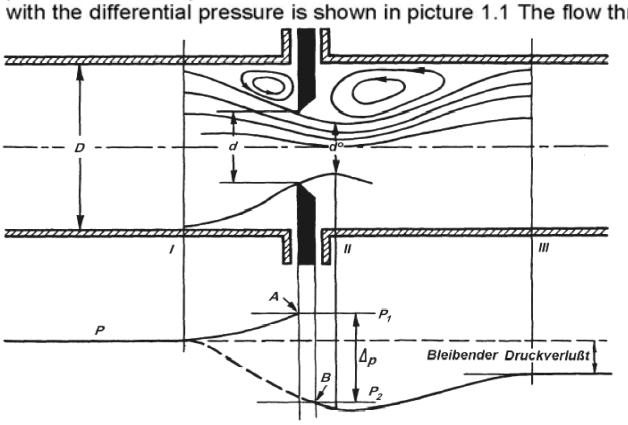
Primary differential pressure devices

Prinziple of measurement

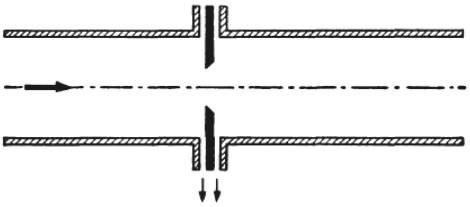
At this method a cross - section reduction becomes fitted into a pipe. The flow velocity is increased on this restriction point and the pressure energy becomes lower. A pressure loss arises in this point, which is described as differential pressure.
The differential pressure is a measure for the quantity of fluid which is streaming in a time unit. The measuring of the differential pressure makes it possible to determine the flow on reason of this relation. The flow-picture and pressure relation in accordance with the differential pressure is shown in picture 1.1 The flow through the cross-section of the measuring-opening with the pipe diameter D become restricted to $d^{\prime}$. The pressure-difference at the measuring point is shown schematically in the picture 1.1. In front of the measuring opening an increase of the static pressure p arises at the pipe wall on the jam-pressure p_1 (at point A), while the pressure in the pipe axis of p on p_2 becomes reduced (at point B, cross-section II). From this results the differential pressure $\Delta P = P_1 - P_2$.
In the cross-section III the flow beam has spread again, the initial pressure however is not reached again. A permanent pressure-loss arises.



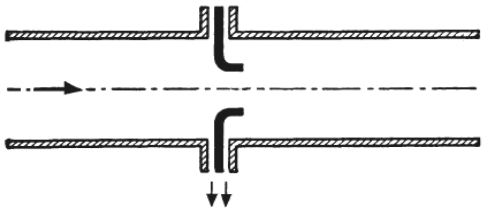
Picture 1.1 Flow and pressure loss at an norm orifice plate

Types of the primary differential pressure devices

As a differential pressure device, a orifice is installed into the pipe in form of a plate or an adapter with an opening which is smaller than the cross-section of the pipe in this place. At pipes with circular cross - section the opening is alsousually circular and lies centrally to the pipe axis. The pictures 2.1 to 2.4 show the basic forms of the orifice plates. A special form is the classic Venturi-pipe (picture 2.5) as well as the segment orifice (picture 2.6).



Picture 2.1 Norm orifice plate



Pictute 2.2 Norm nozzle

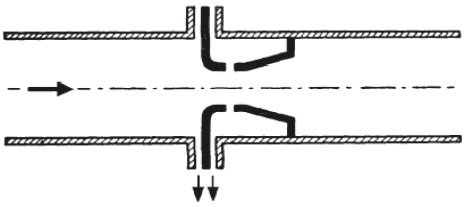


Bild 2.3 Norm Venturi nozzle, short type

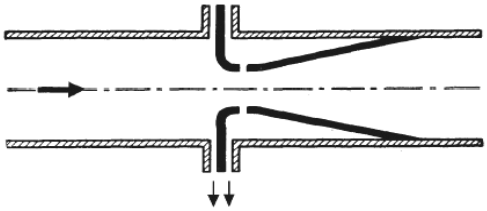
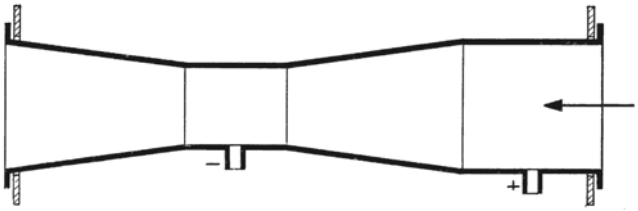
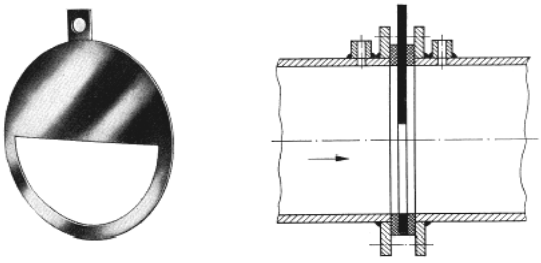


Bild 2.4 Norm Venturi nozzle, long type



Picture 2.5 Classic Venturi pipe

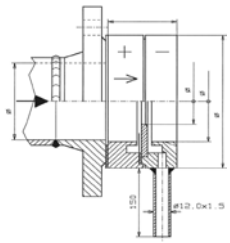


Picture 2.6 Segment orifice plate installed between flanges

Primary differential pressure devices

Overview - primary devices to installation between flanges and welding in pipes

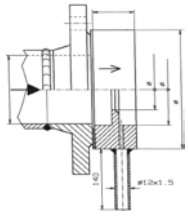
Orifice plate with annular chamber



Nominal diameters DN 50 to DN 1600

Nominal pressures PN 6 to PN 160

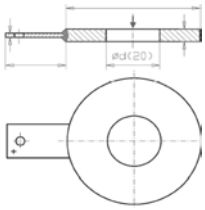
Orifice plate with single tappings



Nominal diameters DN 50 to DN 1600

Nominal pressures PN 6 to PN 400

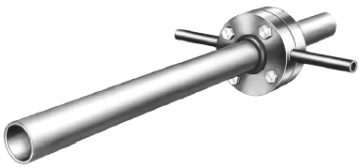
Orifice plate

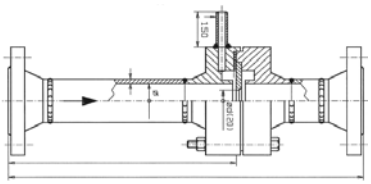


Nominal diameters DN10 to DN 1600

Nominal pressure PN 6 to PN 400

Metering pipe with weld ends or for installation between flanges

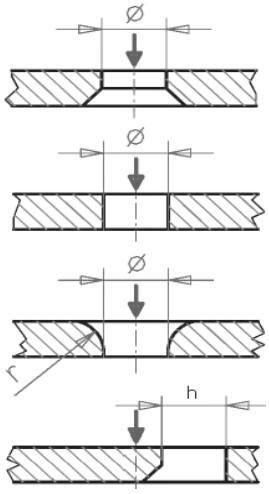




Nominal diameters DN 6 to DN 50

Nominal pressure PN 6 to PN 400

Shapes of the orifice disks



The differential pressure devices are manufactured according to DIN EN ISO 5167 According to this, the application range of the standard orifice disk appreture form A is limited by the Reynolds number. The limits depends on the diameter ratio ß = d/D. (D = internal ∅, d = ∅ of pipe) The orifice disk form B is used for measurement in both flow directions. The form C = quadrant disk and D = segment disk become used at special applications The calculation of the orifices will be carried out in accordance with EN ISO 5167-1 : 1995/A1

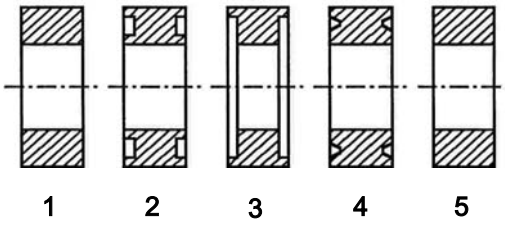
Flow velocity at differential pressure devices

The flow velocity are calculated. The following flow velocities shouldn't be exceeded:

Water (liquids)		
Pump sucking lines	:	bis 2 m/sec.
Pump pressure lines		
Feet water lines	:	bis 5 m/sec.
Dampf		
Saturated steam lines	:	bis 30 m/sec.
Overheated steam lines	:	bis 70 m/sec.
Gases		
Gas lines	:	bis 15 m/sec.

Primary differential pressure devicesr

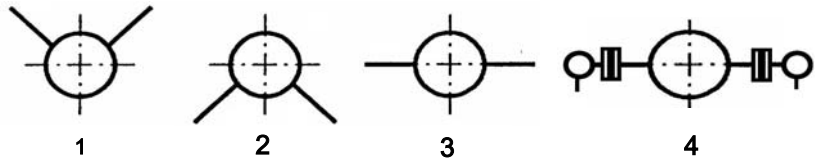
Installation - sealing faces of the orifice plates



1	Sealing face plane	DN 2526, to PN 400
2	Sealing face with groove	DIN 2512, to PN 160
3	Sealing face with recess	DIN 2513, to PN 100
4	Sealing face	ANSI B 16.5 RJ
5	Sealing face	ANSI B 16.5 RF

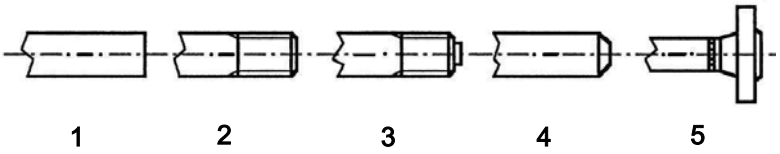
Position of tapping pipes

The arrangement of the tapping pipes depends of the fluid, gas or steam as well of the following equipment like equalizing vessels (at steam applications), stop valves etc. The length of the tapping pipes depends of the temperature of measuring substance (heat insulation) and the nominal diameter of pipe. The position of the tapping pipes depends of the measuring substance and the flow direction. At steam measurings equalizing vessels are used. The vessels must lie on same height. In case of horizontal steam pipe straight tappings are arranged in opposition of each other, in case of vertical and inclined steam pipes, the lower tapping is bended upwards so that the connection flanges and equalizing vessels are also at the same height



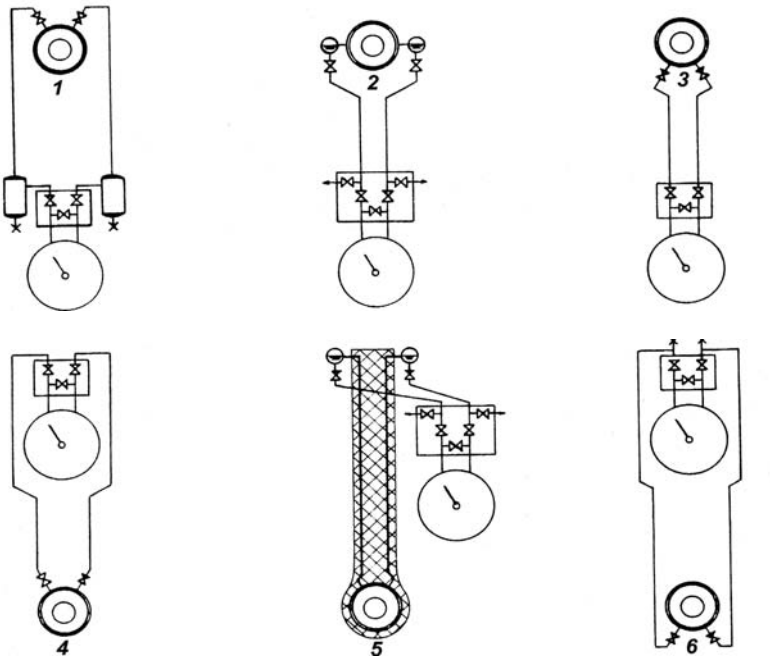
1 Air - Gas
2 Fluids
3 Gas -Steam
4 Steam

Tapping pipe connections



1 smooth
2 male thread
3 thread connection
4 weld connection
5 flange connection

Measuring connections



1 Air-gas measuring, measuring device below the pipe, with 3-valve manifold and drenage vessels

2 Steam measuring, measuring device below the pipewith equalizing vessels and 5-valve manifold

3 Liquid measuring, measuring device below the pipe, with 3-valve manifold

4 Air-gas measuring, measuring device above the pipe, with 3-valve manifold

5 Steam measuring, measuring device above the pipe, with equalizing vessel 5-valve manifold and isolated impuls lines

6 Liquid measuring, measuring device above the pipe, with 3-valve manifold and ventilation valves