



# Flow Line Options



## MEMFlo Flowmeter Manual

# Table of Contents

Introduction.....	2
Safety Precautions.....	2
Installation Preparation.....	2
Maximum Flows.....	3
Startup.....	5
Temperature Limits.....	6
Maintenance.....	8
Disassembly.....	9
Inspection & Cleaning.....	10
Operating Limits.....	11
Trouble Shooting.....	13

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## INTRODUCTION

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Please read this instruction manual and enclosed data sheets before installation and startup! Pay particular attention to safety precautions and operating limits. MEMFlo flow meters are designed for industrial environments, and reviewing this information will assure years of trouble-free service.

## SAFETY PRECAUTIONS

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Personnel safety should be considered before pressurizing and operating the system. There are numerous possibilities for error in system operation and maintenance as well as component installation. Because human eyes must necessarily come into close proximity with the flowmeter to read it, Flow Line Options recommends that safety shielding be used with the meter along with safety glasses. Flow Line Options can provide an optional, tubular shield that slips over the flowmeter sight tube. Our panel mount kit (available for most standard models) also provides shielding. Another protective measure is to use a sheet of transparent, high-impact material in a broad area in front of the meter. If hazardous, toxic, or flammable fluids are being metered, recommended safeguards should include methods to protect personnel from splash or rebound. A method of quick, safe removal of dangerous fluids should also be included.

## INSTALLATION PREPARATION

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MEMFlo flow meters are ready to install as-is, although the sight tube may need repositioning so the scale is visible after installation. First, remove the protective caps from the connections ports. **ALSO, REMOVE THE PLASTIC SHIPPING TUBING ABOVE THE INLET CAP IN THE METER CORE TUBE!** Check that the float moves freely within the core tube, and that no packing materials are in the meter.

### RECOMMENDED PIPING:

MEMFlo flow meters generally have no special straight run or other piping requirements. Inlet piping should be the same size as the meter connection. Some effect on meter accuracy may occur at high flow velocities if inlet piping guidelines are violated. Please refer to the table on the next page. When installing on different size pipe, use standard pipe adapters and come into the meter inlet with a nipple 8 diameters long of the same size for greatest accuracy. Control valves should be mounted on the outlet side of the meter. The use of a three valve manifold around the meter is suggested (per Figures 2 & 3) as it allows uninterrupted process flow while the meter is being cleaned.

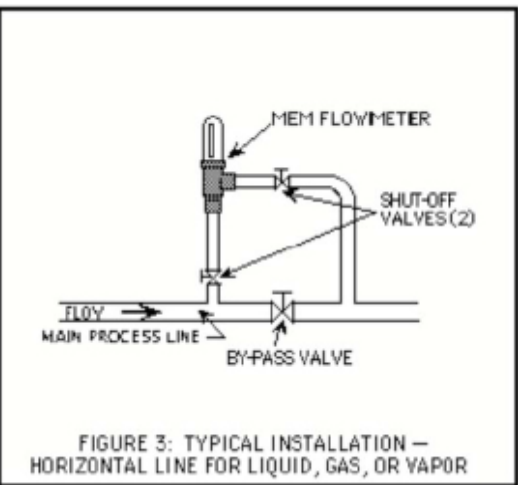
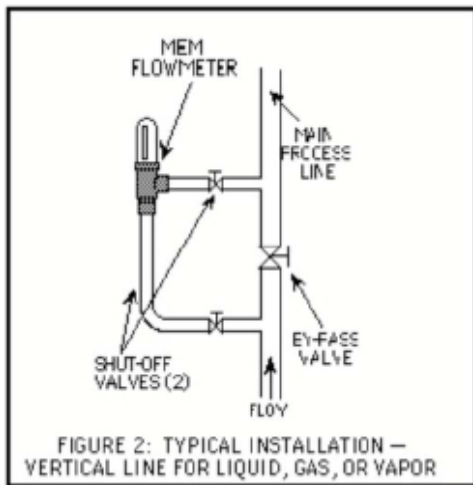
# MAXIMUM FLOWS

## MAXIMUM FLOWS (WITHOUT EFFECTING ACCURACY) FOR UNDERSIZED PIPES CONNECTED DIRECTLY TO MEMFLO FLOWMETER INLETS

PIPE NPS	*LIQUID FLOW		GAS FLOW			
	DATA (ID) <sup>2</sup>	MAX. * GPM LIQ.	ATMOS.	50 PSIG	MAX. SCFM AIR @ ‡	
					100 PSIG	200 PSIG
1/4	0.132	1.72	0.864	3.80	6.74	12.6
3/8	0.243	2.98	1.59	7.00	12.4	23.2
1/2	0.387	4.74	2.53	11.1	19.8	37.2
3/4	0.679	8.31	4.44	19.5	34.7	64.9
1	1.100	13.47	7.20	31.7	56.1	105
1-1/4	1.904	23.32	12.5	58.8	97.2	182
1-1/2	2.592	31.74	17.0	74.6	132	248
2	4.272	52.29	28.0	123	218	408
2-1/2	6.096	74.56	39.9	176	311	582
3	9.413	115.2	61.6	271	480	804
4	16.209	198.4	106	467	827	1549
6	36.784	450.0	241	1059	1878	3514

\* Data per *Cameron Hydraulic Data*. Based on 5 FPS max. liquid velocity having no effect on MEMFlo flowmeter accuracy if the inlet pipe is smaller than the meter connections.

‡ SCFM = 0.445 x (psig + 14.7) x (ID)<sup>2</sup>. Based on 20 FPS max. air velocity having no effect on MEMFlo flowmeter accuracy if the inlet pipe is smaller than the meter connections.



Apply wrenches only on the flats or outer rims of the connection ports. Avoid over-tightening (particularly with PVC or CPVC models- no more than one turn after hand tight), and do not use wrenches on other portions of the body or sight tube. **When solvent cementing in the vicinity of a meter with a polysulfone sight tube, the tube should be removed until the cement dries and fumes clear.**

**SURGE CHAMBERS & ACCUMULATORS:**

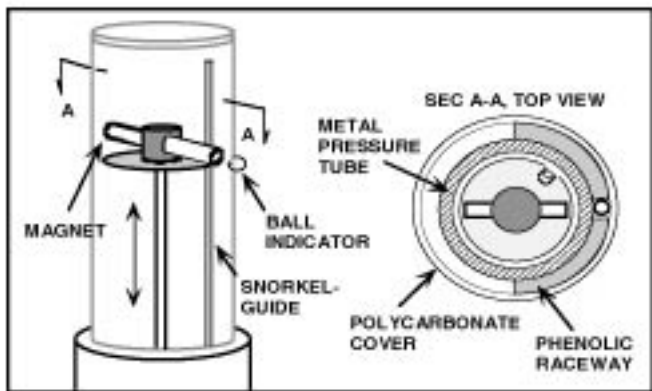
Flow meters are more accurate and less likely to be damaged when the fluid flow is smooth. If the meter must be installed on a line where reciprocating pumps or compressors causing pulsation are used, surge chambers or accumulators are strongly suggested to damp the shock wave.

**SIGHT TUBE ROTATION:**

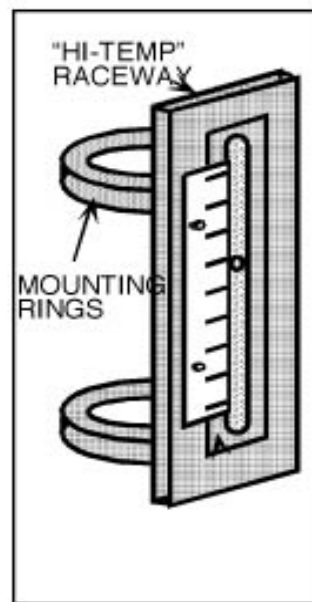
On visual (the float disk is seen) indication models with PLASTIC sight tubes, grasp the tube firmly BY HAND near the body and twist until the scale faces the desired direction. USE NO TOOLS!

On most armored glass sight tube models, only two positions are available. To reposition the scale to the other side, remove the cotter pins and lock rings (models without cotter pins and lock rings may be rotated in the same manner as plastic sight tube models), rotate the tube 180°, and replace the rings and cotter pins. (Consult Flow Line Options for special modifications providing other scale positions.)

On meters using magnetically-linked ball indicators, the scale usually may be positioned over approximately a 300° range. However, the magnet position must also be changed accordingly, requiring removal of the sight tube (see "Disassembly"). On standard METAL flow meters as depicted in Figure 4, the magnet slides out of the carrier at the top of the float assembly. The screw holding the carrier to the float may be loosened to allow rotating the carrier toward the desired scale location. Re-tighten the screw (thread sealant is recommended), replace magnet, and reassemble the meter (see "Assembly"). Verify that the ball indicator has been "captured" by the magnet. If not, rotate the sight tube (DO NOT twist on the edges of the plastic raceway assembly) until the ball is "grabbed" by the float magnet.



**FIGURE 4: REPRESENTATIVE INTERNAL VIEW OF ALL METAL FLOWMETER TOP**



**FIGURE 5: MEMFLO HIGH TEMPERATURE RACEWAY ("HOT TOP" OPTION) FOR 375°F & HIGHER**

On PLASTIC (PVC, CPVC) flow meters, the magnet is encapsulated in the top of the float assembly to seal it from the wetted system. If a different scale position is essential, a new guide notch must be added to the float disk (the notch rides over the snorkel tube/guide, aligning the magnet with the ball indicator). It is recommended that you mark the required location for the new notch and return the float to Flow Line Options (there is no charge for the modification other than shipping costs).

## START UP

System flow should be started with the by-pass valve open and meter inlet and outlet valves closed. After the system is operating, open the meter inlet valve gradually to equalize internal pressure. Then slowly crack meter outlet valve and wait for float to stabilize. Finally, slowly open the meter outlet and/or flow regulating valve all the way and close the system by-pass valve. **AVOID SUDDEN SURGES THAT CAUSE THE METER FLOAT TO SLAM INTO THE TOP OF THE SIGHT TUBE!** Although not essential, the meter sight tube should be filled to a level above the float on liquid systems. The snorkel tube (present in most standard models) allows escape of entrapped gases except for a small pocket in the upper end which helps cushion hydraulic shock. To assure proper filling and to flush any foreign particles from the meter, operate the system at full flow briefly at startup.

### READING FLOW:

On transparent sight tube models, read flow directly from the scale as the number nearest the top edge of the float indicator disk. For magnetically-linked models, flow is read at the center of the ball indicator.

### COMPENSATING FOR SYSTEM CHANGES:

To find the correct flow reading for a system whose fluid conditions vary from those for which the meter is scaled, use the conversion data below. The most practical method of applying the formula is to calculate a conversion factor for the new system conditions, multiplying the scale reading by that factor. In the problems below, "Qs" has been assigned a value of "1" to determine the conversion factor. (Flow Line Options can provide special scales at additional cost for other fluids and/or units).

**CAUTION:** Do not operate the flowmeter on a system exceeding the operating limits of the unit. When changing operating conditions, make sure that the new system conditions are within the flowmeter operating limits, and all wetted materials are compatible with the fluid. If in doubt, consult Flow Line Options before operating!

### CORRECTING READINGS FOR NEW LIQUID CONDITIONS:

$$Q_a = Q_s \sqrt{\frac{P_s (P_f - P_a)}{P_a (P_f - P_s)}} \quad \text{OR} \quad Q_a = Q_s \sqrt{\frac{d_s (d_f - d_a)}{d_a (d_f - d_s)}}$$

Where:

$Q_a$  = Actual flow, GPM (or same units as scale)

$Q_s$  = Meter reading from scale, (scale units)

$P_s$  = Specific gravity of calibration liquid related to water in std. atmosphere at 70° F. being 1.00

$P_a$  = Specific gravity of metered liquid, same base

$d_s$  = Density of calibration liquid, lbs/ft<sup>3</sup>

$d_a$  = Density of metered liquid, lbs/ft<sup>3</sup>

$P_f$  = Specific gravity of meter float

$d_f$  = Density of the meter float

## TEMPERATURE LIMITS

### TEMPERATURE LIMITS OF STANDARD MEMFLO MATERIALS

BRASS	400°F	T316 STAINLESS	600°F	POLYSULFONE	300°F
PVC	140°F	CPVC	210°F	GLASS	400°F
BUNA N	250°F	EPR (STD.)	250°F	KALREZ	575°F
NEOPRENE	300°F	SILICONE	450°F	TEFLON	500°F
VITON	475°	GEOTHERMAL EPR		600°F on Water/Steam	only

f = Specific gravity of meter float  
df = Density of the meter float per Table below

### FLOAT SPECIFIC GRAVITIES/DENSITIES

MATERIAL	f	df
Stainless Steel	8.05	501.1
Brass	8.30	516.6
Aluminum	3.99	248.3
PVC/CPVC	VARIES*	VARIES*

\* "Average" for these floats is f = 3.50, df = 2.17.8

**EXAMPLE:** Using a standard brass meter scaled for water ( s = 1.00), what is the conversion factor for and oil with a specific gravity of 0.85?

$$Q_a = 1.00 \times \sqrt{\frac{1.00 (8.30 - 0.85)}{0.85 (8.30 - 1.00)}} = 1.096$$

Thus, actual flow of the oil would be the observed scale reading time 1.096.

## CORRECTING READINGS FOR NEW GAS CONDITIONS

$$Q_g = Q_a \sqrt{\frac{P_g \times T_s \times p_s}{P_s \times T_g \times p_g}}$$

Where:

$Q_g$  = SCFM, corrected to new conditions.

$Q_s$  = SCFM read on meter scale.

$P_g$  = Operating pressure, psia (psig + 14.7)

$P_s$  = Pressure stated on scale, psia (psig + 14.7)

$T_g$  = Operating temperature, absolute (°F + 460)

$T_s$  = Temperature stated on scale, absolute (°F + 460)

$p_g$  = Specific gravity of metered gas.

$p_s$  = Specific gravity stated on scale.

**EXAMPLE:** If using a standard meter scaled for SCFM Dry Air @ 100 psig, 70°F on argon (SP. GR. = 1.378) at 50 psig, 100°F., what would the conversion factor be?

$$Q_a = 1.00 \sqrt{\frac{64.7 \times 1.00 \times 530}{114.7 \times 1.378 \times 560}} = 0.622$$

Thus, actual flow of the argon would be the observed scale differently. The table below provides **general guidelines** for the typical maximum viscosity for meter models without affecting accuracy.

## STEAM

MEMFlo gas flowmeters may be used for vapors such as steam.

The conversion factor may be determined with the following formula:

$$M_{fh} = Q_m \frac{5.879}{\sqrt{S_v}}$$

Where:

$M_{fh}$  = Actual flow, lbs/hr.

$Q_m$  = Meter scale reading, MEMFlo Std. (SCFM Dry Air @ 100 psig, 70°F)

$S_v$  = Specific volume of media (from steam tables)

**EXAMPLE:** When using a standard MEMFlo gas meter scaled for SCFM Dry Air & 100 psig, 70°, what is the conversion factor for lbs/hr. steam at 50 psig, 300°F?

$$M_{fh} = 1 \times \frac{5.879}{\sqrt{6.727}}$$

Thus, actual flow of steam in lbs/hr. would be the observed scale reading times 2.267

A wide variety of ranges and different fluids can be accommodated in **one meter body** by changing the metering core tube and float combinations. In gas, flowmeters, any capacity range offered in a given body size can be interchanged in this fashion. However, some low flow capacity liquid flowmeters incorporate a restriction in the outlet of the meter to facilitate filling of the sight tube. This restriction creates significant pressure drop if higher flows are used, and must be removed. The table below shows the liquid flow capacity ranges which can be interchanged without removing the restriction.

100% LIQUID FLOW CAPACITIES THAT ARE INTERCHANGEABLE WITHIN SAME FLOWMETER BODY WITHOUT REMOVING OUTLET PLUG.

GPM @ 100%, SIZE 6	GPM @ 100%, SIZE 12
0.54 - 1.64	11.0 - 15.0
2.60 - 3.80	21.0 - 120.
5.40 - 23.0	

**VISCOSITY CONSIDERATIONS:**

Each MEMFlo liquid flowmeter has a so-called “Viscosity Immunity Ceiling” (V.I.C.). Usually, if the viscosity of the metered liquid is less than the V.I.C. of the meter, the accuracy will not be influenced by changes in viscosity. When greater than the V.I.C., the meter will be influenced significantly, and must be calibrated for that viscosity. Effects of viscosity on a given flowmeter are not always predictable.

**AVERAGE V.I.C. CENTISTROKES, FOR STANDARD “THRU VIEW” FLOWMETERS**

100% GPM, SIZE 6	CTS	100% GPM, SIZE 12	CTS
0.54-0.80	3	11.0-15.0	50
1.20-2.60	7	21.0-35.0	100
3.80-7.00	15	50.0	250
10.0-23.0	25	70.0-120.	500

**MAINTENANCE**

Occasional cleaning of the sight tube and internal sensing elements to assure float visibility and continues accuracy is the only maintenance necessary for MEMFlo flow meters. Frequency will depend on the application---in most cases, and annual cleaning is adequate. It is not necessary to remove the MEMFlo flow meter from the pipeline for cleaning or replacing parts. The body remains plumbed into the pipe, allowing easy service and even installation of different sensing elements to accommodate new flow rates or fluids.

## DISASSEMBLY

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The spare parts sheet included for each flowmeter model type ordered includes cutaway drawings. Please refer to the appropriate sheet during the disassembly and assembly procedures.

**CAUTION:** BE SURE PRESSURE IS FULLY VENTED AND FLUIDS COMPLETELY DRAINED BEFORE DISASSEMBLING THE FLOWMETER. WEAR SAFETY GLASSES AND PROTECTIVE CLOTHING IF THERE IS ANY CHANCE OF EXPOSURE TO HAZARDOUS CHEMICALS!

The sight tubes of all standard MEMFlo flowmeters may be removed by, depending on model type: (a) removing the cotter pins and pulling the lock rings out horizontally; (b) removing the bolts from the body/sight tube flange; or (c) removing the internal snap ring with retaining ring pliers (on most models with magnetic-linked ball indicators, the plastic raceway assembly or hot top will have to be removed to allow access to the snap ring). Using hands only, pull the sight tube straight up out of the body with a slight twisting motion, lifting it clear of the body and snorkel or guide rod.

Remove the float assembly by lifting it up and away from the snorkel/guide rod (on PVC, CPVC, some Series T and H models, the snorkel/guide rod transition assembly must be lifted out with the float). The core tube assembly may then be lifted out---if stuck, CAREFULLY pry up at the top of the slot with a brass rod, taking care not to damage the body or core tube. On Thru View and All Metal models, the spider ring, "O" ring, (and back-up ring on glass sight tube styles) will come out with the core tube. If the core tube is stuck, try removing the metal spider ring first.

## INSPECTION & CLEANING

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Inspect parts for nicks, scratches, chips, wear, and contaminant build-up. The edges of the core tube slot, ID of the core tube, and OD of the piston (largest section at the float assembly bottom) are precision machined. Damage to these areas can destroy the meter's accuracy. Also inspect the "O" ring, the bottom section of the sight tube, and the inside of the upper body section. Damage to these areas may result in leaking. Clean, rinse, and dry all parts carefully, including the "O" ring, preferably with a mild detergent and water and a soft cloth or soft tube brush. If solvents are used, make sure they are compatible with all meter parts (plastic sight tubes may be attacked by chemical vapors or solvents---consult Flow Line Options).

**CAUTION:** DO NOT SCRAPE OR USE ABRASIVE MATERIALS FOR CLEANING!

**ASSEMBLY:** Replace all parts in reverse order of disassembly. Note the small key on the core tube that must be aligned with a corresponding keyway in the meter body. Seat the "O" ring on the sight tube before assembly (put the metal back-up ring on first for glass sight tube models). Lubricate the "O" ring with a small amount of serive-compatible silicone grease or petroleum jelly to facilitate replacement.

After replacing the internals, using hands only, press the sight tube firmly down into the meter body with a twisting motion. Be careful not to rock the sight tube side to side and bend the snorkel tube/guide inward where it might interfere with float movement. Rotate sight tube as necessary for scale visibility and/or alignment of slots for lock ring tabs. Reinsert lock rings and cotter pins, lower flange and snap ring (be sure snap ring engages groove in body), or flange bolts (do not over-tighten). If reassembled correctly, the top edge of the indicator disk or center of the ball should line up with the scale "zero" (either dotted black or scribed line). If it does not disassemble the meter completely and carefully reassemble it, making sure core tube is completely seated in the body.

If new flow internals are used, the scale may have to be remounted on the sight tube. Depending on the model type, this can be done either by loosening the mounting screw, or reattaching the scale with double sided adhesive (new flow internals are shipped with a new scale).

### **REPLACEMENT PARTS:**

Under proper care, there should be no need to stock replacement parts. If the service or environment is quite harsh, or frequent meter disassembly dictated, a spare "O" ring, sight tube, or other parts denoted by the asterick (\*) on the assembly details are desirable. These items are usually available from stock.

Otherwise, parts only need to be replaced if damaged. Any visible damage to the entire of the "O" ring or sight tube (particularly from the bottom edge) indicates need for replacement. To insure accuracy, the inside surface of the meter core tube, slot edges, and OD of the float piston should be free of nicks, chips, with no visible erosion of any surfaces. If abrasive particles are suspended in the metered fluid, it may be desirable to keep replacement core tube/float assemblies on hand (Flow Line Options may also be able to recommend a more abrasive-resistant construction.)

Flow Line Options can inspect any suspect parts, or recheck calibration. Parts returned should include information regarding the flow application, suspected problem, and who to contact a repair authorization if required. Again, unless the meter is misused, of service is extremely harsh, there should be no need for replacement parts or factory recalibration.

To order parts, include the model and serial numbers of the units involved, and a description of the part ordered. If converting the meter to a new application, in addition to the model and serial numbers, PLEASE SEND FLOW LINE OPTIONS A COMPLETE APPLICATION DATA INCLUDING FLUID, MAXIMUM FLOW RATE, MAXIMUM AND OPERATING PRESSURES AND TEMPERATURES, AND APPLICATION PARTICULARS OR FLUID CHARACTERISTICS. This information is essential to provide proper items, and verify that the new application is within the operating limits of the flowmeter.

### **STORAGE REQUIREMENTS:**

There are no special requirements for MEMFlo flow meters and parts. They should be kept in a reasonably clean location away from excessive heat (over 120°F) or chemical or solvent fumes and vapors.

## OPERATING LIMITS

### “THRU VIEW” FLOWMETERS\*

#### MAXIMUM NON-SHOCK WORKING PRESSURE, PSIG @ °F

BODY SIZE & DESCRIPTION	70°	80°	100°	120°	140°	200°	250°	300°
6-Brass & Polysulfone	300	300	300	300	300	300	250	115
6-Brass & Polysulfone, High Pressure	440	435	420	405	390	345	250	115
6-Brass & Glass	150	150	150	150	150	150	150	150
6-Brass & Glass, High Pressure Model	240	240	240	240	220	200	175	150
6-Stainless & Polysulfone	300	300	300	300	300	300	250	115
6-Stainless & Polysulfone, High Press.	440	435	420	405	390	345	250	115
6- Stainless & Glass	180	180	180	180	180	180	175	150
6- Stainless & Glass, High Pressure	240	240	240	240	220	200	175	150
6- Stainless & PVC	100	80	60	30	N.R.	N.R.	N.R.	N.R.
6- Stainless & PVC, High Pressure	250	225	150	90	50	N.R.	N.R.	N.R.
12- Brass & Polysulfone	180	180	180	180	180	180	145	70
12-Brass & Polysulfone, High Pressure	310	300	290	280	260	200	150	70
12- Brass & Glass	125	125	125	125	125	125	125	100
12- Brass & Glass, High Pressure Model	180	180	180	180	180	150	130	110
12- Stainless & Polysulfone	180	180	180	180	180	180	145	70
12- Stainless & Polysulfone, High Pressure	310	300	290	280	260	200	150	70
12-Stainless & Glass	125	125	125	125	125	125	125	100
12-Stainless & Glass, High Pressure	180	180	180	180	180	150	130	110
12-Stainless & PVC	100	80	60	30	N.R.	N.R.	N.R.	N.R.
12- Stainless & PVC, High Pressure	170	150	105	65	40	N.R.	N.R.	N.R.

### “ALL METAL” FLOWMETERS\*

#### MAXIMUM NON-SHOCK WORKING PRESSURE, PSIG @ °F

METER SIZE & MATERIAL	0°	70°	300°	350°	400°	450°	500°	600°
6 (3/4" NPT)-Brass	500	500	500	460	235	155	N.R.	N.R.
6 (3/4" NPT)-Stainless	1000	1000	1000	990	970	950	930	900
12 (1 1/2" NPT) -Brass	410	410	410	305	155	105	N.R.	N.R.
12 (1 1/2" NPT) -Stainless	800	800	800	790	780	770	760	750

N.R. = NOT RECOMMENDED

**“PVC/CPVC” FLOWMETERS\***

**MAXIMUM NON-SHOCK WORKING PRESSURE, PSIG @ °F**

BODY SIZE & DESCRIPTION	70°	80°	100°	120°	140°	160°	180°	210°
6-All PVC, Threaded & Socket Connections	250	225	150	90	50	N.R.	N.R.	N.R.
6-All PVC, Flanged Connections	150	150	150	90	50	N.R.	N.R.	N.R.
6-PVC & Polysulfone, Threaded & Socket	300	295	205	130	70	N.R.	N.R.	N.R.
6-PVC & Polysulfone, Flanged	150	150	150	110	50	N.R.	N.R.	N.R.
6-PVC & Glass, Threaded & Socket	240	230	200	125	60	N.R.	N.R.	N.R.
6-PVC & Glass, Flanged	150	150	150	110	50	N.R.	N.R.	N.R.
12/16 - All PVC, Threaded & Socket	170	150	105	65	40	N.R.	N.R.	N.R.
12/16 - All PVC, Flanged Connections	150	150	105	65	40	N.R.	N.R.	N.R.
12/16 - PVC & Polysulfone, Threaded Only	210	190	130	85	40	N.R.	N.R.	N.R.
12/16 - PVC & Polysulfone, Socket Only	265	255	185	120	40	N.R.	N.R.	N.R.
12/16 - PVC & Polysulfone, Flanged	150	150	150	110	40	N.R.	N.R.	N.R.
12/16 - PVC & Glass, Threaded & Socket	180	180	130	85	40	N.R.	N.R.	N.R.
12/16 - PVC & Glass, Flanged	150	150	150	110	40	N.R.	N.R.	N.R.
24/32 - All PVC, Threaded & Socket	160	150	105	65	40	N.R.	N.R.	N.R.
24/32 - All PVC, Flanged Connections	150	150	105	65	40	N.R.	N.R.	N.R.
24 - PVC & Polysulfone, Threaded Only	190	170	120	75	40	N.R.	N.R.	N.R.
32 - PVC & Polysulfone, Threaded Only	160	145	100	65	40	N.R.	N.R.	N.R.
24/32 - PVC & Polysulfone, Socket Only	265	255	185	120	40	N.R.	N.R.	N.R.
24/32 - PVC & Polysulfone, Flanged	150	150	150	110	40	N.R.	N.R.	N.R.
24 - PVC & Glass, Threaded & Socket	180	170	120	75	40	N.R.	N.R.	N.R.
32 - PVC & Glass, Threaded & Socket	160	145	100	65	40	N.R.	N.R.	N.R.
24/32 - PVC & Glass, Flanged	150	150	150	110	40	N.R.	N.R.	N.R.
6 - CPVC & Polysulfone, Threaded & Socket	300	300	280	230	180	130	80	50
6 - CPVC & Polysulfone, Flanged	150	150	150	150	150	130	80	50
6 - CPVC & Glass, Threaded & Socket	240	240	220	210	160	130	80	50
6 - CPVC & Glass, Flanged	150	150	150	135	110	90	70	40
6 - All CPVC, Flanged Connections	270	270	250	200	150	130	80	50
6 - All CPC, Flanged Connections	150	150	150	135	110	90	70	40
12/16 - CPVC & Polysulfone, Threaded Only	210	200	180	145	115	85	50	30
12/16 - CPVC & Polysulfone, Socket Only	265	255	250	200	160	120	75	45
12/16 - CPVC & Polysulfone, Flanged	150	150	150	135	110	90	70	40
12/16 - CPVC & Glass, Threaded Only	180	180	180	145	115	85	50	30
12/16 - CPVC & Glass, Socket Only	180	180	180	180	160	120	75	45
12/16 - CPVC & Glass, Flanged	150	150	150	135	110	90	70	40
12/16 - All CPVC, Threaded Only	180	180	170	145	115	85	50	30
12/16 - All CPVC, Socket Only	180	180	180	170	150	110	75	45
12/16 - All CPVC, Flanged Connections	150	150	150	135	110	90	70	40
24- CPVC & Polysulfone, Threaded Only	180	180	160	135	105	75	50	30
32 - CPVC & Polysulfone, Threaded Only	160	155	135	110	90	65	40	25
24/32 - CPVC & Polysulfone, Socket Only	265	255	250	200	160	120	75	45
24/32 - CPVC & Polysulfone, Flanged	150	150	150	135	110	90	70	40
24 - CPVC & Glass, Threaded & Socket	180	180	160	135	105	75	50	30
32 - CPVC & Glass, Threaded & Socket	160	155	135	110	90	65	40	25
24/32 - CPVC & Glass, Flanged	150	150	150	135	110	90	70	40
24 - All CPVC, Threaded Only	160	160	140	125	105	75	50	30
32 - All CPVC, Socket Only	225	215	210	160	150	120	75	45
24/32 - All CPVC, Flanged Connections	150	150	150	135	110	90	70	40

## SERIES T FLOWMETERS\*

BODY SIZE & MODEL	To 100°F	150°F	200°F	250°F	300°F	350°F	400°F
16-32 Brass & Polysulfone	180	180	180	140	70*	NR	NR
16-32 Brass & Poly. High Pressure	300	260	200	150	70*	NR	NR
16-32 Stainless & Polysulfone	180	180	180	145	70	NR	NR
16-32 Stainless & Poly., High Pressure	225	225	225	150	70	NR	NR
16-32 All Brass	300	275	200	150	160*	150*	NR
16-32 All Stainless	400	400	400	400	400	375	350

\* OPERATING LIMITS GIVEN ARE BASED ON WATER OR AIR. FOR MORE SEVERE SERVICE, CORROSIVES, AND OTHER MEDIA AND/OR ENVIRONMENTAL FACTORS, AN ADDITIONAL CORRECTION FACTOR DOWNRATING THESE LIMITS MAY BE REQUIRED. LIMITS ARE BASED ON TESTING AND PRACTICAL EXPERIENCE. POSSIBLE EXTREME APPLICATION CONDITIONS CANNOT BE FORESEEN. THUS, DATA IS OFFERED ONLY AS A GUIDE. IT IN NO WAY CONSTITUTES A SPECIFIC RECOMMENDATION OR WARRANTY EXPRESSED OR IMPLIED.

## TROUBLESHOOTING

SYMPTOM	USUAL CAUSE	SUGGESTED REMEDY
FLOAT HANG-UP	Caused by particles, sludge, etc. (including failure to remove the plastic tubing used to block meter float during shipment) inside the core tube and/or sight tube holding float. A bent snorkel tube/guide rod (usually caused by careless disassembly or violent surges) may also be causing float to stick. Violent surges may also unseat the internals in extreme cases.	Remedies include tapping the meter gently to temporarily dislodge the float, but if problem occurs, meter should be disassembled & cleaned, and/or snorkel/guide rod straightened. If hang-up caused by sludge or pipe scale, clean lines & install a filter or other form of cleaner in supply line. If surges have caused the internals to unseat, install a desurger, accumulator, etc. You may also wish to order a buffer serves as a resilient cushion for the float, and prevents unseating.
FLOAT BOUNCE	Caused by pumping/compressor surges or other pulsation sources, loose valve disks or similar mechanical components, extreme violation of inlet piping recommendations, or for gas applications, harmonics commonly found in systems with low pressure, low density gas.	Modification of piping, such as addition of a desurger, receiver, accumulator, vibration eliminators, loops, hoses, etc. between the source and meter should remedy the problem. Severe vibration may ultimately damage the meter, and should be avoided. If "bounce" seems to be from some other source, or shocks such as "water hammer" (a potentially dangerous condition), discontinue using the meter and contact Flow Line Options.
APPARENT FALSE READING, GAS METERS	Gas density not according to calibration data (different pressure, temperature, gas, etc), high water vapor content, saturated gas going into vapor or condensation phases, partially clogged core tube slot or foreign matter interfering with float movement, and/or violation of piping recommendations at high flow velocities.	Remedies include checking meter pressure (Flow Line Options can install a pressure gage on the meter) & temperature, determining actual gas mixture density & correcting with appropriate formulae in this bulletin. Modifying inlet piping, relocating meter to point of higher temperature and/or lower pressure to eliminate vapor or condensation phase effects, and/or cleaning the meter (install filter or other form of cleaner if dirt repetitive problem) may also be required. If accuracy still questioned, return core tube/float assembly to Flow Line Options for calibration check.

## TROUBLESHOOTING CONT...

SYMPTOM	USUAL CAUSE	SUGGESTED REMEDY
APPARENT FALSE READINGS, LIQUID METERS	<p>Liquid density not according to calibration data (different temperature or new liquid mixture), excessive dissolved or suspended solids or gases, partial clogging of core tube slot or foreign matter interfering with float movement, or viscosity levels above the meter's immunity index (V.I.C.).</p> <p>NOTE: If the MEMFlo meter is suspected of giving false readings, and none of the causes mentioned is found, please advise MEMFlo as to the method used in determining the suspected flow "error." Each MEMFlo flowmeter is individually calibrated by traceable methods, and carefully inspected. There may be some error in checking the MEMFlo meter against another standard.</p>	<p>By determining the actual density (due to changes in mixture, temperature, etc.), the correction formula may be applied. If dissolved gases are in the liquid, some elimination means should be provided on the supply side (also recheck all piping, as improper seals at connection points are common sources of air in the liquid.) If the metered liquid is near the boiling point producing partial "flash gas" at the meter, relocate the meter to point of lower temperature and/or higher pressure, or cool lines and/or increase system pressure.</p> <p>Note: It is potentially dangerous to meter near the "flash point" of any fluid, and this practice should be avoided. Consult Flow Line Options for recommendations. The previous recommendations regarding cleaning the meter and/or filtration will also solve problems due to dirt. If metering liquids with high viscosities, consult Flow Line Options (may require special calibration). If none of these causes seem to be present, return meter core tube/float assembly to Flow Line Options along with the application data.</p>
APPARENT METER READING MIGRATION (reading changes but flow appears constant)	<p>Frequently caused by use of soft disc type valves, which may need to be replaced with a valve more suited to flow control. Can also be indicative of changing fluid conditions (density, viscosity, etc.) Problems with other elements of the flow system, including leaks, clogged filters, pump/compressor wear, etc. may first appear as a change in meter reading-one of the functions of a flowmeter.</p>	<p>Verifying the proper fluid conditions are known and applying correction formulae as needed will remedy problems associated with changing fluids. Cleaning, servicing, and replacement and/or repair of other system components may be required.</p>
LEAKAGE	<p>If at the junction of the body and sight tube, it is indicative of either (a) damaged "O" ring (most common); (b) damaged sight tube; or (c) damage to the gland section of the body. It may also be caused by improper reassembly of the flowmeter in the field.</p> <p>If there is leakage at the pipe connections to the meter, it is probably caused from over-tightening pipes on a prior installation (or the initial installation, particularly with PVC or CPVC flow meters).</p>	<p>Replace any damaged parts immediately, using the proper assembly procedures indicated in this instruction and the assembly detail drawings.</p> <p>Remove the body and inspect for damage--if none is visible, check pipe threads, reapply proper thread lubricant/sealant, and reinstall. If leak persists, replace meter body.</p>

**NOTE:** All MEMFlo flow meters are hydrostatically pressure tested before they are shipped. Flow Line Options encourages you to contact the factory with any questions regarding proper installation and operation of MEMFlo flow meters.