Orifice Installation Instructions

1. **Plate Installation**: Always handle orifice plates with care. A bend or damage to the internal bore or upstream face can create measurement errors. Orifice plates have data stamped on the handle for easy identification. The orifice plate is to be installed and secured in place between two flanges. Flange gaskets are to be used. The plate outside diameter is sized to fit within the flanges bolt circle with all bolts installed. Care must be taken during installation so that the orifice bore is centered and as concentric as possible with the pipe centerline.

2. **Upstream Face:** Beveled orifice plates need to be installed with the upstream face in the correct orientation relative to the direction of flow (see figure 1). The sharp edge of the bore is the upstream face. The beveled edge is the downstream face. "Upstream Face" will be stamped on the upstream face of the tang. Normal plate thickness for pipe sizes up to 14" will be 1/8". Normal plate thickness for pipe sizes 16" and larger will be ¼". Certain applications with high differential pressures may require a thicker than normal plate to prevent plate distortion. If the plate material thickness exceeds the calculated maximum allowable plate thickness, the bore will be beveled. Plates that are not beveled are considered bidirectional.

3. **Types of Pressure Tappings:** Standard pressure tap locations shall be used. Follow the specified tap location dimensions precisely. Install only the type of pressure tappings that correspond with the each orifice plate calculation. Orifice plates can be calculated for Flange tappings, *D* and *D/2* tappings or Corner tappings. Specific orifice flange assemblies can be supplied with standard flange tappings (see figure 1) or standard corner tappings (not shown in fig. 1). For orifice plates without tappings in the flange, *D* and *D/2* tappings shall be used. *D* and *D/2* tappings cannot be used for pipe sizes of 1-1/2" and under. Dimensional limitations due to flange thickness may prevent the use of *D* and *D/2* tappings on some larger pipe sizes. Vena contracta tappings are not addressed or used in International Standard ISO 5167-1 &-2.

4. **Flange Installation:** For the most accurate and very precise measurements, weld neck flanges should be used. If slip on flanges are used, the inside face of the pipe should be flush with, or as close as possible to the machined face of flange (some welding standards requirements may not accommodate this). If screwed flanges are used, the pipe threads will not allow the pipe to be flush with the machined face of the flange. The use of screwed and slip on flanges can create an unknown % of error but have worked satisfactorily for most ratio control systems. The pipe or weld should never extend beyond the machined face of the flange. Assure the flange gaskets do not extend inside the pipe line.

5. **Pressure Tap Installation:** Tappings should be oriented or installed on top or side of pipe to avoid moisture or dirt accumulating in them. ½" npt tap connections are typically used for tappings. A half coupling should be welded to the pipe for *D* and *D/2* tappings. After installing couplings or after welding pipe to flanges with flange taps, carefully drill through the tap connections, drilling through the pipe. The actual diameter of the drilled pressure tap holes at inner surface of pipe should not exceed: ¼" for 2-1/2" pipe and smaller; 3/8" for 3" pipe; ½" for pipes 4" and over. Remove all burrs from drilled holes; smooth the inside surface of the pipe around the drilled holes; clean all chips from pipe and tap connections.

6. **Straight Pipe Run Requirements:** The minimum straight lengths required are the lengths between various fittings located upstream or downstream of the orifice plate itself. Additional uncertainty or loss of accuracy cannot be predicted when straight lengths are shorter than the values listed in table 1 (values expressed as multiples of internal diameter, *D*). It is recommended that control valves are located downstream of the orifice plate. The valve listed in Table 1 assumes it is a full bore valve and is in the wide open position. Per Table 1, straight lengths to be measured from the downstream end of the curved portion of the nearest (or only) bend, or of the tee, or the downstream end of the curved or conical portion of the reducer or expander. The bends on which the lengths in this table are based on had a radius of curvature equal to 1.5*D*. Column A for each fitting gives lengths corresponding to "zero additional uncertainty" values. Column B for each fitting gives lengths corresponding to "0.5% additional uncertainty" values. Values are based on International Standard Table 3-ISO 5167-2:2003(E) and are for reference only. For more precise measurement or for other fittings and the limitations of the separation between the two bends and appropriate lengths of reducers and expanders see the ISO 5167-2 standard. A flow conditioner will permit the use of shorter upstream pipe runs.

	Upstream (inlet) side of orifice plate																	
β ratio	Single 90 degree bend.		Two 90 degree bends in the same plane.		Single 90 degree tee with or with out extension.		Single 45 degree bend.		Full bore ball valve.		Concentric reducer		Concentric Expander		Abrupt symmetrical reduction.		Down-stream (outlet) side	
d/D	Two 90 degree bends in any plane.				Mitre 90 degree bend.		Two 45 degree bends in the same plane.		Gate valve fully open.									
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
<=0.20	6	3	10	10	3	3	7	7	12	6	5	5	6	6	30	15	4	2
0.40	16	3	10	10	9	3	30	9	12	6	5	5	12	8	30	15	6	3
0.50	22	9	18	10	19	9	30	18	12	6	8	5	20	9	30	15	6	3
0.60	42	13	30	18	29	18	30	18	14	7	9	5	26	11	30	15	7	3.5
0.67	44	20	44	18	36	18	44	18	18	9	12	6	28	14	30	15	7	3.5
0.75	44	20	44	18	44	18	44	18	24	12	13	8	36	18	30	15	8	4

Table 1