

## DIMENSIONS AND INSTALLATION

### FLOWMETER MM SERIES TYPE SS (and Ti, Ha, Du) Screwed or flanged

This unit is a flowmeter with an integral electronics that transmits a pulse output linear to flow. Various pressure rating types are available with the most popular being 30 bar and 100 bar. Please consult the transmitter calibration certificate to establish the pressure rating of the unit that is supplied. The temperature rating is 135°C subject to chemical compatibility. The integral electronics is stalk mounted to reduce its temperature to less than 70°C. Again, please check the certificate. Some versions use a direct mount or screw-in electronics.

The meter is constructed in 316 stainless steel. Ti, Ha, Du are constructed in other materials. The turbine rotor is manufactured in PFA Teflon on a 316 stainless steel shaft with sapphire bearing balls. The rotor is equipped with ferrites which are sealed against the process medium and sensed by a coil mounted in the transmitter stalk, producing a linear pulse output in relation to flow rate. Please consult the calibration certificate to confirm materials used. There is an M12 sensor connector (see LM0092 for wiring detail) *except Intrinsically Safe models*.

The transmitter electronics has a 4-way M12 sensor connector [IEC-61076-2-101] rated to IP67 e.g. compatible with Brad Harrison, Hirschmann, ERNI, Murr and Turck Banner. The flowmeter is normally supplied with a separate 5m lead with the mating connector. The signal is an NPN open collector, 8 to 28Vdc input. *TTL and PNP are optional outputs.* (see LM0092 for wiring detail).

In most versions the stalk may be removed from the cap under pressure by knocking out the 1/8" cross pin. In the 120bar version the electronics may be unscrewed under pressure. *In intrinsically safe versions the coil cartridge is removed by undoing the nut nearest the flowmeter body on the main connection between the body and the electronics enclosure and then undoing the retaining screw (max pressure 590 bar) or undoing the knurled nut.* If it is necessary to remove the cap, then the line should be non-pressurised and drained down. The turbine ring assembly can then be simply pulled out and cleaned for handling. If it is held against the cap and gently blown, then the flowmeter action will be duplicated.

#### Connections

Between sizes MM12.5 and MM30 inclusive the meters have in-line female BSP parallel threads corresponding to their body size. Please see note below regarding the use of couplings (and drawing C4726). Spot faces are provided if Dowty washers (bonded seals) are to be used. Larger sizes (MM37 to MM150) are designed to fit within the bolt circle diameter of the corresponding flange size (C3564).

In certain circumstances meters may be provided with pipes or pipes and flanges welded into the body. The type of coupling will depend on the customer's requirements but could typically be 15 mm PN16 flanges or 2" ASA1500 RJT flanges.

**Options** (check with transmitter certificate in all cases):

**SS 100 bar & 120 bar** This meter is rated to 100 or 120 bar pressure and uses a PTFE gasket. The cap is fixed by 8 off M6 bolts (or for MM100 + MM150 - 30 bar).

**SS 200 bar** This meter has a larger diameter body with the seal being an FPM O-ring. FPM can be substituted by EPDM, Nitrile, PTFE covered or Kalrez™. The cap is fixed

by 8 off M10 socket cap head bolts. The pipes are usually welded into the body.

**SS 345 bar** This meter has a larger diameter body sealed with a Viton O-ring. The cap is fixed by 8 off M10 socket cap head bolts. The connections are normally female in-line or wafer.

**Other** Other pressure ratings and specials are available. Please consult the calibration certificate to confirm materials used.

**Ti, Du or Ha 50 bar** This meter uses the same body style as the lower pressure 100 bar stainless steel versions but all wetted metallic parts are in Titanium, Duplex or Hastelloy.

### Installation

The MM flowmeter is designed with an orifice having flow tapplings on the upstream and downstream side which diverts flow through the pelton wheel turbine measurement chamber. As they include an orifice, the normal practice associated with orifice plate installation should be adopted.

Where possible the flowmeter should be fitted in a horizontal pipe run (with the electronics horizontal, i.e. on the side) with ideally 25 diameters of straight pipe upstream and 5 diameters downstream. This is illustrated on the accompanying drawing C4726 or C3564. For maximum accuracy install as shown. The transmitter should be installed in the horizontal plane with the electronics cover uppermost. If the electronics are intrinsically safe the plate should be legible to the side. Inscribed on face "A" is the word "TOP". Please ensure that the word "TOP" is at the top of face "A" as viewed from the end of the body. This installation attitude will duplicate that of the flowmeter's calibration test.

It is **VERY IMPORTANT** that any couplings used at the meter do not restrict the flow. They should have the same internal diameter as the meter itself. This is equivalent to the internal diameter of Schedule 40 pipe as given in the table below.

Nominal Bore		True Pipe id	Nominal Bore		True Pipe id
½"	MM12.5	15.76	2"	MM50	52.48
¾"	MM20	20.96	2½"	MM62	62.68
1"	MM25	26.64	3"	MM75	77.92
1¼"	MM30	35.08	4"	MM100	102.26
1½"	MM37	40.94	6"	MM150	154.08

It should be noted that inside the body is an orifice with an access hole on each side leading to the bypass chamber which houses the rotor and ring assembly. If the direction of flow arrow is obscured, then the direction of flow can be determined since the smaller of the two access holes should be on the meter inlet side.

The caps can be removed without affecting calibration. Simply undo the screws and remove the cap. The ring assembly can be taken out and cleaned (see separate instructions). Some jets are screwed into the base of the chamber. These can be removed with the appropriate tool and cleaned, if required.

Care should be taken with the following undesirable situations (see also C3729):

1. Two or more elbow bends or loops in different planes. This causes swirl in the pipe which could be corrected by separating the two bends by, if possible, 25 diameters of straight pipe and similarly installing the flowmeter 25 diameters after the second bend.

2. Partly closed valves should be avoided as these cause the flow across the pipe to travel at different velocities. This poor velocity profile can cause either high or low readings, depending on the relative orientation of the flowmeter. Filters and bends have similar effects and in virtually all cases 25 to 30 diameters of straight pipe would eradicate these disturbances.
3. If the flowmeter is installed after a valve that can be more than half closed, up to 50 diameters of pipe may be required for the highest accuracy of measurement.

If space is very restricted and the above conditions cannot be met, the loss in meter accuracy can be minimised by using a Zanker (or other) type flow straightener.

The flow straightener has two elements: the first is a plate with many holes in it. This creates a pressure drop across the pipe which evens out the poor velocity profile. This cannot, however, remove swirl in the pipe: correction is made with the second element which consists of a honeycomb or tube bundle at least one diameter long. The use of the Zanker straightener allows the flowmeter to be installed within 10 diameters of the disturbance with little or no loss in flowmeter performance.

If the installation is poor then it may be possible to effect an in-situ flow calibration at various flow rates to establish the effect on the flowmeter. If the operating flow range is small, a new "meter factor" of pulses per litre could be used optimised for the smaller range as a result of in-situ testing. Non-linearity over a wide flow range can be minimised using a microprocessor instrument having a linearising signal processing facility. In this case the display or flow rate signal will have an enhanced accuracy over and above the flowmeter performance.

#### **Viscosity effects**

Viscosity affects all turbine type meters. If the viscosity is low this is minimal. Viscosity imposes drag on the rotor reducing the RPM even at high flows. Rangeability (turndown) is also reduced and it is desirable to operate in the higher end of the meter flow range as non-linearity appears particularly at low flows.

A relatively high viscosity fluid can be metered if the flow rate is stable or of a limited range and if the application temperature and resulting viscosity of the fluid is also stable. This applies to many batching systems where simple recalibration will provide system accuracy.

All viscous fluids create an increased pressure drop throughout the pipe line systems. Since it is desirable to operate flowmeters at the higher end of their flow range, most users operate pumped rather than gravity fed systems for viscous fluids.

#### **Possible sources of error – specific to low flow:**

1. The installation must have the flowmeters inlet and outlet pipes in the horizontal plane. In addition, the electronics must also be in the horizontal plane. This ensures that the rotor axis is vertical and that there is minimum friction on the bearings. With higher friction, then at lower flows errors will be observed. In the worst case, the minimum flow measurable will be higher as well.
2. Air pockets within the flowmeter. The simple throughput of water removes the air, but some assistance may be required. Removing the air pocket can also be effected just by twisting the flowmeter along the axis of the pipe.
3. Vibrations in the pipe and flowmeter may cause extra pulses to occur but we would find this unusual. Clamping the meter may assist.

Drawings included:

- \* C4726 Installation diagram and dimensions for MM BSP screwed meters
- \* C3564 Installation diagram for MM SS type flange mounted flowmeters
- \* C3729 MM Flowmeter installation

