

## **5.25.55 – PNEUMATIC CONTROL SYSTEMS DESIGN AND CONSTRUCTION STANDARD**

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### **PART 1 - GENERAL**

#### 1.01 Purpose:

- A. This design guideline contained here in includes the requirements for pneumatic control systems at The University of Texas at Austin. It is the intent to provide the highest level of quality and standardization possible.
- B. This design guideline applies only to renovation applications where the existing control system is to remain pneumatic.

#### 1.02 References:

- A. Codes and Standards that are Standard at the University:
  - 1. Electrical Standards: Provide electrical components of pneumatic control systems, which have been UL-listed and labeled, and comply with NEMA standards.
  - 2. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for pneumatic control systems.
  - 3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems: where applicable to controls and control sequences.

#### 1.03 Requirements:

- A. Provide manufacturer's verification that instruments and control valves supplied are appropriate and acceptable to meet specified performance criteria for the intended application.
- B. Provide instruments including pipe, tubing, manual valves, supports, pipe and tube fittings, wire/cable, conduit, tray, terminations, racks, mounting stands, mounting plates, and other accessories as needed to complete a working and operable pneumatic control system.
- C. Provide intrinsic safety barriers for instruments and actuators that are installed in hazardous areas as defined by NFPA 70.
- D. Provide protection for materials during shipment and storage prior to installation.
- E. All pneumatic and electro-pneumatic components including dampers, valves and actuators shall comply with UT Austin standards.

**5.25.55 – PNEUMATIC CONTROL SYSTEMS**  
**DESIGN AND CONSTRUCTION STANDARD**

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**PART 2 - PRODUCTS**

2.01 Acceptable Manufacturers:

- A. Subject to compliance with requirements, provide pneumatic control systems of one of the following:
  - 1. Honeywell, Inc.
  - 2. Johnson Controls, Inc.

2.02 Materials and Equipment:

A. General:

- 1. Provide pneumatic control products in sizes and capacities indicated, consisting of valves, dampers, thermostats, clocks, sensors, controllers, and other components as required for complete installation. Except as otherwise indicated, provide manufacturer's standard materials and components as published in their product information, designed and constructed as recommended by manufacturer, and as required for application indicated.

B. Air Piping:

- 1. Complete air piping systems adhering to the highest standards of quality and appearance shall be provided for each pneumatic control system.
- 2. All piping shall be concealed except in mechanical rooms or areas where other piping is exposed. Hard drawn copper tubing shall be used in all exposed areas, and in all concealed areas except as specifically described to the contrary below. Where copper tubing is run exposed, each tube shall be securely fastened at intervals no greater than 42" for 1/4" tubing and 48" for 3/8" tubing. Fasten tubing with metal gang straps, type Johnson controls, F-1000-64 or approved equal. All tubing shall run parallel to the building lines. Only tool-made bends will be acceptable.
- 3. Fittings for copper tubing shall be hard drawn brass or copper solder joint type except at connections to apparatus, where brass compression or barbed typed fittings shall be used.
- 4. All pneumatic tubing shall be routed to within a maximum of 18" of each control actuator. At actuators, contractor shall minimize the use of poly tubing and associated fittings. At junctions with main air tubing, contractor shall limit use of poly tubing to a maximum run of 6" and install isolation valves at each connection with the main.
- 5. All tubing shall be periodically tested for leaks during installation and all

## 5.25.55 – PNEUMATIC CONTROL SYSTEMS

### DESIGN AND CONSTRUCTION STANDARD

---

tubing shall be blown out to purge installation impurities and moisture before connections to the control instrument. The entire piping system shall be tested by placing it under 30-psig pressures for 24 hours. The pressure drop during this period shall not exceed 2 psig.

#### C. Pneumatic Actuators:

1. Actuators shall be of cast metal bodies with field serviceable neoprene diaphragm and shall include adjustable springs and stops to permit proper synchronization of dampers. They shall be ample size to develop a torque 50% greater than required by the load imposed on them (15 inch-pounds minimum). Actuators shall be of the long stroke design such that the stroke length is attained without the use of levers, short coupled crank arms or other devices. All actuators shall have an actual and direct stroke length equal to or greater than the diameter of the diaphragm.
2. Provide a minimum of one actuator for each damper and one actuator for each 16 square feet of damper area.
3. Dampers 16 square feet and smaller shall be driven by an externally mounted damper actuator. Dampers larger than 16 square feet shall have each section independently driven by a separate internally mounted damper actuator. Actuators on multi-section dampers shall operate smoothly and in unison.

#### D. Room Thermostats:

1. Approved thermostats are Johnson T-4002 and Honeywell TP970, direct or reverse acting, to match what exists in the building. These are the only approved models, no substitutions.
2. Thermostats provided shall be full-proportioning type or two-positioning as required and shall control within plus or minus 1 degree F of the temperature setting at the thermostats location, unless otherwise specified.
3. Room thermostats shall have bi-metal element, adjustable setpoint, pneumatic feedback, be two-pipe with calibration gauge test port. Public and general assembly spaces shall have concealed adjustment under locking type covers without thermometers to prevent unauthorized adjustments or damage. Other spaces shall have similar thermostats with occupant adjustability. Finish shall be nickel or approved equal.
4. Thermostats shall be mounted on (stainless steel) cover-plates for 4" x 4" junction boxes. The cover-plates shall be secured by slotted or Phillips screws to plaster rings of depth suitable to the sheetrock thickness. The plaster rings shall be secured to 4" x 4" 2 1/2" electric junction boxes.

#### E. Sequencing Cumulator:

**5.25.55 – PNEUMATIC CONTROL SYSTEMS**  
**DESIGN AND CONSTRUCTION STANDARD**

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1. The sequencing cumulator shall provide an output of 2 to 9 psi below the input, field adjustable. The sequencing cumulator is used to skew the pressure to the cold damper, since the hot and cold damper actuators have the same (8 to 13 psi) spring range. Johnson Model No. C-9200-1.

**F. Air Gauges:**

1. Air gauges of at least 2" in diameter shall be installed for visual indication of supply air, control air, and reset air pressure at all remote bulb thermostats, static pressure controllers, relays, E.P. switches, and comparators.
2. Gauges shall be located at each valve, damper actuator, and all other points throughout the system where visual indication of air pressure is required for operation purposes. All such gauge dials shall be visible from the floor. Gauge bodies shall be of stamped metal, threaded gauge connections and Bourdon tube shall be of brass only. Two types of gauges shall be used: P – pressure gauge; TP – temperature reading pressure gauge.

**G. Control Valves:**

1. The control valve shall be modulating plug or cage trim type. The valve shall be cast brass with female pipe thread connections. The valve shall be operated by a pneumatic actuator, which has a die cast aluminum body with a field serviceable neoprene diaphragm.
2. Actuator assembly should be removable by loosening a single screw without disturbing the valve assembly. Large flanged valves to be VSI characterized v-ball or Keystone figure 360, with 158 trim with actuator, positioner and gauges.

**H. Isolation Valves:**

1. Pneumatic tubing isolation valves shall be type Parker XV500P series

**I. Solenoid Valves:**

1. Solenoid valves shall be 24 VDC, 9 watts maximum or proper voltage for system.
2. Solenoid valves shall be rated for 50 psig when used for 25 psig or less applications, or rated for 150 psig when used for 100 psig or less applications.
3. Coils shall be equipped with transient suppression devices to limit transients to 150 percent of the rated coil voltage.

**5.25.55 – PNEUMATIC CONTROL SYSTEMS**  
**DESIGN AND CONSTRUCTION STANDARD**

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- J. Pressure-Electric (PE) Switches:
  - 1. Brass bellows, operating pressure rated 8-60 psig differential pressure range with maximum overpressure of 180 psig, 1.5 psig switch differential. SPDT snap-acting switch, 6 amp contact rating at 120 volt, 50/60 Hz, UL listed.
  - 2. Switches shall be enclosed type for remote installation. Enclosed type shall be NEMA 1 unless otherwise specified.

**PART 3 – EXECUTION**

- A. Installation
  - 1. Provide details for installation instructions to match any special installations as found during area examination and inspections. Otherwise install systems and materials in accordance with the manufacturer's instructions.
- B. Testing
  - 1. Controls equipment to be calibrated and tested by qualified controls contractor, not the mechanical contractor. Controls contractor to have a minimum of 5 years experience calibrating this type of equipment.

END OF SECTION