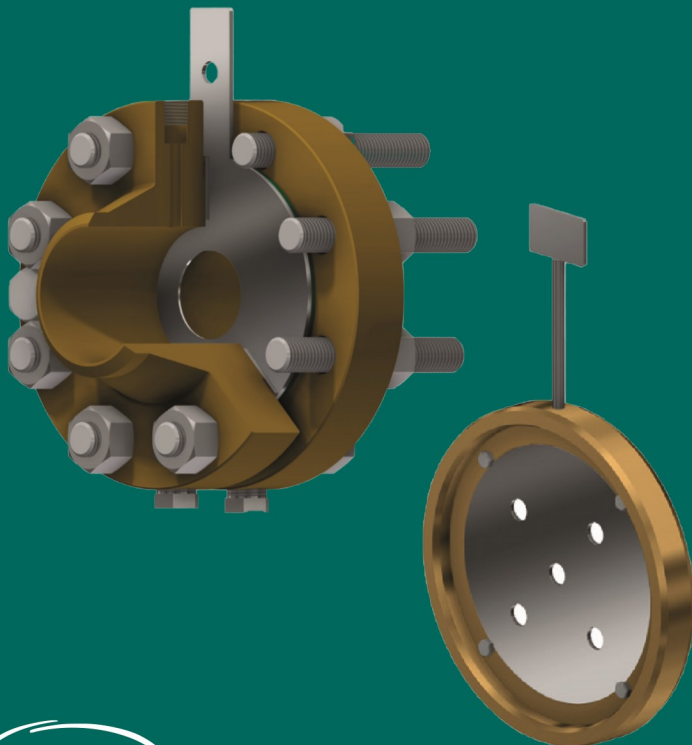




FLOW MEASURING WITH ORIFICE



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Introduction

Restriction orifice 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 measured and also limited to a certain value, irrespective of changes in the downstream pressure.

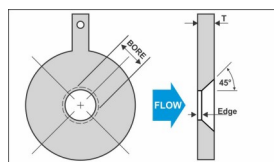
Applications

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) upstream of the plate and the low pressure (outlet or downstream) tapping is considered to be $8D$ downstream of the plate.

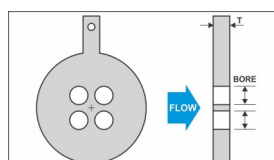
Orifice plate bore profiles

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

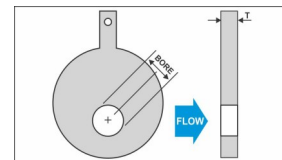
- circular bore, single square-edged hole, concentric with the pipe



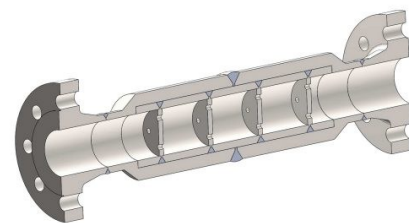
- circular bore, multiple square-edged holes across the plate face



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



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





Specification

Materials

Plates:

Standard: 316/316L stainless steel

Other plate materials:

PVC

304 S.S.,

310 S.S.,

321 S.S.,

Alloy C276,

Titanium.

Gaskets:

Spiral Wound

Maximum working pressure

Limited by the process application flange rating.

Maximum working temperature

Dependent on the material selection and process application.

Pipeline size range (typical)

DN15 to 900 ($\frac{1}{2}$ 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 pro-

cess application and design conditions.

Calculation standards

R W Miller

ISO 5167

AGA Section 8

Design standards

Plate: Preferred – Aramak

Pipeline installation

Facing:

Raised face; flat face; RTJ (octagonal profile)

Rating standards:

ASME 150; 300; 400; 600; 900;

1500; 2500 lb.

Plates to fit between the flanges of other standards can be supplied



Up-down stream lengths

A symmetrical flow profile is required for accurate measurement, and is ensured by building up 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, bends, elbows, etc. The flow settles down again when it passes through a straight section of the 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 profile at the pressure tapping point. Therefore try to keep the 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

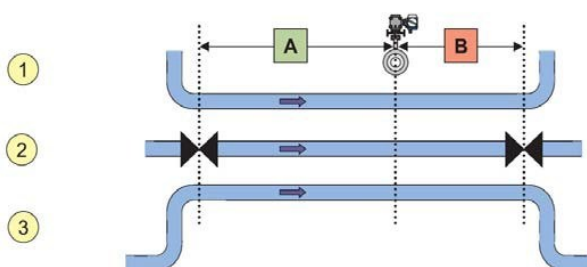
these must be:

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
	$\beta = 0,1$	$\beta = 0,5$	$\beta = 0,75$	$\beta = 0,1$	$\beta = 0,5$	$\beta = 0,75$		
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 variables of flow q . If there are no strong fluctuations in pressure and temperature, then the accuracy of the differential pressure 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.

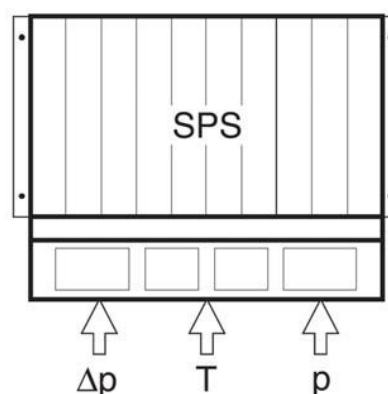
The following parameters are required for compensation:

- 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 Code Information

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