

### FLOCO POSITIVE DISPLACEMENT METERS



**F2500-1**



**F2500-2**



**F2500-3**

## Installation Manual

Version 01A08a

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## SECTION 1 - INTRODUCTION

### General

The Models F2500-1, F2500-2, F2500-3, FS2500-1, FS2500-2, and FS2500-3 Floco Positive Displacement Meters are designed to measure the flow of a broad range of liquids, including viscous, corrosive, and abrasive substances. Like all Floco meters, these models measure the flow by separating it into segments of known volume and then counting the segments.

Flow rates from 6 to 90 gallons per minute can be accommodated. Versions of the F2500 and FS2500 are fitted with either NPT fittings, Gruvlock (Victaulic) connections, or flanges of various pressure ratings and face styles. End fittings on the -1 models mate with one-inch pipe fittings. Similarly, the end fittings on the -2 and -3 models mate with two and three-inch pipe fittings. All meter bodies can be coated with an epoxy liner to improve corrosion resistance.

Four elastomers (Buna-N, Viton, Ethylene Propylene, and Neoprene) are available to cover a broad range of fluid applications. The elastomer selection covers all O-rings that are wetted by the measured liquid. In addition, rotors are available with teflon blades and grommets for high temperature applications. Four bearing materials (carbon, aluminumbronze, meehanite and teflon) are offered to optimize performance in a variety of corrosive or abrasive environments.



### SAFETY

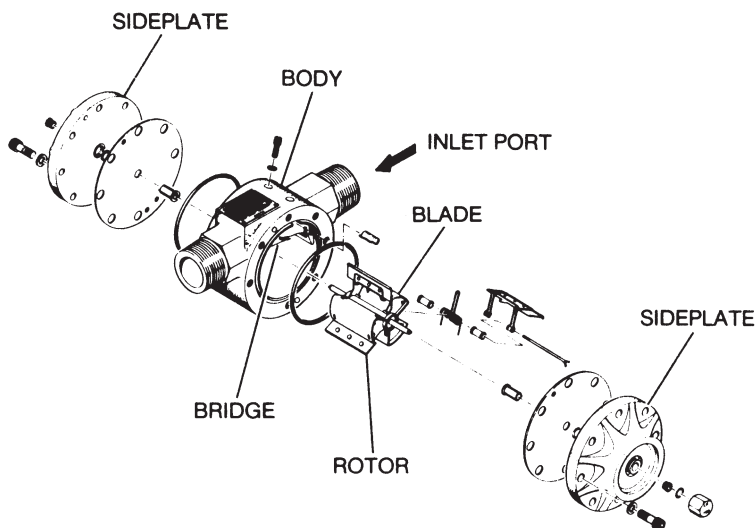
**Before installing this instrument**, become familiar with the installation instructions in Section 2. **WARNING** notes that appear on the following pages of this manual should be reviewed before proceeding: **NONE**.

Most internal parts of the meter are made from AISI 316 stainless steel. Wearing surfaces are hard-chrome plated.

A wide selection of registers is offered to accommodate most common units (barrels, gallons, cubic meters, liters, etc.). Resettable models are offered in both small and large digit styles. A ticket printer and a batch counter are available for use with the large digit registers.

The utility of these Floco meters is enhanced by a selection of accessories including electrical pulse transmitters which provide switch closure (Model 308) or current pulse (Model 573) outputs.

The **Models FS2500-1, FS2500-2 and FS2500-3** are specifically designed for use in hydrogen sulfide contaminated environments. All materials comply with the recommendations of standard MR-01-75 of the National Association of Corrosion Engineers (NACE) for resistance to sulfide-stress cracking. The pressure-retaining components of each and every FS-Series meter are individually certified with regard to composition and hardness to verify compliance with established standards.



Floco Positive Displacement Meters are made up of five basic components (see illustration above): body, bridge, rotor, side plates and register. The fluid passing through the meter is divided into segments by the blades of the rotor. Three segments pass through the meter each time the rotor completes a revolution. By counting rotor revolutions, a measure of the fluid is obtained.

Liquid entering the meter is deflected downward by the bridge against the rotor blades. The force of the liquid on each successive blade causes the rotor to turn. The liquid between the blades is moved to the outlet port, where it is discharged as the bridge reduces the volume of the flow segment.

The rotor is magnetically coupled to the register drive shaft which is connected to the register by appropriate calibration gears.

The design of the rotor allows small particles to pass through the meter without causing damage or malfunction.

Specifications

The specifications and outline drawings for the Models F2500-1, F2500-2 and F2500-3 Floco meters are shown below. All information applies to comparable version of the FS2500-1, FS2500-2 and FS2500-3.

Minimum measured flow rate (1" & 2")	6 GPM
Minimum measured flow rate (3")	9 GPM
Maximum flow rate (1" & 2")	60 GPM
Maximum flow rate (3")	90 GPM

Note: Flow rates based on 100 SSU oil.

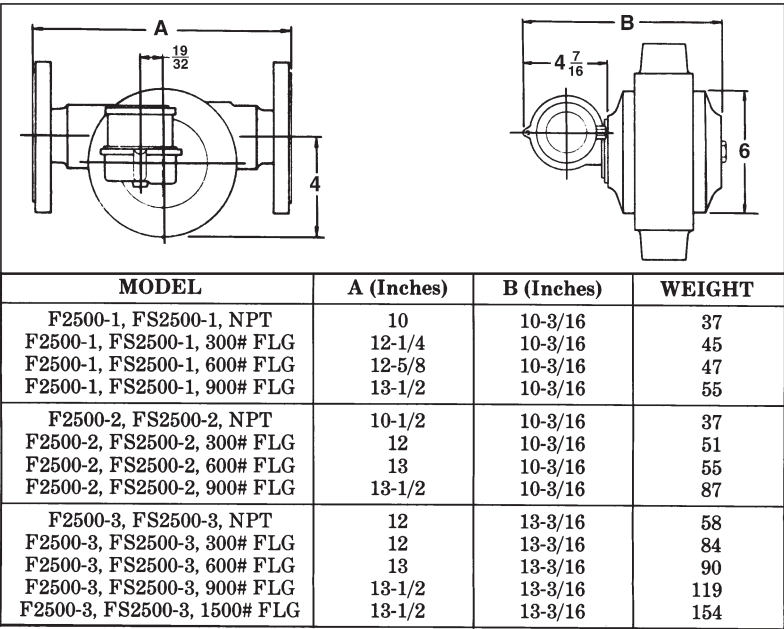
Maximum operating pressure (depending on end connection & body)	2500 psi
Operating temperature range (Viton)	-20°F to +300°F
Operating temperature range (Neoprene Ethylene-Propylene)	-30°F to +250°F
Operating temperature range (Buna-N)	-30°F to +200°F
Operating temperature range (Teflon)	60°F to 400°F

F2500-1 & F2500-2:

Pressure drop at 60 GPM (Water)	13 psi
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F2500-3:

Pressure Drop at 90 GPM (Water)	5 psi
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The accuracy and pressure drop of Models F2500-1, F2500-2, F2500-3 and FS2500FS25002 and FS2500-3 are shown in charts on page 5.

## **Performance Data**

The graphs on the next page can be used as a guide in selecting the appropriate Floco meters for a particular application.

### **Meter Accuracy with Various Component Materials**

This graph shows the relative effect on the accuracy of the four most popular combinations of bridge and elastomer materials for a fluid of 100 SSU, and a two-inch Floco Industrial Meter. The pressure drop across the meter was not effected by changing bridge and elastomer material.

An increase in the viscosity would flatten these curves, while a decrease in the viscosity would cause the curves to droop more, but the relative positions would remain the same.

The steel bridge and Buna-N elastomer gave the best accuracy over the full range of the meter.

By selecting the proper calibration gears, it is possible to calibrate the meter for optimum accuracy on the fluid being measured at the normal operating point.

Similar curves on the three-inch Floco Industrial Meter would show the same relative relations.

### **Accuracy and Pressure Drop**

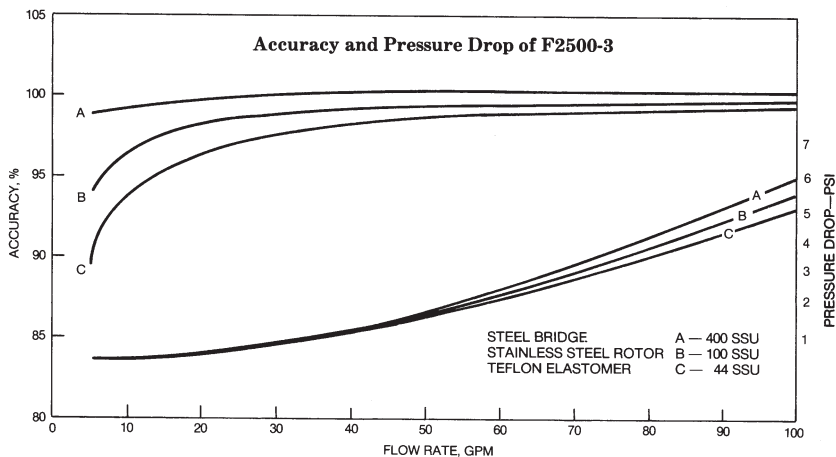
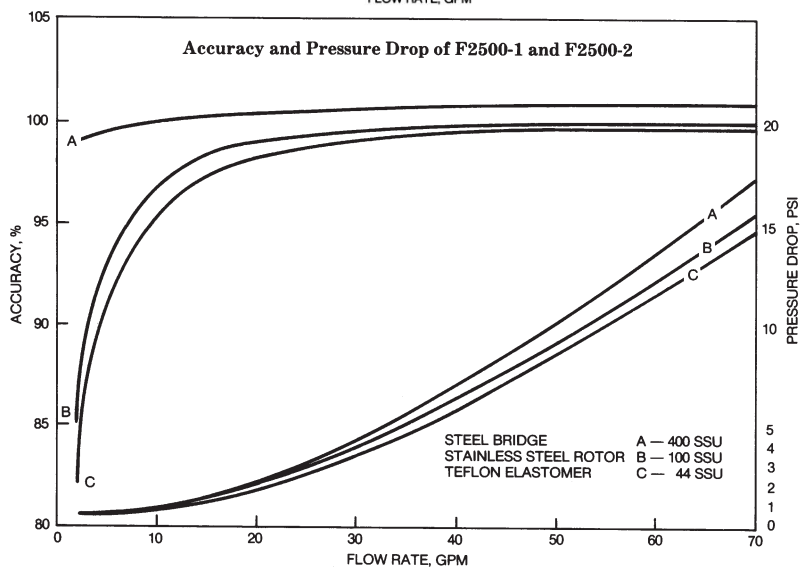
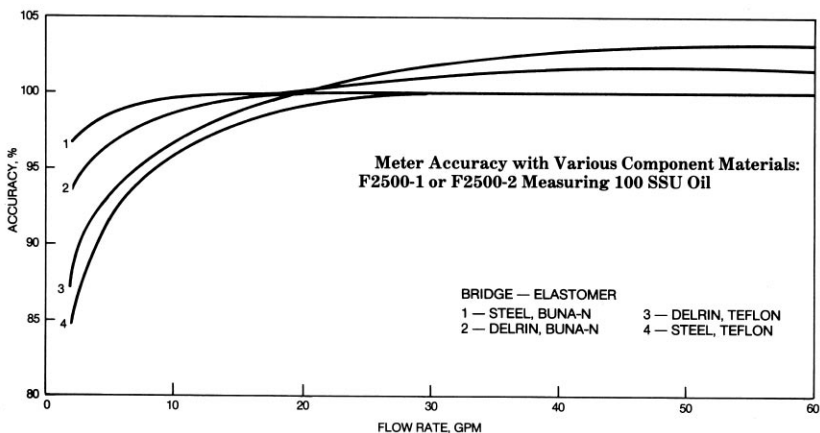
The next two graphs show the relationship of flow rate, pressure drop across the Floco meter, and accuracy for fluids of various viscosities flowing in a meter with a steel bridge, stainless steel rotor, and teflon elastomers. The viscosities used were 44,100 and 400 SSU.

Water at 68° F has a viscosity of 31 SSU, which would give curves for accuracy and pressure drop very close to those of the 44 SSU viscosity tested.

The steel bridge, stainless steel rotor, with teflon elastomers was selected as it is being used more and more on industrial applications on corrosive fluid. When the fluid is abrasive, the elastomers should be changed to Viton or Buna-N, if fluid compatibility will allow. The customer is actually in the best position to determine the choice of materials compatible with his service. You should advise him of the material available and let his experience help determine the proper choice of material.

A review of the Accuracy and Pressure Drop graphs will show that the pressure drop on the three-inch Floco meter is about 50% of the pressure drop on the one- and two-inch Floco meters. If this parameter is more important than the slight difference in accuracy and cost, then the three-inch size should be recommended.

Measurements have been made which indicate that Floco meters will work well with fluid viscosities at least as high as 10,000 SSU.



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## SECTION 2 - INSTALLATION

### Unpacking

Check the shipment for damage and, if any is noted, file a claim with the transportation company and notify the nearest Barton Sales Office as soon as possible.

### Precautions

The following precautions must be observed to assure safe and effective performance of Floco meters:

**Temperature:** The temperature of the metered liquid must be maintained to prevent either boiling or freezing at the operating pressure. In addition, parts made from elastomers restrict the operating temperature to the following ranges:

Buna-N .....	-30°F to +200°F (-34°C to +93°C)
Neoprene .....	-30°F to +250°F (-34°C to +121°C)
Ethylene-Propylene.....	-30°F to +250°F (-34°C to +121°C)
Viton.....	-20°F to +300°F (-29°C to +149°C)
Teflon.....	+60°F to +400°F (+16°C to +240°C)

**Pressure:** Do not subject the meter to pressures higher than the rated operating pressure. This is 2500 psi for meters with NPT fittings, or class 1500 rated flanges, and lower for other flanged meters and meters with Gruvlock (Victaulic) connections.

**Corrosion:** The meter body is made from ASTM A216 WCB carbon steel (with or without epoxy lining).

Most internal parts are made from AISI 316 stainless steel. O-ring seals are made from Buna-N, Neoprene, Ethylene-Propylene, or Viton, as specified.

Rotor bearings are made from carbon-graphite, aluminum-bronze, glass-filled teflon or meehanite, as specified. Some bearing surfaces are hard-chrome plated. Assume that these materials are compatible with the liquid being metered.

**Flow Rate:** Models F2500-1, F2500-2, FS2500-1 and FS2500-2 are designed to meter flows over the range from 6 to 60 gallons per minute (23 to 226 liters per minute). Models F2500-3 and FS2500-3 are rated from 9 to 90 gallons per minute (34 to 340 liters per minute). Although maximum flow rates can be exceeded for short periods, prolonged operation at excessive speed will significantly reduce the life of wearing surfaces.

**Gases and Vapors:** Floco meters are designed for metering only liquids. Gases and vapors moving through the meter will cause serious overspeeding and premature failure of moving parts. If the liquid stream contains entrained gas or vapor, install a gas eliminator upstream from the meter.

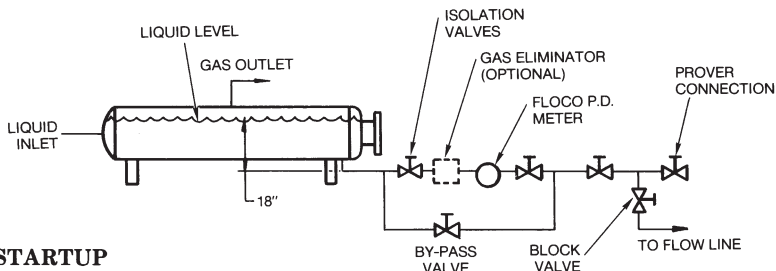
**Discharge Pressure:** Do not discharge the meter to atmospheric pressure. For proper operation, a back pressure of at least twice the pressure drop across the meter is required.

**Mounting Position:** The meter may be mounted either horizontally or vertically. When mounting horizontally, orient the nameplate upward.

## Typical Installations

The meter should be installed free of external loadings. See the install illustrations that follow (pages 8-11).

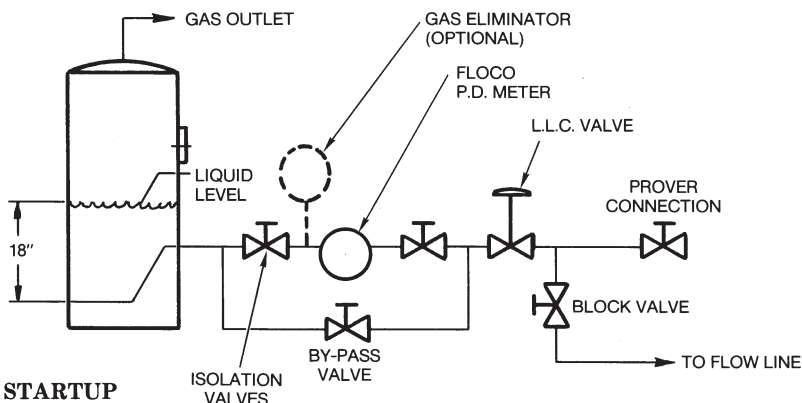
### Horizontal Separator, Liquid Flow



#### STARTUP

1. Open bypass valve and block valve. Close isolation valves and prover connection.
2. Allow sufficient flow through bypass loop to purge vessel and piping of gas and debris.
3. Set liquid level control valve to maintain a maximum height practicable above oil outlet.
4. Slowly open upstream isolation valve to equalize pressure and charge the Floco P.D. Meter.
5. Slowly open downstream isolation valve to permit meter to operate.
6. Close bypass valve.

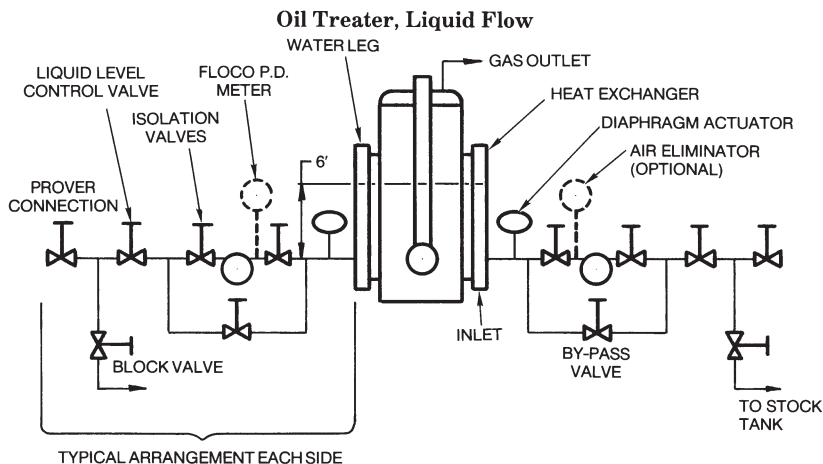
### Vertical Separator, Liquid Flow



#### STARTUP

1. Open bypass valve and block valve. Close isolation valves and prover connection.
2. Allow sufficient flow through bypass loop to purge vessel and flow lines of gas and debris.
3. Set liquid level control valve to maintain a minimum level of 18 inches above oil outlet.
4. Slowly open upstream isolation valve to equalize pressure and charge the Floco P.D. Meter.
5. Slowly open downstream isolation valve to permit meter to operate.
6. Close bypass valve.





### STARTUP

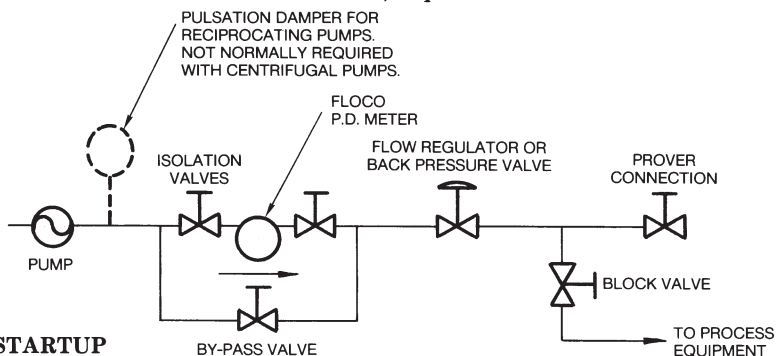
1. Close all valves until liquid level has been established in treater.
2. Open both block valves and bypass valves.
3. Allow sufficient flow to purge lines of gas and debris.
4. Set liquid level controls on each side to maintain a minimum height of 6 feet above liquid outlet.

### NOTICE

WATER LEG AND OIL LEG SHOULD BE APPROXIMATELY TWO PIPE DIAMETERS, OR 4 INCHES OD MINIMUM.

5. Open upstream isolation valves slowly to permit pressure to equalize and to charge Floco P.D. Meter.
6. Open downstream valves to permit meter to operate.
7. Close bypass valves.

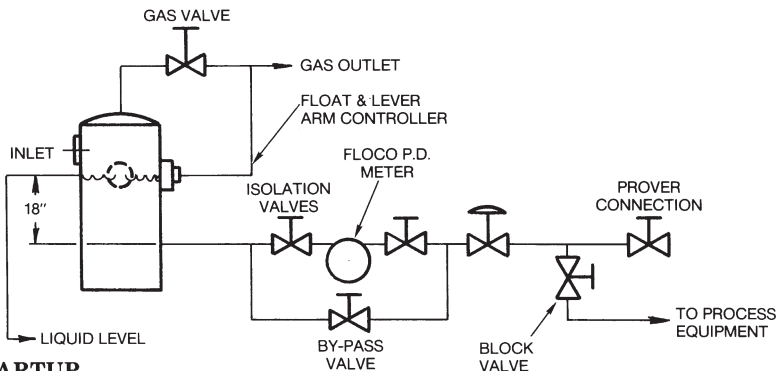
### Flow Line, Liquid Flow



#### STARTUP

1. Open bypass valve and block valve. Close isolation valves and prover connection.
2. Start pump and set back pressure valve to control flow rate or back pressure.
3. Allow sufficient flow through bypass loop to purge flow lines of gas and debris.
4. Open upstream isolation valve slowly to equalize pressure and charge the Floco P.D. Meter.
5. Open downstream valve slowly to permit meter to operate.
6. Close bypass valve.

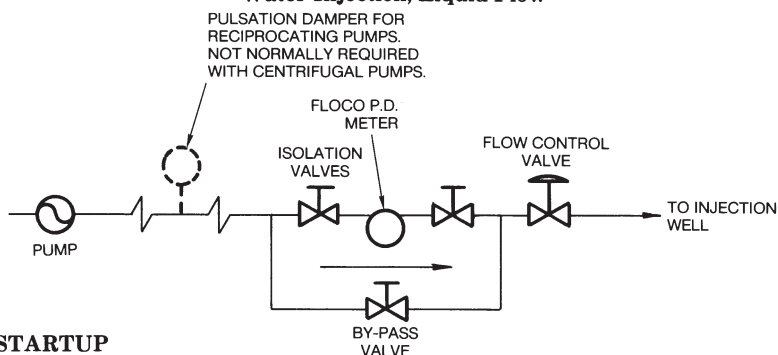
### Gas Eliminator, Liquid Flow



#### STARTUP

1. Close prover connection and isolation valves. Open bypass valve and block valve.
2. Allow sufficient flow through bypass loop to purge the vessel and piping of excessive gas and debris.
3. Adjust lever arm float controller to open gas valve when liquid level falls below 18 inches above oil outlet. Set back pressure valve to correct back pressure.
4. Open upstream isolation valve slowly to equalize pressure and charge the Floco P.D. Meter.
5. Open downstream isolation valve slowly to permit meter to operate.
6. Close bypass valve.

### Water Injection, Liquid Flow



#### STARTUP

1. Close isolation valves. Open bypass valve and flow control valve.
2. Start pump and allow sufficient flow through bypass loop to purge flow line of air, gas and debris.
3. Open upstream isolation valve slowly to equalize pressure and charge Floco P.D. Meter.
4. Open downstream isolation valve slowly to permit Floco meter to operate.
5. Close bypass valve.
6. Set proper flow rate by adjusting flow control valve.

## SECTION 3 - OPERATION/CALIBRATION

### **Startup Procedures**

Specific application procedures are on pages 8-11. General startup procedures are as follows:

1. Start with isolation valves closed.
2. Permit flow through the bypass for a time sufficient to purge the flow lines of gas and other undesirables. During the startup phase, adjust the liquid level controls (where applicable).
3. Open the isolation valve ahead of the meter slowly to equalize the pressure across the meter.
4. Open the downstream isolation valve or control valve slowly to allow the meter to start operating.
5. Close the bypass valve.
6. Adjust the downstream control valve to obtain proper flow rate through the meter.

### **Proving**

The Floco Positive Displacement Meter may be calibrated by three proving methods: Gravimetric Proving, Volumetric Proving, or Master Meter Proving. Meter proving by any method is basically a laboratory operation and should be performed carefully to obtain accurate data and exact mathematical calculations. (Refer to *American Petroleum Institute API Standard 1101, August 1960.*)

#### **A. Gravimetric Proving**

The Gravimetric Proving method is particularly advantageous when the metered liquid contains entrained gas or vapor, paraffin, wax, sand or other solids, or is heavy or viscous.

This method requires careful weighing of the quantity of liquid that passes through the meter. The net weight of the metered liquid is converted to volume (corrected for temperature and pressure where necessary). The metered volume is compared to the computed volume and the correct meter factor is obtained.

#### **B. Volumetric Proving**

The Volumetric Proving method requires fewer calculations than does the Gravimetric Proving Method and, therefore, requires less time to perform. However, errors may result if the liquid is viscous or if the liquid contains entrained gas or vapor, solids, paraffins, or other impurities which may adhere to the calibrating vessel.

This method requires the use of a vessel calibrated for a known volume. The calibration vessel must be cleaned thoroughly before and after each use. The metered volume through the meter is compared to the true volume of the calibrated vessel to obtain the correct meter factor.

#### **C. Master Meter Proving**

The Master Meter Proving method requires installing a meter of known accuracy into a prover loop. The readings of the production meter (meter being calibrated) are compared after the test with the readings of the master meter.

**Calibration**

F2500 meters are factory calibrated with water. If subsequent proving shows a change in the calibration constant, the meter can be corrected by changing the calibration gears.

To determine the required correction, compare TRUE VOLUME of fluid that passes through the meter (during proving procedure) with METERED VOLUME shown on the register. The required correction is:

$$\text{Correction (\%)} = \frac{\text{TRUE VOLUME}}{\text{METERED VOLUME}} - 1 \times 100$$

Selected new calibration drive and driven gears so the percent change in gear ratio is as close to the correction as possible. The percent correction obtained by changing the calibration gears is equal to:

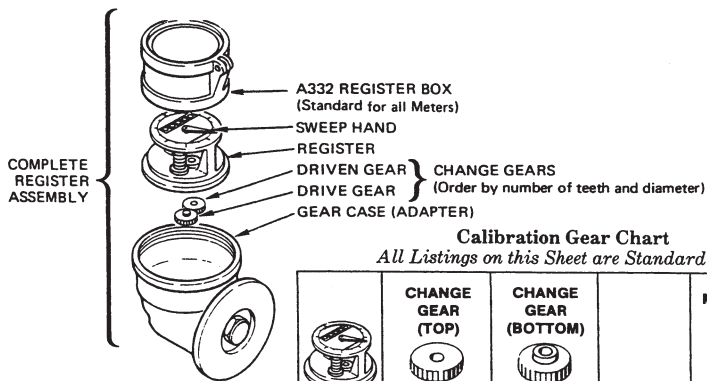
$$\frac{\text{DeN/DnN}}{\text{DeO/DnO}} - 1 \times 100$$

- Where    DeN = number of teeth in new drive calibration gear  
          DnN = number of teeth in new driven calibration gear  
          DeO = number of teeth in old drive calibration gear  
          DnO = number of teeth in old driven calibration gear











Barton stocks a variety of calibration gears — nominal 100% drive and driven calibration gears are listed in table below.

Calibration Gears (1" & 2" Meters)	
42 Gallon Barrel	Drive: 27 teeth, 0.0670" diameter Driven: 30 teeth, 0.0670" diameter
U.S. Gallon	Drive: 38 teeth, 0.860" diameter Driven: 20 teeth, 0.460" diameter
Liters	Drive: 33 teeth, 0.770" diameter Driven: 23 teeth, 0.570" diameter
Cubic Meters	Drive: 33 teeth, 0.770" diameter Driven: 23 teeth, 0.570" diameter
Calibration Gears (3" Meters)	
42 Gallon Barrel	Drive: 36 teeth, 0.860" diameter Driven: 20 teeth, 0.460" diameter
U.S. Gallon	Drive: 45 teeth, 0.958" diameter Driven: 19 teeth, 0.375" diameter
Liters	Drive: 33 teeth, 0.770" diameter Driven: 23 teeth, 0.570" diameter
Cubic Meters	Drive: 33 teeth, 0.770" diameter Driven: 23 teeth, 0.570" diameter

Other gears available are listed in table on page 12.



**Calibration Gear Chart**  
*All Listings on this Sheet are Standard Issue*

				CHANGE GEAR (TOP)  DRIVEN		CHANGE GEAR (BOTTOM)  DRIVE		MAGNETIC DRIVE GEAR RATIO	MODEL MC-500 MAGNETIC COUPLING ASSEMBLY	
		METER	REGISTER PART NO.	NO. TEETH	DIA.	NO. TEETH	DIA.		KIT NO.	PART NO.
42 GAL. BBL.		F500-1, F500-2	3059	30	.670	27	.670	40:1	1	0500-0009A
		F500-3	3059	20	.460	36	.860	40:1	1	0500-0009A
		F2500-1, F2500-2	3059	30	.670	27	.670	40:1	4	0500-0009A 0500-0021A
		F2500-3		20	.460	36	.860	40:1	1	0500-0009A
		U.S. GALS.		F500-1, F500-2	3015	20	.460	38	.860	20:1
F500-3	3015			19	.375	45	.958	12:5 to 1	3	0500-0006A
F2500-1, F2500-2	3015			20	.460	38	.860	20:1	2	0500-0007A
F5000-1				5	0500-0019A					
F2500-3	3015			19	.375	45	.958	12:5 to 1	3	0500-0006A
IMP. BBL.		F500-1, F500-2	3131	30	.670	27	.670	40:1	1	0500-0009A
		F500-3	3131	20	.460	36	.860	40:1	1	0500-0009A
		F2500-1, F2500-2	3131	30	.670	27	.670	40:1	1	0500-0009A
		F5000-1		4	0500-0021A					
		F2500-3	3131	20	.460	36	.860	40:1	1	0500-0009A
IMP. GALS.		F500-1, F500-2	3127	23	.570	36	.770	20:1	2	0500-0007A
		F500-3	3127	21	.460	41	.860	12:5 to 1	3	0500-0006A
		F2500-1, F2500-2	3127	23	.570	36	.770	20:1	2	0500-0007A
		F5000-1		5	0500-0019A					
		F2500-3	3127	21	.460	41	.860	12:5 to 1	3	0500-0006A
CUBIC METERS		F500-1, F500-2	3132	23	.570	33	.770	40:1	1	0500-0009A
		F500-3	3132	23	.570	33	.770	20:1	2	0500-0007A
		F2500-1, F2500-2	3132	23	.570	33	.770	40:1	1	0500-0009A
		F5000-1		4	0500-0021A					
		F2500-3	3132	23	.570	33	.770	20:1	2	0500-0007A
LITERS		F500-1, F500-2	3129	23	.570	33	.770	40:1	1	0500-0009A
		F500-3	3129	23	.570	33	.770	20:1	2	0500-0007A
		F2500-1, F2500-2	3129	23	.570	33	.770	40:1	1	0500-0009A
		F5000-1		4	0500-0021A					
		F2500-3	3129	23	.570	33	.770	20:1	2	0500-0007A

### Meter Factor Number

All positive displacement meters require a meter factor number for extreme accuracy. To determine the meter factor number, divide the true volume by the metered volume as in the following equation:  $\frac{\text{True Volume}}{\text{Metered Volume}} = \text{Meter Factor}$

The metered volume for future accounting is then multiplied by the meter factor to obtain the true volume:  $\text{Meter Volume} \times \text{Meter Factor} = \text{True Volume}$

## SECTION 4 - MAINTENANCE AND REPAIR

### **Maintenance**

Regular inspection and preventive maintenance of Floco meters will ensure a long and trouble-free service life. The following procedure is suggested as a maintenance program. However, this program should be adapted to the type of liquid metered, based on corrosive and abrasive qualities.

1. Inspect the register assembly semi-annually: All gears shall turn freely and assembly shall be free of scale and corrosion.
2. Lubricate magnetic coupling and gears with one ounce of light oil.
3. If the meter accuracy changes, inspect the rotor assembly. Inspect specifically the edges of the hinges and the rotor hub (where a positive seal is required) for separation or splitting of the elastomer. Replace the rotor blades or rotor body if splitting or separation of the elastomer is apparent or if portions of the elastomer are missing.
4. Inspect bearings every 25,000 barrels (4,000 cubic meters) for excessive wear. Tests on brine indicate satisfactory service even after metering 100,000 barrels (16,000 cubic meters). Replace bearings if rotor shafts become scored, if bearings surface shows excessive wear, or if bearing becomes out of round.
5. Inspect bridge and bridge seals semi-annually or whenever sideplate is removed. Bridge seals should not be split, chipped or elongated.
6. Liners should be inspected annually for excessive wear or scoring. If liner is excessively worn, replace with new liner (refer to para. **A. Body** on next page). If slightly scored, the liner may be polished with a fine emery cloth.
7. Inspect the wearplates whenever the sideplate is removed or whenever the meter accuracy varies. If the wearplates show excessive wear (worn through chrome plating), reverse or replace the plates. Do not confuse a normal wear pattern with excessive wear. The rotor will normally wear a pattern on the wearplate.

### **Tools Required For Maintenance And Troubleshooting**

Item	Purpose
5/16-inch hex key	To remove sideplate bolts.
1-inch open-end wrench	To remove magnetic coupling.
7/32-inch hex key	To remove bridge screws.
Long-nose pliers	To remove rotor hinge pin.
File	To dress replaced liner.
Wide blade screwdriver	To replace bearings.
Rotor spring tool No. 0000.22090	To remove rotor springs.
Sideplate bushing tool No. 0000.14340	To remove and replace bushings.
E-018 Truarc applicator	To remove retaining ring.
1/32-inch pin punch	To remove pin in worm.
Small ballpeen hammer	To install pin in worm.

## Troubleshooting

**NOTE:** Visual inspection of the rotor assembly and the magnetic coupling will reveal most causes of malfunctions in the Floco Meters.

Problem	Possible Sources	Probable Cause	Corrective Action
No Flow Indication	Rotor Hinge	Broken Hinge	Replace Hinge
	Rotor Shaft	Broken or Worn Shaft	Replace Rotor Body
			Inspect Bearing Surfaces (wear of these surfaces may be the cause of shaft failure)
	Magnetic Coupling	Slipping Magnetic Coupling	Remove Register and observe worm gear. If it is rotating, check register for excessive drag. Determine the cause and correct. If worm gear is not rotating, trouble is in magnetic coupling.
Low Flow Indication	Bypass Valve	Valve Leak	Repair or Replace Valve
	Wearplates	Plate Worn	Reverse or Replace Wearplates
	Calibration Gears	Worn or Incorrect Gears	Replace Gears
	Bridge Seals	Worn Seals	Replace Bridge Seals
	Rotor Hinge	Worn or Broken Hinges	Replace Hinges
		Slow Closing Rotor Hinges due to large change in viscosity of service fluid	Recalibrate Meter Using Service Fluid
High Flow Indication	Excessive Rotor Spin	Gas in Liquid	Install Gas Eliminator ahead of meter or raise liquid level in vessel to a height sufficient to prevent gas flow. Inspect Rotor Assembly for wear or damage.

## Repair Procedures

Numbers in parentheses (#) are items in parts drawing/lists starting on page 27.

### A. Body

1. Remove the sideplates (7) and the rotor assembly (14).
2. Remove bridge screws (24) and washers (25) using 7/32-inch hex key.
3. Remove the bridge (21).
4. Remove the liner (17). The liner should slide out of the body freely.
5. Clean the meter body by removing scale deposits or rust with a wire brush and emery cloth. Apply a thin coat of rust inhibitor to all machined surfaces.
6. Replace the liner. Attach one sideplate assembly with three bolts, but without the O-ring. Insert the liner, positioned with its edges equally spaced from the bridge screws and snug against the sideplate.
7. Insert the wedge (15) between the bridge screws with the wedge apex against the bridge.
8. Insert the bridge with the screws very loose.



9. Tighten the bridge screws evenly until the wedge is slightly flattened. Check the liner clearance to the sideplate with a 0.0015" to 0.002" feeler gage. If the feeler gage slides beneath the liner, tap the liner (with a hardwood or plastic mallet). Tighten the bridge screws until the bridge is snug against the liner.
10. With the liner wedged in place, remove the bridge and sideplate. Dress the edges of the liner until they are smooth and flush with the meter body facings.
11. Replace the bridge, leaving the bridge screws loose. Do not tighten the bridge screws until the sideplate assemblies are attached and snug. The sideplates will align the bridge in the correct position when the bridge screws are tightened.
12. Replace the body seal O-rings (16).
13. Proceed to further assembly as required.

## **B. Rotor**

Inspect all rubber covered parts. Some visible wear is normal and will not affect the accuracy of the meter. If the rubber coating is missing from any part, replace the part.

Inspect for broken springs, broken or missing boots, missing or damaged rotor blade hinge grommets.

### **Replacement of hinge assemblies:**

1. Remove retaining clips (50) from hinge pins (10).
2. Remove hinge pins with pliers allowing hinges, springs and grommets to be removed.
3. To assemble rotor, insert hinge pin in appropriate hole in web so that hinge arm will slip on.
4. Insert spring with grommets in place so that holes are aligned with pin.
5. Insert hinge pin through all grommet holes and through pin hole in opposite web.
6. Hold hinge pin firmly in place and insert retaining clip.

### **NOTICE**

Hinge pin should be firmly in place without wobble or lateral movement.

7. Repeat steps 1 through 6 for each hub section.

## **C. Sideplate**

**NOTE:** Sideplate bushings are designed with left-hand threads.

1. Remove register and register adapter, magnetic coupling assembly, or blind nut from sideplate.
2. Unscrew bearing nut (6) with a wide blade screwdriver.
3. Slide out bearing assembly (9).
4. Remove wearplate (8) from the sideplate.
5. Remove O-ring (52).
6. To remove bushing (3), place sideplate face down on flat surface such as 2 x 8-inch wood block with a 1/2-inch O.D. hole bored in wood.

*Continued on next page...*

7. Using bushing insertion tool 1434 or similar flat tool, place tool against bushing and tap sharply with a small hammer. The bushing is pressed in place and will fall out easily when the pressure is released.
8. To replace bushing, turn sideplate face up, insert the bushing using tool 1434, and tap with small hammer until bushing is flush with sideplate face. Do not dent or sear bushing or sideplate. Bushing must be flush with sideplate to within 0.003 of an inch.
9. Replace O-ring (52) and wearplate (8).
10. Insert bearing assembly (9) taking care that bearing sleeve lugs fit into lug slots in bushing.
11. Insert and tighten bearing nut (6).

#### **D. Magnetic Coupling**

1. Remove driven magnet assembly (33).
2. Remove flange bearing (51) from housing bearing assembly (31). *Do not beat end of housing bearing assembly on hard surface to remove bushing.* Instead, use small needle nose pliers with smooth surfaces that will not damage the bearing.
3. Remove drive coupling and shaft assembly (28) with drive magnet (29) as one unit from the housing bearing assembly (31).
4. Remove all O-rings.
5. Remove retaining ring (30) with flat surface of standard screwdriver or E-018 Truarc applicator and slide drive magnet (29) off end of drive coupling and shaft assembly (28).
6. Clean parts with petroleum cleaning (Stoddard) solvent.
7. Inspect all parts for excessive/uneven wear. Replace all worn parts.
8. Place a drop of oil on each O-ring and work the oil into the surface.
9. Apply a heavy coat of grease to outside of housing bearing assembly (31).
10. Install O-ring (32) onto housing bearing assembly (31).
11. Install drive pin (27) in drive coupling and shaft assembly (28). Slide drive magnet (29) over drive coupling and shaft assembly (28). Secure drive magnet with retaining ring (30) by using E-018 Truarc applicator. E-ring fits into groove in the drive coupling and shaft assembly.
12. Slide drive coupling and shaft assembly (28) with drive magnet (29) attached into housing bearing assembly (31), aligning end of shaft into bearing in the inside of bearing housing assembly.
13. Install O-rings on bushing (26) and then insert bushing (larger inside diameter [approx. 7/16-inch] end first) into bearing housing (31).
14. Slide driven magnet assembly (33) over housing bearing assembly (31).
15. Slowly start threading housing bearing assembly (31) onto bushing of register sideplate assembly (left-hand thread) and at the same time rotate driven magnet assembly (33) back and forth until slot of drive coupling and shaft assembly is engaged into rotor shaft. If drive coupling and shaft assembly is not properly engaged onto rotor shaft, housing assembly will not thread properly and will jam.

16. When it is determined that drive coupling and shaft assembly is firmly engaged onto rotor shaft, continue to thread the housing bearing assembly (31) onto register sideplate assembly until it is tight against O-ring. Tighten securely with one-inch open-end wrench. The housing bearing assembly (31) will move approximately 1/4-inch into bushing of sideplate assembly when completely tightened.
17. Push register adapter (37) over driven magnet assembly (33) so the worm (35) is in alignment with worm gear (38) and register adapter (37) is tight against the sideplate (7). Secure with two 10-32 x 1/2 screws (36).
18. Re-install calibration gears (39 & 40), register assembly (41), register gasket (43) and register cover (47) using two screws (36).

### **Selection Of Replacement Bearings**

Three factors must be considered when selecting a bearing material:

1. Lubrication (lubricity of the working fluid).
2. Corrosion resistance of bearing material.
3. Wear resistance of the shaft and bearing when used in abrasive fluids.

In oil service, unless hydrogen sulfide (H<sub>2</sub>S) is present in significant quantities, aluminum-bronze is the preferred bearing material. Carbon-graphite is recommended for use when hydrogen-sulfide is present. Carbon-graphite bearings should also be used in salt water service, where lubrication is poor, and where corrosion or galvanic attack is a possibility.

In some abrasive fluid applications, meehanite offers longer service life; however, service liquid should have reasonably good lubricity.

For highly corrosive fluid applications, teflon bearings are recommended. Generally, the service life will not be as long as that of the other bearing materials. Under no circumstances should teflon bearings be used with abrasive fluids.

### **Rotor Elastomer Identification**

A letter is molded into the face of the rotor blades to identify the elastomer. The meaning is as follows:

- B = Buna-N
- N = Neoprene
- E = Ethylene-Propylene
- V = Viton

Teflon blades are easily recognized by the white color of the material. All other blades are black.

### **Selection Of Replacement Elastomer Parts**

The factors affecting the selection of the best elastomer include the operating temperature, the chemical properties of the metered fluid, and the degree of abrasiveness of the metered fluid. See guidelines below:

#### **A. Buna-N**

A general purpose elastomer, particularly well suited for use with petroleum products, including crude oil. Recommended for metering water, silicone oils, and ethylene glycol base fluids. Good abrasion resistance and excellent dynamic properties. Useful over a temperature range from -30°F (-34°C) to +200°F (+93°C).

B. Ethylene-Propylene

A general purpose elastomer suited for applications other than petroleum products. Recommended for metering sour water and brine, silicone oils, weak acids and alkalis, alcohols and ketones. Excellent abrasion resistance and dynamic properties. Useful from -30°F (-34°C) up to +250°F (+121°C).

C. Neoprene

Useful with many fluids, including combinations of fluids, where Buna-N and Ethylene-Propylene are not recommended. Applications include sour crude oil (cold), refrigerants, high aniline point petroleum oils and mild acids. Good abrasion resistance. Usable at temperatures from -30°F (-34°C) to +250°F (+121°C).

D. Viton

Used for high temperature applications. Acceptable for metering petroleum products including crude oil, di-ester and silicate ester lubricants, silicone fluids, halogenated hydrocarbons, and acids. Good abrasion resistance and excellent dynamic properties. The operating temperature range extends from -20°F (-29°C) to +300°F (+149°C).

E. Teflon

Recommended for highly corrosive liquids and for high temperature applications. Resistant to almost all chemicals. Poor abrasion resistance and fair-to-poor dynamic properties. The operating temperature range extends from +60°F (+16°C) to +400°F (+204°C).

## SECTION 5 - M500 MAGNETIC COUPLING OPTION

### **Introduction**

The Floco M500 Magnetic Coupling transmits power from the rotor to a standard small register, small reset register, large numeric reset register/ticket printer, and other accessories. A magnet on the rotor side is magnetically coupled to a magnet on the register side — eliminating pressure seals.

The M500 can be installed on applicable meter already in use, provided the rated torque limit is not exceeded. The register adapter (0000.2931.0) is used with the F2500 Series meters.

### **M500 Installation**

If the M500 was ordered separately, turn worm gear by hand and check that the drive coupling (0500.1024.B) and shaft assembly rotates.

Make sure the torque demanded from the worm in the coupling is limited to a maximum of 12 ounce-inches.

#### **Tools Required for Installation and Repair:**

- 7/8-inch open-end wrench (to remove AE9 gear case)
- 1-inch open-end wrench (to install magnetic coupling)
- Standard Screwdriver (for removal of screws)
- Can of lightweight Oil (Lubrication)
- E-018 Truac Applicator (to remove retaining rings)
- 1/32-inch Pin Punch & Small Ballpeen Hammer (to remove/install worm pin)

**Note:** Letters in parentheses (X) correspond to items in illustration on page 22.

#### **A. Preliminary Procedure**

The following preliminary procedure is necessary to mount the magnetic coupling on the applicable meter if the coupling was ordered as a separate item. If a complete meter was ordered with the magnetic coupling included, omit the mounting instructions in this supplement and mount the entire meter as directed in the installation section of the applicable technical manual.

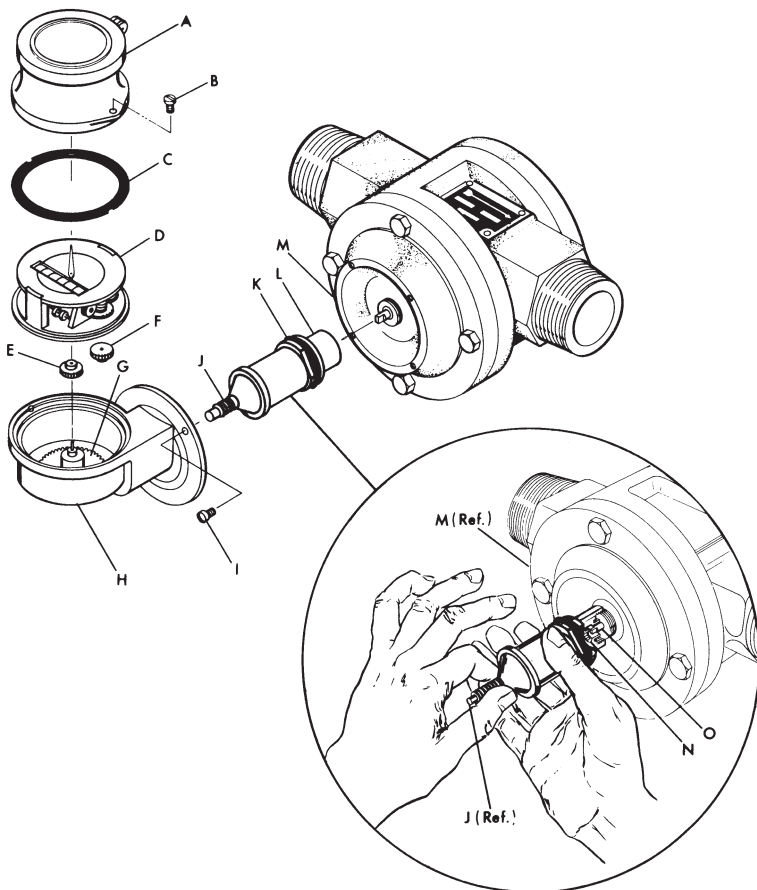
1. Close isolation valves upstream and downstream from the Floco meter.
2. Relieve pressure from Floco meter, using a method suited to the particular installation.

#### **B. Removal of AE9 Gear Case Adapter Assembly**

1. Remove the two 10-32 x 1/2 screws (B) that secure register box assembly (A) to the AE9 (H), lift off register box assembly, and register assembly (D), and remove drive calibration gear (E) from AE9.
2. Remove the two 10-32 x 1/2 screws (I) that secure AE9 (H) to register sideplate assembly (M).
3. Using a 7/8-inch open-end wrench, loosen 916 nut (left-hand thread), turn clockwise to loosen until AE9 (H) can be removed from register sideplate assembly (M).

#### **C. Mounting the Model 500 Magnetic Coupling**

1. Remove coupling housing (L) from register adapter (H).



Item	Description	Item	Description
A	Register Box Assembly	I	Screw, 10-32 x ½-inch 10-32 x ¼-inch
B	Screw, 10-32 x ½-inch	J	Worm
C	Register Gasket	K	O-Ring
D	Register Assembly	L	Housing Bearing Assembly
E	Drive Calibration Gear	M	Register Sideplate Assembly
F	Driven Calibration Gear	N	Drive Coupling & Shaft Assembly
G	Worm Gear & Shaft Assembly	O	Rotor Shaft
H	Register Adaptor Housing 0000.2931.0 fits F-500 & F-2500 0000.2932.0 fits F-5000		

- Slowly start threading coupling housing Q onto bushing of register sideplate assembly (M) (left-hand thread) and at the same time rotate worm (J) back and forth until slot of drive coupling and shaft assembly (N) is engaged onto rotor shaft (O). If drive coupling and shaft assembly is not properly engaged onto rotor shaft, housing assembly will not thread properly and will jam.

### C. Mounting the Model 500 Magnetic Coupling (Continued)

3. When it is determined that drive coupling and shaft assembly (N) is firmly engaged onto rotor shaft (O), continue to thread coupling housing (L) onto register sideplate assembly (M) until coupling housing is tight against O-ring. Tighten securely with 1-inch open-end wrench. Coupling housing (L) will move approximately  $\frac{1}{4}$  inch onto bushing or sideplate assembly to be completely tightened.
4. Push register adapter (H) over coupling housing (L) so that magnetic drive assembly and worm (J) is in alignment with worm gear (G) and tight against flange of sideplate assembly (M), and secure with two 10-32 x  $1\frac{1}{2}$  screws. If necessary, install worm gear assembly (G) in register adapter.
5. Install drive calibration gear (E) which was previously removed onto end of split shaft of worm gear assembly (G), with small hub of gear facing up.
6. Place register assembly (D) over register adapter assembly (H), set register gasket (C) in flange of register assembly, place register box assembly (A) over register assembly, and secure with the two 10-32 x  $1\frac{1}{2}$  screws (B).

## **M500 Troubleshooting And Repair**

### **Servicing**

The servicing information in this section refers only to the Model 500 Magnetic Coupling, which has replaced the AE9 gear case. To service those portions of the meter that were not changed by the installation of the magnetic coupling, refer to the applicable sections or pages as directed.

### **Troubleshooting Suggestions**

If regularly maintained, Floco meters will provide long trouble-free service. If trouble becomes evident, the source of trouble will usually be found in the magnetic coupling, rotor assembly, or bearings.

### **Maintenance**

#### **A. Register Removal** (refer to page 22)

Regular inspection and preventive maintenance on the magnetic couplings of Floco meters, in addition to the prescribed maintenance of the other major parts of the meter, will ensure many months of trouble-free service. It is suggested that the following maintenance program be performed semiannually. However, this program should be adapted to the type of liquid metered, based on corrosive and abrasive qualities. Only the maintenance of the magnetic coupling is described in detail in this supplement; refer to the maintenance section in the main portion of the manual as directed for maintenance of other parts of the meter.

**Remove Register** as follows:

1. Close isolation valves upstream and downstream from Floco meter.
2. Relieve pressure on meter.

3. Remove screws (B) that secure register box assembly (A) to register adapter (H), and remove register box assembly, register gasket (C), and register assembly (D).
4. Remove screws (I) that secure register adapter (H) to register sideplate assembly (M) of body assembly, and slide register adapter off coupling housing.
5. Use a 1-inch open-end wrench to loosen coupling housing (L) from bushing of register sideplate assembly (M) (left-hand thread) and then continue to unscrew and finally separate coupling housing from sideplate assembly.

## B. Magnetic Coupling Maintenance

Refer to the following troubleshooting table for suggestions and inspection procedures.

### ***Troubleshooting Table:***

Part No. & Name	Inspection	Probable Cause
0087.1014.T Retaining Ring	If ring is distorted or corroded it should be replaced.	
Worm, Worm Gear & Shafts	If tops of teeth are thin or sharp, especially in center area, replace. On shafts, any visible wear that can be felt with the fingernail is cause for replacement of corresponding assembly (worm or worm gear and associated shaft).	Water getting into worm & worm gear area or misalignment between worm & worm gear. Wrong worm & worm gear ratio.
	<b>Note:</b> Always replace O-rings (if any) associated with worn parts that are replaced. Be sure new O-rings are of the same material as used in original O-ring.	
0000.2944.0 O-Ring Bushing	Check if bore is out of round. If it is, replace bushing. Inspect O-rings associated with 0000.2944.0 bushings; if worn, replace.	Badly worn rotor bearings or rotor shaft. Worn drive coupling & shaft assembly. 0500.1024.B
0500.1024.B Drive Coupling & Shaft Assy.	If wear is uneven or excessive, replace.	Wear of rotor bearings, or other parts. Evidence of even wear would be normal if the coupling had been in service for a long time.
0500.1025.B Magnet Drive Assembly	Check for uneven or excessive wear. If wear is uneven, inspect magnet for grooves or gouges, and replace, if necessary.	Worn housing bearing assembly. 0500.1026.B

**NOTE:** The following procedure assumes that register and magnetic coupling have already been removed from meter and that coupling housing has been removed from register adapter as previously described.

1. Disassembly of Magnetic Coupling (refer to pages 37-38):
  - a. Remove magnet drive assembly with worm.
  - b. Drive out roll pin from worm if necessary to replace with new worm.
  - c. Remove bushing from housing bearing assembly. Do not beat end of housing bearing assembly on hard surfaces to remove bushing. Remove with small needle nose pliers that have smooth surfaces so as not to damage bushing.



- d. Remove drive coupling and shaft assembly with drive magnet as one unit from the housing bearing assembly.
  - e. Remove all O-rings.
  - f. Remove retaining ring with flat surface of standard screwdriver or E-018 Truac applicator and slide drive magnet off end of drive coupling and shaft assembly.
  - g. Clean parts with petroleum cleaning (Stoddard) solvent.
2. Inspection of Magnetic Coupling Parts
- a. Inspect all parts closely for signs of excessive or uneven wear.
  - b. Check that drive magnet slot is aligned against drive pin of shaft. If necessary, push magnet tight against pin and reset retaining ring with E-018 Truac applicator.
  - c. Replace all worn parts.

**NOTE:** Make sure new O-rings are of the same material as the original O-rings or of a material compatible with fluid conditions.

3. Reassembly of Magnetic Coupling:

**NOTE:** Before reassembling magnetic coupling place one drop of oil on each O-ring used in reassembly and work oil onto all surfaces of O-ring. Lubricate bearing surfaces with oil or good grease lubricant.

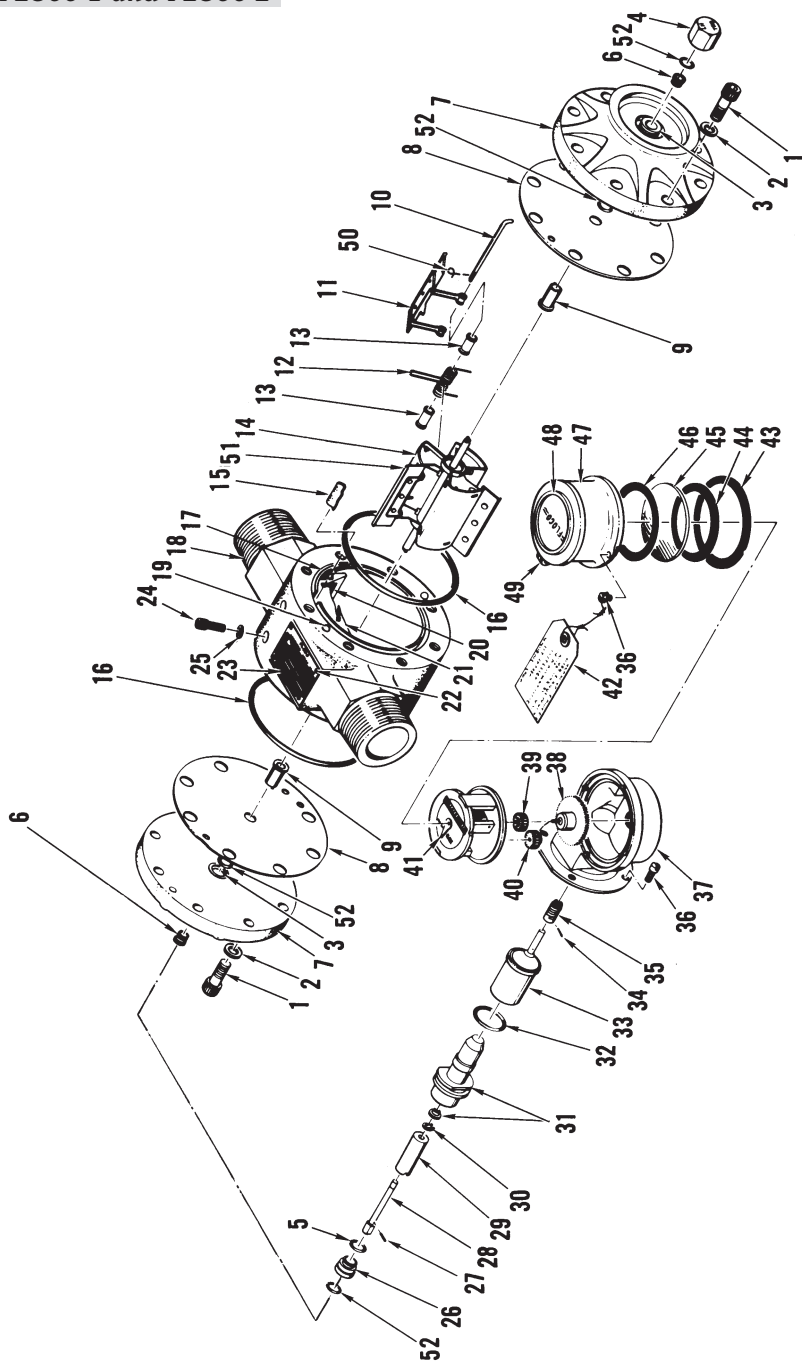
- a. Install O-ring onto housing bearing assembly.
- b. Install drive pin in drive coupling and shaft assembly. Slide drive magnet over drive coupling and shaft assembly. Secure drive magnet with retaining ring by using E-018 Truac applicator. Retaining ring fits into groove in the drive coupling and shaft assembly.
- c. Slide drive coupling and shaft assembly with drive magnet attached into housing bearing assembly, aligning end of shaft into bearing in the inside of bearing housing assembly.
- d. Install O-rings on bushing and then insert bushing into bearing housing assembly, with end having larger inside diameter (about 7/16") being inserted first.
- e. Install worm over shaft on drive magnet assembly and align holes for worm pin. Drive roll pin through holes in worm and shaft, being careful not to bend or distort shaft or assembly.
- f. Slide magnet drive assembly over housing bearing assembly.
- g. **Refer to page 22.** Assuming register sideplate assembly (M) has been reinstalled on body, slowly start threading coupling housing (L) onto bushing of sideplate assembly (left-hand thread) and at the same time rotate worm (J) back and forth until slot of drive coupling and shaft assembly (N) is engaged onto rotor shaft (O). If drive coupling/shaft assembly is not properly engaged onto rotor shaft, housing assembly will not thread properly and will jam.

B. Magnetic Coupling Maintenance (continued)

- h. When it is determined that drive coupling and shaft assembly is firmly engaged onto rotor shaft (O), continue to thread coupling housing (L) onto register sideplate assembly (M) until it is tight against O-ring.  
Tighten securely with 1-inch open-end wrench. Coupling housing will move approximately 1/4-inch onto bushing of sideplate assembly to be completely tightened.
- i. Push register adapter (H) over coupling housing (L) so that magnetic drive assembly and worm (J) is in alignment with worm gear (G) and tight against flange of register sideplate assembly (M), and secure with the two screws (I).
- j. Pour enough lightweight lubricating oil into register adapter (H) to cover approximately half the thickness of toothed section of worm gear (G).
- k. Place register assembly (D) over register adapter (H), set register gasket (C) in flange of register assembly, place register box assembly (A) over register assembly, and secure with the two 10-32 x 1/2 screws (B).

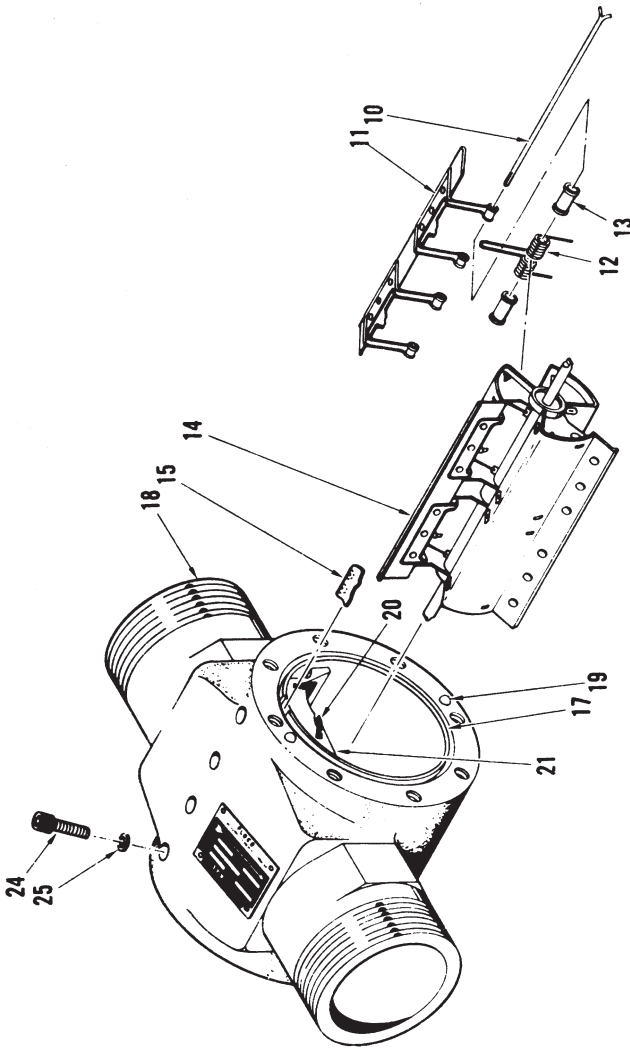
**NOTE:** Drive and driven magnets are of sintered material (very hard) and could be broken if struck a direct hard blow with a hammer.

### F2500-1 and F2500-2



**SECTION 6 - PARTS LIST/DRAWING (Continued)**

**F2500-3 (Unique Parts Only)**



## F2500 Parts List (F2500-1/-2/-3 and FS2500-1/-2/-3)

**Calibration Gears:** When ordering replacement calibration gears, specify the diameter (0.460, 0.570, 0.770, or 0.860) and the number of teeth.

**FS-Series Certified Parts:** When ordering pressure-retaining components for FS-Series meters, specify whether the components are to be certified in compliance with NACE Standards for hydrogen sulfide applications.

Item	Description	Part No.	NACE Part No.	Per Unit
1	Body Bolt, 3/8-24 x 1-1/4 Soc. Hd.	0220.1053.J		16
2	Washer, 3/8 Flat	0000.1985.0		16
3	Bushing, Sideplate	2500.2112.C		2
4	Nut, Blind	0000.0915.0	2500.2110.C	1
5	O-Ring			1
	(a) Buna-N	0001.0105.R		
	(b) Viton	0001.0037.R		
	(c) Teflon	0001.0116.R		
6	Nut, Bearing			2
7	Sideplate:			1
	(a) Register-Side	0000.2475.0	2500.2107.B	
	(b) Plain-Side	0000.2476.0	2500.2106.B	
8	Wearplate	0000.2275.0		2
9	Rotor Bearing:			2
	(a) Al Bronze	0000.2529.0		
	(b) Carbon-Graphite	0000.2496.0		
	(c) Meehanite	0000.2528.0		
	(d) Glass-Filled Teflon	0000.2947.0		
10	Hinge Pin, Rotor:			3
	(a) Delrin Rotor, 1" & 2"	0000.1517.0		
	(b) Riveted or SST Rotor, 1" & 2"	0500.2030.0		
	(c) Riveted or SST Rotor, 3"	0500.2031.C		
11	Rotor Hinge Assembly:			3
	(a) Buna-N, 1" & 2"	0000.0361.0		
	(b) Buna-N, 3"	0000.0252.0		
	(c) Neoprene, 1" & 2"	0000.2692.0		
	(d) Neoprene, 3"	0000.2693.0		
	(e) EPR, 1" & 2"	0000.2775.0		
	(f) EPR, 3"	0000.2780.0		
	(g) Viton, 1" & 2"	0000.2334.0		
	(h) Viton, 3"	0000.2569.0		
	(i) Teflon, 1" & 2", +320 - +400°F (+160° - +205°C)	0000.3143.0		
	(j) Teflon, 3", +320 - +400°F (+160° - +205°C)	0000.3148.0		
	(k) Teflon, 1" & 2", +250 - +320°F (+120° - +160°C)	0000.3144.0		
	(l) Teflon, 3", +250 - +320°F (+120° - +160°C)	0000.3149.0		
	(m) Teflon, 1" & 2", +140 - +250°F (+60° - +120°C)	0000.3145.0		
	(n) Teflon, 3", +140 - +250°F (+60° - +120°C)	0000.3150.0		
	(o) Teflon, 1" & 2", +60 - +140°F (+15° - +60°C)	0000.3146.0		
	(p) Teflon, 3", +60 - +140°F (+15° - +60°C)	0000.3151.0		
12	Spring:			3*
	(a) Epoxy-Coated Inconel	0003.6229.0		
	(b) Inconel	0000.0362.0		

## SECTION 6 - PARTS LIST/DRAWING (Continued)

### F2500 Parts List (F2500-1/-2/-3 and FS2500-1/-2/-3) Continued

Item	Description			Part No.	NACE Part No.	Per Unit
13	Spring Grommet:					6*
	(a)	Buna-N		0000.3046.0		
	(b)	Neoprene		0000.3049.0		
	(c)	EPR		0000.2724.0		
	(d)	Viton		0000.3047.0		
	(e)	Teflon		0000.2958.0		
14	Hub Assembly:					1
	(a)	Delrin, 1" & 2"		0000.1166.0		
	(b)	SST Brazed, 1" & 2"		0000.3195.0		
	(c)	SST Brazed, 3"		0000.3199.0		
	(d)	Riveted, Buna-N, 1" & 2"		0000.3031.0		
	(e)	Riveted, Buna-N, 3"		0000.3038.0		
	(f)	Riveted, Viton, 1" & 2"		0000.3032.0		
	(g)	Riveted, Viton, 3"		0000.3039.0		
15	Wedge			0000.0302.0		1*
16	O-Ring, Body Seal:					2
	(a)	Buna-N		0001.0167.R		
	(b)	Neoprene		0001.0168.R		
	(c)	EPR		0001.0170.R		
	(d)	Viton		0001.0171.R		
17	Linear:					1
	(a)	1" & 2" Meters		0000.0301.0		
	(b)	3" Meters		0000.2656.0		
18	<b>Meter Body Model</b>	<b>Connections</b>	<b>Epoxy Lined</b>			1
	F2500-1	NPT	No	0000.2631.0	2500.2102.C	
	F2500-1	300# RF	No	2500.1035.B	2500.2035.B	
	F2500-1	600# RF	No	2500.1014.B	2500.2014.B	
	F2500-1	900/1500# RF	No	2500.1015.B	2500.2015.B	
	F2500-1	300# RTJ	No	2500.1037.B	2500.2037.B	
	F2500-1	600# RTJ	No	2500.1016.B	2500.2016.B	
	F2500-1	900/1500# RTJ	No	2500.1017.B	2500.2017.B	
	F2500-1	NPT	Yes	2500.1097.C	2500.2097.C	
	F2500-1	300# RF	Yes	2500.1039.B	2500.2039.B	
	F2500-1	600# RF	Yes	2500.1040.B	2500.2040.B	
	F2500-1	900/1500# RF	Yes	2500.1041.B	2500.2041.B	
	F2500-1	300# RTJ	Yes	2500.1042.B	2500.2042.B	
	F2500-1	600# RTJ	Yes	2500.1043.B	2500.2043.B	
	F2500-1	900/1500# RTJ	Yes	2500.1044.B	2500.2044.B	
	F2500-2	NPT	No	0002.6410.0	2500.2103.C	
	F2500-2	300# RF	No	2500.1054.B	2500.2054.B	
	F2500-2	600# RF	No	2500.1018.B	2500.2018.B	
	F2500-2	900/1500# RF	No	2500.1019.B	2500.2019.B	

## F2500 Parts List (F2500-1/-2/-3 and FS2500-1/-2/-3) Continued

Item	Description			Part No.	NACE Part No.	Per Unit
18 (Cont)	<b>Meter Body Model</b>	<b>Connections</b>	<b>Epoxy Lined</b>			1
	F2500-2	300# RTJ	No	2500.1057.B	2500.2057.B	
	F2500-2	600# RTJ	No	2500.1020.B	2500.2020.B	
	F2500-2	900/1500# RTJ	No	2500.1021.B	2500.2021.B	
	F2500-2	Gruvlock (Victaulic)	No	0000.2609.0	2500.2056.C	
	F2500-2	NPT	Yes	2500.1098.C	2500.2098.C	
	F2500-2	300# RF	Yes	2500.1059.B	2500.2059.B	
	F2500-2	600# RF	Yes	2500.1060.B	2500.2060.B	
	F2500-2	900/1500# RF	Yes	2500.1061.B	2500.2061.B	
	F2500-2	300# RTJ	Yes	2500.1062.B	2500.2062.B	
	F2500-2	600# RTJ	Yes	2500.1063.B	2500.2063.B	
	F2500-2	900/1500# RTJ	Yes	2500.1064.B	2500.2064.B	
	F2500-2	Gruvlock (Victaulic)	Yes	2500.1105.C	2500.2105.C	
	F2500-3	NPT	No	0000.2636.0	2500.2104.C	
	F2500-3	150# RF	No	2500.1125.B		
	F2500-3	300# RF	No	2500.2073.B	2500.1073.B	
	F2500-3	600# RF	No	2500.2022.B	2500.1022.B	
	F2500-3	900# RF	No	2500.2023.B	2500.1023.B	
	F2500-3	1500# RF	No	2500.2075.B	2500.1075.B	
	F2500-3	300# RTJ	No	2500.2076.B	2500.1076.B	
	F2500-3	600# RTJ	No	2500.2024.B	2500.1024.B	
	F2500-3	900# RTJ	No	2500.2025.B	2500.1025.B	
	F2500-3	1500# RTJ	No	2500.2074.B	2500.1074.B	
	F2500-3	Gruvlock (Victaulic)	No	2500.1108.C	2500.2108.C	
	F2500-3	NPT	Yes	2500.1099.C	2500.2099.C	
	F2500-3	300# RF	Yes	2500.1077.B	2500.2077.B	
	F2500-3	600# RF	Yes	2500.1078.B	2500.2078.B	
	F2500-3	900# RF	Yes	2500.1079.B	2500.2079.B	
	F2500-3	1500# RF	Yes	2500.1080.B	2500.2080.B	
	F2500-3	300# RTJ	Yes	2500.1081.B	2500.2081.B	
	F2500-3	600# RTJ	Yes	2500.1082.B	2500.2082.B	
	F2500-3	900# RTJ	Yes	2500.1083.B	2500.2083.B	
	F2500-3	1500# RTJ	Yes	2500.1084.B	2500.2084.B	
	F2500-3	Gruvlock (Victaulic)	Yes	2500.1109.C	2500.2109.C	
19	Dowel Pin			0000.0303.0		4
20	Bridge Seal (2 per Set):					1*
	(a) Buna-N			0000.2791.0		
	(b) Neoprene			0000.2727.0		
	(c) Viton			0000.0347.0		
	(d) EPR			0000.2729.0		
	(e) Teflon, 1" & 2", +320 - +400°F (+160° - +205°C)			0000.3163.0		
	(f) Teflon, 1" & 2", +250° - +320°F (+120° - +160°C)			0000.3164.0		

**F2500 Parts List (F2500-1/-2/-3 and FS2500-1/-2/-3) Continued**

Item	Description	Part No.	NACE Part No.	Per Unit
20	Bridge Seal (2 per Set) (Cont):			1*
	(g) Teflon, 1" & 2", +140° - +250°F (+60° - +120°F)	0000.3165.0		
	(h) Teflon, 1" & 2", +60° - +140°F (+15° - +60°C)	0000.3166.0		
	(i) Teflon, 3", +320 - +400°F (+160° - +205°C)	0000.3168.0		
	(j) Teflon, 3", +250 - +320°F (+120° - +160°C)	0000.3169.0		
	(k) Teflon, 3", +140 - +250°F (+60° - +120°F)	0000.3170.0		
	(l) Teflon, 3", +60° - +140°F (+15° - +60°C)	0000.3171.0		
21	Bridge:			1
	(a) Delrin, 1" & 2"	0000.2370.0		
	(b) SST, 1" & 2"	0000.2290.0		
	(c) Carbon Steel, 1" & 2"	0000.0342.0		
	(d) Delrin, 3"	0000.2762.0		
	(e) SST, 3"	0000.2817.0		
	(f) Carbon Steel, 3"	0000.2816.0		
22	Drive Screw	0000.0370.0		4
23	Nameplate	0000.2287.0		1
24	Bridge Screw, 5/16-18 x 7/8, Soc. Hd.	0000.0309.0		2*
25	Bridge Screw Washer	0000.2300.0		2*
26	Bushing, O-Ring	0000.2944.0	2500.2127.C	1
27	Drive Pin	0000.1699.0		1
28	Drive Coupling and Shaft Assembly	0500.1024.B		1
29	Magnet, Drive	0382.1057.C		1
30	E-Ring	0087.1014.T		1
31	Housing Bearing Assembly	0500.1022.C	0500.2022.C	1
32	O-Ring, Buna-N	0001.0104.R		1
33	Magnet, Driven, Assembly	0500.1025.B		1
34	Drive Pin	0000.0324.0		1
35	Worm:			1
	(a) 12.5:1 Ratio	0000.3192.0		
	(b) 20:1 Ratio	0000.0255.0		
	(c) 40:1 Ratio, Zytel	0002.5435.0		
	(d) 40:1 Ratio, Steel	0000.0254.0		
36	Screw, 10-32 x 1/2	0000.1612.0		4
37	Register Adapter Assembly	0000.2931.0		1
38	Worm Gear Assembly:			1
	(a) 12.5:1 Ratio	0000.3193.0		
	(b) 20:1 Ratio	0000.0257.0		
	(c) 40:1 Ratio, Delrin	0002.5637.0		
	(d) 40:1 Ratio, Brass	0000.0256.0		
39	Calibration Driven Gear (Specify Diameter & # of Teeth):			1
	Dia. .375, Teeth 15	0020.1011.C		
	Dia. .375, Teeth 16	0020.1012.C		
	Dia. .375, Teeth 17	0020.1013.C		
	Dia. .375, Teeth 18	0020.1014.C		



**F2500 Parts List (F2500-1/-2/-3 and FS2500-1/-2/-3) Continued**

Item	Description	Part No.	NACE Part No.	Per Unit
39	Calibration Driven Gear (Specify Diameter & # of Teeth) (Cont):			1
	Dia. .375, Teeth 19	0020.1015.C		
	Dia. .460, Teeth 18	0020.1016.C		
	Dia. .460, Teeth 19	0020.1017.C		
	Dia. .460, Teeth 20	0020.1018.C		
	Dia. .460, Teeth 21	0020.1019.C		
	Dia. .460, Teeth 22	0020.1020.C		
	Dia. .460, Teeth 23	0020.1021.C		
	Dia. .460, Teeth 24	0020.1022.C		
	Dia. .570, Teeth 21	0020.1023.C		
	Dia. .570, Teeth 22	0020.1024.C		
	Dia. .570, Teeth 23	0020.1025.C		
	Dia. .570, Teeth 24	0020.1026.C		
	Dia. .570, Teeth 25	0020.1030.C		
	Dia. .570, Teeth 26	0020.1028.C		
	Dia. .570, Teeth 27	0020.1029.C		
	Dia. .570, Teeth 28	0020.1030.C		
	Dia. .670, Teeth 21	0020.1031.C		
	Dia. .670, Teeth 22	0020.1032.C		
	Dia. .670, Teeth 23	0020.1033.C		
	Dia. .670, Teeth 24	0020.1034.C		
	Dia. .670, Teeth 25	0020.1035.C		
	Dia. .670, Teeth 26	0020.1036.C		
	Dia. .670, Teeth 27	0020.1037.C		
	Dia. .670, Teeth 28	0020.1038.C		
	Dia. .670, Teeth 29	0020.1039.C		
	Dia. .670, Teeth 30	0020.1040.C		
	Dia. .670, Teeth 31	0020.1041.C		
	Dia. .670, Teeth 32	0020.1042.C		
	Dia. .670, Teeth 33	0020.1043.C		
	Dia. .670, Teeth 34	0020.1044.C		
	Dia. .670, Teeth 35	0020.1045.C		
	Dia. .670, Teeth 36	0020.1046.C		
	Dia. .670, Teeth 37	0020.1047.C		
	Dia. .670, Teeth 19	0020.1097.C		
	Dia. .670, Teeth 20	0020.1098.C		
	Dia. .670, Teeth 38	0020.1099.C		
	Dia. .670, Teeth 40	0020.1100.C		
	Dia. .670, Teeth 41	0020.1101.C		
	Dia. .770, Teeth 26	0020.1048.C		
	Dia. .770, Teeth 27	0020.1049.C		
	Dia. .770, Teeth 28	0020.1050.C		
	Dia. .770, Teeth 29	0020.1051.C		
	Dia. .770, Teeth 30	0020.1052.C		

**F2500 Parts List (F2500-1/-2/-3 and FS2500-1/-2/-3) Continued**

Item	Description	Part No.	NACE Part No.	Per Unit
39	Calibration Driven Gear (Specify Diameter & # of Teeth) (Cont):			1
	Dia. .770, Teeth 31	0020.1053.C		
	Dia. .770, Teeth 32	0020.1054.C		
	Dia. .770, Teeth 33	0020.1055.C		
	Dia. .770, Teeth 34	0020.1056.C		
	Dia. .770, Teeth 35	0020.1057.C		
	Dia. .770, Teeth 36	0020.1058.C		
	Dia. .770, Teeth 37	0020.1059.C		
	Dia. .770, Teeth 38	0020.1060.C		
	Dia. .770, Teeth 39	0020.1061.C		
	Dia. .860, Teeth 32	0020.1062.C		
	Dia. .860, Teeth 33	0020.1063.C		
	Dia. .860, Teeth 34	0020.1064.C		
	Dia. .860, Teeth 35	0020.1065.C		
	Dia. .860, Teeth 36	0020.1066.C		
	Dia. .860, Teeth 37	0020.1067.C		
	Dia. .860, Teeth 38	0020.1068.C		
	Dia. .860, Teeth 39	0020.1069.C		
	Dia. .860, Teeth 40	0020.1070.C		
	Dia. .860, Teeth 41	0020.1071.C		
	Dia. .860, Teeth 42	0020.1072.C		
	Dia. .860, Teeth 43	0020.1073.C		
	Dia. .860, Teeth 44	0020.1074.C		
	Dia. .968, Teeth 41	0020.1075.C		
	Dia. .968, Teeth 42	0020.1076.C		
	Dia. .968, Teeth 43	0020.1077.C		
	Dia. .968, Teeth 44	0020.1078.C		
	Dia. .968, Teeth 45	0020.1079.C		
	Dia. .968, Teeth 46	0020.1080.C		
	Dia. .968, Teeth 47	0020.1081.C		
	Dia. .968, Teeth 48	0020.1082.C		
	Dia. .968, Teeth 49	0020.1083.C		
	Dia. .968, Teeth 50	0020.1084.C		
	Dia. .968, Teeth 51	0020.1085.C		
40	Calibration Driven Gear (Same as Item #39)			1
41	Register, Assembly:			1
	(a) 42 Gallon Barrels	0000.3059.0		
	(b) U.S. Gallons	0000.3015.0		
	(c) 10 U.S. Gallons (3" only)	0000.3126.0		
	(d) Imperial Barrels	0000.3131.0		
	(e) Imperial Gallons	0000.3127.0		
	(f) 10 Imperial Gallons (3" only)	0000.3128.0		
	(g) Cubic Meters	0000.3132.0		
	(h) Liters	0000.3129.0		

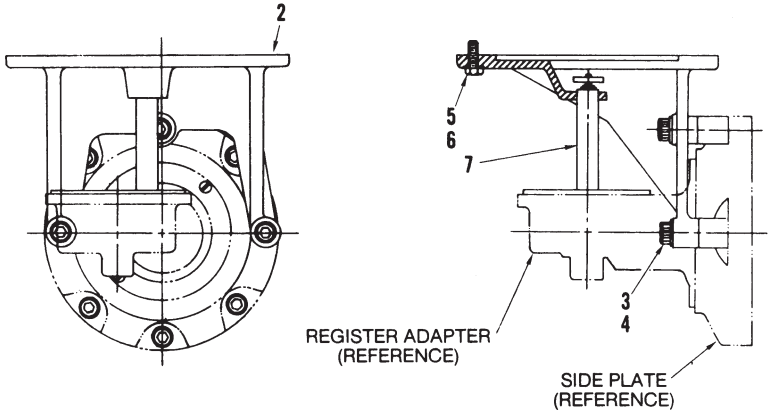
## F2500 Parts List (F2500-1/-2/-3 and FS2500-1/-2/-3) Continued

Item	Description	Part No.	NACE Part No.	Per Unit
41	Register Assembly (Cont):			1
	(i) 42 Gallon Barrels, Reset	0000.2386.0		
	(j) U.S. Gallons, Reset	0000.2574.0		
	(k) 10 U.S. Gallons, Reset (3" only)	0000.2576.0		
	(l) Imperial Gallons, Reset	0000.2578.0		
	(m) 10 Imperial Gallons, Reset (3" only)	0000.2580.0		
	(n) Cubic Meters, Reset	0000.2584.0		
	(o) Liters, Reset	0000.2582.0		
42	Not Required			
43	Register Gasket	0000.0253.0		1
44	Gasket, Seal	0000.1214.0		1
45	Glass Register	0000.0337.0		1
46	Retainer, Register Glass	0000.1216.0		1
47	Register Box Assembly (Includes Items 43, 44, 45, 48, & 49)	0000.0332.0		1
48	Lid, Register Housing	0000.0293.0		1
49	Pin Register Lid	0000.0292.0		1
50	Clip, Retaining	0500.2032.C		3
51	Rotor Assembly (Includes Items 10, 11, 12, 13, 14, & 50):			1
	(a) Riveted with Buna-N (1" & 2" Meters)	0000.1532.0		
	(b) SST, Welded with Buna-N (1" & 2" Meters)	0000.3197.0		
	(c) Riveted with Buna-N (3" Meters)	0000.1534.0		
	(d) SST, Welded with Buna-N (3" Meters)	0000.3201.0		
	(e) Riveted with Viton (1" & 2" Meters)	0000.2326.0		
	(f) SST, Welded with Viton (1" & 2" Meters)	0000.3196.0		
	(g) Riveted with Viton (3" Meters)	0000.2561.0		
	(h) SST, Welded with Viton (3" Meters)	0000.3200.0		
	(i) SST, Welded with Teflon (1" & 2" Meters):			
	+320° - +400°F (+160° - +205°C)	0000.3153.0		
	+250° - +320°F (+120° - +160°C)	0000.3154.0		
	+140° - +250°F (+60° - +120°C)	0000.3155.0		
	+60° - +140°F (+15° - +60°C)	0000.3156.0		
	(j) SST, Welded with Teflon (3" Meters):			
	+320° - +400°F (+160° - +205°C)	0000.3158.0		
	+250° - +320°F (+120° - +160°C)	0000.3159.0		
	+140° - +250°F (+60° - +120°C)	0000.3160.0		
	+60° - +140°F (+15° - +60°C)	0000.3161.0		
	(k) SST, Welded with Neoprene (1" & 2" Meters)	0500.1125.B		
	(l) SST, Welded with Neoprene (3" Meters)	0500.1130.B		
	(m) SST, Welded with EPDM (1" & 2" Meters)	0500.1126.B		
	(n) SST, Welded with EPDM (3" Meters)	0500.1131.B		
52	O-Ring:			4
	(a) Buna-N	0001.0146.R		
	(b) Neoprene	0001.0148.R		
	(c) Viton	0001.0087.R		
	(d) EPDM	0001.0150.R		

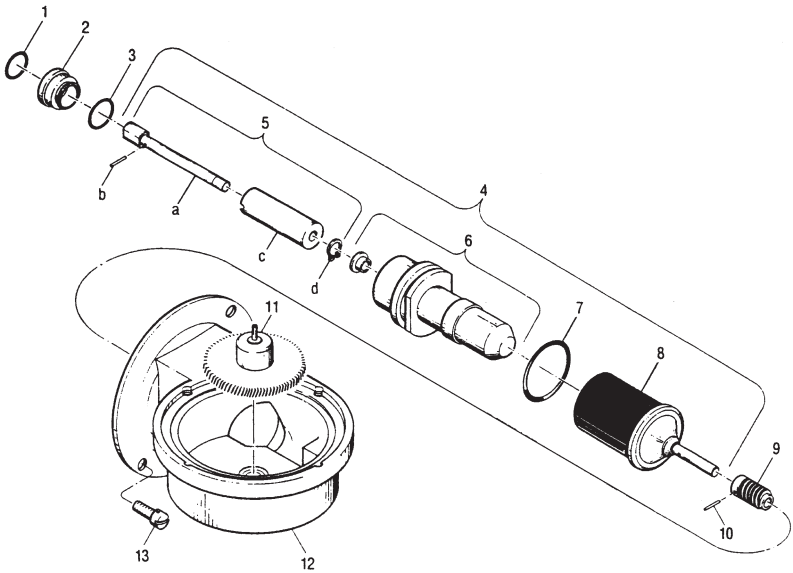
\* (Twice this quantity for 3" Meters)

**Large Numeral Register Mounting Assembly Parts List**

Item	Description	Part No.	Per Unit
1	Not Used	—	—
2	Bracket and Bushing Assembly	0500.1064.B	1
3	Screw, Cap	0000.1622.0	3
4	Washer	0000.1679.0	3
5	Screw, Cap	0000.1680.0	4
6	Washer	0000.2157.0	4
7	Assembly (Items 1-6)	0000.1964.0	1



## M500 Parts Drawing/Parts List



Item	Description	Part No.	Per Unit
*1	O-Ring: Buna-N Viton Teflon	0001.0146.R 0001.0087.R 0001.0116.R 0000.2944.0	1
2	Bushing		1
*3	O-Ring: Buna-N Viton Teflon	0001.0105.R 0001.0037.R 0001.0127.R	1
4	Magnetic Coupling Assembly	0500.1028.B	1
*5	Magnet-Drive Assy. (Includes the following):	0500.1027.B	1
	(a) Drive Coupling and Shaft Assembly	0500.1024.B	1
	(b) Drive Pin	0000.1699.0	1
	(c) Magnet, Drive	0382.1057.C	1
	(d) Retaining Ring "E"	0087.1014.T	1
6	Housing Bearing Assembly	0500.1026.B	1
*7	O-Ring, Buna-N	0001.0104.R	1
*8	Magnet Driven Assembly	0500.1025.B	1
9	Worm:		1
	12½:1 Ratio, Steel	0000.3192.0	
	20:1 Ratio, Steel	0000.0255.0	
	40:1 Ratio, Steel	0000.0254.0	
	40:1 Ratio, Zytel	0002.5435.0	

## M500 Parts Drawing/Parts List (continued)

Item	Description	Part No.	Per Unit
10	Pin, Worm	0000.0324.0	1
11	Worm Gear Assembly:		1
	12½:1 Ratio, Brass	0000.3193.0	
	20:1 Ratio, Brass	0000.0257.0	
	40:1 Ratio, Brass	0000.0256.0	
	40:1 Ratio, Delrin	0002.5637.0	
12	Register Adapter Assembly:		1
	F500 and F2500 Series Meters	0000.2931.0	
	F5000 Series Meters	0000.2932.0	
13	Screw	0000.1612.0	4
14	Magnetic Coupling Assy. (Items 1 thru 10):		1
	12½:1 Ratio, Steel, with Buna-N	0500.1030.B	
	20:1 Ratio, Steel, with Buna-N	0500.1031.B	
	40:1 Ratio, Steel, with Buna-N	0500.1032.B	
	40:1 Ratio, Zytel, with Buna-N	0500.1033.B	
	12½:1 Ratio, Steel, with Viton	0500.1034.B	
	20:1 Ratio, Steel, with Viton	0500.1035.B	
	40:1 Ratio, Steel, with Viton	0500.1036.B	
	40:1 Ratio, Zytel, with Viton	0500.1037.B	
	12½:1 Ratio, Steel, with Teflon	0500.1038.B	
	20:1 Ratio, Steel, with Teflon	0500.1039.B	
	40:1 Ratio, Steel, with Teflon	0500.1040.B	
	40:1 Ratio, Zytel, with Teflon	0500.1041.B	
15	Register Adapter Assy. for F500 & F2500 Series (Items 1 thru 13):		1
	12½:1 Ratio, Steel w/Brass Gear, w/Buna-N	0500.0006.A	
	20:1 Ratio, Steel w/Brass Gear, w/Buna-N	0500.0007.A	
	40:1 Ratio, Steel, with Buna-N	0500.0008.A	
	40:1 Ratio, Zytel, with Buna-N	0500.0009.A	
	12½:1 Ratio, Steel, with Viton	0500.0010.A	
	20:1 Ratio, Steel, with Viton	0500.0011.A	
	40:1 Ratio, Steel, with Viton	0500.0012.A	
	40:1 Ratio, Zytel, with Viton	0500.0013.A	
	12½:1 Ratio, Steel, with Teflon	0500.0014.A	
	20:1 Ratio, Steel, with Teflon	0500.0015.A	
	40:1 Ratio, Steel, with Teflon	0500.0016.A	
	40:1 Ratio, Zytel, with Teflon	0500.0017.A	
16	Register Adapter Assy. for F5000 Series (Items 1 thru 13):		1
	20:1 Ratio, Steel, with Buna-N	0500.0019.A	
	40:1 Ratio, Steel, with Buna-N	0500.0020.A	
	40:1 Ratio, Zytel, with Buna-N	0500.0021.A	
	20:1 Ratio, Steel, with Viton	0500.0023.A	
	40:1 Ratio, Steel, with Viton	0500.0024.A	
	40:1 Ratio, Zytel, with Viton	0500.0025.A	
	20:1 Ratio, Steel, with Teflon	0500.0027.A	
	40:1 Ratio, Steel, with Teflon	0500.0028.A	
	40:1 Ratio, Zytel, with Teflon	0500.0029.A	

### Notes:

\* Indicates recommended spare parts.

When ordering parts, specify meter model and serial number.

Item 5: Part 0500.1027.B Magnet Drive Assembly, purchase as one assembly.

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## Product Warranty

### A. Warranty

Cameron International Corporation ("Cameron") warrants that at the time of shipment, the products manufactured by Cameron and sold hereunder will be free from defects in material and workmanship, and will conform to the specifications furnished by or approved by Cameron.

### B. Warranty Adjustment

- (1) If any defect within this warranty appears, Buyer shall notify Cameron immediately.
- (2) Cameron agrees to repair or furnish a replacement for, but not install, any product which within one (1) year from the date of shipment by Cameron shall, upon test and examination by Cameron, prove defective within the above warranty.
- (3) No product will be accepted for return or replacement without the written authorization of Cameron. Upon such authorization, and in accordance with instructions by Cameron, the product will be returned shipping charges prepaid by Buyer. Replacements made under this warranty will be shipped prepaid.

### C. Exclusions from Warranty

- (1) THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER EXPRESSED OR IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE.
- (2) Components manufactured by any supplier other than Cameron shall bear only the warranty made by the manufacturer of that product, and Cameron assumes no responsibility for the performance or reliability of the unit as a whole.
- (3) "In no event shall Cameron be liable for indirect, incidental, or consequential damages nor shall the liability of Cameron arising in connection with any products sold hereunder (whether such liability arises from a claim based on contract, warranty, tort, or otherwise) exceed the actual amount paid by Buyer to Cameron for the products delivered hereunder."
- (4) The warranty does not extend to any product manufactured by Cameron which has been subjected to misuse, neglect, accident, improper installation or to use in violation of instructions furnished by Cameron.
- (5) The warranty does not extend to or apply to any unit which has been repaired or altered at any place other than at Cameron's factory or service locations by persons not expressly approved by Cameron.

## Product Brand

Barton® is a registered trademark of Cameron International Corporation ("Cameron").

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