# FLOW

## Platon Flo-Bar

**AVERAGING PITOT TUBE**

**INDEX**

The company policy is one of continuous product improvement and the right is reserved to modify the specifications contained herein without notice.

All the dimensions stated are in millimetres (mm), Unless otherwise stated

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## Introduction

The basic principle of this type of primary flow element is well documented and recorded. Throughout the water, nuclear, steel., chemical, oil, gas, food, pharmaceutical and HVAC industries, thousands of installed Pitot devices show their proven track record over many years as a reliable flow monitor.

The well established Platon Flo-Bar range of Averaging Pitot tubes, offer a family of flow measuring devices which cover from 50mm to 3000mm.
The Flo-Bar is suitable for installations in pipes, ducts and chimneys and for use with liquids and gases.

The unique Flo-Bar probe tube geometry ensures that a constant and stable flow signal is generated over a wide flow range. This generated Differential Pressure follows the standard square root law in respect to the flowing velocity.

The Insertion Flo-Bar is a rugged design with all 316 Stainless Steel construction being standard material of manufacture although others are available on request. The Flo-Bar is available in three sizes, 13, 25 and 60mm to suit varying sizes of pipelines (larger than 50mm). If the pipe is smaller than 50mm then an Inline Flo-Bar is available with built in upstream and downstream diameters.
The Insertion Flo-Bars are available with two different styles of head block, a 3-way Valve Manifold or a Plain Head for remote mounting of gauge / transmitter.

With the 3-way Valve Manifold version, it is unnecessary for a seperate manifold block to be purchased. This head block also allows a Differential Pressure Transmitter to be bolted directly onto the Flo-Bar without the need for any other hardware.

The Plain Head terminates in a simple block threaded with side mounted process connections.
Both versions are available with integral or remoted RTD.

The Flo-Bar can be mounted into the process pipeline by one of two methods:

- Adjustable Locking Gland and Weld Boss / Mounting Plate
- Flange

Due to large pipe diameters and/or velocities the resonance frequency of the Flo-Bar can be reached. When this is the case a Lower Support will need to be fitted to the opposite side of the pipeline, to the insertion point.

RM&C application engineers can offer further advice.

## General Mechanical Specifications

| Process | • Liquids, Gases and Steam |
| Probe Tube | • 316 Stainless Steel, Hast C276, Morel 400, Brass etc. |
| Internals | • 316 Stainless Steel |
| Head Block | • 316 Stainless Steel in two styles, refer to page 3 for more information |
| Label (Tag) | • Stainless Steel |

\* Flange, Boss and Gland Materials dependant on Flo-Bar material \*

| Weld Boss | • 13mm Flo-Bar - $^1/_2$ " NPT Female |
| | • 25mm Flo-Bar 1" NPT Female |
| | • NOT to be used with 60mm Flo-Bars |
| Locking Gland | • 13mm Flo-Bar - $^1/_2$ " NPT Male |
| | • 25mm Flo-Bar 1" NPT Male |
| | • NOT to be used with 60mm Flo-Bars |
| Flange | • Flanged to BS or ANSI Standards |
| | • 13mm Flo-Bar - 25mm (1") NB Flanged |
| | • 25mm Flo-Bar - 40mm (1.5") NB Flanged |
| | • 60mm Flo-Bar - 80mm (3") NB Flanged |
| Lower Support | • Welded |
| Mount Plate | • For use with rectangular ducts |
| | • Available for both Weld Boss and Lower supports. |
| Pipeline | • Round or Rectangular pipelines, within the range 50 - 3000mm, larger sizes on application |
| Accuracy | • <1% with standard square root flow output |
| Temperature | • Locking Gland @ pressure <1 bar g - up to + 400°c |
| | • Locking Gland @ pressure >1 bar g - up to 90°c |
| Pressure | • The limiting pressure component will either be the locking gland or the flange |
| | • Flange - The limitation will be the flange rating derated to the process temperature |
| | • Locking Gland<br>- 13mm Flo-Bar - 10 bar g @ 20°C ❶<br>- 25mm Flo-Bar - 5 bar g @ 20°C ❶ |

| Flo-Bar size | Locking Gland | | |
|---|---|---|---|
| | **Stainless Steel** | **Carbon Steel** | **Brass** |
| 13mm | 6500 psig | 8100 psig | 3700 psig |
| 25mm | 5200 psig | 6500 psig | 2900 psig |

Table 1 - Locking Gland Pressure ratings @ 20°c
*All the specifications are for standard configuration only*

❶ These pressures should NOT be exceeded, unless the flobar is restrained using a chain or similar device. When restrained the pressure valves in table 1 can be used

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## Head Block Mechanical Specification

### 3 Valve Manifold

When a Flo-Bar is to be used in conjunction with a direct mount, gauge, instrument or a Differential Pressure Transmitter, then a three way valve manifold is required. Due to the three way manifold being designed into the head block, there is no need to purchase a seperate manifold. Thus the system can be isolated and equalised at the Flo-Bar head block. The drain and vent facility is available via the D.P. cell flange.
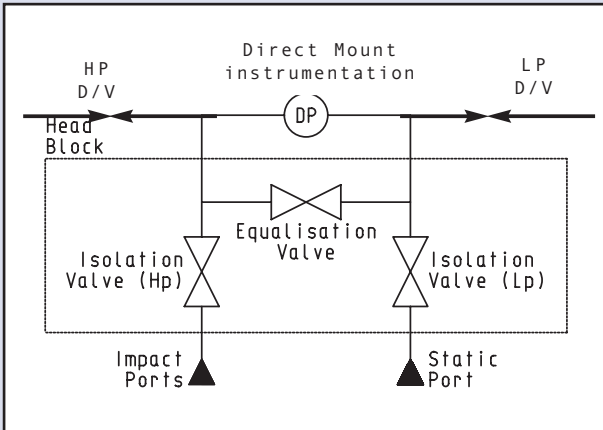


Figure 1  3-way  Valve Manifold Schematic

Connections
• 2 x 1/4 " NPT Female on 54mm centres
• Each manifold block comes with 2 x PTFE seals for placing between the manifold block and DP transmitter (others available)

Temperature
• The limiting factor is related to the valve seats
• Valves - Standard              up to + 232°C
      - Graphoil              up to + 300°C
      - High Temperature      up to + 530°C

Pressure
• At the above valve temperatures the manifold block is rated up to 6000 psig
• However as stated on the previous page the limiting pressure component will either be the locking gland or flange.
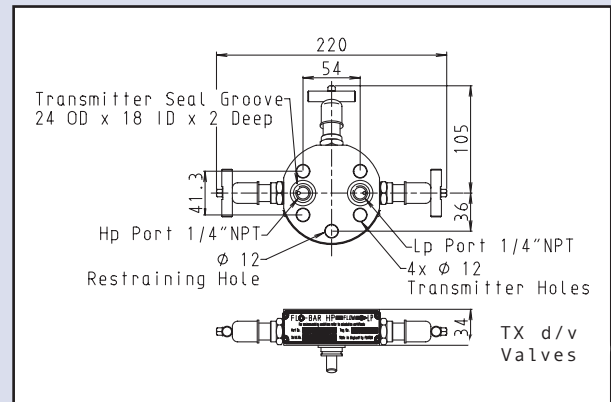


Figure 2 - 3-way Valve Manifold
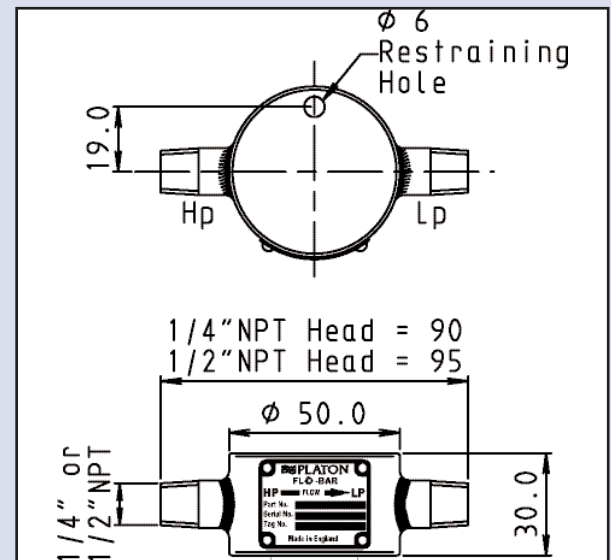


Figure 3 - Plain Head

### Plain Head

With this head block the impulse lines must be connected to the two process connections on each side of the head block.  To achieve isolation and equalisation, additional valving will be required before the DP transmitter or gauge to facilitate the commissioning of any secondary instrumentation.

Connections
• 2 x 1/4" NPT Male - Available on size 13 & 25mm
  Flo-Bars only
• 2 x 1/2" NPT Male - Available on all three size
  Flo-Bars

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## Principle of Operation

A very small amount of energy is produced due to the process flow and converted into an increase in pressure within the upstream leg of the Flo-Bar. This increase in pressure with respect to the static line pressure (LP) is directly proportional to the flowing velocity of the process. The Flo-Bar also offers an additional advantage by placing the 'Static Port' at the rear of the probe, facing away from the flow path to improve the s/n ratio. As the flow passes the Flo-Bar an area of lower pressure forms to the rear of the probe. It is at this point where the 'Line Static' pressure measurement is taken. The differential pressure produced is not only proportional to the velocity of the flowing medium, but also to its inertia due to the mass of the process. Therefore, for a given velocity the generated DP will alter with a change in the density of the process.

The upstream or 'impact' ports are ranged across the pipe so that any non - uniform velocity profiles can be hydraulically averaged. The number and position of these high pressure impact ports will vary for each individual application, based upon the dimensions of the pipeline supplied.

The operation and theory of any Pitot device is well documented and available from many reference sources. The basic formula for a classical Pitot type device is as follows:

$$Generated\ DP = \left(\frac{\rho}{2}\right) * v^2$$

This formula assumes that the Pitot offers no significant constriction to the inside area of the pipe. This is achieved by using a probe, which has a small cross sectional area in relationship to the inside of the pipeline. However both the probe area and its 'Probe Geometry' (page 4) offer some restriction to the flow. For these reasons' a Probe Discharge Coefficient, 'K', has to be included into the above formula. The modified formula now becomes:

$$Generated\ DP = \left(\frac{\rho}{2}\right) * \left(\frac{v}{K}\right)^2 \ ,\ where\ \ V = \frac{Flow\ Rate}{C.S.A.}$$

| Symbols | Units |
|---------|-------|
| Generated DP | Pascal |
| v (Velocity) | m/sec |
| p (Working Density) | kg/m³ |
| K | Probe Constant ❶ |
| Flow Rate | m³/s |
| C.S.A (Duct cross sectional area) | m² |

Table 2 - Formula Units

Although a Pitot device has a large measuring range or "turn down ratio" of greater that 10:1, the problem arises when the Generated DP is to be measured, as most standard commercial DP Transmitters have a flow turn down ratio of approx. 10:1 max. One method to increase the turn down ratio is to 'Stack' transmitters. For more information consultant RM&C.

❶ 'K' the Probe Constant is a dimensionless valve, whose value has been determined by flow calibration tests, at a NAMAS approved test organisation. A table of 'K' factors for Platon Insertable Flo-Bars are detailed in Table 3.

### Flo-Bar Probe Geometry

The Platon Flo-Bar Averaging Pitot Tube has all the advantages of the established round Pitot tube, but with the additional feature of the unique Flo-Bar probe geometry.

We must start by first considering the basic principles of the Pitot type device. When the Flo-Bar is inserted into the flow stream there is a differential pressure produced across the probe. The high pressure is sensed by the pressure ports which are ranged down the front of the probe, the low pressure (or line static) is measured at the rear face of the probe. In a Classical Pitot installation the low pressure would represent the line static pressure, but in the case of the Flo-Bar this low pressure is slightly less than the line static pressure due to less noise. This is a very important factor as it gives a higher differential pressure to measure, as in many cases the DP can be relatively small.

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This decrease in line static pressure is caused by the constriction to the inside pipe are due to the blockage factor of the Flo-Bar, and the flowing velocity increase around the probe tube. Refer to 'Principle of Operation' for more information.

As the process flows past the Flo-Bar, vortices are shed from either side of the probe. If the probe was completely round in section (Figure 4, A) these vortices would shed from the same point irrespective of the flowing velocity, and this would hold true for a wide range of conditions. However, at elevated flow rates the point from where the shedding effect occurs, moves towards the back of the probe ( Figure 4, B). As this movement takes place the discharge coefficient 'K' will tend to alter, and this will result in accuracies in the flow signal.

The unique shape of the Flo-Bar (Figure 4, C) means that the point on either side of the probe where the shedding occurs remains fixed and hence the Flo-Bar discharge coefficient remains more constant over a much greater flow measurement range (turndown) giving excellent accuracy and reliability
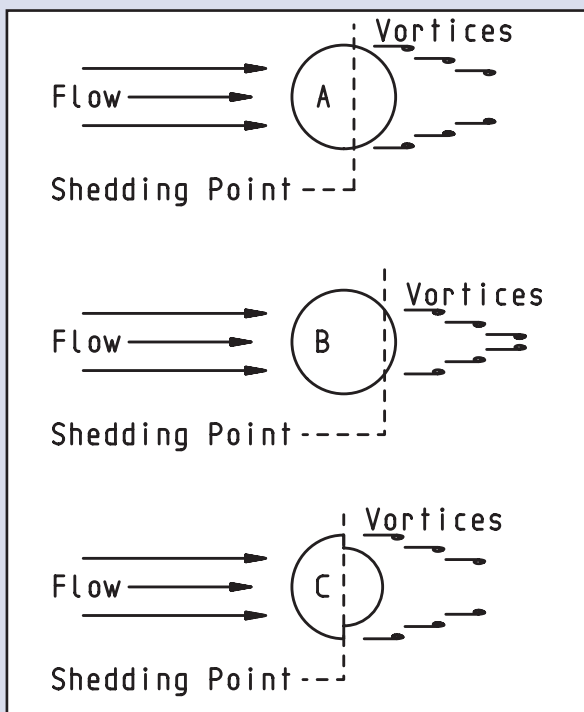


Figure 4 - Probe Geometry

## Flobar 'K' factors

The valves given below should be used in the Flobar formula given on the previous page. When selecting the correct 'K' factor from table 3, the pipe ID should be used for round pipes. For square or rectangle ducts on the other hand, the cross sectional area of the inside of the pipe should be used to find the equivalent round pipe ID.

ie. What is the 'K' factor for a 25mm Flobar being installed in a diameter 352mm ID pipe? From the table select the pipe ID that is closest to and lower than the installation pipe ID. The installation pipe ID is 352mm, so the closest & lower pipe ID from the table is 350mm. Reading across to the 25mm Flo-Bar column it is found that the 'K' factor is 0.742 for this scenario.

Table 3 - K Factors

| PipeID (mm) | Flobar Size | | |
|---|---|---|---|
| | 13mm | 25mm | 60mm |
| 50 | 0.715 | | |
| 75 | 0.720 | | |
| 100 | 0.735 | 0.611 | |
| 125 | 0.736 | 0.700 | |
| 150 | 0.737 | 0.720 | |
| 200 | 0.743 | 0.735 | |
| 250 | 0.748 | 0.736 | |
| 300 | 0.750 | 0.737 | |
| 350 | | 0.742 | |
| 400 | | 0.743 | |
| 450 | | 0.744 | |
| 500 | | 0.748 | 0.736 |
| 600 | | 0.750 | 0.737 |
| 750 | | 0.751 | 0.738 |
| 900 | | 0.751 | 0.738 |
| 1050 | | 0.751 | 0.739 |
| 1200 | | 0.753 | 0.740 |
| 1500 | | 0.753 | 0.742 |
| 1800 | | 0.753 | 0.744 |
| 2100 | | 0.753 | 0.745 |
| 2400 | | 0.753 | 0.746 |
| 2700 | | 0.753 | 0.748 |
| 3500 | | | 0.753 |

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If we now consider the same 25mm Flo-Bar, but this time in a rectangular duct :

Duct ID dimensions 350 * 389mm, So

Cross Sectional Area=350 * 389 = 136150mm$^2$

$$Equivalent\ \phi\ of\ Pipe = \sqrt{\frac{(4 * CSA)}{\pi}}$$

$$Equivalent\ \phi\ of\ Pipe = \sqrt{\frac{4*136150}{3.142}}$$

So the equivalent round pipe ID = 416.4mm, Therefore, the 'K' factor for this installation would be 0.743

**General installation**

1) Remove the instrument from the packaging and examine it for any transit damage, prior to installation into the pipeline. Consult RM&C immediately if any damage is found.

2) Ensure that there is enough clearance around the pipe for installation and removal.

3) Each Flo-Bar is built, based on the pipe size and flowing parameters, supplied at the ordering / quotation stage (Page 11). To this end RM&C have supplied the Flo-Bar for a specific application. The use of the Flo-Bar in any other application is therefore strictly at the users risk and will invalidate any warranty.

4) Check that the flowing conditions at the point of installation are the same as those RM&C quoted and/or supplied against. Often when confirming the generated DP a Flo-Bar DP calculation sheet (see example on Page 12) may be issued, which will detail the supplied pipeline properties. Any deviation from the flowing parameters stated may result in alteration to the differential pressure, maximum allowable Velocity and Resonant Frequency.

5) Check that the process flowing pressure is within the pressure limitations detailed on Page 2.

6) Mount the Flo-Bar onto the pipeline as detailed on Page 7. Do not drill any holes into the pipe, until the flowing pressure has been reduced to a safe level and any harmful material has been removed from the process.

7) Install the Flo-Bar in the pipeline with sufficient upstream and downstream pipe diameters as detailed on Page 7.

8) The Flo-Bar should be inserted into the pipeline either until
a) The flanges mate together,
or
b) For locking gland mounting, the Flo-Bar should be bottomed out on the opposite side of the pipe and then withdrawn slightly (approx. 5mm).

9) Ensure the direction arrow on the Flo-Bar Label (located on the headblock) is pointing in the same direction as the flow through the pipe. Also ensure that the Flo-Bar is within the rotation tolerance as detailed in figure 9 on page 7. Also detailed on the label is specific information relating to the order, the Flo-Bar was built under.
a) Part No.      The build specification
b) Serial No.   RM&C's Order No. the Flo-Bar was built under
c) Tag No.      The customers Tag No., if one was supplied



Figure 5 - 3 Valve Manifold Label



Figure 6 - Plain Head Label

10) Before starting the process or increasing the pressure to its operating conditions, ensure that any flange bolts, locking glands, etc... are sufficiently tightened.
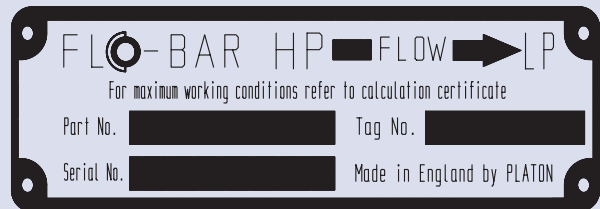


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## Installation location

The position and location of the Flo-Bar Averaging Pitot Tube, are both critical to the successful operation of the device. Any disturbance within the pipeline or ducting system can significantly effect the metering accuracy. The table below gives an indication of the number of pipe[1] diameters that should be provided, both upstream and downstream for any Flo-Bar installation. If any of these pipe diameters can not be achieved, please consult with RM&C.

| Pipeline Configuration | Upstream Diameters if in Plane | Upstream Diameters if out of Plane | Downstream Diameter |
|---|---|---|---|
| Elbow | 6 | 8 | 3 |
| Tee | 6 | 8 | 3 |
| Two Elbows in the same plane | 9 | 12 | 3 |
| Two Elbows in different planes | 12 | 20 | 4 |
| Expanded Section | 7 | 8 | 3 |
| Reducer Section | 7 | 8 | 3 |
| Valves [2] (which could become partially closed) | 20 | 20 | 4 |

Table 4 - Flo-Bar location in respect of pipeline build

If the Flo-Bar is to be installed in a ventilation duct, it should be located well clear or any Fire and Control dampers.

2 - Wherever possible the Flo-Bar should be positioned upstream of any valves

1 - Avoid pulsating flows and vibrating pipelines as they cause noisy signal outputs. Vibrating pipelines could also affect the structural integrity of the Flo-Bar.

As well as location, the orientation and alignment of the Flo-Bar is also important when considering its installation. For correct operation the Flo-Bar should be installed within the tolerances shown in the three figures below.
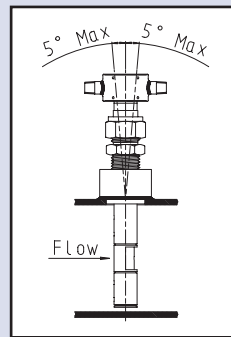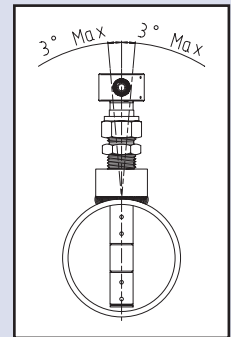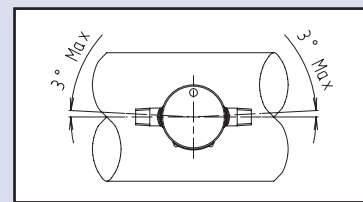

Figure 7


Figure 8


Figure 9

## INSTALLATION MOUNTING

The type of flowing medium must be taken into consideration when the installation position is decided upon. Refer to Installation for Liquids (Page 9) and Installation for Gases (Page 10) for specific information.

### Weld Boss

If a weld boss and locking gland is being used to mount the Flo-Bar to the pipeline then it will be suitable for either a 13 or 25mm probe. The weld boss can be supplied in two different styles, dependant on the specific order requirements.
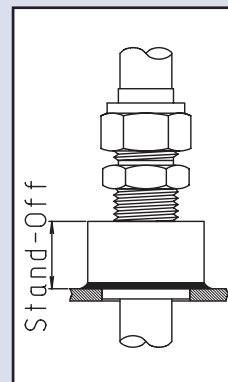


Dependant on the weld boss supplied or used, a different size hole will need to be cut in the side of the pipeline. Refer to Table 5 for dimensions relating to RM&C supplied weld bosses. As standard a profiled weld boss is supplied which is shaped to closely match the OD of round pipes. This can also be used with square/rectangular ducts.

Figure 10 - Weld Boss Height

When a Flo-Bar build has specific special requirements then a specially machined weld boss (figure 10) may be supplied. This boss will be non-profiled and will locate into the pipe wall.

| Flobar Size | Profiled Weld Boss (standard) | Non Profiled Weld Boss (Special Height) |
|---|---|---|
| 13mm | 24.0mm | 30mm |
| 25mm | 36.5mm | 44mm |

Table 5 - Weld Boss Duct Cut-out Diameters
(When supplied by RM&C)

When the weld boss is not being supplied by RM&C, table 8 specifies the actual Flo-Bar probe diameters.

**Mount Plate**

This is another form of weld boss or lower support to be used with square/rectangular ducts. It can either be welded or fastened to the duct. The plate has the same dimensions for both 13 and 25mm Flo-Bars, but the boss or support welded onto it varies (Figure 11). A hole is not specifically required for the mount plate, but is required, so as to enable the Flo-Bar to pass through the duct wall (table 8).
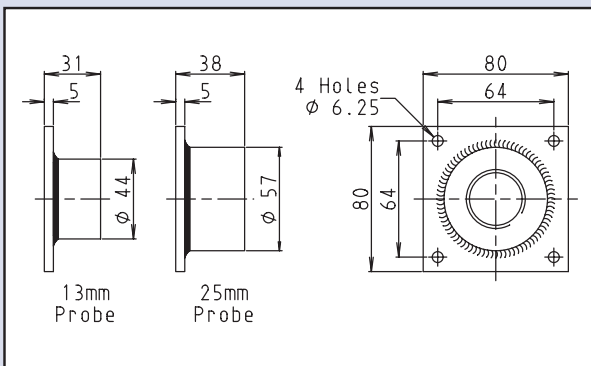


Figure 11 - Mount Plate Details

**Flanged**

When flanged mounting has been specified the mating stand-off and gasket is generally supplied by the user. If this is the case it is imperative that the overall height (Figure 12) conforms to the data supplied to RM&C at the quotation/order stage. The critical dimension is from the pipe OD to the top face of the flange plus the gasket, where the gasket thickness is when it is compressed.
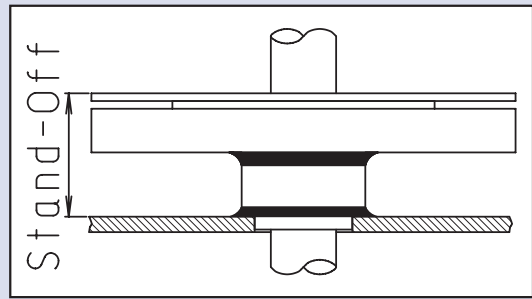


Figure 12 - Flanged stand off Height

If the stand-off is shorter than specified (or the pipe smaller) then the end of the Flo-Bar will bottom out on the opposite side of the pipe, leaving a gap between the flanges!! If the stand off is longer (or the pipe larger) the flanges will mate together, but the Flo-Bar will not be inserted into the pipe at its optimum position.

| Flo-Bar Size | Stand-Off |
|---|---|
| 13mm | 30mm |
| 25mm | 44mm |
| 60mm | 83mm |

Table 6 - Flanged Stand off Duct Cut-out Diameters
(when supplied by RM&C)

As with the weld boss, a hole has to be cut into the pipe to accept the stand off. Refer to Table 6 for dimensions relating to RM&C supplied stand offs.

Before securing the flanged stand off to the pipe it is important to take note of the bolt hole orientation (Figure 13). This figure shows a flange with only four bolt hole's. If more bolt holes are present, modify the dimension detailed in order that the holes straddle the centre of the pipeline similarly as pictorially shown.
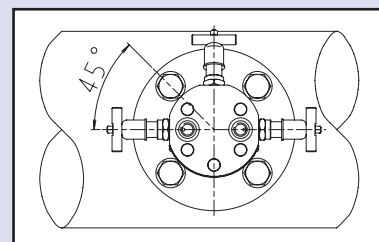


Figure 13 - Stand-off bolt hole orientation

**Lower Support**

A lower support is only required for those installations where the Flo-Bars limits of resonance frequency and/or velocity stipulate that one should be used.

| Flo-Bar Size | Lower Support |
|---|---|
| 13mm | 30mm |
| 25mm | 44mm |
| 60mm | 83mm |

Table 7 - Lower Support Duct Cut-out Diameters

When supplied a hole is required as listed in Table 7 diametrically opposite (ie. 180 degrees ) to the insertion mounting point. The hole should be made maintaining the tolerance as shown in the three figures on Page 7.
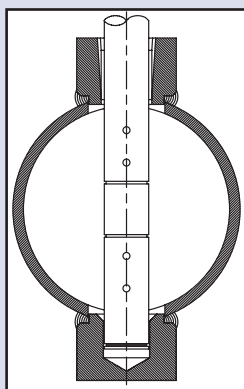


Figure 14 - Lower Support

## Probe Diameter

For information Table 8 details the Flo-Bars actual probe diameter, which may be required when RM&C do not supply the weld boss, etc...

| Flo-Bar Size | Probe actual diameter |
|---|---|
| 13mm | 12.7mm |
| 25mm | 25.4mm |
| 60mm | 60.33mm |

Table 8 - Flo-Bar Probe Diameter

## Installation for liquids

The Flo-Bar should be used with clean, debris free liquids.

## Vertical Pipes

The Flo-Bar may be inserted at any angle around the circumference of the pipe (Figure 15)



Figure 15 Vertical Pipe



Figure 16 Horizontal Pipe

## Horizontal Pipes

The Flo-Bar should be mounted so that the process connections are below the centreline of the pipe (Figure 16).

## Either Pipe Orientation

For best results the process connections (which are connected to any secondary instrumentation) should be angled slightly downwards below the end of the probe tube. The angling downwards of the head block will assist in keeping the impulse lines full of liquid and free of any gas likely to cause blockages. By doing this any gas will be able to exit through the probe tube.

If this is not possible, then any secondary instrumentation should be mounted below the level of the Flo-Bar head block. This will stop any air pockets from forming within the impulse lines.

Care must be taken to ensure that the impulse lines are completely filled with liquid, as any gas bubbles trapped in the lines or the secondary instrumentation will cause inaccuracy in the readings. If bubbles were to form in only one of the impulse lines, this would result in an off-set being introduced into the system.

The impulse tubing should be at least 6mm ($^1/_4$") OD , but the actual specification will depend upon the flowing parameters:

i.e Pressure and Temperature

## Installation for gases

### Vertical Pipes

The Flo-Bar may be inserted at any angle around the circumference of the pipe (Figure 17)
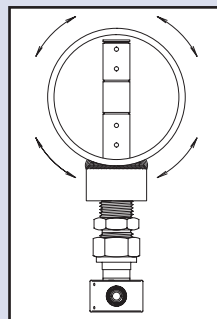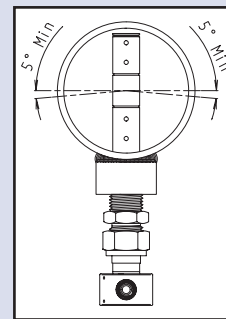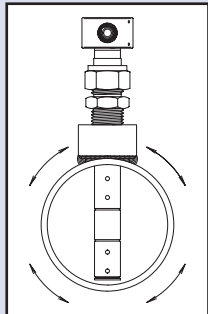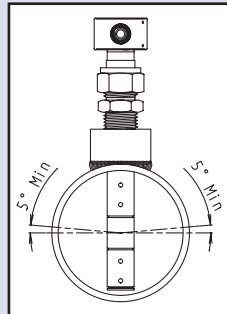


Figure 17 Vertical Pipe



Figure 18 Horizontal Pipe

### Horizontal Pipes

The Flo-Bar should be mounted so that the process connections are above the centreline of the pipe (Figure 18).

### Either Pipe Orientation

For best result the process connections (which are connected to any secondary instrumentation) should be angled slightly upwards above the end of the probe tube. The angling upwards of the head block ensures that any moisture caused by condensation, does not enter the impulse lines.

As with all DP installations the Primary and Secondary instrumentation should be as near to each other as is possible. If the secondary instrumentation is mounted remotely from the Flo-Bar, it should be positioned higher than the Flo-Bar head block (so as to avoid any condensation problems), using either rigid or flexible tubing. If flexible tubing is used, it should be pinned 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.

i.e. Near hot pipes or other objects

Particular care must be taken to run the lines together in regions of high temperature gradients. This is because the generated DP's can be very low and the thermal gradients could induce an off-set to the readings.

The impulse line bores should be in the region of 2 to 10mm. Larger bores are less susceptible to blockage by water or foreign bodies, but bores over 3mm make it difficult to flush any liquid out, unless the lines have a continuous slope, with drainage provision at the lowest point.

A considerable number of system failures can be attributed to problems in the impulse lines, particularly with water ingress. Once a liquid meniscus forms across the full bore of the tube, false DP's will result. If contamination with solids (e.g. dust) is at all likely, it is advisable to make provision for means to blow the lines clear with compressed air. If a purge system is to be used, then extra isolation valves must be installed between the purge connection and any DP transmitter, so that during the purging process, no damage is caused to the DP cell.

### Maintenance

The instrument should not normally require any attention, but if any problems occur check the following:

- That the process is active
- That the process conditions are the same under which the Flo-Bar was supplied and the secondary instrumentation was set up.
- That the Flo-Bar internal piping or impact ports are not blocked (refer to purging below)
- That the process connection impulse piping is not damaged.
- That both Hp & Lp impulse pipes are:
    - Of the same or similar size
    - Of the same or similar length
    - Follow the same or similar path, re: temperature gradients
    - Are supported over their entire length
    - Are free from vibration

### Purging

Occasionally the Flo-Bar and/or impulse piping may become contaminated with dust or moisture affecting the DP reading. When this happens, the internal capillary tubes or the impact sensing holes may become partially or fully blocked. If this is possible then the Flo-Bar will need purging from time to time. This can be carried out in si-tu or preferably after removal from the pipeline using compressed air. Before removing the Flo-Bar from the pipeline, reduce the flowing pressure to a safe level or stop the process completely.

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When purged in situ extra valving should be provided to isolate the secondary instrumentation from damage. However in situ it is not possible to verify that there is a clear path between the process tappings and the impact ports. When removed from the pipeline this becomes possible to verify by monitoring that the compressed air flows from the relevant impact sensing ports.

Also whilst uninstalled from the pipeline any excessive contamination around the impact sensing hole scan be manually removed.

## Spares

In its simplest form with a Plain head block the Flo-Bar has no serviceable parts. However with a Three Valve Manifold head block the valves can be changed.

If the Flo-Bar is found to be permanently blocked the only course of action is to order a replacement, by quoting the information stated on the Head Block's label (see page 6).
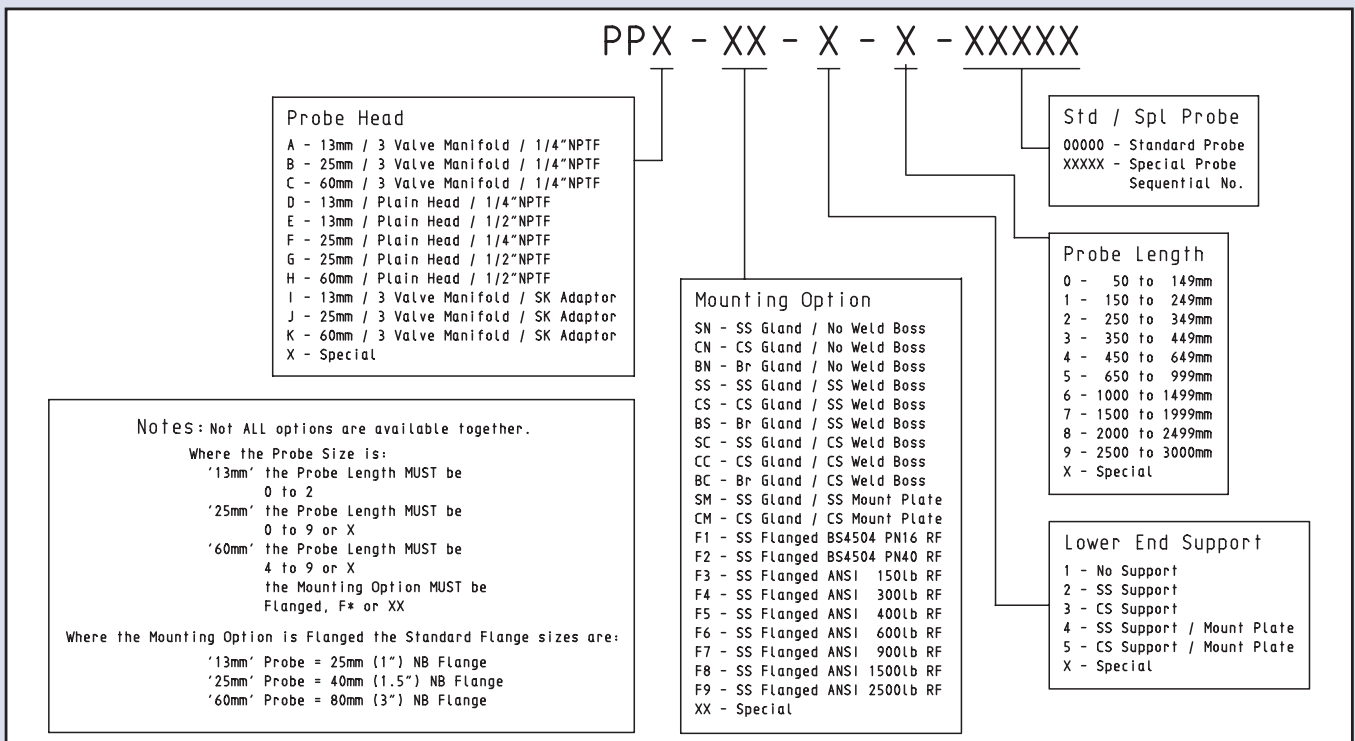
## Quotation / Order Information

Before a Flo-Bar can be quoted accurately, as number of things need to be known about the application:
- Two dimensions to describe the pipe
    - i.e the pipe ID and wall thickness
- Pipe section (round or square /rectangular)
- Mounting option (Flange or Weld Boss)
    - If the flanged stand off or weld boss is not to be of RM&C's supply, state height from Duct OD
- Fluid Name
- Process conditions (Temperature and Pressure)
    - If an unusual fluid then the Density and Viscosity will also be required
- Flow rates and Units
    - If a volumetric flow rate then which conditions is it referenced back to:
    - Actual - at the actual temperature & pressure
    - Normal - at 15°C & 1 Atmosphere Absolute
    - Standard - at 0°C & 1 Atmosphere Absolute
- As appropriate, detail a basic probe build using the Product Coding System below.

Based on this information our in house software generates a flow calibration curve (page 14). Within this software, seperate calculation checks are done for Resonance Frequency effects and Strength limitations in high velocity flows. If necessary the software will recommend the use of a Lower Support or a larger size Flo-Bar.

## Product Coding System

```
                    PPX – XX – X – X – XXXXX
```

**Probe Head**
A – 13mm / 3 Valve Manifold / 1/4"NPTF
B – 25mm / 3 Valve Manifold / 1/4"NPTF
C – 60mm / 3 Valve Manifold / 1/4"NPTF
D – 13mm / Plain Head / 1/4"NPTF
E – 13mm / Plain Head / 1/2"NPTF
F – 25mm / Plain Head / 1/4"NPTF
G – 25mm / Plain Head / 1/2"NPTF
H – 60mm / Plain Head / 1/2"NPTF
I – 13mm / 3 Valve Manifold / SK Adaptor
J – 25mm / 3 Valve Manifold / SK Adaptor
K – 60mm / 3 Valve Manifold / SK Adaptor
X – Special

**Std / Spl Probe**
00000 – Standard Probe
XXXXX – Special Probe
          Sequential No.

**Notes:** Not ALL options are available together.
Where the Probe Size is:
'13mm' the Probe Length MUST be
        0 to 2
'25mm' the Probe Length MUST be
        0 to 9 or X
'60mm' the Probe Length MUST be
        4 to 9 or X
        the Mounting Option MUST be
        Flanged, F* or XX

Where the Mounting Option is Flanged the Standard Flange sizes are:
'13mm' Probe = 25mm (1") NB Flange
'25mm' Probe = 40mm (1.5") NB Flange
'60mm' Probe = 80mm (3") NB Flange

**Mounting Option**
SN – SS Gland / No Weld Boss
CN – CS Gland / No Weld Boss
BN – Br Gland / No Weld Boss
SS – SS Gland / SS Weld Boss
CS – CS Gland / SS Weld Boss
BS – Br Gland / SS Weld Boss
SC – SS Gland / CS Weld Boss
CC – CS Gland / CS Weld Boss
BC – Br Gland / CS Weld Boss
SM – SS Gland / SS Mount Plate
CM – CS Gland / CS Mount Plate
F1 – SS Flanged BS4504 PN16 RF
F2 – SS Flanged BS4504 PN40 RF
F3 – SS Flanged ANSI 150lb RF
F4 – SS Flanged ANSI 300lb RF
F5 – SS Flanged ANSI 400lb RF
F6 – SS Flanged ANSI 600lb RF
F7 – SS Flanged ANSI 900lb RF
F8 – SS Flanged ANSI 1500lb RF
F9 – SS Flanged ANSI 2500lb RF
XX – Special

**Probe Length**
0 – 50 to 149mm
1 – 150 to 249mm
2 – 250 to 349mm
3 – 350 to 449mm
4 – 450 to 649mm
5 – 650 to 999mm
6 – 1000 to 1499mm
7 – 1500 to 1999mm
8 – 2000 to 2499mm
9 – 2500 to 3000mm
X – Special

**Lower End Support**
1 – No Support
2 – SS Support
3 – CS Support
4 – SS Support / Mount Plate
5 – CS Support / Mount Plate
X – Special

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# Roxspur Measurement & Control

1-4 Campbell Court, Bramley, Tadley, Hampshire, RG26 5EG, UK
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## Differential Pressure Calculation for a PLATON Insertion FLO-BAR Averaging Pitot Tube

| | | | |
|---|---|---|---|
| **Customer :** | Joe Bloggs | **Date :** | 05 September 2003 |
| **Cust. Ref :** | 654321 | **RM&C Ref. :** | F123456 |
| **Tag No. :** | N/A | **Flobar Part No. :** | PPB-SN-1-2-00000 |
| **Process :** | Air | **Item No. :** | |

### The Flowing Parameters are for a 25mm Probe with a Flanged Mounting Connection & is Supported at Both Ends

| | | | |
|---|---|---|---|
| Pipe/Duct ID : | 300 mm | | Round Pipe/Duct |
| Pressure : | 15 bar g | | |
| Temperature : | 48 C | 3mm | Wall Thickness |
| Working Density : | 17.37360958 kg/m3 | 102.2 mm | Stand off Height |
| Viscosity : | 0.012cp | | |
| Reynolds Number : | 2539923.97 | | |
| 'K' Factor : | 0.737 | 405.2 mm | |

### If ANY of the above values alter, the Generated Differential Pressure is likely to Change

| | | |
|---|---|---|
| **The Actual Flowing Velocity is** | 5.85 Am/s | Therefore the Flowing Velocity |
| **Maximum Permitted Velocity is** | 181.97 Am/s | is Acceptable |
| | | |
| **The Srouhol (Actual) Frequency is** | 48.352 Hz | Therefore the Frequency Ratio |
| **The Resonant Frequency is** | 603.55 Hz | is Acceptable |

Therefore this Flo-Bar is Suitable for this Application

### Standard Valves are Suitable for this Temperature Application

| | | | **Generated DP** | | Un-recovered Pressure Loss | |
|---|---|---|---|---|---|---|
| | | | 547.0 | | 76.1 | Pascals |
| **Flow Rate** | 2000 | Nm3/h | 55.9 | | 7.8 | mm wg |
| | | | 5.5 | | 0.8 | mbar g |

#### Graph of Flow / DP
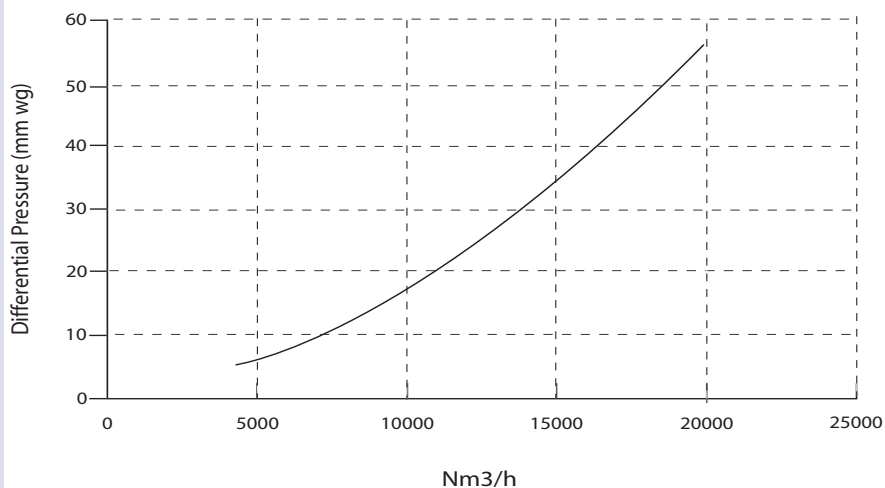
## RETURNS & WARRANTY

Before returning any goods to RM&C you must obtain a Returns form containing a unique returns (CA) authorisation number. Failure to do so will result in the goods being returned to you, without any inspection, etc… To obtain this form, contact the Q.A. department of our Sheffield office and by return the form will be faxed to you.

On receipt of the Returns form, fill in any required fields and return it with the goods to the Sheffield office. It is advisable to keep a copy of this form (with authorisation No.) for reference purposes.

If the goods have come in contact with any processes or environments that may be harmful to a user, then COSHH Regulations must also be observed. It is requested that a Material Safety Data Sheet (MSDS) is also supplied with returned goods, if this is likely to be the case. If not provided and the goods are suspected of being contaminated, they will be returned to you.

On receipt of appropriate documentation the goods will be examined & assessed in accordance with the terms of any Warranty agreement.

### Repairs

Prior to any repair work being carried out, you will be informed of our findings & any charges that may be incurred.

### Replacements

Prior to the supply of any replacements, you will be informed of our findings & any charges that may be incurred.

No replacements will be sent prior to receiving the goods back from you, unless an Order number is supplied to cover the cost of the new unit/s. After inspection, etc…. of the returned goods a Credit may be issued, based on our findings

### Warranty (extract from Terms & Conditions)

The warranty period is normally 12 months from the date of shipment, except as agreed at the time of sale.

Any misuse of the goods will void any warranty.

For full Warranty & other Contract details refer to our 'Terms & Conditions'.

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UKAS CALIBRATION 0043

CERTIFICATE No. FM22358

07HWAR0910

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