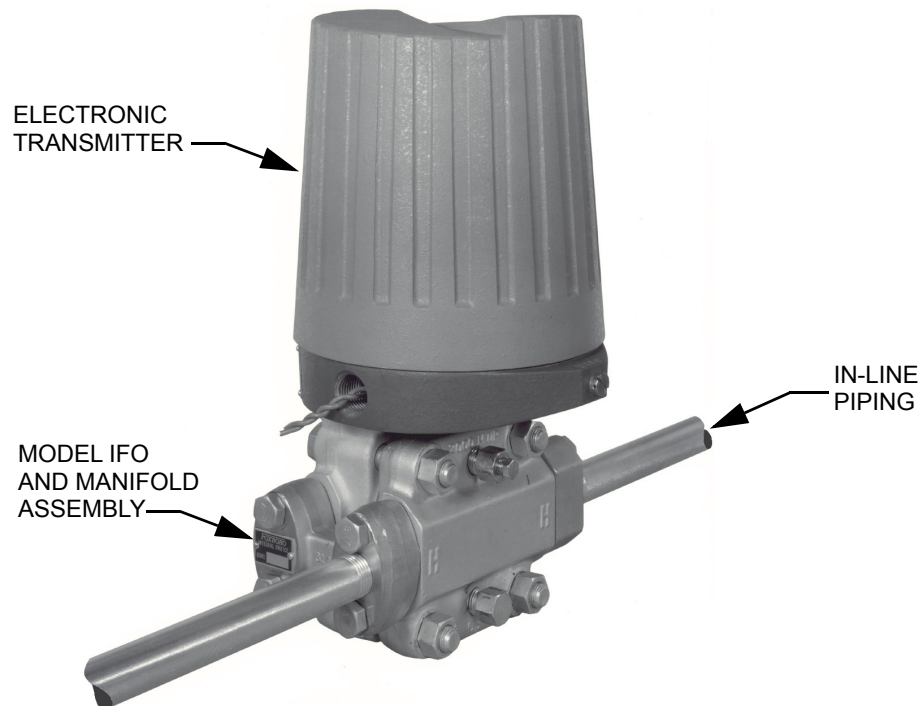


**Model IFO Integral Flow Orifice
In-Line Type Used with Foxboro
d/p Cell Transmitters**



This in-line type integral flow orifice is used in combination with a Foxboro pneumatic or electronic d/p Cell Transmitter to accurately measure very low flow rates of liquids or gases. Static pressure ratings up to 40 MPa (6000 psi) can be accommodated.

USED WITH MANY FOXBORO TRANSMITTERS

The Model IFO can be used with the following Foxboro d/p Cell transmitters: 13A, 13H, and 15A Series Pneumatic Transmitters, and E13DL, E13DM, E13H, and 823DP-3 Series Electronic Transmitters.

SIMPLIFIED INSTALLATION

Since the IFO assembly is installed directly onto the transmitter, and since the transmitter is connected to the process line, the orifice assembly and transmitter become part of the piping.

INTEGRAL STRAIGHT-THROUGH DESIGN

The Model IFO is an in-line type orifice assembly that is integrally mounted to Foxboro pneumatic or electronic d/p Cell Transmitters. The measured fluid passes through the high pressure side of the transmitter and orifice only (not the low pressure side). No separate piping is required for instrument impulse leads, and an upstream straight line of pipe is also not required.

HANDLES WIDE RANGE OF LOW FLOW RATES CONVENIENT SIZING

The orifice is available with a choice of seven standard bore diameters (see Physical Specifications section). In addition, any bore diameter between 0.508 and 6.350 mm (0.020 and 0.250 in) can be supplied as an option.

Selecting among the seven standard orifices, water flows as low as 0.020 L/min (0.005 U.S. gpm) and as high as 60 L/min (15 U.S. gpm) at standard conditions can be measured; and air flows as low as 0.03 m³/h (0.02 ft³/min) and as high as 60 m³/h (35 ft³/min) at standard conditions can be measured. In addition, lower flow rates than those listed can be achieved by adding an optional jewel insert to the orifice. The jewel insert can have an orifice diameter as small as 0.0508 mm (0.0020 in) and permits the measurement of extremely low flow rates.

The Model IFO is suitable for liquid and gas applications. By choosing the correct orifice bore, almost any desired low flow rate within the stated flow rate limits can be measured. Using flow data supplied by the user at the time the order is placed for the orifice assembly and the d/p Cell transmitter, A flow calculation-specification data sheet will be supplied with the orifice assembly.

This data sheet lists complete transmitter-orifice assembly flow data for the user's process. If desired, the user can calculate the required differential pressure range or orifice bore himself by following the procedures in Technical Information document TI 37-81a. The user can also determine approximate values of this data by using the procedures in Instruction MI 022-332.

FUNCTIONAL SPECIFICATIONS

Static Pressure Rating

Static pressure rating is 40 MPa (6000 psi), or up to the static pressure rating of the d/p Cell Transmitter, whichever is less.

Process Connections

Tapped for 1/2 NPT.

Pressure Loss

100% of the measured differential pressure.

Standard Orifice Diameters

0.508, 0.864, 1.511, 2.527, 4.039, 6.350, or 8.890 mm (0.0200, 0.0340, 0.0595, 0.0995, 0.1590, 0.2500, or 0.3500 in). The 8.890 mm (0.3500 in) orifice diameter is not used with the 823DP Transmitter, or in gas flow applications.

Flow Rate Ranges

See Table 1.

Table 1. Approximate Flow Rate Ranges at Standard Conditions

| Orifice Diameter | | Flow Rate Limit | Water at 15.6°C (60°F) | | Air at 15°C and 101.3 kPa (59°F and 14.7 psia) | |
|------------------|--------|-----------------|------------------------|----------|--|------|
| mm | in | | L/min | U.S. gpm | scmh | scfm |
| 0.508 | 0.0200 | Minimum | 0.02 | 0.005 | 0.03 | 0.02 |
| | | Maximum | 0.22 | 0.06 | 0.37 | 0.22 |
| 0.864 | 0.0340 | Minimum | 0.05 | 0.013 | 0.09 | 0.05 |
| | | Maximum | 0.65 | 0.17 | 1.1 | 0.65 |
| 1.511 | 0.0595 | Minimum | 0.15 | 0.04 | 0.26 | 0.15 |
| | | Maximum | 2.1 | 0.5 | 3.5 | 2.1 |
| 2.527 | 0.0995 | Minimum | 0.35 | 0.1 | 0.67 | 0.35 |
| | | Maximum | 5.0 | 1.3 | 9.0 | 5.0 |
| 4.039 | 0.1590 | Minimum | 0.90 | 0.25 | 1.6 | 0.90 |
| | | Maximum | 12 | 3.3 | 21 | 12 |

Table 1. Approximate Flow Rate Ranges at Standard Conditions (Continued)

| | | | | | | |
|----------|-----------|--------------------|-----------|-----------|-------------|-------------|
| 6.350 | 0.2500 | Minimum Maximum | 2.5 35 | 0.7 9 | 4.5 60 | 2.5 35 |
| 8.890(a) | 0.3500(a) | Minimum Maximum | 4.2 60 | 1.2 15 | Not Used(a) | Not Used(a) |

(a) Not for use with 823DP Transmitter or gas flow applications.

PERFORMANCE SPECIFICATIONS

Orifice Coefficient Tolerance

±3.0% for standard orifice bore sizes and Reynolds Numbers as low as 1000. Coefficient of uncertainty may be reduced by flow calibration of the entire assembly including the orifice, manifold, and d/p Cell Transmitter. Refer to Global Customer Support for available calibration services.

Transmitter Accuracy

Refer to applicable Transmitter Product Specification Sheet (PSS).

PHYSICAL SPECIFICATIONS

Materials of Construction

MANIFOLD AND INLET CONNECTION

AISI Type 316 stainless steel (316 ss)

ORIFICE

316 ss, Monel, or Hastelloy C.

GASKETS

Glass reinforced ptfe

Threaded End Connections

Tapped for either R 1/2 or 1/2 NPT, as specified

AS REFERENCE CODE (ORDERING CODE)

| | |
|---|-----|
| In-Line Type Integral Flow Orifice | IFO |
| Manifold Material and End Connections | |
| 316 ss, Tapped for 1/2 NPT | -S2 |
| Number of Orices | |
| One | -1 |
| Six (Available with Orifice Material Code M or S only)(a) | -6 |
| Orifice Material | |
| Hastelloy C | C |
| Monel | M |
| 316 ss | S |
| Example: AS Code IFO-S2-1S | |

(a) Orifice kits, see Optional Features section.

OPTIONAL FEATURES

Special Orifice Bores

Any bore between 0.381 and 6.350 mm (0.0150 and 0.2500 in) can be provided.

To order, specify material and bore, or provide complete flow data for calculation.

Orifice Kit

A kit of six standard bore orifices in 316 ss or Monel is available. This kit may be ordered by specifying "-6" in the Number of Orifices section of the AS Reference Code.

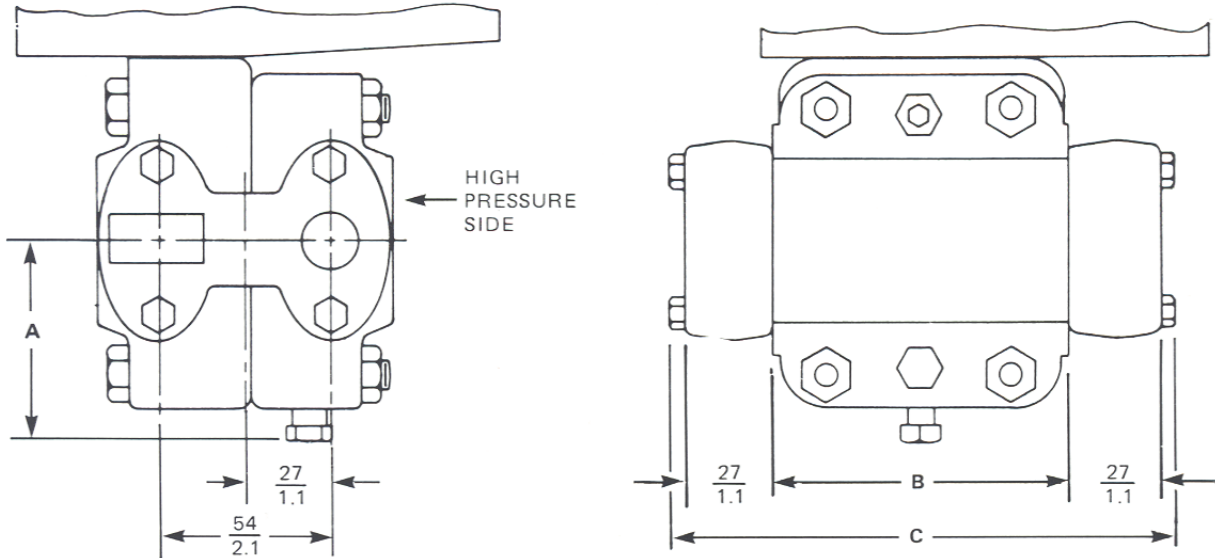
Jeweled Orifice

Jeweled center synthetic sapphire orifices mounted in 316 ss holders are available in any bore size between 0.0508 and 0.381 mm (0.0020 and 0.0150 in) in 0.0254 mm (0.0010 in) increments. These can be used for upper range-value flow rates as low as $10 \text{ cm}^3/\text{h}$ (5×10^{-5} U.S. gpm) of water at standard conditions and $340 \text{ cm}^3/\text{h}$ (2×10^{-4} ft³/min) of air at standard conditions. To order, substitute "J" for Orifice Material in the AS Reference Code and specify bore, or provide complete flow data for calculation.

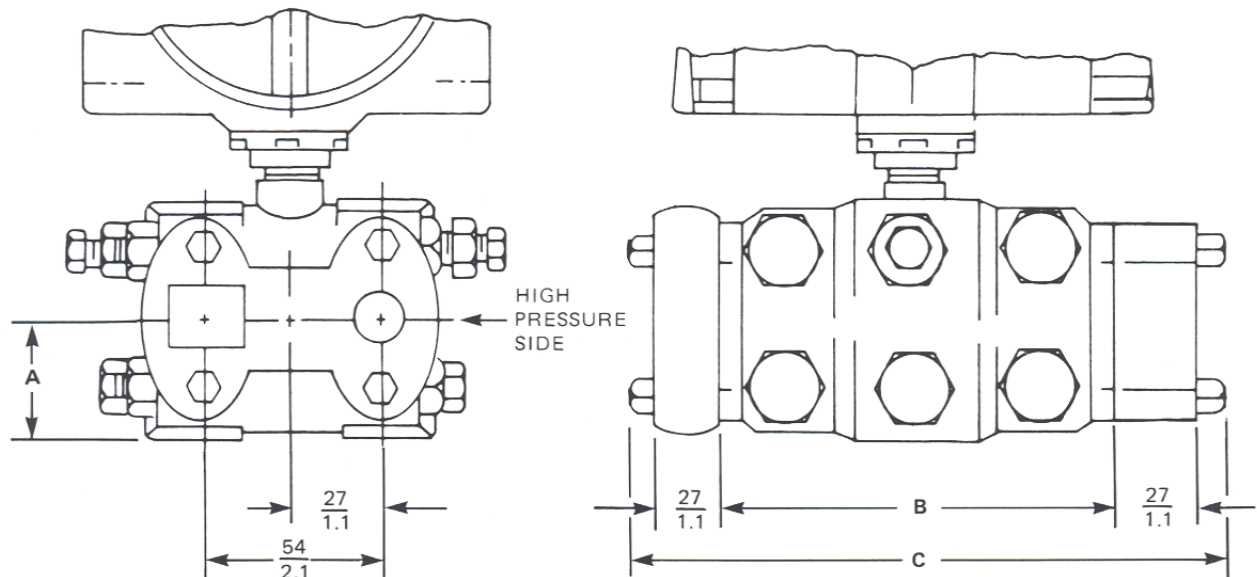
DIMENSIONS – NOMINAL

mm
in

IFO WITH 13, 13H, 15, E13DL, E13DM, AND E13DH TRANSMITTERS



IFO WITH 823DP-3 TRANSMITTER



| DIMENSION | 15, E13DL | | 13, E13DM | | 13H, E13DH | | 823DP-3 | |
|-----------|-----------|-----|-----------|-----|------------|-----|---------|-----|
| | mm | in | mm | in | mm | in | mm | in |
| A | 83 | 3.3 | 76 | 3.0 | 89 | 3.5 | 38 | 1.5 |
| B | 159 | 6.3 | 114 | 4.5 | 172 | 6.8 | 119 | 4.7 |
| C | 227 | 9.0 | 183 | 7.2 | 240 | 9.5 | 188 | 7.4 |

NOTES

ORDERING INSTRUCTIONS

1. Specify AS Reference Code
2. Specify Orifice Bore Diameter, or Provide Complete Flow Data for calculation.
3. Optional Features
4. User Tag Data

OTHER FOXBORO PRODUCTS

The Foxboro product lines offer a broad range of measurement and instrument products, including solutions for pressure, flow, analytical, temperature, positioning, controlling, and recording. For a list of these offerings, visit our web site at:

www.fielddevices.foxboro.com