Meriam Instrument
a Scott Fetzer company
10920 MADISON AVENUE • CLEVELAND, OHIO 44102
(216) 281-1100 TELEX 980-188

GENERAL INSTALLATION INSTRUCTIONS
ORIFICE PLATES AND FLANGES

MERIAM INSTRUMENT Division of The Scott & Fetzer Company

The conditions under which orifice plates are installed may have as much effect on the accuracy of the flow measurement as the characteristics of the elements themselves. Therefore, the following instructions should be carefully read and followed:

1. INSPECTION

Before installing, inspect the *orifice plate* to verify:

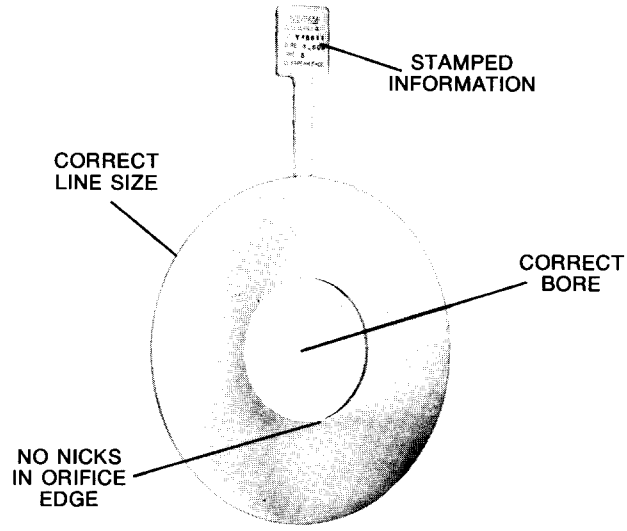
A. Correct line size (plate OD)

B. Correct bore as ordered.

C. Orifice edge free of nicks.

D. Correct stamped information

E. Serial numbers of meter and orifice agree when furnished together.



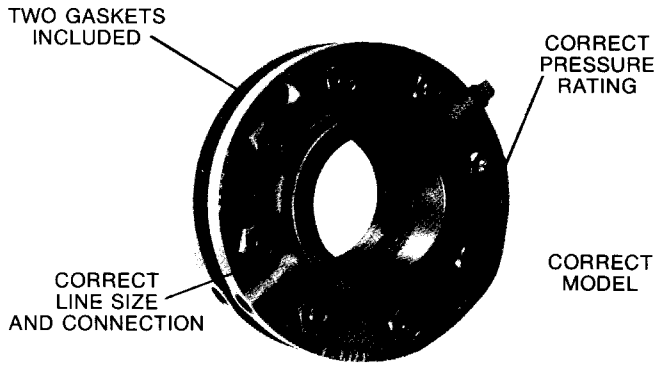
INSPECT *ORIFICE FLANGES* FOR:

A. Correct line size and connection.

B. Correct pressure rating.

C. Correct material.

D. Two gaskets included.



2. FLUID CHARACTERISTICS AND LOCATING THE ORIFICE IN THE LINE

The orifice plate should be located where the fluid is cleanest. In pipes where scale, sediment, tarry substance, or other forms of matter will accumulate on the inside of the pipe at the point of orifice installation, make arrangements for periodic cleaning and drawing of these accumulations. Collection of such substances in the pipe changes the effective area of the pipe and, therefore, causes inaccuracy in the metering.

Locate the orifice upstream from any regulating or control valve, preceding the valve by at least six pipe diameters.

3. INSTALLATION

The orifice plate is normally installed by inserting it between orifice flanges with gaskets on either side. Note the following:

A. The orifice opening must be correctly centered with respect to the internal pipe wall.

B. If the orifice bore is beveled, the bevel must face downstream.

C. Pipe ends must be flush (within ¼ in.) with orifice plate.

D. Inside diameter of gaskets must be large enough, and the gaskets must be so positioned that they will not protrude beyond the inner surface of the pipe.

E. Orifice plate must be installed flat without distortion.

F. Flange bolts must be tightened evenly to prevent buckling the plate.

G. On other than corner tap or weld neck orifice flanges, holes must be drilled through pipe from orifice pressure taps. There must be no roughness, burrs or wire edge on the inside of the pipe. The edge of the hole may be left square or it may be dulled (rounded) very slightly.

4. INSTRUMENT DIFFERENTIAL CONNECTIONS

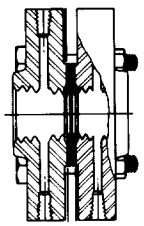
Theoretically, the orifice taps may be located at any point on the circumference, provided a line through the center of this opening passes through the center of the pipe. Practice has shown, however, that certain locations, depending on the fluid being measured, are desirable. When *liquids* and *steam* are being measured, a horizontal connection is recommended. An exception is when the *connecting* meter piping is filled with a *volatile fluid,* it may then be desirable to locate the tap not more than 45° below the horizontal so that the connecting piping will not become gas-bound.

For gas measurement, taps in the top of the pipe are recommended to allow moisture to drain back into the flow line. Since extraneous matter may be carried along the bottom of the pipe, taps in this location are not recommended.

5. TYPES OF ORIFICE FLANGES

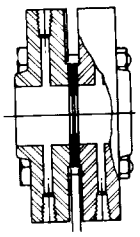
There are several types of orifice flanges, the more common being:

A. Threaded
B. Slip on welding
C. Weld neck
D. Socket (PVC or brass)



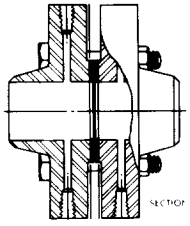
THREADED

Threaded Orifice Flanges: These are threaded completely through the flange, and for greatest accuracy should be screwed onto the pipe so that the end of each pipe is even with the face of its flange. Be certain to have enough threads on your pipe end to accomplish this. It is then necessary to drill through the pipe at the pressure connections and to remove the burr on the inside of the pipe. Meriam cast iron threaded flanges have threads for steel pipe, not a cast iron pipe thread.



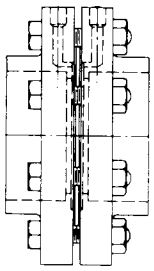
SLIP-ON WELDING

Slip on Welding Orifice Flanges: The pipe is slipped into the flange, brought to within ⅛" of the face of the flange, and securely welded on both sides of the flange. It is then necessary to drill through the pressure connections and to remove the burr.



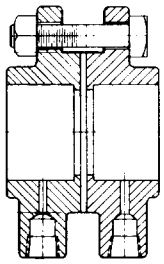
WELDING NECK

Welding Neck Orifice Flanges: These are lined up with the square end of the pipe, the ID of which must be the same as the ID of the flange, and are then securely welded.



PVC SOCKET

PVC Socket Orifice Flanges: The connecting line is solvent welded to the flanges. No drilling required with corner taps.



BRASS SOCKET

Brass Socket Orifice Flanges: The connecting line is brazed or soldered.

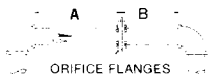
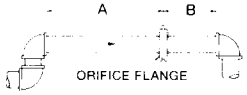
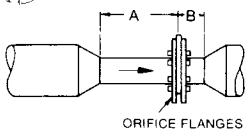
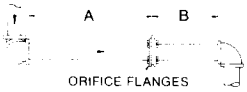
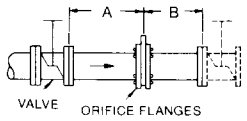
6. STRAIGHT PIPING REQUIREMENT

To insure accurate flow measurement, the fluid should enter the primary element with a fully developed velocity profile, free from swirls or vortices. Such a condition is best achieved by the use of adequate lengths of straight pipe, both preceding and following the primary element.

The generally accepted rule for locating the orifice plate is that it should have 10 to 15 pipe diameters of straight pipe upstream and 5 to 10 pipe diameters downstream. Actual minimums are governed by the d/D ratio and are indicated in the table below. The d/D ratio is orifice bore (d), divided by the pipe ID (D). For example, the orifice ratio of a 5-inch orifice in a 10-inch line gives a ratio of 0.5.

EXAMPLE:
In a line with two ells or two bends in the same plane, as shown in the table below, minimum upstream distance "A" is 10 pipe diameters; minimum downstream distance is 4.

STRAIGHT PIPING REQUIREMENT FOR FLANGE TAPS

Fitting Before Straight Run	Piping Layout (Note 1)	Straightening Vanes (Note 2)	Minimum Upstream Distance "A" (in pipe dia.) with Orifice Radio d/D equal to: (Note 3) 0.2	0.3	0.4	0.5	0.6	0.7	0.75
Elbow, Tee or Cross		None	6.0	6.0	6.0	7.0	9.0	14.0	16.0
		with	–	–	–	–	–	11.0	12.0
Two Ells or Two Bends in same plane		None	8.5	8.5	8.5	10.0	13.5	18.0	22.0
		with	–	–	–	–	10.3	12.5	13.6
Reducer		None	6.0	6.0	6.2	7.5	9.5	12.0	13.5
Two Ells or Two Bends at right angles		None	14.7	16.0	18.0	20.7	24.6	31.0	35.0
		with	–	–	–	–	11.0	13.2	14.3
ORIFICE LOCATION									
Globe or Regulating Valve (NOTE 4)		None	15.0	17.0	19.0	24.0	31.0	40.0	50.0
		with	–	–	–	–	12.3	15.2	16.7

NOTES:
1. Downstream minimum distance "B" for all cases is four pipe diameters.
2. Vane length should be at least 10 times the greatest dimension of individual vane passage.
3. For pipe taps, increase "A" two diameters and "B" eight diameters.
4. Wide open gate valve equivalent to straight run of pipe.

7. USE OF STRAIGHTENING VANES

When installation configuration does not permit recommended straight lengths of pipe, straightening vanes may be used. Two types are available: 1. The In-Line type is installed inside the pipe and held with a pin, and 2. The Flanged type is mounted between a pair of flanges in the upstream piping.

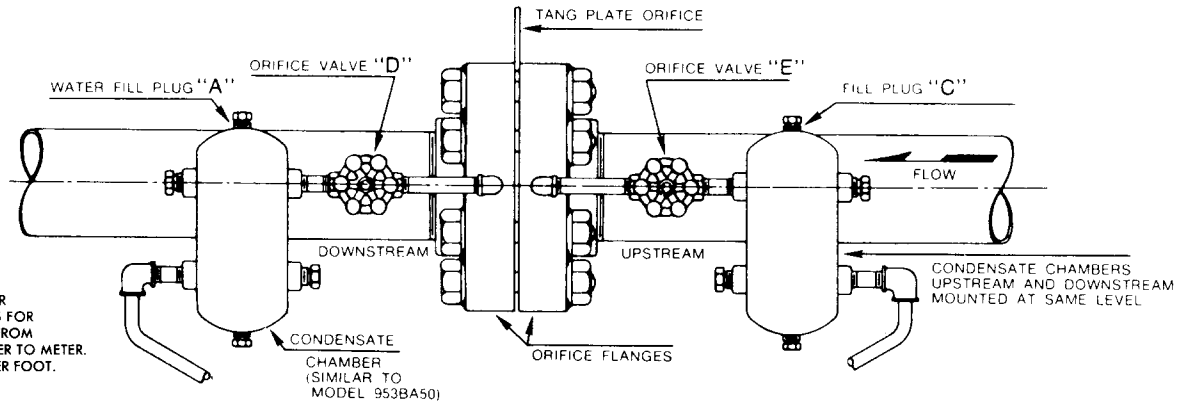
8. SHUTOFF VALVES

Shutoff valves should be provided for every pressure tap connection and should be located as close as possible to the main pipe containing the orifice plate. These valves must be capable of withstanding full pipe-line pressure and temperature and must be installed so as to close against the pressure in the main pipe. Gate valves or other full opening valves are recommended to facilitate cleaning.

9. MERIAM SEAL POTS

Seal pots should be used at the primary element when measuring steam, liquids above 250°F and corrosive fluids. On steam applications, these seal pots provide water legs of equal density and elevation on both sides of a manometer or other differential pressure instrument. They eliminate the possibility of live steam or corrosive flowing fluid from damaging the instrument. The volume of these seal pots should be at least equal to the maximum displacement of the manometer or other differential pressure instrument to which they are connected and a volume two or three times this amount is preferable. They should be installed and supported so as to be level with each other at all times.

A typical installation of seal pots is shown below.



10. CONNECTING TUBING

For connecting the primary element to the secondary instruments, ½ in. OD copper tubing may be used. For higher pressures and temperatures, ½ in. carbon steel, stainless steel, or chrome molybdenum steel tubing or pipe are recommended.

All connecting tube should be arranged and installed to have a slope of 1 in. per ft. or more. Liquid flowmeter installations should have this slope-down to the instrument with a high point at the orifice flanges to permit venting of air in these connecting lines. Gas flowmeter installations should slope up to the meter so condensate will drain back into the line. As an alternate, a low point with a blow-off valve can be provided between the orifice flanges and the meter.

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