sECTION 25 11 00 – BAS basic materials, interface devices, and sensors

1. GENERAL
	* + 1. SUMMARY
				1. This section contains requirements for pneumatic, electric and digital control systems as indicated on the contract drawings.
				2. All control system components, devices, sensors, etc. shall be compatible with Johnson Controls METASYS.
				3. General Contractor is responsible for installation of field mounted devices furnished by BAS Provider.
				4. BAS Provider is responsible for connecting all sensors, actuators, control valves, control dampers, electrical components and all interconnecting pneumatic tubing and electrical wiring between these devices and the Direct Digital Controller (DDC).
				5. After all equipment has been installed, wired and piped, BAS Provider will be responsible for all termination connections at the DDC controllers and for checking, testing, programming and start-up of the control system. General Contractor must be on site at start-up to make any necessary hardware adjustments as required.
				6. For projects involving renovation of existing controls, BAS Provider shall remove all unused sensors, operators, panels, wiring, tubing, conduit, etc., within the project scope of work. Owner shall have the option of retaining any removed controls. Turn over salvaged controls to BJC Remote Operations Center (ROC) Manager.
				7. Devices and controllers shall not be reinstalled without direction from BJC ROC Manager.
			2. RELATED DOCUMENTS
				1. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.
				2. All other Division 25 sections are applicable to this section.
				3. Divisions 23 and 26 sections are applicable to this section.
				4. The latest published version of the BJC Healthcare Manual of Practice, which incorporates the BJC Healthcare Controls Programming Guide, apply to this section except as edited in these documents.
			3. REFERENCE STANDARDS
				1. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
				2. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
				3. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within all references.
			4. WORK BY OTHERS
				1. Control Valves furnished under this Section shall be provided by BAS Provider to General Contractor for installation under the applicable piping Section. BAS Provider will give direction to the installing contractor and will be fully responsible for the proper operation of the valve.
				2. Control Dampers shall be installed under the applicable air distribution or air handling equipment Section under the direction of the BAS Provider who will be fully responsible for the proper operation of the damper.
				3. Water Pressure Taps, Thermal Wells, Flow Switches, Flow Meters, etc. that will have wet surfaces, shall be installed under the applicable piping Section under the direction of the BAS Provider who will be fully responsible for the proper installation and application.
				4. Variable Frequency Drives shall be provided with BacNet communication protocol information compatible with Johnson Control Metasys. BAS Provider shall be responsible to interface and make available VFD information in the building automation system. Control of the VFD shall meet controller standalone requirements of Division 25.
2. PRODUCTS
	* + 1. GENERAL
				1. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
				2. Provide electronic, pneumatic, and electric control products in sizes and capacities indicated, consisting of valves, dampers, controllers, sensors, and other components as required for complete installation. Except as otherwise indicated, provide BAS Provider’s standard materials and components as published in their product information; designed and constructed as recommended by manufacturer, and as required for application indicated.
			2. materials and equipment

[Edit the following to suit the Project. Engineer shall assess the cost effectiveness of pneumatically driven actuators. Engineer shall also assess the condition, reliability, and capacity of existing control air supplies where applicable to the Project. Pneumatic systems information is applicable to minor renovations only and as approved by bjc corporate engineer. design and installation shall match existing methods.]

* + - * 1. Control Air Supply: Contractor may reuse existing control air in buildings where pneumatic controls will be replaced. Contractor shall install air dryers and air filters so that all controllers and new pneumatic devices receive a clean and dry air supply.

Copper Tubing: Seamless copper tubing, Type M or L, ASTM B 88; wrought-copper solder-joint fittings, ANSI B16.22; except brass compression-type fittings at connections to equipment.

Flex Tubing: Virgin Polyethylene non-metallic tubing, ASTM D 2737, with flame-retardant harness for multiple tubing. Use compression or push-on polyethylene fittings. Tubing used above suspended ceilings to be plenum rated per NFPA 90A. See section 3.1.b for locations where flex tubing can be used.

Copper to polyethylene connections shall be compression barbed fittings or solder barbed fittings.

* + - * 1. Conduit and Raceway:

Electrical Metallic Tubing: EMT and fittings shall conform to ANSI C80.3.

Surface Metal Raceway and Fittings: Wiremold 500, Ivory, or approved equal.

Flexible Metal Conduit: Indoors, per National Electric Code for connection to moving or vibrating equipment.

Liquidtight Flexible Conduit: Outdoors, per National Electric Code for connection to moving or vibrating equipment.

* + - 1. Standard and CRITICAL SERVICE CONTROL VALVES
				1. Control valve selection is the initial responsibility of the Engineer. Engineer shall provide a valve schedule on the drawings that lists the requirements of the valves for close off, temperature etc. This should be a result of analyzing the valves performance across the range of control. Final sizing and selection shall be by the BAS Provider based on information provided by the Engineer. Engineer shall consult with BAS Provider when specifying control valves. [Information in the ‘Control Valve Specification Sheet’ located at the end of this Section shall be included in a Control Valve Schedule on the drawings by the Engineer and then deleted from this specification].
				2. Provide factory fabricated pneumatic or electric control valves of type, body material, and pressure class as indicated on the drawings. Equip pneumatic control valves with heavy-duty pneumatic actuators, with proper shutoff rating for each individual application.
			2. control dampers

[Note to Engineer of Record: The EOR is responsible for sizing and selecting control dampers. Engineer shall provide control damper schedule on drawings and edit specification to include specific information for control damper manufacture. If control damper isn’t furnished with the equipment, edit information below to indicate BAS Provider to furnish instead of General Contractor.]

* + - * 1. General: General Contractor shall provide factory fabricated automatic control dampers of sizes, velocity and pressure classes as required for smooth, stable, and controllable airflow. Provide parallel damper for two-position control or opposed blade dampers for modulating control as recommended by manufacturer’s sizing techniques. For dampers located near fan outlets, provide dampers rated for fan outlet velocity and close-off pressure, and recommended by damper manufacturer for fan discharge damper service. Provide multiple sections and operators as required by opening size and sequence of operations. Control dampers used for smoke dampers shall comply with UL 555S. Control Dampers used for fire dampers shall comply with UL 555.
			1. actuators
				1. General: Size actuators and linkages to operate their appropriate dampers or valves with sufficient reserve torque or force to provide smooth modulating action or 2-position action as specified. Select spring-return actuators with manual override to provide positive shut-off of devices as they are applied.
			2. general field devices
				1. Provide field devices for input and output of digital (binary) and analog signals into controllers. Provide signal conditioning for all field devices as recommended by field device manufacturers and as required for proper operation in the system.
				2. Field devices specified herein are generally ‘four-wire’ type equal transmitter with necessary regulated DC power supply or 120 VAC power supply, as required.
				3. For field devices specified hereinafter that require signal conditioners, signal boosters, signal repeaters, or other devices for proper interface to controllers, BAS Provider shall furnish and install proper device, including 120V power as required. Such devices shall have accuracy and repeatability equal to, or better than, the accuracy and repeatability listed for respective field devices.
				4. All controllers on the BacNet trunk shall be wired in series. ***T-taps are expressly prohibited.***
			3. TEMPERATURE SENSORS (TS)
				1. Sensor range: Sensor range shall provide a resolution of no worse than 0.3 degrees F (unless noted otherwise). Where thermistors are used, the stability shall be better than 0.25 degrees F over five (5) years.

[Engineer of record shall carefully specify other applications where matched sensors are required for the specific Project.]

* + - * 1. Matched Sensors: The following applications shall require matched sensors:

Hydronic Temperature Difference Calculations: Provide matched supply and return temperature sensors where the pair is used for calculating temperature difference for use in load calculations or sequencing such as across chillers and plants. Sensing element shall be nickel RTD guaranteeing an accuracy of .

Air Handling Unit Sequencing: Provide matched pair for the cooling and heating coil leaving sensors where the sequence includes calculating an offset from the supply air setpoint to maintain a leaving heating coil temperature. Sensing element shall be nickel RTD guaranteeing an accuracy of +/- 0.5º F.

[Engineer of record must designate where various amenities to room sensors are required. The following assumes that this will be indicated on the Contract drawings. Otherwise Engineer must add the clarification below. Edit/Delete the following to suit the systems as applicable.

These are sensors for standard control and monitoring. Consult Owner for direction in the application of sensing element types.]

* + - * 1. Room Temperature Sensor: Shall be an element contained within a ventilated cover, suitable for wall mounting, unless noted otherwise. Provide insulated base if mounted on exterior wall. Following sensing elements are acceptable:

Sensing element shall be nickel RTD, thermistor, or integrated circuit, +/- 0.5°F accuracy at calibration point.

Provide setpoint adjustment where indicated. The setpoint adjustment shall be a warmer/cooler indication that shall be scalable via the BAS. [Engineer: edit to suit project conditions. Display and setpoint adjustment to be coordinated by engineer with Owner’s Rep.]

Provide an occupancy override button on the room sensor enclosure where indicated. This shall be a momentary contact closure.

Provide current temperature indication via an LCD or LED readout, where noted.

[These are sensors for critical control and monitoring. Consult Owner for direction in the application of sensing element types.]

* + - * 1. Critical Room Temperature Sensor: Shall be an element contained within a ventilated cover, suitable for wall mounting. Provide insulated base. Following sensing elements are acceptable:

Sensing element shall be nickel RTD, +/- 0.1 degrees C measured at 0 degrees C.

Provide setpoint adjustment where indicated. The setpoint adjustment shall be a warmer/cooler indication that shall be scalable via the BAS.

Provide an occupancy override button on the room sensor enclosure where indicated. This shall be a momentary contact closure

Provide current temperature indication via an LCD or LED readout, where noted.

[These are sensors for standard control and monitoring. Consult Owner for direction in the application of sensing element types.]

* + - * 1. Single-Point Duct Temperature Sensor: Shall consist of sensing element, junction box for wiring connections and gasket to prevent air leakage or vibration noise. Temperature range as required for resolution indicated. Sensor probe shall be 316 stainless steel.

Sensing element shall be nickel RTD, thermistor, or integrated circuit, +/- 0.3 degrees F accuracy at calibration point

[These are sensors for critical control and monitoring. Consult Owner for direction in the application of sensing element types.]

* + - * 1. Single-Point Duct Temperature Sensor: Shall consist of sensing element, junction box for wiring connections and gasket to prevent air leakage or vibration noise. Temperature range as required for resolution indicated. Sensor probe shall be 316 stainless steel.

Sensing element shall be nickel RTD, +/- 0.1 degrees C measured at 0 degrees C.

[Edit the following averaging length per square foot based on how homogeneous the air temperature will be at the installed location. For instance, a preheat sensor of a mixed air plenum will require more length than the discharge off a preheat coil in a 100 percent outside air handling unit.

These are sensors for standard control and monitoring. Consult Owner for direction in the application of sensing element types.]

* + - * 1. Averaging Duct Temperature Sensor: Shall consist of an averaging element, junction box for wiring connections and gasket to prevent air leakage. Provide sensor lengths and quantities to result in one lineal foot of sensing element for each three square feet of cooling coil/duct face area. Provide a minimum of two sensors when coil/duct face area exceeds 149 square feet. Temperature range as required for resolution indicated.

Sensing element shall be nickel RTD, or thermistor, +/- 0.3 degrees F accuracy at calibration point.

[These are sensors for critical control and monitoring. Engineer shall identify critical applications in the contract documents. ]

* + - * 1. Averaging Duct Temperature Sensor: Shall consist of an averaging element, junction box for wiring connections and gasket to prevent air leakage. Provide sensor lengths and quantities to result in one lineal foot of sensing element for each three square feet of cooling coil/duct face area. Provide a minimum of two sensors when coil/duct face area exceeds 149 square feet. Temperature range as required for resolution indicated.

Sensing element shall be nickel RTD, +/- 0.2 degrees C measured at 0 degrees C.

* + - * 1. Liquid immersion temperature sensor shall include brass thermowell, sensor and connection head for wiring connections. Temperature range shall be as required for resolution of 0.15 degrees F.

Sensing element (chilled water/glycol systems) shall be nickel RTD +/- 0.2 degrees C measured at 0 degrees C.

* + - * 1. Pipe Surface-Mount Temperature Sensor: Shall include metal junction box and clamps and shall be suitable for sensing pipe surface temperature and installation under insulation. Provide thermally conductive paste at pipe contact point. Temperature range shall be as require for resolution indicated in this Section.

Sensing element shall be nickel RTD, thermistor, or integrated circuit, +/- 0.4 degrees F accuracy at calibration point.

* + - * 1. Outside air sensors shall consist of a sensor, sun shield, utility box, and watertight gasket to prevent water seepage. Temperature range shall be as require for resolution indicated in this Section.

+/- 0.2 degrees C measured at 0 degrees C.

* + - 1. humidity transmitters

##### Units shall be suitable for duct, wall (room) or outdoor mounting The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.

##### The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion:

3% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.

##### The sensor shall be a solid-state type, relative humidity sensor of the Thin Film Capacitance or Bulk Polymer Design. The sensor element shall resist service contamination.

##### The sensor shall be a solid-state type, relative humidity sensor of the Thin Film Capacitance or Bulk Polymer Design. The sensor element shall resist service contamination.

##### The sensor shall be a solid-state type, relative humidity sensor of the Thin Film Capacitance or Bulk Polymer Design. The sensor element shall resist service contamination.

##### Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R (IP54) or NEMA 4 (IP65) enclosure with sealtite fittings.

##### A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.

##### Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.

##### Acceptable Manufacturers: Johnson Controls and Vaisala.

* + - 1. DIFFERENTIAL PRESSURE TRANSMITTERS (DP)
				1. Liquid, Steam and Gas:

General: Two-wire smart DP cell type transmitter, 4-20 mA or 1-5 Vdc linear output, adjustable span and zero, stainless steel wetted parts.

Ambient Limits: –40 to 175 degrees F (-40 to 121 degrees C), 0 to 100% RH.

Process Limits: –40 to 400 degrees F (-40 to 205 degrees C).

Accuracy: Less than 0.1 percent.

Output Damping: Time constant user selectable from 0 to 36 seconds.

Vibration Effect: Less than +/- 0.1 percent of upper range limit from 15 to 2000 Hz in any axis relative to pipe mounted process conditions.

Electrical Enclosure: NEMA 4, 4X, 7, 9.

Approvals: FM, CSA.

Acceptable Manufacturers: Rosemount Inc. 3051 Series, Foxboro, Johnson-Yokagawa.

* + - * 1. General Purpose Low Pressure Air: Generally for each measurement of duct pressure, filter differential pressure or constant volume air velocity pressure measurement where the range is applicable.

General: Loop powered two-wire differential capacitance cell-type transmitter.

Output: Two wire 4-20 mA output with zero adjustment.

Overall Accuracy: Plus or minus 1 percent.

Minimum Range: 0.1 inches w.c.

Maximum Range: 10 inches w.c.

Housing: Polymer housing suitable for surface mounting.

Acceptable Manufacturers: Units shall be Setra, Modus T30, Veris PX Series, or Dwyer Series 616.

Static Sensing Element: Pitot-type static pressure sensing tips similar to Dwyer model A-301 and connecting tubing.

Range: Select for specified setpoint to be between 25 percent and 75 percent full-scale.

Magnehelic Gauges: Provide Dwyer Series 200 Magnehelic Differential Pressure Gauge (or equal) for each DP transmitter. Provide gauge, mounting bracket, ¼ inch aluminum tubing, static pressure tips, and molded plastic vent valves for each gauge connection. Select range for specified recommended filter loading pressure drop to be 75 percent full-scale. For other DP transmitters select range for specified setpoint to be between 25 percent and 75 percent full-scale.

* + - * 1. General Purpose Low Pressure/Low Differential Air: Generally for use in static measurement of space pressure or constant volume air velocity pressure measurement where the range is applicable.

General: Loop powered, two-wire differential capacitance cell type transmitter.

Output: Two-wire 4-20 mA output with zero adjustment.

Overall Accuracy: Plus or minus 1 percent.

Minimum Repeatability: +/- 0.25 percent of reading.

Maximum Range: 0.1, 0.25, or 0.5 inches w.c.

Housing: Polymer housing suitable for surface mounting.

Acceptable Manufacturers: Setra, Modus T30.

Static Sensing Element: Pitot-type static pressure sensing tips similar to Dwyer model A-301 and connecting tubing.

Range: Select for specified setpoint to be between 25 percent and 75 percent full-scale.

* + - * 1. VAV Velocity Pressure: Generally for use in variable volume air velocity pressure measurement where the range is applicable.

General: Loop powered two-wire differential capacitance cell type transmitter.

Output: Two-wire, 4-20 mA output with zero adjustment.

Overall Accuracy: Plus or minus 0.25 percent.

Minimum Range: 0 inches w.c.

Maximum Range: 1 inch w.c.

Housing: Polymer housing suitable for surface mounting.

Acceptable Manufacturers: Setra.

Range: Select for minimum range that will accept the maximum velocity pressure expected.

Magnehelic Gauges: Provide Dwyer Series 200 Magnehelic Differential Pressure Gauge (or equal) for each DP transmitter. Provide gauge, mounting bracket, ¼ inch aluminum tubing, static pressure tips, and molded plastic vent valves for each gauge connection. Select range for specified setpoint to be between 25 percent and 75 percent full-scale.

* + - 1. AIRFLOW MEASURING STATIONS (AFMS)
				1. Fan Inlet Probe: Shall consist of vortex shedding multi-sensor probes which are installed in the inlet of the fan. Individual sensors on the probe provide direct proportional and linear signals to airflow velocity.

Sensor Accuracy: +/- 2.0 percent.

Interchangeability: +/- 0.5 percent.

Velocity Range: 750 to 9000 fpm.

Electronics Accuracy: +/- 0.05 percent.

Temperature Limits: -20 degrees F to 140 degrees F.

Enclosure for Electronics: NEMA 1.

Material: Aluminum.

Operating Range: Select minimum range to accommodate the expected flow range of the equipment.

Acceptable Manufacturers:Ebtron Gold Series, or approved equal.

* + - 1. VALVE BYPASS FOR DIFFERENTIAL PRESSURE SENSORS
				1. Provide a five valve bypass kit for protection of DP sensors where the static on the pipe can cause an over pressure when connected to one port with the other at atmospheric pressure. Kit shall include high and low pressure isolation valves, high and low pressure vent valves, calibration taps, and a bypass valve contained in a NEMA 1 enclosure.
			2. DIFFERENTIAL PRESSURE SWITCHES (DPS)
				1. General Service Auto Reset - Air: Diaphragm with adjustable setpoint and differential and snap acting form C contacts rated for the application. Provide manufacturer's recommended static pressure sensing tips and connecting tubing. Acceptable Manufacturer - Dwyer Series 1900 or approved equal.
				2. General Service Manual Reset - Air: Diaphragm with adjustable setpoint and differential and snap acting form C contacts rated for the application. Manual reset shall be readily accessible in reach of personnel installed at height not to exceed 5 feet above finished floor. Provide manufacturer's recommended static pressure sensing tips and connecting tubing. Acceptable Manufacturer - Dwyer Series 1900 or approved equal. . The High Static Pressure Safety Switch shall alarm to the Building Automation System upon activation.
				3. General Service - Water: Diaphragm with adjustable setpoint, 2 psig or adjustable differential and snap-acting Form C contacts rated for the application. 60 psid minimum pressure differential range and 0 degrees F to 160 degrees F operating temperature range.
			3. PRESSURE SWITCHES (PS)
				1. Diaphragm or bourdon tube with adjustable set point and differential and snap-acting Form C contacts rated for the application. Pressure switches shall be capable of withstanding 150 percent of rated pressure.
			4. TRANSDUCERS
				1. With approval of BJC Corporate Engineer.
			5. CURRENT SWITCHES (CS)
				1. Clamp-On Design Current Operated Switch (for Constant Speed Motor Status Indication):
				2. Clamp-on Wire Through Current Switch (CS/CR) (for Constant Speed Motors): Same as CS with 24v command relay rated at 5A @ 240 Vac resistive, 3A @ 240 Vac inductive, load control contact power shall be induced from monitored conductor (minimum conductor current required to energize relay 5A, max. rating of 135A). Acceptable Manufacturers shall be Veris Industries, Inc., Model # H938 or RE Technologies RCS 1150.
				3. Clamp-On Design Current Operated Switch for Variable Speed Motor Status Indication:
				4. Clamp-On Wire Through Current Switch (CS/CR) (for Variable Speed Motors): Same as CS with 24v command relay rated at 5A @ 240 Vac resistive, 3A @ 240 Vac inductive, load control contact power shall be induced from monitored conductor (minimum conductor current required to energize relay 5A, max. rating of 135A). Acceptable manufacturer shall be Veris Industries, Inc., Model # H934.
				5. Variable Speed Status: Where current switches are used to sense the status for variable speed devices, the CT shall include on-board VA/Hz memory to allow distinction between a belt break and subsequent ramp up to 60 Hz, versus operation at low speed. The belt break scenario shall be indicated as a loss of status and the operation at low speed shall indicate normal status.
			6. CURRENT TRANSFORMERS (CT)
				1. Clamp-On Design Current Transformer (for Motor Current Sensing):
			7. OUTDOOR AIR STATIC PRESSURE SENSING TIP
				1. Pressure Sensor: Pressure sensing tip shall be designed to minimize the effects of wind and resulting velocity pressure up to 80 mph. Acceptable manufacturers shall be Dwyer A-306.
			8. ULTRASONIC FLOW METER FOR STEAM SERVICE:

**[Engineer shall confirm meter type for steam service and edit as appropriate after approval by BJC Healthcare Infrastructure Management.]**

* + - * 1. General: Single-channel ultrasonic meter to measure the mass flow rate of saturated or superheated steam and the volumetric flow of wet steam.
			1. CO2 SENSORS/TRANSMITTERS (CO2)
				1. General: CO2 sensors shall use silicon based, diffusion aspirated, infrared single beam, dual-wavelength sensor.
			2. NAMEPLATES
				1. Provide engraved phenolic or micarta nameplates for all equipment, components, and field devices furnished. Nameplates shall be 1/8 inch thick, black, with white center core, and shall be minimum 1 inch x 3 inch, with minimum ¼ inch high block lettering. Nameplates for devices smaller than 1 inch x 3 inch shall be attached to adjacent surface.
				2. Each nameplate shall identify the function for each device.
1. EXECUTION
	* + 1. PREPARATION
				1. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Owner.
			2. INSTALLATION OF CONTROL SYSTEMS
				1. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
				2. All installation shall be in accordance with manufacturer’s published recommendations.
				3. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings. Install electrical components and use electrical products complying with requirements of the latest edition of the National Electrical Code and all local codes.

**[Include D and E only for small renovation or repair projects. Pneumatic systems for new facilities or major renovations are expressly prohibited.]**

* + - * 1. Main Control Air Piping: All main air piping between the compressors and the control panels shall be copper, run per ASTM B88.
				2. Branch Control Air Piping: Accessible tubing is defined as that tubing run in mechanical equipment rooms; inside mechanical equipment enclosures, such as heating and cooling units, instrument panels; across roofs, in pipe chases, etc. Inaccessible tubing is defined as that tubing run in concrete slabs; furred walls; or ceilings with no access.

Provide copper tubing with maximum unsupported length of three (3) feet for accessible tubing run exposed to view. Terminal single-line connections less than 18 inches length may be copper tubing, or polyethylene tubing run. Tubing exposed to ambient conditions must be properly protected from sunlight and protected from damage.

Provide copper tubing for inaccessible tubing, other than in concrete pour. In a concrete pour polyethylene tubing may be used, install in rigid conduit or vinyl-jacketed polyethylene tubing. Install in galvanized rigid steel conduit at all exterior locations. Install in PVC Schedule 40 conduit if encased in concrete.

Polyethylene tubing may be used in control panels provided it is run in a neat and orderly fashion, bundled where applicable, properly supported and installed in a neat and workman like manner. Fasten flexible connections bridging cabinets and doors, neatly along hinge side, and protect against abrasion.

Pressure test control air piping at 30 psi (207 kPa) for 24 hours. Test fails if more than 2 psi loss occurs.

Number-code or color-code tubing, except local individual room control tubing, for future identification and servicing of control system. Code shall be as indicated on approved installation drawings.

* + - * 1. Control Wiring: The term "control wiring" is defined to include providing of wire, conduit and miscellaneous materials as required for mounting and connection of electric control devices.

Wiring System: Install complete wiring system for electric control systems. Conceal wiring exposed in mechanical rooms and areas where other conduit and piping are exposed. Installation of wiring shall generally follow building lines. Install in accordance with the latest edition of the National Electrical Code and Division 26. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.

Control Wiring Conductors: Install control wiring conductors, without splices between terminal points, color-coded. Install in neat workmanlike manner, securely fastened. Install in accordance with the latest edition of the National Electrical Code and Division 26.

Communication wiring, signal wiring and low voltage control wiring shall be installed separate from any wiring over thirty (30) volts. Signal wiring shield shall be grounded at controller end only, unless otherwise recommended by the controller manufacturer.

BAS low voltage wiring/cables: All cables shall have legible printed sleeve identification labels at each device and the panel termination.

 [Engineer shall consult with Owner prior to allowing exposed cable and including the applicable paragraphs.]

Terminate all control wiring internal to panels to screw terminals connections or owner approved wire connection equivalent. Wire nuts and/or splices are not allowed in panels. When terminating a wire cable, the cable jacket, cable shielding wire, and cable shielding material shall be finished in a neat consistent workmanlike manner.

[Install all control wiring external to panels in electric metallic tubing or raceway. Installation of wiring shall generally follow building lines. Provide compression type connectors. Install wiring in galvanized rigid steel conduit at all exterior locations and where subjected to moisture. Install in PVC Schedule 40 conduit if encased in concrete. All conduits penetrating partitions, walls or floors shall be sealed with a submitted and approved fire/smoke sealant material to prevent migration of air through the conduit system.

[Communication wiring, signal wiring and low voltage control wiring may be run without conduit in concealed, accessible locations if noise immunity is ensured.

Contractor shall be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance.

Accessible locations are defined as areas inside mechanical equipment enclosures, such as heating and cooling units, instrument panels etc.; in accessible pipe chases with easy access, or suspended ceilings with easy access. Installation of wiring shall generally follow building lines.

Run in a neat and orderly fashion, bundled where applicable, and completely suspended (strapped to rigid elements or routed through wiring rings) away from areas of normal access. Tie and support conductors neatly with suitable nylon ties and not to exceed five (5) foot intervals.

Conductors shall not be supported by the ceiling system or ceiling support system. Conductors shall be pulled tight and be installed as high as practically possible in ceiling cavities. Wiring shall not be laid on the ceiling or duct.

Conductors shall not be installed between the top cord of a joist or beam and the bottom of roof decking.]

Secondary LAN Communication cabling shall be provided in an Owner approved color dedicated to the BAS.

Number-code or color-code conductors appropriately for future identification and servicing of control system. Code shall be as indicated on approved installation drawings.

* + - * 1. Control Valves: Install so that actuators, wiring, and tubing connections are accessible for maintenance. Where possible, install with valve stem axis vertical, with operator side up. Where vertical stem position is not possible or would result in poor access, valves may be installed with stem horizontal. Do not install valves with stem below horizontal, or down.

[Engineer must specifically show locations of all flow measuring stations and flow meters and design the straight length of duct of pipe required for accurate sensors. This length must be specifically shown on the drawing and be adequate for the installation.]

* + - * 1. Airflow Measuring Stations: Install per manufacturer’s recommendations in an unobstructed straight length of duct (except those installations specifically designed for installation in fan inlet). For installations in fan inlets, provide on both inlets of double inlet fans and provide inlet cone adapter as recommended by AFM station manufacturer.

[Engineer must specifically show locations of all flow measuring stations and flow meters and design the straight length of duct of pipe required for accurate sensors. This length must be specifically shown on the drawing and be adequate for the installation.]

* + - * 1. Fluid Flow Sensors: Install per manufacturer’s recommendations in an unobstructed straight length of pipe.
				2. Relative Humidity Sensors: Provide element guard as recommended by manufacturer for high velocity installations. For high limit sensors, position remote enough to allow full moisture absorption into the air stream before reaching the sensor.
				3. Water Differential Pressure Transmitters: Provide valve bypass arrangement to protect against over pressure damaging the transmitter.
				4. Steam Differential Pressure Transmitters: Install as shown on the Drawings per manufacturer’s instructions.
				5. Pipe Surface Mount Temperature Sensors: Install with thermally conductive paste at pipe contact point. Where sensor is to be installed on an insulated pipe Contractor shall neatly cut insulation install sensor, repair or replace insulation and vapor barrier and adequately seal vapor barrier.
				6. Flow Switches: Where possible, install in a straight run of pipe at least 15 diameters in length to minimize false indications.
				7. Current Switches for Motor Status Monitoring: Adjust so that setpoint is below minimum operating current and above motor no load current.
				8. Supply Duct Pressure Transmitters:

General: Install pressure tips with at least four (4) ‘round equivalent’ duct diameters of straight duct with no takeoffs upstream. Install static pressure tips securely fastened with tip facing upstream in accordance with manufacturer’s installation instructions. Locate the transmitter at an accessible location to facilitate calibration.

VAV System ‘Down-Duct’ Transmitters: Locate pressure tips approximately 2/3 of the hydraulic distance to the most remote terminal in the air system.

* + - * 1. Cutting and Patching Insulation: Repair insulation to maintain integrity of insulation and vapor barrier jacket. Use hydraulic insulating cement to fill voids and finish with material matching or compatible with adjacent jacket material.

Control valve selection is the initial responsibility of the Engineer and NOT left SOLELY to the BAS Provider. The items noted with a \* and \*,\*\* shall be completed by the Engineer to list the requirements of the valves for close off, temperature ratings, cage material, seat material, trim material etc. for each individual application. This should be a result of analyzing the valves performance and application across the range of control. Engineer shall consult with bas pROVIDER prior to and during specifcation of these valves.]

END OF SECTION 25 11 00

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| --- |
| BJC Healthcare |
| Steam Control Valve Specification Sheet (Globe Body) |
| Project Name | Revisions | SHEET | xx of xx |
| NO.  | BY | DATE | DESCRIPTION | SPEC. NO. | REVISION |
| 1 |   |   |   | 251100 | \* |
| 2 |   |   |   | CONTRACT | DATE |
| 3 |   |   |   | X | mm/dd/yy |
| 4 |   |   |   | PROJECT NUMBER |
| 5 |   |   |   | XXXX.XX |
| 6 |   |   |   | BY | CHECKED | APPROVED |
| 7 |   |   |   | XYZ | XYZ | XYZ |
| GENERAL | Tag Number | \* |
| Service Description | \* |
| Drawing Number | \* |
| Equipment ID | \* |
| Line Size / Mat'l / Sch. | \* |
| Electrical Class | Power Supply | \* | \* |
| PROCESS DATA | Fluid | Fluid State | SATURATED STEAM <125 PSIG | VAPOR |
| Operating Condition | Units | Minimum  | Normal | Maximum | Other |   |   |
| Flow Rate | LB/HR | \* | \* | \* | \* |   |   |
| Inlet Pressure | PSIG | \* | \* | \* | \* |   |   |
| Outlet Pressure | PSIG | \* | \* | \* | \* |   |   |
| Temperature | DEG F | \* | \* | \* | \* |   |   |
|   |   |   |   |   |   |   |   |
| Mol. Wt. |   |   |   |   |   |   |   |
| Sp. Wt | Sp. Grav |   |   |   |
| Viscosity | Sp Heat |   |   |   |

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| --- | --- | --- | --- | --- |
| BODY | Style | Size | GLOBE | xx" |
| End Connection | Rating | xx" RF FLANGED | ANSI CLASS 150 |
| Port Size | Travel | \* | \* |
| Valve Cv | Valve C1/Km | \* | \*\* |
| Body Matl. | Bonnet | ASTM A216 WCB | ASTM A216 WCB |
| Characteristic | Trim Number | EQUAL PERCENTAGE | \*,\*\* |
| Cage Matl. | Retainer Matl. | \* | \* |
| Seat Matl. | Seat Ring Matl. | \*,\*\* | \*,\*\* |
| Plug Matl. | Stem Matl. | \*,\*\* | \*,\*\* |
| Flow Action | DOWN |
| Gaskets | SPIRAL METALLIC |
| Stem Guide | \*\* |
| Packing | GLASS FILLED PTFE\*\* |
| Required Seat Tightness  | ANSI CLASS IV |
| Max. Allowable Sound Level (dBA) | <75 dBA |
| ACTUATOR | Type | PNEUMATIC |
| Size | Bench Set | \* | \* |
| Push-Down To | Fail Position | CLOSE\* | CLOSE\* |
| Close At | Open At | 6 PSIG\* | 30 PSIG\* |
| Handwheel | NONE\* |
| POSITIONER | Type | Electronic |
| Communications Protocol | \* |
| Input Signal  | Output Signal | 4-20 mA |   |
| Air Supply | 80 PSIG NOMINAL\* |
| TRANSDUCER | Type | \* |
| Input Signal | \* |
| Output Signal | \* |
| OPTIONS | Air Set w/ Gauges | YES\* |
| Solenoids | \* |
| Position Switches | \* |

|  |  |  |
| --- | --- | --- |
| SELECTION BASED ON | Manufacturer | Fisher, Valtek, Dezurik-Copes, Leslie  |
| Valve Model Number | \* |
| Actuator Model No. | \* |
| Positioner Model No. | \* |
| Filter Regulator | YES |
| NOTES | \*, \*\* Engineer to consult with and use manufacturer’s recommended steam trim for the service, usually a hardened 400 series stainless steel.\* Engineer shall fill in to suit application.\*\* BAS Provider to confirm based on process data provided. |
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| BJC Healthcare |
| Water Control Valve Specification Sheet (Globe Body) |
| Project Name | Revisions | SHEET | xx of xx |
| NO.  | BY | DATE | DESCRIPTION | SPEC. NO. | REVISION |
| 1 |   |   |   | 251100 | \* |
| 2 |   |   |   | CONTRACT | DATE |
| 3 |   |   |   | X | mm/dd/yy |
| 4 |   |   |   | PROJECT NUMBER |
| 5 |   |   |   | XXXX.XX |
| 6 |   |   |   | BY | CHECKED | APPROVED |
| 7 |   |   |   | XYZ | XYZ | XYZ |
| GENERAL | Tag Number | \* |
| Service Description | \* |
| P&ID Sheet Number | \* |
| Line No. or Vessel No. | \* |
| Line Size / Mat'l / Sch. | \* |
| Electrical Class | Power Supply | \* | \* |
| PROCESS DATA | Fluid | Fluid State | WATER | LIQUID |
| Operating Condition | Units | Minimum  | Normal | Maximum | Other |   |   |
| Flow Rate | GPM | \* | \* | \* | \* |   |   |
| Inlet Pressure | PSIG | \* | \* | \* | \* |   |   |
| Outlet Pressure | PSIG | \* | \* | \* | \* |   |   |
| Temperature | DEG F | \* | \* | \* | \* |   |   |
| Level | FEET | \* | \* | \* | \* |   |   |
| Mol. Wt. |   |   |   |   |   |   |   |
| Sp. Wt | Sp. Grav |   |   |   |
| Viscosity | Sp Heat |   |   |   |

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| --- | --- | --- | --- | --- |
| BODY | Style | Size | GLOBE | xx" |
| End Connection | Rating | xx" RF FLANGED | ANSI CLASS 150 |
| Port Size | Travel | \* | \* |
| Valve Cv | Valve C1/Km | \* | \*\* |
| Body Matl. | Bonnet | ASTM A216 WCC | ASTM A216 WCC |
| Characteristic | Trim Number | EQUAL PERCENTAGE | \*\* |
| Cage Matl. | Retainer Matl. | \* | \* |
| Seat Matl. | Seat Ring Matl. | 316 STAINLESS STEEL | 316 STAINLESS STEEL |
| Plug Matl. | Stem Matl. | 316 STAINLESS STEEL | 316 STAINLESS STEEL |
| Flow Action | DOWN |
| Gaskets | PTFE |
| Stem Guide | \*\* |
| Packing | PTFE |
| Required Seat Tightness  | ANSI CLASS IV |
| Max. Allowable Sound Level (dBA) | <75 dBA |
| ACTUATOR | Type | PNEUMATIC |
| Size | Bench Set | \* | \* |
| Push-Down To | Fail Position | CLOSE\* | CLOSE\* |
| Close At | Open At | 6 PSIG\* | 30 PSIG\* |
| Handwheel | NONE\* |
| POSITIONER | Type | Electronic |
| Communications Protocol | \* |
| Input Signal  | Output Signal | 4-20 mA |   |
| Air Supply | 80 PSIG NOMINAL\* |
| TRANSDUCER | Type | \* |
| Input Signal | \* |
| Output Signal | \* |
| OPTIONS | Air Set w/ Gauges | YES\* |
| Solenoids | \* |
| Position Switches | \* |
|   |   |

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| --- | --- | --- |
| SELECTION BASED ON | Manufacturer | Fisher, Valtek, Dezurik-Copes, Leslie |
| Valve Model Number | \* |
| Actuator Model No. | \* |
| Positioner Model No. | \* |
| Filter Regulator | YES |
| NOTES | \* Engineer shall fill in to suit application.\*\* BAS Provider to confirm based on process data provided. |
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| BJC Healthcare |
| Water Control Valve Specification Sheet (Globe Body) |
| Project Name | Revisions | SHEET | xx of xx |
| NO.  | BY | DATE | DESCRIPTION | SPEC. NO. | REVISION |
| 1 |   |   |   | 251100 | \* |
| 2 |   |   |   | CONTRACT | DATE |
| 3 |   |   |   | X | mm/dd/yy |
| 4 |   |   |   | PROJECT NUMBER |
| 5 |   |   |   | XXXX.XX |
| 6 |   |   |   | BY | CHECKED | APPROVED |
| 7 |   |   |   | XYZ | XYZ | XYZ |
| GENERAL | Tag Number | \* |
| Service Description | \* |
| P&ID Sheet Number | \* |
| Line No. or Vessel No. | \* |
| Line Size / Mat'l / Sch. | \* |
| Electrical Class | Power Supply | \* | \* |
| PROCESS DATA | Fluid | Fluid State | WATER | LIQUID |
| Operating Condition | Units | Minimum  | Normal | Maximum | Other |   |   |
| Flow Rate | GPM | \* | \* | \* | \* |   |   |
| Inlet Pressure | PSIG | \* | \* | \* | \* |   |   |
| Outlet Pressure | PSIG | \* | \* | \* | \* |   |   |
| Temperature | DEG F | \* | \* | \* | \* |   |   |
| Level | FEET | \* | \* | \* | \* |   |   |
| Mol. Wt. |   |   |   |   |   |   |   |
| Sp. Wt | Sp. Grav |   |   |   |
| Viscosity | Sp Heat |   |   |   |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| BODY | Style | Size | GLOBE | xx" |
| End Connection | Rating | xx" RF FLANGED | ANSI CLASS 150 |
| Port Size | Travel | \* | \* |
| Valve Cv | Valve C1/Km | \* | \*\* |
| Body Matl. | Bonnet | ASTM A216 WCC | ASTM A216 WCC |
| Characteristic | Trim Number | EQUAL PERCENTAGE | \*\* |
| Cage Matl. | Retainer Matl. | \* | \* |
| Seat Matl. | Seat Ring Matl. | 316 STAINLESS STEEL | 316 STAINLESS STEEL |
| Plug Matl. | Stem Matl. | 316 STAINLESS STEEL | 316 STAINLESS STEEL |
| Flow Action | DOWN |
| Gaskets | PTFE |
| Stem Guide | \*\* |
| Packing | PTFE |
| Required Seat Tightness  | ANSI CLASS IV |
| Max. Allowable Sound Level (dBA) | <75 dBA |
| ACTUATOR | Type | PNEUMATIC |
| Size | Bench Set | \* | \* |
| Push-Down To | Fail Position | CLOSE\* | CLOSE\* |
| Close At | Open At | 6 PSIG\* | 30 PSIG\* |
| Handwheel | NONE\* |
| POSITIONER | Type | Electronic |
| Communications Protocol | \* |
| Input Signal  | Output Signal | 4-20 mA |   |
| Air Supply | 80 PSIG NOMINAL\* |
| TRANSDUCER | Type | \* |
| Input Signal | \* |
| Output Signal | \* |
| OPTIONS | Air Set w/ Gauges | YES\* |
| Solenoids | \* |
| Position Switches | \* |
|   |   |

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| --- | --- | --- |
| SELECTION BASED ON | Manufacturer | Fisher, Valtek, Dezurik-Copes, Leslie |
| Valve Model Number | \* |
| Actuator Model No. | \* |
| Positioner Model No. | \* |
| Filter Regulator | YES |
| NOTES | \* Engineer shall fill in to suit application.\*\*BAS Provider to confirm based on process data provided. |
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