

Averaging Pitot tube is a multiport self averaging flow meter. It is a primary element for flow measurement of gas, liquid, vapour in pipelines and ducts based on the principle of measurement of differential pressure created when an obstruction is placed in the fluid flow due to increase in fluid velocity.

## Principle of operation

Averaging pitot tube is nothing but an element which is suppose to measure the flow rate and offer the differential pressure to the flow meter mounted on top. The averaging pitot tube works on the 80% velocity of the media rate at the top of the centre line in a velocity gradient in a pipe line or duct and 70% velocity of the media in the below portion of the centre line. it does not work on the centre line velocity which is 100% for the media as what a orifice, a ventury and nozzle, and many more flow meter works. Thus the velocity of the media is perfectly averaged out and offered for DP measurement in the flow meter.

The differential pressure created by the dynamic force at the inlet and static force at the output, creates the average at the out put to enable the flow rate measurement more accurately with lesser free length

For bidirectional measurement, the concept is completed by holes at the other side for measurement, at 1.5% lesser than the length at the dynamic side of the unidirectional flow measurement device.

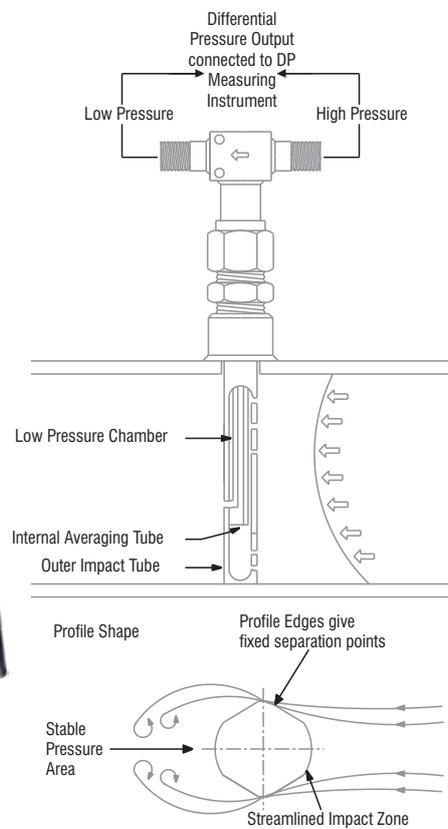
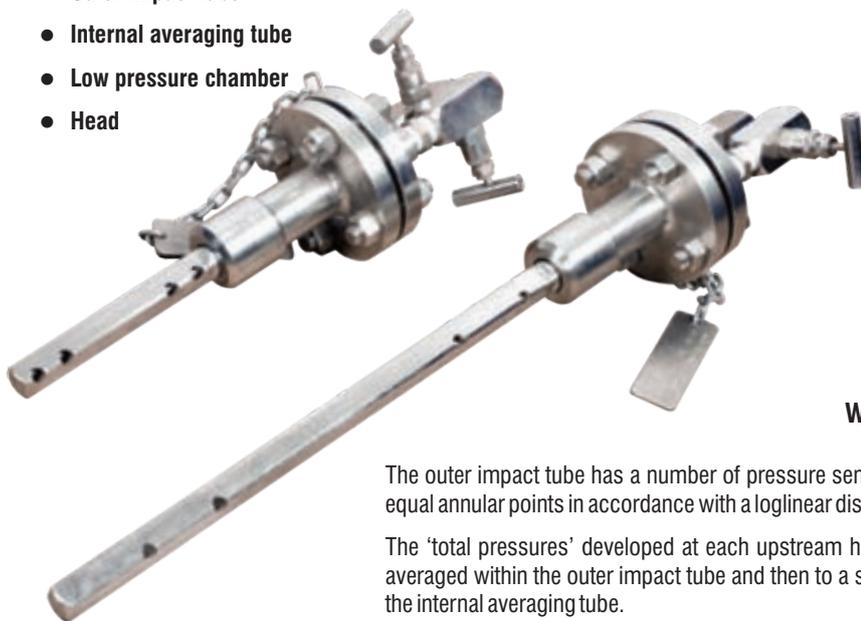
## Features:

- Unique profile shape enables high flow rate turn down
- Dual averaging for better accuracy
- Suitable for Liquid ,gas and steam flow measurement
- Repeatability of measurement  $\pm 0.1 \%$
- Short upstream and downstream straight pipe lengths
- Long term accuracy unaffected by wear.

Averaging pitot tubes are generally used for large line sizes or ducts where other primary devices become relatively expensive.

Averaging Pitot tube comprises of following components:

- **Outer impact tube**
- **Internal averaging tube**
- **Low pressure chamber**
- **Head**



**Fig. 7.1**

## Working Principle of Averaging Pitot Tube

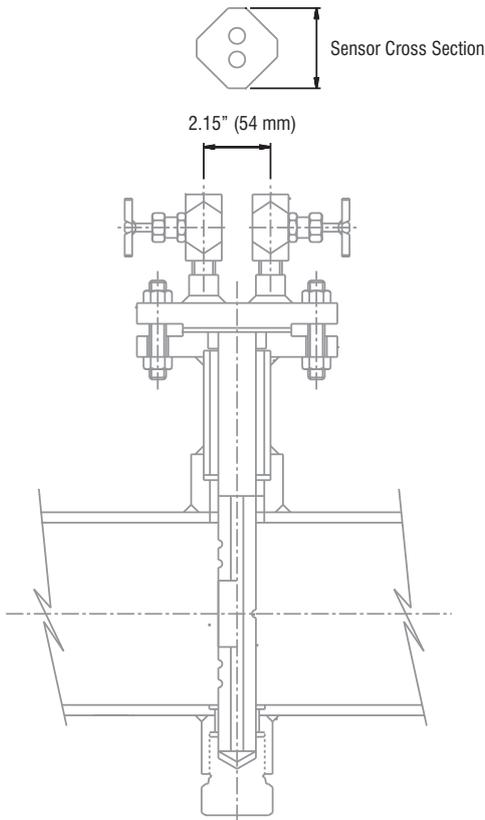
The outer impact tube has a number of pressure sensing holes facing upstream which are positioned at equal annular points in accordance with a loglinear distribution.

The 'total pressures' developed at each upstream hole by the impact of the flowing medium are firstly averaged within the outer impact tube and then to a second order (and more accurately) averaged within the internal averaging tube.

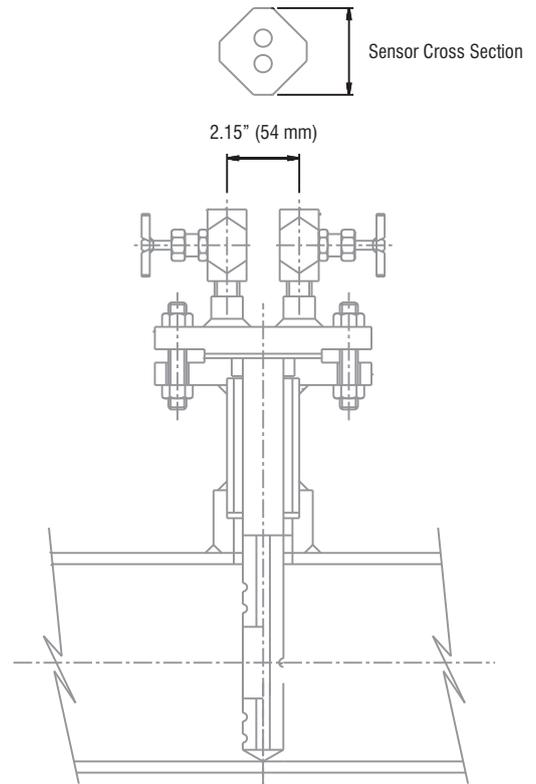
This pressure is represented at the head as the high pressure component of the DP output. The low pressure component is generated from a single sensing hole located on the downstream side of the outer impact tube.

Stable flow coefficient which is the result of typical diamond shape, makes it a reliable flow measuring primary flow element.

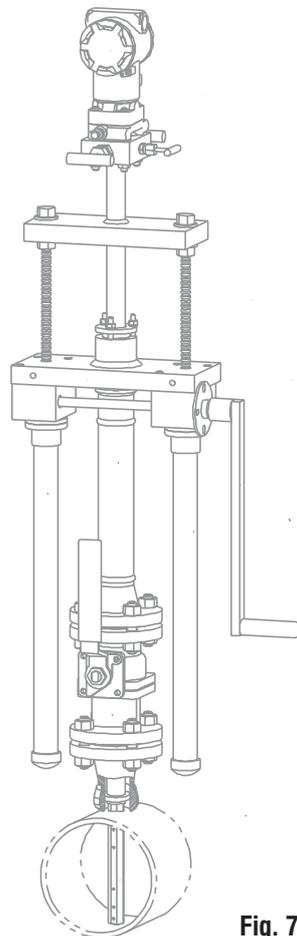
Simple and inexpensive, long term accuracy within acceptable limits over wide range of flow, low permanent pressure loss & minimum operating cost makes it ideal choice of any design engineer.



**Fig. 7.2**  
**Averaging Pitot Tube with End Support**

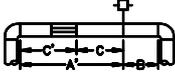
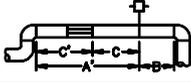
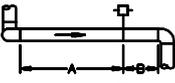
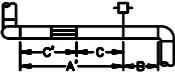
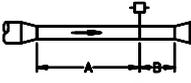
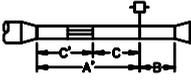
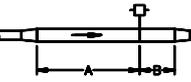
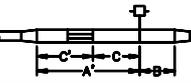
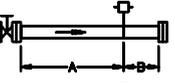
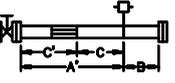


**Fig. 7.3**  
**Averaging Pitot Tube without End Support**



**Fig. 7.4**  
**Annubar with Gear Drive Mechanism**

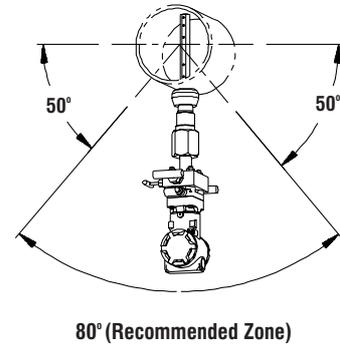
## Straight Run Requirements

	Upstream dimension					Downstream Dimensions	
	Without vanes		With vanes				
	In plane A	Out of plane A	A'	C	C'		
1.		8	10	—	—	—	4
		—	—	8	4	4	4
2.		11	16	—	—	—	4
		—	—	8	4	4	4
3.		23	28	—	—	—	4
		—	—	8	4	4	4
4.		12	12	—	—	—	4
		—	—	8	4	4	4
5.		18	18	—	—	—	4
		—	—	8	4	4	4
6.		30	30	—	—	—	4
		—	—	8	4	4	4

## Installation, Location and Orientation

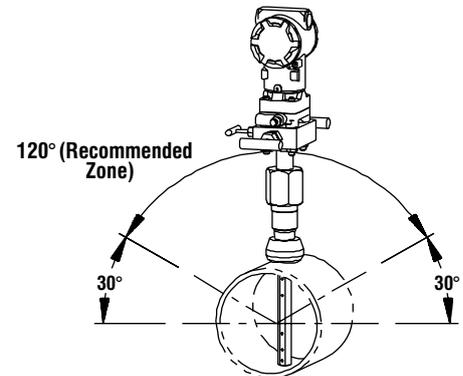
**Annubar Orientation** Proper venting or draining must be considered when selecting a location. For liquid service, mount the side drain/vent valve upward; this allows gases to vent. For gas service, mount the drain/vent valve down to allow any accumulated liquid to drain. In steam service, fill lines with water to prevent contact of the live steam with the electronics; condensate chambers are not needed because the volumetric displacement of the electronics is negligible.

**Horizontal Pipe: Steam Application** Due to the possibility of air getting trapped in the probe, the Annubar should be located per as per the drawing below. The area between 0° and 50° (50° angle) should not be used unless full bleeding of air from the probe is possible. Figure 7.5 illustrates the recommended location of the flowmeter.



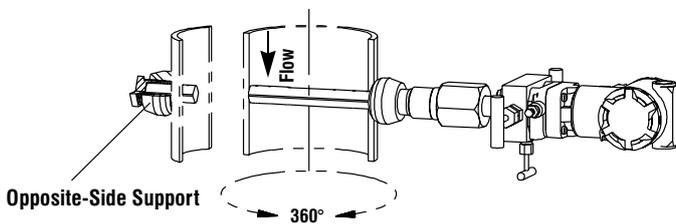
**Figure 7.5**  
Liquid or Steam Service In a horizontal Pipe

**Horizontal Pipe: Air and Gas Applications** The Annubar should be located on the upper half of the pipe, at least 30° above the horizontal line. Figure 7.6 illustrates the recommended location of the flowmeter.



**Figure 7.6**  
Air and Gas Applications in a Horizontal Pipe.

**Vertical Pipe: Gas, and Steam Applications** Liquid, Air, The Annubar can be installed in any position around the circumference of the pipe, provided the vents are positioned properly for bleeding or venting. Vertical pipe installations require more frequent bleeding or venting depending on the location. Figure 7.7 illustrates the recommended location of the flowmeter.



**Figure 7.7**  
Liquid, Air, and Gas Applications in a Vertical Pipe.

Remote mounting is required for steam installations; see Figure 7.8

**Figure 7.8.**  
Steam Service in a Vertical Pipe.

