LITREMETER
Specialist flow measurement engineering

VFF flowmeters for chemical injection

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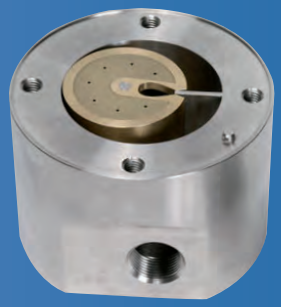
VFF Overview

Advantages of the measurement principle

- Very Low Flow Measurement, 0.0001 l/min
- Tolerant of particulate up to 150 microns
- Low pressure drop
- Single Moving Part
- Low Maintenance
- Large Viscosity range
- Measures pulsing flow accurately
- Preserves Molecular Integrity of fluid
- Highly Durable
- Proven over 25 years
- Positive Displacement

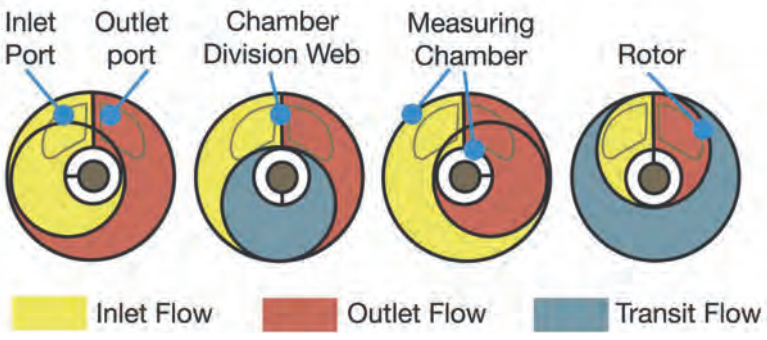


Key Property	Coriolis	Rotary Piston	Gear	Turbine
Very Low Flow Measurement, 0.0001 l/min		√		
Tolerant of particulate up to 150 microns	√	√		√
Low pressure drop		√		√
Single Moving Part	√	√		√
Large Viscosity range including methanol	√	√		
Measures pulsing flow accurately		√	√	
Preserves Molecular Integrity of fluid	√	√		√
Pressure independent including over 6,000 psi /400 bar	√	√		√
Up to 2500 bar		√		√

Used worldwide, thousands of chemical injection points are monitored today using VFF flowmeters.

VFF – Rotary Piston Principle of Operation:

The flow causes a rotor to move within a measuring chamber. This movement is sensed, giving an output representing an increment of volume flow. The rotor is a disc shape with an annular groove on its underside capable of holding and transporting flow from the chamber inlet to the outlet. Some fluid is also transported in a cavity formed between the rotor outside wall and the chamber wall. A centre 'peg' under the rotor is constrained to run in a circular groove in the body. A web (or plate) in the body is engaged with a slot in the rotor and this modifies the rotation to that of an oscillation as flow passes. It is this oscillation that compartments the fluid into 'positively displaced pockets'. The top of the rotor is equipped with a powerful magnet directly above the 'peg' that is on the underside and so this also has a circular path which allows it to engage and disengage a reed switch sensor located in the top cap above. A volt-free contact closure output signal is given for each oscillation which represents a volume increment. The fluid is transported in a 'positive' manner at all times. The typical metering repeatability is better than 0.2% and a meter accuracy of 1% actual reading.



The flow of the chemical causes the rotor to rotate.
Each rotation produces one pulse.

Selected Recent Oil and Gas Contracts

Project	Meter Type	Application	Operator	Customer	FPSO?
Brent Charlie	VFF	Chemical Injection	Shell UK	Shell UK	
Daniel Boone	VFF	Corrosion Inhibitor		EDG	
Ekofisk	VFF	Scale Inhibitor/MEG	ConocoPhilips	Aker Solutions	
Kapuni	VFF	Corrosion Inhibitor		Transfield Worley/Krohne	y
In Amenas	VFF	Corrosion Inhibitor	BP	SPX	
West Sole Alpha	VFF/Hoffer	KHI/Methanol	BP	BP	
Chim Sao (formerly Blackbird)	VFF	Corrosion Inhibitor, Scale Inhibitor, Wax Inhibitor, Pour Point Depressant, Methanol, Demulsifier	VietsovPetro	Tecmach	y
Lankahuasa-B	VFF	Chemical Injection		CIT	
Britannia	VFF	Methanol		AMEC	
Mukhaizana	VFF	Scale Inhibitor		Occidental of Oman	
Dubai	VFF	Corrosion Inhibitor		TPC FZE	
Armada	VFF	Potable Water	BG	AMEC	
Heidrun	VFF	HW540 hydraulic		Anzett Norway	
Elgin-Franklin	LM	Wash Water	Total	Total	
Dunbar	VFF	Methanol	Total	Total	
Jack & St Malo for Subsea and Topsides	VFF x 137	Corrosion Inhibitor, Scale Inhibitor, Wax Inhibitor, Pour Point Depressant, Methanol, Demulsifier etc injection up to 15,000 psi	Chevron	Lewa	y
Angola, Block 31	VFF subsea x 90	Chemical injection	BP	confidential	
Jasmine	VFF	Chemical injection and methanol injection	ConocoPhilips	SPX Process	
IGDP	VFF	Chemical injection	ADMA-OPCO	SPX Process	
P47 (Brazil)	VFF	Scale inhibitor	Petrobras Brazil	Ultratec/ Projemar	y
P50 (Brazil)	VFF	Chemical injection	Petrobras		y
P51 (Brazil)	VFF	Chemical Injection	Petrobras	Flutrol Brazil	
P52 (Brazil)	VFF x 142	Chemical Injection	Petrobras	IFS Houston	
P52 (Brazil)	VFF	Chemical Injection	Petrobras	Petreco Singapore	
P53 (Brazil)	VFF	Methanol	Petrobras	CAM Petreco	
P53 (Brazil)	VFF	Chemical Injection	Petrobras	Milton Roy	y
P54 (Brazil)	VFF	Chemical Injection	Petrobras	IFS Houston	
P56 (Brazil)	VFF	Chemical Injection	Petrobras	Flutrol Brazil	
Thunderhorse (GOM)	VFF	Corrosion Inhibitor	BP	Lewa	
Tombua Landana	VFF x 99	Chemical Injection	Chevron	Integrated Flow Solutions	
Sakhalin Island, EPC3 Orlan (Russia)	VFF	Chemical injection	Exxon Neftegas	Fluor	

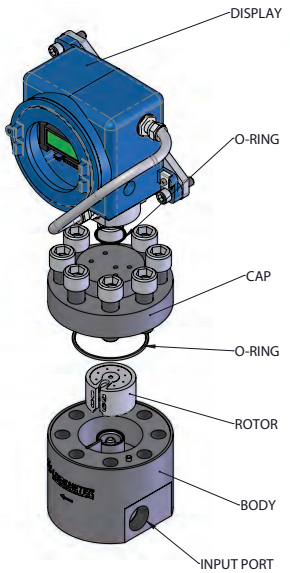
VFF Datasheet

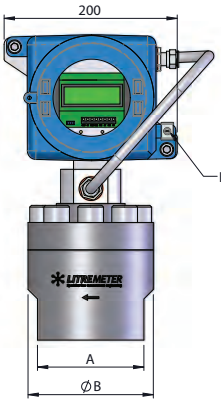
Model:	LF05, LF15, MF30, VFF4, VFF8 & HF20 Rotary Piston Positive Displacement Flowmeters
Body:	207bar (3000 psi) or 414bar (6000 psi) body provided in 316L stainless steel with ½", ¾" or 1" NPT female process connections in-line. Higher pressure versions available with connections to suit e.g. AE MP 3/8"OD tube. Alternate materials are available such as titanium, duplex, super duplex and 17-4PH steel.
Rotor:	The rotor is provided in either anti galling stainless steel (AG, Nitronic 60), Titanium (Ti), Brass (B) or Carbon graphite (C), with a 316SS encapsulated magnet depending on the application. An optional coating is available on the rotor & chamber which more than doubles the maximum flow rate and increases the low flow capability (AGPVD & TiPVD).
Seal:	There is a single FPM O-ring seal between the top cap and body. Other elastomers are available e.g. FFKM, FEP covered silicon and in higher pressure versions PTFE and Inconel.
Pick-up/Transmitter/Pulse Output:	There is one reed switch installed in a SS housing which is O-sealed to the meter body providing a rating of IP68. The optional display is mounted on this housing or remotely. The reed switch outputs in pulses per litre are approximately LF05: 1200, LF15: 500, MF30: 200, VFF4: 80, VFF8: 45, HF20: 20, HF60: 7. Typical reed switch life is 30 years at continuous maximum operating flow rate.
Pressure rating:	207, 414, 690, 1035, 1380, 2500 and 4000 bar. (3000, 6000, 10000, 15000, 20000, 36000 and 60000 psi).
Temperature rating:	-40°C to +150°C (subject to chemical compatibility, pressure rating and location of the display), higher temperature sensor available. With an integral mounted Exd display instrument, temperature rating is -20 - 55°C.
Viscosity range:	0.8 to 2000 cSt or greater. The normal meter maximum flow rate applies for viscosities from 1.2 to 30 cSt. For higher viscosities up to 2000 cSt a reduced maximum flow rate may apply.
Flow rate range:	With AGPVD option. LF05:0-30 l/hr (0-0.5 l/min, 7.9 USG/hr, 45 USGPD) TiPVD only LF15: 0-90 l/hr (0-1.5 l/min, 23.8 USG/hr, 570 USGPD). MF30: 0-180 l/hr (0-3 l/min, 47.2 USG/hr, 1134 USGPD). VFF4: 0-480 l/hr (0-8 l/min, 127 USG/hr, 3040 USGPD). VFF8: 0-960 l/hr (0-16 l/min, 252 USG/hr, 6040 USGPD). HF20: 0-2400 l/hr (0-40 l/min, 640 USG/hr, 15200 USGPD). HF60: 0-7200 l/hr (0-120 l/min, 1920 USG/hr, 45,600 USGPD). Larger sizes available.
Filtration:	A 100 micron filter is advisable for 100% long life serviceability. If filtration is not possible, consult Litre Meter.
Accuracy:	A calibration certificate is provided based on a representative viscosity fluid for the application. The calibration certificate confirms the flowmeter accuracy. Improved system accuracy can be provided typically to ±1% of actual reading where the linearisation signal processing facility of the display instrument is employed.
Optional Display, remote or head mounted:	Exd display of rate and total, 24Vdc, 3 or 4 wire with Optional HART, MODBUS or Fieldbus comms. ATEX, INMETRO, FM or UL. Coated aluminium or stainless. See separate FPodExd data sheet.
	Exia display of rate and total also available, battery or loop-powered, optional flow alarms, ATEX. GRP or coated aluminium. See separate F112 or F118 data sheet.

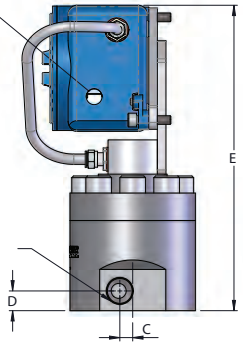
Documentation:

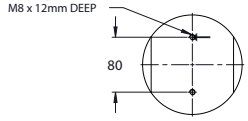
Operating & Maintenance Manual	LM0333 with Quick Start Info on LM0548
Conformity:	These products conform to PED and EMC. Hazardous Area approved as standard.

	Meter	LF05		Meter	LF15		Meter	MF30		Meter	VFF4	
	Rotor	TiPVD		Rotor	AGPVD		Rotor	AGPVD		Rotor	AGPVD	
	Maximum	30		Maximum	90		Maximum	180		Maximum	500	
		l/hour	Turndown		l/hour	Turndown		l/hour	Turndown		l/hour	Turndown
Standard		min. flow			min. flow			min. flow			min. flow	
minimum	Water	0.600	50 : 1	Water	1.7	52.9 : 1	Water	10	18 : 1	Water	15	33.3 : 1
	1.5cSt	0.300	100 : 1	3cSt	0.5	180 : 1	3cSt	2.4	75 : 1	3cSt	3.5	143 : 1
	2.5cSt	0.200	150 : 1	10cSt	0.4	225 : 1	10cSt	1.5	120 : 1	10cSt	2	250 : 1
	10cSt	0.100	300 : 1	50cSt	0.1	900 : 1	50cSt	1	180 : 1	50cSt	1.6	313 : 1
	50cSt	0.060	500 : 1	250cSt	0.02	4500 : 1	250cSt	0.3	600 : 1	250cSt	1.25	400 : 1
Optional		min. flow			min. flow			min. flow			min. flow	
minimum	Water	0.400	75 : 1	Water	1	90 :1	Water	8	22.5 : 1	Water	9	55.5 : 1
at extra	1.5cSt	0.220	136 : 1	3cSt	0.3	300 : 1	3cSt	1.8	100 : 1	3cSt	2	250 : 1
cost:	2.5cSt	0.080	375 : 1	10cSt	0.2	450 : 1	10cSt	0.8	225 : 1	10cSt	1.6	313 : 1
£350	10cSt	0.020	1500: 1	50cSt	0.08	1125 : 1	50cSt	0.6	300 : 1	50cSt	1	500 : 1
	50cSt	0.012	2500 : 1	250cSt	0.008	11250 : 1	250cSt	0.2	900 : 1	250cSt	0.8	625 : 1

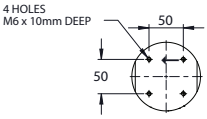






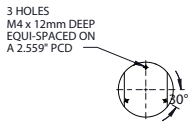


MOUNTING METHOD 1



MOUNTING METHOD 2

	NPTf		F to F A	OD øB	offset C	height to CL D	*Height E	Weight kg	Mounting Method
LF15	1/2"	414bar	62.5	80	7	18	263	8	1
MF30	1/2"	414bar	90	100	7	21	276	12	2
VFF4	1/2"	414bar	80	90	7	21	263	11	1
VFF8	1/2"	414bar	90	100	7	21	276	12	2
HF20	3/4"	207bar	105	125	10	24	287	16	2
HF60	1"	414bar	130	145	29.4	33	314	24	3



MOUNTING METHOD 3

					FINISH 0.8µm Ra unless otherwise stated	MATERIAL:	Dimensions in mm unless otherwise stated
					LITREMETER Specialist flow measurement engineering	Litre Meter Ltd 50/53 Rabans Close Rabans Lane Ind Est Aylesbury Bucks HP19 8TG	Tel: 01296 420341 Fax: 01296 436446
6	2353	DRB		10.08.09	Website http://www.litremeter.com	E-mail do@litremeter.com	
Issue	DCMR	Drawn	Appd	Date			

TOLERANCES x. 1mm x.xx 0.25mm x.x 0.5mm x.xxx 0.05mm x° ¼°

Title: VFF THREADED FLOWMETER RANGE WITH Exd ENCLOSURE
INSTALLATION DIMENSIONS

Drawing No. C5830 (1 of 2)

STOCK CODE:

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