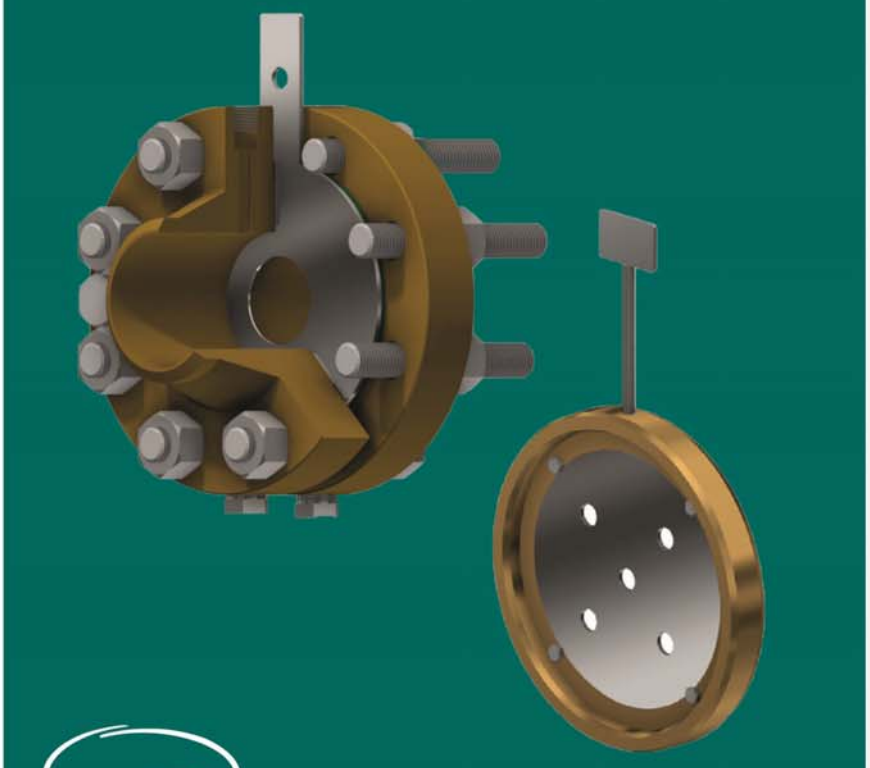
FLOW MEASURING

WITH ORIFICE



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Introductions

Restriction or orifice plates are an incredibly versatile technology and can be used wherever a specific pressure drop is required or where the flowrate is to be limited to a certain value, irrespective of changes in the downstream pressure.

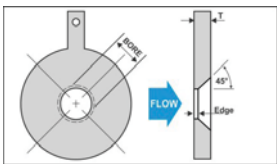
Applications

The overall pressure loss generated by the plate is calculated at a pair of theoretical tapping points. The high pressure (inlet or upstream) tapping is considered to be located 2.5 D (pipe diameters) in front of the plate and the low pressure (outlet or downstream) tapping is considered to be 8D downstream of the plate.

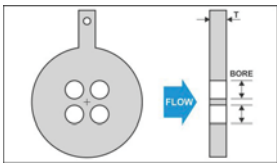
Orifice plate bore profiles

Aramak offers a variety of orifice plate bore profiles for restriction plates and these can be classified as follows:

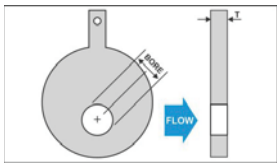
- circular bore, single square-edged hole, concentric with the pipe



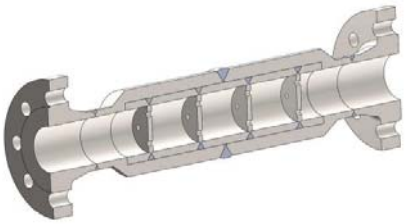
- circular bore, multiple square-edged holes across the plate face



- circular bore, single square-edged hole, Ec-concentric with the pipe



- Multiple-stage fabricated assemblies are also available, designed specifically for an application.



Specification

Materials

Plates:

Standard – 316/316L stainless steel

Other plate materials:

PVC

310 St Stl;

321 St Stl;

Alloy C276;

Titanium;

Gaskets:

Spiral Wound

Maximum working pressure

Limited by the application flange rating.

Maximum working temperature

Dependent on the material selection and application.

Pipeline size range (typical)

DN15 to 900 (1/2 to 36 in.).
Other sizes may be possible.

Plate thickness

Aramak Standard: 4, 8, 10 mm
Others available: 12, 15, 16 mm
The thickness of the orifice plate depends significantly on the application and design conditions.

Calculation standards

R W Miller
ISO 5167
AGA Section8

Design standards

Plate: Preferred – Aramak

Pipeline installation

Facing:

Raised face; flat face; RTJ (octagonal profile)

Facing standards:

ASME 150; 300; 400; 600; 900;
1500; 2500 lb.

Plates to fit between other flange standards can be supplied

Up-down stream lengths

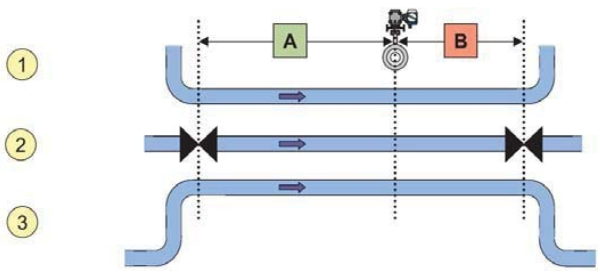
A symmetrical flow profile is the requirement for accurate measurement and is ensured by buildup free piping and sufficiently long up- and downstream lengths.

The flow profile is altered by obstacles in the process line, in the form of narrowing's, bends, elbows, etc. The flow settles down again when it passes through a straight section of piping, the Inlet run section. The same is true for obstacles after the measuring point: the back-pressure which occurs leads to a change in the flow pro- file at the pressure tapping point. Therefore, try and keep to straight outlet runs. The use of flow conditioners allows a reduction in the length of the necessary up- and downstream lengths. The increase in expected errors through reduction without a flow conditioner is shown in the following diagram (see “Reduced upstream length”).

The standard prescribes the up- and downstream lengths to maintain the flow profiles. Use the diagram and the table to determine how large
these must be:

A Upstream; B Downstream

1)90° elbow
2)Valves open
3)2x 90° elbows



	Orifice plate or nozzle Venturi: use half lengths						Pitot tube	
	Upstream			Downstream			Upstream	Downstream
	β= 0,1	β= 0,5	β= 0,75	β= 0,1	β= 0,5	β= 0,75		
90° elbow	10	14	36	4	6	8	7 x D	3 x D
2x 90° elbow	14	20	42	4	6	8	9 x D	3 x D
3x 90° elbow	34	40	70	4	6	8	18 x D	4 x D
Pipe constriction	5	6	22	4	6	8	7 x D	3 x D
Pipe expander	16	18	38	4	6	8	24 x D	4 x D
Valve, open	18	22	36	4	6	8	30 x D	4 x D

Compensation

Alongside differential pressure Δp, pressure p and temperature T are test variable of flow q. If there are no strong fluctuations in pressure and temperature, then the accuracy of the differential pres- sure signal is fully sufficient for the majority of measuring points. There is then no need for any Compensation.

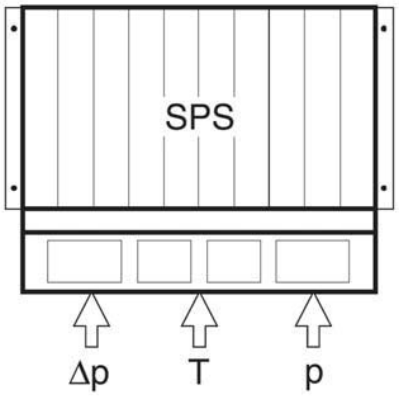
With some applications, particularly in the gas and steam sectors, a special compensation is required. A change in pressure and/or temperature leads to a change in density. If this is not taken into account, total accuracy may be reduced.

The following parameters are required for compensation:

- Gases: compensation of P and T
- Saturated steam: either P or T are compensated
- Superheated steam: compensation of P and T
- Liquids: compensation of T (very rare)

Both on the process side and on the system side, there are two possibilities for implementing compensation (large differences in price and effort).

The process variables are fed into the (available) PLC or Flow Computer. The flow equations are programmed there. With this solution the investment costs are low, but the commissioning costs are increased.



Ordering Information

OFT-	XXX	XX	XX	XX	XX	XX	XXX	XXX	XX	XX	XX	XXX
Design												
RF Orifice plate	RF1											
RF 2-way Orifice Plate	RF2											
RTJ Orifice Plate- M	RJ1											
Wafer Orifice Plate	RW1											
Holder & Orifice Plate	RH1											
RF Restriction Orifice plate single hole	RF3											
RF Restriction Orifice plate multi hole	RF4											
RTJ Restriction Orifice plate single hole	RJ2											
RTJ Restriction Orifice plate multi hole	RJ3											
RF Restriction multi stage single hole	RF5											
RF Restriction single stage multi hole	RF6											
RTJ Restriction Orifice multi stage single hole	RJ4											
RTJ Restriction Orifice single stage multi hole	RJ5											
Plate Size												
DN 15 (1/2 in.)		15										
DN 20 (3/4 in.)		20										
DN 25 (1 in.)		25										
DN 32 (11/4 in.)		32										
DN 40 (11/2 in.)		40										
DN 50 (2 in.)		50										
DN 65 (21/2 in.)		65										
DN 80 (3 in.)		80										
DN 90 (31/2 in.)		90										
DN 100 (4 in.)		100										
DN 125 (5 in.)		125										
DN 150 (6 in.)		150										
DN 200 (8 in.)		200										
DN 250 (10 in.)		250										
DN 300 (12 in.)		300										
DN 350 (14 in.)		350										
DN 400 (16 in.)		400										
DN 450 (18 in.)		450										
DN 500 (20 in.)		500										
DN 550 (22 in.)		550										
DN 600 (24 in.)		600										
DN 650 (26 in.)		650										
DN 700 (28 in.)		700										
DN 750 (30 in.)		750										
DN 800 (32 in.)		800										
DN 850 (34 in.)		850										
DN 900 (36 in.)		900										
DN 950 (38 in.)		950										
Others		999										

Ordering Information

Plate Material											
316 / 316L stainless		I1									
310 stainless steel		I2									
321 stainless steel		I3									
Alloy 625		I4									
Alloy 800		I5									
Alloy C276		I6									
PVC		P1									
GRPE		P2									
PVDF		P3									
Polyethylene		P4									
Other		P5									
Line Sch.											
Schedule 10S			A1								
Schedule 30S			A2								
Schedule 40S			A3								
Schedule STD			A4								
Schedule 80S			A5								
Schedule XS			A6								
Schedule 100			A7								
Schedule 120			A8								
Schedule 140			A9								
Schedule 160			B1								
Schedule XXS			B2								
Others			XX								
Rating											
ANSI Class 150				A1							
ANSI Class 300				A2							
ANSI Class 600				A3							
ANSI Class 900				A4							
ANSI Class 1500				A5							
ANSI Class 2500				A6							
PN 10				P1							
PN 16				P2							
PN 25				P3							
PN 40				P4							
PN 63				P5							
PN 100				P6							
PN 160				P7							
Flanged Material											
Not Applicable					I0						
316 / 316L stainless					I1						
310 stainless steel					I2						
321 stainless steel					I3						
Carbon Steel A105					I4						

Ordering Information

Alloy 400		I5						
Alloy 625		I6						
Alloy 800		I7						
Alloy C276		I8						
PVC		P1						
GRPE		P2						
PVDF		P3						
Polyethylene		P4						
Other		P5						
Drain / Vent hole								
Drain hole (gas applications)			DH1					
Vent hole (liquid applications)			DH2					
Not Applicate			DH3					
Plate Thickness								
3 mm				HA1				
4 mm				HA2				
6 mm				HA3				
8 mm				HA4				
10 mm				HA5				
15 mm				HA6				
Others				HA7				
Transmitter								
Not Applicable					0			
4~20 mA with Display, 24VDC Loop					10			
4~20 mA without Display, 24VDC Loop					11			
4~20 mA HART with Display, 24VDC Loop					20			
4~20 mA HART without Display, 24VDC Loop					21			
Other					30			
Bolt & Nut								
Not Applicable						0		
C.S A192/A193						CS		
C.S A192/A193 Cold Galvanized						CG		

Ordering Information

C.S A192/A193 ETFE Coated		CE		
C.S A192/A193 Zinc Reach		CZ		
Stainless Steel 304 A192/A193		S1		
Stainless Steel 316 A192/A194		S2		
Other		O1		
Certification				
Material certificates			C0	
Material NACE MR0175			C1	
Material NACE MR0103			C2	
100% dimensional check			C3	
Hardness survey			C4	
Impact testing @ –196 °C (–320.8 °F)			C5	
Others			C6	
Added requirements				
Manufactured to customer drawing				DW
Special device				SP
Gate Valve 1/2" Carbone Steel				GV1
Gate Valve 1/2" Stainless Steel 304				GV2
Gate Valve 1/2" Stainless Steel 316				GV3
Ball Valve 1/2" Stainless Steel 304				BV1
Ball Valve 1/2" Stainless Steel 316				BV2
Niddle Valve 1/2" Stainless Steel 304				NV1
Niddle Valve 1/2" Stainless Steel 316				NV2
Nipple Carbone Steel 1/2*1/2" Male				NP1
Nipple Stainless Steel 304, 1/2*1/2" Male				NP2
Nipple Stainless Steel 316, 1/2*1/2" Male				NP3
Compress Fitting 1/2" to tube				CF
C.S Gasket SPW Single ring				CG1
C.S Gasket SPW +inner ring				CG2
Stainless Steel Gasket SPW Single ring				SG1
Stainless Steel Gasket SPW + Inner ring				SG2
Jack Screw Bolt				GS
Tap Orientation 90°C				TO1
Tap Orientation 45°C				TO2
Others				OT

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