Apollo Flow Measurement Ltd
Hoverflo 2 Flowmeter Manual
Issue 4
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Installation & Operation of the Hoverflo 2 Flowmeter

Note

Read this manual prior to installation

CONTENTS

Hoverflo 2 Stainless Steel
Bearingless Turbine Flowmeter

Hoverflo 2 All Plastic
Bearingless Flowmeter

1 INTRODUCTION

This unique bearingless flowmeter has been designed to measure the flow of aggressive and non-lubricating liquids. The all PVC or PVDF construction is ideal for acid duties. The characteristics of conventional turbine meters, high accuracy and repeatability are present but the absence of bearings gives very long term reliability.

The normal materials of construction are A.I.S. Grade 316 Stainless Steel, Polyvinylidene Fluoride (PVDF) or Polyvinylchloride (PVC). Other materials are available to special order.

The intrinsically safe version has ATEX certification for use in hazardous areas. Coded II 1 G EEx ia IIC T5.

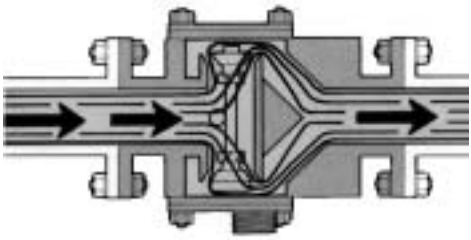
2 PRINCIPLE OF OPERATION

Liquid enters the flowmeter body chamber from the inlet port. The chamber contains a removable cartridge, which encloses a rotor. The rotor consists of a turbine and hoverdisc positioned at each end of the central shaft. Without flow the rotor rests on the top hoverseat. When flow commences the pressure drop across the lower hoverdisc lifts the rotor.

The liquid flow passes through both turbines causing the rotor to spin at a speed proportional to the flowrate. The liquid leaves the body chamber by way of the channels that lead to the exit port.

The lower hoverdisc has a series of magnets embedded in to the rim. These magnets are completely isolated from the line liquid. A variable reluctance pickoff coil situated below the rotor assembly senses the movement of the magnets, and a sine wave output at a frequency proportional to flow velocity is generated. This frequency is either fed directly to one of the Apollo instruments or locally conditioned by a preamplifier for transmission to remote instrumentation.

An ATEX approved pickoff and preamplifier is available for use in hazardous areas. When used with the appropriate barrier, this gives a completely intrinsically safe metering system.



3 INSTALLATION

(1) Ensure that all packaging and other foreign materials are removed from the flowmeter prior to installation.

(2) The meter must be installed with the arrow on the label pointing in the direction of the flow (refer to section 6). The flowmeter is unidirectional and conditions of reverse flow are to be avoided. Where reverse flow is unavoidable the rate of flow must be restricted to a flow rate of less than the normal minimum flow requirement.

(3) The preferred mounting for the flowmeter is in a horizontal pipeline with the pickoff/preamplifier below the centre line. Mounting in a vertical line results in an increase in the minimum flow requirement and reduces the linear range.

(4) The inlet and outlet pipework to the flowmeter must be of equal bore to the flowmeter and be straight over a distance of 10 pipe diameters upstream and 5 pipe diameters downstream. Where the inlet is preceded by a sudden change to flow direction, i.e. an elbow or diaphragm valve, the straight pipe requirements should be increased to 20 times.

(5) If it is necessary to install a plastic bodied meter into metal pipelines particular care must be taken during the installation. The meter must not be subjected to any stress resulting from the weight or misalignment of the pipeline. Expansion and contraction of the pipeline due to heat must also be taken into consideration. Thought should be given to the consequences of any fracture of the body resulting in spillage.

(6) Site the flowmeter away from strong magnetic fields, avoid locations where vibration may occur, screen and segregate cables carefully.

(7) A P5 preamplifier is required if the distance between the flowmeter and the electronic instrumentation is greater than 4 metres or where the installation is in an electrically or magnetically noisy environment close to pumps, motors, generators or switchgear. Intrinsically safe systems always require an I.S. Preamplifier if the signal is taken out of the I.S. area.

(8) Connect screens at only one point.

On Non IS systems screens are connected to the instrument.
On IS systems screens are connected to the barrier earth bus bar.

The screen terminal in the preamplifier is only an isolated terminal for the junction of screens from the coil and the cable to the instrument.

On plastic bodied flowmeters the screen terminal is earthed to the preamplifier case, this ensures the coil is earthed.

On steel bodied flowmeters the coil is earthed through the pipe line. Screens are not connected at the coil socket end.

If the coil is connected directly to the instrumentation, i.e. no preamplifier fitted, the screen is connected to the coil socket clamp on plastic bodied flowmeter to earth the coil. No screen connection is needed on the steel bodied flowmeter.

(9) As the flowmeter must remain full of liquid during all periods of use, any associated control valve should be situated downstream.

(10) On new pipework systems, prior to installation of the flowmeter the system should be purged to remove all foreign matter that may be detrimental to the operation of the flowmeter.

(11) After installing the flowmeter, gradually fill the line with the process liquid avoiding severe flow surges.

General Notes:-

(a) The application of a full bore flow to an empty pipework system is dangerous and should be avoided as damage to the flowmeter may result.

(b) Flow surges and ‘water hammer’ effects may result in inaccurate metering.

(c) Reverse flow may damage the flowmeter.

4 DISMANTLING AND MAINTENANCE

If cartridge removal is required the following procedure should be followed. (Refer to component identification, Section 5).

(1) Close all upstream and downstream valves.

(2) Release the securing nuts slowly to relieve any pressure. (Take care if aggressive liquids are being metered).

(3) Remove upper and lower covers and sealing plates.

(4) Carefully remove the upper collet (a pair of circlip pliers may be helpful).

(5) Withdraw the cartridge downwards.

(6) To replace the cartridge, insert it from below so that the locating pin engages in the body.

(7) Snap the upper collet into place.

(8) Replace upper and lower covers and tighten the securing nuts, ensuring both O'rings are in position. Inspect O'rings and replace if damaged.

(9) The flowmeter is now ready for service.

To remove the pickoff and preamplifier (where fitted).

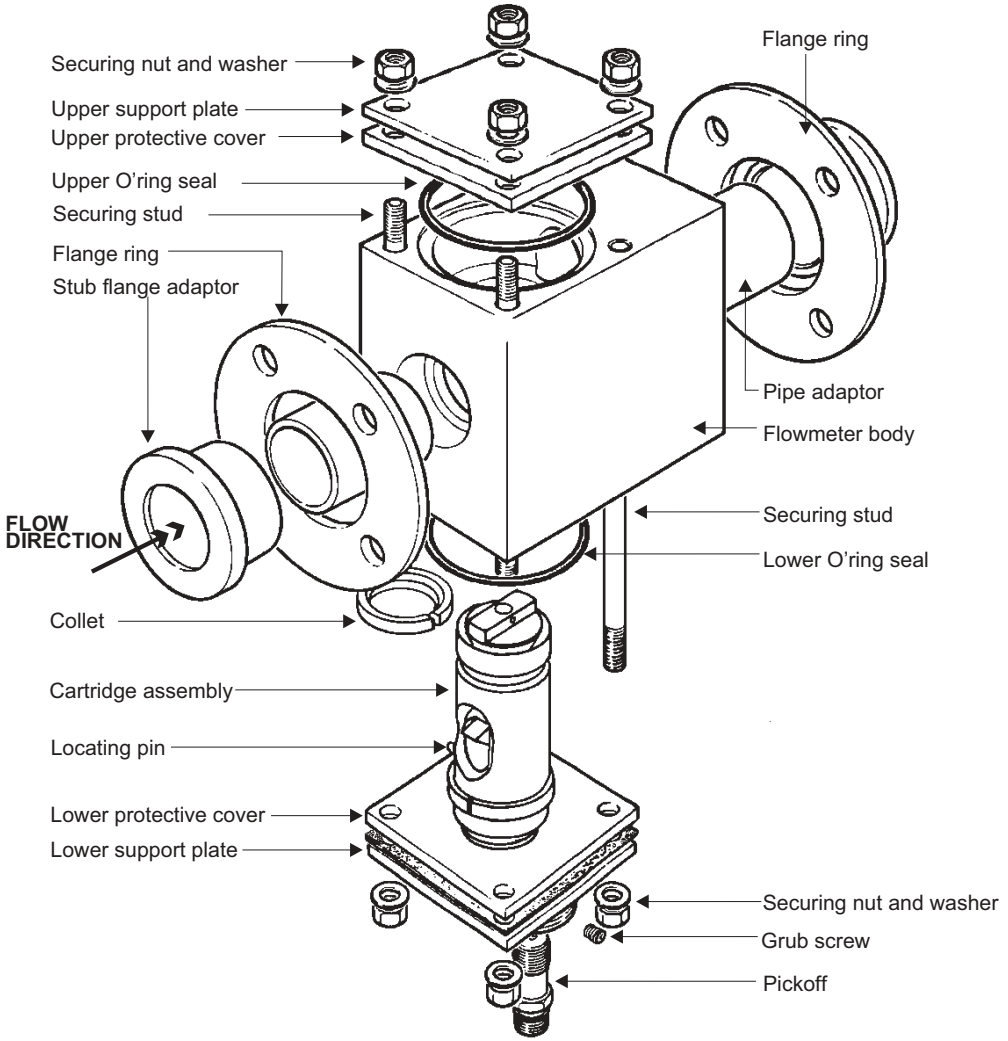
(1) Disconnect wiring and unscrew preamplifier from lower cover (or extension piece in case of IS systems).

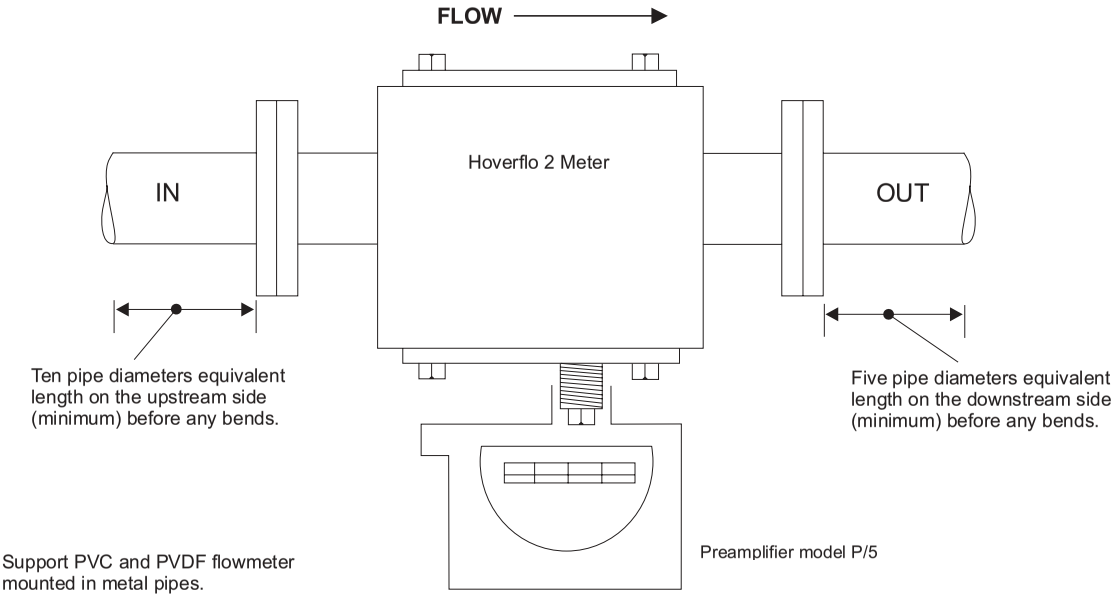
(2) Unscrew pickoff coil from lower cover. A box spanner ¾" A/F may be needed if the lock nut is tight.

On plastic bodied flowmeters supplied after October 1984 the pickoff coil is retained by a 4mm grub screw in the side of the screwed boss of the lower cover. This requires a 2mm socket key to release the coil (This revised method of fixing was adopted to avoid screwing the coil through the plastic protective cover).

(3) Reassembly is a reversal of the above procedure.

5 COMPONENT IDENTIFICATION





Support PVC and PVDF flowmeter mounted in metal pipes.
See section 3.

7 SPECIFICATION

Performance is dependent on size, model and liquid. Data is typical of performance obtained, based on calibration with water at 20°C.

Linearity:	+/- 0.5% of reading over the linear range +/- 1% of maximum reading over non-linear range			
Turndown ratio:	10:1 nominal overall 5:1 nominal over linear range			
Repeatability:	+/- 0.125% of reading			
Pressure drop:	0.85 bar (12 1bf/in2) at maximum flow			
Calibration:	Calibration is on water at ambient temperature			
Maximum working: pressure	PVC body	8 bar	@	20°C
		3 bar	@	60°C
	PVDF body	16 bar	@	20°C
		9 bar	@	60°C
		5 bar	@	110°C
	Carbon Steel body 70 bar - subject to flange rating (40 bar for 80mm body)			
	Stainless Steel body 70 bar - subject to flange rating (40 bar for 80mm body)			
Temperature range:	PVC body	-10°C	to	60°C
	PVDF body	-40°C	to	110°C
	Steel Bodies/ PVDF Internals	-40°C	to	110°C
	Steel bodies/ PVC Internals	-10°C	to	60°C

Table 1 : (Part 1)

Performance Specification

Hoverflo 2 Flowmeters : Plastic bodied version

Size mm	Cartridge Material	Overall Flow range lit/min	Linear Flow range lit/min	'K' Factors pul/lit	Maximum particle size mm
15	PVC	3.5 - 35	7 - 35	160	0.4
15	PVDF	4 - 35	7.5 - 35	160	0.4
25	PVC	10 - 110	22 - 110	83	1.0
25	PVDF	12 - 110	22 - 110	83	1.0
40	PVC	15 - 250	40 - 250	29	1.5
40	PVDF	18 - 250	50 - 250	29	1.5
50	PVC	35 - 440	85 - 440	17	2.0
50	PVDF	42 - 440	85 - 440	17	2.0
80	PVC	70 - 1000	220 - 1000	10.5	3.0
80	PVDF	85 - 1000	240 - 1000	10.5	3.0

Table 1 : (Part 2)

Performance Specification

Hoverflo 2 Flowmeters : Steel bodied version

Size mm	Cartridge Material	Overall Flow range lit/min	Linear Flow range lit/min	'K' Factors pul/lit	Maximum particle size mm
15	PVC	3.5 - 35	7 - 35	160	0.4
15	PVDF	4 - 35	7.5 - 35	160	0.4
25	PVC	10 - 110	22 - 110	83	1.0
25	PVDF	12 - 110	22 - 110	83	1.0
40	PVC	15 - 250	40 - 250	29	1.5
40	PVDF	18 - 250	50 - 250	29	1.5
50	PVC	35 - 440	85 - 440	17	2.0
50	PVDF	42 - 440	85 - 440	17	2.0
80	PVC	70 - 1000	220 - 1000	10.5	3.0
80	PVDF	85 - 1000	220 - 1000	10.5	3.0

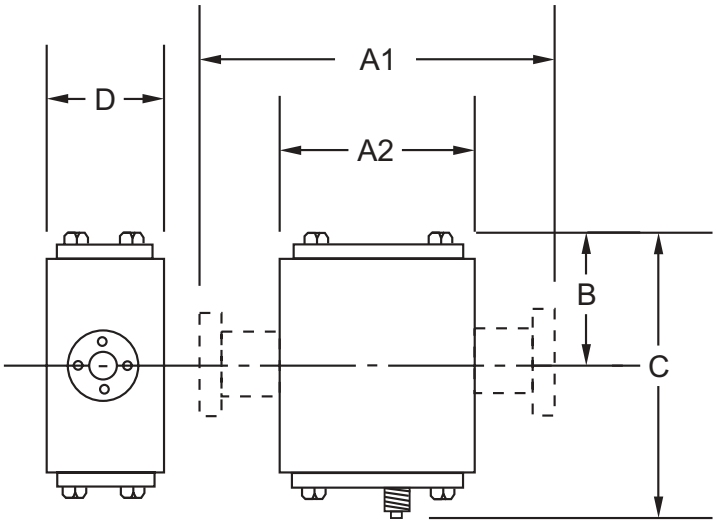
8 MATERIALS OF CONSTRUCTION

Body	PVC	PVDF	Carbon Steel	Stainless Steel
Removable Cartridge	PVC	PVDF	PVC or PVDF	PVC or PVDF
Rotor	PVC	PVDF	PVC or PVDF	PVC or PVDF
Bearings	No bearing surfaces			
O'rings (standard) (optional)	Viton PTFE	Viton PTFE	Viton PTFE	Viton PTFE
Upper & Lower Sealing Plates	PVC backed By SS	PVDF backed By SS	Stainless Steel	Stainless Steel
Body Connections	Socket weld or ring flange	Ring flange	BSP taper male or flanged	BSP taper male or flanged
Pickoff Assembly	Refer to catalogue sheet FM29 for complete details and electrical connections.			

9 OUTLINE DIMENSIONS

1. PVC and PVDF bodied flowmeters.

Connections:- Socket Weld (PVC only) or stub flanges with rings drilled to BS10 Table D, E ; DIN ND 10,16 ; ANSI 150

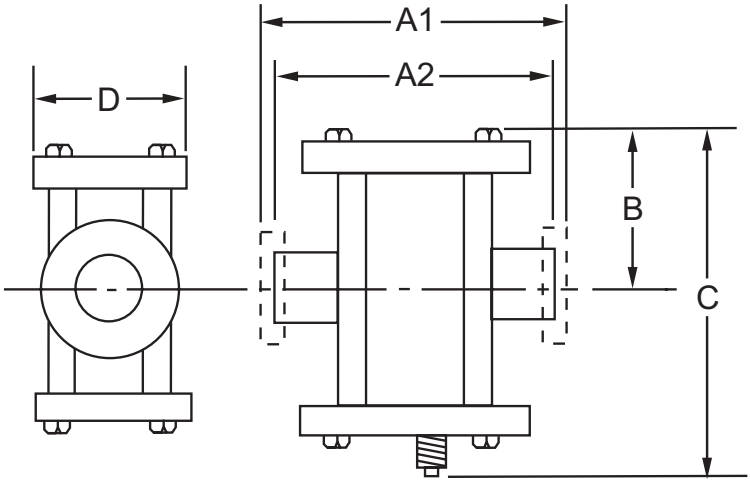


SIZE	A1 Flanged	A2 Socket	B	C	D
15	150	85	55	150	64
25	200	115	65	170	70
40	250	150	90	220	125
50	280	180	105	250	125
80	430	245	160	340	190

All dimensions in mm

2. Steel bodied flowmeters.

Connections:- BSP taper male or Flanges -
BS10 Table F ; DIN ND 16, 40 ; ANSI 150, 300.



SIZE	A1 Flanged	A2 Screwed	B	C	D
15	125	110	55	150	64
25	150	150	70	180	100
40	220	220	95	230	140
50	300	300	130	300	175
80	400	N/A	165	370	225

All dimensions in mm

10 PREAMPLIFIER DETAILS

(a) Models:

Two amplifiers are available for direct mounting onto the Hoverflo 2.

Model P/5 is a 2 wire non IS amplifier that is coupled to a standard pickoff coil.

Model IS P/5 is a 2 wire intrinsically safe amplifier and is coupled to an IS certified pickoff coil.

Ensure that you have the correct version for your application.

(b) Principle of operation:

Both models convert the low level voltage output from the Hoverflo 2 pickoff coil into current pulses prior to transmission to remote instruments. The circuits are conventional two wire systems with the power for operation using the same two wires as the transmitted current signal.

The amplifiers are enclosed in a weatherproof aluminium housing. This mounts directly to the lower coverplate of the flowmeter. Removal of the threaded front cover provides access to the single circuit board.

(c) Connections:

Model P/5 and IS P/5

Screen
Coil input
Coil input
Power supply (positive)
Power supply (negative)

Preamplifier Specifications

Standard		Intrinsically Safe
4V dc min to 40V dc max 15mA	Power Requirements	7V dc min to 40V dc max 15mA
3 Hz to 3 kHz	Pickoff coil input frequency range	3 Hz to 3 kHz
7.5 mV min	Pickoff coil input voltage	7.5 mV min
Typically 1.5mA to 12mA peak to peak current pulses	Signal Output	Typically 1.5mA to 12mA peak to peak current pulses
0 to 70^{o}C	Operating Temperature	0 to 70^{o}C
Weatherproof to IEC 529 1976 and IP 65 (BS 5490, 1977)	Casing Detail	Weatherproof to IEC 529 1976 and IP 65 (BS 5490, 1977)
	IS Certification	ATEX Code II 1 G EEx ia IIC T5

11 RECOMMENDED SPARES

In the event of maintenance or meter damage, we recommend the stocking of the following components (refer to section 5). Section 8 gives the Table of Materials of construction for each body material.

1. Cartridge Assembly (including collet).
2. Upper and Lower O'ring seals.
3. Pickoff.
4. Upper protective cover (PVC & PVDF bodies only).
5. Lower protective cover (PVC & PVDF bodies only).

TO ORDER SPARES PLEASE STATE:

1. Serial No. of Meter.
2. Body Material.
3. Cartridge Material.
4. No. of each component required.