DESCRIPTION

The FE-1500 airflow measurement station consists of single or multiple airflow elements, factory mounted and pre-piped in a casing designed for flanged connection to the ductwork. Standard materials consist of a G90 galvanized casing and 6063-T5 anodized aluminum flow sensors, suitable for most HVAC applications.

The airflow averaging element, utilized in the FE-1500, is a head type device, which generates a differential (velocity) pressure signal similar to the orifice, venturi, and other head producing primary elements. The FE-1500 is constructed so that strategically located sensing ports (based on duct size) continually sample the total and static pressures, when inserted normal to flow. The total pressures sensed by the upstream ports are continually averaged within the element in an isolated chamber. The static sensing ports (located where the influence of the velocity head is zero) are averaged in a second isolation chamber. Multiple elements are manifolded together for connection to a differential measurement device (gauge, transmitter, etc.) for flow measurement and indication purposes.

Features

- Low signal-to-noise ratio
- Multiple total and static pressure sensing ports along the length of the element
- Factory mounted and pre-piped in a flanged duct section (casing)
- ±2% accuracy throughout the velocity ranges of 100 fpm and over
- Standard construction includes a galvanized casing and 6063-T5 anodized aluminum flow sensors
- Available in optional corrosive or high temperature resistance materials including Type 304L and 316L stainless steel, Hasteloy, Type 1 PVC, and phenolic and polyurethane enamel coatings
- Standard airflow stations can be operated (in air) continuously in temperatures up to 350°F or intermittently in temperatures up to 400°F
- All airflow stations can be operated in humidity ranges of 0 to 100%
- Standard airflow stations have good salt air resistance and are suitable for most HVAC applications
FE-1500 Technical Specifications

1. **Accuracy**
   Within 2% of actual flow when installed in accordance with published recommendations

2. **Operating Velocity Range**
   100 to 10,000 fpm

3. **Material**
   **Elements**
   - 6063-T5 anodized aluminum (standard)
   - Type 316L stainless steel (optional)
   - Hasteloy (optional)
   - Type 1 PVC (optional)
   **Casings**
   - 16 ga G90 galvanized steel (standard)
   - Type 304L stainless steel (optional)
   - Type 316L stainless steel (optional)
   - Hasteloy (optional)
   **Coatings**
   - Heresite VRL 500 phenolic coating (optional)
   - Imron 333 polyurethane enamel (optional)

4. **Temperature**
   **Galvanized Casings and Aluminum Elements**
   - 350°F continuous operation (in air)
   - 400°F intermittent operation (in air)
   **Stainless Steel Casings and Elements**
   - Type 304L-900°F continuous or intermittent operation (in air)
   - Type 316L-1600°F continuous or intermittent operation (in air)
   **Hastaloy Casings and Elements Elements**
   - 900°F continuous or intermittent operation (in air)
   **PVC Elements**
   - 120°F continuous operation and 170°F intermittent operation (in air)
   **Heresite Phenolic Coating**
   - 150°F continuous operation and 3200°F intermittent operation (in air)
   **Imron Polyurethane Enamel**
   - 200°F continuous operation and 300°F intermittent operation (in air)

5. **Humidity**
   **All Airflow Stations**
   0 to 100% non condensing

6. **Corrosion Resistance**
   **Galvanized Casings**
   Widely used for most air handling systems; not recommended for corrosive atmospheres
   **Aluminum Elements**
   Good salt, air, and mild acid gas resistance; excellent solvent and aromatic hydrocarbon resistance
   **Stainless Steel Elements and Casings**
   Good for sulfates, phosphates and other salts, as well as reducing acids such as sulphurous and phosphoric
   **Hastaloy Elements and Casings**
   Excellent resistance to strong oxidizers such as ferric and cupric chlorides, chlorine, formic and acetic acids, acetic anhydride, and salts.
   **PVC Elements**
   Excellent acid and alkalis resistance
   **Heresite Phenolic Coating**
   Excellent resistance to acids and salt air. Good resistance to alkalis and solvent.
   **Imron Polyurethane Enamel**
   Excellent resistance to acids, alkalis, salts, weather, and humidity. Very good resistance to solvents.

7. **Instrument Connections**
   **Aluminum Elements**
   ¼” compression, suitable for use with thermoplastic or copper tubing; thermoplastic tubing requires the use of tubing inserts, which are supplied with the fittings
   **Stainless Steel and Hastaloy Elements**
   1/8-27 Female NPT
   **PVC Elements**
   1/8-27 Female NPT

Note
Corrosive resistant element maximum operating temperatures vary greatly with the concentration of the media in the process stream. Consult factory for further information.
FE-1500 Casing Construction

**Circular Stations**

Standard circular airflow measuring stations include a 16 gage galvanized casing with attached 90° connecting flanges as listed below:

<table>
<thead>
<tr>
<th>Station Size</th>
<th>Flange Thickness</th>
<th>Flange Size</th>
<th>Casing Length “L”</th>
</tr>
</thead>
<tbody>
<tr>
<td>6” – 15”</td>
<td>0.064”</td>
<td>1”</td>
<td>6”</td>
</tr>
<tr>
<td>16” – 44”</td>
<td>0.064”</td>
<td>1½”</td>
<td>6”</td>
</tr>
<tr>
<td>45” – 72”</td>
<td>0.188”</td>
<td>1½”</td>
<td>10”</td>
</tr>
<tr>
<td>73” &amp; Over</td>
<td>0.188”</td>
<td>2”</td>
<td>12”</td>
</tr>
</tbody>
</table>

**Rectangular Stations**

Standard rectangular airflow measuring stations include a 16 gage galvanized casing, 5 inches long, with formed integral 90° connecting flanges as listed below:

<table>
<thead>
<tr>
<th>Station Size</th>
<th>Flange Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>8” – 72”</td>
<td>1½”</td>
</tr>
<tr>
<td>73” &amp; Over</td>
<td>2”</td>
</tr>
</tbody>
</table>

**Oval Stations**

Standard oval airflow measuring stations include a 18 gage galvanized casing, 5 inches long between beads with 1¼ inch connecting sleeve on each end (7½ inch overall length). Actual O.D. dimensions are ¼ inch less than specified duct I.D. dimensions.

<table>
<thead>
<tr>
<th>Station Width</th>
<th>Flange Thickness</th>
<th>Flange Size</th>
<th>Casing Length “L”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 48”</td>
<td>0.064”</td>
<td>1½”</td>
<td>6”</td>
</tr>
<tr>
<td>Over 48”</td>
<td>0.188”</td>
<td>1½”</td>
<td>8”</td>
</tr>
</tbody>
</table>
FE-1500 Dimensions

Circular Stations

Rectangular Stations
FE-1500 Dimensions (Continued)

Oval Stations

FE-1500 Minimum Installation requirements

The elements may be installed in any duct configuration. However, the accuracy of the installation is dependent on the flow conditions in the duct. The minimum installation requirements for the elements based upon a uniform velocity profile approaching the duct disturbance for flow rates less than 2,500 fpm are shown below. Add one duct diameter to the installation requirements shown below for each additional flow rate of 1,000 fpm. These are not ideal locations. It is always best to locate the elements as far as possible from all duct disturbances, with upstream disturbances being the most critical consideration.

Notes:

Round Ducts:

D = Duct diameter

Rectangular Ducts:

D = \sqrt{\frac{4HW}{\pi}}

H = Duct height

W = Duct width
FE-1500 Resistance to Airflow

FE-1500 Ordering Information

FE-1500-   -   -   -   x   -   -

Insulation Thickness (inches)
Indicates insulation thickness for an internally insulated duct (if applicable)
0 = No Insulation

Configuration
R = Rectangular
C = Circular
O = Oval

Duct Height (inches) – Rectangular and Oval
0 = Circular Duct

Duct Width or Diameter (inches) – Element Length

Protective Coatings
0 = No Coating
1 = Heresite VRL 500 phenolic coating
2 = Imron 333 polyurethane enamel

Element Material
A = 6063-T5 anodized aluminum (standard)
S = Type 316L stainless steel (optional)
P = Type 1 PVC (optional)
H = Hastaloy (optional)

Casing Material
1 = 16 ga G90 galvanized steel (standard)
2 = Type 304L stainless steel (optional)
3 = Type 316L stainless steel (optional)
4 = Hastaloy (optional)
FE-1500 Specification Guide

Airflow Measurement Stations

1. Provide where indicated and/or scheduled airflow traverse elements capable of continuously monitoring the fan or duct air volumes they serve.

2. Each element shall be designed and built to comply with, and provide results in accordance with, accepted practice for duct system traversing as defined in the ASHRAE Handbook of Fundamentals, AMCA publication #203, as well as the Industrial Ventilation Handbook. The number of sensing ports on each element, and the quantity of elements utilized at each installation, shall comply with ASHRAE Standard #111 for equal area duct traversing.

3. Each airflow measuring element shall contain multiple total and static pressure sensing ports placed along the leading edge of the cylinder. The static pressure chamber shall incorporate dual offset static taps on opposing sides of the averaging chamber, so as to be insensitive to flow angle variations of as much as ± 20 degrees in the approaching airstream.

4. The airflow traverse elements shall be capable of producing steady, non-pulsating signals of true total and static pressure, with an accuracy of 2% of actual flow for operating velocities as low as 100 feet per minute (fpm). Signal amplifying sensors requiring flow correction (K factors) for field calibration are not acceptable.

5. The airflow traverse elements shall not induce a measurable pressure drop, greater than 0.18 inch at 4,000 fpm. The units shall have a self-generated sound rating of less than NC40 and the sound level within the duct shall not be amplified, nor shall additional sound be generated.

6. The probes shall be manifolded together in a 16 gauge galvanized steel duct section with 90 degree undrilled flanges, fabricated to the duct size, and shall contain multiple airflow traverse elements interconnected as herein before described.

7. Where primary flow elements are located outside of the manufacturer’s published installation guidelines the manufacturer shall be consulted, and approve of any special configurations, such as air equalizers and/or additional and strategically placed measuring points, as may be required.

8. Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct. Station flanges shall be sized to facilitate matching connecting ductwork.

Installation Considerations

1. Primary flow elements shall be installed in strict accordance with the manufacture’s published requirements and with ASME guidelines effecting non-standard approach conditions. These elements serve as the primary signals for the airflow systems; it shall be the responsibility of the contractor to verify correct installation to assure that accurate primary signals are obtained.

2. An identification label shall be placed on each unit casing listing model number, size, area, and specified airflow capacity.

Manufacturer

1. Airflow measurement stations shall be Paragon Controls Inc. Model FE-1500 or equal as approved by the Engineer.

2. Naming of a manufacturer does not automatically constitute acceptance of this standard product nor waive the responsibility of the manufacturer to comply totally with all requirements of the proceeding specification.
### Engineering Reference Table

#### VEL0CITY VERSUS VELOCITY PRESSURE

<table>
<thead>
<tr>
<th>V = VELOCITY IN FEET PER MINUTE</th>
<th>P_V = VELOCITY PRESSURE IN INCHES H_2O</th>
</tr>
</thead>
<tbody>
<tr>
<td>180 0.020 620 0.0240 1060 0.0701</td>
<td>1500 0.1403</td>
</tr>
<tr>
<td>190 0.023 630 0.0247 1070 0.0714</td>
<td>1510 0.1422</td>
</tr>
<tr>
<td>200 0.025 640 0.0255 1080 0.0727</td>
<td>1520 0.1440</td>
</tr>
<tr>
<td>210 0.027 650 0.0263 1090 0.0741</td>
<td>1530 0.1459</td>
</tr>
<tr>
<td>220 0.030 660 0.0272 1100 0.0754</td>
<td>1540 0.1479</td>
</tr>
<tr>
<td>230 0.033 670 0.0280 1110 0.0768</td>
<td>1550 0.1498</td>
</tr>
<tr>
<td>240 0.036 680 0.0288 1120 0.0782</td>
<td>1560 0.1517</td>
</tr>
<tr>
<td>250 0.039 690 0.0297 1130 0.0796</td>
<td>1570 0.1537</td>
</tr>
<tr>
<td>260 0.042 700 0.0305 1140 0.0810</td>
<td>1580 0.1556</td>
</tr>
<tr>
<td>270 0.045 710 0.0314 1150 0.0825</td>
<td>1590 0.1576</td>
</tr>
<tr>
<td>280 0.049 720 0.0323 1160 0.0839</td>
<td>1600 0.1596</td>
</tr>
<tr>
<td>290 0.052 730 0.0332 1170 0.0853</td>
<td>1610 0.1616</td>
</tr>
<tr>
<td>300 0.056 740 0.0341 1180 0.0868</td>
<td>1620 0.1636</td>
</tr>
<tr>
<td>310 0.060 750 0.0351 1190 0.0883</td>
<td>1630 0.1656</td>
</tr>
<tr>
<td>320 0.064 760 0.0360 1200 0.0898</td>
<td>1640 0.1677</td>
</tr>
<tr>
<td>330 0.068 770 0.0370 1210 0.0913</td>
<td>1650 0.1697</td>
</tr>
<tr>
<td>340 0.072 780 0.0379 1220 0.0928</td>
<td>1660 0.1718</td>
</tr>
<tr>
<td>350 0.076 790 0.0389 1230 0.0943</td>
<td>1670 0.1739</td>
</tr>
<tr>
<td>360 0.081 800 0.0399 1240 0.0959</td>
<td>1680 0.1760</td>
</tr>
<tr>
<td>370 0.085 810 0.0409 1250 0.0974</td>
<td>1690 0.1781</td>
</tr>
<tr>
<td>380 0.090 820 0.0419 1260 0.0990</td>
<td>1700 0.1802</td>
</tr>
<tr>
<td>390 0.095 830 0.0429 1270 0.1016</td>
<td>1710 0.1823</td>
</tr>
<tr>
<td>400 0.100 840 0.0440 1280 0.1021</td>
<td>1720 0.1844</td>
</tr>
<tr>
<td>410 0.105 850 0.0450 1290 0.1037</td>
<td>1730 0.1866</td>
</tr>
<tr>
<td>420 0.110 860 0.0461 1300 0.1054</td>
<td>1740 0.1888</td>
</tr>
<tr>
<td>430 0.115 870 0.0472 1310 0.1070</td>
<td>1750 0.1909</td>
</tr>
<tr>
<td>440 0.121 880 0.0483 1320 0.1086</td>
<td>1760 0.1931</td>
</tr>
<tr>
<td>450 0.126 890 0.0494 1330 0.1103</td>
<td>1770 0.1953</td>
</tr>
<tr>
<td>460 0.132 900 0.0505 1340 0.1119</td>
<td>1780 0.1975</td>
</tr>
<tr>
<td>470 0.138 910 0.0516 1350 0.1136</td>
<td>1790 0.1998</td>
</tr>
<tr>
<td>480 0.144 920 0.0528 1360 0.1153</td>
<td>1800 0.2020</td>
</tr>
<tr>
<td>490 0.150 930 0.0539 1370 0.1170</td>
<td>1810 0.2042</td>
</tr>
<tr>
<td>500 0.156 940 0.0551 1380 0.1187</td>
<td>1820 0.2065</td>
</tr>
<tr>
<td>510 0.162 950 0.0563 1390 0.1205</td>
<td>1830 0.2088</td>
</tr>
<tr>
<td>520 0.169 960 0.0575 1400 0.1222</td>
<td>1840 0.2111</td>
</tr>
<tr>
<td>530 0.175 970 0.0587 1410 0.1239</td>
<td>1850 0.2134</td>
</tr>
<tr>
<td>540 0.182 980 0.0599 1420 0.1257</td>
<td>1860 0.2157</td>
</tr>
<tr>
<td>550 0.189 990 0.0611 1430 0.1275</td>
<td>1870 0.2180</td>
</tr>
<tr>
<td>560 0.196 1000 0.0623 1440 0.1293</td>
<td>1880 0.2203</td>
</tr>
<tr>
<td>570 0.203 1010 0.0636 1450 0.1311</td>
<td>1890 0.2227</td>
</tr>
<tr>
<td>580 0.210 1020 0.0649 1460 0.1329</td>
<td>1900 0.2251</td>
</tr>
<tr>
<td>590 0.217 1030 0.0661 1470 0.1347</td>
<td>1910 0.2274</td>
</tr>
<tr>
<td>600 0.224 1040 0.0674 1480 0.1366</td>
<td>1920 0.2298</td>
</tr>
<tr>
<td>610 0.232 1050 0.0687 1490 0.1384</td>
<td>1930 0.2322</td>
</tr>
</tbody>
</table>

Above P_v Values Are Based On Standard Air Density Of 0.075 lbm/ft^3 Which Is Air At 68°F, 50% Relative Humidity, and 29.92" Hg. The equation for converting air volume (Q) into velocity (V) and velocity pressure (P_v) is:

\[
V = \frac{Q}{A}
\]

\[
P_v = \left(\frac{V}{C}\right)^2 \times \rho
\]

Where:
- \(V\) = Velocity, in fpm
- \(Q\) = Flow, in cfm
- \(A\) = Area, in ft^2
- \(\rho\) = Density of air, in lb/ft^3
- \(P_v\) = Velocity pressure, in inches H_2O

\[C = 1096.7\]

Paragon Controls Incorporated
P.O. Box 99, Forestville, CA 95436
http://www.paragoncontrols.com
Phone 707 / 579-1424
Fax 707 / 579-8480
Revision Level 000