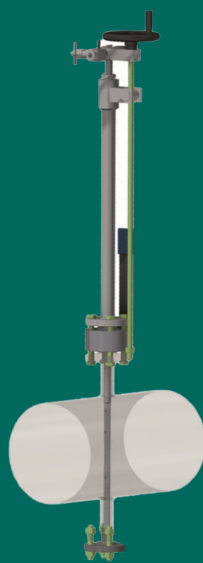
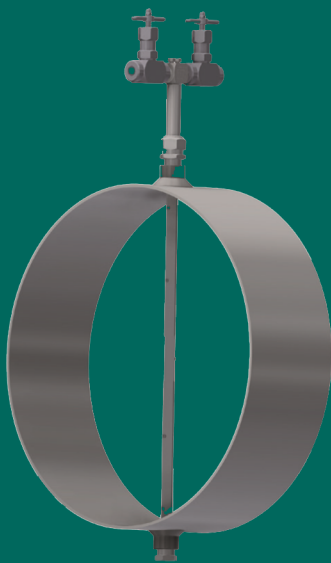




FLOW MEASURING WITH PITOT TUBE





Introduction

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

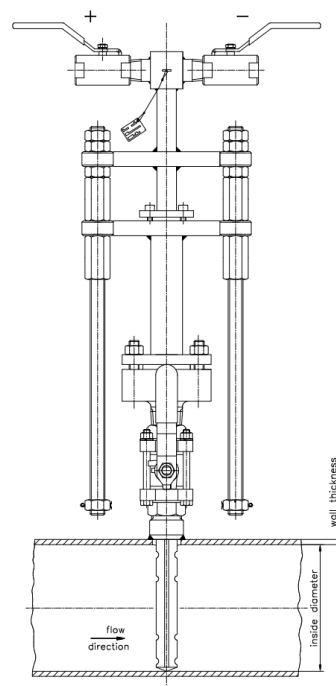
The measuring principle of the pitot tube utilizes the differences between the pressure ridge on the upstream side of a bluff body and the static pressure on its down stream side.

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
Hastelloy C276
Titanium

Isolating Valve (Niddle or Ball)

316 stainless steel
304 Stainless Steel
Monel 400
Hastelloy C276
Titanium

Seals

PTFE

Flange

316 stainless steel
304 Stainless Steel
Monel 400
Hastelloy C276
Titanium

Weld adaptor

316 stainless steel
304 Stainless Steel
Monel 400
Hastelloy 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

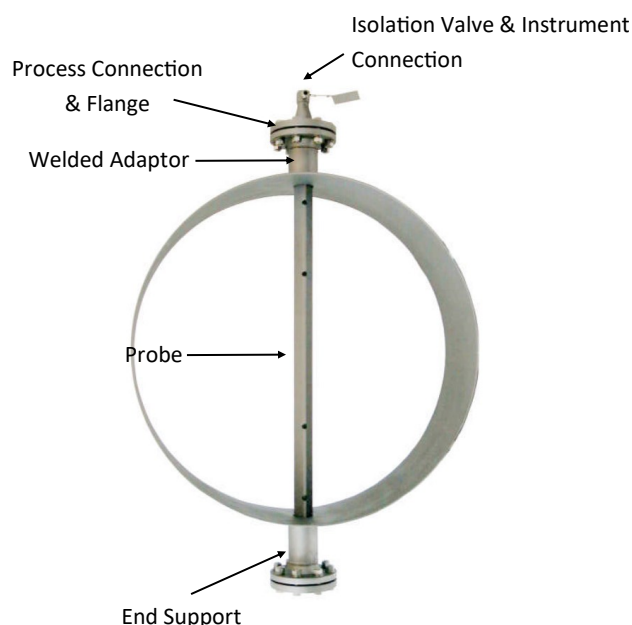
8:1

Maximum pressure

20 Bar @ 45 °C

Humidity

Relative humidity: up to 100 %





Up-down stream lengths

A symmetrical flow profile is 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'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 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").

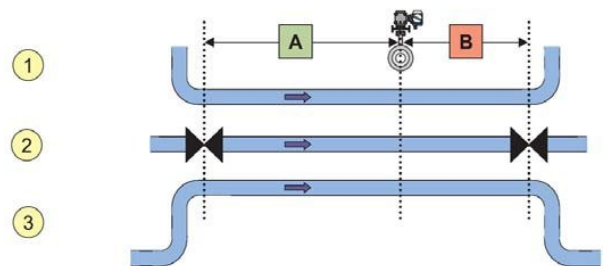
The standard prescribes the up- and downstream lengths to maintain the flow profiles. Use the diagram and the table to determine how large these must be:

A Upstream; B Downstream

1) 90° elbow

2) Valves open

3) 2x 90° elbows

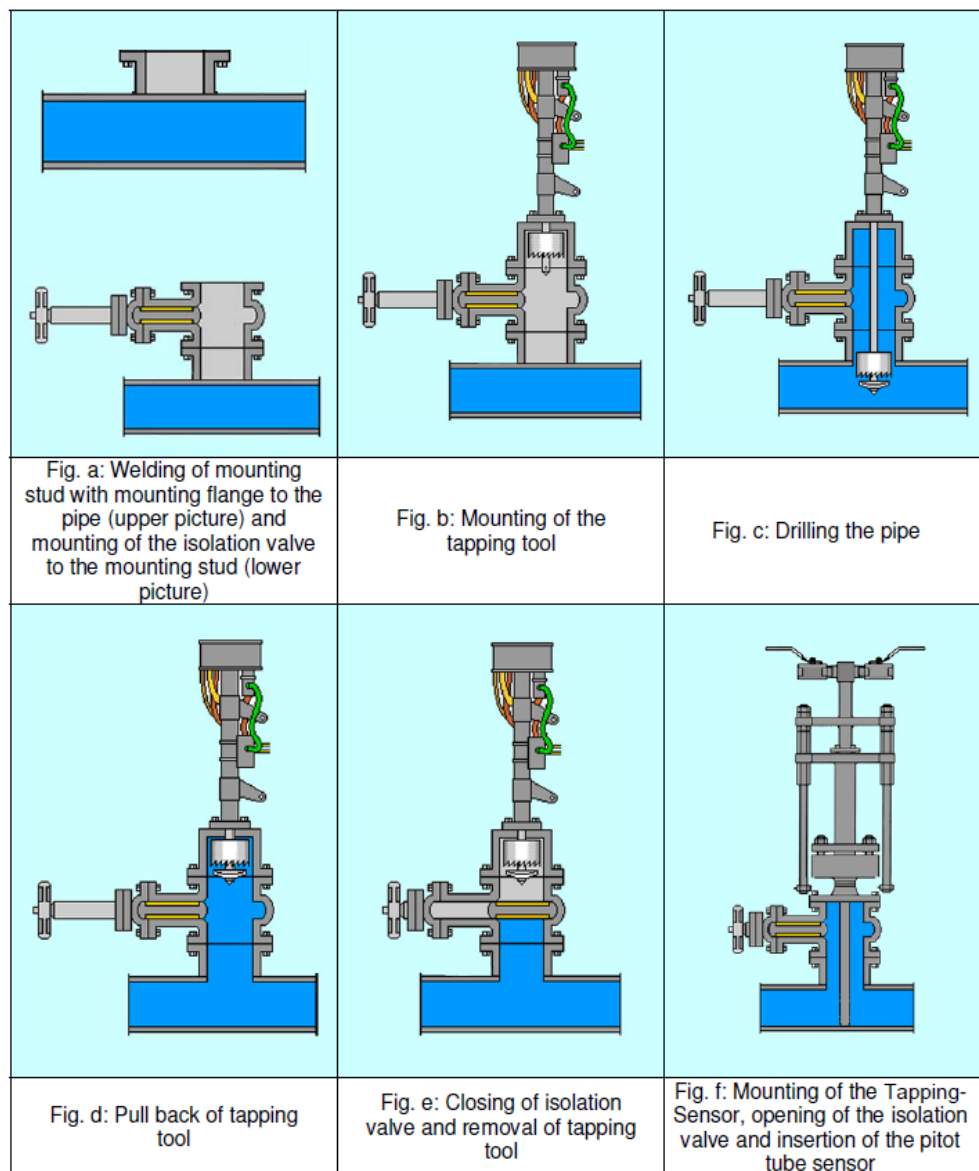


D = pipe diameter	A = upstream	B = downstream
	7	3
	9	3
	17	4
	18	4
constriction of the piping	7	3



Removal without process shut-down

- All Tappings of the Pitot-tube sensor allow the removal under pressure. These features are valuable in applications requiring
- an exchange after extended service in abrasive fluids or
 - cleaning during normal maintenance operations
 - periodic check of the flow sensor's measurement accuracy





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 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.

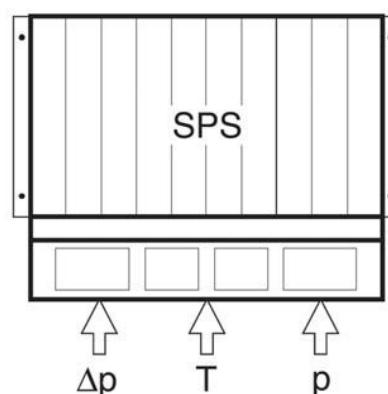
The following parameters are required for compensation:

- 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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