PLATON

FLOW

Operation & Maintenance Manual **OMM1036**

Flo-bar - Averaging Pitot Tube Flowmeter

INLINE

The Platon Flo-Bar™ range of Averaging Pitot Tubes, offer a family of flow measuring devices which cover a wide range of sizes and process applications.

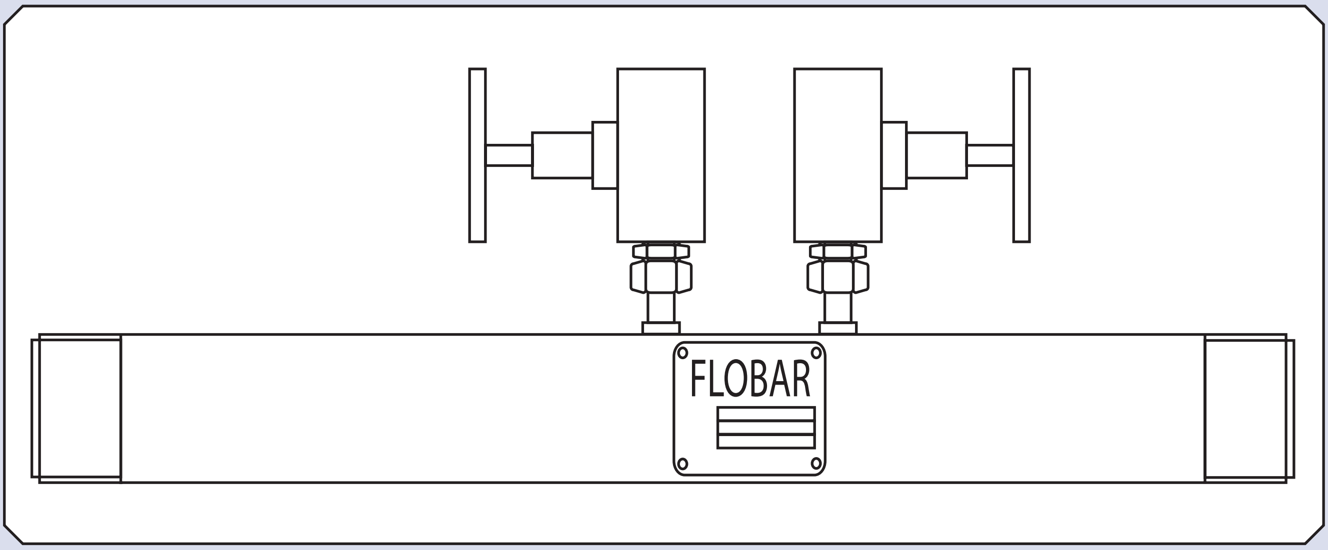
The Flo-Bar™ is a rugged design with all 316 stainless steel construction being the standard material of manufacture, although other materials are available; in addition the probe is all Electron beam welded. The generated differential pressure follows a true square root law in respect to the flowing velocity.

On the 3 valve block version, a three valve manifold-block forms an integral part of the probe head block, thus making it unnecessary for a separate manifold block to be purchased. This head-block also allows a differential pressure transmitter to be mounted directly onto the probe without any other mounting hardware being added.
On the plain block version, the probe head terminates in a plain block with two $\frac{1}{4}$" NPT^{MALE} side mounted process signal connections.

The mounting onto the process line can be by either locking gland, flange, or 'Hot-Tap' method. The unique Flo-Bar™ probe geometry ensures that and constant and stable flow signal is generated over a wide flow range.

The "In-line" version of the Flo-Bar is in the form of a pipe section which houses the Pitot heads. This type of device may be used on line sizes up to 2" (50mm).

For insertable Flo-Bars, please refer to OMM1035
For In-line Flo-Bars, please refer to OMM1036



INSTALLATION

GASES

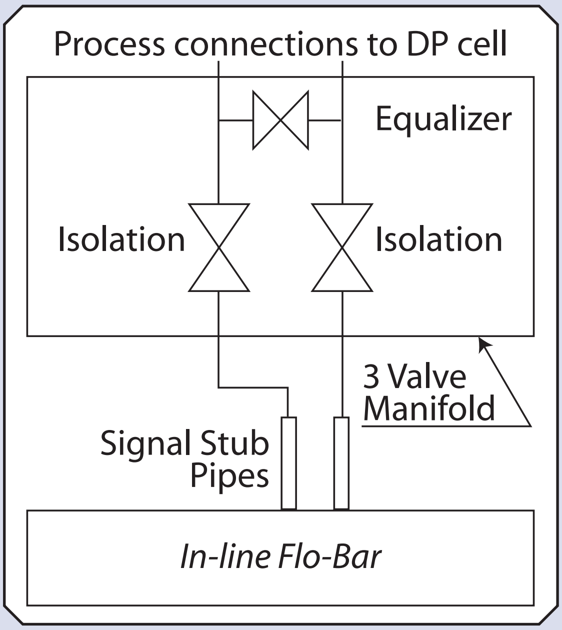
Gases in Vertical Pipes
The Insertable Flo-Bar may be inserted with the signal stub pipes at any angle around the circumference.

Gases in Horizontal Pipes
The Flo-Bar should be mounted so that the probe DP connections are above the centreline of the pipe, with the pipe, so that any moisture caused by condensation, does not enter the secondary instrumentation.

If the secondary instrumentation is mounted remotely from the probe, it should be positioned higher than the Flo-Bar to eliminate condensate problems as described above. Rigid or flexible impulse tubing may be used, but if however flexible tubing is used, it should be clipped down to eliminate false signals due to pipe movements. The two impulse-lines should run close together, be of similar length and bore, and be as short as possible. Longer pipe runs may give more problems with contamination (e.g. water), or with false signals due to temperature gradients. Particular care must be taken to run the lines together in regions of high temperature gradient, i.e. near hot pipes or other objects.

The impulse-line bores should be in the 2mm to 10mm region. Larger bores are less susceptible to blockage with water ingress. Once a liquid meniscus forms across the full bore of the tube, false DPs will result. If solid (e.g. dust) contamination is at all likely, it is advisable to make provision for means to blow the lines clear with compressed air.

3-Valve Manifold
When used in conjunction with a differential pressure transmitter, a three valve manifold should be installed between the In-line Flo-Bar and the transmitter. This is to allow isolation of the process and equalisation, so that the transmitter may be adjusted.



INSTALLATION

LIQUIDS

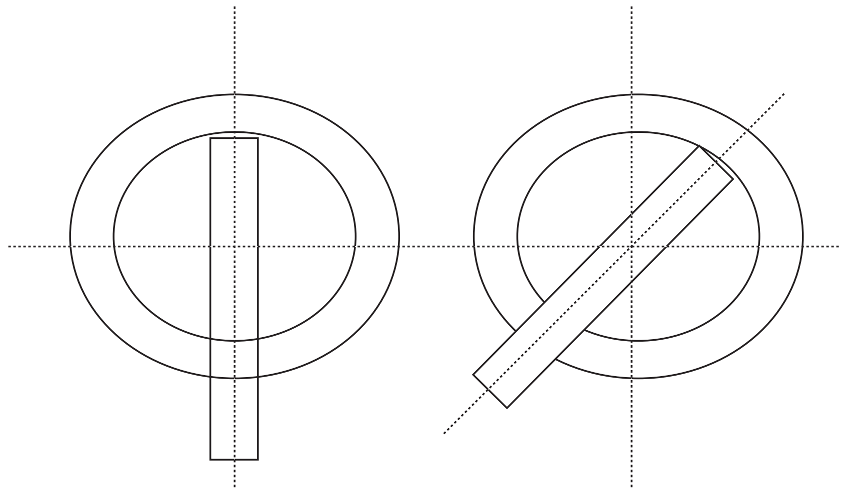
For correct installation, the Flo-Bar must be located at the right position.

The type of flowing medium must be taken into consideration when the installation position is decided upon. The type of flowing medium fall into three main fields:

Liquids - Gases - Steam

Liquids in Vertical pipes.
The In-line Flo-Bar may be inserted into the pipeline with the signal connection stems facing at any angle around the circumference, but for best results, the impulse lines which will be connected to any secondary instrumentation should be angled slightly downwards away from the probe. This will assist in keeping the impulse lines full of liquid. As design for the Flo-Bar has two Pitot-heads arranged one above the other, when used on vertical installations the differential pressure transmitter MUST be zeroed after the impulse lines have been primed. Any air bubbles or air pockets in these lines will cause false signals to be measured by the DP cell or gauge. A three valve manifold will have to be added to the differential pressure transmitter, so that the system can be isolated and then equalised.

Liquid in Horizontal Pipes.
The Flo-Bar should be installed with the signal connections facing downwards, if this is impractable the signal connection stems should always be kept below the pipes centreline, this again will assist in keeping the impulse lines filled with liquid and any gas will be able to exit through the probe. Care must be taken to ensure that the impulse-lines are completely filled, any gas bubbles in the lines or trapped within the secondary instrumentation will cause inaccuracy in the reading.



If the Flo-Bar can not have the signal connections facing downwards, they should always be below the centreline

PRINCIPLE OF OPERATION

The operation and theory of any Pitot device is well documented and available from many reference sources:

The very small amount of energy produced due to the process flow is converted into an increase in pressure within the upstream sensing-manifold system of the Flo-Bar. This increase in pressure with respect to the static line pressure is directly proportional to the flowing velocity of the process (be it gas or liquid). The Flo-bar also offers an additional advantage by placing the 'Static Port' at the back of the rear probe, facing away from the flow path. The effect of the flow pass the rear probe forms an area of slightly lower pressure, to the back of the probe. It is at this point where the 'line static' pressure measurement is taken. The resultant differential pressure generated tends to be proportionally higher than if the line static had been measured at some other point. The up-stream or 'impact' ports are ranged across the pipe so that any non-uniform velocity profile is hydraulically averaged. The number and position of these high pressure impact ports are calculated for each individual application, based upon the customers flowing parameters.

Flo-Bar Formula:

The basic formula for a classical Pitot type device is:

$$\text{Generated DP} = {}^{\text{DENSITY}}/_{2} \text{ X Velocity}^{2}$$

Where DP = Pascals
Velocity = m/sec
Density = kg/m^3

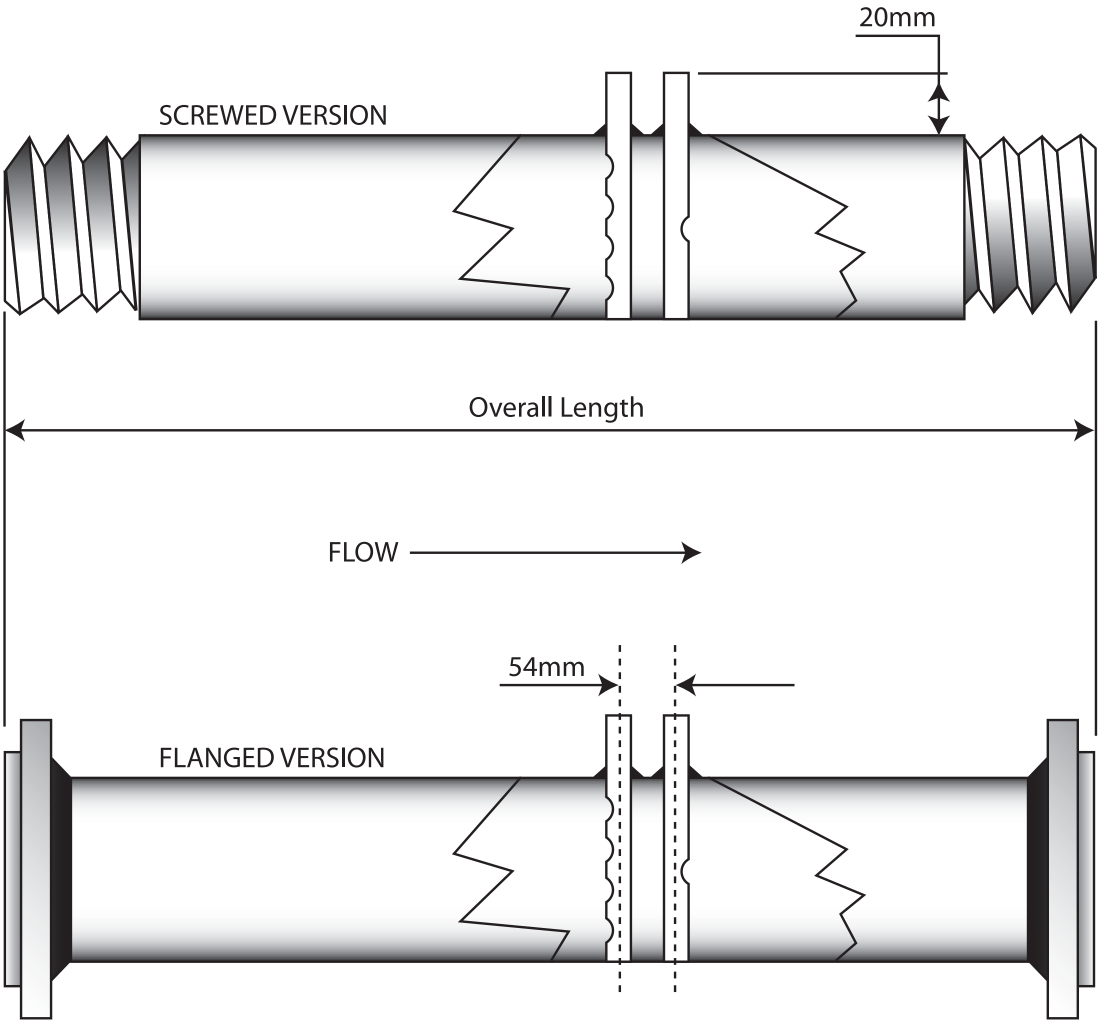
This formula assumes that the Pitot offers no significant constriction to the inside area of the pipe/duct. (This is achieved by using a probe of very small area in relationship to the overall inside cross-sectional area of the pipe). The Flo-Bar does offer a restriction to the flow and for this reason and also because of its 'Probe Geometry', a probe discharge coefficient has to be included into the formula. The modified formula now becomes:

$$\text{Generated DP} = {}^{\text{DENSITY}}/_{2} \text{ X } ({}^{\text{VELOCITY}}/_{\text{K}})^{2}$$

Where DP = Pascals
Velocity = m/sec
Density = kg/m^3
K = Probe constant

The probe constant is a dimensionless value, whose value has been determined by flow calibration tests, by NAMAS approved test organisations.

For a table of 'K' factor values, please refer to the following page.



PIA	=	Pipe nominal bore size is $\frac{1}{2}$"
PIB	=	Pipe nominal bore size is $\frac{3}{4}$"
PIC	=	Pipe nominal bore size is 1"
PID	=	Pipe nominal bore size is 1$\frac{1}{4}$"
PIE	=	Pipe nominal bore size is 1$\frac{1}{2}$"
PIF	=	Pipe nominal bore size is 2"

PIPE ENDS

T1	=	NPT Thread
T2	=	BSP Thread
W1	=	Welded
F1	=	Flanged ANSI 150lb RF
F2	=	Flanged ANSI 300lb RF
F3	=	Flanged ANSI 600lb RF
F4	=	Flanged PN16
F5	=	Flanged PN40
XX	=	Special

PIPE SPECIFICATION

0	=	Schd 40
1	=	Schd 80
X	=	Special

PROCESS CONNECTION

0	=	$\frac{1}{4}$" Plain Stub Ends
1	=	$\frac{1}{8}$" Compression
2	=	$\frac{1}{4}$" Compression
3	=	$\frac{1}{4}$" NPTM
X	=	Special

UKAS CALIBRATION 0043

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