pressure range of all pressure independent control valves.] [Total system flow shall be verified to be within +/-10% of system design.] [10%] [20%] [25%] <Insert Percentage> of the total installed product shall be randomly checked for individual conformance. Exact locations of tested product to be coordinated with the design engineer.] Any individual adjustments for the pressure independent valve assembly (valve and actuator combination) for field conditions shall be performed using the pressure independent control valve manufacturer's documented procedure following the guidelines of the National Environmental Balancing Bureau (NEBB) and the Testing Adjusting Balancing Bureau (TABB)]**