

Integral Orifice Assembly to Measure Small Flow Rates

34-ST-03-33
11/95

Specification

Function

The Integral Orifice Assembly adapts Honeywell's ST 3000 transmitters for measurement of small flow rates. This assembly economically solves the physical problem of installing an orifice in pipes of 1/2-inch diameter or less by mounting the transmitter's meter body either directly or indirectly through an equalizing manifold.

Typical applications requiring the measurement of very small flow rates include pilot plants, ratio control systems, and flow lines used to add inhibitors to petroleum products.

Description

The orifice assembly (Figure 1) consists of an orifice body, an orifice plate, and a positioning sleeve. Bolts and Teflon O-ring gaskets mount the assembly to the meter body.

Installation Data

The integral orifice assembly (30374613-004) is supplied with oval flanges having 1/2-inch process connections (see Figure 1). Since the orifice assembly mounts directly to the 3-valve manifold or directly to ST 3000, do not specify the optional adapter flanges when ordering ST 3000.

The optional 3-valve equalizing manifold mounts between the meter body and the orifice assembly. The manifold, which takes the place of three separate valves and

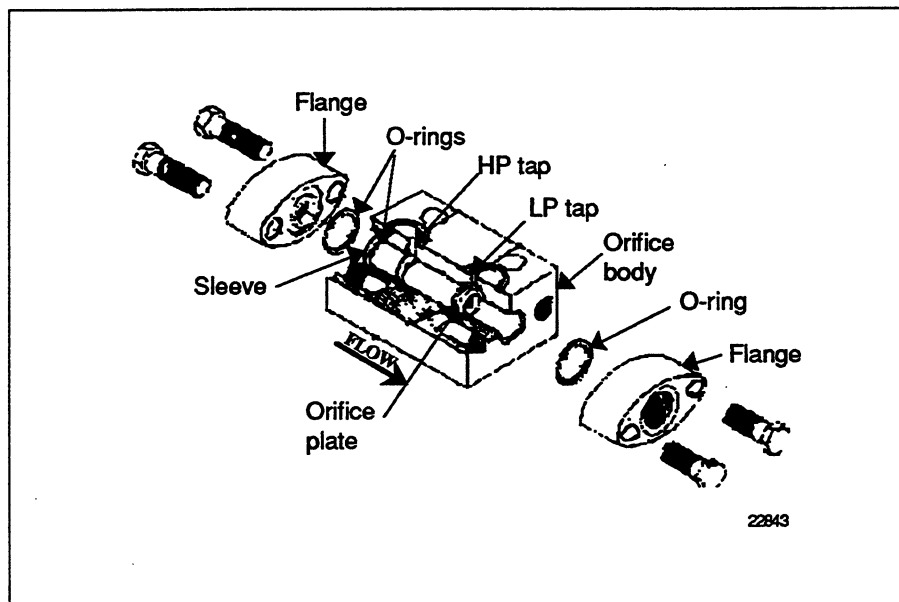


Figure 1—Cutaway view of integral orifice assembly.

connecting piping, permits the user to equalize the meter for calibration checks or to remove the meter body and transmitter for service without disturbing the process.

Maintenance Data

No special tools or alignment procedures are required to remove the orifice plate for cleaning or replacement. The orifice plate makes metal-to-metal contact with the orifice body; no internal gaskets are used. Teflon O-rings are used at the outer end of the sleeve and at both flanges.

To remove the plate, remove the oval flange from the high pressure side and slide out the sleeve and orifice plate; to replace, slide in new (or cleaned) orifice plate, replace sleeve and O-rings, and bolt flange into place.

Meter Body Protection

Since the orifice assembly mounts outside the meter body, the transmitter can measure fluids at temperatures above the rating of the meter body. The fluid in the passages to the meter body is not flowing, so the temperature inside the meter body is considerably lower than that in the flow lines. The outside mounting also reduces the possibility of entrained solids or corrosive fluids entering the meter body chambers. This significantly reduces downtime for cleaning or replacing the meter body.

Specifications

Operating Pressure	1500 psig (10.34 MPa), tested to 2250 psig (15.51 MPa) maximum
Operating Temperature	350°F (177°C) maximum
Materials	Orifice Body: 316 Stainless Steel Sleeve: 316 Stainless Steel Orifice Plate: 316 Stainless Steel Gaskets (O-rings): Molded Teflon
Mounting	Mounts on any meter body having taps on 2-1/8-inch centers.
Dimensions	See Figure 2.
Flow—Differential Pressure Calculations	Refer to "Equivalent Flow Calculations" paragraphs which permit using Figures 3 and 4 for liquids for gases other than water and air.

Ordering Data

Use Table 1 to specify part numbers for the desired items.

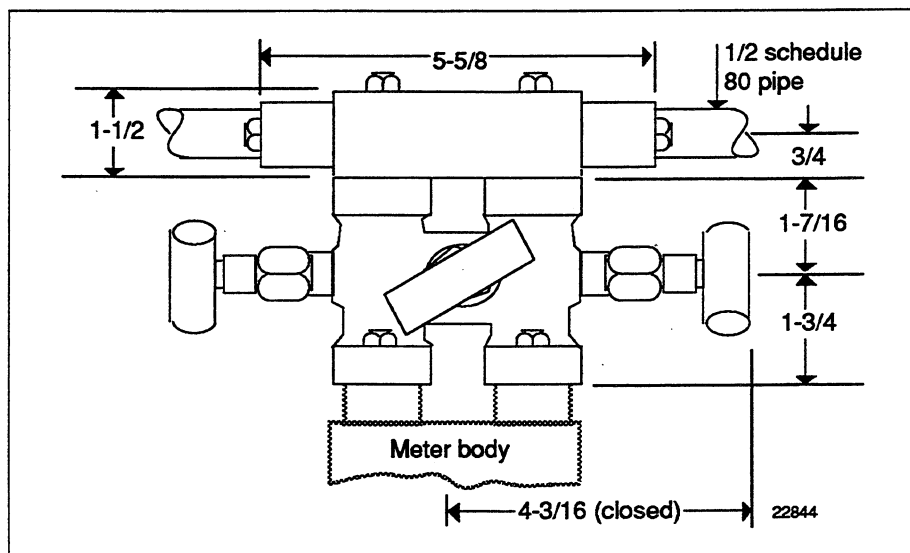
TABLE 1—Parts and Related Options for Integral Orifice Assembly

1	Orifice Body Assembly with two 1/2" adapter flanges part number	30374613-004					
2	Orifice Plate	(Kit, part number 30374615-001, contains entire set of 6 orifice plates)					
	Diameter (inches)	0.3390	0.1960	0.1130	0.0635	0.035	0.0200
	Part Number	30689802-001	30689802-002	30689802-003	30689802-004	30689802-005	30689802-006
	Water Flow (GPH)	125 to 600	35 to 200	11 to 60	3.5 to 20	1.25 to 6.5	0.5 to 2.5
	Air Flow (SCFM)	10.5 to 64	3.1 to 20	1.0 to 66	0.3 to 2.1	0.1 to 0.7	0.04 to 0.3
3	DP Transmitter Model STDXXX-XXA-00000-.	See 34-ST-03-60 or -65.					
4	Optional Anderson-Greenwood 3-Valve Manifolds	Cast Carbon Steel M4AVIC: 30667597-001 316 Stainless Steel M4AVIS: 30667597-002					

Honeywell Services can include installation, system calibration and checkout, system startup, and a choice of maintenance plans.

For more information, contact the nearest Honeywell sales office, or
 Honeywell Inc.
 Industrial Automation and Control
 16404 N. Black Canyon Hwy.
 Phoenix, AZ 80523

In Canada:
 Honeywell Limited
 155 Gordon Baker Road
 Willowdale, Ontario M2H 3N7



Specifications are subject to change without notice.

Figure 2—Dimensions to nearest 1/8" of the 3-valve manifold and integral orifice.

Equivalent Flow Calculations

Use the equation in one of the following paragraphs to determine equivalent flow for a specific liquid or gas referenced to water or air.

Then use the appropriate flow data graph (Figure 3 or 4) to determine the correct orifice plate and the pressure differential to be measured by the transmitter.

NOTE: Liquid flows (Figure 3) are based on water at 60°F and differential pressures between 20 and 600 inches of water. Gas flows (Figure 4) are based on dry air flowing at 100 psig at 70°F.

Accuracy of uncalibrated orifices is within ±5% for the measured differential (as read from the graph) for water flows, and ±10% for air flows.

Liquid Flow

Determine the equivalent flow of a specific liquid referenced to water at the base conditions:

1. Identify

Q_{gh} = desired maximum liquid flow

G_b = specific gravity of liquid at the base temperature (60°F; 15.6°C)

G_r = specific gravity of liquid at operational flow temperature. (1.00 = specific gravity of water at 60°F)

Definition: The specific gravity of a liquid is the value of the liquid's density divided by the density of water at 60°F (62.37 lbs/ft.³).

2. Convert any metric (SI) value of flow into the English unit equivalent in standard gallons per hour (GPH). (Convert any other English unit into GPH.)

NOTE: Standard GPH is defined at a reference temperature of 60°F (15.6°C) on which specific gravity of the fluid is based.

3. The equivalent water flow value (for reference to Figure 3) is:

$$Q_{gh} = (Q'_{gh}) \times \left(\frac{G_b}{1.00} \right) \times \sqrt{\left(\frac{1.00}{G_r} \right)}$$

4. Identify the appropriate orifice diameter and differential pressure for the equivalent flow value to specify the correct orifice and transmitter range.

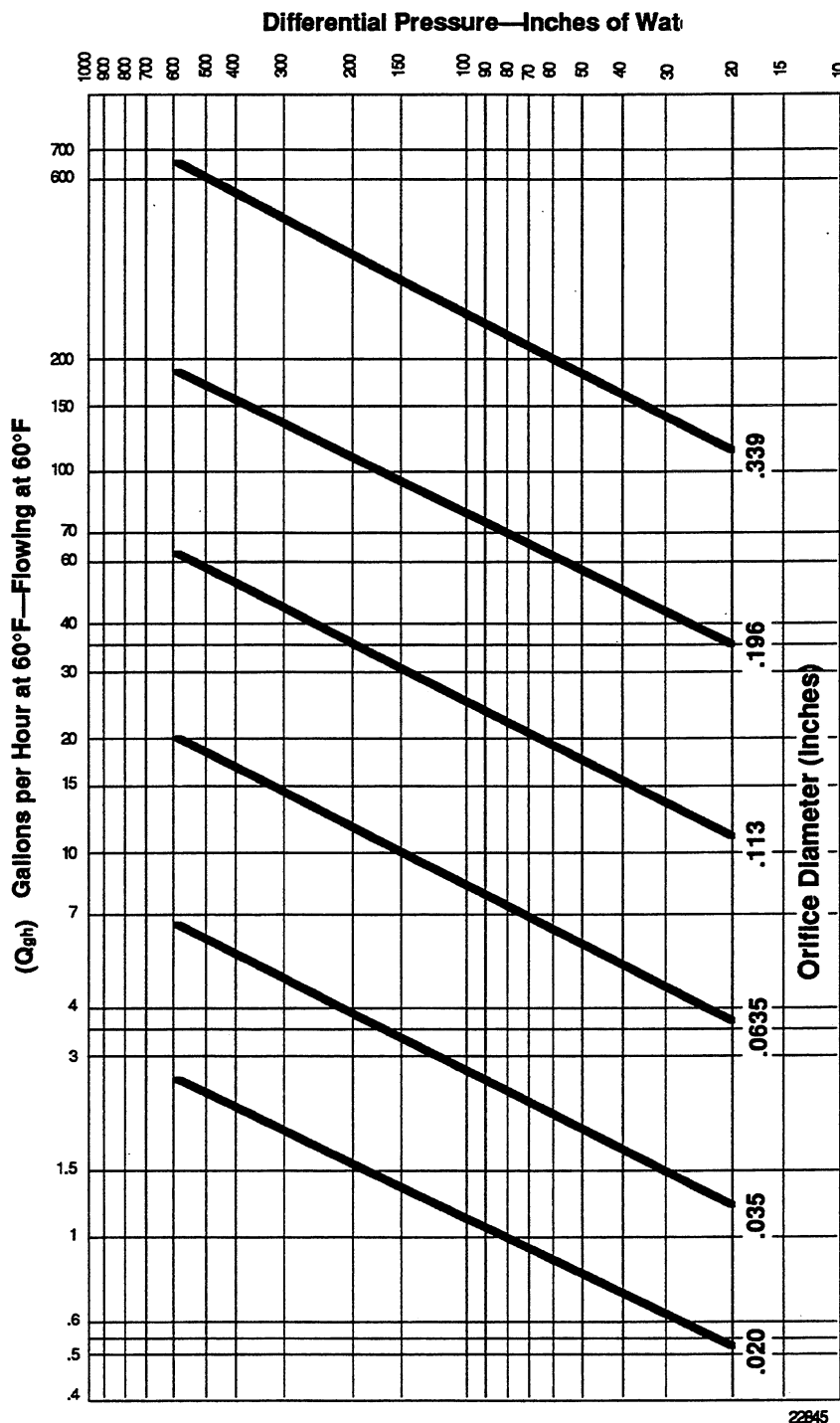


Figure 3—Water flow.

Gas Flow

Determine the equivalent flow of a specific gas referenced to air at the base conditions:

1. Identify

Q_m = desired maximum gas flow

P_f = absolute pressure of the flowing gas

T_f = absolute temperature of the gas

G = specific gravity of the gas.

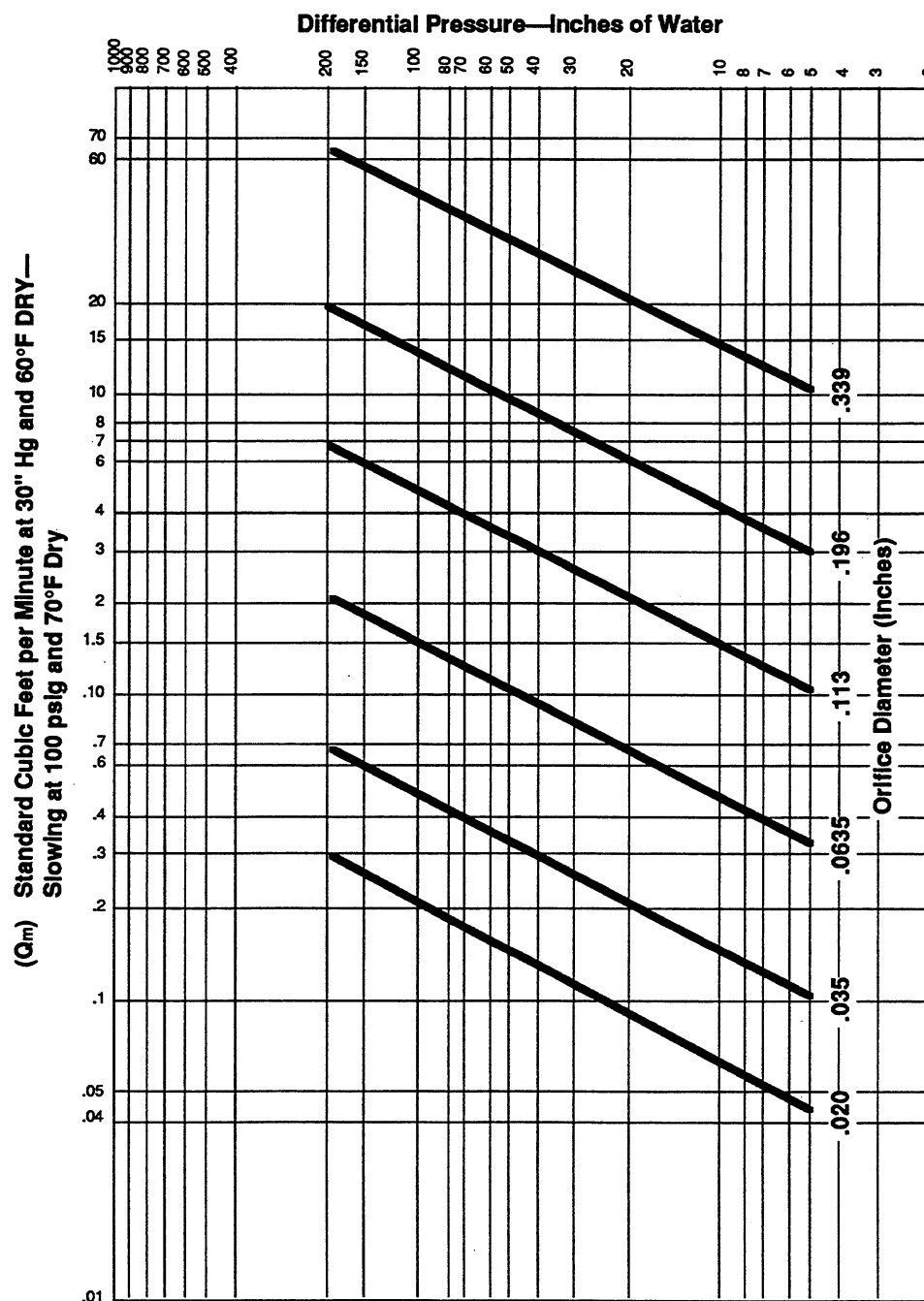
2. Convert any metric (SI) values of the previous parameters into the English unit equivalents (i.e., flow into Standard Cubic Feet per Minute (SCFM), absolute pressure into Pounds per Square Inch Absolute (psia), absolute temperature into Rankine degrees ($^{\circ}R = ^{\circ}F + 460$)).

NOTE: SCFM is defined at reference conditions of 30 inches of Mercury and 60°F for dry air.

3. The equivalent air flow value (for reference to Figure 4) is:

$$Q_m = \frac{Q_m}{2.150 \sqrt{\left(\frac{P_f}{(T_f \times G)} \right)}}$$

4. Identify the appropriate orifice diameter and differential pressure for the equivalent flow value to specify the correct orifice and transmitter range.



22846

Figure 4—Air flow.