

# INSTRUCTIONS FOR MEM RANGEMASTER™ FLOWMETERS (3" NPT MODELS)



## INTRODUCTION

Please read this instruction and review enclosed data sheets (if supplied) before installation and startup! Pay particular attention to safety precautions and operating limits. RangeMaster Flowmeters are designed for industrial environments, and by taking a few moments to review this information, long trouble-free service will be assured.

## BASIC OPERATION

The fluid to be metered enters the flowmeter inlet port (port closest to the meter scale) and flows vertically upward in the core tube, horizontally thru the core tube slot, exiting thru the meter outlet (top of the body in line with the inlet) port. During this process, the fluid lifts the float assembly in the core tube, displacing it in proportion to the rate of flow passing thru the slot.

The float assembly includes a lower extension and indicator moving within a transparent sight tube below the body. When gas is being metered, this sight tube is filled with a transparent oil (or water for oxygen service) to dampen pulsations. The indicator is a sharp-edged disk, and flow is read directly from the external scale as the number nearest the top edge of the disk. On models with metal sight tubes, magnets attached to the float carry an external ball indicator. Flow is read as the number nearest the center of the ball.

## INSTALLATION

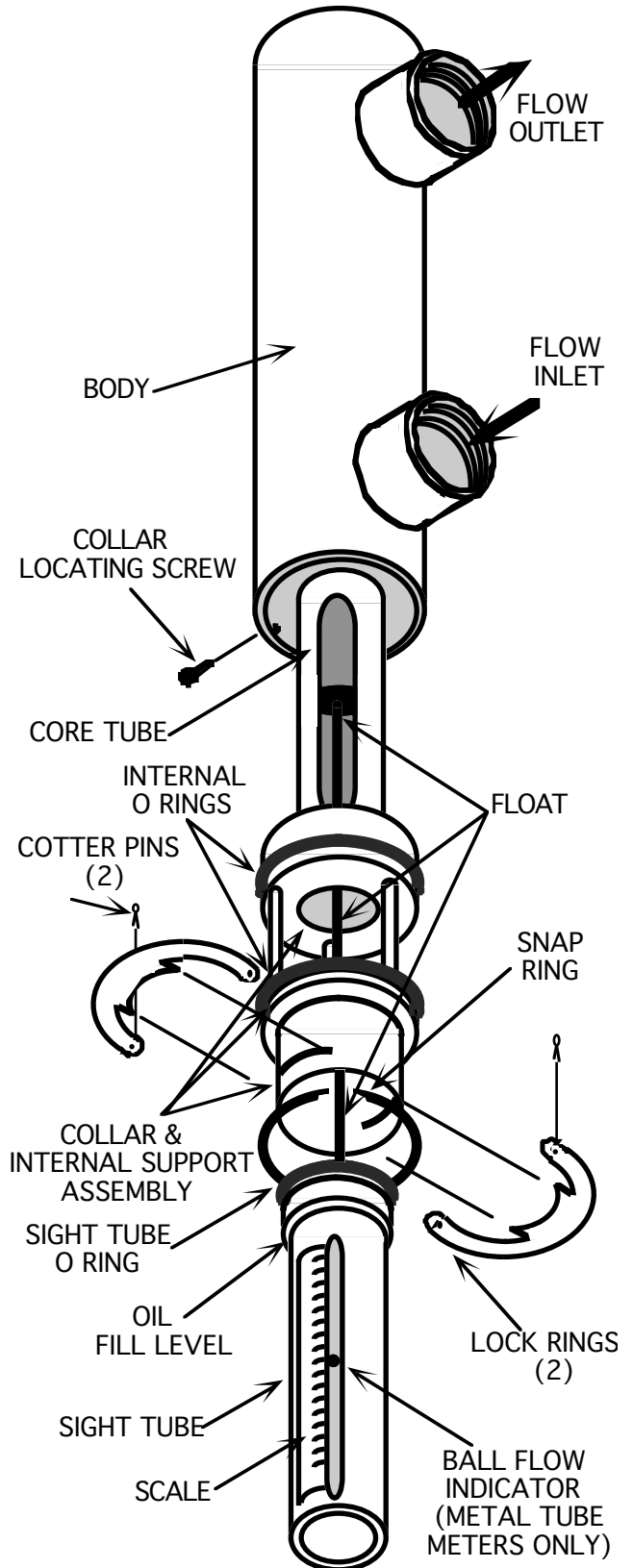
First remove the protective coverings from the inlet and outlet ports, making sure no packing material remains in the ports. Pipe should be cut to the proper lengths to avoid stress on the meter, and the proper pipe lubricant (avoid any excess that could lodge in the meter) used. There are no straight run requirements, but RangeMaster Flowmeters must be vertically mounted. Where practical, it is recommended that flowmeters be installed on a by-pass loop off the main line, using a three valve manifold. This allows system flow to be directed to the meter, or isolated from the meter for maintenance operations without system shutdown.

## ADDING DAMPING FLUID, GAS MODELS ONLY

For gas applications, a DAMPING FLUID MUST BE ADDED TO THE SIGHT TUBE PRIOR TO STARTUP. Usually, this fluid is a special oil provided by Flowline Options in dispenser bottles supplied with each meter.

Other liquids should not be used as damping fluids without prior approval of Flowline Options, as different liquids may alter meter accuracy or performance.

**WARNING: DO NOT USE DAMPING OIL IN ANY FLOWMETER USED FOR OXYGEN OR CHLORINE SERVICE!**



To add the damping fluid, remove the meter sight tube by removing the cotter pins and pulling the lock rings out horizontally. If the meter is equipped with a Safety Guard Shield, first remove the guard screw and slip the shield off the sight tube. Using hands only, pull the sight tube straight down out of the body with a slight twisting motion, carefully pulling it down past the float shaft and indicator.

The “O” ring may slide down with the sight tube. If it does not, remove the “O” ring and replace it on the sight tube.

Fill the sight tube to within 1-1/4” of the top of the sight tube assembly — the sight tube OD increases at the proper fill line. Use a slight amount of the damping fluid on the “O” ring to act as a lubricant, and replace the sight tube. Press the sight tube (on metal sight tube units, FIRST ALIGN THE FLOAT SLOT WITH THE GUIDE RAIL ON INSIDE THE SIGHT TUBE) firmly up into the body with a slight twisting motion. Rotate the sight tube as required for desired scale positioning (see “Repositioning the Flowmeter Scale & Transducer” in the Flow Courier Instruction for meters equipped with that system), and reinsert the lock rings (by hand only) and cotter pins.

If reassembled correctly, the top edge of the indicator disk should align with the scale “zero” (either an imprinted dotted line or scribe mark). On units with the ball indicator, the center of the ball should be opposite the “zero” (the ball may reposition itself after the float has been moved up and down). If it does not, disassemble the meter and reassemble carefully, making sure all components are properly seated.

#### SAFETY PRECAUTIONS

Personnel safety should be considered carefully before pressurizing and operating the system. Depending on the service, recommended safeguards should include, but are not limited to, transparent safety shielding in front of the meter, a method of quick and safe removal of hazardous fluids, proper clothing and protective wear for operators.

#### SYSTEM STARTUP

System flow should be started with the by-pass valve open and the meter inlet and outlet valves closed. After the system is flowing, open the meter inlet valve slowly to equalize internal pressure, then gradually crack the outlet and/or flow regulating valve. Once the float stabilizes, slowly open the outlet valve fully (or to desired point) and close the system by-pass valve. AVOID SUDDEN SURGES!

#### READING FLOW

As previously stated, flow is read directly from the meter scale as the number nearest the top edge of the indicator disk, or center of the ball indicator.

#### COMPENSATING FOR SYSTEM CHANGES

To find the correct flow reading for a system with fluid conditions other than those for which the meter was scaled,

use the conversion formula below. The most practical method of correcting readings is to establish a conversion factor for the new fluid and/or system conditions, and multiply scale readings by that factor. Flowline Options can provide special scales at additional cost for other fluids and/or flow units.

$$Q_a = Q_c \sqrt{\frac{P_a \times \rho_c \times T_c}{P_c \times \rho_a \times T_a}}$$

Where:

$Q_a$  = SCFH, corrected to application conditions

$Q_c$  = SCFH read on meter scale

$P_c$  = Calibration/scale pressure, psia (psig + 14.7)

$P_a$  = Metering pressure, psia (psig + 14.7)

$T_c$  = Calibration/scale temperature, absolute (°F. + 460)

$T_a$  = Metering temperature, absolute (°F. + 460)

$\rho_c$  = Specific gravity of gas used for calibration/scale

$\rho_a$  = Specific gravity of gas being metered

#### MAINTENANCE

Occasional cleaning of the internal sensing elements and/or sight tube to assure continued accuracy and readability is the only maintenance necessary for MEMFlo RangeMaster Flowmeters. Frequency will depend on the application — in most cases, an annual cleaning is adequate. It is not necessary to remove the 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 ranges or different fluids.

#### METER DISASSEMBLY & REASSEMBLY

Please refer to the drawing on the front page for meter disassembly. Spare parts’ sheets also include cutaway drawings. Please refer to the appropriate diagrams for disassembly and reassembly.

ON METERS EQUIPPED WITH FLO-SENTRY™ ALARMS OR FLOW/MASS COURIER™ SYSTEMS, REMOVE THE SWITCH ENCLOSURE OR TRANSDUCER PER THE INSTRUCTIONS FOR THE ACCESSORY DEVICE.

**CAUTION: BE SURE FLOW TO THE METER IS COMPLETELY OFF, PRESSURE FULLY VENTED, AND FLUIDS COMPLETELY DRAINED BEFORE DISASSEMBLING THE RANGEMASTER™. WEAR SAFETY GLASSES AND PROTECTIVE CLOTHING IF THERE IS ANY CHANCE OF EXPOSURE TO HAZARDOUS FLUIDS. IF FLOWMETER IS EQUIPPED WITH AN ALARM OR FLOW/MASS COURIER™ SYSTEM, BE SURE POWER IS OFF BEFORE BEGINNING DISASSEMBLY!**

Remove the meter sight tube by removing the cotter pins and pulling the lock rings out horizontally. If the meter is equipped with a Safety Guard Shield, first remove the guard screw and slip the shield off the sight tube. Using hands

only, pull the sight tube straight down out of the body with a slight twisting motion, carefully pulling it down past the float shaft and indicator. KEEP THE SIGHT TUBE VERTICAL TO AVOID SPILLING THE DAMPING LIQUID (GAS METERS ONLY).

The sight tube “O” ring may slide down with the sight tube. If it does not, remove the “O” ring from the body and replace it on the sight tube.

Next, remove the collar locating screw and the internal snap ring holding the collar & support assembly by prying it out with a small screwdriver. Grabbing the collar by hand, rotate the assembly while pulling it downward. Be careful that it does not fall. Carefully pull straight down on the collar, extracting the internal assembly consisting of the support and core tube/float sub-assemblies. Be careful not to scratch or nick the seals or corresponding seats. Note the internal “O” ring on the support sub-assembly — this “O” ring must be free of damage to prevent leaking past sensing internals.

To check the float and core tube, loosen the three screws at the bottom of the core tube until they are withdrawn past the core tube ID. Next, remove the three holding screws at the top of the support sub-assembly, and lift the core tube up past the piston disk of the float. If the float must be removed from the collar & support sub-assembly (this is NOT recommended for normal cleaning), extract either of the shaft screws at the ends of the float assembly. BE VERY CAREFUL NOT TO BEND THE FLOAT SHAFT!

#### INSPECTING & CLEANING

Inspect parts for nicks, scratches, chips, wear, and contaminant build up. The edges of the core tube slot(s), the ID of the core tube, and OD of the piston portion of the float (the largest diameter section at the upper end, as installed) are precision machined, and damage to these areas may reduce meter accuracy.

Also inspect all “O” rings and their corresponding seats, as damage to these areas may result in leaking.

Clean, rinse, and dry all parts carefully, including the “O” rings, 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 components.

**CAUTION: DO NOT SCRAPE OR USE ABRASIVE MATERIALS FOR CLEANING METER COMPONENTS! USE OF CLEANING SOLVENTS SHOULD BE AVOIDED UNLESS YOU ARE CERTAIN OF THEIR COMPATIBILITY WITH ALL METER COMPONENTS (ESPECIALLY METERS WITH POLYSULFONE SIGHT TUBES)!**

#### ASSEMBLY

Replace all parts in reverse order of disassembly. The inner “O” rings must be properly seated on the collar & support sub-assembly. Loctite™ or a similar, fluid compatible thread locking compound should be applied only to the float shaft and core tube holding screws. Use an appropriate lubricant (media compatible) such as silicone grease, petroleum jelly, or damping oil on all “O” rings to facilitate reassembly.

**CAUTION: DO NOT USE OIL OR GREASE LUBRICANTS ON THE “O” RINGS OF OXYGEN OR CHLORINE SERVICE FLOWMETERS!**

After reassembling the internal assembly, guide it up into the body. Grabbing the collar, push upward (it may help to rotate the assembly back and forth a little while pushing) until you feel the “O” ring seat properly. Make sure the groove at the collar base is aligned with the locating screw hole in the body. Replace the snap ring and screw.

After adding damping liquid (gas meters only) as required, press the sight tube (on metal sight tube units, FIRST ALIGN THE FLOAT SLOT WITH THE GUIDE RAIL INSIDE THE SIGHT TUBE) firmly up into the collar with a slight twisting motion. Rotate the sight tube as required for desired scale positioning, and reinsert the lock rings (by hand only) and cotter pins. If they were supplied, replace the Safety Guard Shield, switch enclosure, or transducer assembly.

If reassembled correctly, the top edge of the indicator disk or center of the ball should align with the scale “zero” (either an imprinted dotted line or scribe mark). If it does not, disassemble the meter and reassemble carefully, making sure all components are properly seated.

If new flow internals were installed, the scale may require repositioning on the sight tube by removing and reattaching it with double sided adhesive (new flow internals are shipped with new scales, adhesive-backed).

Damping oil can be reused as long as it remains reasonably clean. Flowline Options can supply additional damping oil in several different sizes of dispenser bottles. If water is used as a damping liquid (oxygen service), the level must be checked frequently due to evaporation.

#### REPLACEMENT PARTS

Under proper care, there should be no need to stock replacement meter parts. Extra damping oil (available from Flowline Options) should be kept on hand. If the flowmeter service or environment is quite harsh, or frequent meter disassembly is dictated, spare “O” rings and sight tubes should be considered. Otherwise, parts only need to be replaced if damaged.

Flowline Options can inspect any suspect parts or recheck calibration. Parts returned should include information regarding the flow application, suspected problem, and who to contact for further details and/or authorization for repairs.

The only storage or handling requirements of MEMFlo RangeMaster Flowmeters or parts is to keep them in a reasonably clean location away from excessive heat or chemical or solvent fumes and vapors.

**TO ORDER PARTS, INCLUDE MODEL AND SERIAL NUMBERS FROM THE METER TAGS, AND USE THE DESCRIPTIONS AND/OR NUMBERS FROM THE PARTS LISTS IF PROVIDED OR THE DRAWING NUMBER AND “DASH” NUMBER OPPOSITE THE REQUIRED COMPONENT ON ANY DRAWING(S) PROVIDED WITH THESE INSTRUCTIONS.**

TROUBLESHOOTING

SYMPTOM	USUAL CAUSE	SUGGESTED REMEDY
FLOAT HANG-UP:	Usually 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 float shaft or guide rod (usually caused by careless disassembly or violent surges) may also be causing float to stick.	Remedies include tapping the meter gently to temporarily dislodge the float, but if problem reoccurs, meter should be disassembled and cleaned, and/or float shaft or guide rod straightened. If hang-up caused by sludge or pipe scale, clean lines and install a filter or other fom of cleaner in supply line.
APPARENT FALSE READINGS, GAS METERS:	SIGHT TUBE NOT FILLED TO PROPER LEVEL WITH DAMPING FLUID. (IF FLOAT BOUNCES DURING OPERATION, LACK OF DAMPING FLUID IS ALMOST CERTAINLY THE CAUSE.)  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.	ADD DAMPING FLUID AS REQUIRED. Other remedies include checking meter pressure (Flowline Options can install a pressure gage on the meter) & temperature, determining actual gas mixture density and correcting with appropriate fomulae 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 fom of cleaner if dirt repetitive problem) may also be required. If accuracy still seems off, return core tube/float assembly to Flowline Options for calibration check.
APPARENT METER READING MIGRATION (reading changes although flow appears constant):	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 the meter reading — one of the benefits of a flowmeter.	Verifying the proper fluid conditions are known and applying correction fomulae as needed will remedy problems associated with changing fluids. Cleaning, servicing, and replacement and/or repair of other system components may be required.  ALSO CHECK TO MAKE SURE DAMPING FLUID LEVEL IS CORRECT.
LEAKAGE:	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. If there is leakage at the pipe connections to the meter, it is probably caused from over-tightening pipes (particularly with PVC or CPVC flowmeters).	Replace any damaged parts immediately, using the proper assembly procedures indicated in this instruction and the assembly detail drawings.  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.

NOTE: All MEMFlo Flowmeters are hydrostatically pressure tested before they are shipped. Flowline Options encourages you to contact your MEM representative or the factory with any questions regarding the proper installation and operation of our flowmeters.

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