Reference Manual
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Rosemount™ 1495 Orifice Plate and 1496 Orifice Flange Union

ROSEMOUNT™

EMERSON™

Safety messages

⚠ WARNING

Failure to follow these installation guidelines could result in death or serious injury.

Ensure only qualified personnel perform the installation.

⚠ WARNING

Physical access

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

Physical security is an important part of any security program and fundamental in protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

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1 Introduction

1.1 Product recycling/disposal

Consider recycling equipment and packaging.

Dispose of the product and packaging in accordance with local and national legislation.

2 Installation, location, and orientation

2.1 Installation checklist

The installation checklist for the Rosemount 1495 Orifice Plate involves determining placement within the piping system, establishing proper orientation, confirming configurations, measuring the pipe's internal diameter, installing hardware, checking for leaks, and commissioning the flow meter, with steps varying based on whether it is a new installation or an existing flange union.

The following list is a summary of the steps required to complete a 1495 installation. If this is an entirely new installation, begin with Step 1. If the flange union is already in place, verify that the orifice flange size and rating match the recommended specifications and begin with Step 5.

Procedure

1. Determine where the 1495 is to be placed within the piping system.
2. Establish the proper orientation as determined by the intended service for the orifice plate.
3. Confirm the 1495 and/or Rosemount 1496 configurations.
4. Measure the pipe’s internal diameter (ID), preferably at 1 x ID from the orifice flange (upstream or downstream), or at the tap location for flange taps.

   NOTICE

   Providing the pipe internal diameter at the time of purchase is necessary to maintain published orifice plate accuracy.

5. Install the hardware.
6. Check for leaks.
7. Commission the orifice plate flow meter.

Related information

Recommended installation requirements
Installation instructions
Hardware installation for Rosemount 1496 Flange Union

2.2 Receiving and inspection

Devices are available in different models and with different options. Before installation, it is important to inspect and verify that the appropriate model was delivered.

Upon receipt of the shipment, check the packing list against the material received and the purchase order. All items are tagged with a model number, serial number, and customer tag number. Report any damage to the carrier.

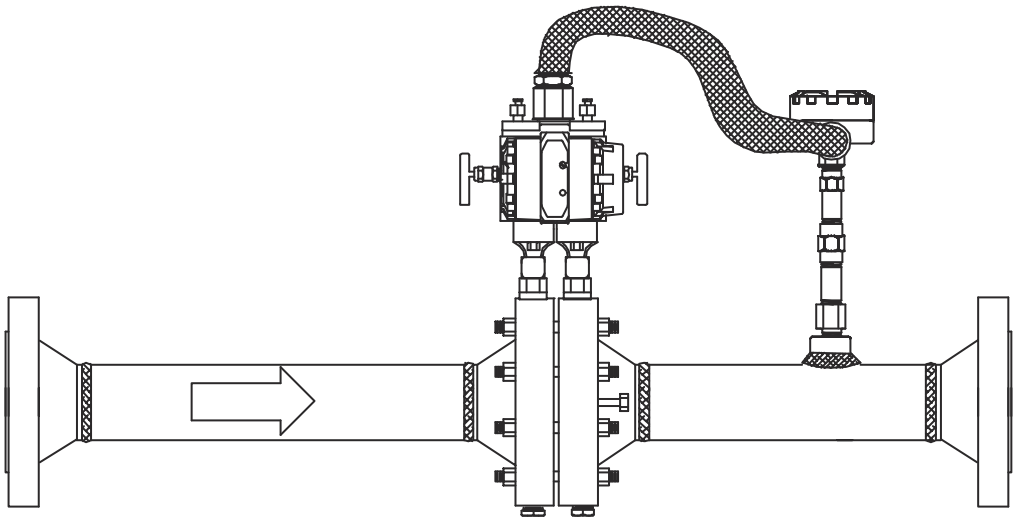
2.3 Installation configuration

You must install the Orifice Flow Meter assembly in a specific orientation relative to the pipe and fluid being measured, with different guidelines for gas, liquid, and steam applications to ensure proper drainage, venting, and balance, and additional considerations for temperature, flow conditioning, and transmitter zeroing.

Gas applications

Mount hardware upward to allow moisture to drain out and not fill the impulse piping:

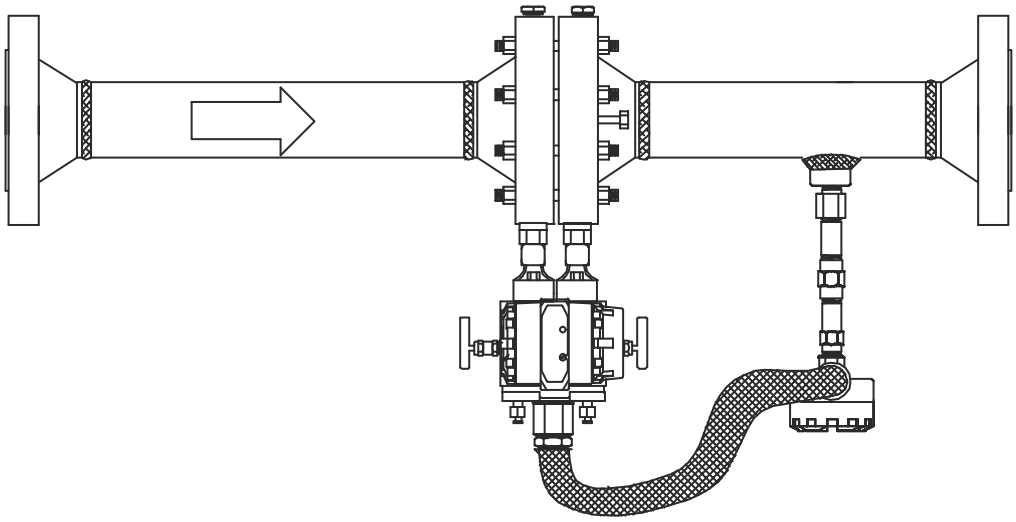
- Slope impulse piping at least one inch per foot (8 centimeters per meter) downward from the transmitter toward the process connection.



Liquid applications

Mount hardware downward to allow the escape of trapped vapor in the impulse piping:

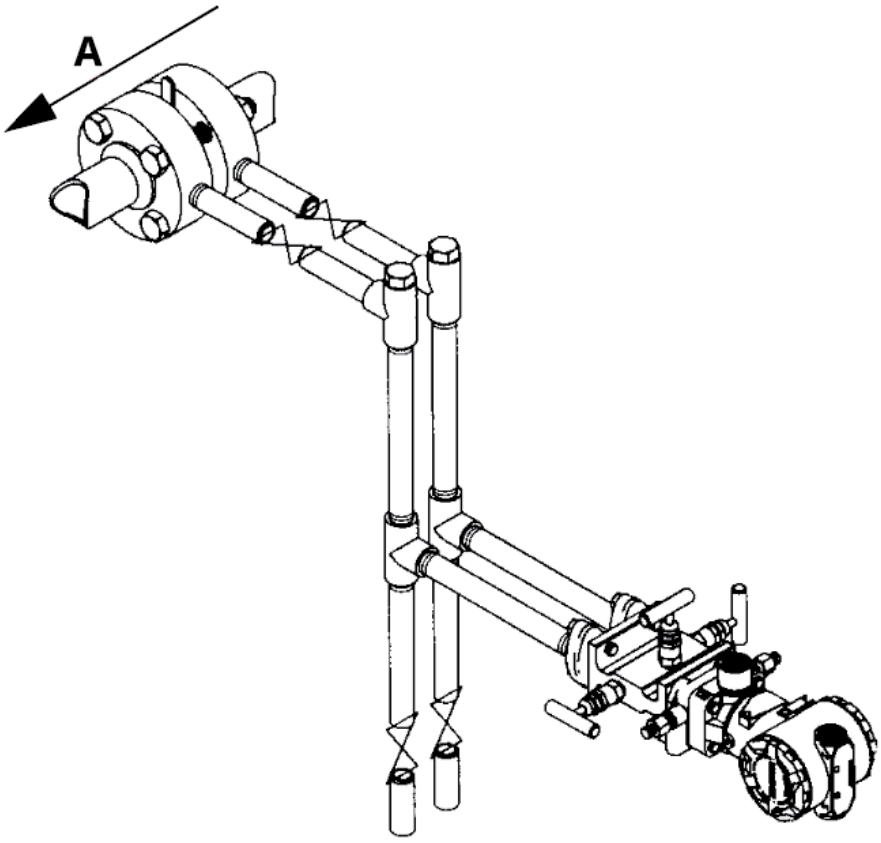
- Slope impulse piping at least one inch per foot (8 centimeters per meter) upward from the transmitter toward the process connection.
- Vent all gas from the liquid piping legs.
- Prevent sediment deposits in the impulse piping.
- Keep the liquid head balanced on both legs of the impulse piping.



Steam applications

Mount hardware to allow for a water leg in the impulse piping:

- In steam or other elevated temperature services, do not allow the temperatures at the transmitter process flanges to exceed +300 °F (+149 °C).
- Do not blow down impulse piping through the transmitter. Flush the lines with the blocking valves closed and refill the lines with water before resuming measurement
- Keep the liquid head balanced on both legs of the impulse piping.



A. Flow

Other Installation Considerations:

- Orient the high side of transmitter to measure upstream of the differential pressure (DP) element.
- Orient the low side of transmitter to measure downstream of the DP element.
- Locate temperature taps and thermowells downstream of the DP element.
- Always locate flow conditioners and straighteners upstream of the DP element.
- The handle of the orifice plate has the word `Inlet` stamped on the side that faces upstream.
- To correct for installation effects, zero the transmitter after mounting.

Related information

Recommended straight run requirements

2.4 Straight run requirements

To obtain published accuracy, sufficient straight run is required to produce a fully developed flow profile. Shorter straight run lengths are possible, but accuracy will be affected. Consult the factory for further information. Refer to Recommended straight run requirements for recommended straight pipe lengths.

3 Hardware installation for Rosemount 1495 Orifice Plate

3.1 Rosemount 1495 types

This section provides hardware installation instructions for the 1495 Orifice Plate. Installation procedures are similar for all services. Service-specific instructions are provided where necessary. Otherwise, all instructions in this section apply to all services.

Refer to transmitter installation instructions where applicable.

Bore types

Figure 3-1: Concentric square-edged (standard)

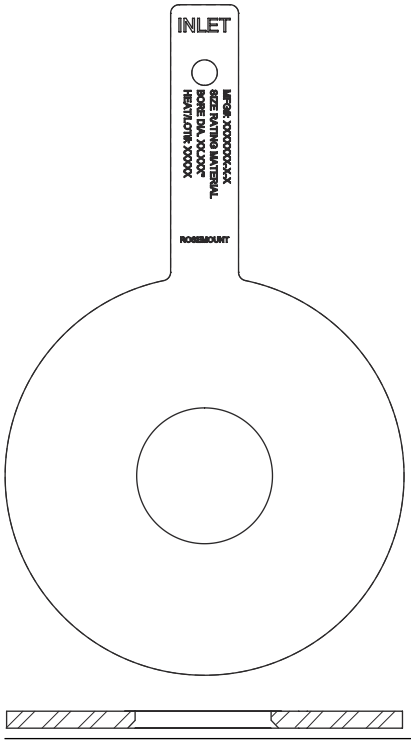


Figure 3-2: Conical entrance bore (option code TC)

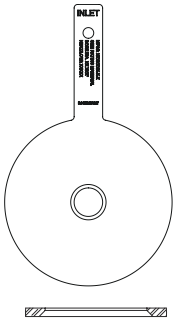


Figure 3-3: Eccentric bore (option code TE)

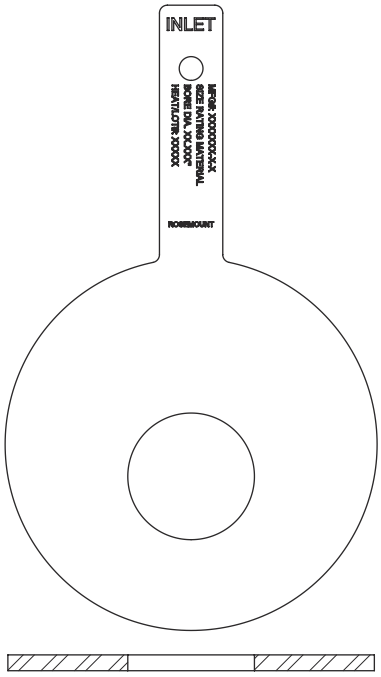


Figure 3-4: Segmental bore (option code TS)

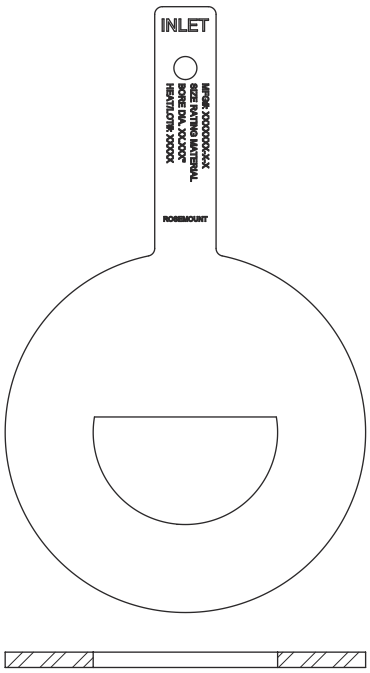


Figure 3-5: Quadrant edged bore (option code TQ)

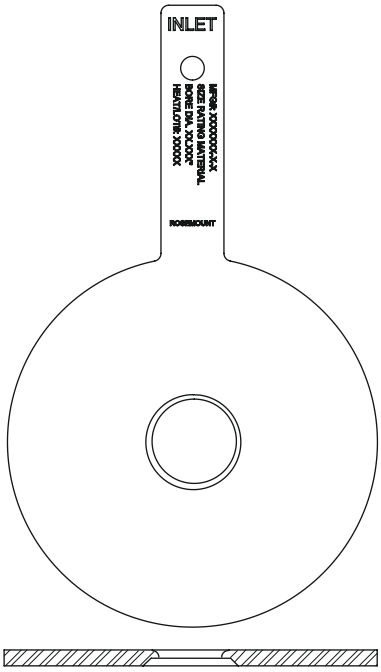
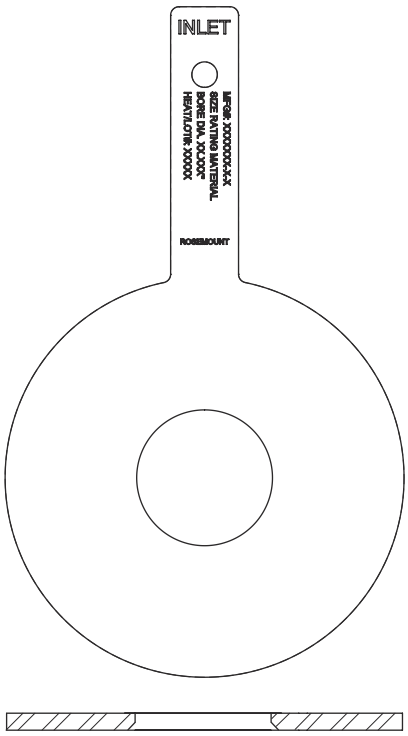


Figure 3-6: Restriction orifice - beveled bore (option code RO)



3.2 Install Rosemount 1495

Refer to published standards (American Gas Association [AGA]3, American Society of Mechanical Engineers [ASME] MFC-3M, and International Organization for Standardization [ISO] for installation guidelines.

General installation instructions to install (or remove) the orifice plate are as follows:

1. Make certain the pipeline is not under pressure and has been drained or purged.
2. Loosen all studs and nuts.
3. Remove the studs in one half of the flange union.
4. Spread flange union by turning jackscrews clockwise.
5. Install new plate or remove existing plate for replacement or inspection.
6. Install new gaskets when installing plate. It is recommended to install new gaskets each time orifice flange union is separated.
7. Release the flange union by turning Jackscrews counter clockwise.
8. Replace studs.
9. Tighten studs in a star pattern. See Bolt torque recommendations.

Procedure

1. Determine the proper placement by ensuring adequate straight run.
2. Determine the proper orientation.
3. Weld the flange union.

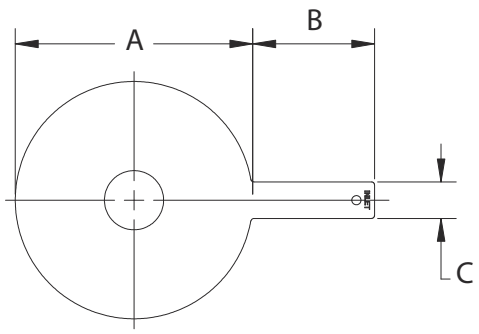
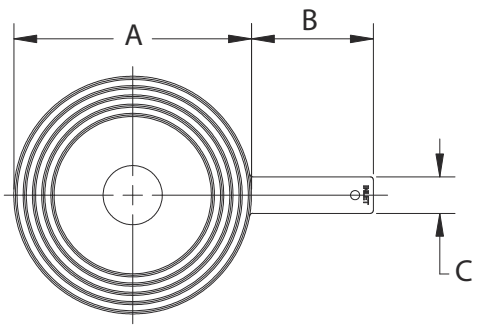
4. Install the orifice plate.
   a) Make certain the pipeline is not under pressure and has been drained or purged.
   b) Loosen all studs and nuts.
   c) Remove the studs in one half of the flange union.
   d) Spread flange union by turning jackscrews clockwise.
   e) Install new plate or remove existing plate for replacement or inspection.
   f) Install new gaskets when installing plate.
      Emerson recommends installing new gasket each time the orifice flange union is separated.
   g) Release the flange union by turning jackscrews counter clockwise.
   h) Replace studs.
   i) Tighten studs in a star pattern.

Postrequisites

Once the orifice plate is installed, proceed by installing connection systems, manifolds, and/or transmitters per manufacturer's recommended specifications and plant standards.

Note
Universal style orifice plates are designed for installation into junior or senior orifice fittings as well as into RTJ Plate Holders.

Figure 3-7: Paddle Types

1495PC Orifice Paddle Type (Paddle, square edged, concentric)	**1495PG Orifice Paddle Type (Paddle, square edged, concentric, spiral finish)**
	

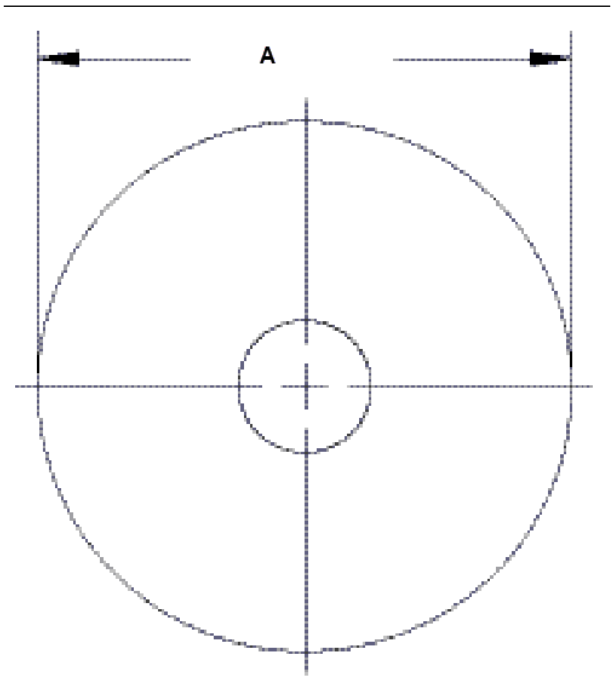
A. Diameter
B. Handle length
C. Handle width

Line size	Diameter for paddle type (1)						Handle length	Handle width
	150#	300#	600#	900#	1500#	2500#		
2 in.	4.125 (105)	4.375 (111)	4.375 (111)	5.625 (143)	5.625 (143)	5.75 (146)	4 (102)	1 (25)

Line size	Diameter for paddle type (1)						Handle length	Handle width
	150#	300#	600#	900#	1500#	2500#		
2½ in.	4.875 (124)	5.125 (130)	5.125 (130)	6.5 (165)	6.5 (165)	6.625 (168)	4 (102)	1 (25)
3 in.	5.375 (137)	5.875 (149)	5.875 (149)	6.625 (168)	6.875 (175)	7.75 (197)	4 (102)	1 (25)
4 in.	6.875 (175)	7.125 (181)	7.625 (194)	8.125 (207)	8.25 (210)	9.25 (235)	4 (102)	1 (25)
6 in.	8.75 (222)	9.875 (251)	10.5 (267)	11.375 (289)	11.125 (283)	12.5 (318)	4 (102)	1 (25)
8 in.	11 (279)	12.125 (308)	12.625 (321)	14.125 (359)	13.875 (353)	15.25 (387)	6 (127)	1.5 (38)
10 in.	13.375 (340)	14.25 (362)	15.75 (400)	17.125 (435)	17.125 (435)	18.75 (476)	6 (152)	1.5 (38)
12 in.	16.125 (410)	16.625 (422)	18 (457)	19.625 (498)	20.5 (521)	21.625 (549)	6 (152)	1.5 (38)
14 in.	17.750 (451)	19.125 (486)	19.375 (340)	20.5 (521)	22.75 (578)	N/A	6 (152)	1.5 (38)
16 in.	20.25 (514)	21.25 (540)	22.25 (565)	22.625 (575)	25.25 (641)	N/A	6 (152)	1.5 (38)
18 in.	21.5 (546)	23.375 (594)	24 (610)	25 (635)	27.625 (702)	N/A	6 (152)	1.5 (38)
20 in.	23.750 (603.25)	25.625 (651)	26.75 (679)	27.375 (695)	29.625 (752)	N/A	6 (152)	1.5 (38)
24 in.	28.125 (714)	30.375 (772)	31 (787)	32.875 (835)	35.5 (902)	N/A	6 (152)	1.5 (38)

(1) Measurement is in inches (millimeters).

1495UC Orifice Universal Type (Universal, square edged, concentric)	Line size	Diameter for universal type(1)
	2 in.	2.437 (62)
	2½ in.	2.812 (71)
	3 in.	3.437 (88)
	4 in.	4.406 (112)
	6 in.	6.437 (164)
	8 in.	8.437 (214)
	10 in.	10.687 (271)
	12 in.	12.593 (320)
	14 in.	14 (356)
	16 in.	16 (406)
	18 in.	18 (457)
	20 in.	20 (508)

1495UC Orifice Universal Type (Universal, square edged, concentric)	Line size	Diameter for universal type[1]
 *A. Diameter*	24 in.	24 (610)

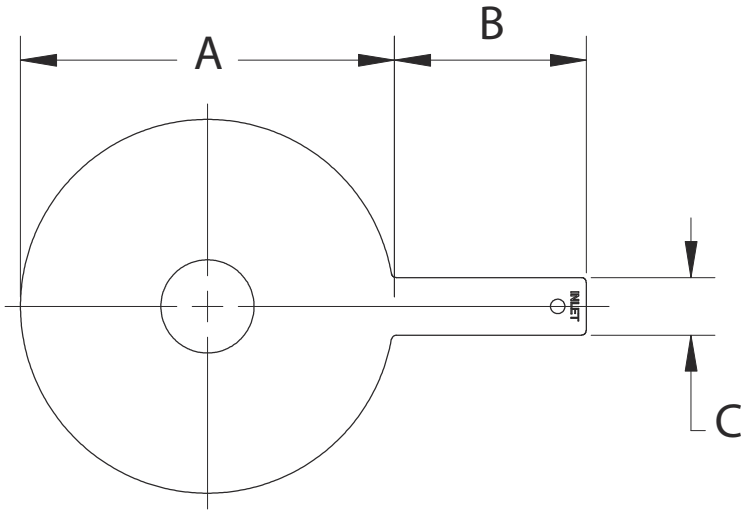
(1) Measurement is in inches (millimeters).

Related information

Installation configuration
Bolt torque recommendations
Recommended straight run requirements

3.3 Rosemount 1495 dimensional drawings

Figure 3-8: 1495 Paddle Type Orifice Plate (DIN, paddle, square edged, concentric)



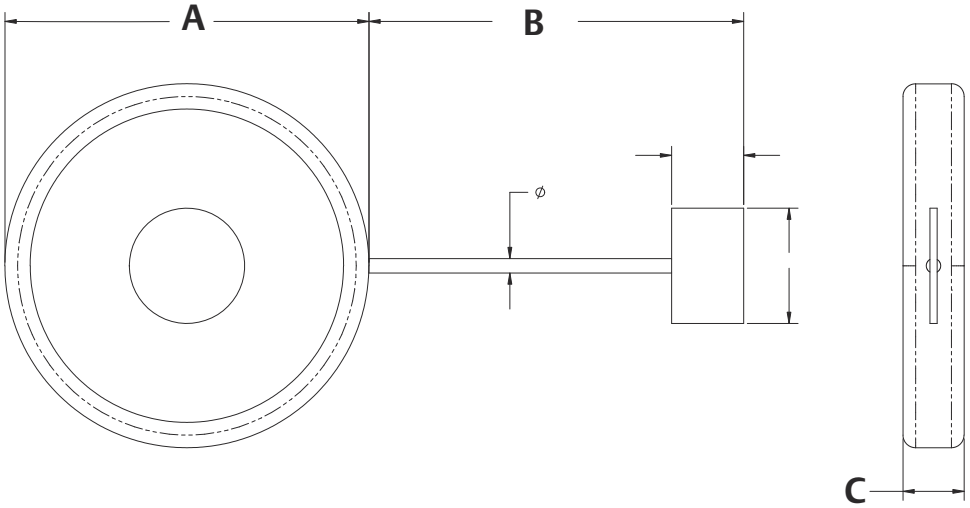
A. Diameter
B. Handle length
C. Handle width

Table 3-1: 1495 orifice plate dimensions(1)

DN	Diameter (maximum) – by flange rating						Handle width	Handle length
	PN 10	PN 16	PN 25	PN 40	PN 63/64	PN 100		
DN 50	4.21 (107)	4.21 (107)	4.21 (107)	4.21 (107)	4.45 (113)	4.69 (119)	1.5 (40)	6.3 (160)
DN 65	5 (127)	5 (127)	5 (127)	5 (127)	5.43 (138)	5.67 (144)	1.5 (40)	6.3 (160)
DN 80	5.6 (142)	5.6 (142)	5.6 (142)	5.6 (142)	5.82 (148)	6.06 (154)	1.5 (40)	6.3 (160)
DN 100	6.38 (162)	6.38 (162)	6.61 (168)	6.61 (168)	6.85 (174)	7.09 (180)	1.5 (40)	6.3 (160)
DN 125	7.56 (192)	7.56 (192)	7.64 (194)	7.63 (194)	8.27 (210)	8.54 (217)	1.5 (40)	6.3 (160)
DN 150	8.58 (218)	8.58 (218)	8.82 (224)	8.82 (224)	9.72 (247)	10.12 (257)	1.5 (40)	6.3 (160)
DN 200	10.74 (273)	10.74 (273)	11.18 (284)	11.42 (290)	12.17 (309)	12.76 (324)	1.5 (40)	6.3 (160)
DN 250	12.91 (328)	12.95 (329)	13.39 (340)	13.86 (352)	14.33 (364)	15.39 (391)	1.5 (40)	6.3 (160)
DN 300	14.88 (378)	15.11 (384)	15.75 (400)	16.42 (417)	16.69 (424)	18.03 (458)	1.5 (40)	6.3 (160)
DN 350	17.24 (438)	17.48 (444)	17.99 (457)	18.66 (474)	19.13 (486)	20.16 (512)	1.5 (40)	6.3 (160)
DN 400	19.25 (489)	19.49 (495)	20.24 (514)	21.49 (546)	21.38 (543)	22.52 (572)	1.5 (40)	6.3 (160)
DN 450	21.22 (539)	21.85 (555)	22.24 (565)	22.48 (571)	Not Applicable	Not Applicable	1.5 (40)	6.3 (160)
DN 500	23.39 (594)	24.29 (617)	24.57 (624)	24.72 (628)	25.87 (657)	27.72 (704)	1.5 (40)	8.0 (200)
DN 600	27.36 (695)	28.9 (734)	28.78 (731)	29.41 (747)	30.08 (764)	32.01(813)	1.5 (40)	8.0 (200)

(1) Measurement is in inches (millimeters).

Figure 3-9: Integral plate holder (if ordered)



A. Diameter
B. Handle length
C. Handle width

Table 3-2: Integral plate holder dimensions for 150#, 300#, and 600#

Dimensions are in inches (millimeters).

Flange rating												
Line size	**150#**				**300#**				**600#**			
	Ring number	**A**	**B**	**C**	**Ring number**	**A**	**B**	**C**	**Ring number**	**A**	**B**	**C**
2 in. (DN 50)	R-22	3.56 (90)	5.5 (140)	1.06 (27)	R-23	3.69 (94)	5.5 (140)	1.06 (27)	R-23	3.69 (94)	5.5 (140)	1.06 (27)
2½ in. (DN 65)	R-25	4.31 (109)	6.5 (165)	1.06 (27)	R-26	4.44 (113)	6.5 (165)	1.06 (27)	R-26	4.44 (113)	6.5 (165)	1.06 (27)
3 in. (DN 80)	R-29	4.81 (122)	6.5 (165)	1.06 (27)	R-31	5.31 (135)	6.5 (165)	1.06 (27)	R-31	5.31 (135)	6.5 (165)	1.06 (27)
4 in. (DN 100)	R-36	6.19 (157)	6.5 (165)	1.06 (27)	R-37	6.31 (160)	6.5 (165)	1.06 (27)	R-37	6.31 (160)	6.5 (165)	1.06 (27)
6 in. (DN 150)	R-43	7.94 (202)	7.5 (191)	1.06 (27)	R-45	8.75 (222)	7.5 (191)	1.06 (27)	R-45	8.75 (222)	7.5 (191)	1.06 (27)
8 in. (DN 200)	R-48	10.06 (256)	7.5 (191)	1.06 (27)	R-49	11.06 (281)	7.5 (191)	1.06 (27)	R-49	11.06 (281)	7.5 (191)	1.06 (27)

Table 3-2: Integral plate holder dimensions for 150#, 300#, and 600# *(continued)*

Flange rating												
Line size	**150#**				**300#**				**600#**			
	Ring number	**A**	**B**	**C**	**Ring number**	**A**	**B**	**C**	**Ring number**	**A**	**B**	**C**
10 in. (DN 250)	R-52	12.31 (313)	8.5 (216)	1.06 (27)	R-53	13.19 (335)	8.5 (216)	1.06 (27)	R-53	13.19 (335)	8.5 (216)	1.06 (27)
12 in. (DN 300)	R-56	15.31 (389)	8.5 (216)	1.06 (27)	R-57	15. (392)	8.5 (216)	1.06 (27)	R-57	15.44 (392)	8.5 (216)	1.06 (27)
14 in. (DN 350)	R-59	15.94 (405)	8.5 (216)	1.06 (27)	R-61	16.94 (430)	8.5 (216)	1.06 (27)	R-61	16.94 (430)	8.5 (216)	1.06 (27)
16 in. (DN 400)	R-64	18.06 (459)	8.5 (216)	1.19 (30)	R-65	18.94 (481)	8.5 (216)	1.19 (30)	R-65	18.94 (481)	8.5 (216)	1.19 (30)
18 in. (DN 450)	R-68	20.69 (526)	8.5 (216)	1.19 (30)	R-69	21.44 (545)	8.5 (216)	1.19 (30)	R-69	21.44 (545)	8.5 (216)	1.19 (30)
20 in. (DN 500)	R-72	22.31 (567)	8.5 (216)	1.25 (32)	R-73	23.5 (597)	8.5 (216)	1.25 (32)	R-73	23.50 (597)	8.5 (216)	1.25 (32)
24 in. (DN 600)	R-76	26.81 (681)	8.5 (216)	1.44 (37)	R-77	27.88 (708)	8.5 (216)	1.44 (37)	R-77	27.88 (708).	8.5 (216)	1.44 (37)

Table 3-3: Integral plate holder dimensions for 900#, 1500#, and 2500#

Flange rating												
Line size	**900#**				**1500#**				**2500#**			
	Ring number	**A**	**B**	**C**	**Ring number**	**A**	**B**	**C**	**Ring number**	**A**	**B**	**C**
2 in. (DN 50)	R-24	4.19 (106)	6.5 (165)	1.06 (27)	R-24	4.19 (106)	6.5 (165)	1.06 (27)	R-26	4.44 (113)	6.5 (165)	1.06 (27)
2½ in. (DN 65)	R-27	4.69 (119)	6.5 (165)	1.06 (27)	R-27	4.69 (119)	6.5 (165)	1.06 (27)	R-28	4.83 (123)	6.5 (165)	1.19 (30)
3 in. (DN 80)	R-31	5.31 (135)	6.5 (165)	1.06 (27)	R-35	5.81 (148)	6.5 (165)	1.06 (27)	R-32	5.5 (140)	7.5 (191)	1.19 (30)
4 in. (DN 100)	R-37	6.31 (160)	6.5 (165)	1.06 (27)	R-39	6.81 (173)	6.5 (165)	1.06 (27)	R-38	6.81 (173)	7.5 (191)	1.31 (33)
6 in. (DN 150)	R-45	8.75 (222)	7.5 (191)	1.06 (27)	R-46	8.81 (224)	7.5 (191)	1.19 (30)	R-47	9.75 (248)	8.5 (216)	1.44 (37)

Table 3-3: Integral plate holder dimensions for 900#, 1500#, and 2500# *(continued)*

Flange rating												
Line size	**900#**				**1500#**				**2500#**			
	Ring number	**A**	**B**	**C**	**Ring number**	**A**	**B**	**C**	**Ring number**	**A**	**B**	**C**
8 in. (DN 200)	R-49	11.06 (281)	7.5 (191)	1.06 (27)	R-50	11.25 (286)	7.5 (191)	1.44 (37)	R-51	11.88 (302)	9.5 (241)	1.69 (43)
10 in. (DN 250)	R-53	13.19 (335)	8.5 (216)	1.06 (27)	R-54	13.38 (340)	8.5 (216)	1.44 (37)	R-55	14.63 (372)	9.5 (241.3)	2 (51)
12 in. (DN 300)	R-57	15.44 (392)	8.5 (216)	1.06 (27)	R-58	15.88 (403)	9.5 (241)	1.44 (37)	R-60	17.25 (438)	10.5 (267)	2.13 (54)
14 in. (DN 350)	R-62	17.13 (435)	8.5 (216)	1.31 (33)	R-63	17.5 (445)	9.5 (241)	1.88 (48)	N/A	N/A	N/A	N/A
16 in. (DN 400)	R-66	19.13 (486)	8.5 (216)	1.44 (37)	R-67	19.63 (499)	10.5 (268)	2.13 (54)	N/A	N/A	N/A	N/A
18 in. (DN 450)	R-70	21.75 (552)	8.5 (216)	1.56 (40)	R-71	22.13 (562)	10.5 (268)	2.13 (54)	N/A	N/A	N/A	N/A
20 in. (DN 500)	R-74	23.75 (603)	8.5 (216)	1.56 (40)	R-75	24.25 (616)	11.5 (292)	2.13 (54)	N/A	N/A	N/A	N/A
24 in. (DN 600)	R-78	28.25 (718)	10.5 (267)	1.88 (48)	R-79	28.63 (727)	11.5 (292)	2.13 (54)	N/A	N/A	N/A	N/A

3.4 Rosemount 1495 weights (estimated)

Weights are in pounds (kilograms).

Estimated weight based on:

- Paddle style
- Beta = 0.65 (schedule standard pipe)
- 316/316L stainless steel (SST) materials of construction

Any deviation in configuration may affect estimated weights.

	Line size						
Flange rating	**2 in. (50 mm)**	**2.5 in. (64 mm)**	**3 in. (80 mm)**	**4 in. (100 mm)**	**6 in. (150 mm)**	**8 in. (200 mm)**	**10 in. (250 mm)**
ANSI thickness = 0.125 in. (3.2 mm)							
A3 ANSI Class 300	0.68 (0.31)	0.89 (0.4)	1.12 (0.51)	1.58 (0.72)	2.91 (1.32)	4.50 (2.04)	6.09 (2.76)
A6 ANSI Class 600	0.68 (0.31)	0.89 (0.4)	1.12 (0.51)	1.79 (0.81)	3.27 (1.48)	4.85 (2.20)	7.36 (3.34)

	Line size						
Flange rating	**2 in. (50 mm)**	**2.5 in. (64 mm)**	**3 in. (80 mm)**	**4 in. (100 mm)**	**6 in. (150 mm)**	**8 in. (200 mm)**	**10 in. (250 mm)**
A6 ANSI Class 900	1.04 (0.47)	1.34 (0.61)	1.39 (0.63)	2.02 (0.91)	3.82 (1.73)	5.99 (2.72)	8.65 (3.92)
AF ANSI Class 1500	1.04 (0.47)	1.34 (0.61)	1.48 (0.67)	2.07 (0.94)	3.66 (1.66)	5.79 (2.63)	8.65 (3.92)
AT ANSI Class 2500	1.08 (0.49)	1.39 (0.63)	1.85 (0.84)	2.57 (1.17)	4.58 (2.08)	6.92 (3.14)	10.30 (4.67)
DIN thickness = 0.098 in. (2.5 mm)							
D1 DIN PN10	0.66 (0.3)	0.83 (0.37)	0.97 (0.44)	1.18 (0.53)	1.91 (0.87)	2.85 (1.29)	3.99 (1.81)
D2 DIN PN16	0.66 (0.3)	0.83 (0.37)	0.97 0344)	1.18 (0.53)	1.91 (0.87)	2.85 (1.29)	4.02 (1.82)
D3 DIN PN25	0.66 (0.3)	0.83 (0.37)	0.97 (0.44)	1.24 (0.56)	2.01 (0.91)	3.06 (1.39)	4.27 (1.94)
D4 DIN PN40	0.66 (0.3)	0.83 (0.37)	0.97 (0.44)	1.24 (0.56)	2.01 (0.91)	3.18 (1.44)	4.56 (2.07)
D5 DIN PN63	0.71 (0.32)	0.93 (0.42)	1.02 (0.46)	1.32 (0.60)	2.38 (1.08)	3.58 (1.62)	4.86 (2.20)
D6 DIN PN100	0.76 (0.34)	0.99 (0.45)	1.09 (0.49)	1.39 (0.63)	2.56 (1.16)	3.91 (1.77)	5.56 (2.52)

	Line size					
Flange rating	**12 in. (300 mm)**	**14 in. (350 mm)**	**16 in. (400 mm)**	**18 in. (450 mm)**	**20 in. (500 mm)**	**24 in. (600 mm)**
ANSI thickness = 0.125 in. (3.2 mm)						
A3 ANSI Class 300	8.17 (3.7)	10.7 (4.85)	13.14 (5.96)	15.83 (7.18)	18.96 (8.6)	26.5 (12.02)
A6 ANSI Class 600	9.52 (4.32)	5.4 (2.45)	14.37 (6.52)	16.67 (7.56)	20.63 (9.36)	27.59 (12.52)
A6 ANSI Class 900	11.25 (5.1)	12.15 (5.56)	14.85 (6.74)	18.06 (8.19)	21.59 (9.79)	30.99 (14.06)
AF ANSI Class 1500	12.25 (5.56)	15.01 (6.81)	18.42 (8.35)	21.98 (9.97)	25.23 (11.44)	36.08 (16.37)
AT ANSI Class 2500	13.59 (6.17)	N/A	N/A	N/A	N/A	N/A
DIN thickness = 0.098 in. (2.5 mm)						
D1 DIN PN10	5.22 (2.37)	6.91 (3.13)	8.55 (3.88)	10.33 (4.69)	12.56 (5.7)	17.07 (7.74)
D2 DIN PN16	5.37 (2.44)	7.1 (3.22)	8.76 (3.97)	10.94 (4.96)	13.52 (6.13)	19 (8.62)
D3 DIN PN25	5.81 (2.64)	7.5 (3.40)	9.42 (4.27)	11.32 (5.13)	13.83 (6.27)	18.85 (8.55)
D4 DIN PN40	6.29 (2.85)	8.05 (3.65)	10.59 (4.80)	11.56 (5.24)	13.99 (6.35)	19.67 (8.92)
D5 DIN PN63	6.49 (2.94)	8.44 (3.83)	10.48 (4.75)	N/A	15.29 (6.94)	20.56 (9.32)
D6 DIN PN100	7.53 (3.42)	9.35 (4.24)	11.60 (5.26)	N/A	17.51 (7.94)	23.23 (10.54)

	Line size						
Flange rating	**2 in. (50 mm)**	**2.5 in. (64 mm)**	**3 in. (80 mm)**	**4 in. (100 mm)**	**6 in. (150 mm)**	**8 in. (200 mm)**	**10 in. (250 mm)**
ANSI thickness = 0.25 in. (6 mm)							
A3 ANSI Class 300	1.37 (0.62)	1.78 (0.81)	2.25 (1.02)	3.17 (1.44)	5.82 (2.64)	8.99 (4.08)	12.17 (5.52)
A6 ANSI Class 600	1.37 (0.62)	1.78 (0.81)	2.25 (1.02)	3.59 (1.63)	6.54 (2.97)	9.7 (4.4)	14.73 (6.68)
A6 ANSI Class 900	2.08 (0.94)	2.68 (1.22)	2.78 (1.26)	4.03 (1.83)	7.63 (3.46)	11.97 (5.43)	17.29 (7.84)
AF ANSI Class 1500	2.08 (0.94)	2.68 (1.22)	2.97 (1.35)	4.15 (1.88)	7.31 (3.32)	11.57 (5.25)	17.29 (7.84)
AT ANSI Class 2500	2.16 (0.98)	2.78 (1.26)	3.69 (1.68)	5.14 (2.33)	9.16 (4.15)	13.85 (6.28)	20.60 (9.34)

	Line size						
Flange rating	**2 in. (50 mm)**	**2.5 in. (64 mm)**	**3 in. (80 mm)**	**4 in. (100 mm)**	**6 in. (150 mm)**	**8 in. (200 mm)**	**10 in. (250 mm)**
DIN thickness = 0.118 in. (3 mm)							
D1 DIN PN10	0.80 (0.36)	0.99 (0.45)	1.16 (0.53)	1.41 (0.64)	2.3 (1.04)	3.41 (1.55)	4.49 (2.17)
D2 DIN PN16	0.8 (0.36)	0.99 (0.45)	1.16 (0.53)	1.41 (0.64)	2.3 (1.04)	3.41 (1.55)	4.82 (2.19)
D3 DIN PN25	0.8 (0.36)	0.99 (0.45)	1.16 (0.53)	1.49 (0.68)	2.41 (1.09)	3.67 (1.67)	5.13 (2.33)
D4 DIN PN40	0.8 (0.36)	0.99 (0.45)	1.16 (0.53)	1.49 (0.68)	2.41 (1.09)	3.82 (1.73)	5.47 (2.48)
D5 DIN PN63	0.85 (0.39)	1.11 (0.50)	1.23 (0.56)	1.58 (0.72)	2.86 (1.30)	4.29 (1.95)	5.83 (2.64)
D6 DIN PN100	0.91 (0.41)	1.18 (0.54)	1.31 (0.59)	1.67 (0.76)	3.07 (1.39)	4.69 (2.13)	6.67 (3.03)

	Line size					
Flange rating	**12 in. (300 mm)**	**14 in. (350 mm)**	**16 in. (400 mm)**	**18 in. (450 mm)**	**20 in. (500 mm)**	**24 in. (600 mm)**
ANSI thickness = 0.25 in. (6 mm)						
A3 ANSI Class 300	16.33 (7.41)	21.41 (9.71)	26.28 (11.92)	31.66 (14.36)	37.91 (17.2)	53.01 (24.04)
A6 ANSI Class 600	19.04 (8.63)	10.8 (4.9)	28.74 (13.04)	33.34 (15.12)	41.26 (18.71)	55.19 (25.03)
A6 ANSI Class 900	22.51 (10.21)	24.5 (11.11)	29.7 (13.47)	36.12 (16.38)	43.18 (19.58)	61.98 (28.11)
AF ANSI Class 1500	24.5 (11.11)	30.02 (13.62)	36.83 (16.71)	43.96 (19.94)	50.46 (22.89)	72.17 (32.73)
AT ANSI Class 2500	27.19 (12.33)	N/A	N/A	N/A	N/A	N/A
DIN thickness = 0.118 in. (3 mm)						
D1 DIN PN10	6.26 (2.84)	8.29 (3.76)	10.26 (4.65)	12.39 (5.62)	15.08 (6.84)	20.48 (9.29)
D2 DIN PN16	6.44 (2.92)	8.51 (3.86)	10.51 (4.77)	13.12 (5.95)	16.23 (7.36)	22.80 (10.34)
D3 DIN PN25	6.97 (3.16)	9 (4.08)	11.31 (5.13)	13.58 (6.16)	16.59 (7.53)	22.62 (10.26)
D4 DIN PN40	7.55 (3.43)	9.66 (4.38)	12.7 (5.76)	13.87 (6.29)	16.79 (7.62)	23.6 (10.7)
D5 DIN PN63	7.79 (3.53)	10.13 (4.6)	12.58 (5.71)	N/A	18.35 (8.32)	24.67 (11.19)
D6 DIN PN100	9.04 (4.1)	11.22 (5.09)	13.92 (6.31)	N/A	21.01 (9.53)	27.88 (12.65)

	Line size						
Flange rating	**2 in. (50 mm)**	**2.5 in. (64 mm)**	**3 in. (80 mm)**	**4 in. (100 mm)**	**6 in. (150 mm)**	**8 in. (200 mm)**	**10 in. (250 mm)**
ANSI thickness = 0.375 in. (10 mm)							
A3 ANSI Class 300	2.05 (0.93)	2.66 (1.21)	3.37 (1.53)	4.75 (2.16)	8.73 (3.96)	13.49 (6.12)	18.26 (8.28)
A6 ANSI Class 600	2.05 (0.93)	2.66 (1.21)	3.37 (1.53)	5.38 (2.44)	9.82 (4.45)	14.54 (6.60)	22.09(10.02)
A6 ANSI Class 900	3.12 (1.41)	4.02 (1.83)	4.17 (1.89)	6.05 (2.74)	11.45 (5.19)	17.96 (8.15)	25.94 (11.77)
AF ANSI Class 1500	3.12 (1.41)	4.02 (1.83)	4.45 (2.02)	6.22 (2.82)	10.97 (4.97)	17.36 (7.88)	25.94 (11.77)
AT ANSI Class 2500	3.24 (1.47)	4.16 (1.89)	5.54 (2.51)	7.71 (3.50)	13.73 (6.23)	20.77 (9.42)	30.90 (14.02)
DIN thickness = 0.118 in. (4 mm)							
D1 DIN PN10	1.06 (0.48)	1.32 (0.6)	1.55 (0.7)	1.88 (0.85)	3.06 (1.39)	4.55 (2.07)	6.39 (2.9)
D2 DIN PN16	1.06 (0.48)	1.32 (0.6)	1.55 (0.70)	1.88 (0.85)	3.06 (1.39)	4.55 (2.07)	6.42 (2.91)

	Line size						
Flange rating	**2 in. (50 mm)**	**2.5 in. (64 mm)**	**3 in. (80 mm)**	**4 in. (100 mm)**	**6 in. (150 mm)**	**8 in. (200 mm)**	**10 in. (250 mm)**
D3 DIN PN25	1.06 (0.48)	1.32 (0.6)	1.55 (0.7)	1.99 (0.9)	3.21 (1.46)	4.9 (2.22)	6.84 (3.1)
D4 DIN PN40	1.06 (0.48)	1.32 (0.6)	1.55 (0.7)	1.99 (0.9)	3.21 (1.46)	5.09 (2.31)	7.3 (3.31)
D5 DIN PN63	1.13 (0.51)	1.48 (0.67)	1.64 (0.74)	2.11 (0.96)	3.81 (1.73)	5.72 (2.6)	7.77 (3.52)
D6 DIN PN100	1.21 (0.55)	1.58 (0.72)	1.74 (0.79)	2.23 (1.01)	4.09 (1.86)	6.25 (2.84)	8.9 (4.04)

	Line size					
Flange rating	**12 in. (300 mm)**	**14 in. (350 mm)**	**16 in. (400 mm)**	**18 in. (450 mm)**	**20 in. (500 mm)**	**24 in. (600 mm)**
ANSI thickness = 0.375 in. (10 mm)						
A3 ANSI Class 300	24.5 (11.11)	32.11 (14.56)	39.41 (17.88)	47.49 (21.54)	56.87 (25.8)	79.51 (36.07)
A6 ANSI Class 600	28.56 (12.95)	16.2 (7.35)	43.12 (19.56)	50.01 (22.68)	61.89 (28.07)	82.78 (37.55)
A6 ANSI Class 900	33.76 (15.31)	36.75 (16.67)	44.55 (20.21)	54.18 (24.57)	64.77 (29.38)	92.97 (42.17)
AF ANSI Class 1500	36.75 (16.67)	45.03 (20.43)	55.25 (25.06)	65.94 (29.91)	75.68 (34.33)	108.25 (49.10)
AT ANSI Class 2500	40.78 (18.50)	N/A	N/A	N/A	N/A	N/A
DIN thickness = 0.157 in. (4 mm)						
D1 DIN PN10	8.34 (3.79)	11.05 (5.01)	13.68 (6.2)	16.53 (7.5)	20.1 (9.12)	27.31 (12.39)
D2 DIN PN16	8.59 (3.9)	11.35 (5.15)	14.01 (6.35)	17.5 (7.94)	21.64 (9.81)	30.4 (13.79)
D3 DIN PN25	9.3 (4.22)	12 (5.44)	15.07 (6.84)	18.11 (8.22)	22.13 (10.04)	30.16 (13.68)
D4 DIN PN40	10.07 (4.57)	12.88 (5.84)	16.94 (7.68)	18.49 (8.39)	22.39 (10.16)	31.47 (14.27)
D5 DIN PN63	10.39 (4.71)	13.51 (6.13)	16.77 (7.61)	N/A	24.47 (11.10)	32.89 (14.92)
D6 DIN PN100	12.05 (5.47)	14.96 (6.79)	18.56 (8.42)	N/A	28.01 (12.71)	37.17 (16.86)

4 Hardware installation for Rosemount 1496 Flange Union

4.1 Rosemount 1496 types

This section provides hardware installation instructions for the 1496 Flange Union. Installation procedures are similar for all services. Service-specific instructions are provided where necessary. Otherwise, all instructions in this section apply to all services.

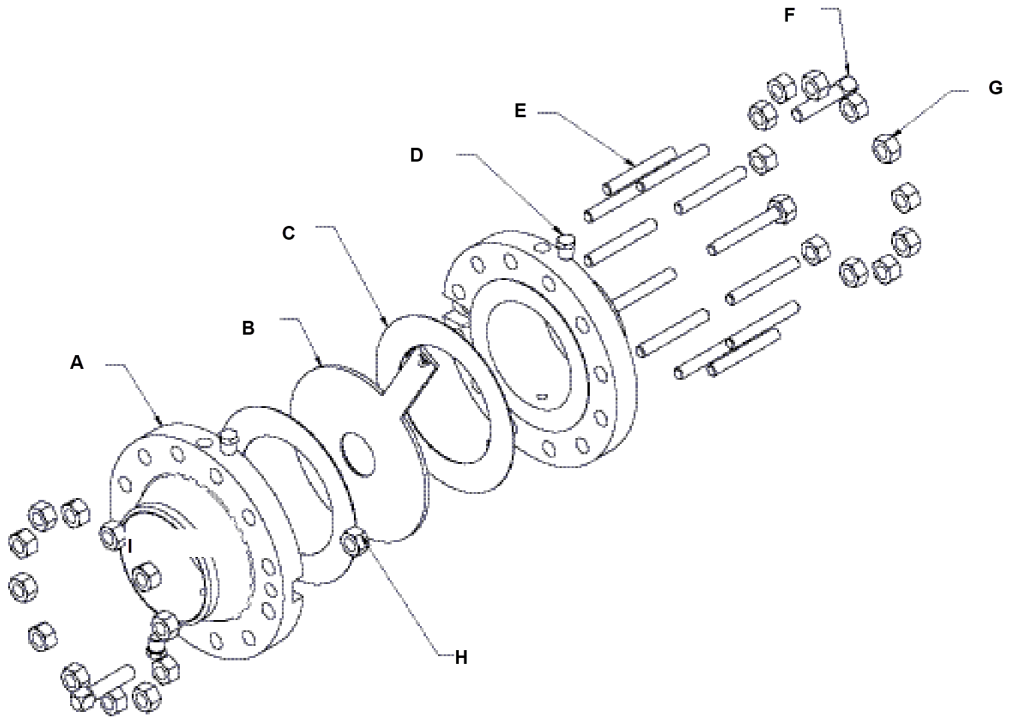
Refer to transmitter installation instructions where applicable.

4.2 Rosemount 1496 components

Figure 4-1 identifies the components of the 1496.

See the actual installation instructions for proper positioning of the orifice plate.

Figure 4-1: 1496 components



A. Orifice flange
B. Rosemount 1495 (not included)
C. Gasket
D. Tap plug
E. Stud
F. Jackscrew
G. Nut
H. Jackscrew nut
I. Pipe plugs

4.3 Install Rosemount 1496

Note
Universal style orifice plates are designed for installation into junior or senior office fittings as well as into RTJ plate holders.

Procedure

1. Determine the proper placement by ensuring adequate straight run.
2. Determine the proper orientation.
3. Weld the orifice flange to the pipe.
    a) Make sure the line is depressurized.
    b) Prep the pipe ends as required.
    c) Ensure that the orifice flange is the correct size and rating.

d) Make certain that the flange taps are aligned and level.

e) Weld the orifice flanges to the pipe.

f) To avoid serious burns, allow the orifice flanges to cool before installing the orifice plate per all applicable plant and local codes.

4. Install the orifice plate.
   a) Make certain the pipeline is not under pressure and has been drained or purged.
   b) Loosen all studs and nuts.
   c) Remove the studs in one half of the flange union.
   d) Spread flange union by turning jackscrews clockwise.
   e) Install new plate or remove existing plate for replacement or inspection.
   f) Install new gaskets when installing plate.
      Emerson recommends installing new gaskets each time the orifice flange union is separated.
   g) Release the flange union by turning jackscrews counter clockwise.
   h) Replace studs.
   i) Tighten studs in a star pattern.

Postrequisites

Once the orifice plate is installed, proceed by installing connection systems, manifolds, and/or transmitters per manufacturer's recommended specifications and plant standards.

Related information

Recommended straight run requirements
Installation configuration
Bolt torque recommendations
American Gas Association (AGA) Report Number 3
American Society of Mechanical Engineers (ASME) B16.36-1996
International Organization for Standardization (ISO) 5167-2

4.4 Rosemount 1496 dimensional drawings

Figure 4-2: Weld neck

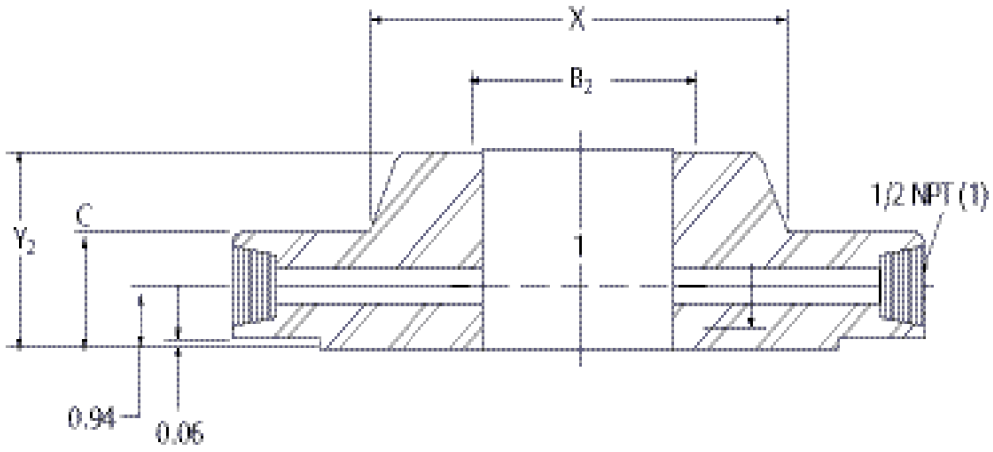


Figure 4-3: Slip-on

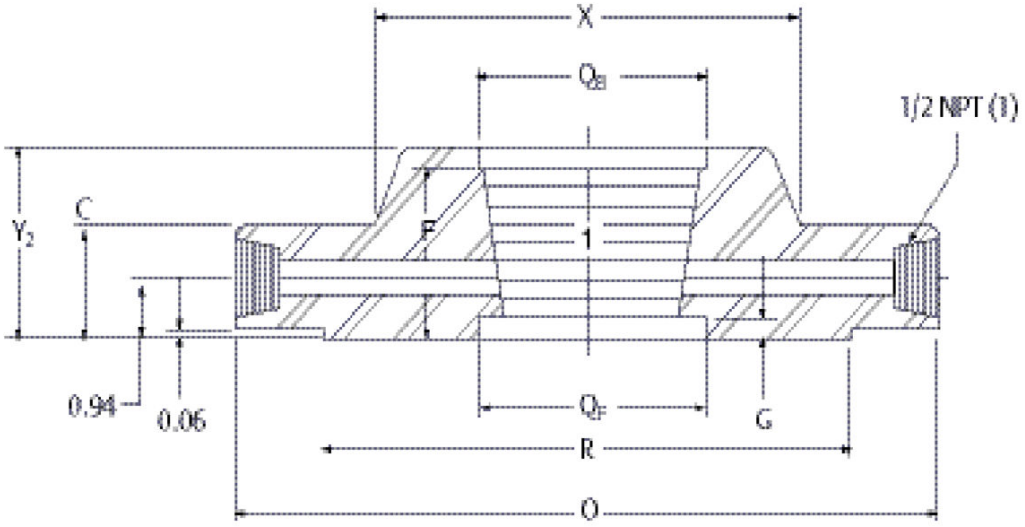
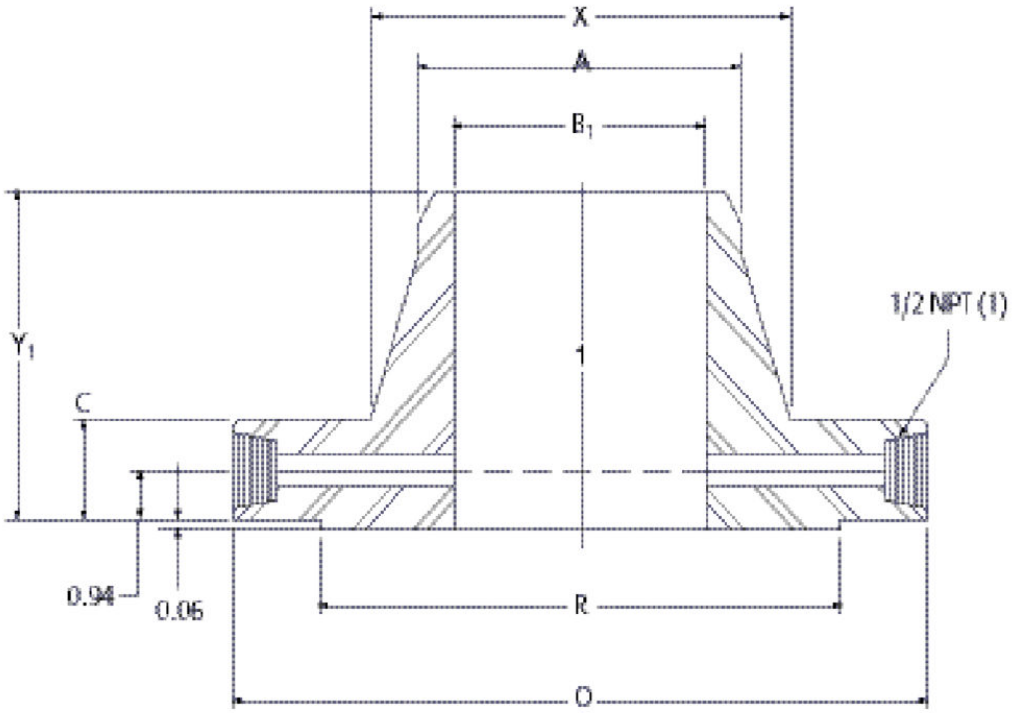


Figure 4-4: Threaded



A. Hub diameter beginning of chamber (weld neck)

B_1	Bore (weld neck)
B_2	Bore (slip-on
C	Thickness of flange, minimum
G	Counter bore depth (from face)
O	Outside diameter of flange
Q_B	Diameter of counter bore (back)
Q_F	Diameter of counter bore (face)
R	Outside diameter of raised face
X	Diameter of hub
Y_1	Length through hub (weld neck)
Y_2	Length through hub (slip-on and threaded)

4.5 American Society of Mechanical Engineers (ASME) B16.36-1996

Table 4-1: Class 300 orifice flanges, welding neck, slip-on, and threaded[(1) (2)]

Dimensions are in inches.

Nominal pipe size (NPS)	R	O	C	Length through hub		X	A	Diameter of counter-bore		Counter-bore depth (from face)		Bore	
				Y_2	Y_1			Q_B	Q_F	F	G	B_2	B_1
1	2	4.88	1.5	1.88	3.25	2.12	1.32	1.41	1.3	1.44	0.75	1.36	(3)
1½	2.88	6.12	1.5	1.88	3.38	2.75	1.9	1.99	1.89	1.47	0.72	1.95	
2	3.62	6.5	1.5	1.94	3.38	3.31	2.38	2.50	2.36	1.50	0.69	2.44	
2½	4.12	7.5	1.5	2	3.5	3.94	2.88	3	2.84	1.75	0.56	2.94	
3	5	8.25	1.5	2.06	3.5	4.62	3.5	3.63	3.46	1.81	0.56	3.57	
4	6.19	10	1.5	2.12	3.62	5.75	4.5	4.63	4.45	1.88	0.56	4.57	
6	8.5	12.5	1.5	2.12	3.94	8.12	6.63	6.75	6.57	1.88	0.31	6.72	
8	10.62	15	1.62	2.44	4.38	10.25	8.63	8.75	8.55	2.19	0.44	8.72	
10	12.75	17.5	1.88	2.62	4.62	1262	10.75	(4)				10.88	
12	15	20.5	2.00	2.88	5.12	14.75	12.75					12.88	
14	16.25	23	2.12	3	5.62	16.75	14					14.14	
16	18.50	25.5	2.25	3.25	5.75	19	16					16.16	
18	21	28	2.38	3.5	6.25	21	18					18.18	
20	23	30.5	2.5	3.75	6.38	23.12	20					20.2	
24	27.25	36	2.75	4.19	6.62	27.62	24					24.25	

(1) Weld neck flanges NPS 3 and smaller are identical to Class 600 flanges and may be so marked.
(2) All other dimensions are in accordance with ASME B16.5.
(3) Threaded flanges are furnished in NPS 1-8 only.
(4) Purchaser must specify bore diameter of weld neck flanges.

Dimensions are in inches.

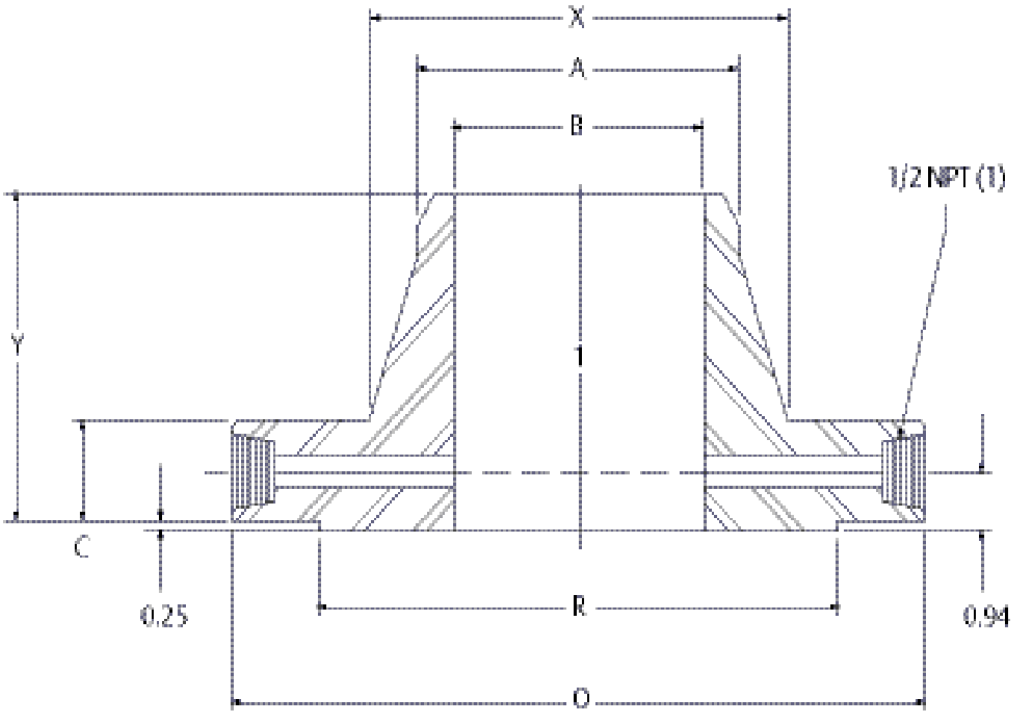
NPS	Diameter of pressure connection, TT	Drilling template				Bolt length(1) (2)	
		Bolt circle	Number of holes	Diameter of holes	Diameter of bolts	Machine bolts	Stud bolts
1	¼	3.5	4	0.69	⅝	4.5	5
1½	¼	4.5	4	0.81	¾	4.75	5.25
2	¼	5	8	0.69	⅝	4.5	5
2½	¼	5.88	8	0.81	¾	4.75	5.25
3	⅜	6.62	8	0.81	¾	4.75	5.25
4	½	7.88	8	0.81	¾	4.75	5.25
6	½	10.62	12	0.88	¾	4.75	5.25
8	½	13	12	1	⅞	5	5.75
10	½	15.25	16	1.12	1	5.75	6.5
12	½	17.75	16	1.25	1⅛	6.25	7
14	½	20.25	20	1.25	1⅛	6.5	7.25
16	½	22.5	20	1.38	1¼	7	7.75

NPS	Diameter of pressure connection, TT	Drilling template				Bolt length[1] [2]	
		Bolt circle	Number of holes	Diameter of holes	Diameter of bolts	Machine bolts	Stud bolts
18	½	24.75	24	1.38	1¼	7.25	8
20	½	27	24	1.38	1¼	7.5	8.5
24	½	32	24	1.62	1½	8.25	9.5

(1) Bolt lengths include allowance for orifice and gasket thickness of 0.25 in. for NPS 1-12 and 0.38 in. for NPS 14-24.
(2) In conformance with ASME B16.5, stud bolt lengths do not include point heights.

Class 600

Figure 4-5: Raised face



A. Hub diameter, beginning of chamber
B. Bore

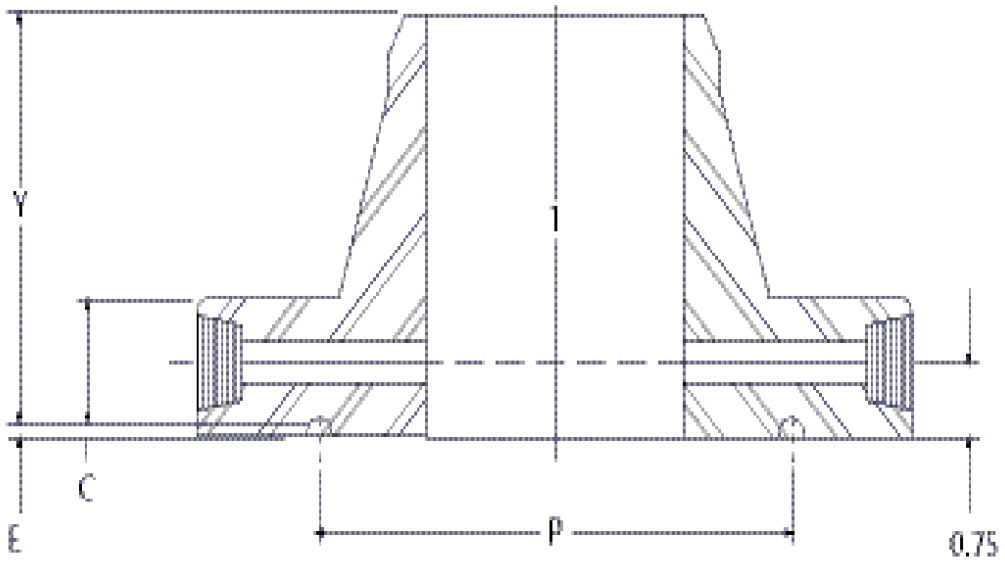
O Outside diameter of flange

R Outside diameter of raised face

X Diameter of hub

Y Length through hub

Figure 4-6: Ring type joint



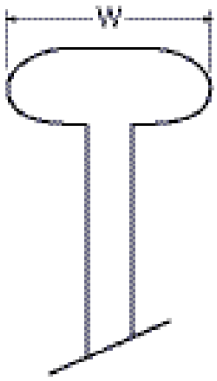
C Thickness of flange, minimum

E Ring type joint, groove depth

P Pitch diameter

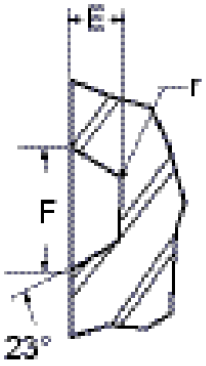
Y Length through hub

Figure 4-7: Special one or two piece ring and orifice plate assembly



W Special oval ring height

Figure 4-8: Groove detail



E Ring type joint, groove depth

F Ring type joint, groove width

r Radius at bottom

Table 4-2: Class 600 orifice flanges, welding neck (1) (2)

Dimensions are in inches.

NPS	R	O	C	Y	Height of raised face, H	Ring Type Joint						X	A
						Groove number	P	E	F	r_{max}	W		
1	2	4.88	1.44	3.19	0.06	R16	2	0.25	0.344	0.03	1	2.12	1.32
1½	2.88	6.12	1.44	3.32	0.06	R20	2.688	0.25	0.344	0.03	1	2.75	1.9
2	3.62	6.5	1.44	3.32	0.06	R23	3.25	0.312	0.469	0.03	1.06	3.31	2.38
2½	4.12	7.5	1.44	3.44	0.06	R26	4	0.312	0.469	0.03	1.06	3.94	2.88
3	5	8.25	1.44	3.44	0.06	R31	4.875	0.312	0.469	0.03	1.06	4.62	3.5
4	6.19	10.75	1.5	4	0.25	R37	5.875	0.312	0.469	0.03	1.06	6	4.5
6	8.5	14	1.88	4.62	0.25	R45	8.312	0.312	0.469	0.03	1.06	8.75	6.63
8	10.62	16.5	2.19	5.25	0.25	R49	10.625	0.312	0.469	0.03	1.06	10.75	8.63
10	12.75	20	2.5	6	0.25	R53	12.75	0.312	0.469	0.03	1.06	13.5	10.75
12	15	22	2.62	6.12	0.25	R57	15	0.312	0.469	0.03	1.06	15.75	12.75
14	16.25	23.75	2.75	6.5	0.25	R61	16.5	0.312	0.469	0.03	1.06	17	14
16	18.5	27	3	7	0.25	R65	18.5	0.312	0.469	0.03	1.19	19.5	16
18	21	29.25	3.25	7.25	0.25	R69	21	0.312	0.469	0.03	1.19	21.5	18
20	23	32	3.5	7.5	0.25	R73	23	0.375	0.531	0.06	1.25	24	20
24	27.25	37	4	8	0.25	R77	27.25	0.438	0.656	0.06	1.44	28.25	24

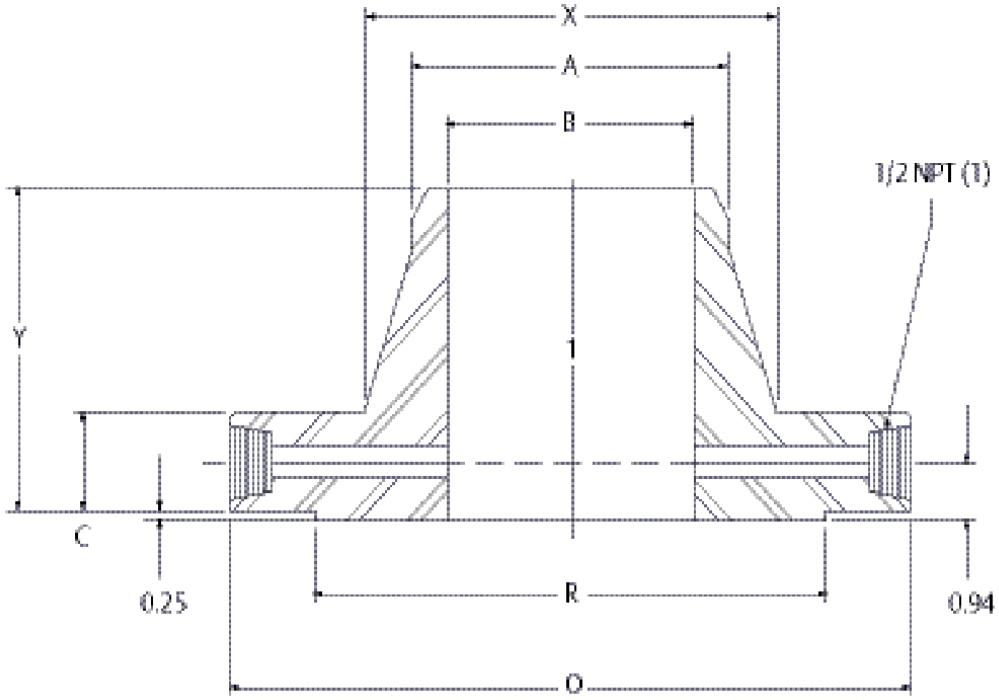
Dimensions are in inches.

NPS, raised face[1] [2]	B	Diameter of pressure connection, TT	Drilling template				Diameter of bolts	Length of stud bolts [3] [4]	
			Bolt circle	Number of holes	Diameter of holes			Raised face	Ring joint
1	[5]	¼	3.5	4	0.69	0.75	⅝	5	5.5
1½		¼	4.5	4	0.81	0.88	¾	5.25	5.5
2		¼	5	8	0.69	0.75	⅝	5	5.5
2½		¼	5.88	8	0.81	0.88	¾	5.25	5.75
3		⅜	6.62	8	0.81	0.88	¾	5.25	5.75
4		½	8.5	8	1	1	⅞	6	6.5
6		½	11.5	12	1.12	1.12	1	7	7.5
8		½	13.75	12	1.25	1.25	1⅛	7.75	8.25
10		½	17	16	1.38	1.38	1¼	8.75	9.25
12		½	19.25	20	1.38	1.38	1¼	9	9.5
14		½	20.75	20	1.5	1.5	1⅜	9.5	10
16		½	23.75	20	1.62	1.62	1½	10.25	10.75
18		½	25.75	20	1.75	1.75	1⅝	11	11.5
20		½	28.5	24	1.75	1.75	1⅝	11.75	12.5
24		½	33	24	2	2	1⅞	13.25	13.75

(1) Weld neck flanges NPS 3 and smaller are identical to Class 300 flanges except for bolting and may be used for such service.
(2) All other dimensions are in accordance with ASME B16.5.
(3) Bolt lengths for raised face flanges include allowance for orifice and gasket thickness of 0.25 in. for NPS 1-12 and 0.38 in. for NPS 14-24. Bolt lengths for ring type joint flanges include allowance of 0.62 in. for NPS 1-10, 0.75 in. for NPS 12-18, and 0.88 in. for NPS 20.
(4) In conformance with ASME B16.5, stud bolt lengths do not include point heights.
(5) Purchaser must specify bore.

Class 900

Figure 4-9: Class 900 raised face



A. Hub diameter, beginning of chamber
B. Bore

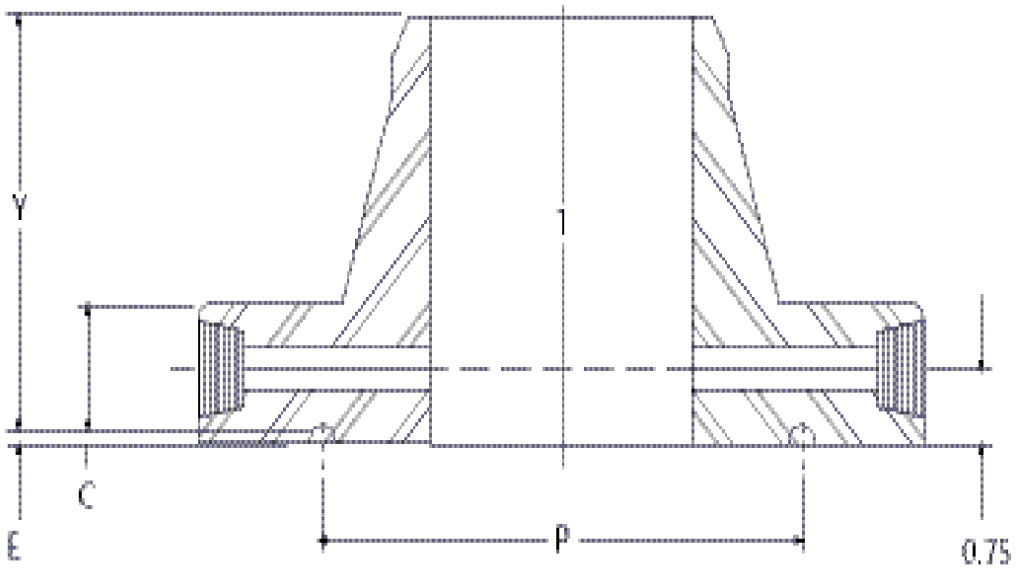
O Outside diameter of flange

R Outside diameter of raised face

X Diameter of hub

Y Length through hub

Figure 4-10: Class 900, ring type joint



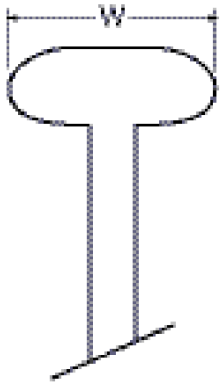
C Thickness of flange, minimum

E Ring type joint, groove depth

P Pitch diameter

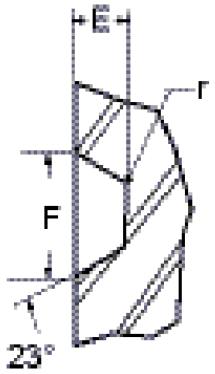
Y Length through hub

Figure 4-11: Class 900, special one or two piece ring and orifice plate assembly



W Special oval ring height

Figure 4-12: Groove detail



E Ring type joint, groove depth

F Ring type joint, groove width

r Radius at bottom

Table 4-3: Class 900 orifice flanges, welding neck

All other dimensions are in accordance with ASME B16.5

NPS	R	O	C	Y	Ring type joint						X	A
					Groove number	P	E	F	r_{max}	W		
1	For NPS 2½ and smaller, use Class 1500											
1½												
2												
2½												
3	5	9.5	1.5	4	R31	4.875	0.312	0.469	0.03	1.06	5	3.5
4	6.19	11.5	1.75	4.5	R37	5.875	0.312	0.469	0.03	1.06	5.25	4.5
6	8.5	15	2.19	5.5	R45	8.312	0.312	0.469	0.03	1.06	9.25	6.63
8	10.62	18.5	2.5	6.38	R49	10.625	0.312	0.469	0.03	1.06	11.75	8.63
10	12.75	21.5	2.75	7.25	R53	12.75	0.312	0.469	0.03	1.06	14.5	10.75
12	15	24	3.12	7.88	R57	15	0.312	0.469	0.03	1.06	16.5	12.75
14	16.25	25.75	3.38	8.38	R62	16.5	0.438	0.656	0.06	1.31	17.75	14
16	18.5	27.75	3.5	8.5	R66	18.5	0.438	0.656	0.06	1.44	20	16
18	21	31	4	9	R70	21	0.5	0.781	0.06	1.56	22.25	18
20	23	33.75	4.25	9.75	R74	23	0.5	0.781	0.06	1.56	24.5	20
24	27.25	41	5.5	11.5	R78	27.25	0.625	1.062	0.09	1.88	29.5	24

Table 4-4:

NPS	B	Diameter of pressure connection, TT	Drilling template				Length of stud bolts(1) (2)	
			Diameter of bolt circle	Number of holes	Diameter of holes	Diameter of bolts	Raised Face	Ring Joint
1	(3)	¼	4.25	4	1	7/8	6	6.25
1.5		¼	5.75	4	1.25	1⅛	7	7.5
2		¼	6.75	8	1.12	1	7.25	7.75
2.5		¼	7.75	8	1.25	1⅛	8	8.5
3		⅜	9	8	1.38	1¼	9	9.5
4		½	10.75	8	1.62	1½	10.25	10.75
6		½	14.5	8	2.12	2	13.75	14.5
8		½	17.25	12	2.12	2	15.25	16
10		½	21.25	12	2.62	2 1/2	19.25	20.25
12		½	24.38	12	2.88	2 3/4	21.25	22.5

(1) Bolt lengths for raised face flanges include allowance for orifice and gasket thickness of 0.25 in. for NPS 1-12 and 0.38 in. for NPS 14-24. Bolt lengths for ring type joint flanges include allowance of 0.62 in. for NPS 1-10, 0.75 in. for NPS 12-18, and 0.88 in. for NPS 20.
(2) In conformance with ASME B16.5, stud bolt lengths do not include point heights.
(3) Purchaser must specify bore.

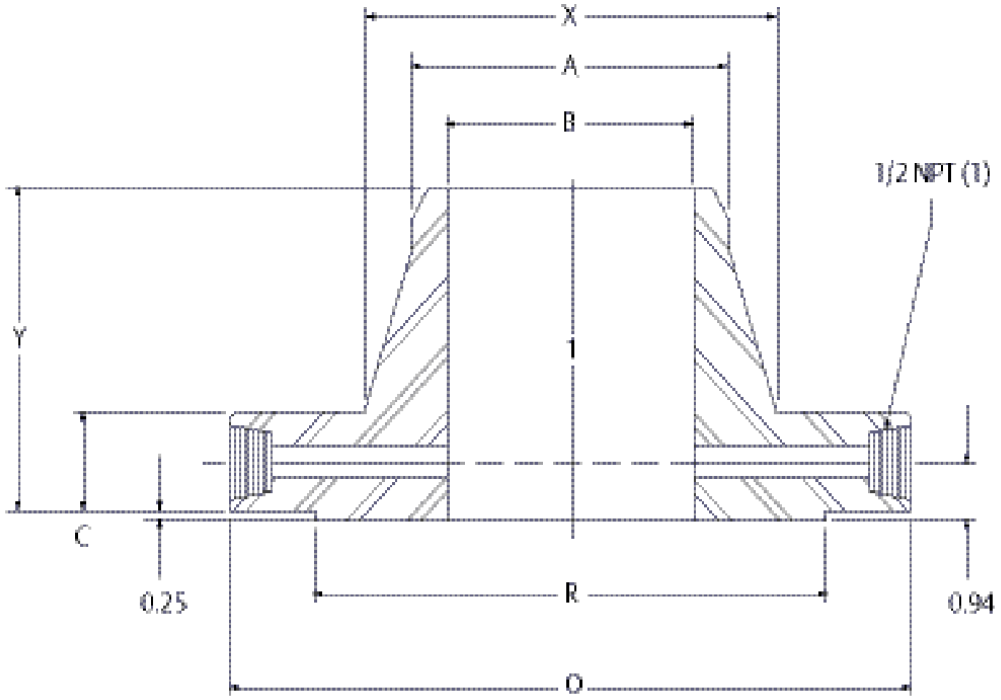
NPS(1)	B	Diameter of pressure connection TT	Drilling template				Length of stud bolts(2)(3)	
			Diameter of bolt circle	Number of holes	Diameter of holes	Diameter of bolts	Raised face	Ring joint
1	For NPS 2½ and smaller, use Class 1500.							
1½								
2								
2½								
3	Purchaser must specify bore	⅜	7.5	8	7.5	⅞	6	6.5
4		½	9.25	8	9.25	1⅛	7	7.5
6		½	12.5	12	12.5	1⅛	7.75	8.25
8		½	15.5	12	15.5	1⅜	9	9.5
10		½	18.5	16	18.5	1⅜	9.5	10
12		½	21	20	21	1⅜	10.25	10.75
14		½	22	20	22	1½	11	11.5
16		½	24.25	20	24.25	1⅝	11.5	12
18		½	27	20	27	1⅞	13	13.75
20		½	29.5	20	29.5	2	14	14.75

NPS[1]	B	Diameter of pressure connection TT	Drilling template				Length of stud bolts[2][3]	
			Diameter of bolt circle	Number of holes	Diameter of holes	Diameter of bolts	Raised face	Ring joint
24		½	35.5	20	35.5	2½	17.5	18.5

(1) All other dimensions are in accordance with ASME B16.5
(2) In conformance with ASME B16.5 stud bolt lengths do not include point heights.
(3) Bolt lengths for raised face flanges include allowance for orifice and gasket thickness of 0.25 in. for NPS 3-12 and 0.38 in. for NPS 14-24. Bolt lengths for ring type joint flanges include allowance of 0.62 in. for NPS 3-10 and 0.75 in. for NPS 12.

Class 1500

Figure 4-13: Class 1500 raised face



A. Hub diameter, beginning of chamber
B. Bore

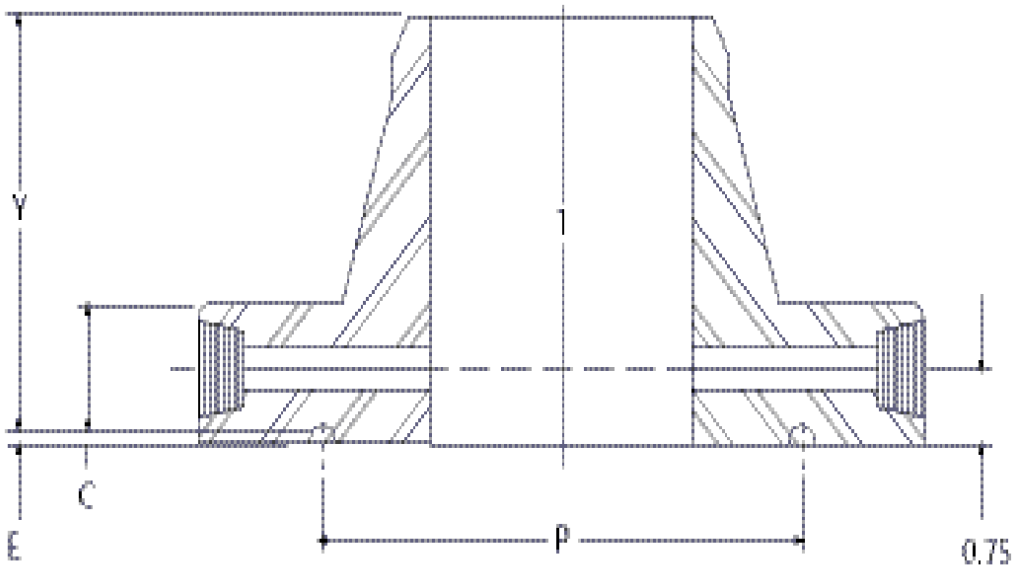
O Outside diameter of flange

R Outside diameter of raised face

X Diameter of hub

Y Length through hub

Figure 4-14: Class 1500, ring type joint



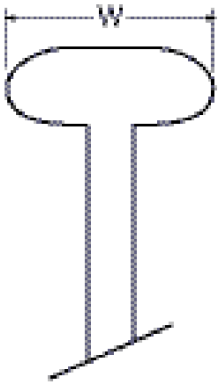
C Thickness of flange, minimum

E Ring type joint, groove depth

P Pitch diameter

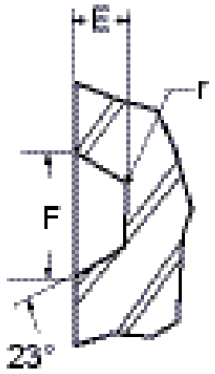
Y Length through hub

Figure 4-15: Class 1500, special one or two piece ring and orifice plate assembly



W Special oval ring height

Figure 4-16: Class 1500, groove detail



E Ring type joint, groove depth

F Ring type joint, groove width

r Radius at bottom

Table 4-5: Class 1500 orifice flanges, welding neck (1)

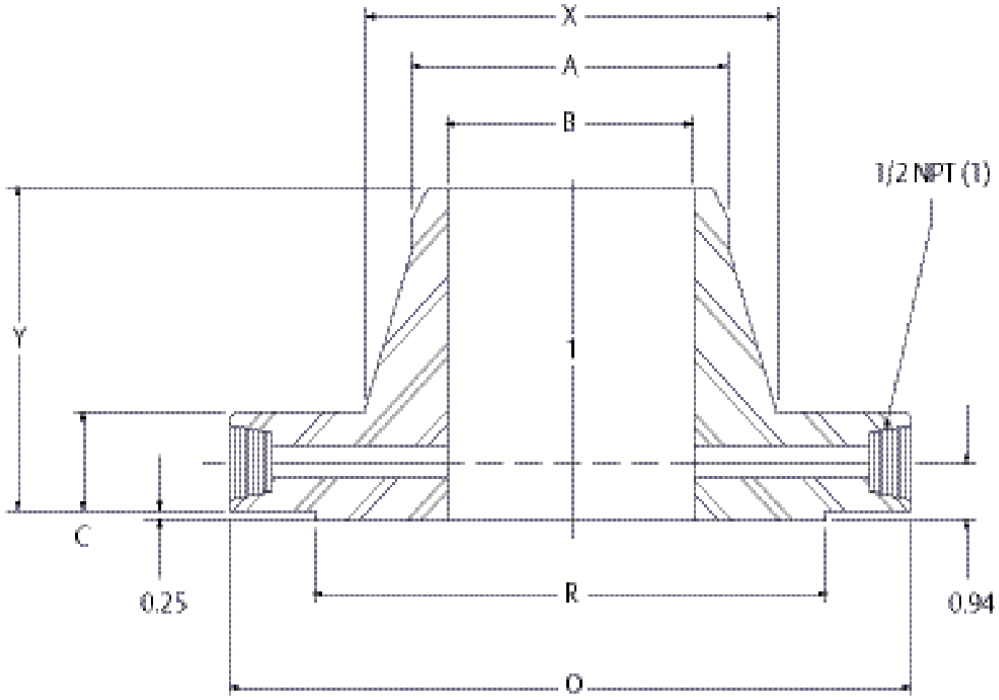
NPS	R	O	C	Y	Ring type joint						X	A
					Groove number	P	E	F	r_{max}	W		
1	2	5.88	1.5	3.25	R16	2	0.25	0.344	0.03	1	2.06	1.32
1½	2.88	7	1.5	3.5	R20	2.688	0.25	0.344	0.03	1	2.75	1.9
2	3.62	8.5	1.5	4	R24	3.75	0.312	0.469	0.03	1.06	4.12	2.38
2½	4.12	9.62	1.62	4.12	R27	4.25	0.312	0.469	0.03	1.06	4.88	2.88
3	5	10.5	1.88	4.62	R35	5.375	0.312	0.469	0.03	1.06	5.25	3.5
4	6.19	12.25	2.12	4.88	R39	6.375	0.312	0.469	0.03	1.06	6.38	4.5
6	8.5	15.5	3.25	6.75	R46	8.312	0.375	0.531	0.06	1.12	9	6.63
8	10.62	19	3.62	8.38	R50	10.625	0.438	0.656	0.06	1.31	11.5	8.63
10	12.75	23	4.25	10	R54	12.75	0.438	0.656	0.06	1.31	14.5	10.75
12	15	26.5	4.88	11.12	R58	15	0.562	0.806	0.06	1.56	17.75	12.75
14	16.25	29.5	5.25	11.75	R63	16.5	0.625	1.062	0.09	1.75	19.5	14
16	18.5	32.5	5.75	12.25	R67	18.5	0.688	1.188	0.09	2	21.75	16
18	21	36	6.38	12.88	R71	21	0.688	1.188	0.09	2	23.5	18
20	23	38.75	7	14	R75	23	0.688	1.312	0.09	2.12	25.25	20
24	27.25	46	8	16	R79	27.25	0.812	1.438	0.09	2.31	30	24

NPS[1]	B	Diameter of pressure connection, TT	Drilling template				Length of stud bolts [2] [3]	
			Diameter of bolt circle	Number of holes	Diameter of holes	Diameter of bolts	Raised face	Ring joint
1	[4]	¼	4	4	1	⅞	6	6.25
1½		¼	4.88	4	1.12	1	6.25	6.5
2		¼	6.5	8	1	⅞	6	6.5
2½		¼	7.5	8	1.12	1	6.5	7
3		⅜	8	8	1.25	1⅛	7.25	7.25
4		½	9.5	8	1.38	1¼	8	8.5
6		½	12.5	12	1.5	1⅜	10.5	11
8		½	15.5	12	1.75	1⅝	11.75	12.25
10		½	19	12	2	1⅞	13.5	14
12		½	22.5	16	2.12	2	15	15.75
14		½	25	16	2.38	2¼	16.25	17.52
16		½	27.75	16	2.62	2½	17.75	19
18		½	30.5	16	2.88	2¾	19.75	21
20		½	32.75	16	3.12	3	21.5	22.5
24		½	39	16	3.62	3 1/2	24.5	26

(1) All other dimensions are in accordance with ASME B16.5.
(2) Bolt lengths for raised face flanges include allowance for orifice and gasket thickness of 0.25 in. for NPS 1-12 and 0.38 in. for NPS 14-24. Bolt lengths for ring type joint flanges include allowance of 0.62 in. for NPS 1-10, 0.75 in. for NPS 12-18, and 0.88 in. for NPS 20.
(3) In conformance with ASME B16.5, stud bolt lengths do not include point heights.
(4) Bore is to be specified by the purchaser.

Class 2500

Figure 4-17: Class 2500 raised face



A. Hub diameter, beginning of chamber
B. Bore

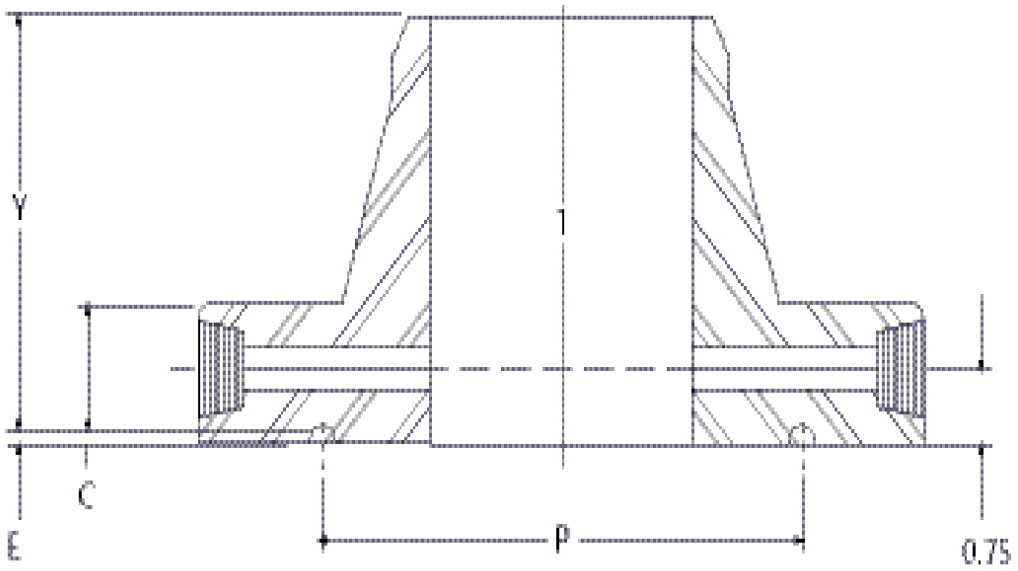
O Outside diameter of flange

R Outside diameter of raised face

X Diameter of hub

Y Length through hub

Figure 4-18: Class 1500, ring type joint



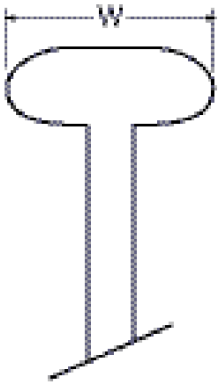
C Thickness of flange, minimum

E Ring type joint, groove depth

P Pitch diameter

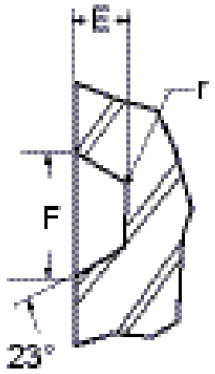
Y Length through hub

Figure 4-19: Class 1500, special one or two piece ring and orifice plate assembly



W Special oval ring height

Figure 4-20: Class 1500, groove detail



E Ring type joint, groove depth

F Ring type joint, groove width

r Radius at bottom

Table 4-6: Class 2500 Orifice Flanges, welding neck(1)

Dimensions are in inches.

NPS	R	O	C	Y	Ring type joint						X	A
					Groove Number	P	E	F	r_{max}	W		
1	2	6.25	1.5	3.62	R18	2.375	0.25	0.344	0.03	1	2.25	1.32
1.5	2.88	8	1.75	4.38	R23	3.25	0.312	0.469	0.03	1.06	3.12	1.9
2	3.62	9.25	2	5	R26	4	0.312	0.469	0.03	1.06	3.75	2.38
2.5	4.12	10.5	2.25	5.62	R28	4.375	0.375	0.531	0.06	1.19	4.5	2.88
3	5	12	2.62	6.62	R32	5	0.375	0.531	0.06	1.19	5.25	3.5
4	6.19	14	3	7.35	R38	6.188	0.438	0.656	0.06	1.31	6.5	4.5
6	8.5	19	4.25	10.75	R47	9	0.5	0.781	0.06	1.31	6.5	4.5
8	10.62	21.75	5	12.5	R51	11	0.562	0.906	0.06	1.56	12	8.63
10	12.75	26.5	6.5	16.5	R55	13.5	0.688	1.188	0.09	1.88	14.75	10.75
12	15	30	7.25	18.25	R60	16	0.688	1.312	0.09	2	17.38	12.75

(1) All other dimensions are in accordance with ASME B16.5.

Dimensions are in inches.

NPS(1)	B	Diameter of pressure connection, TT	Drilling template				Length of stud bolts (2) (3)	
			Diameter of bolt circle	Number of holes	Diameter of holes	Diameter of bolts	Raised face	Ring joint
1	(4)	¼	4	4	1	⅞	6	6.25
1½		¼	4.88	4	1.12	1	6.25	6.5

NPS[1]	B	Diameter of pressure connection, TT	Drilling template				Length of stud bolts [2] [3]	
			Diameter of bolt circle	Number of holes	Diameter of holes	Diameter of bolts	Raised face	Ring joint
2		¼	6.5	8	1	⅞	6	6.5
2½		¼	7.5	8	1.12	1	6.5	7
3		⅜	8	8	1.25	1⅛	7.25	7.25
4		½	9.5	8	1.38	1¼	8	8.5
6		½	12.5	12	1.5	1⅜	10.5	11
8		½	15.5	12	1.75	1⅝	11.75	12.25
10		½	19	12	2	1⅞	13.5	14
12		½	22.5	16	2.12	2	15	15.75
14		½	25	16	2.38	2¼	16.25	17.52
16		½	27.75	16	2.62	2½	17.75	19
18		½	30.5	16	2.88	2¾	19.75	21
20		½	32.75	16	3.12	3	21.5	22.5
24		½	39	16	3.62	3½	24.5	26

(1) All other dimensions are in accordance with ASME B16.5.
(2) Bolt lengths for raised face flanges include allowance for orifice and gasket thickness of 0.25 in. for NPS 1-12 and 0.38 in. for NPS 14-24. Bolt lengths for ring type joint flanges include allowance of 0.62 in. for NPS 1-10, 0.75 in. for NPS 12-18, and 0.88 in. for NPS 20.
(3) In conformance with ASME B16.5, stud bolt lengths do not include point heights.
(4) Purchaser must specify bore.¼

4.6 Rosemount 1496 weights (estimated)

Weights are in pounds (kilograms). Estimated weight based on:

- ANSI schedule standard pipe
- Carbon steel materials of construction
- Flange tap design
- Any deviation in configuration may affect estimated weights.

Flange ratings		Line size						
		2 in. (50 mm)	2.5 in. (64 mm)	3 in. (80 mm)	4 in. (100 mm)	6 in. (150 mm)	8 in. (200 mm)	10 in. (250 mm)
ANSI	150	12 (5.44)	16 (7.27)	20 (9.09)	30 (13.64)	48 (21.82)	78 (35.45)	104 (47.27)
	300	18 (8.18)	24 (10.91)	30 (13.64)	50 (22.73)	84 (38.18)	134 (60.91)	182 (82.73)
	600	24 (10.91)	36 (16.36)	46 (20.91)	84 (38.18)	162 (73.64)	240 (109.09)	380 (172.73)
	900	50 (22.73)	72 (32.73)	82 (37.27)	102 (46.36)	220 (100)	350 (159.09)	520 (236.36)
	1500	50 (22.73)	72 (32.73)	96 (43.64)	146 (66.36)	330 (150)	550 (250)	910 (413.64)
	2500	84 (38.18)	104 (47.27)	188 (85.45)	290 (131.82)	760 (345.45)	1160 (527.27)	2150 (977.27)

Flange ratings		Line size						
RTJ	300	19 (8.64)	25 (11.36)	31 (14.09)	51 (23.18)	85 (38.63)	136 (61.82)	184 (83.64)
	600	25 (11.36)	37 (16.82)	47 (21.36)	85 (38.64)	163 (74.09)	242 (110.00)	382 (173.64)
	900	51 (23.18)	73 (33.18)	83 (37.73)	103 (46.82)	221 (100.45)	352 (160.00)	522 (237.27)
	1500	51 (23.18)	73 (33.18)	97 (44.09)	147 (66.82)	331 (150.45)	552 (250.91)	912 (414.54)
	2500	85 (38.64)	105 (47.73)	189 (85.91)	291 (132.27)	761 (345.91)	1162 (528.18)	2152 (978.18)

Flange ratings		Line size						
		12 in. (300 mm)	14 in. (350 mm)	16 in. (400 mm)	18 in. (450 mm)	20 in. (500 mm)	22 in. (550 mm)	24 in. (600 mm)
ANSI	150	160 (72.72)	220 (99.79)	280 (127)	300 (136)	360 (163.29)	450 (204.12)	520 (235.87)
	300	280 (127.27)	360 (163.29)	500 (226.79)	640 (290.3)	800 (362.87)	930 (421.84)	1160 (526.17)
	600	450 (204.54)	560 (254.01)	780 (353.8)	950 (430.91)	1180 (535.23)	1440 (653.17)	1660 (752.96)
	900	650 (295.45)	800 (362.87)	990 (449.05)	1360 (616.88)	1660 (752.96)	2500 (1133.98)	3000 (1360.77)
	1500	1380 (627.27)	1880 (852.75)	2500 (1133.98)	3250 (1474.17)	4100 (1859.72)	5200 (2358.68)	6650 (3016.38)
	2500	3050 (1386.36)	4050 (1837.04)	5100 (2313.32)	6450 (2925.67)	7200 (3265.86)	8250 (3742.13)	9300 (4218.4)
RTJ	300	282 (128.18)	362 (164.2)	503 (228.16)	643 (291.66)	803 (364.23)	933 (423.2)	1164 (527.98)
	600	452 (205.45)	562 (254.92)	783 (355.16)	953 (432.27)	1183 (536.60)	1443 (654.53)	1664 (754.78)
	900	652 (296.36)	802 (363.78)	993 (450.42)	1363 (618.24)	1663 (754.32)	2500 (1133.98)	3004 (1362.59)
	1500	1382 (628.18)	1882 (853.66)	2503 (1135.34)	3253 (1475.53)	4103 (1861.09)	5100 (2313.32)	6654 (3018.20)
	2500	3052 (1387.27)	4100 (1859.73)	5150 (2335.99)	6200 (2812.27)	7300 (3311.22)	8400 (3810.17)	9400 (4263.76)

A Reference data

A.1 View ordering information, specifications, and dimensional drawings

To view current Rosemount 1495 and 1496 ordering information, specifications, and drawings:

Procedure

1. Go to Rosemount 1495 Orifice Plate or Rosemount 1496 Orifice Flange Union.
2. Scroll as needed to the green menu bar and click **Documents & Drawings**.
3. For installation drawings, click **Drawings & Schematics** and select the appropriate document.
4. For ordering information, specifications, and dimensional drawings, click **Data Sheets & Bulletins** and select the appropriate Product Data Sheet.
5. For the Declaration of Conformity, click **Certificates & Approvals** and select the most current document.

A.2 View product certifications

Procedure

To view current Rosemount 1495 and 1496 product certifications, see the Rosemount 1495 Orifice Plate and Rosemount 1496 Orifice Flange Union Quick Start Guide.

B Recommended installation requirements

B.1 Recommended straight run requirements

B.1.1 International Organization for Standardization (ISO) 5167-2

International standard

First Edition

March 1, 2003

Measurement of fluid flow by means of pressure differential devices inserted in circular-cross section conduits running full - Part 2: Orifice Plates

Table B-1: Required straight run lengths between orifice plates and fittings without flow conditioners

Values expressed as multiples of internal diameter, D

Dia-meter ratio, β	Upstream (inlet) side of orifice plate													
	Single 90° bend Two 90° bends in any plane (S > 30D)(1)		**Two 90° bends in the same plane: S-configuration (30D ≥ S >10D)(1)**		**Two 90° bends in the same plane: S-configuration (10D ≥ S)(1)**		**Two 90° bends in perpen-dicular planes**		**Two 90° bends in perpen-dicular planes (5D > S)(1)(2)**		**Single 90° tee with or without an extension Mitre 90° bend**		**Single 45° bend Two 45° bends in the same plane: S-configuration (S ≥ 2D)(1)**	
1	2		3		4		5		6		7		8	
--	A(3)	B(4)	A(3)	B(4)	A(3)	B(4)	A(3)	B(4)	A(3)	B(4)	A(3)	B(4)	A(3)	B(4)
≤ 0.2	6	3	10	(5)	10	(5)	19	18	34	17	3	g	7	g
0.4	16	3	10	(5)	10	(5)	44	18	50	25	9	3	30	9
0.5	22	9	18	10	22	10	44	18	75	34	19	9	30	18
0.6	42	13	30	18	42	18	44	18	65	25	29	18	30	18
0.67	44	20	44	18	44	20	44	20	60	18	36	18	44	18
0.75	44	20	44	18	44	22	44	20	75	18	44	18	44	18

(1) S is the separation between the two bends measured from the downstream end of the curved portion of the upstream end to the upstream end of the curved portion of the downstream bend.
(2) This is not a good upstream installation; use a flow conditioner where possible.
(3) Column A for each fitting gives lengths corresponding to zero additional uncertainty values.
(4) Column B for each fitting gives lengths corresponding to 0.5% additional uncertainty values.
(5) The straight length in Column A gives zero additional uncertainty; data are not available for shorter straight lengths which could be used to give the required straight lengths for Column B.

Diameter ratio, β	Upstream (inlet) side of orifice plate										Downstream (outlet) side of the orifice plate	
	Concentric reducer 2D to D over a length of 1.5D to 3D		Concentric reducer 0.5D to D over a length of D to 2D		Full bore ball valve or gate valve fully open		Abrupt symmetrical reduction		Thermometer pocket or well [c] of diameter ≤ 0.03D [(1)]		Fittings (columns 2 to 11) and the densitometer pocket	
1	9		10		11		12		13		14	
--	A[(2)]	B[(3)]	A[(2)]	B[(3)]	A[(2)]	B[(3)]	A[(2)]	B[(3)]	A[(2)]	B[(3)]	A[(2)]	B[(3)]
≤ 0.2	5	[(4)]	6	[(4)]	12	6	30	15	5	3	4	2
0.4	5	[(4)]	12	8	12	6	30	15	5	3	6	3
0.5	8	5	20	9	12	6	30	15	5	3	6	3
0.6	9	5	26	11	14	7	30	15	5	3	7	3.5
0.67	12	6	28	14	18	9	30	15	5	3	7	3.5
0.75	13	8	36	18	24	12	30	15	5	3	8	4

(1) A thermometer pocket or well of diameter between 0.03D and 0.13D may be installed provided that the value in Columns A and B are increased to 20 and 10 respectively. However, Emerson does not recommend this type of installation.
(2) Column A for each fitting gives lengths corresponding to zero additional uncertainty values.
(3) Column B for each fitting gives lengths corresponding to 0.5% additional uncertainty values.
(4) The straight length in Column A gives zero additional uncertainty; data are not available for shorter straight lengths which could be used to give the required straight lengths for Column B.

Note
The minimum straight lengths required are the lengths between various fittings located upstream or downstream of the orifice plate and the orifice plate itself. Measure straight lengths 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 the expander.

Note
Most of the bends on which the lengths in this table are based had a radius of curvature equal to 1.5D.

Table B-2: Permitted range of straight lengths between an orifice plate and a 19-tube bundle flow straightener (1998) downstream of fittings located at a distance, L_f, from the orifice plate

Values expressed as multiples of internal diameter, D

Diameter ratio, β	Single 90° bend[(1)]				Two 90° bends[(1)] in perpendicular planes (2D ≥ S)[(2)]				Single 90° tee			
	30 > L_f ≥ 18		L_f ≥ 30		30 > L_f ≥ 18		L_f ≥ 30		30 > L_f ≥ 18		L_f ≥ 30	
1	2		3		4		5		6		7	
--	A[(3)]	B[(4)]	A[(3)]	B[(4)]	A[(3)]	B[(4)]	A[(3)]	B[(4)]	A[(3)]	B[(4)]	A[(3)]	B[(4)]
≤ 0.2	5 to 14.5	1 to n[(5)]	5 to 25	1 to n [(5)]	5 to 14.5	1 to n [(5)]	5 to 25	1 to n[(5)]	5 to 14.5	1 to n[(5)]	1 to 25	1 to n[(5)]
0.4	5 to 14.5	1 to n[(5)]	5 to 25	1 to n[(5)]	5 to 14.5	1 to n[(5)]	5 to 25	1 to n[(5)]	5 to 14.5	1 to n[(5)]	1 to 25	1 to n[(5)]

Table B-2: Permitted range of straight lengths between an orifice plate and a 19-tube bundle flow straightener (1998) downstream of fittings located at a distance, L_f, from the orifice plate *(continued)*

Diameter ratio, β	**Single 90° bend(1)**				**Two 90° bends(1)in perpendicular planes (2D ≥ S)(2)**				**Single 90° tee**			
	30 > L_f ≥ 18		**L_f ≥ 30**		**30 > L_f ≥ 18**		**L_f ≥ 30**		**30 > L_f ≥ 18**		**L_f ≥ 30**	
Diameter ratio, β	Single 90° bend(1)				Two 90° bends(1) in perpendicular planes(2D ≥ S)(2)				Single 90° tee			
	30 > L_f ≥ 18		L_f ≥ 30		30 > L_f ≥ 18		L_f ≥ 30		30 > L_f ≥ 18		L_f ≥ 30	
0.5	11.5 to 14.5	3 to n(5)	11.5 to 25	3 to n(5)	9.5 to 14.5	3 to n(5)	9 to 25	1 to n(5)	11 to 13	1 to n(5)	9 to 23	1 to n(5)
0.6	12 to 13	5 to n(5)	12 to 25	5 to n(5)	13.5 to 14.5	5 to n(5)	9 to 25	1 to n(5)	(6)(7)	7 to n(5)	11 to 16	1 to n(5)
0.67	13	7 to n(5)	13 to 16.5	7 to n(5)	13 to 14.5	7 to n(5)	10 to 16	5 to n(5)	(6)	8 to n(5)	11 to 13	6 to n(5)
0.75	14	8 to n(5)	14 to 16.5	8 to n(5)	(6)	9.5 to n(5)	12 to 12.5	8 to n(5)	(6)	9 to n(5)	12 to 14	7 to n(5)
Recommended	13 for ≤ 0.67	13 for ≤ 0.75	14 to 16.5 for ≤ 0.75	14 to 16.5 for ≤0.75	13.5 to 14.5 for ≤0.67	13.5 to 14.5 for ≤0.75	12 to 12.5 for ≤ 0.75	12 to 12.5 for ≤ 0.75	13 for ≤ 0.54	13 for ≤ 0.75	12 to 13 for ≤ 0.75	12 to 13 for ≤ 0.75

(1) Bends must have a radius of curvature equal to 1.5D.
(2) S is the separation between the two bends measured from the downstream end of the curved portion of the upstream end to the upstream end of the curved portion of the downstream bend.
(3) Column A for each fitting gives lengths corresponding to zero additional uncertainty values.
(4) Column B for each fitting gives lengths corresponding to 0.5% additional uncertainty values.
(5) n is the number of diameters such that the upstream end of the 19-tube bundle flow straightener (1998) is situated 1D from the downstream end of the curved or conical portion of the nearest fitting. It is desirable that the length between the upstream end of the 19-tube bundle flow straightener (1998) and the downstream end of the curved or conical portion of the nearest fitting should be at least 2.5D, except where this would not give an acceptable value for the distance between the orifice plate and the downstream end of the 19-tube bundle flow straightener.
(6) It is not possible to find an acceptable location for a 19-tube bundle flow straightener (1998) downstream of the particular fitting for all values of L_f to which the column applies.
(7) if β = 0.54 a value of 13 is possible.

B.1.2 American Gas Association (AGA) Report Number 3

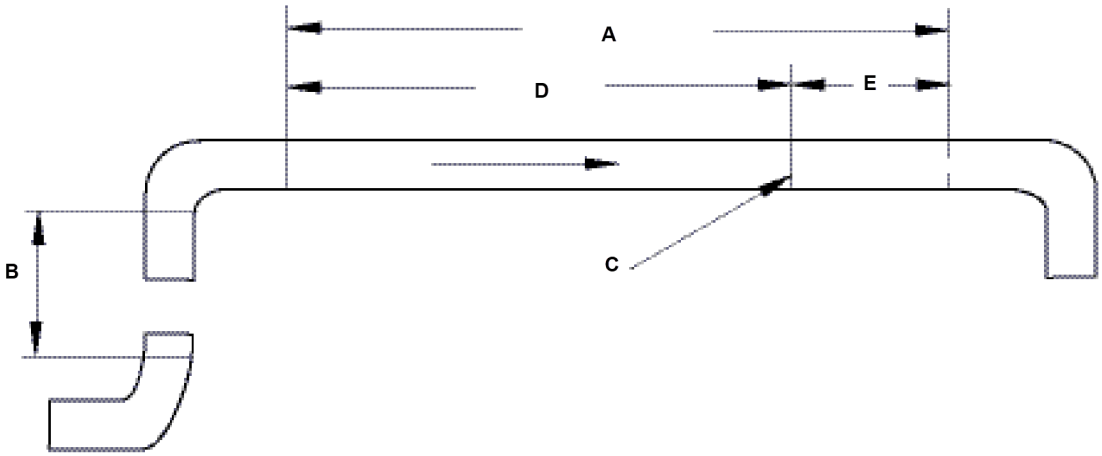
Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids

American Gas Association

Fourth Edition, April 2000

Second Printing, June 2003

Figure B-1: Orifice meter tube layout for flanged or welded inlet



A. Meter tube
B. Separation distance, S
C. Orifice plate
D. Upstream length (UL)
E. Downstream length (DL)

Note
The tolerance on specified lengths for UL and DL is ±0.25D_i.

Table B-3: Orifice meter installation requirements without a flow conditioner

	Minimum straight unobstructed meter tube length from the upstream side of the orifice plate (in multiples of published internal pipe diameter, D_i)										
Diameter ratio β	**a. Single 90° elbow** **b. Two 90° elbows in the same plane with S > 30D_i** **c. Two 90° elbows in perpendicular planes with S>15D_i**	**Two 90° elbows in the same plane S configuration(1) spacer** **S ≤ 10D_i**	**Two 90° elbows in the same plane, S configuration spacer** **10D_i < S < 30D_i**	**Two 90° elbows in perpendicular planes, S < 5D_i(2)**	**Two 90° elbows in perpendicular planes,** **D_i ≤ S ≤ 15D_i**	**Single 90° Tee used as an elbow but not as a header element**	**a. Single 45° elbow** **b. Two 45° elbows in the same plane S configuration** **S ≥ 22D_i**	**Gate valve at least 50% open**	**Concentric reducer**	**Any other configuration (catch all category)(2)**	**Downstream tube length**
	UL(3)	UL(3)	UL (3)	UL (3)	UL (3)	UL(3)	UL (3)	UL(3)	UL (3)	UL(3)	DL(4)
β ≤ 0.20	6	10	10	50	19	9	30	17	6	70	2.8
0.3	11	10	12	50	32	9	30	19	6	108	3

Table B-3: Orifice meter installation requirements without a flow conditioner *(continued)*

	Minimum straight unobstructed meter tube length from the upstream side of the orifice plate (in multiples of published internal pipe diameter, D_i)										
Diameter ratio β	**a. Single 90° elbow** **b. Two 90° elbows in the same plane with S > $30D_i$** **c. Two 90° elbows in perpendicular planes with S>$15D_i$**	**Two 90° elbows in the same plane S configuration[1] spacer** **S ≤ $10D_i$**	**Two 90° elbows in the same plane, S configuration spacer** **$10D_i$ < S < $30D_i$**	**Two 90° elbows in perpendicular planes, S < $5D_i$[2]**	**Two 90° elbows in perpendicular planes,** **D_i ≤ S ≤ $15D_i$**	**Single 90° Tee used as an elbow but not as a header element**	**a. Single 45° elbow** **b. Two 45° elbows in the same plane S configuration** **S ≥ $22D_i$**	**Gate valve at least 50% open**	**Concentric reducer**	**Any other configuration (catch all category)[2]**	**Downstream tube length**
0.4	16	10	13	50	44	9	30	21	6	145	3.2
0.5	30	30	18	95	44	19	30	25	7	145	3.5
0.6	44	44	30	95	44	29	30	30	9	145	3.9
0.67	44	44	44	95	44	36	44	35	11	145	4.2
0.75	44	44	44	95	44	44	44	44	13	145	4.5
Recommended length for maximum range β ≤ 0.75	44	44	44	95	44	44	44	44	13	145	4.5

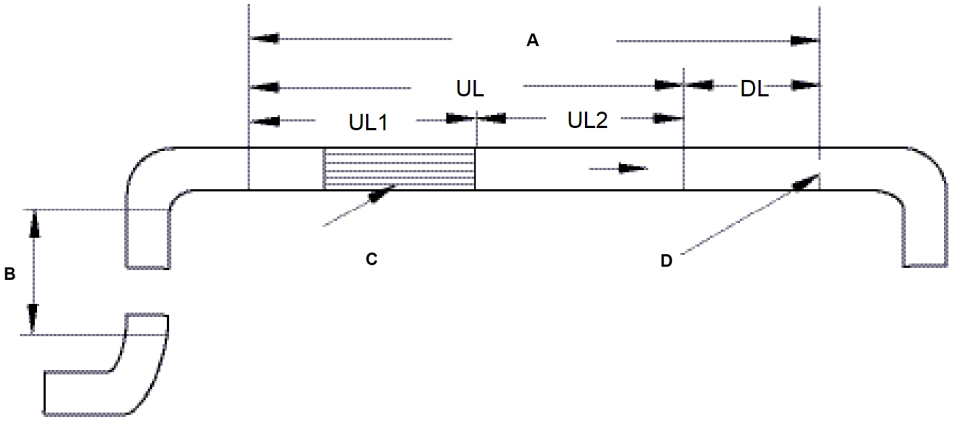
(1) S = Separation distance between piping elements in internal pipe diameter (D_i) measured from the downstream end of the curved portion of the upstream elbow to the upstream end of the curved portion of the downstream elbow.

(2) These installations exhibit the strong effect of Reynolds number and pipe roughness on the recommended length due to the rate of swirl decay. The present recommendations have been developed for high Reynolds numbers and smooth pipes to capture the worst case.

(3) UL = Minimum meter tube length upstream of the orifice plate in internal pipe diameter (D_i). Straight length shall be measured from the downstream end of the curved portion of the nearest (or only) elbow or of the tee or the downstream end of the conical portion of reducer or expander.

(4) DL = Minimum downstream meter tube length in internal pipe diameters (D_i).

Figure B-2: Orifice Meter Tube Layout for Flanged or Welded Inlet with Bundle Flow Straightener



A. Meter tube
B. Separation distance, S
C. 1998 uniform concentric 19-tube bundle flow straightener
D. Orifice

Note

1. Lengths shown under the UL2 column are the dimensions, expressed as the number of published internal pipe diameters (D_i) between the downstream end of the 1998 Uniform Concentric 19-Tube Bundle Flow Straightener and the upstream surface of the orifice plate.
2. The tolerance on specified lengths for UL, UL2, and DL is $\pm 0.25D_i$.
3. Not allowed means that it is not possible to find an acceptable location for the 1998 Uniform Concentric 19-Tube Bundle Flow Straightener downstream of the particular fitting for all values of UL.

Table B-4: Orifice Meter Installation Requirements With 1998 Uniform Concentric 19-Tube Bundle Flow Straightener for Meter Tube Upstream Length of $17D_i \leq UL \leq 29D_i$.

	Single 90° elbow $R/D_i = 1.5$	**Two 90° elbows out of plane $S^{(1)} \leq 2D_i$ $R/D_i = 1.5$**	**Singe 90° tee used as an elbow but not as a header element**	**Partially closed valves (at least 50% open)**	**High swirl combined with single 90° Tee**	**Any fitting (catch-all category)**	**Downstream meter tube length**
Diameter ratio, β	**UL2[2]**	**UL2**	**UL2**	**UL2**	**UL2**	**UL2**	**DL**
0.10	5-14.5	5-14.5	5-14.5	5-11	5-13	5-11.5	2.8
0.20	5-14.5	5-14.5	5-14.5	5-11	5-13	5-11.5	2.8
0.30	5-14.5	5-14.5	5-14.5	5-11	5-13	5-11.5	3.0
0.40	5-14.5	5-14.5	5-14.5	5-11	5-13	5-11.5	3.2
0.50	11.5-14.5	9.5-14.5	11-13	[3]		[4]	3.5
0.60	12-13	13.5-14.5	[5]	Not allowed	[5]	Not allowed	3.9

Table B-4: Orifice Meter Installation Requirements With 1998 Uniform Concentric 19-Tube Bundle Flow Straightener for Meter Tube Upstream Length of $17D_i \leq UL \leq 29D_i$. *(continued)*

	Single 90° elbow $R/D_i = 1.5$	Two 90° elbows out of plane $S^{(1)} \leq 2D_i$ $R/D_i = 1.5$	Singe 90° tee used as an elbow but not as a header element	Partially closed valves (at least 50% open)	High swirl combined with single 90° Tee	Any fitting (catch-all category)	Downstream meter tube length
Diameter ratio, β	**UL2[2]**	**UL2**	**UL2**	**UL2**	**UL2**	**UL2**	**DL**
0.67	13	13-14.5	Not allowed	Not allowed	Not allowed	Not allowed	4.2
0.75	14	Not allowed	Not allowed	Not allowed	Not allowed	Not allowed	4.5
Recommended tube bundle location for maximum range of β	13 β ≤ 0.67	13.5-14.5 β ≤ 0.67	13 β ≤ 0.54	9.5 β ≤ 0.47	13 β ≤ 0.54	9.5 β ≤ 0.46	4.5

(1) S = Separation distance between elbows
(2) UL1 = UL - UL2.
(3) $9.5D_i$ allowed for up to β = 0.47.
(4) $9.5D_i$ allowed for up to β = 0.46.
(5) $13D_i$ allowed for up to β = 0.54.

Note
The tolerance on specified lengths for UL, UL2, and DL is $\pm 0.25D_i$.

Note
Not allowed means that it is not possible to find an acceptable location for the 1998 Uniform Concentric 19-Tube Bundle Flow Straightener downstream of the particular fitting for all values of UL.

Table B-5: Orifice Meter Installation Requirements With 1998 Uniform Concentric 19-Tube Bundle Flow Straightener for Meter Tube Upstream Length of $UL \geq 29D_i$.

	Single 90° elbow $R/D_i = 1.5$	Two 90° elbows out of plane $S^{(1)} \leq 2D_i$ $R/D_i = 1.5$	Singe 90° tee used as an elbow but not as a header element	Partially closed valves (at least 50% open)	High swirl combined with single 90° Tee	Any fitting (catch-all category)	Downstream meter tube length
Diameter Ratio, β	**UL2 [2]**	**UL2**	**UL2**	**UL2**	**UL2**	**UL2**	**DL**
0.10	5-25	5-25	5-25	5-13	5-23	5-13	2.8
0.20	5-25	5-25	5-25	5-13	5-23	5-13	2.8
0.30	5-25	5-25	5-25	5-13	5-23	5-13	3.0
0.40	5-25	5-25	5-25	5-13	5-23	5-13	3.2
0.50	11.5-25	9-25	9-23	7.5-15	9-19.5	11.5-14.5	3.5
0.60	12-25	9-25	11-16	10-17	11-16	12-16	3.9
0.67	13-16.5	10-16	11-13	10-13	11-13	13	4.2
0.75	14-16.5	12-12.5	12-14	11-12.5	14	Not allowed	4.5

Table B-5: Orifice Meter Installation Requirements With 1998 Uniform Concentric 19-Tube Bundle Flow Straightener for Meter Tube Upstream Length of UL ≥ 29D_i. *(continued)*

	Single 90° elbow R/D_i = 1.5	Two 90° elbows out of plane S(1) ≤ 2D_i R/D_i = 1.5	Singe 90° tee used as an elbow but not as a header element	Partially closed valves (at least 50% open)	High swirl combined with single 90° Tee	Any fitting (catch-all category)	Downstream meter tube length
Diameter Ratio, β	**UL2 (2)**	**UL2**	**UL2**	**UL2**	**UL2**	**UL2**	**DL**
Recommended tube bundle location for maximum range of β	13 β ≤ 0.75	12-12.5 β ≤ 0.75	12-13 β ≤ 0.75	11-12.5 β ≤ 0.75	13 β ≤ 0.75	13 β ≤ 0.67	4.5

(1) S = Separation distance between elbows
(2) UL1 = UL - UL2.

B.1.3 ASME MFC-3M-2004

Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi

Table B-6: Required Straight Lengths Between Orifice Plates and Fittings Without Flow Conditioners (Upstream)

Upstream (Inlet) Side of Orifice Plate																
Diameter ratio β	**Single 90° bend, Two 90° bends in any Plane: S-configuration (S > 30D) (1)**		**Two 90° bends in Same Plane: S-configuration (30D ≥ S > 10D) (1)**		**Two 90° bends in Same Plane: S-configuration (10D ≥ S)(1)**		**Two 90° bends in Perpendicular Planes: (30D ≥ S > 5D) (1)(2)**		**Two 90° bends in Perpendicular Planes: (5D < S) (1)(3)**		**Single 90° Tee with or without Extension Mitre 90° Bend**		**Single 45° Bend, Two 45° Bends in Same Plane: S-Configuration (S ≥ 2D)(1)**		**Concentric Expander 2D to D Over Length of 1.5D to 3D**	
1	2		3		4		5		6		7		8		9	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
≤0.20	6	3	10	(4)	10	(4)	19	18	34	17	3	(4)	7	(4)	5	(4)
0.40	16	3	10	(4)	10	(4)	44	18	50	25	(4)	3	30	(4)	5	(4)
0.50	22	9	18	10	22	10	44	18	75	34	19	9	30	18	8	5
0.60	42	13	30	18	42	18	44	18	65(5)	25	29	18	30	18	9	5
0.67	44	20	44	18	44	20	44	20	60	18	36	18	44	18	12	6
0.75	44	20	44	18	44	22	44	20	75	18	44	18	44	18	13	8

(1) S is the separation between the two bands measured from the downstream end of the curved portion of the upstream bend to the upstream end of the curved portion of the downstream bend.
(2) Values expressed as multiples of internal diameter, D.
(3) This is not a good upstream installation; a flow conditioner should be used where possible.
(4) The straight length in each Column A gives zero additional uncertainty; data are not available for shorter straight lengths which could be used to give the required straight lengths for each Column B.
(5) 95D is required for Re_D X 10^6 if S << 2D.

Table B-7: Required Straight Lengths Between Orifice Plates and Fittings Without Flow Conditioners (Downstream)

Diameter Ratio, β	Concentric Expander 0.5D to D Over Length of D to 2D		Full Bore Ball Valve or Gate Valve Fully Open		Abrupt Symmetrical Reduction		Thermometer Pocket or Well of Diameter ≤ 0.03D [1][2]		Downstream (outlet) Side of the Orifice Plate	
									Fittings (Columns 2 to 11) and Densitometer Pocket	
1	10		11		12		13		14	
	A	B	A	B	A	B	A	B	A	B
≤0.20	6	[4]	12	6	30	15	5	3	4	2
040	12	8	12	6	30	15	5	3	6	3
0.50	20	9	12	6	30	15	5	3	6	3
0.60	26	11	14	7	30	15	5	3	7	3.5
0.67	28	14	18	9	30	15	5	3	7	3.5
0.75	36	18	24	12	30	15	5	3	8	4

(1) The installation of thermometer pockets or wells will not alter the required minimum upstream straight lengths for the other fittings.

(2) A thermometer pocket or well of diameter between 0.03D and 0.13D may be installed provided that the values in each Column A and B are increased to 20 and 10 respectively. Such an installation is not, however, recommended.

GENERAL NOTES:

(a) Values expressed as multiples of internal diameter, D.

(b) The minimum straight lengths required are the lengths between various fittings located upstream or downstream of the orifice plate and the orifice plate itself. Straight lengths shall 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 the expander.

(c) Most of the bends on which the lengths in this table are based had a radius of curvature equal to 1.5D.

(d) Column A for each fitting gives lengths corresponding to “zero additional uncertainty” values.

(e) Column B for each fitting gives lengths corresponding to “0.5% additional uncertainty” values.

Table B-8: Permitted range of straight lengths between orifice plate and 19-tube bundle flow straightener (1998) downstream of fittings located at a distance, L_f, from the orifice plate

Diameter ratio, β	Single 90° bend[1]				Two 90° bends[1] in perpendicular planes (2D ≥S)[2]				Single 90° tee			
	30 > L_f≥18		L_f ≥ 30		30 ≥ L_f ≥ 18		L_f ≥ 30		30 > L_f≥18		L_f ≥ 30	
1	2		3		4		5		6		7	
--	A[3]	B[4]	A[3]	B[4]	A[3]	B[4]	A[3]	B[4]	A[3]	B[4]	A[3]	B[4]
≤ 0.2	5 to 14.5	1 to n[5]	5 to 25	1 to n[5]	5 to 14.5	1 to n[5]	5 to 25	1 to n[5]	5 to 14.5	1 to n[5]	1 to 25	1 to n[5]

Table B-8: Permitted range of straight lengths between orifice plate and 19-tube bundle flow straightener (1998) downstream of fittings located at a distance, L_f, from the orifice plate *(continued)*

Diameter ratio, β	Single 90° bend[1]				Two 90° bends[1] in perpendicular planes (2D ≥S)[2]				Single 90° tee			
	30 > L_f≥18		L_f ≥ 30		30 ≥ L_f ≥ 18		L_f ≥ 30		30 > L_f≥18		L_f ≥ 30	
0.4	5 to 14.5	1 to n[5]	5 to 25	1 to n[5]	5 to 14.5	1 to n[5]	5 to 25	1 to n[5]	5 to 14.5	1 to n[5]	1 to 25	1 to n[5]
0.5	11.5 to 14.5	3 to n[5]	11.5 to 25	3 to n[5]	9.5 to 14.5	3 to n[5]	9 to 25	1 to n[5]	11 to 13	1 to n[5]	9 to 23	1 to n[5]
0.6	12 to 13	5 to n[5]	12 to 25	5 to n[5]	13.5 to 14.5	5 to n[5]	9 to 25	1 to n[5]	[6][7]	7 to n[5]	11 to 16	1 to n[5]
0.67	13	7 to n[5]	13 to 16.5	7 to n[5]	13 to 14.5	7 to n[5]	10 to 16	5 to n[5]	[6]	8 to n[5]	11 to 13	6 to n[5]
0.75	14	8 to n[5]	14 to 16.5	8 to n[5]	[6]	9.5 to n[5]	12 to 12.5	8 to n[5]	[6]	9 to n[5]	12 to 14	7 to n[5]
Recommended	13 for β ≤ 0.67	13 for β ≤0.75	14 to 16.5 for β ≤ 0.75	13.5 to 14.5 for β ≤ 0.67	13.5 to 14.5 for β ≤ 0.75	12 to 12.5 for β ≤ 0.75	12 to 12.5 for β ≤ 0.75	13 for β ≤ 0.54	13 for β ≤ 0.75	12 to 13 for β ≤ 0.75	12 to 13 for β ≤0.75	12 to 13 for β ≤0.75

(1) Bends must have a radius of curvature equal to 1.5D.
(2) S is the separation between the two bends measured from the downstream end of the curved portion of the upstream end to the upstream end of the curved portion of the downstream bend.
(3) Column A for each fitting gives lengths corresponding to zero additional uncertainty values.
(4) Column B for each fitting gives lengths corresponding to 0.5 percent additional uncertainty values.
(5) n is the number of diameters such that the upstream end of the 19-tube bundle flow straightener (1998) is situated 1D from the downstream end of the curved or conical portion of the nearest fitting. It is best that the length between the upstream end of the 19-tube bundle flow straightener (1998) and the downstream end of the curved or conical portion of the nearest fitting is at least 2.5 D, except where this would not give an acceptable value for the distance between the orifice plate and the downstream end of the 19-tube bundle flow straightener.
(6) It is not possible to find an acceptable location for a 19-tube bundle flow straightener (1998) downstream of the particular fitting for all values of L_f to which the column applies.
(7) If β = 0.54, a value of 13 is possible.

Diameter ratio, β	Any fitting			
	30 > L_f ≥ 18		L_f ≥ 30	
1	8		9	
--	A[1]	B[2]	A[1]	B[2]
≤0.20	5 to 11	1 to n[3]	5 to 13	1 to n [3]
0.40	5 to 11	1 to n[3]	5 to 13	1 to n[3]
0.50	[4][5]	1 to n[3]	11.5 to 14.5	3 to n[3]
0.60	[4]	7 to n[3]	12 to 16	6 to n[3]
0.67	[4]	8 to 10	13	7 to n-1.5[3]
0.75	[4]	9.5	[4]	8 to 22
Recommended	9.5 for ≤ 0.54	9.5 for ≤ 0.75	13 for ≤ 0.67	13 for ≤ 0.75

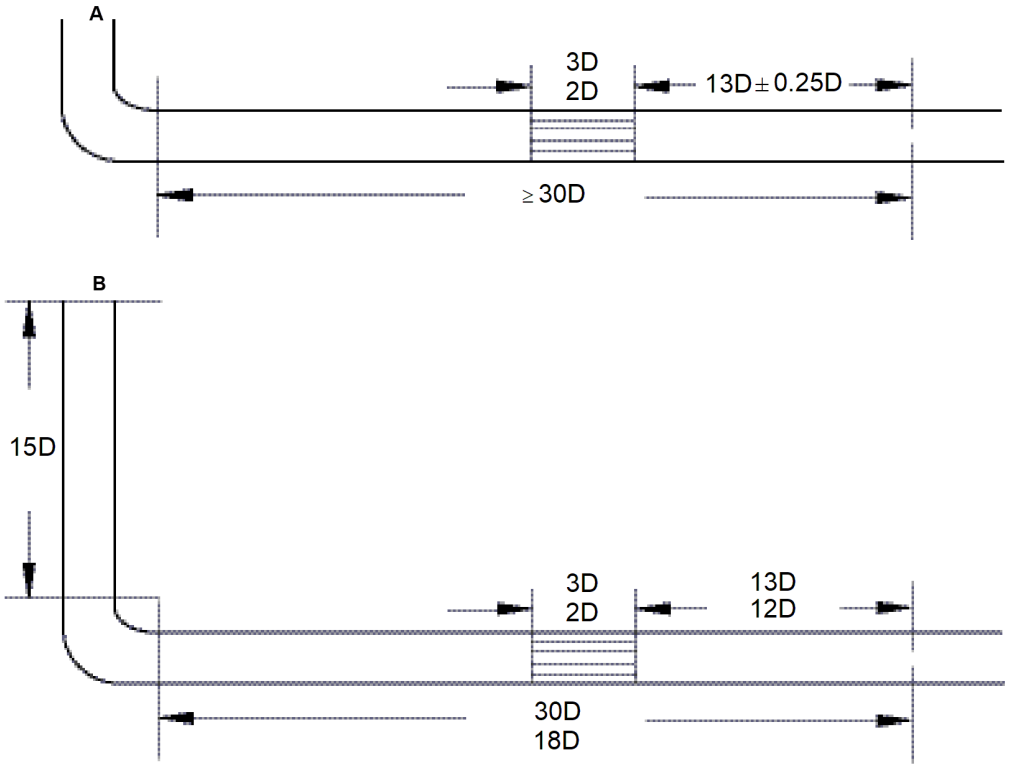
(1) Column A for each fitting gives lengths corresponding to "zero additional uncertainty" values.
(2) Column B for each fitting gives lengths corresponding to "0.5% additional uncertainty" values.

(3) n is the number of diameters such that the upstream end of the 19-tube bundle flow straightener (1998) is situated 1D from the downstream end of the curved or conical portion of the nearest fitting. It is desirable that the length between the upstream end of the 19-tube bundle flow straightener (1998) and the downstream end of the curved or conical portion of the nearest fitting should be at least 2.5D, except where this would not give an acceptable value for the distance between the orifice plate and the downstream end of the 19-tube bundle flow straightener.

(4) It is not possible to find an acceptable location for a 19-tube bundle flow straightener (1998) downstream of the particular fitting for all values of L_f to which the column applies.

(5) If β = 0.46 a value of 9.5 is possible.

Figure B-3: Examples of Installations With a 19-Tube Bundle Flow Straightener Downstream of a Single Bend



A. Position of any fitting placed at any distance upstream of the single bend.

B. Position of previous fitting placed before straight length upstream of the single bend.

B.2 Bolt torque recommendations

The Bolt Torque tables are to be used for reference only, as each installation must be checked for leaks and tightened as necessary.

The torque required to produce adequate bolt stress is a function of many parameters, including but not limited to:

- Diameter of bolt
- Type and # of threads of bolt
- Material of bolt

- Gasket type
- Condition of nut bearing surfaces
- Lubrication of bolt threads and nut bearing surfaces

The following tables are typical torque recommendations by Emerson Gasket Vendors for use with gaskets provided:

Table B-9: Class 300# 1/16-in. Non-Asbestos Flat Gasket

Flange Size in. (mm)	Number of Bolts	Bolt Diameter in. (mm)	Bolt Torque ft.-lbs. (N-m)
2 (5.08)	8	5/8 (15.9)	52 (71)
2.5 (6.35)	8	3/4 (19.1)	73 (99)
3 (7.62)	8	3/4 (19.1)	106 (144)
4 (10.16)	8	3/4 (19.1)	136 (185)
6 (15.24)	12	3/4 (19.1)	149 (185)
8 (20.32)	12	7/8 (22.2)	246 (335)
10 (25.4)	16	1 (25.4)	261 (355)
12 (30.48)	16	1 1/8 (28.6)	391 (532)
14 (35.56)	20	1 1/8 (28.6)	341 (464)
16 (40.64)	20	1 1/4 (31.8)	488 (664)
18 (45.72)	24	1 1/4 (31.8)	542 (737)
20 (50.8)	24	1 1/4 (31.8)	598 (813)
24 (60.96)	24	1 1/2 (38.1)	927 (1261)

Table B-10: Class 600# 1/8-in. Thick Spiral Wound Gasket

Flange Size in. (mm)	Number of Bolts	Bolt Diameter in. (mm)	Bolt Torque ft.-lbs. (N-m)
2 (5.08)	8	5/8 (15.9)	90 (122)
2.5 (6.35)	8	3/4 (19.1)	150 (203)
3 (7.62)	8	3/4 (19.1)	150 (203)
4 (10.16)	8	7/8 (22.2)	240 (325)
6 (15.24)	12	1 (25.4)	368 (499)
8 (20.32)	12	1 1/8 (28.6)	533 (723)
10 (25.4)	16	1 1/4 (31.8)	750 (1017)
12 (30.48)	20	1 1/4 (31.8)	750 (1017)
14 (35.56)	20	1 3/8 (34.9)	1020 (1383)
16 (40.64)	20	1 1/2 (38.1)	1200 (1627)
18 (45.72)	20	1 5/8 (41.3)	1650 (2237)
20 (50.8)	24	1 5/8 (41.3)	1650 (2237)
24 (60.96)	24	1 7/8 (47.6)	3000 (4067)

Table B-11: Class 900# 1/8-in. Thick Spiral Wound Gasket

Flange Size in. (mm)	Number of Bolts	Bolt Diameter in. (mm)	Bolt Torque ft.-lbs. (N-m)
2 (5.08)	USE CLASS 1500#		
2.5 (6.35)	USE CLASS 1500#		
3 (7.62)	8	7/8 (22.2)	240 (325)
4 (10.16)	8	1 1/8 (28.6)	533 (723)
6 (15.24)	12	1 1/8 (28.6)	533 (723)
8 (20.32)	12	1 3/8 (34.9)	1020 (1383)
10 (25.4)	16	1 3/8 (34.9)	1020 (1383)
12 (30.48)	20	1 3/8 (34.9)	1020 (1383)
14 (35.56)	20	1 1/2 (38.1)	1200 (1627)
16 (40.64)	20	1 5/8 (41.3)	1650 (2237)
18 (45.72)	20	1 7/8 (47.6)	3000 (4067)
20 (50.8)	20	2 (50.8)	3300 (4474)
24 (60.96)	20	2 1/2 (63.5))	6600 (8948)

Table B-12: Class 1500# 1/8-in. Thick Spiral Wound Gasket

Flange Size in. (mm)	Number of Bolts	Bolt Diameter in. (mm)	Bolt Torque ft.-lbs. (N-m)
2 (5.08)	8	7/8 (22.2)	240 (325)
2.5 (6.35)	8	1 (25.4)	368 (499)
3 (7.62)	8	1 1/8 (28.6)	533 (723)
4 (10.16)	8	1 1/4 (31.8)	750 (1017)
6 (15.24)	12	1 3/8 (34.9)	1020 (1383)
8 (20.32)	12	1 5/8 (41.3)	1650 (2237)
10 (25.4)	12	1 7/8 (47.6)	3000 (4067)
12 (30.48)	16	2 (50.8)	3300 (4474)
14 (35.56)	16	2 1/4 (57.2)	4770 (6467)
16 (40.64)	16	2 1/2 (63.5)	6600 (8948)
18 (45.72)	16	2 3/4 (69.9)	8880 (12040)
20 (50.8)	16	3 (76.2)	11580 (15700)
24 (60.96)	16	3 1/2 (88.9)	18750 (25422)

Table B-13: Class 2500# 1/8-in. Thick Spiral Wound Gasket

Flange Size in. (mm)	Number of Bolts	Bolt Diameter in. (mm)	Bolt Torque ft.-lbs. (N-m)
2 (5.08)	8	1 (25.4)	368 (499)
2.5 (6.35)	8	1 1/8 (28.6)	533 (723)

Table B-13: Class 2500# 1/8-in. Thick Spiral Wound Gasket *(continued)*

Flange Size in. (mm)	Number of Bolts	Bolt Diameter in. (mm)	Bolt Torque ft.-lbs. (N-m)
3 (7.62)	8	1 1/4 (31.8)	750 (1017)
4 (10.16)	8	1 1/2 (38.1)	1200 (1627)
6 (15.24)	8	2 (50.8)	3300 (4474)
8 (20.32)	12	2 (50.8)	3300 (4474)
10 (25.4)	12	2 1/2 (63.5)	6600 (8948)
12 (30.48)	12	2 3/4 (69.9)	8880 (12040)

C Sample *CALCULATION REPORT*

ROSEMOUNT INC.

Rosemount™ 1495 Orifice Plate

CALCULATION REPORT

EMERSON

GENERAL DATA

Customer:	ROSEMOUNT INC
P. O. No:	
S. O. No:	16966559
Tag No:	
Sizing Name:	1495
Emerson Sizing Reference ID:	R555811
Calculation Date:	04-Sep-2024
Model No:	1495PC040A3SA01375BCFH

PRODUCT DESCRIPTION

Bore configuration:	Concentric Bore, Square Edge	Tap Type:	Flange Tapping
		Line Size:	4 in
Primary Element Material:	316/316L Stainless Steel	Pipe Schedule:	STD
Process Connection:	ASME B16.36 CL 300 RF	Pipe Material:	Carbon Steel
Calculation Standard:	ISO-5167-2 (2022)		

INPUT DATA

Fluid Type:	Gas				
Fluid Name:	Air				
Pipe I.D.:	4.026	in			
Wall Thickness:	0.237	in			
Normal Operating Conditions					
Pressure:	350.0000	psig	Base Pressure:	14.696	psia
Temperature:	70	F	Base Temperature:	60	F
Density:	30.000	kg/m3			
Compressibility:	0.992566		Base Density:	1.223140	kg/m3
Isentropic Exponent:	1.402133		Atmospheric Pressure:	14.696	psia
Absolute Viscosity:	0.018	cP			
Flow Rates					
Minimum:					
Normal:	1000	SCF/min			
Maximum:					
Full Scale:	2000	SCF/min			

CALCULATED DATA **(Calculation Performed at Normal Conditions.)**

Bore Size:	1.375	in	Pipe Reynolds Number (Normal):	393420	
			Gas Expansion Factor:	0.9983	
DP at Min Flow:			Permanent Pressure Loss		
DP at Normal Flow:	67.091	inH2O@68F	at Normal Flow:	58.288	inH2O@68F
DP at Max Flow:			at Full scale flow:	233.154	inH2O@68F
URV (DP at Full Scale):	268.364	inH2O@68F	Velocity at Max Flow:	15.3	ft/sec
Beta:	0.3415				
Discharge Coefficient:	0.5992				
Pipe ID (Thermally Corrected):	4.0260	in			
			Orifice Bore Size (thermally corrected):	1.3750	in
Plate Thickness:	0.125	in	Minimum Required Plate Thickness:	0.036	in

GUIDELINES

Primary Element Min Limit of Use:	38.607	SCF/min	Min Recommended Pipe Reynolds:	5000	
Max. Allow. Pressure@Design Temp:	750.0000	psig	Recommended Min DP:	0.10000	inH2O@68F
Design Pressure/Temperature:	400	psig 150 F	Max. Allowable Temp.:	1200.00	F
			Min. Allowable Temp.:	-430.00	F

WARNINGS

NOTES

It is the purchaser's sole responsibility to make a careful analysis of all process parameters (such as all chemical components, temperature, pressure, flow rate, abrasives, contaminants, etc.), when specifying product materials, options, and components for the particular application. Emerson is not in a position to evaluate or guarantee the compatibility of the process fluid or other process parameters with the product options.

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