

Datasheet *Orifice plate - sharp edge*

Rev.4 Jan 2015

- ✓ Orifice plate design based on ISO5167, BS1042, ASME.MFC.3M and ISO TR15377 :2007 industry standards
- ✓ Accuracy, repeatability and reliability of the flow element
- ✓ Use for custody transfer metering
- ✓ Easy and quick installation and commissioning
- ✓ Very long life-time product
- ✓ Cost-effective and maintenance-free system
- ✓ Other types of orifice plates available depending on the application



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The sharp-edge orifice plate is the most widely used for flow measurement thanks to its accuracy, easy installation and maintenance



Applications - standards

Standards	ISO5167, BS1042, ASME.MFC.3M, ISO TR15377 :2007
Fluid temperature	-110°C to +800°C
Type of fluid	Gas, steam, liquid (single-phase fluids)
Nominal diameters	ND50 to ND1000 according ISO5167-1 (from 2 up to 40 inches) ND15 up to ND50 according ISO TR 15377 :2007 (from 1/2 up to 2 inches)
Maximum operating pressure	Limited by the flange rating

The orifice plate is dimensionally checked in compliance with the manufacturing quality controls. Manufacturing is possible according the european directive DESP97/23 CE requirements.

Features

Ratio pressure loss	42% to ΔP for $\beta=0,75$ up to 95% to ΔP for $\beta=0,2$
Accuracy	<1% to 2,5% depending on the installation
Material	Stainless steel, Carbon steel, Monel alloy, Hastelloys, Inconels, Titanium, Tantalum, PVC, etc

Mounting

Assembly	Between flanges / Inserted between 2 carrier rings with annular slots
Piping connection	Between straight sections (variable lengths regarding β and obstacles located up and downstream – see table here-after)
Type of gaskets	Flat seal (spiral wound gasket, graphite, PTFE) or RTJ (mild steel, stainless steel, monel alloy...)
Centering of orifice bore relative to piping	Distance e between the centerline of the orifice and the centerline of the pipe in the direction parallel to the pressure tapping : $e \leq 0,002 5D / (0,1 + 2,3 \beta^4)$

Technical description

Upstream face	Raised Face with sharp edge : radius $r < 0,0004 d$ Smoothed face : roughness criterion $Ra < 10^{-4} d$ Plane : default $< 0,005 (D-d)/2$
Plate thickness	Between $0,005D$ and $0,05D$

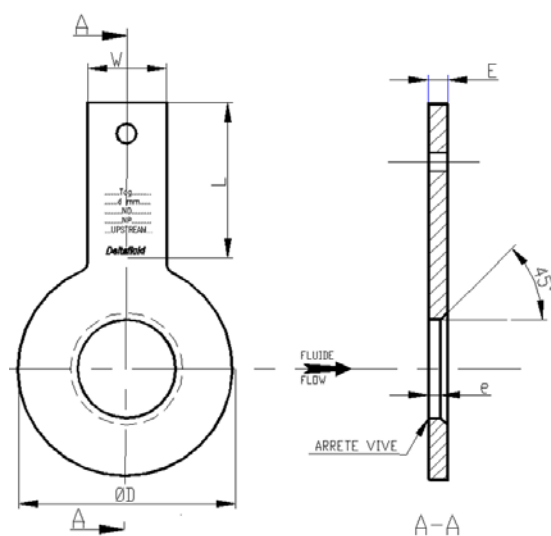
Other types of orifice plates : RF quadrant edge, conical entrance, eccentric, segmental, RTJ – see relevant datasheet.

Limits of use

Pressure taps type D - D/2 Or corner taps	$d \geq 12.5 \text{ mm}$ $0.1 \leq \beta \leq 0.75$ $Re_D \geq 5000$ for $0.1 \leq \beta \leq 0.559$ $Re_D \geq 16000 \beta^2$ for $\beta > 0.559$
Flange taps	$d \geq 12.5 \text{ mm}$ $0.1 \leq \beta \leq 0.75$ $Re_D \geq 5000$ & $Re_D \geq 170 \beta^2 D$

Orifice plate dimensions

DN	E	e	L	W	ØD : EXTERNAL DIAMETER OF THE PLATE					
					150# RF	300# RF	600# RF	900# RF	1500# RF	2500# RF
1/2"	3	0.5	100	20	46	52	52	61	61	68
3/4"	3	0.5	100	20	55	65	65	68	68	74
1"	3	0.5	100	20	65	71	71	77	77	84
1 1/2"	3	0.8	100	20	84	93	93	96	96	115
2"	3	0.8	100	20	103	109	109	141	141	144
2 1/2"	3	1.2	100	20	122	128	128	163	163	166
3"	3	1.6	100	20	135	147	147	166	173	195
4"	3	1.6	150	25	173	179	192	204	208	233
6"	3	3	150	25	220	249	265	287	281	315
8"	3	3	150	25	277	306	319	357	350	385
10"	3	3	150	25	338	360	398	433	433	474
12"	3	3	150	25	408	420	455	496	519	547
14"	6	6	150	25	449	484	490	519	576	
16"	6	6	150	25	512	538	563	573	639	
18"	6	6	150	25	547	595	611	636	703	
20"	6	6	150	25	604	652	681	696	754	
24"	6	6	150	25	716	773	789	836	900	



Standardised principle
ISO5167, ISO TR 15377,
BS1042, ASME.MFC.3M

- The only flow measurement which doesn't need calibration
- Warranty of accuracy, of repeatability and reliability
- Use for custody transfer flow metering

Robust

- No moving parts, proven technology
- Very long life time
- Zero long-term drift

Integrated and preset
system

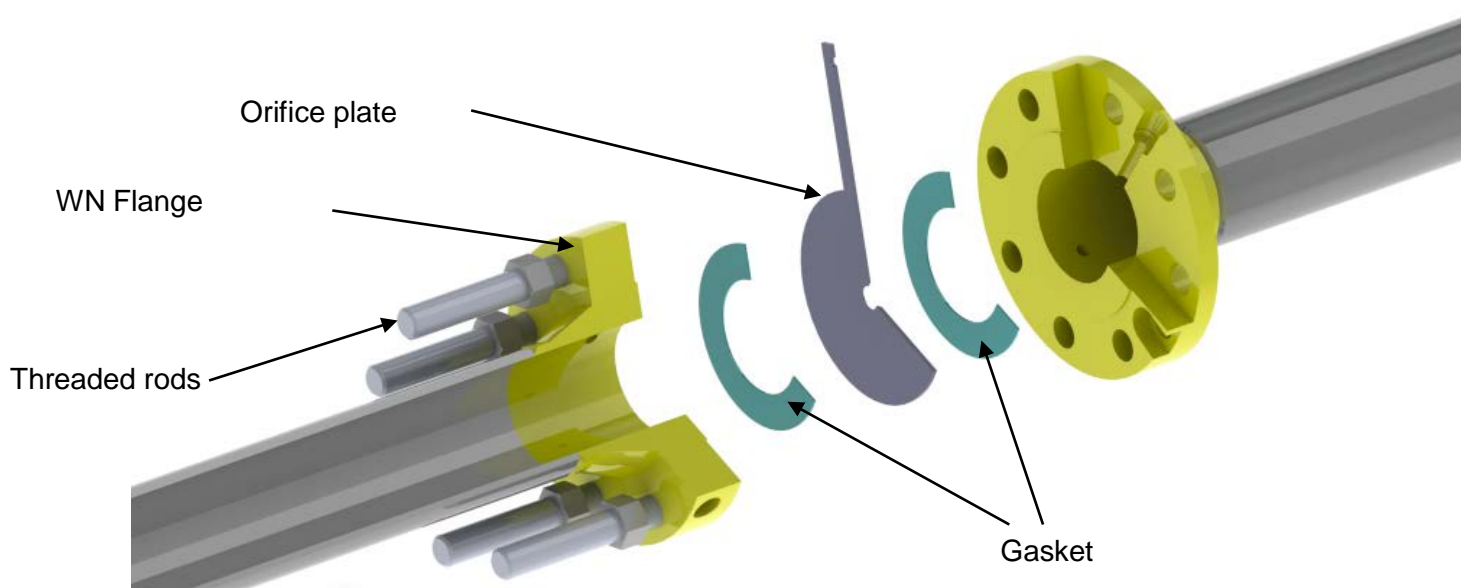
- Quick installation and commissioning
- Direct assembly on piping
- Compact system : manifold and preset transmitter directly mounted on the differential pressure element

Budget saving system

- No calibration cost
- Cost-effective installation
- Zero maintenance needed

Assembly

Example of assembly : a sharp-edge orifice plate between Welding-Neck flanges



Ordering information – MAIN CODE

Delta OP-	MAIN CODE								
Orifice Plate	XX	XXX	X	XX	XX	XXX	XXXXX	XXX	XXX
Type of upstream face									
Sharp Edge	SE								
Conical Entrance	CO								
Quarter Circle	QC								
Eccentric	EC								
Segmental	SG								
Multi holes	MH								
Type of face									
Raising Face		RF*							
Ring Torque Joint		RTJ							
for RTJ :									
Male			M						
Female**			F						
in 1 piece or in 2 pieces									
Monobloc				MO					
Screwed - <i>see plate support material</i>				SC					
Type of finishing									
Polished 1 face					P				
Polished 2 faces					2P				
Others - SPECIFY					O				
Nominal diameter									
DN15 - 1/2"						1			
DN20 - 3/4"						0,75			
DN25 - 1"						1			
DN32 - 1"1/4						1,25			
DN40 - 1"1/2						1,5			
DN50 - 2"						2			
DN65 - 2"1/2						2,5			
DN80 - 3"						3			
DN100 - 4"						4			
DN125 - 5"						5			
DN150 - 6"						6			
DN200 - 8"						8			
DN250 - 10"						10			
DN300 - 12"						12			
DN350 - 14"						14			
DN400 - 16"						16			
DN450 - 18"						18			
DN500 - 20"						20			
DN600 - 24"						24			

MAIN CODE									
	XX	XXX	X	XX	XX	XXX	XXXXX	XXX	XXX
Rating									
150#							A150		
300#							A300		
600#							A600		
900#							A900		
1500#							A1500		
2500#							A2500		
PN10							D10		
PN16							D16		
PN25							D25		
PN40							D40		
PN63							D63		
PN100							D100		
Plate material									
Stainless steel 304								SS4	
Stainless steel 316								SS6	
Inconel								INC	
Monel								MON	
Hastelloy								HLY	
PTFE								PTF	
Duplex								DPX	
Superduplex								SDX	
Others - SPECIFY								O	
Plate support material <i>for OP RTJ screwed</i>									
Stainless steel 304									SS4
Stainless steel 316									SS6
carbon steel									CS
Soft iron									SI
Others - SPECIFY									O
* OP-XX-RF can be assembled with simple or double & male or female facing depending on the flange									
** Pipe schedule or inner diameter ID to be specified									

Ordering information – OPTIONS

OPTIONAL CODE	XX	XX	XXX	XXX	XXX	X	XX	XX	XX	X	X
Mounting											
pressure taps 0/0 - annular chamber	0										
pressure taps 25/25 - orifice flange	25										
pressure taps D - D/2	D										
Flanges*⁽¹⁾											
Welding neck		WN									
Orifice welding neck		WO									
Slip on		SO									
Others		O									
Flanges material											
ASTM A105			105								
A350LF2			350								
Carbon steel* ⁽²⁾			CST								
Stainless steel 304			SS4								
Stainless steel 316			SS6								
Inconel			INC								
Monel			MON								
Hastelloy			HLY								
PTFE			PTF								
Duplex			DPX								
Superduplex			SDX								
Other			O								
Pipe Schedule											
5-5S				5							
10-10S				10							
20				20							
30				30							
40S-Std				STD							
40				40							
60				60							
XS-80S				XS							
80				80							
100				100							
120				120							
140				140							
160				160							
XXS				XXS							
Annular chamber material											
Carbon steel						CS					
Stainless steel 304						SS4					
Stainless steel 316						SS6					
Other						O					
Gaskets											
Flat						F					
Graphite						G					
Spiral wound						S					
PTFE						P					
Others						O					
Boltings material											
Carbon steel							CS				
Stainless steel							SS				
Others							O				

OPTIONAL CODE	XX	XX	XXX	XXX	XXX	X	XX	XX	XX	XX	X	X
Manifold												
3-way direct mounting									3D			
3-way remote mounting									3R			
5-way direct mounting									5D			
5-way remote mounting									5R			
DP Transmitter												
Standard										SD		
Multivariable										MV		
Temperature sensor * ⁽³⁾												
With temperature sensor											Y	
Without temperature sensor											N	
Piping * ⁽⁴⁾												
Upstream												U
Downstream												D
* ⁽¹⁾ OP-SE-RF can be assembled with simple or double & male or female facing depending on the flange												
* ⁽²⁾ Type of carbon steel to be specified												
* ⁽³⁾ Type of temperature sensor to be specified												
* ⁽⁴⁾ Process connection to be specified												

Straight lengths

Required straight lengths between orifice plates and fittings – without flow conditioners

Values expressed as multiples of internal diameter, D

Diameter ratio d/D	UPSTREAM SIDE OF PRIMARY ELEMENT													DOWN STREAM OF PRIMARY ELEMENT													
	β	single 90° bend or two 90° bends in any plane (S>30D)	Two 90° bends in the same plane: S-config. 30D>S>10D	Two 90° bends in the same plane: S-config. 10D>S	Two 90° bends in perpendicular planes 30D>S>5D	Two 90° bends in perpendicular planes 5D>S	Simple 90° tee with or without an extension	Simple 45° bend or 2 bends in the same plane : S-config (S>2D)	Concentric reducer 2D to D over a length of 1,5D to 3D	Concentric expander 0,5D to D over a length D to 2D	Full bore ball valve or gate valve fully open	Abrupt symmetrical reduction	Thermometer pocket or well of $\varnothing < 0,03 D$		Fittings (columns 2 to 11) and the densitometer pocket												
	1	2	3	4	5	6	7	8	9	10	11	12	13	12													
<0,2		6	3	10	10	19	18	34	17	3	7	5	6	12	6	30	15	5	3	4	2						
0,40		16	3	10	10	44	18	50	25	9	3	30	5	12	8	12	6	30	15	5	3	6	3				
0,50		22	9	18	10	22	10	44	18	75	34	19	9	30	18	8	5	20	9	12	6	30	15	5	3	6	3
0,60		42	13	30	18	42	18	44	18	65	25	29	18	30	18	9	5	26	11	14	7	30	15	5	3	7	3,5
0,67		44	20	44	18	44	20	44	20	60	18	36	18	44	18	12	6	28	14	18	9	30	15	5	3	7	3,5
0,75		44	20	44	18	44	22	44	20	75	18	44	18	44	18	13	8	36	18	24	12	30	15	5	3	8	4

Notes:

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

Straight lengths shall be measured from the upstream face of the orifice plate.

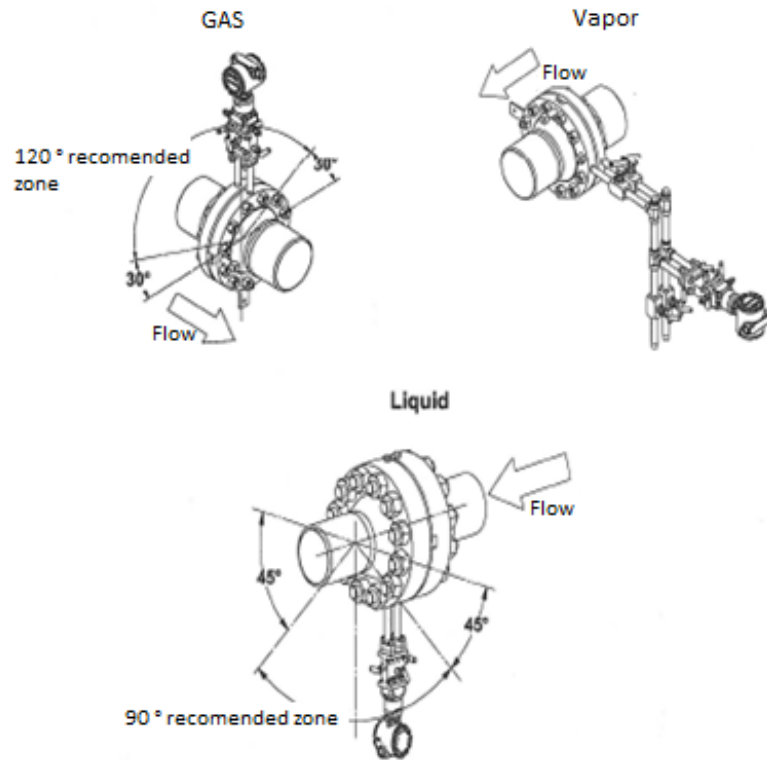
First column for each fitting gives lengths corresponding to « zero additional uncertainty » values (cf standard ISO 5167.1)

Second column for each fitting gives lengths corresponding to “0,5% additional uncertainty” values (cf standard ISO 5167.1).

S represents the distance between two accessories

Orientation of the primary element

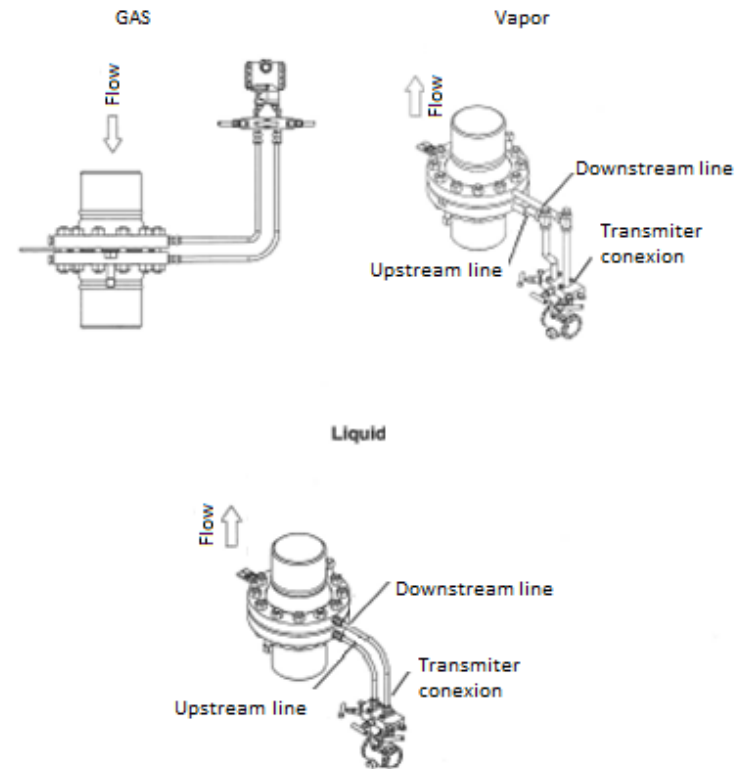
Horizontal line



With liquid applications, the transmitter must be mounted below the pipe. This ensures that air bubbles rise back to the process pipe and thus do not influence the measurement.

With gas applications, the transmitter must be mounted above the pipe. This ensures that any condensate flows back into the process pipe and thus does not influence the measurement.

Vertical line



* Align the Upstream line with the downstream line before plugging to the transmitter

With steam applications, two condensate pots should be used. They must be mounted on the same level so that the pipes between the transmitter and the condensate pots must be completely filled with water. The transmitter must be placed below the pipe.