SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

2.8 ELECTRONIC SENSORS

A. Manufactured, brand labelled or distributed by Belimo.

B. Description: Vibration and moisture resistant with SI Protection; for pipe, duct, or outside air mounting. SI Protection shall consist of an epoxy resin and a fluidized bed coating joining the temperature sensing element with the insulation material of the wire.

C. Enclosure shall be a color contrasting NEMA Type 4X/IP65 including a NEMA 4X/IP65 cable gland, a 1/2 NPT conduit adapter fitting a tool-free access.

D. The manufacturer shall warrant all components for a period of 5 years, except where noted, from the date of production with the first two years unconditional.

E. Thermistor Temperature Sensors:
   1. Accuracy: Plus or minus 0.3°F (0.2°C) at 77°F (25°C).
   2. Cable: Single pair shielded, plenum rated to 300°F (150°C) 22AWG, tinned copper, green jacket, 300V.
   3. UL listed: cULus acc. to UL60730-1A/-2-9/-2-13, CAN/CSA E60730-1:02/-2-9, CE acc. to 2004/108/EC and 2006/95/EC, NEMA 4X, IP65, UL Enclosure Type 4X.

F. RTDs and Transmitters:
   1. Accuracy: (RTD) +/- 0.5°F (0.3°C) at 32°F (zero °C); (Transmitter) +/- 1% of upper selected measurement range.
   2. Cable: Single pair shielded, plenum rated to 300°F (150°C) 22AWG, tinned copper, green jacket, 300V.
   3. PT1000 Averaging element shall incorporate a true averaging continuous sensing element throughout the length of the probe.
   4. UL listed: cULus acc. to UL60730-1A/-2-9/-2-13, CAN/CSA E60730-1:02/-2-9, CE acc. to 2004/108/EC and 2006/95/EC, NEMA 4X, IP65, UL Enclosure Type 4X.

G. Humidity Sensors: Complementary Metal Oxide Semiconductor (CMOSens).
   1. Accuracy: ±2% between 10 to 90% RH at calibration point.
   2. Duct Sensor: 0 to 100% relative humidity range with stainless steel wire mesh filter and adjustable rubber mounting flange.
   3. Outside Air Sensor: 0 to 100% relative humidity range with mounting enclosure and detachable mounting plate suitable for operation at outdoor temperatures of minus 31 to plus 160 °F [(minus 35 to plus 70 °C)].
   4. Duct/Outside Air Sensor shall have selectable output for relative humidity, enthalpy, dew point or absolute humidity.
   5. Duct/Outside Air Sensor shall have temperature integration with dual outputs of 0-5/10 Vdc or 4 to 20 mA.
   6. UL listed: cULus acc. to UL60730-1A/-2-9/-2-13, CAN/CSA E60730-1:02/-2-9, CE acc. to 2004/108/EC and 2006/95/EC, NEMA 4X, IP65, UL Enclosure Type 4X.
H. Pressure Transmitters/Transducers:

1. Air Differential-Pressure Transmitter: Eight field selectable ranges in a single unit.
   a. Range: 0- to 1-inch wc (0 to 250 Pa)
      1) Accuracy: +/- 0.004 inch wc (1 Pa)
      2) Outputs: 0 to 5/10 VDC and 4 to 20 mA integrated into one unit.
      3) True-Auto zero calibration.
   b. Duct Air Differential-Pressure Range: 0- to 10-inch wc (0 to 2500 Pa)
      1) Accuracy: 2 inch wc (498 Pa) or less: +/- 0.02 inch wc (5 Pa)
      2) Accuracy: 2 inch wc (498 Pa) to 12 inch wc (2500 Pa): +/- 0.04 inch wc (10 Pa)
      3) Outputs: 0 to 5/10 Vdc and 4 to 20 mA integrated into one unit.
   c. Duct Air Differential-Pressure Range: 0- to 28-inch wc (0 to 7000 Pa)
      1) Accuracy: 8 inch wc (1991 Pa) or less: +/- 0.04 inch wc (10 Pa)
      2) Accuracy: 9 inch wc (2240 Pa) to 29 inch wc (7000 Pa): +/- 0.1 inch wc (25 Pa)
      3) Outputs: 0 to 5/10 Vdc and 4 to 20 mA integrated into one unit.
   d. UL listed: cULus acc. to UL60730-1A/-2-9/-2-13, CAN/CSA E60730-1:02/-2-9, CE acc. to 2004/108/EC and 2006/95/EC, NEMA 4X, IP65, UL Enclosure Type 4X.

2. Air pressure transmitters (0- to 1-inch) shall incorporate True Auto-Zero Calibration. This shall consist of an internal solenoid that equalizes the pressure and performs calibration automatically every 10 minutes.

3. Liquid Gauge Pressure Transducers: NEMA Type 4/IP65, stainless steel housing, stainless steel diaphragm construction, suitable for service; linear output 0 to 10 Vdc or 4 to 20 mA.
   a. Measurement range: 0 to 15 psig (0 to 105 kPa), single sided 30 psig (210 kPa) operating pressure and tested to 45 psig (310 kPa)
   b. Measurement range: 0 to 50 psig (0 to 345 kPa), single sided 100 psig (689 kPa) operating pressure and tested to 150 psig (1034 kPa)
   c. Measurement range: 0 to 100 psig (0 to 689 kPa), single sided 200 psig (1378 kPa) operating pressure and tested to 300 psig (2068 kPa)
   d. Measurement range: 0 to 200 psig (0 to 1378 kPa), single sided 400 psig (2757 kPa) operating pressure and tested to 600 psig (4136 kPa)

4. Liquid Differential-Pressure Transducers: NEMA Type 4/IP65 stainless steel housing, ceramic/stainless steel diaphragm construction, suitable for service; linear output 0 to 10 Vdc or 4 to 20 mA.
   a. Measurement range 0-15/30 psig (105/210 kPa), single sided 87 psig (590 kPa) operating pressure and tested to 305 psig (2070 kPa)
   b. Measurement range 0-50/-100 psig (345/690 kPa), single sided 232 psig (1600 kPa) operating pressure and tested to 305 psig (2070 kPa)

1.2 AIR QUALITY

A. Manufactured, brand labelled or distributed by Belimo.

B. Enclosure shall be a color contrasting NEMA Type 4X/IP65 including a NEMA 4X/IP65 cable gland, a 1/2 NPT conduit adapter fitting a tool-free access.
C. Carbon Dioxide Sensor Transmitter
   1. NDIR sensor with stainless steel wire mesh filter with dual channel calibration for duct mounting. Dual channel calibration shall incorporate a single infrared beam with two detectors incorporating different optical filters. One filter shall measure the wavelength region absorbed by CO2 and the other filter shall measure the wavelength region not absorbed by CO2. Dual channel NDIR calibration shall be once every 24 hours. ABC Calibration Logic utilizing a single beam shall not be acceptable.
   2. Accuracy: 3% of the reading +/- 50 ppm; suitable over a temperature range of 32 to 122 °F (Zero to 50 °C).
   3. Outputs: 0 to 5/10 Vdc or 4 to 20 mA output

D. Volatile Organic Compound (VOC) Transmitter:
   1. Heated tin oxide semiconductor auto calibrated sensing technology; suitable over a temperature range of 32 to 122 °F (Zero to 50 °C), 0 to 5/10 Vdc output, for duct mounting.

E. UL listed: cULus acc. to UL60730-1A/-2-9/-2-13, CAN/CSA E60730-1:02/-2-9, CE acc. to 2004/108/EC and 2006/95/EC, NEMA 4X, IP65, UL Enclosure Type 4X.

SECTION 230923.14 - FLOW INSTRUMENTS

1.3 LIQUID FLOW SENSORS

A. General Requirements for Liquid Flow Meters:
   1. Manufactured, brand labeled or distributed by Belimo.
   2. Manufacturer shall certify that each flow instrument indicated complies with specified performance requirements and characteristics.
   3. Product shall be wet calibrated to NIST traceable certified testing standards.

B. Inline Ultrasonic Flow Sensor 6” (DN150) and Smaller:
   1. NPS 2 (DN 50) and Smaller: Inline meter with dual transducers/emitters/acoustic mirrors utilizing transit time technology with glycol and temperature compensation.
   2. NPS 2-1/2 (DN 65) through NPS 6 (DN 150): Inline meter with four transducers/emitters/acoustic mirrors utilizing transit time technology with glycol and temperature compensation.
   3. Performance:
      a. Media: Chilled water and hot water, up to 60 percent glycol.
      b. Velocity Range (1/2” to 2”): 0.08 to 9.62 fps (0.02 to 2.93 mps).
      c. Velocity Range (2 1/2” to 6”): 0.10 to 9.92 fps (0.03 to 3.02 mps)
      d. Volumetric Flow: 0.07 to 855 GPM (0.004 to 45.0 l/s)
      e. Accuracy: Within +/- 2 percent of full scale at 77 °F (25 °C) and pure water over flow range. For whole range temperature and glycol +/- 6 percent.
      f. Linearity: Within 1.2 percent of full scale over flow range.
      g. Repeatability: Within +/- 0.5 percent of full scale over flow range.
      h. Ambient Temperature: Minus 22 to plus 122 °F (Minus 30 to plus 50 °C).
      i. Maximum Process Temperature: 250 °F (120 °C).
      j. Maximum Pressure: 360 psig at 100 °F (2482 kPa at 38 °C).
      k. Max Pressure Drop (1/2” to 2”): 2.16 PSI
      l. Max Pressure Drop (2 1/2” to 6”): 3.13 PSI
4. Construction:
   c. Process Connection:
      1) NPS 2 (DN 50) and smaller: NPT female inlet, NPT male outlet
      2) NPS 2 1/2 (DN 65) through 6 (DN 150): [ANSI 125] [ANSI 250]
      3) Polyphenylene sulfide (PPS) with Viton seal.
      4) Electrical Connection: 3 ft., 18 GA appliance cable.

5. Transmitter:
   a. Power Supply: 24VAC/DC, 0.5W/1VA.
   b. Output Signal: 0-10 VDC with 1.25mV resolution.
   c. Enclosure Material: Polycarbonate with tongue and groove, with neoprene sealed cover.
   d. NEMA Type 2 enclosure.
   e. Linearity less than two percent.
   f. Operating Temperature: Minus 4 to plus 250 °F (Minus 20 to plus 120 °C).