SECTION 230923.14 FLOW INSTRUMENTS

Data contained in this guide specification may be placed in either of the following sections, depending on the specifics of the system design, or incorporated within the next higher level controls specifications (230923.14 FLOW INSTRUMENTS or even higher in 230923 DIRECT DIGITAL CONTROL (DDC) SYSTEMS FOR HVAC).

PART 2 PRODUCTS

2.1 PRODUCTS INCLUDED IN THIS SECTION

A. Acceptable Manufacturers
  1. EBTRON, Inc.
  2. Approved performance equal

B. Duct and plenum mounted airflow and temperature measurement devices (ATMD) with integral control damper and sleeve assembly (for unducted plenum return air openings or outdoor air intake duct or plenum openings)

2.2 ACCEPTABLE AMD MANUFACTURERS and MODELS

A. EBTRON, Inc. model Fan IQ is the basis of design
  1. Basis of Design and Acceptable Manufacturers
    a. Airflow measurement devices shall use the principle of thermal dispersion and provide one self-heated bead-in-glass thermistor and one zero power bead-in-glass thermistor at each sensing node.
      1) Thermal dispersion devices that indirectly heat a thermistor are not acceptable.
    b. Substitution requests for acceptance less than 60 days prior to bid date or products submitted in non-conformance with the requirements of this specification will not be considered.
      1) For any product to be considered for substitution, a written document shall be submitted to the engineer detailing exceptions and compliance, section-by-section with supporting documentation, before an approval will be considered.
      2) Any product submitted as an equal shall be expected to comply with all performance capabilities and functional aspects of this specification.
    c. Excluded devices:
      1) Fan airflow measurement devices.
      2) Measurement technologies using “chip-in-glass”, “chip-in-epoxy” or other “chip” type thermistors for the heated sensor component are not acceptable.
      3) Vortex shedding airflow measurement devices.
      4) Pitot tubes, pitot arrays, piezo-rings and other differential pressure measurement devices.

B. Products approved as equals that comply with all requirements in this section.
  1. [list approved equals here that comply with ALL requirements of this section]

2.3 PRODUCTS INCLUDED IN THIS SECTION

A. Airflow Measurement Devices (AMD) with Temperature Output and Airflow Alarming Capability
  1. General
    a. Provide one AMD for each measurement location provided on the plans, schedules and/or control diagrams to determine the average airflow rate and temperature at each measurement location.
    b. Each AMD shall be provided with a microprocessor-based transmitter and one or more sensor probes.

1) Devices that have electronic signal processing components on or in the sensor probe are not acceptable.

c. Airflow measurement shall be field configurable to determine the average actual or standard mass airflow rate.

1) Actual airflow rate calculations shall have the capability of being adjusted automatically by the transmitter for altitudes other than sea level.

d. Temperature measurement shall be field configurable to determine the velocity weighted temperate or simple arithmetic average temperature.

2. Sensor Probes:

a. Sensor probes shall consist of one sensor node mounted on a 304 stainless steel block with two adjustable zinc plated steel rods connected to 304 stainless steel pivoting mounting feet.

b. Sensor node internal wiring connections shall be sealed and protected from the elements and suitable for direct exposure to water.

c. Each sensor probe shall be provided with an integral, FEP jacket, plenum rated CMP/CL2P, UL/cUL Listed cable rated for exposures from -67°F to 392 °F (-55° C to 200° C) and continuous and direct UV exposure.

1) Plenum rated PVC jacket cables are not acceptable.

d. Each sensor probe cable shall be provided with a connector plug with gold plated pins for connection to the transmitter.

e. Sensor node airflow and temperature calibration data shall be stored in a serial memory chip in the cable connecting plug and not require matching or adjustments to the transmitter in the field.

f. Each sensor node shall be provided with two bead-in-glass, hermetically sealed thermistors potted in a marine grade waterproof epoxy with sensor housings constructed of glass-filled polypropylene. Upon request, the manufacture shall provide a written independent laboratory test result of 100% survival rate in a 30 day saltwater and acid vapor test.

1) Devices that use epoxy or glass encapsulated chip thermistors are not acceptable.

2) Devices with exposed leads are not acceptable.

g. Each thermistor shall be individually calibrated at a minimum of 3 temperatures to NIST-traceable temperature standards.

h. Each sensor node shall be individually calibrated at 16 measurement points to airflow standards directly calibrated at NIST to the NIST Laser Doppler Anemometer (LDA) primary velocity standard and have an accuracy of ±2% of reading over the entire calibrated airflow range of 0 to 10,000 FPM (50.8 m/s).

1) Upon request the manufacture shall submit for AMD approval a copy of the NIST report of calibration used for the reference standard used.

(i) Devices calibrated against standards other than the NIST LDA or against NIST temperature standards only are not acceptable.

2) Accuracy shall include the combined uncertainty of the sensor nodes and transmitter.

3) Devices whose overall accuracy is based on individual accuracy specifications of the sensor probes and transmitter shall demonstrate compliance with this requirement over the entire operating range.

   i. Each sensing node shall have a temperature accuracy of ±0.15° F (0.08° C) over an operating range of -20° F to 160° F (-28.9° C to 71.1° C) and humidity range of 0 to 100% RH.
   j. The number of independent sensor nodes provided shall be as follows:
      1) SWSI and DWDI fans: 2 probes x 1 sensor node/per probe in each fan inlet.
      2) Fan Arrays (1 to 8 fans): 1 probe x 1 sensor node probe in each fan inlet.

3. Transmitter
   a. A remotely located microprocessor-based transmitter shall be provided for each measurement location.
   b. The transmitter shall be comprised of a main circuit board and interchangeable interface card.
   c. All printed circuit board interconnects, edge fingers, and test points shall be gold plated.
   d. All printed circuit boards shall be electroless nickel immersion gold (ENIG) plated.
   e. All integrated circuitry shall be temperature rated as ‘industrial-grade’. Submissions containing ‘commercial-grade’ integrated circuitry are not acceptable.
   f. The transmitter shall be capable of determining the airflow rate and temperature of each fan.
      1) Separate integration buffers shall be provided for display airflow output, airflow signal output (analog and network) and individual sensor output (Bluetooth).
   g. The transmitter shall have startup firmware to facilitate setup of multiple fans and fan areas.
   h. The transmitter shall be capable of providing a low and/or high airflow set point alarm.
   i. The transmitter shall be capable of providing individual fan alarming on fan array configurations.
   j. The transmitter shall be capable of identifying an AMD malfunction via the system status alarm and ignore any sensor node that is in a fault condition.
   k. The transmitter shall be capable of field configuration, diagnostics and include Field Output Adjustment Wizard that allows for a one or two point field adjustment to factory calibration for installations that require adjustment.
   l. The transmitter shall be provided with a 16-character, alpha-numeric, LCD display.
   m. The transmitter shall be provided one of the following output options:
      1) two field selectable (0-5/0-10 VDC or 4-20mA), scalable, isolated and over-current protected analog output signals (AO1=airflow, AO2=temperature or alarm) and one RS-485 BACnet/Modbus connection, or
      2) two field selectable (0-5/0-10 VDC or 4-20mA), scalable, isolated and over-current protected analog output signals (AO1=airflow, AO2=temperature or alarm) and one Ethernet BACnet/Modbus connection, or one isolated RS-485 (field selectable BACnet MS/TP or Modbus RTU) network connection, or
      3) two field selectable (0-5/0-10 VDC or 4-20mA), scalable, isolated and over-current protected analog output signals (AO1=airflow, AO2=temperature or alarm) and one proprietary wireless connection to EBTRON “Commissioner” based devices, or
      4) One RS 485 BACnet/Modbus network connection and one Ethernet BACnet/Modbus or

        5) One Lonworks Free Topology network connection, or
        6) One thumb drive data logger (no output).
    n. The analog signal capability shall include two output terminals: the first (AO1), shall provide the total airflow rate; while the second output (AO2) shall be field configurable to provide one of the following:
        1) temperature
        2) low and/or high airflow user-defined set point alarm
        3) individual fan alarm; or
        4) system status alarm
    o. The transmitter shall also be available with a single isolated LonWorks Free Topology network interface. Transmitters shall be available alternatively with one USB connection for thumb-drive data logging of sensor data. Neither of these options shall include analog output signals.
    p. Network communications RS 485 (BACnet MS/TP or Modbus RTU) or Ethernet (BACnet Ethernet or BACnet IP, Modbus TCP and TCP/IP) shall provide: the average airflow rate, temperature, hi and/or low airflow set point alarm, system status alarm, individual sensor node airflow rates and individual sensor node temperatures. Individual node airflow rates and temperatures shall be available via the network with Lon.
    q. The transmitter shall be provided with a Bluetooth low energy interface card to interface with Android or iOS devices. Provide free Android or iOS software that allows real-time airflow and temperature monitoring and airflow and temperature traverses. Software shall capture, save or e-mail airflow and temperature data, transmitter settings and diagnostics information.
    r. The transmitter shall have an on-off power switch. Isolation transformers shall not be required.
    s. The transmitter shall be powered by 24 VAC (22.8 to 26.4 under load) @16 V-A maximum and use a switching power supply that is over-current and over-voltage protected.
    t. The transmitter shall use a “watchdog” timer circuit to ensure automatic reset after power disruption, transients and brown-outs.
    u. Each transmitter shall have an operating range of -20° F to 120° F (-28.9° C to 48.9° C) and humidity range of 5 to 95% RH.
    Performance
4. Listings and Certifications
    a. The AMD shall be UL/cUL873 Listed as an assembly.
        1) Devices claiming compliance with the UL Listing based on individual UL component listing are not acceptable.
    b. The AMD shall be BTL Listed.
    c. The AMD shall be tested for compliance with EMC Directive’s requirements and be certified to carry the CE Mark for European Union Shipments.

B. Integral Heavy Duty Backdraft Damper

1. Provide one or more heavy-duty backdraft damper sections with integral airflow measurement devices for each location indicated on the plans.
2. Provide extruded aluminum (6063T5) damper frames, not less than .080” (2.03 mm) thick and 8” (203 mm) deep, which act as an integrated sleeve. Frame to be assembled using mounting fasteners. Welded frames shall not be acceptable.
3. Provide a 1” (25.4 mm) radius aluminum entry flare, not less than .060” (1.52 mm) thick.

4. Provide extruded aluminum (6063T5) backdraft damper blade profiles, not less than 0.09” (2.28 mm) in thickness Blades shall be designed with a rounded head to reduce pressure loss.
5. Blade and frame seals shall be extruded silicone. Seals shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals will not be approved.
6. Bearings shall be a dual bearing system composed of a Celcon inner bearing, fixed around a 7/16” (11.1 mm) aluminum hexagon blade pivot pin, rotating within a polycarbonate outer bearing inserted in the frame. Single axle bearing, rotating in an extruded or punched hole shall not be acceptable.
7. Hexagonal control shaft shall be 7/16” (11.1 mm). It shall have an adjustable length and shall be an integral part of the blade axle. A field-applied control shaft shall not be acceptable.
8. Linkage hardware shall be installed in the frame side and constructed of aluminum and corrosion resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.
9. Backdraft dampers shall be custom made to required size, with blade stops not exceeding 1¼” (31.7 mm) in height.
10. Backdraft dampers shall be designed for operation in temperatures ranging between -72 °F (-57.8 °C) and 212 °F (100 °C). Note that the temperature range for the airflow measuring device differs.

C. TAMCO/EBTRON FAN-IQ

PART 3 EXECUTION

3.1 SECTION INCLUDES

A. Installation
B. Adjusting

3.2 INSTALLATION

A. Install in accordance with manufacturer’s placement guidelines. A written report shall be submitted to the consulting mechanical engineer if any discrepancies are found.

3.3 ADJUSTING

A. The AMD shall not be adjusted to match field measurements without approval from the consulting mechanical engineer when installations meet or exceed manufacturer’s suggested placement guidelines. Field adjustment, when required shall be accomplished using transmitter firmware that calculates adjustment gain and offset coefficients based on one or two reference measurements.