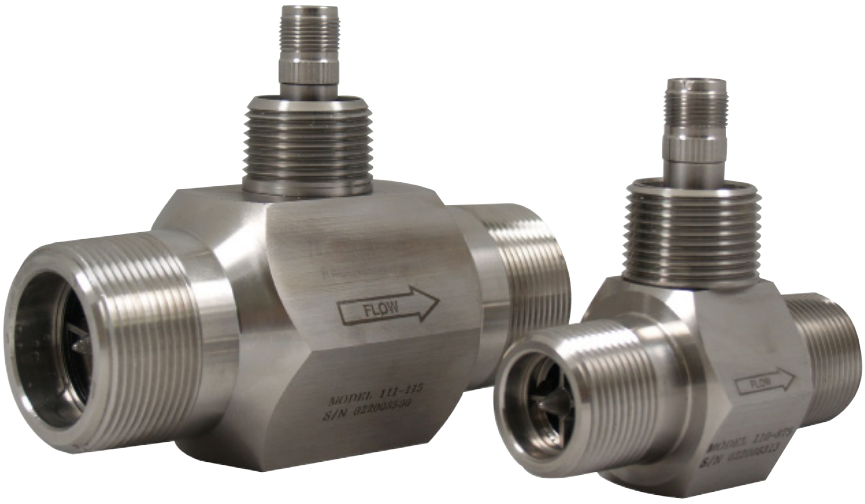
FLO-CORP.com

SURGEPRO™ TFM1
Turbine Flow Meter
OPERATING INSTRUCTIONS



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OPERATIONAL START-UP

Fluid entering the meter passes through the inlet flow straightener which reduces its turbulent flow pattern and improves the fluid's velocity profile. Fluid then passes through the SurgePro blades causing it to rotate at a speed proportional to the fluid velocity. As each blade passes through the magnetic field, created at the base of the pickoff transducer, AC voltage (pulse) is generated in the pickup coil (see Figure 1). These impulses produce an output frequency proportional to the volumetric flow through the meter. The output frequency is used to represent flow rate and/or totalization of fluid passing through the SurgePro flow meter.

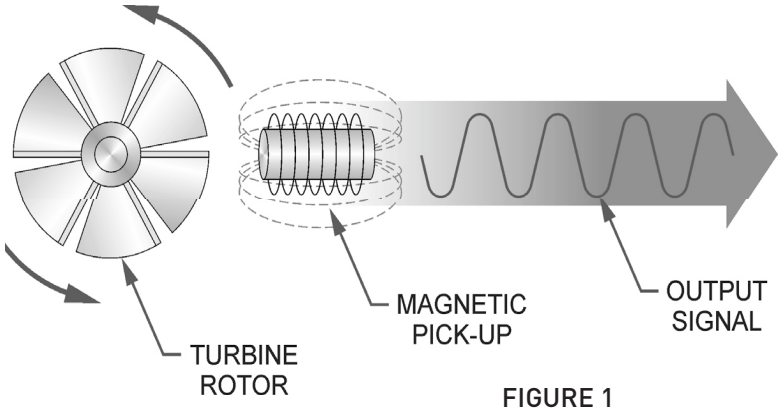

FIGURE 1

Schematic illustration of electric signal generated by rotor movement.

SurgePro METER AND REPAIR KIT

The Model TFM1 SurgePro flow meter is designed withstand the rigorous demands of the most remote flow measurement applications. The Model TFM1 SurgePro Flow meter maintains measurement accuracy and mechanical integrity in the corrosive and abrasive fluids commonly found in oil field waterflood projects pipelines, in-situmining operations, offshore facilities and plant locations. Simple to install and service, it can operate in any orientation (horizontal to vertical) as long as the "flow direction" arrow is aligned in the same direction as the actual line flow. For optimum performance, the flow meter should be installed with a minimum of 10 diameters upstream pipe length and 5 diameters down stream pipe length.

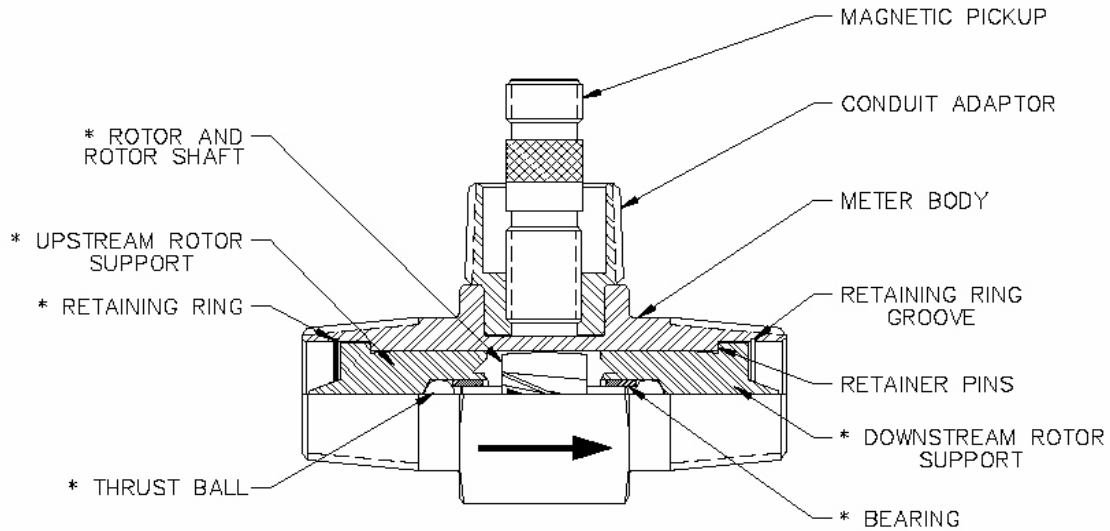

FIGURE 2

Typical cross-section of SurgePro™ TFM1 Turbine Flow Meter

NOTE: * INDICATES PARTS CONTAINED IN REPAIR KITS

SPECIFICATIONS

Accuracy:	+/-1 % of reading
Repeatability:	+/-0.1%
Operating Temperature:	-150°F to +350°F (-101°C to +177°) standard Temperatures to +425°F (+232°C) with high-temp pick-up
Turndown Ratio:	About 10:1
End Connections:N	PT, BSP, Flange, Grooved End

WARNING: Pressure in excess of allowable rating may cause the housing to burst and cause serious personal injury.

REPAIR KIT

The SurgePro™ TFM1 Turbine Flow Meter Repair Kit is designed for easy field service of a damaged flow meter, rather than replacing the entire flow meter (see Appendix B for repair kit information). Repair parts are constructed of stainless steel alloy and tungsten carbide and is factory calibrated to ensure accuracy throughout the entire flow range. Each kit is complete and includes the calibrated K-factor which used to recalibrate the flow monitor or, other electronics, to provide accurate output data.

ORDERING INFORMATION

Model Number (1)	Meter Size	End Connection (2)	Maximum Pressure	Flow Ranges		K-Factor Pulses/Gal (3)
				GPM	BPD	
TFM1-03-04M	3/8”	1/2” x 1/2” MALE NPT	5,000 PSI	0.6 - 3	20 - 100	18,000
TFM1-04-04M	1/2”	1/2” x 1/2” MALE NPT	5,000 PSI	0.75 - 7.5	25 - 250	13,000
TFM1-06-04M	3/4”	1/2” x 1/2” MALE NPT	5,000 PSI	2 - 15	68 - 515	3,300
TFM1-03-08M	3/8”	1” x 1” MALE NPT	5,000 PSI	0.6 - 3	20 -100	18,000
TFM1-04-08M	1/2”	1” x 1” MALE NPT	5,000 PSI	0.75 - 7.5	25 - 250	13,000
TFM1-06-08M	3/4”	1” x 1” MALE NPT	5,000 PSI	2 - 15	68 - 515	3,300
TFM1-07-08M	7/8”	1” x 1” MALE NPT	5,000 PSI	3 - 30	100 - 1000	3,100
TFM1-08-08M	1”	1” x 1” MALE NPT	5,000 PSI	5 - 50	170 - 1700	870
TFM1-12-12M	1.5”	1.5” x 1.5” MALE NPT	5,000 PSI	15 - 180	515 - 6000	330
TFM1-12-16M	1.5”	2” x 2” MALE NPT	5,000 PSI	15 - 180	515 - 6000	330
TFM1-16-16T	2”	2” x 2” FEMALE NPT	5,000 PSI	40 - 400	1300 - 13000	52
TFM1-24-00G	3” G	ROOVED END	800 PSI	60 - 600	2100 - 21000	57
TFM1-32-00G	4”	GROOVED END	800 PSI	100 - 1200	3400 - 41000	29
TFM1-48-00G	6”	GROOVED END	800 PSI	200 - 2500	6800 - 86000	7
TFM1-64-00G	8”	GROOVED END	800 PSI	250 - 3500	12000 - 120000	3
TFM1-80-00G	10”	GROOVED END	800 PSI	500 - 5000	17000 - 171000	1.6

Ordering Notes

1) Select the best model configration based on your requirements.
2) If you require a Special End Connection, please consult factory with your requirments. Grooved or Flange End Connections may be requested on all units.
3) All K-Factors are approximate.

INSTALLATION INSTRUCTIONS

Prior to installation, the flow meter should be checked internally for foreign material and to ensure the SurgePro rotor spins freely. Fluid lines should also be checked and cleared of all debris. The flow meter must be installed with the flow arrow, etched on the exterior of the meter body, pointing in the direction of fluid flow. Though the meter is designed to function in any position it is recommended, where possible, to install horizontally with the magnetic pick-up facing upward. The liquid being measured should be free of any large particles that may obstruct rotation of the rotor. If particles are present, a mesh strainer should be installed upstream before operation of the flow meter.

PART NUMBER	STRAINER MESH	CLEARANCE	FILTER SIZE
TFM1-03-08M	60 X 60	.0092	260 MICRON
TFM1-04-08M	60 X 60	.0092	260 MICRON
TFM1-06-08M	60 X 60	.0092	260 MICRON
TFM1-07-08M	60 X 60	.0092	260 MICRON
TFM1-08-08M	60 X 60	.0092	260 MICRON
TFM1-12-08M	20 X 20	.0340	.86 mm
TFM1-16-16T	10 X 10	.0650	1.6 mm
TFM1-12-16M	20 X 20	.0340	.86 mm
TFM1-24-00G	8 X 8	.0900	2.3 mm
TFM1-32-00G	10 X 10	.0650	1.6 mm
TFM1-48-00G	4 X 4	.1875	4.8 mm
TFM1-64-00G	8 X 8	.0900	2.3 mm
TFM1-80-00G	4 X 4	.1875	4.8 mm

Table 1
Strainer Mesh Installation Details

The preferred plumbing setup is one containing a by-pass line (Figure 3) that allows meter inspection and repair without interrupting flow. If a by-pass line is not utilized, it is important that all control valves be located down-stream of the flow meter (Figure 4).

CAUTION: Damage can be caused by striking an empty meter with a high velocity flow stream.

This is true with any restriction in the flow line that may cause the liquid to flash. If necessary, air eliminators should be installed to ensure that the meter is not incorrectly measuring entrained air or gas. It is recommended that a minimum length, equal to ten (10) pipe diameters of straight pipe, be installed on the up-stream side and five (5) diameters on the down-stream side of the flow meter. Otherwise meter accuracy may be affected. Piping should be the same size as the meter bore or threaded port size. Do not locate the flow meter or connection cable close to electric motors, transformers, sparking devices, high voltage lines, or place connecting cable in conduit with wires furnishing power for such devices. These devices can induce false signals in the flow meter coil or cable, causing the meter to read inaccurately.

OPERATIONAL START-UP

The following steps should be folllowed when installing and starting the meter.

WARNING: Make sure that fluid flow has been shut off and pressure in the line released before attempting to install the meter in an existing system.

1). After meter installation, close the isolation valves, and open the by-pass valve. Flow liquid through the by-pass valve for sufficient time to eliminate any air or gas in the flow line.

CAUTION: High velocity air or gas may damage the internal components of the meter.

2). Open up-stream isolating valve slowly to eliminate hydraulic shock while charging the meter with the liquid. Open the valve to full open.

3). Open down-stream isolating valve to permit meter to operate.

4). Close the bypass valve to a full closed position.

5). Adjust the downstream valve to provide the required flow rate through the meter. Note: The downstream valve may be used as a control valve.

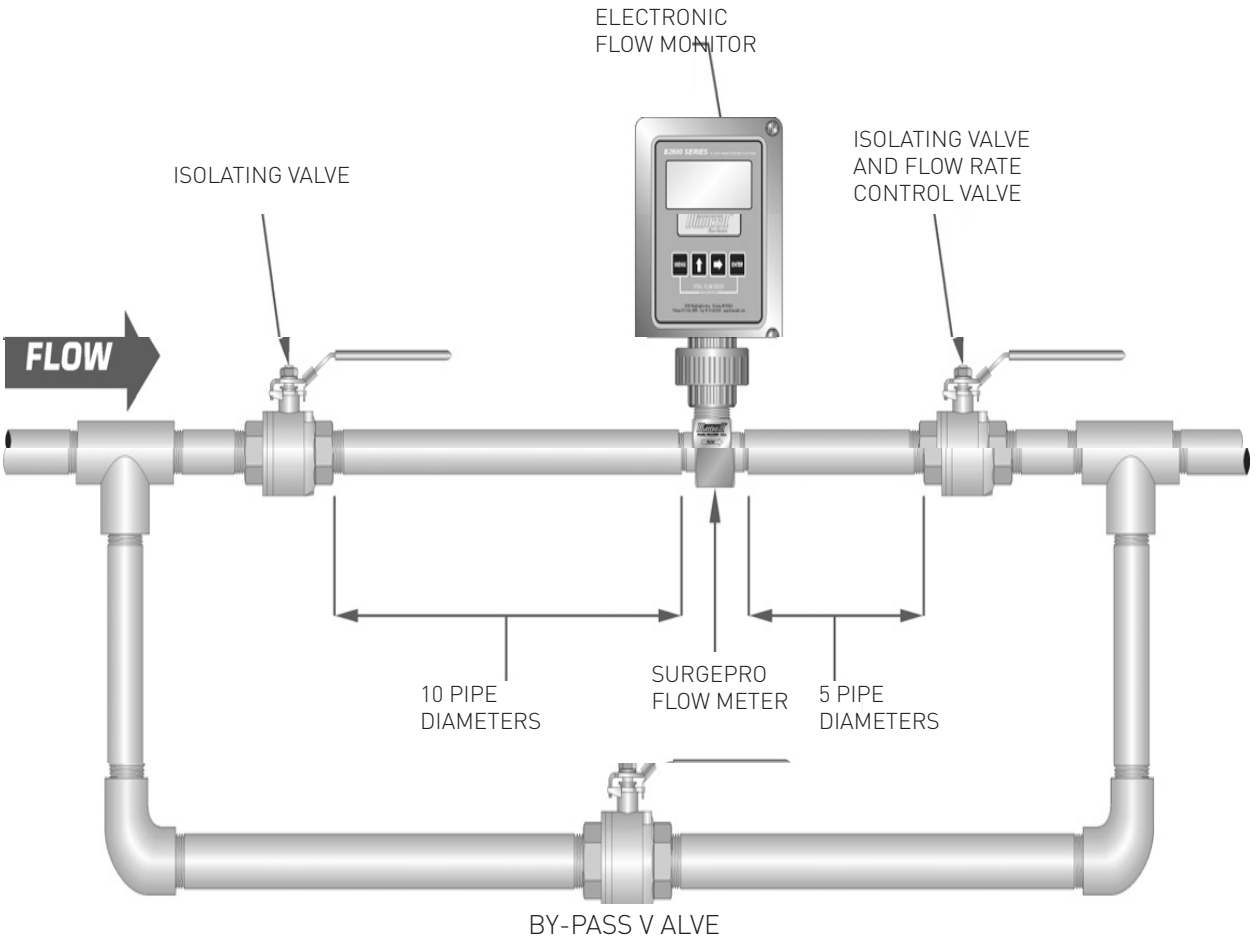

Figure 3
Meter installation utilizing a bypass line

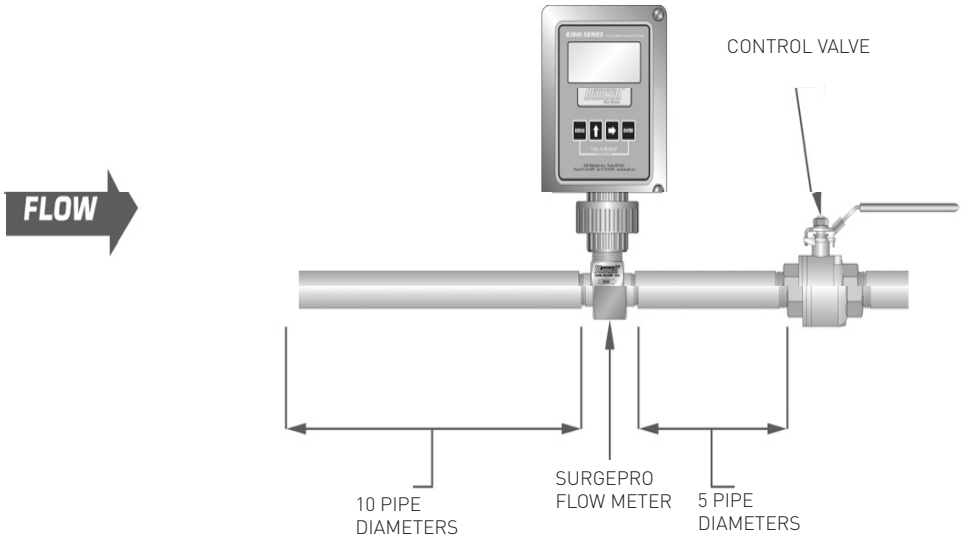

Figure 4
Meter installation without
utilizing a bypass line

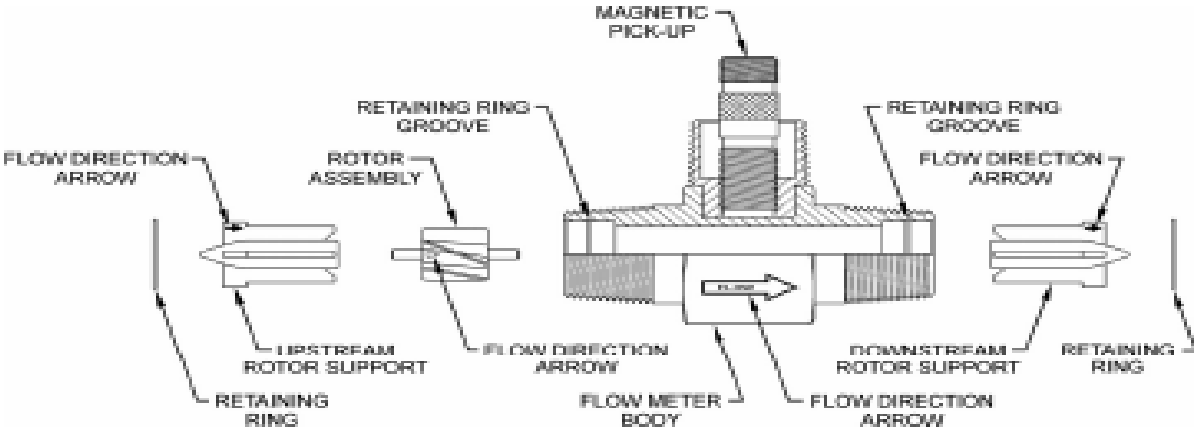

Figure 5
Typical turbine meter component directory

TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSE	REMEDY
Meter indicates higher than actual flow rate	-Cavitation -Debris on rotor support -Build up of foreign material on meter bore -Gas in liquid	-Increase back pressure -Clean meter -Clean meter -Install gas eliminator ahead of meter
Meter indicates lower than actual flow rate	-Debris on rotor -Worn bearing -Viscosity higher than calibrated	-Clean meter and add filter -Clean meter and add filter -Recalibrate monitor
Erratic system indication, meter alone works well (remote monitor application only)	Ground loop in shielding	Ground shield one place only. Look for internal electronic instrument ground. Reroute cables away from electrical noise
Indicator shows flow when shut off	Mechanical vibration causes rotor to oscillate without turning	Isolate meter
No flow indication. Full or partial open position	Fluid shock, full flow into dry meter or impact caused bearing separation or broken rotor shaft	Rebuild meter with repair kit and recalibrate monitor. Move to location where meter is full on start-up or add downstream flow control valve
Erratic indication at low flow, good indication at high flow	Rotor has foreign material wrapped around it	Clean meter and add filter
No flow indication	Faulty pick-up	Replace pick-up
System works perfect, except indicates lower flow over entire range	Bypass flow, leak	Repair or replace bypass valves, or faulty solenoid valves
Meter indicating high flow, upstream piping at meter smaller than meter bore	Fluid jet impingement on rotor	Change piping
Opposite effects of above	Viscosity lower than calibrated	Change temperature, change fluid or recalibrate meter

STATEMENT OF WARRANTY

Flow Line Options warrants the end purchaser, for a period of one year from the date of shipment from the factory, that all flow meters manufactured by it are free from defects in materials and workmanship. This Warranty does not cover products that have been damaged due to defects caused by abnormal use, misapplication, abuse, lack of maintenance, modified or improper installation. Flow Line Options obligation under this warranty is limited to the repair of replacement of a defective product, at no charge to the end purchase, if the product is inspected by Flow Line Options and found to be defective. Repair or replacement is at Flow Line Options discretion. A return goods authorization (RGA) number must be obtained from Flow Line Option before any product may be returned for warranty repair or replacement. The product must be thoroughly cleaned and any process chemicals removed before it will be accepted for return. The purchaser must determine the applicability of the product for its desired use and assumes all risks in connection therewith. Flow Line Options assumes no responsibility or liability for any omissions or errors in connection with the use of its products. Flow Line Options will under no circumstances be liable for any incidental, consequential, contingent or special damages or loss to any person or property arising out of the failure of any product, component or accessory. All expressed or implied warranties, including the implied warranty of merchantability and the implied warranty of fitness for a particular purpose or application are expressly disclaimed and shall not apply to any products sold or services rendered by Flow Line Options. The above warranty supersedes and is in lieu of all other warranties, either expressed or implied and all other obligations or liabilities. No agent or representative has any authority to alter the terms of this warranty in any way.