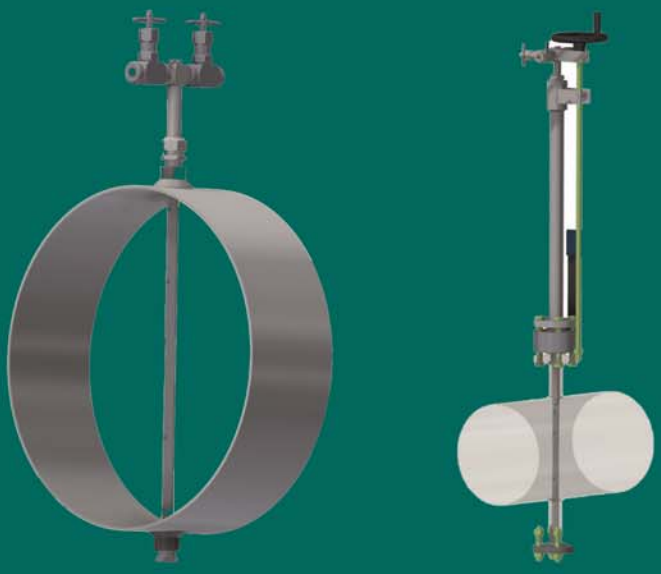
FLOW MEASURING
WITH PITOT TUBE



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Introductions

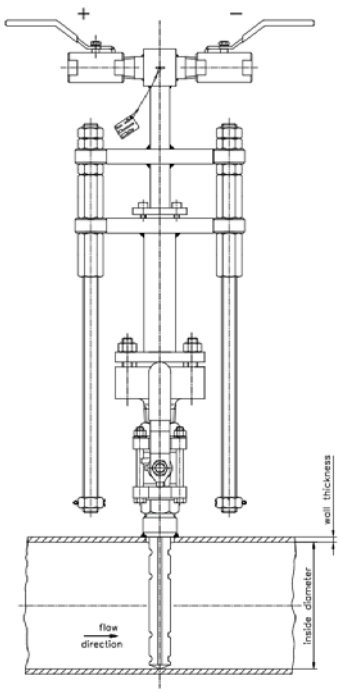
Pitot tubes are classified as Differential Pressure sensors for flow measurement.

The measuring principle of the pitot tube utilizes the differences between the pressure ridge on the upstream side of a bluff body and the static pressure on its down stream side.

Applications

Pitot tube sensors are mainly used to measure the volumetric flow of liquids, gases and steam in closed pipes ranging from 3“ to 480“ (DN 80 to DN 12000).

Examples of their applications are precise volumetric flow measurement in batch processes, continuous measurement of liquid ingredients in the process industry, fuel, air, steam and gases as primary energy source as well as in control functions requiring a high degree of stability and repeatability.



The averaging pitot tube flowmeter requires the least installation effort of all DP flowmeters. It is cost-effective and suitable for a variety of applications. Its low remaining pressure loss and bi-directional flow capabilities make it the preferred instrument for water, sea water, condensate, cooling water, crude oil, saturated and superheated steam, nitrogen, combustion gases, ventilation air and many other liquids and gases.

Specification

Fluids :
Liquids, gases and saturated steam

Line sizes :
3“ to 480“ (DN 80 to DN 12000)

Probe
25 or 35 mm (diameter probe with optional end support)

Process connection
- Threaded G or NPT
- Flanged DN25 (1 in.) to DN 80 (3 in.) to ANSI 150RF, 300RF or NP10/16, NP25/40

Construction materials Probe
316 stainless steel
304 Stainless Steel
Monel 400
Has alloy C276
Titanium

Isolating Valve (Niddle or Ball)
316 stainless steel
304 Stainless Steel
Monel 400
Has alloy C276
Titanium

Seals
PTFE

Flange
316 stainless steel
304 Stainless Steel
Monel 400
Has alloy C276
Titanium

Weld adaptor
316 stainless steel
304 Stainless Steel
Monel 400
Has alloy C276
Titanium

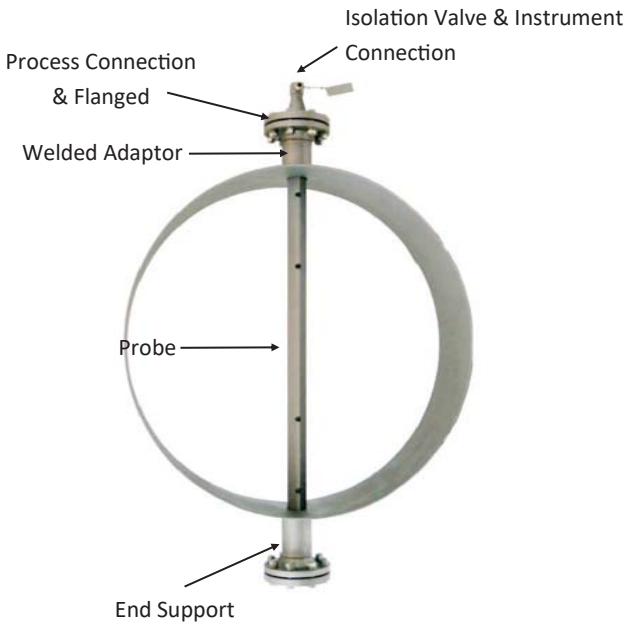
Output signal
- Two-wire, 4 to 20 mA, selected for square-root output
- Low flow cut-off facility
- HART® communication provides digital process variable (%, mA or engineering units) superimposed on 4 to 20 mA signal, with protocol based on Bell202 FSK standard
- Optional Profibus PA, Foundation Fieldbus or Modbus communications

Accuracy Uncalibrated
±1.15 % of actual flow

Flow range
8:1

Maximum pressure
20 Bar @ 45 °C

Humidity
Relative humidity: up to 100 %



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”).

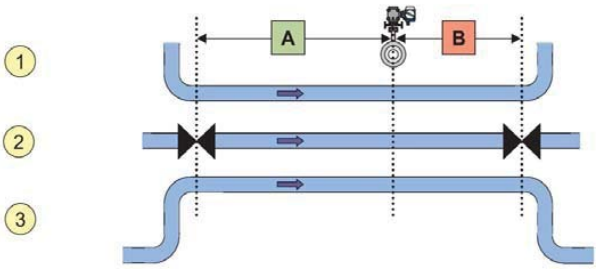
The standard prescribes the up- and downstream lengths to maintain the flow profiles. Use the diagram and the table to determine how large these must be:

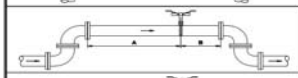
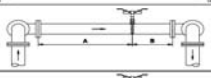
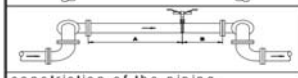
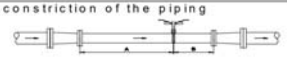
A Upstream; B Downstream

1)90° elbow

2)Valves open

3)2x 90° elbows



D = pipe diameter	A = upstream	B = downstream
	7	3
	9	3
	17	4
	18	4
constriction of the piping 	7	3

Removal without process shut-down

All Tapping of the Pitot-sensor allow the removal under pressure. These features are valuable in applications requiring

- periodic check of the flow sensor's measurement accuracy
- an exchange after extended service in abrasive fluids or
- cleaning during normal maintenance operations

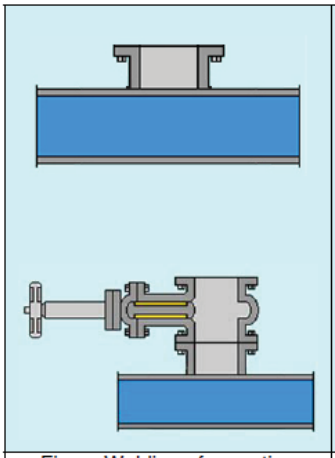


Fig. a: Welding of mounting stud with mounting flange to the pipe (upper picture) and mounting of the isolation valve to the mounting stud (lower picture)

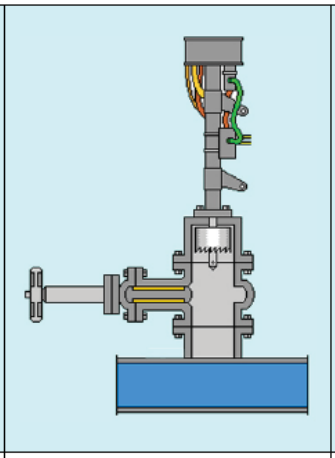


Fig. b: Mounting of the tapping tool

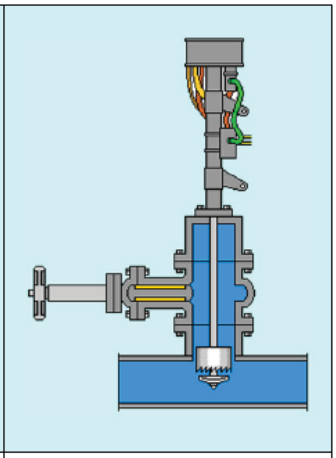


Fig. c: Drilling the pipe

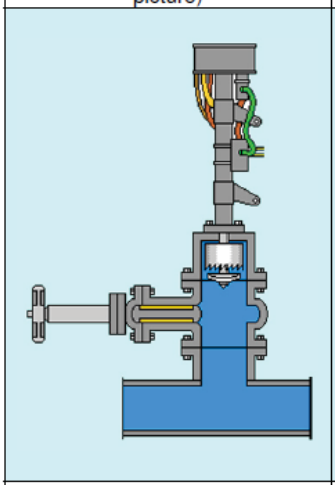


Fig. d: Pull back of tapping tool

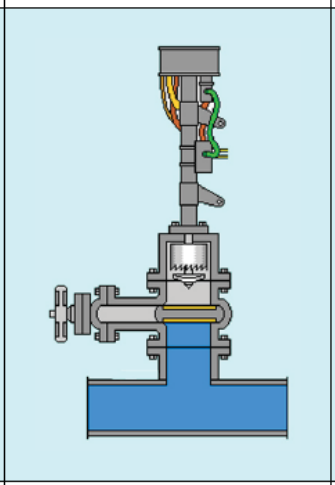


Fig. e: Closing of isolation valve and removal of tapping tool

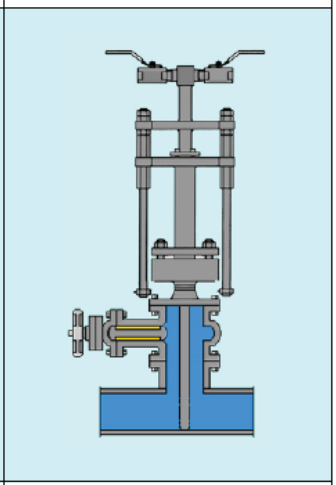


Fig. f: Mounting of the Tapping-Sensor, opening of the isolation valve and insertion of the pitot tube sensor

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.

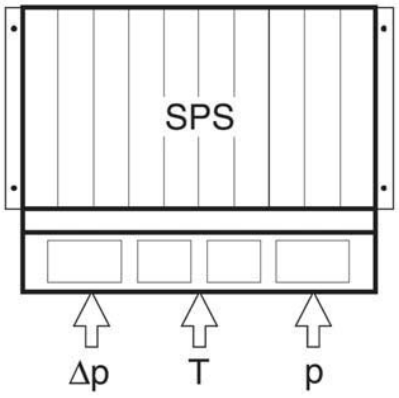
With some applications, particularly in the gas and steam sectors, a special compensation is required. A change in pressure and/or temperature leads to a change in density. If this is not taken into account, total accuracy may be reduced.

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

PTT-	XXX	XXXX	XX	XX	XX	XX	XXX	XXX	XX	XX	XX	XXX	XX	XXX
Design														
Retractable without End Support	R1													
Retractable with End Support	R2													
None Retractable without End Support	S1													
None Retractable with End Support	S2													
Pipe Diameter														
..... (mm, inside Diameter)		XXXX												
Sensor Material														
316 / 316L stainless			I1											
310 stainless steel			I2											
304 stainless steel			I3											
Alloy 600			I4											
Titanium			I5											
Alloy C276			I6											
Other			P5											
Pipe thickness														
..... (mm, Pipe Thickness)				XXX										
Connection 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									
Connection Size														
2 inch, thread						I0								
3 inch, thread						I1								
2" Flanged						I2								
3" Flanged						I3								
4" Flanged						I4								
Other						P5								
Welded Coupling														
Not Applicable							I0							

Ordering Information

316 / 316L stainless		I1							
310 stainless steel		I2							
321 stainless steel		I3							
22 % Cr duplex		I4							
Alloy 400		I5							
Alloy 625		I6							
Alloy 800		I7							
Alloy C276		I8							
Carbone Steel		I9							
Other		P5							
RTD Sensor									
Not Applicable			0						
Included			1						
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					
Mounting									
Horizontal					H				
Vertical					V				
Instrument Tapping									
1/2" Male						10			
1/2" Female						11			
1/4" Male						12			
1/4" Female						13			
Flanged 1/2" 150#						14			
Flanged 1" 150#						15			
Other						O1			
Isolating Valve									
Not Applicable							0		
Ball Valve Carbone Steel							BC		
Ball Valve Stainless Steel							BS		
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	

Ordering Information

Added requirements		
Manufactured to customer drawing		DW
Special device		SP
Isolating Gate Valve 1/2" Carbone Steel		GV1
Isolating Gate Valve 1/2" Stainless		GV2
Isolating Gate Valve 1/2" Stainless		GV3
Isolating Ball Valve 1/2" Stainless Steel 304		BV1
Isolating Ball Valve 1/2" Stainless Steel 316		BV2
Isolating Niddle Valve 1/2" Stainless Steel 304		NV1
Seal pot		SP
5-way Valve Manifold		MF
Compress Fitting 1/2" to tube		CF
Others		OT

Contact us

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