

Rosemount 1595 Conditioning Orifice Plate

- *Designed to provide superior performance in short straight pipe run applications*
- *Requires only two diameters of straight pipe run after an upstream flow disturbance*
- *Accurate and repeatable*
- *Comprehensive offering*
- *Suitable for most gas, liquid, and steam applications*
- *Patented technology*



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Rosemount 1595 Conditioning Orifice Plate

The 1595 Conditioning Orifice Plate is designed to install downstream of a variety of disturbances with minimal straight pipe run, providing superior performance.

1595 Conditioning Orifice Plate

- A revolutionary innovative technology based on the most common differential primary element in the industry
- Requires only two diameters of straight pipe run after an upstream flow disturbance
- Reduced installation costs
- Easy to use, prove, and troubleshoot
- Good for most gas, liquid, and steam as well as high temperature and high pressure applications

1595 Tailored Use

The 1595 can be used in conjunction with the Rosemount 1496 Flange Union / 1497 Meter Section. See Product Data Sheet document number 00813-0100-4792 and Figure 2 and 3 for 1496 and 1497 products.

FIGURE 1. Rosemount 1595 Conditioning Orifice Plate

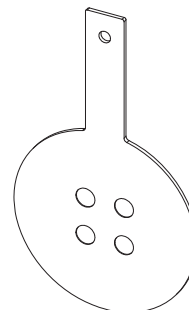


FIGURE 2. Rosemount 1496 Flange Union

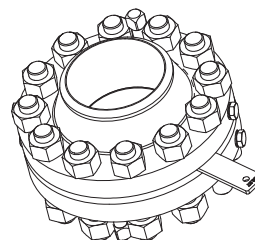
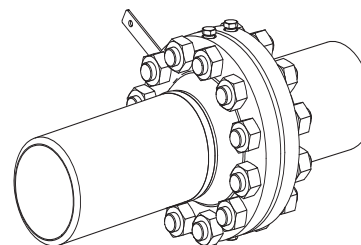


FIGURE 3. Rosemount 1497 Meter Section



Rosemount DP-Flow Solutions

Annubar Flowmeter Series:

Rosemount 3051SFA, 3095MFA, 485, and 285

The state-of-the-art, fifth generation Rosemount 485 *Annubar* combined with the 3051S or 3095MV MultiVariable transmitter creates an accurate, repeatable and dependable insertion-type flowmeter. The Rosemount 285 provides a commercial product offering for your general purpose applications.

Compact Orifice Flowmeter Series: Rosemount 3051SFC, 3095MFC, and 405

Compact Orifice Flowmeters can be installed between existing flanges, up to a Class 600 (PN100) rating. In tight fit applications, a conditioning orifice plate version is available, requiring only two diameters of straight run upstream.

Integral Orifice Flowmeter Series: Rosemount 3051SFP *ProPlate*®, 3095MFP Mass *ProPlate*®, and 1195

These integral orifice flowmeters eliminate the inaccuracies that become more pronounced in small orifice line installations. The completely assembled, ready to install flowmeters reduce cost and simplify installation.

Orifice Plate Primary Element Systems: Rosemount 1495 and 1595 Orifice Plates, 1496 Flange Unions and 1497 Meter Sections

A comprehensive offering of orifice plates, flange unions and meter sections that is easy to specify and order. The 1595 Conditioning Orifice provides superior performance in tight fit applications.

Specifications

The Rosemount 1595 can be used with Rosemount 1496 Orifice Flange Unions and Rosemount 1497 Meter Sections. For product offering see document number 00813-0100-4792.

Performance

Flow Coefficient Uncertainty

TABLE 1. Discharge Coefficient Uncertainty

Beta Ratio ⁽¹⁾	Cd Uncertainty
$\beta = 0.20$	$\pm 0.50\%$
$\beta = 0.40$	$\pm 0.50\%$
$\beta = 0.65$	$\pm 1.00\%$

(1) For 0.65 beta and $ReD < 10,000$ add an additional 0.5% to the Discharge Coefficient Uncertainty.

Sizing

Perform a flow calculation using the Instrument Toolkit® software package. Alternatively, contact an Emerson Process Management representative. The “” on page 11” is required prior to order for application verification.

Straight Pipe Requirement

Use the appropriate lengths of straight pipe upstream and downstream of the 1595 to minimize the effects of moderate flow disturbances in the pipe. Table 2 lists recommended lengths of straight pipe.

TABLE 2. 1595 Straight Pipe Requirements⁽¹⁾

Beta		0.20	0.40	0.65
Upstream (inlet) side of primary	Single 90° bend or tee	2	2	2
	Two or more 90° bends in the same plane	2	2	2
	Two or more 90° bends in different plane	2	2	2
	Up to 10° of swirl ⁽²⁾	2	2	2
	Reducer (1 line size) ⁽²⁾	2	2	2
	Butterfly valve (75% to 100% open) ⁽²⁾	2	2	N/A
Downstream (outlet) side of primary		2	2	2

(1) Consult an Emerson Process Management representative if the type of disturbance is not listed.

(2) Not applicable in line sizes greater than 24-in. (600 mm).

Pressure Tap Orientation

Orient the 1595 Conditioning Orifice Plate so that the pressure taps are centered between any 2 (of 4) orifice bore holes. In addition, the pressure taps should be located at 90° to the plane of the last elbow.

The 1595 Conditioning Orifice Plate can be used with the following pressure taps:

- Flange pressure taps - all beta sizes
- Radius pressure taps (D and D/2) - 0.4 beta size or smaller

Centering Requirements

The 1595 should be installed so that it is centered in the pipes as recommended by ISO-5167.

Functional

Service and Flow Range

Liquid, gas or vapor turbulent flow, for pipe Reynold's Numbers greater than 5,000. For pipe Reynold's Numbers less than 10,000 add an additional +0.5% uncertainty to the discharge coefficient uncertainty.

Pipe Sizes

2 to 24-in. (50 to 600 mm). Contact Emerson Process Management for other pipe sizes.

Operating Limits

For line sizes 2-in. (50 mm) to 24-in. (600 mm)

Temperature Range: -320 to 1200 °F (-196 to 649 °C)

- -320 to 800 °F (-196 to 427 °C) and differential pressure up to 800 inH₂O
- 800 to 1200 °F (427 to 649 °C) and differential pressure up to 400 inH₂O

Maximum Working Pressure

- Flange rating per ANSI B16.5 and DIN EN 1092-1.

Physical Specifications

Materials of Construction

Orifice Plate

TABLE 3.

Code	Description	ASTM	UNS	DIN (W.-Nr.)
S	316/316L SST	A240 Gr 316/316L	S31600 / S31603	1.4401/1.4404 (1.4436/1.4435)
L	304/304L SST	A240 Gr 304/304L	S30400 / S30403	1.4301 / 1.4306
H	Hastelloy C-276	B575 Gr N10376	N10276	2.4819
M	Monel 400	B127 Gr N04400	N04400	2.4360

Flange Mounting Hardware

- The 1595 can be tailored for use in conjunction with the Rosemount 1496 Flange Union and, if required, the Rosemount 1497 Meter Section. See Figures 2 and 3 and Product Data Sheet 00813-0100-4792 for more information regarding the Rosemount 1496 and 1497.

Typical Orifice Hole Sizes

Beta is calculated by: $\beta = d_c / \text{Pipe ID}$, where the calculated bore is equal to 2 x typical orifice hole size ($d_c = 2d$). The table below shows the diameter of each of the four typical orifice holes.

TABLE 4. Typical Orifice Hole Sizes

Line Size	Pipe ID	Beta (β) = 0.20 d	Beta (β) = 0.40 d	Beta (β) = 0.65 d
2-in. (50.8 mm)	2.067-in. (52.502 mm)	0.207 (5.26)	0.413 (10.49)	0.620 (15.75) ⁽¹⁾
3-in. (76.2 mm)	3.068-in. (77.927 mm)	0.307 (7.80)	0.614 (15.60)	0.997 (25.32)
4-in. (101.6 mm)	4.026-in. (102.26 mm)	0.403 (10.25)	0.805 (20.45)	1.308 (32.22)
6-in. (152.4 mm)	6.065-in. (154.051 mm)	0.607 (15.42)	1.213 (30.81)	1.971 (50.06)
8-in. (203.2 mm)	7.981-in. (202.717 mm)	0.798 (20.27)	1.596 (40.54)	2.594 (65.89)
10-in. (254.0 mm)	10.02-in. (254.51 mm)	1.002 (25.45)	2.004 (50.90)	3.257 (82.73)
12-in. (304.8 mm)	12.00-in. (304.80 mm)	1.200 (30.48)	2.400 (60.96)	3.900 (99.06)
14-in. (355.6 mm)	13.124-in. (333.35 mm)	1.312 (33.32)	2.625 (66.68)	4.265 (108.33)
16-in. (406.4 mm)	15.000-in. (381.00 mm)	1.500 (38.10)	3.000 (76.20)	4.875 (123.83)
18-in. (457.2 mm)	16.876-in. (428.65 mm)	1.688 (42.88)	3.375 (85.73)	5.485 (139.32)
20-in. (508.0 mm)	18.812-in. (477.82 mm)	1.881 (47.78)	3.762 (95.55)	6.114 (155.30)
24-in. (609.6 mm)	22.624-in. (574.65 mm)	2.262 (57.45)	4.525 (114.94)	7.353 (186.77)

(1) For 2-in. (50.8 mm) line size, the beta (β) is 0.60.

Orifice Type

- Paddle, square-edge, concentric
- Universal, square-edge, concentric

Dimensional Drawings

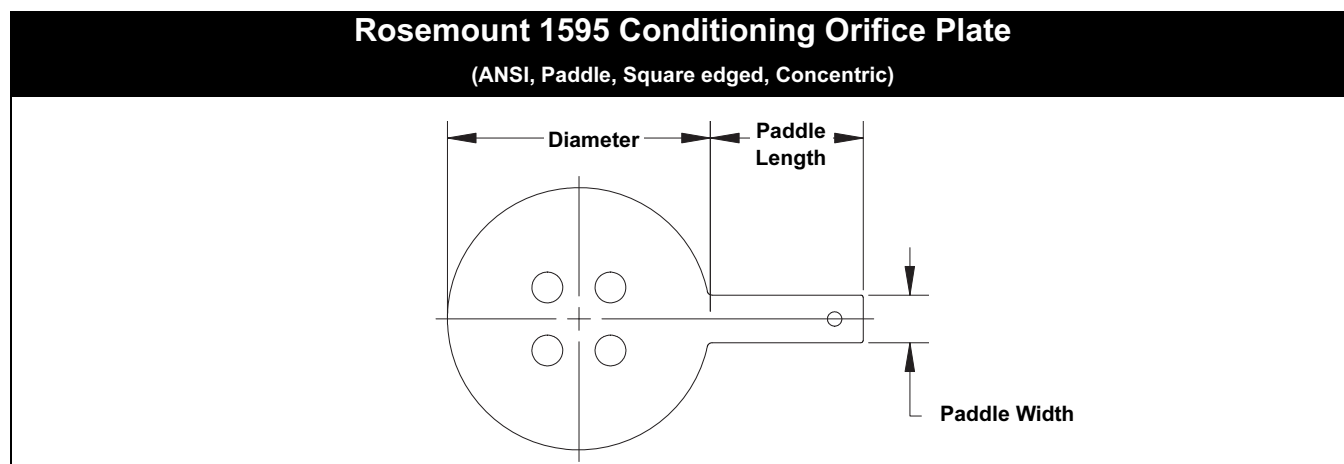


TABLE 5. Orifice Plate Dimensions in inches (millimeters)

Line Size	Diameter for Paddle Type						Paddle Length	Paddle Width
	150#	300#	600#	900#	1500#	2500#		
2-in. (50.8 mm)	4.125 (104.78)	4.375 (111.13)	4.375 (111.13)	5.625 (142.875)	5.625 (142.875)	5.750 (146.050)	4.0 (101.6)	1.0 (25.4)
3-in. (76.2 mm)	5.375 (136.53)	5.875 (149.23)	5.875 (149.23)	6.625 (168.275)	6.875 (174.625)	7.750 (196.85)	4.0 (101.6)	1.0 (25.4)
4-in. (101.6 mm)	6.875 (174.63)	7.125 (180.98)	7.625 (193.68)	8.125 (206.35)	8.250 (209.550)	9.250 (234.95)	4.0 (101.6)	1.0 (25.4)
6-in. (152.4 mm)	8.750 (222.25)	9.875 (250.83)	10.500 (266.7)	11.375 (288.925)	11.125 (282.575)	12.500 (317.50)	4.0 (101.6)	1.0 (25.4)
8-in. (203.2 mm)	11.000 (279.4)	12.125 (307.98)	12.625 (320.675)	14.125 (358.775)	13.875 (352.425)	15.250 (387.350)	6.0 (152.4)	1.5 (38.1)
10-in. (254.0 mm)	13.375 (339.73)	14.250 (361.95)	15.750 (400.05)	17.125 (434.975)	17.125 (434.975)	18.750 (476.25)	6.0 (152.4)	1.5 (38.1)
12-in. (304.8 mm)	16.125 (409.58)	16.625 (422.26)	18.000 (457.2)	19.625 (498.475)	20.500 (520.7)	21.625 (549.275)	6.0 (152.4)	1.5 (38.1)
14-in. (355.6 mm)	17.750 (450.85)	19.125 (485.78)	19.375 (492.125)				6.0 (152.4)	1.5 (38.1)
16-in. (406.4 mm)	20.250 (514.35)	21.250 (539.75)	22.250 (565.15)				6.0 (152.4)	1.5 (38.1)
18-in. (457.2 mm)	21.500 (546.1)	23.375 (593.725)	24.000 (609.6)				6.0 (152.4)	1.5 (38.1)
20-in. (508.0 mm)	23.750 (603.25)	25.625 (650.875)	26.750 (679.45)				6.0 (152.4)	1.5 (38.1)
24-in. (609.6 mm)	28.125 (714.375)	30.375 (771.525)	31.000 (787.4)				6.0 (152.4)	1.5 (38.1)

NOTE: Consult factory for availability of line sizes and flange ratings not shown in the above table.

1595U Orifice Universal Type (Universal, Square edged, Concentric)

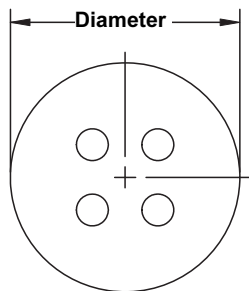


TABLE 6. Orifice Plate Dimensions in inches (millimeters)

Line Size	Diameter for Universal Type
2-in.	2.437-in. (61.8998 mm)
3-in.	3.437-in. (87.2998 mm)
4-in.	4.406-in. (111.912 mm)
6-in.	6.437-in. (163.5 mm)
8-in.	8.437-in. (214.3 mm)
10-in.	10.687-in. (271.45 mm)
12-in.	12.593-in. (319.862 mm)

NOTE: Consult Factory for availability of line sizes not shown in the above table.

Rosemount 1595 Conditioning Orifice Plate (DIN, Paddle, Square edged, Concentric)

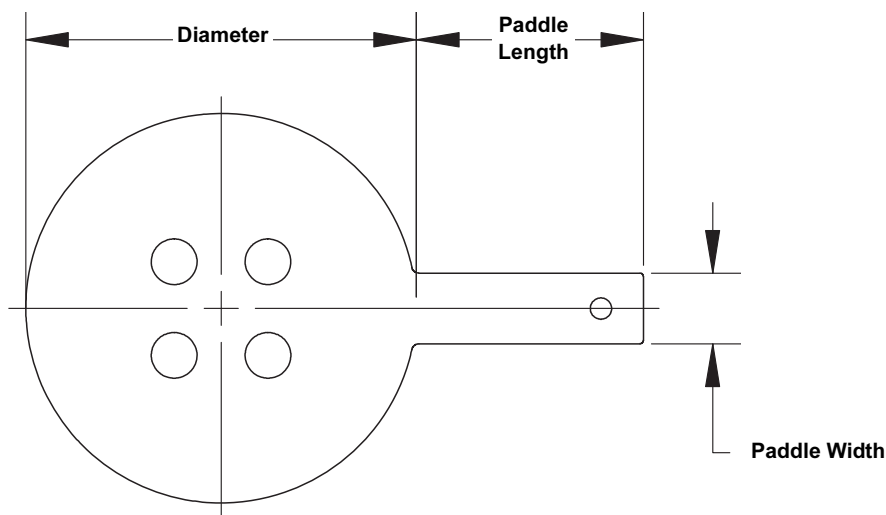


TABLE 7. Orifice Plate Dimensions in millimeters (inches)

Line Size	Diameter (max) – by flange rating						Paddle Length	Paddle Width
	PN 10	PN 16	PN 25	PN 40	PN 63/64	PN 100		
DN 50 (2-in.)	107 (4.21)	107 (4.21)	107 (4.21)	107 (4.21)	113 (4.45)	119 (4.69)	101.6 (4.0)	25.4 (1.0)
DN 80 (3-in.)	142 (5.60)	142 (5.60)	142 (5.60)	142 (5.60)	148 (5.82)	154 (6.06)	101.6 (4.0)	25.4 (1.0)
DN 100 (4-in.)	162 (6.38)	162 (6.38)	168 (6.61)	168 (6.61)	174 (6.85)	180 (7.09)	101.6 (4.0)	25.4 (1.0)
DN 150 (6-in.)	218 (8.58)	218 (8.58)	224 (8.82)	224 (8.82)	247 (9.72)	257 (10.12)	101.6 (4.0)	25.4 (1.0)
DN 200 (8-in.)	273 (10.74)	273 (10.74)	284 (11.18)	290 (11.42)	309 (12.17)	324 (12.76)	152.4 (6.0)	38.1 (1.5)
DN 250 (10-in.)	328 (12.91)	329 (12.95)	340 (13.39)	352 (13.86)	364 (14.33)	391 (15.39)	152.4 (6.0)	38.1 (1.5)
DN 300 (12-in.)	378 (14.88)	384 (15.12)	400 (15.75)	417 (16.42)	424 (16.69)	458 (18.03)	152.4 (6.0)	38.1 (1.5)

NOTE: Consult factory for availability of line sizes and flange ratings not shown in the above table.

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TABLE 8. A.P.I Ring No.'s and Rating

Line Size	A.P.I Ring No.	Rating (lbs.)
02	R-23	300-600
02	R-24	900-1500
02	R-26	2500
03	R-31	300-600 & 900
03	R-35	1500
04	R-37	300-600 & 900
04	R-39	1500
06	R-45	300-600 & 900
06	R-46	1500
08	R-49	300-600 & 900
10	R-53	300-600 & 900
12	R-57	300-600 & 900

NOTE

Refer to Table 5 for line size and pressure rating availability.

TABLE 9. Available Beta Ratio (β)

The table below shows the available Beta Ratio (β) for line size vs. pipe schedule

Line Size	Pipe Schedule	Beta (β) Available	Line Size	Pipe Schedule	Beta (β) Available
2	≤ 80	0.20, 0.40, 0.60	14	≤ 80	0.20, 0.40, 0.65
2	160	0.20	14	100	0.20, 0.40
3	≤ 80	0.20, 0.40, 0.65	14	120	0.20, 0.40
3	160	0.20, 0.40	14	140	0.20, 0.40
3	XXS	0.20	14	160	0.20, 0.40
4	≤ 80	0.20, 0.40, 0.65	14	XXS	0.20, 0.40
4	120	0.20, 0.40	16	≤ 80	0.20, 0.40, 0.65
4	160	0.20, 0.40	16	100	0.20, 0.40
4	XXS	0.20	16	120	0.20, 0.40
6	≤ 80	0.20, 0.40, 0.65	16	140	0.20, 0.40
6	120	0.20, 0.40	16	160	0.20, 0.40
6	160	0.20, 0.40	16	XXS	0.20, 0.40
6	XXS	0.20	18	≤ 80	0.20, 0.40, 0.65
8	≤ 80	0.20, 0.40, 0.65	18	100	0.20, 0.40, 0.65
8	100	0.20, 0.40, 0.65	18	120	0.20, 0.40
8	120	0.20, 0.40	18	140	0.20, 0.40
8	140	0.20, 0.40	18	160	0.20, 0.40
8	160	0.20, 0.40	18	XXS	0.20, 0.40
8	XXS	0.20, 0.40	20	≤ 80	0.20, 0.40, 0.65
10	≤ 80	0.20, 0.40, 0.65	20	100	0.20, 0.40, 0.65
10	100	0.20, 0.40, 0.65	20	120	0.20, 0.40
10	120	0.20, 0.40	20	140	0.20, 0.40
10	140	0.20, 0.40	20	160	0.20, 0.40
10	160	0.20, 0.40	20	XXS	0.20, 0.40
10	XXS	0.20, 0.40	24	≤ 80	0.20, 0.40, 0.65
12	≤ 80	0.20, 0.40, 0.65	24	100	0.20, 0.40
12	100	0.20, 0.40	24	120	0.20, 0.40
12	120	0.20, 0.40	24	140	0.20, 0.40
12	140	0.20, 0.40	24	160	0.20, 0.40
12	160	0.20, 0.40	24	XXS	0.20, 0.40
12	XXS	0.20, 0.40			

Ordering Information

Rosemount 1595 Orifice Plate Ordering Table

Model	Product Description		
1595	Conditioning Orifice Plate		
Code	Plate Type		
P	Paddle, Square Edged		
U ⁽¹⁾	Universal, Square Edge		
Code	Line Size		
020	2-in. (50 mm)		
030	3-in. (76 mm)		
040	4-in. (100 mm)		
060	6-in. (150 mm)		
080	8-in. (200 mm)		
100	10-in. (250 mm)		
120	12-in. (300 mm)		
140	14-in. (350 mm)		
160	16-in. (400 mm)		
180	18-in. (450 mm)		
200	20-in. (500 mm)		
240 ⁽²⁾	24-in. (600 mm)		
Code	Flange Rating		
A1	ANSI Class 150 Raised Face (<i>Note: Not compatible with standard ASME B16.36 Orifice Flanges</i>)		
A3	ANSI Class 300 Raised Face		
A6	ANSI Class 600 Raised Face		
A9	ANSI Class 900 Raised Face		
AF	ANSI Class 1500 Raised Face		
AT	ANSI Class 2500 Raised Face		
D1 ⁽¹⁾	DIN PN 10 (only available with Plate Type P)		
D2 ⁽¹⁾	DIN PN 16 (only available with Plate Type P)		
D3 ⁽¹⁾	DIN PN 25 (only available with Plate Type P)		
D4 ⁽¹⁾	DIN PN40 (only available with Plate Type P)		
D5 ⁽¹⁾⁽³⁾	DIN PN 63 (only available with Plate Type P)		
D6 ⁽¹⁾	DIN PN 100 (only available with Plate Type P)		
R3 ⁽¹⁾	ANSI Class 300 Ring Joint (only available with Orifice Plate Type code U and requires Plate Holder code PH)		
R6 ⁽¹⁾	ANSI Class 600 Ring Joint (only available with Orifice Plate Type code U and requires Plate Holder code PH)		
R9 ⁽¹⁾	ANSI Class 900 Ring Joint (only available with Orifice Plate Type code U and requires Plate Holder code PH)		
RF ⁽¹⁾	ANSI Class 1500 Ring Joint (only available with Orifice Plate Type code U and requires Plate Holder code PH)		
RT ⁽¹⁾	ANSI Class 2500 Ring Joint (only available with Orifice Plate Type code U and requires Plate Holder code PH)		
Code	Material Type		
S	316/316L Stainless Steel		
L	304/304L Stainless Steel		
M	Monel [®]		
H	Hastelloy [®] C-276		
Code	Orifice Plate Thickness	Plate Type P	Plate Type U
A	0.125-in.	Line Sizes 2 to 4-in. (50 to 100 mm)	Line size 2 to 6-in. (50 to 150 mm)
B ⁽⁴⁾	0.250-in.	Line Sizes 6 to 12-in. (150 to 300 mm)	Line size 8 to 12-in. (200 to 300 mm)
C	0.375-in.	Line Sizes 14 to 20-in. (350 to 500 mm)	See footnote ⁽²⁾
D	0.500-in.	Line Size 24-in. (600 mm)	See footnote ⁽²⁾
Code	Beta Ratio		
020	0.20 Beta Ratio		
040	0.40 Beta Ratio		
065	0.65 Beta Ratio (0.60 beta ratio for Line Size option 020 only)		

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Rosemount 1595 Orifice Plate Ordering Table

Code	Options
Flow Calibration	
WC	Discharge Coefficient Verification (3 points)
WD	Discharge Coefficient Verification (10 points)
Plate Holder	
PH	Plate Holder for Universal Type Orifice Plate for use with RTJ flange or section
Special Cleaning	
P2	Cleaning for special processes
Special Inspection	
QC1	Visual and dimensional Inspection with certification
QC7	Inspection and performance certificate
Material Traceability Certification	
Q8	Material Certification per ISO 10474 3.1-B and EN 10204 3.1
Materials Conformance	
J5 ⁽⁵⁾	NACE MR-0175 / ISO 15156
Country Certification	
J1	Canadian Registration
Typical Model	
Number: 1595 P 060 A3 S A 040	

(1) Currently available up to 12-in. (300 mm) line size.

(2) Consult factory for availability of line sizes, flange ratings and plate thicknesses not shown.

(3) Previously PN64.

(4) For a Universal plate style in a 6-in. (150 mm) line size, the plate thickness is 0.125-in. (3.175 mm) and you will need to select code A.

(5) Materials of Construction comply with metallurgical requirements within NACE MR0175/ISO for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.

Calculation Data Sheet

This Calculation Data Sheet can be provided. The detailed sizing calculation may be done through the Configuration Data Sheet, document number 00806-0100-4828.

ROSEMOUNT INC. 1595 CONDITIONING ORIFICE PLATE CALCULATION DATA SHEET			
GENERAL DATA			
Customer:	Customer Name		
Project:	2007 Official Calculation		
S. O. No:	Sales Order Number		
P. O. No:	Customer Name		
Calc. Date:	3/28/2007		
Model No:	1595P080A3SB040		
Tag No:	Tag Number		
PRODUCT DESCRIPTION			
Plate Type:	Paddle, Square-Edged	Tap Type:	Flange tapping
Plate Material:	316/L Stainless Steel	Tap Location:	Upstream
Nominal Beta:	0.4	Line Size:	8-in. (200 mm) (DN 200)
Process Connection:		Pipe Schedule:	40
		Pipe Material:	Carbon Steel
INPUT DATA			
Fluid Type:	Steam	Calibration Factor:	1.000
Fluid Description:			
Pipe I.D.:	7.981	inch	
Pressure:	60	psig	
Temperature at Flow:	307.33	F	
Absolute Viscosity:	0.01409	cP	
Isentropic Exponent:	1.31746		
Compressibility at Flow:			
Density at Flow:	0.171328	lb/ft ³	
Flow Rates:		Atmospheric Pressure:	14.696 psia
Minimum:	6000.00	lb/hr	
Normal:	8000.00	lb/hr	
Maximum:	10000.00	lb/hr	
Full Scale:	10000.00	lb/hr	
CALCULATED DATA (Calculation performed at normal conditions)			
Typical Orifice Hole Size:	1.596	inch	Bore Reynolds Number (Normal): 1120650
Calculated Orifice Bore Size:	3.192	inch	Pipe Reynolds Number (Normal): 448514
DP at Minimum Flow:	42.859	in H ₂ O at 68 °F	Gas Expansion Factor: 0.9900
DP at Normal Flow:	76.194	in H ₂ O at 68 °F	Permanent Pressure Loss:
DP at Maximum Flow:	119.054	in H ₂ O at 68 °F	at Normal Flow: 62.671
URV (DP at Full Scale):	119.054	in H ₂ O at 68 °F	at Max Flow: 97.928
Calculated Beta:	0.400		Velocity at Max. Flow: 46.669
Discharge Coefficient:	0.6009		Minimum Accurate Flow: 1313.27
Max. Allow. Pressure at Temp:	551.000	psig @ 320 °F	
WARNINGS			
Calculation by	HL		
NOTES			
This report is provided according to the terms and conditions of the Instrument Toolkit™ End-Use Customer License agreement.			
Version: 3.0 (Build 135C)		Printed on: 28-Mar-07	

Rosemount 1595

Product Data Sheet

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