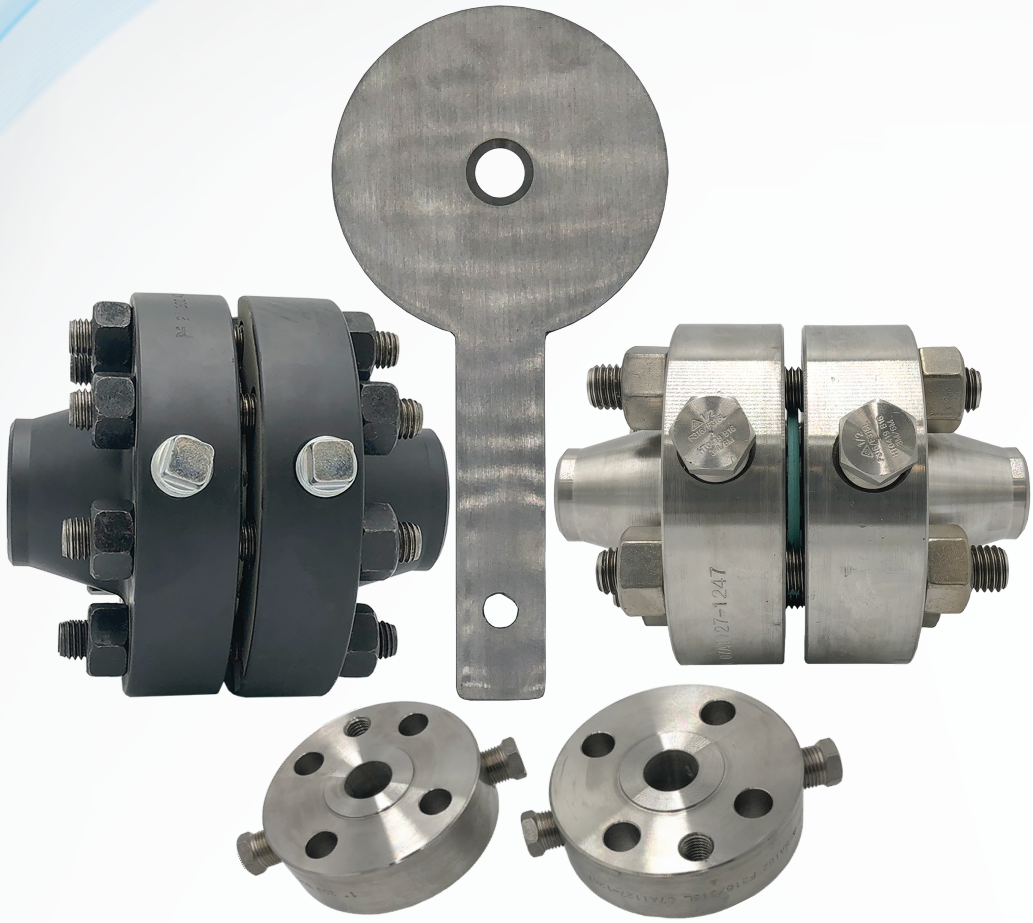
TEKTROL
Technology Solutions

TEK-DP 1610C

Orifice Flanges and Plates

FLOW



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Introduction

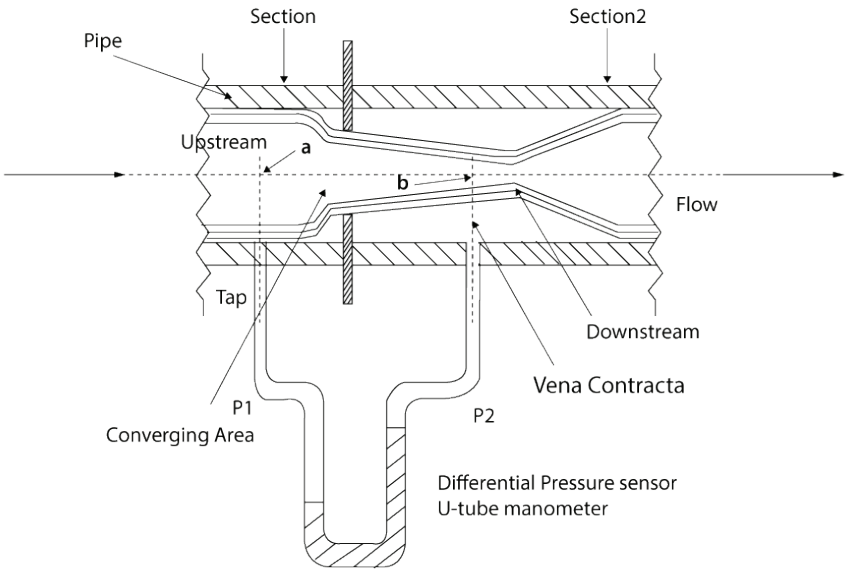
Orifice flanges are essential in orifice metering equipment for holding the pipelines together. Flanges are used in conjunction with orifice meters and accommodate an orifice plate holder for placing the orifice plate. Additional bolts and screws facilitate sturdy flange connections and allow easy dismantling of flanges for plate inspection and replacement.

Tek-DP 1610C series includes weld neck, slip-on and threaded flange types to match your requirement. These flange classes are manufactured in flat face, raised face and ring joint types.

An orifice plate is the backbone of orifice meter. It's a metal plate with a hole in it and is placed in the flow pipeline. It is responsible to create restriction in the flow, which is used for measuring fluid flow rate. Tek-DP 1610C series includes the variants of concentric, eccentric, and segmental orifice plates with conical, quadrant-edge, and square-edged entrance.

Measuring Principle

Orifice meter works on the principle of differential pressure measurement. It is based on Bernoulli's the-ory of conservation of mass and energy in a closed pipe. According to this principle, the obstruction to the flow of fluid leads to increase in flow velocity (i.e. V2 > V1), thereby creating a pressure drop. The flow rate can be determined by measuring the static pressures at upstream and downstream, minimum cross sectional area and temperature. The flow rate of the fluid is calculated by applying the law of conserva-tion of mass and energy.



Bernoulli described this relation between differential pressure and flow rate by equation,

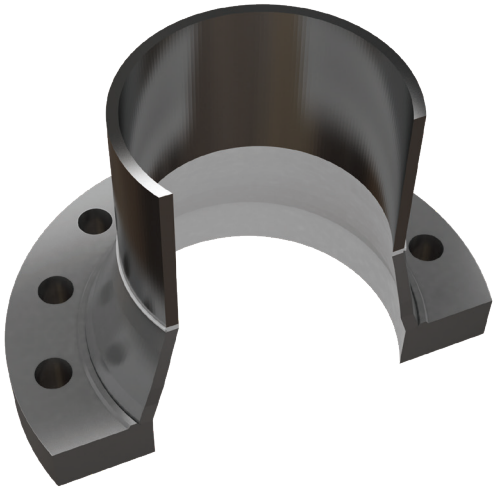
$$\Delta p \; \alpha \; Q_m^2$$

The differential pressure generated, Δp, is proportional to the square of mass flow rate, Q_m. In simple terms, for a given size of restriction, higher the Δp, higher is the flow rate.

Tek-DP 1610C series Orifice Flange Types

The complete flange assembly consists of two pressure tap holes (extending radially outwards), orifice plate holders, and jack screws.

Types of flanges depending on finish of flange connections:

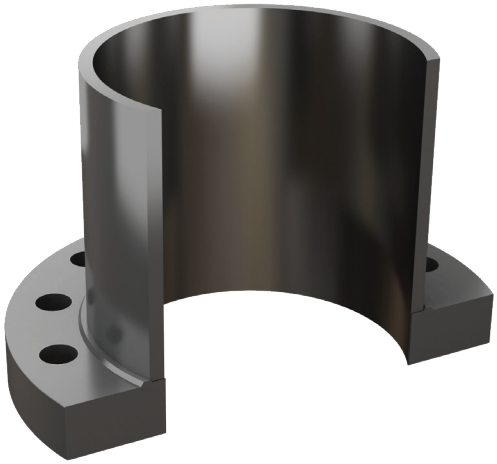


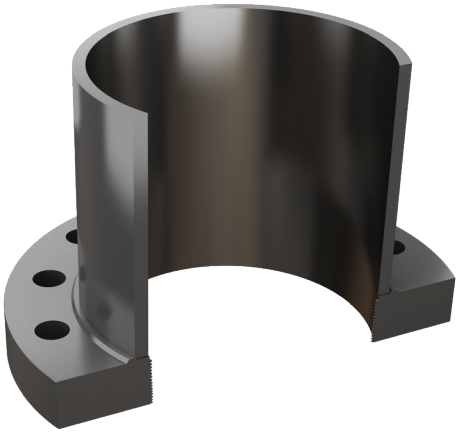
- ## Weld Neck Pipe Flanges

These flanges are attached by welding the pipe to the flange neck. This design transfers stress from the flange to the pipe. Weld neck flanges are suitable in high-pressure applications where welding flanges make the connection strong enough to withstand extreme pressure conditions. The inner diameter of the flange matches the inner diameter of the pipe making a leak-proof connection.

- ## Slip-On Pipe Flanges

Slip-on type orifice flanges slide over the pipe. The inner diameter of the flange is designed slightly higher than the outer diameter of the pipe for easy accommodation.

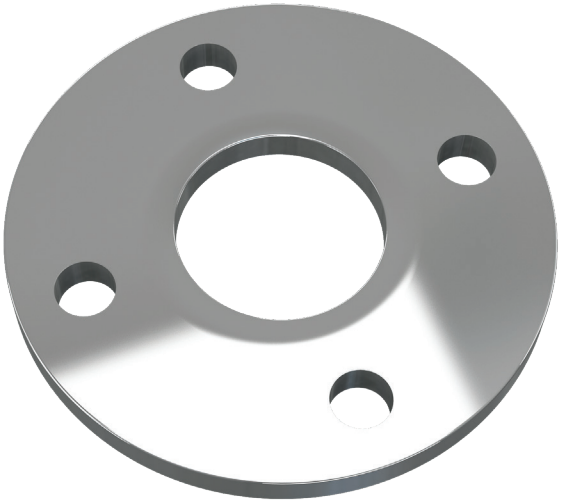




- ## Threaded Pipe Flanges

The bore of threaded pipe flanges has tapered threads on its inner rim to screw it with the pipe. The pipe, on the other hand, has external threads. The threaded flanges orifices do not require welding. These are typically used in small diameter, high-pressure applications.

Types of flanges depending on finish of contact faces

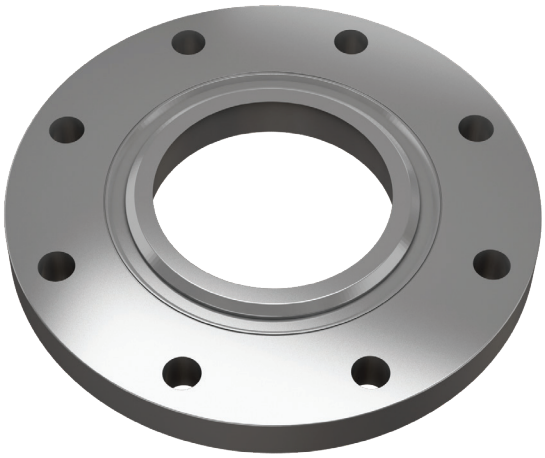


- ### *Flat face flanges*

These flanges have flat contact surfaces at the same height of the bolting line of flange. It is the simplest type of flange facing.

- ### *Raised face flanges*

In raised face flanges, the gasket surface is located above the bolting line of the flange. The height of the raised surface may vary according to the flange pound rating.



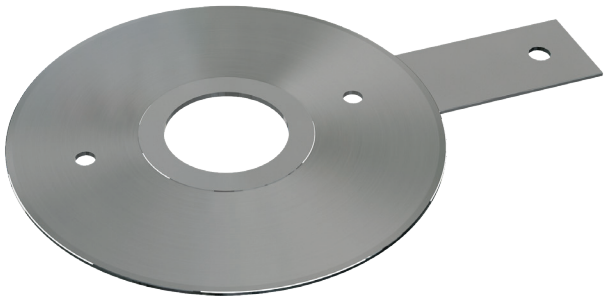
- ### *Ring type joint flanges*

These are the most efficient flanges in pipeline design. Ring joint flanges have a deep groove in a ring around the face. While bolting the faces, a metal ring is compressed in this groove, which ensures extremely tight, leak-proof seal on the connection.

Tek-DP 1610C series Orifice Plate Types

Orifice plates are available in paddle type and universal type. Paddle type plates are designed for using in orifice flanges whereas universal type orifice plates are meant for use in orifice plate holders.

Classification of Orifice Plates Depending on Bore Type:

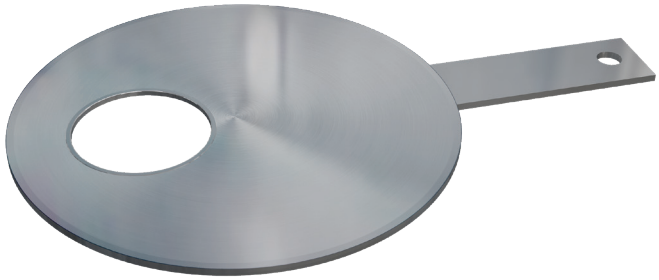


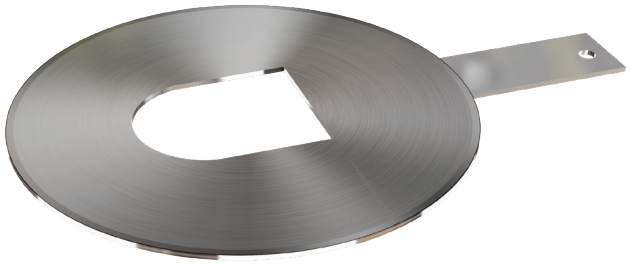
- ### Concentric

Concentric is the most commonly used orifice plate type and is suitable in most processes except highly corrosive medium and slurries.

- ### Eccentric

The hole is positioned off-centred in case of the eccentric orifice. This allows undesired portion of fluid to pass through the orifice and prevents accumulating on upstream face.





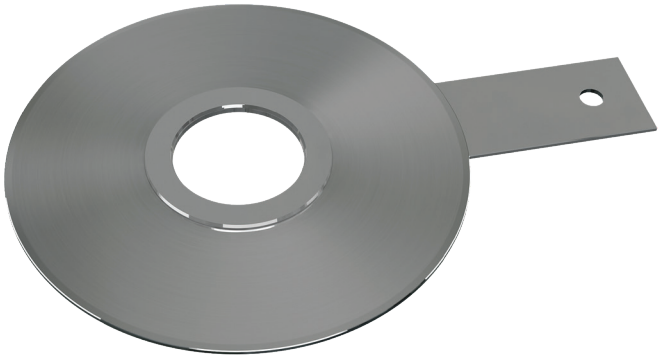
- ### Segmental

Segmental orifice uses a segment of a concentric circle as a hole rather than a circular hole. It is useful in case of colloidal and slurry flow applications.

Classification of Orifice Plates Depending on Bore Profile:

- ### Square-Edge

Square-edge orifice has a sharp edge and appears exactly same from either directions. It can be used for measurement of bi-directional fluid flow rates. The square-edge orifice minimizes contact with the fast moving fluid stream going through the hole.

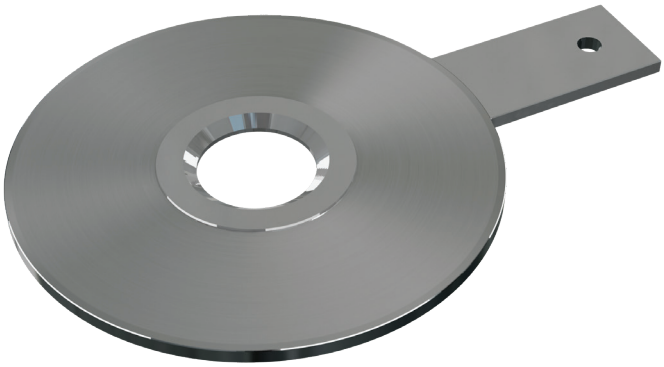


• Quadrant-Edge

The edge of the bore of Quadrant-edge orifice, on the other hand, is rounded to quarter circle. This design makes is effective in viscous fluids and Raynolds number between 1000 to 2000.

• Conical entrance

Conical entrance orifice contains conical-edge entrance and square-edge exit. It looks like beveled square-edge orifice plate installed backwards. These are effective for measurement of viscous fluids and lower Reynolds numbers 80 to 2000.



Benefits

• Orifice Flanges

- Compatible with orifice plate carriers
- Provide leak-proof connection
- Available in flat face, raised face, and ring type joint face
- Available in all pope diameter sizes

• Orifice Plates

- Suitable for various conditions such as liquids, viscous fluids, suspended solids, and gases
- Less costly compared to various other flow measurement instruments
- No maintenance cost
- Robust design

Applications

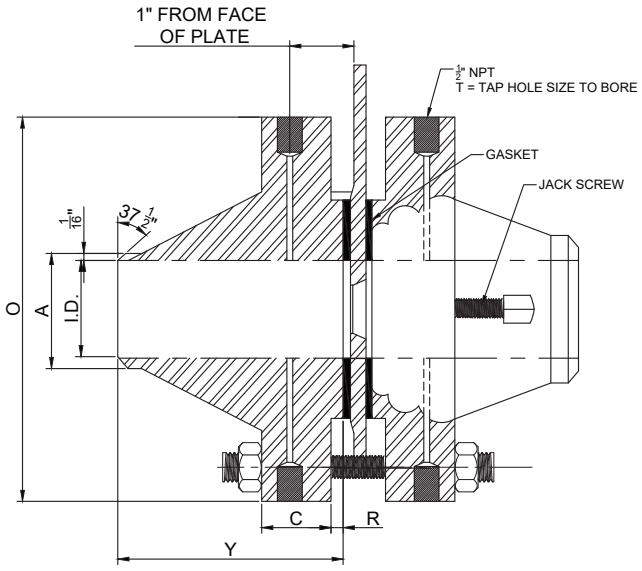
DP flowmeters offer optimized performance in a wide range of industrial applications. To mention a few:

- Oil and Gas flow metering in subsea, onshore and offshore applications
- Water and waste-water treatment plants
- Sprinkler systems for flow control
- Remote sensing of central heating systems for air, steam or water
- Monitoring and controlling pressure drops across valves
- Custody transfers: Selling products on weight or volume
- Pharmaceutical, Food/Beverages industry for maintaining product consistency and proportions

Dimensional Drawing

• Orifice Flanges

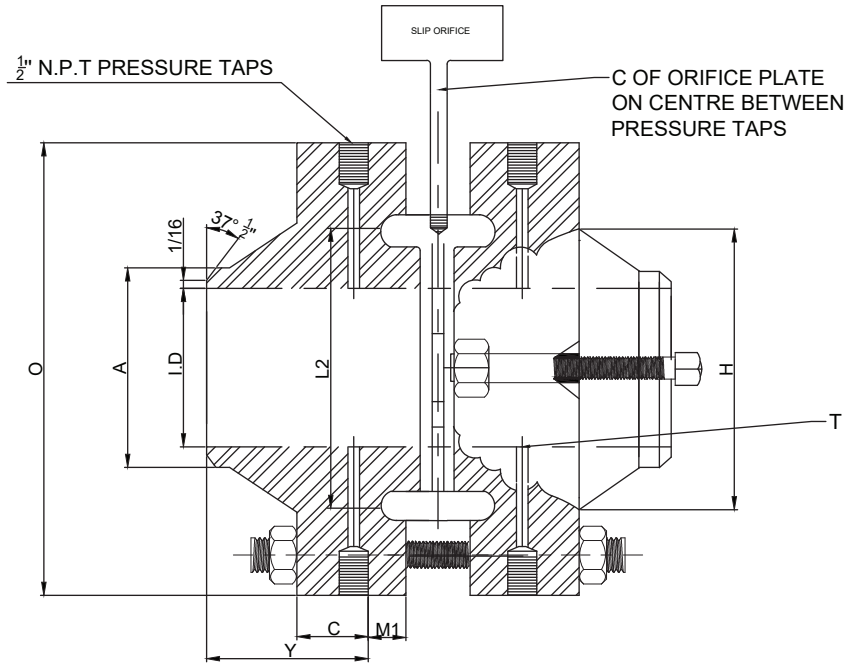
Raised Face Weld Neck Orifice Flanges



Line Size	Line I.D. Standard Sch. ± Tolerance	Flange Diameter	Flange Thickness	Raised Face Diameter	Length Through Hub	Hub Diameter at Base	Weld Neck Diameter	Tap Hole Size	Flange Bolting				Jackscrew Size	Weight (Pounds)
									Bolt Hole Circle Diameter	Hole Diameter	Bolt Holes	Stud Bolt Size		
	I.D.	O	C*		Y*		A	T						
½	0.622	3¾	1½	3⅜	3	1½	0.84	¼	2⅝	9/16	4	½ x 4¾	½ x 3	10
¾	0.824	4⅝	1½	1 11/16	3⅛	1⅞	1.05	¼	3¼	11/16	4	⅝ x 5	½ x 3	10
1	1.049	4⅞	1½	3	3¼	2⅛	1.32	¼	3½	11/16	4	⅝ x 5	⅝ x 3	18
1½	1.610	6⅛	1½	2⅞	3⅜	2¾	1.90	¼	4½	13/16	4	¾ x 5¼	⅝ x 3	25
2	2.067	6½	1½	3⅝	3⅜	3 5/16	2.38	⅜	5	11/16	8	⅝ x 5	⅝ x 3	27
2½	2.469	7½	1½	4⅛	3½	3 15/16	2.88	⅜	5⅞	13/16	8	¾ x 5¼	⅝ x 3	35
3	3.068	8¼	1½	5	3½	4⅝	3.50	⅜	6⅝	13/16	8	¾ x 5¼	¾ x 3	43
4	4.026	10	1½	6 3/16	3⅝	5¾	4.50	½	7⅞	13/16	8	¾ x 5¼	¾ x 3	66
6	6.065	12½	1½	8½	3 15/16	8⅛	6.63	½	10⅝	⅞	12	¾ x 5¼	¾ x 3	106
8	7.981	15	1⅝	10⅝	4⅜	10¼	8.63	½	13	1	12	⅞ x 5¾	¾ x 3	152
10	10.020	17½	1⅞	12¾	4⅝	12⅝	10.75	½	15¼	1⅛	16	1x 6¾	1 x 4 ½	216
12	12.000	20½	2	15	5⅛	14¾	12.75	½	17¾	1¼	16	1⅛ x 7¼	1 x 4 ½	327
14	13.250	23	2⅛	16¼	5⅝	16¾	14.00	½	20¼	1¼	20	1⅛ x 7½	1 x 4 ½	448
16	15.250	15½	2¼	18½	5¾	19	16.00	½	22½	1⅜	20	1¼ x 8¼	1 x 4 ½	596
18	17.250	28	2⅜	21	6¼	21	18.00	½	24¾	1⅜	24	1¼ x 8½	1 x 4 ½	741
20	19.250 ± .007	30½	2½	23	6⅜	23⅛	20.00	½	27	1⅜	24	1¼ x 8¾	1 x 4 ½	887
24	23.250 ± .007	36	2¾	27¼	6⅝	27⅝	24.00	½	32	1⅝	24	1½ x 9¾	1 x 5 ½	1311

***Note:** Class 300 flanges, C and Y dimensions include 1/16" raised face

Ring-Type Joint Weld Neck Orifice Flanges



Line Size (inch)	API Ring Numbers	Line I.D. and Tolerance	Flange Diameter	Flange Thickness	Length Through Hub	Hub Diameter at Base	Weld Neck Diameter	Pitch Diameter of Ring and Groove	Depth of Geoove	Tap Hole Size	Flange Bolting				Jackscrew Size	Weight (Pounds)
											Bolt Hole Circle Diameter	Hole Diameter	Number of Holes	Stud Bolt Size		
		I.D.	O	C*	Y*	H	A	L_2	M_1	T						
1	R-18	† ± .003	6¼	1½	3⅝	2¼	1.32	2⅜	¼	¼	4¼	1	4	⅞ x 6¼	⅝ x 4	26
1 ½	R-23	† ± .003	8	1¾	4⅜	3⅛	1.90	3¼	5/16	¼	5¾	1¼	4	1⅛ x 7½	¾ x 4½	56
2	R-26	† ± .003	9¼	2	5	3¾	2.38	4	5/16	⅜	6¾	1⅛	8	1x 7¾	¾ x 4½	84
2 ½	R-28	† ± .003	10 ½	2¼	5⅝	4½	2.88	4 ¾	⅜	⅜	7¾	1¼	8	1⅛ x 8¾	¾ x 5½	104
3	R-32	† ± .003	12	2⅝	6⅝	5¼	3.50	5	⅜	⅜	9	1⅜	8	1¼ x 9¾	¾ x 7	188
4	R-38	† ± .004	14	3	7½	6½	4.50	6 3/16	7/16	½	10¾	1⅝	8	1½ x 11	¾ x 7	292
6**	R-47	† ± .004	19	4¼	10¾	9¼	6.63	9	½	½	14½	2⅛	8	2 x 14¾	¾ x 9	756
8**	R-51	† ± .004	21¾	5	12½	12	8.63	11	9/16	½	17¼	2⅛	12	2 x 16¾	1 x10	1152
10**	R-55	† ± .005	26½	6½	16½	14¾	10.75	13½	11/16	½	21¼	2⅝	12	2½ x 21¼	1 x13	2136
12**	R-60	† ± .005	30	7¼	18¼	17⅜	12.75	16	11/16	½	24⅜	2⅞	12	2¾ x 23¼	1 x13	3216

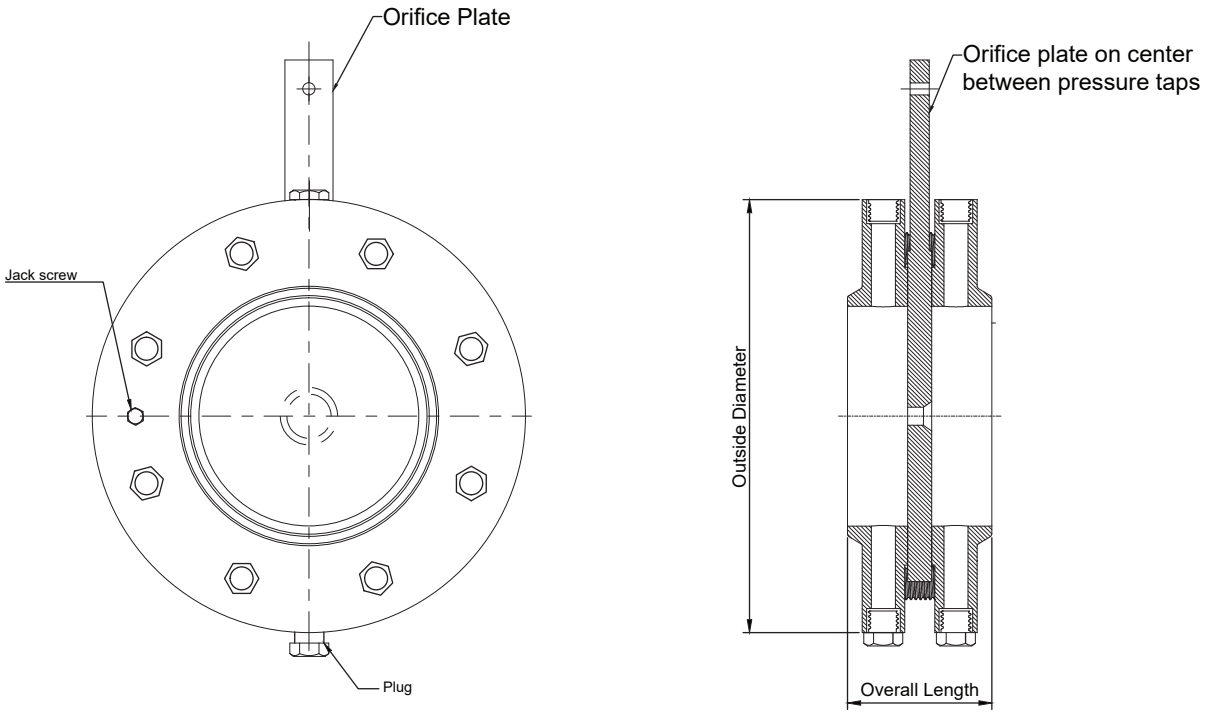
* Does not include depth of Ring Groove.

** Tap hole location exceedsA.G.A. limits due to Ring Groove interference. Tap hole location from the plate is as follows: 6"-1⅛", 8"-1⅛", 10"-1¼", 12"-1¼.

† To be specified by purchaser.

Note: 4"-12" SP 250 JW Orifice Flanges are not recognized by ANSI B16.36.

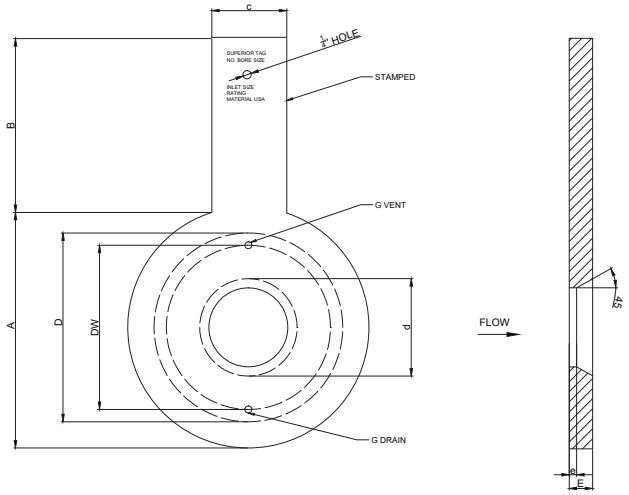
Slip-On Orifice Flanges Assemblies



Nominal Size		Slip-On Orifice Flanges - 300 lb RF				
		Bolts		Approx Weight	Outside Diameter	Overall Length
Feet	Inch	Bolt Qty.	Bolt Size	Kg		
0.08	1	4	5/8" x 4"	7.5	102	124
0.13	1 ½	4	¾" x 5.25"	9.3	102	155
0.16	2	8	5/8" x 5.00"	11.5	105	165
0.21	2 ½	8	¾" x 5.25"	15	108	191
0.26	3	8	¾" x 5.25"	19	111	210
0.32	4	8	¾" x 5.25"	29	114	254
0.49	6	12	¾" x 5.25"	50	114	318
0.65	8	12	7/8" x 5.75"	65	130	381
0.82	10	16	1" x 6.50"	91	139	445
0.98	12	16	1 1/8" x 7.00"	133	152	521
1.14	14	20	1 1/8" x 7.25"	177	158	584
1.31	16	20	1¼ x 7.75"	240	171	648
1.47	18	24	1¼" x 8.00"	323	184	711
1.64	20	24	1"¼ x 8.50"	360	197	775
1.96	24	24	1½" x 9.50"	555	219	914

• *Orifice Plates*

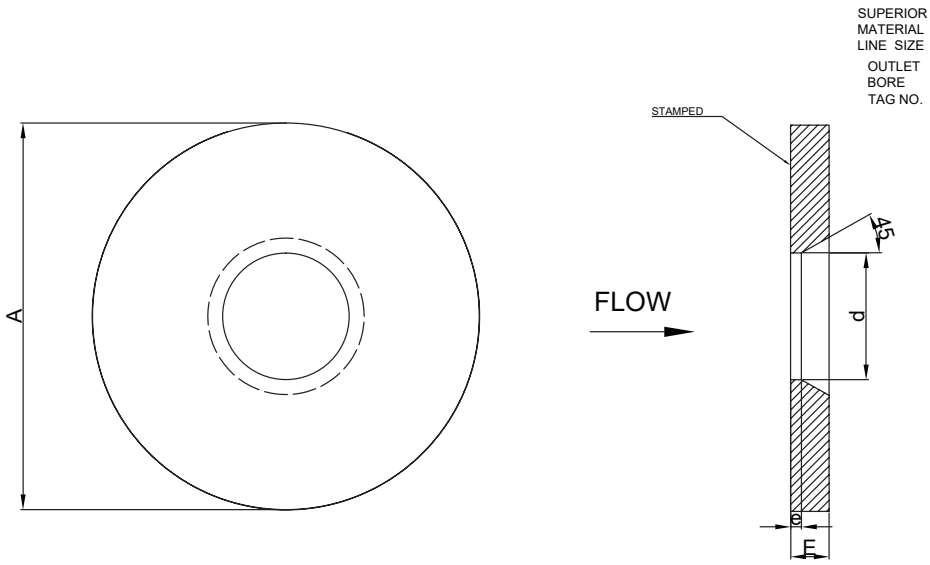
Paddle Type Orifice Plate



ORIFICE PLATE DIMENSIONS										
Line Size (Inch)	A					E	e	B	C	Max Difference LBS β = .50
	125/150 #	300#	600#	900 #	1500#					
½	1 - 7/8	2 - 1/8	2 - 1/8	2 - ½	2 - ½	1/8	1/32	4	1	7596
¾	2 - ¼	2 - 5/8	2 - 5/8	2 - ¾	2 - ¾	1/8	1/32	4	1	4113
1	2 - 5/8	2 - 7/8	2 - 7/8	3 - 1/8	3 - 1/8	1/8	1/32	4	1	2051
1½	3 - 3/8	3 - ¾	3 - ¾	3 - 7/8	3 - 7/8	1/8	1/32	4	1	890
2	4 - 1/8	4 - 3/8	4 - 3/8	5 - 5/8	5 - 5/8	1/8	1/32	4	1 - ¼	530
3	5 - 3/8	5 - 7/8	5 - 7/8	6 - 5/8	6 - 7/8	1/8	1/32	4	1 - ¼	240
4	6 - 7/8	7 - 1/8	7 - 5/8	8 - 1/8	8 - ¼	1/8	1/16	4	1 - ¼	112
6	8 - ¾	9 - 7/8	10 - ½	11 - 3/8	11 - 1/8	1/8	3/32	5	1 - ¼	61
8	11	12 - 1/8	12 - 5/8	14 - 1/8	13 - 7/8	1/8	1/8	4	1 - ¼	35
10	13 - 3/8	14 - ¼	15 - ¾	17 - 1/8	17 - 1/8	1/8	1/8	6	1 - ¼	22
12	16 - 1/8	16 - 5/8	18	19 - 5/8	20 - ½	¼	1/8	6	1 - ¼	63
14	17 - ¾	19 - 1/8	19 - 3/8	20 - ½	22 - ¾	¼	1/8	6	1 - ¼	51
16	20 - ¼	21 - ¼	22 - ¼	22 - 5/8	25 - ¼	¼	¼	6	1 - ¼	38
18	21 - ½	23 - 3/8	24	25	27 - 5/8	¼	¼	6	1 - ¼	30
20	23 - ¾	25 - 5/8	26 - ¾	27 - 3/8	29 - 5/8	3/8	¼	6	1 - ¼	14
24	28 - 1/8	30 - 3/8	31	32 - 7/8	35 - ½	3/8	¼	6	1 - ¼	13

WEEP HOLE DIAMENSIONS			
d Orifice Bore	G Maximum Diameter	d Orifice Bore	G Maximum Diameter
Les than 1.000	Not Recomended	8.376 - 9.250	5/16
1.000 - 3.500	3/32	9.251 - 10.000	11/32
3.501 - 4.125	1/8	10.001 - 10.875	3/8
4.125 - 5.000	5/32	10.876 - 11.625	13/32
5.001 - 6.000	3/16	11.626 - 12.500	7/16
6.001 - 6.750	7/32	12.501 - 13.250	15/32
6.751 - 7.500	¼	13.251 +	½
7.501 - 8.375	9/32		

Universal Type Orifice Plate



Line Size (Inches)	Plate O.D.	Plate Thickness	Blank WT LBS
	A	E	
2	2.437	1/8	.17
3	3.437	1/8	.34
4	4.406	1/8	.55
6	6.437	1/8	1.18
8	8.437	1/8	2.03
10	10.687	1/8	3.25
12*	13.079	1/4	9.02
14*	14.563	1/4	11.16
16*	16.563	1/4	14.58
18*	18.563	1/4	18.45
20*	2.563	3/8	22.78
24*	24.500	3/8	32.80
26*	26.750	3/8	62.00
30*	30.750	1/2	112.00
34*	35.228	1/2	134.00
36*	38.000	1/2	156.00

* "A" dimension for 12 inch and larger Orifice Plates above include the Vulanized Seal. Upon request Teflon and Metal Seals can be manufactured for Orifice Plates 12 inch and larger.

Specifications

• *Orifice Flanges*

Size	1" to 96"diameter, On Customer Request
Material	A105, A305 LF2, 304/304L, 316/316/L, On Customer Request
Pressure Tappings	Standard two ½" NPT tappings
Gaskets	1.5 mm thick IBC ring type, non asbestos - 3.2 mm thick sprial wound type, carbon steel outer, stainless steel inner, 316L windings with graphite filler

• *Orifice Plates*

Universal Type Orifice Plate

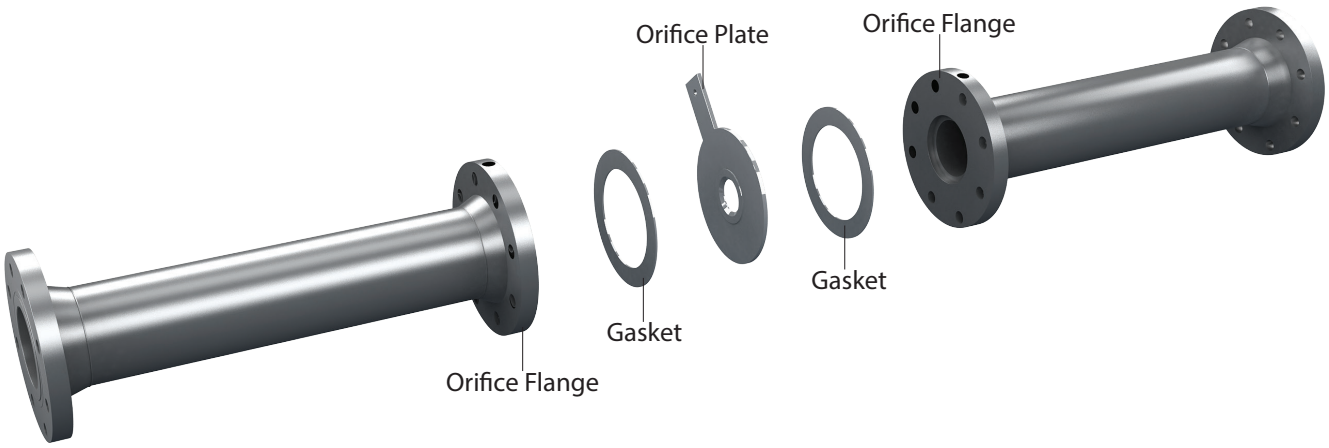
Size	Up to 96" diameter
Material	Stocked in T-304, T-304L, T-316, T-316L, T-321, T-410, Alloy-20, Hastelloy B and C, Monel, and Titanium
Bore	Concentric, Eccentric, Quadrant

Paddle Type Orifice Plate

Size	Up to 96" diameter
Material	Stocked in T-304, T-304L, T-316, T-316L, T-321, T-410, Alloy-20, Hastelloy B and C, Monel, and Titanium
Bore	Concentric, Eccentric, Quadrant, Segmental

Installation Guidelines

- Ensure that the operating staff handling this pressurized instrument is professionally trained and alert while operating
- Face orifice flanges in front of each other and install studs in the lower half
- Insert the orifice plate and gaskets in the orifice plate holder existing between the two flanges
- Ensure that the orifice bore is centered well with the pipe diameter
- Install remaining studs around the orifice flanges with bolts
- Tighten the flange bolts evenly without distorting the plate alignment
- Place the pressure sensors in the pressure tap holes provided on either ends of flanges
- Ensure that all screws and studs are tightened and the system is leak-proof before pressurizing the flow pipe. Use new gaskets every time orifice flange is separated.



Take the following precautions while installing:

Ensure that

- The alignment of the assembly to avoid cracks in the pipe
- The bolts are tight enough but not over torqued
- The flow direction arrow is orientated in the direction of fluid flow
- The 'Inlet' stamped on the orifice plate faces towards inlet flange
- The pressure taps are horizontal to prevent wrong pressure reading

Customer Service and Support

DOC # TEK/AK/180319/TEK-DP/A

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