

M-285
Rev. G
P.D. Oscillating Piston Flowmeter
1" 4D-MD LP Gas

RED SEAL MEASUREMENT

Operating and Maintenance Manual LPG



WARNING!!

To ensure compliance with
U.L. Listing, use only
Genuine Neptune®
Replacement Parts.

TORQUE REQUIREMENTS

The Type 4D-MD primary components (maincase, air/vapor release and valves) are now made of cast aluminum alloy. The bolts used to assemble these components are made of steel, with a special zinc plating to help resist corrosion. Aluminum is lightweight and durable, but sensitive to bolt and component overtorquing and overtightening. To avoid problems associated with these conditions, follow the guidelines given below for all bolt tightening for this meter:

Bolt Size and Threads per Inch	TORQUE	
	IN.-LBS	FT.-LBS
7/16 - 14	264 - 336	22 - 28
3/8 - 16	264 - 336	22 - 28
5/16 - 18	144 - 192	12 - 16
1/4 - 20	96 - 144	8 - 12

Aluminum itself is relatively impervious to corrosion, much more so than cast iron or non-stainless steel alloys. To prevent possible seizing of the bolts, Loctite® Anti-Seize Thread Compound No. 767 is applied to bolts during the factory assembly of the meter.

Make sure that this or equivalent anti-seize compound is used when the meter parts are reassembled after service to prevent bolt seizing.

Torque Requirements
for Bolts Used in
Type 4D-MD Aluminum
Meters

Recommended
Anti-Seize
Compound

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4D-MD LP-GAS COMPACT FLOWMETERS

GENERAL INFORMATION

This manual covers the installation and maintenance of the Type 4D-MD LP-Gas Compact Flowmeter (Figure 1) which includes a Strainer, Vapor Release, Differential Valve and Automatic Temperature Compensator.

The housing and pressure components of the 4D-MD are constructed of A356 aluminum with T6 heat treatment. Nominal line connections of 3/4" and 1" (ductile iron connections) are available. The meter is fully rated to 350 psi and has been approved by UL.

The strainer, housed in the Vapor Release at the intake of the flowmeter, is of a fine (either an 80-84 mesh or special 30 micron) mesh double sleeve construction with O-rings for positive sealing. It is accessible by removing the strainer cover.

The Vapor Release, which prevents entrapped vapor from passing through the flowmeter, has a float-operated valve. When vapor collects in the Vapor Release, the valve opens venting vapor to the supply tank establishing pump pressure to close the Differential Valve. The vapor release employs a sleeve-type valve that permits a constant "leak" flow of approximately 0.2 gpm from the vapor vent back to the supply tank.

The Differential Valve is piston, plug type construction and opens when at least 15-psi pump pressure is established. This valve serves three functions to assure system measurement accuracy by requiring: (1) pump operation for delivery, (2) adequate back pressure to prevent product vaporization during measurement, and (3) blockage of flow when the Vapor Release valve opens.

The type 4D-MD is available with outlet/inlet flanges of 3/4" and 1" diameters to permit connection to varying pipe dimensions. Please refer to the current price list or your RSM distributor for additional information.

The optional temperature compensator, by sensing product temperature, controls the readout drive ratio to provide a registration compensated by 15°C (60°F).

The Type 4D-MD is available with a choice of 600 or 800 Series mechanical resettable totalizing registers. Pulse output is also optionally available.

The recommended temperature range for operation of the 4D-MD is -23° to 60°C (-10° to 140°F) or -23°C to 52°C (-10° to 125°F) for automatic temperature compensator equipped meter.

INSTALLATION

1. Plan the installation for maximum rate of delivery, sizing the supply tank outlet, piping and valve for free gravity flow to the pump suction. To accomplish this, locate the pump as close as possible to the supply tank and use short inlet connections with few restrictions. Keep the number of elbows to a minimum, and use large radius elbows, wherever possible. To further reduce the likelihood of causing vapor in the pump suction line, install a pump bypass valve in a return line to the supply tank as shown in the installation drawing. (See Figure 2).
2. Locate the flowmeter at any convenient place in the pump discharge line. If the flowmeter is to be operated under extremes of environment (dirt, water, physical damage, etc.), an enclosure or other protection should be provided. Allow sufficient clearances for removal of the register, strainer and vapor release as shown in Figure 14. **Do not install any bypass around the flowmeter**; the valve in such a line might eventually leak, work open, or be left open causing improper measurement.

To conform with Weights and Measures requirements, install flowmeter so that the **flowmeter** nameplate is visible.

NOTE

All piping on the inlet side of the flowmeter should be very thoroughly cleaned out. Flush out all lines thoroughly before installing the flowmeter.

While the installation is still new, the strainer should be cleaned once per month minimally for the first three (3) months. After the system has been thoroughly flushed of foreign material, only periodic (minimum annually) cleaning is recommended.

The majority of service calls on new installations would be eliminated if these directions were followed.

GENERAL INFORMATION

INSTALLATION Before Installing the Flowmeter

In order to comply with the European Pressure Directive 97/23/EC the following information is required to be included in the flowmeter manual as part of the **Installation** instructions.

CAUTION!!

Always install the flowmeter according to local Safety Codes for LP Gas equipment. The flowmeter shall be installed **outdoors, away from buildings and sources of ignition**. External examination is recommended every 2 years and a pressure test at the maximum working pressure (24 bar) every 10 years.



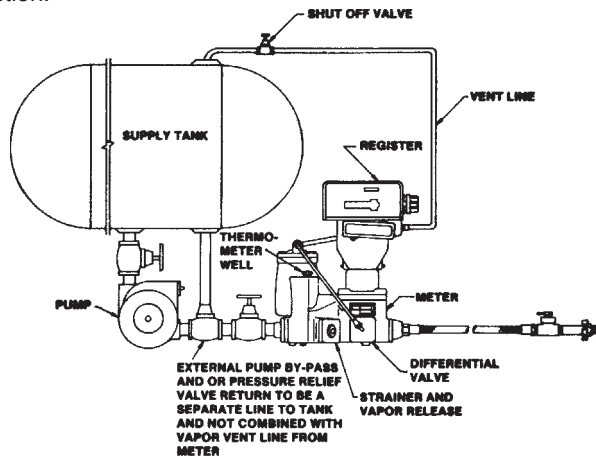
**FIGURE 1.
4D-MD COMPACT FLOWMETER**

Secure the connecting piping to prevent strain on the flowmeter. Use UL approved pipe compound sparingly or suitable pipe tapes on male threads only.

Provide the installation with means for pressure relief as outlined in the National Fire Protection Association Pamphlet 58. Although the differential valve is technically not a completely positive seat, it is positive enough that we recommend the use of a hydrostatic relief valve downstream of the meter to protect the delivery hose.

The vent line from the flowmeter's vapor vent to the vapor space of the supply tank should be 1/4-inch inside diameter tubing or equivalent pipe size. A shut-off valve must be installed in the vapor vent line to permit removal of the strainer for cleaning or when other service is performed on the flowmeter. The Vapor Release vent line must be returned to the vapor space of the supply tank and normally should not be made a common connection with other vapor lines or pump bypass lines. When properly installed, this line must permit free flow in either direction. To assure free flow in either direction, do not install a check valve in the vent line and use a full port ball valve for the shut-off valve. If valve in vent line is closed, flowmeter will not function. These instructions must be followed in order to maintain proper function of the differential valve.

NOTE: A vapor equalizing line should not be used from supply tank to tank being filled, as such connection would cause confusion as to the amount delivered due to possible passage of vapor in either direction.



**FIGURE 2.
INSTALLATION ARRANGEMENT**

When Installing

Vent Line

OPERATION

Pressurize the system slowly by allowing vapor flow through the vent line. Check for system leaks. Then pass sufficient liquid through the system to clear the lines of air and vapor.

After starting pump, slowly open outlet valve downstream of the flowmeter. Check the rate of flow after the system is filled; it should not exceed rated maximum flow of flowmeter.

Adjust the external pump bypass to deliver the maximum practical rate of flow for the least amount of pump pressure.

NOTE: The pump relief valve (normally built into the pump assembly) should relieve at a pressure above which the external bypass has been set.

Maximum working pressure on the system must not exceed 350 psi. Avoid the use of small diameter hose or pipe and resultant need for excessive pressures to achieve the desired flow rates; these may result in leakage, undue wear on pump and unsafe operation.

All flowmeters are carefully calibrated and tested after assembly and no changes should be necessary.

While the installation is still new, clean the strainer frequently. After the system has been in service, only periodic cleaning is necessary.

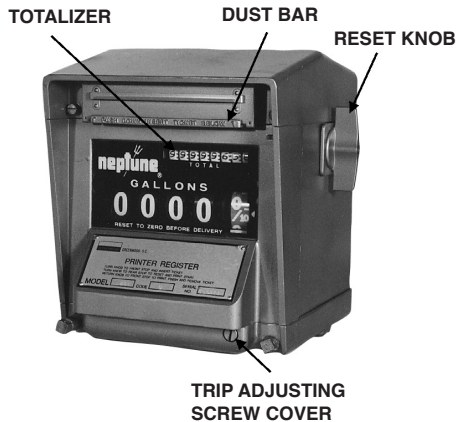
To Operate the Flowmeter

1. Start pump.
2. To prevent register creep, reset register to zero by turning operating knob to the rear stop. On Printer models (800 Series Register), first insert ticket. (See Figure 3.)
3. Open hose valve and make delivery.
4. After completion of delivery on Printer models, stamp final reading on ticket by turning reset knob to the front stop and remove ticket.
5. The cumulative totalizer is visible through the mask at the upper right-hand corner of register.

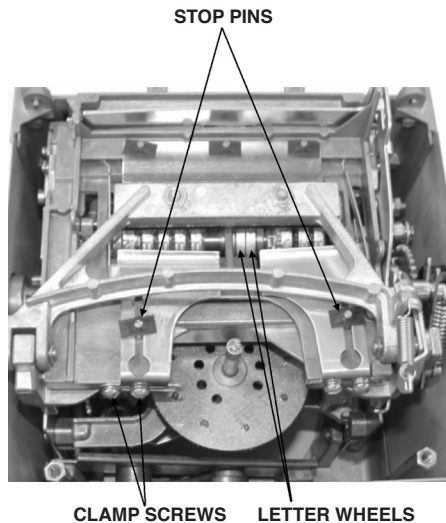
OPERATION

To Operate The Flowmeter

Totalizer PRINTER MODELS To Insert and Remove Tickets



**FIGURE 3
PRINTER REGISTER
(800 Series)**



**FIGURE 4
PRINT UNIT ADJUSTMENTS**

PRINTER MODELS (800 Series Register)

To insert a ticket be sure that the reset knob is turned forward to a stop. Then depress the dust bar above the ticket slot (see Figure 3), and insert ticket either "face down, bottom end first" or "face up, top end first" as noted on instruction plate. Turn reset knob backward to stop. This resets the visible wheels to zero, locks the ticket in place, and prints the initial reading on the ticket. (Ticket now cannot be removed without tearing it.)

Upon completion of delivery, turn the reset knob forward to stop. This operation prints the final reading and releases the ticket.

Printer registers are shipped from factory with the ticket guides properly adjusted. If it is necessary to reposition ticket, proceed as follows:

1. Remove top cover.
2. Insert ticket into printer. Loosen screws on rear of ticket guides. Move guides to right or left as required. Tighten screws. The ticket must slide freely between the guides. If ticket bends at forward end of guide, remove guide and rebend tail.
3. To raise or lower printing, push the two stop pins to the front or rear with end of a screwdriver.
4. Replace top cover and reseal.

To Change “Letter Wheel” Setting:

1. With top cover removed the “letter” wheels are visible. (See Figure 4)
2. Using screwdriver or similar tool, turn wheels until desired letters are in position to print. The letters appearing at top are in position to print.

CALIBRATION

Test the flowmeter using a volumetric prover large enough to permit the flowmeter to operate for at least one minute at maximum flow rate. Slip tube and rotary gauge readings are not sufficiently accurate for proving flowmeters. A detailed description of LP-Gas test procedure may be found in the NIST/Weights and Measures Training Module, “Liquefied Petroleum Gas Liquid – Measuring Devices” Inspector’s Manual. Specifications and Tolerances are contained in NBS Handbook H-44. For meters used outside the USA, please consult your local weights and measures authority for the correct procedures and tolerances.

A thermometer well is provided for taking temperature readings while calibrating. It is located in the vapor release. It is covered by a snap plug to keep dirt from entering the well. The well should be filled with permanent type anti-freeze, if available, or with a light oil when temperature readings are to be obtained.

If a gravimetric test is used, the conversion to gallons must be on the basis of: (1) specific gravity determined at the time of test (not an assumed value), (2) the temperature of the product as it passed through the flowmeter.

Slip tube and rotary gauge readings are not sufficiently accurate for use as flowmeter checks and will produce erratic results.

Erratic registration may be an indication of vapor or dirt in the measuring chamber. It cannot be corrected by recalibration. Clean the strainer and if necessary the flowmeter as directed in the section “Preventative Maintenance Schedule.” For proper operation the installation must be as shown in Figure 2.

When the flowmeter registers consistently either more or less than is delivered, the calibration may be corrected in the following manner:

ON UNCOMPENSATED FLOWMETERS WITH 800 SERIES PRINTER REGISTER

Test the flowmeter to determine any error in registration. If there is an error less than 0.30%, proceed as follows:

1. Remove the register top cover.
2. Lift and turn change gear shifter (see Figure 5) in the direction indicated on the top of the shifter.
3. There is a series of holes in the plate into which the guide pin enters at different settings. Altering the setting by one hole changes the calibration approximately 34 cubic inches in 100 gallons.

Example: Suppose that the flowmeter consistently gives 68 cubic inches too much when it registers 100 gallons. After removing the cover plate move the gear shifter 2 spaces to the right (from position E to position C) to decrease the delivery about 68 cubic inches in 100 gallons.

After changing the calibration always replace the top cover, making sure that the sheet steel housing on the sides and back fits into the groove in the bottom edge of cover. Run a small amount of liquid through the flowmeter before testing. In order to prevent tampering, always reseal after calibration is completed.

**To Adjust
Ticket Guides**

**To Change
“Letter Wheel” Setting**

CALIBRATION

Erratic Registration

**Consistent Over- or
Under-Registration
ON UNCOMPENSATED
FLOWMETERS WITH
800 SERIES
PRINTER REGISTER**

If there is an error greater than 0.30% (approx. 68 cu. in. in 100 gals.), proceed as follows:

1. Remove the register. (Refer to REGISTER MAINTENANCE.)
2. Looking into the bottom of the register, determine the number of teeth on the "R" and "S" change gears. (See Figures 6 & 8.)
3. Refer to CHANGE GEAR CHART (Figure 7) and select the proper gears.
4. Install new gears being sure to put change gear "R" on the "R" spindle and change gear "S" on the "S" spindle.
5. Replace register and tighten two screws.
6. Run a few gallons through the flowmeter, and retest.

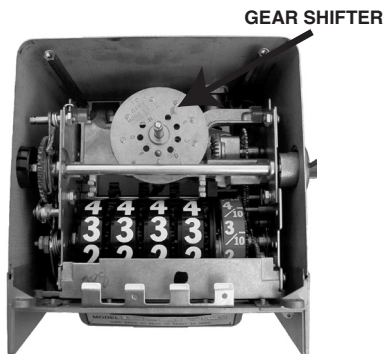


FIGURE 5
GEAR SHIFTER ADJUSTMENTS

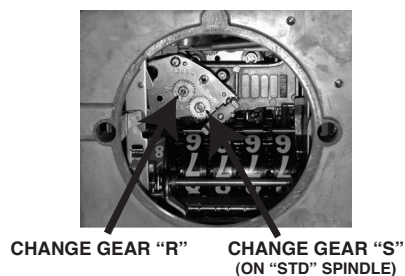


FIGURE 6
CHANGE GEAR ARRANGEMENT

ON UNCOMPENSATED FLOWMETERS WITH 600 SERIES REGISTER

1. The 600 Series Register Change Gears are located inside the register, directly beneath an access plate on top of the register. (See Figure 8.) Remove the two screws on the plate, the cover plate, and replace gears as above. Spread the ends of both spindles and replace the access plate.

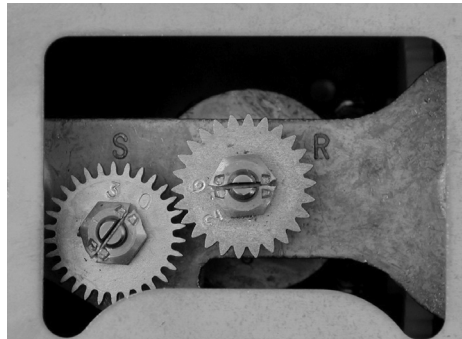
ON UNCOMPENSATED FLOWMETERS WITH 157 REGISTER

1. Determine the number of cubic inches of over- or under-delivery for each test conducted.
2. Remove the register box screws or clamps and take off register.
3. Note the numbers stamped on the Register Change Gear (on register spindle) and on the Stuffing Box Change Gear (on flowmeter spindle). Locate the gear-tooth combination on the CHANGE GEAR CHART.
4. Add the step-wise increments of change in registration until the desired amount is reached. If the flowmeter is under-registering (delivering too much), select a new pair of gears farther up on the chart. If the flowmeter is over-registering (delivering too little), select a new pair of gears farther down on the chart. The right-hand columns of the chart show the difference in delivery between each set of gears in percent or in cubic inches per 5 gallons delivered.
5. Remove the old Change Gears and replace them with the new pair. (New gears may be obtained from the nearest Neptune Distributor). To remove the Register Change Gear on the 157 registers, close the split end of the spindle slightly with a pair of pliers to permit removal of the change gear. After slipping on the new gear, spread the ends of the spindle **slightly**. The Stuffing Box Change Gear should lift off easily, and the new one should slide on without forcing. Do **not** spread the ends of the stuffing box spindle.
6. Reinstall the register, run a few gallons through the flowmeter, and retest.

ON UNCOMPENSATED FLOWMETERS WITH 600 AND 157 SERIES REGISTER

	REG. GEAR	STUFF BOX GEAR	CHANGE	
			%	Cu. Ins. in 5 U.S. Gals.
	26	26	27	3.1
	27	29	24	2.8
	28	30	23	2.7
	29	31	21	2.4
	30	32	20	2.3
	31	33	18	2.1
	32	34	18	2.1
	33	35	17	2.0
	34	36	32	3.7
	18	19	27	3.1
	19	20	24	2.8
	20	21	23	2.7
	21	22	21	2.4
	22	23	18	2.2
	23	24	18	2.2
	24	25	18	2.1
	25	26	16	1.9
	26	27	15	1.7
	27	28	15	1.7
	28	28	12	1.4
	29	30	11	1.3
	30	31	12	1.4
	32	33	20	2.3
	35	36	26	3.0

**FIGURE 7
REGISTER CHANGE GEARS**

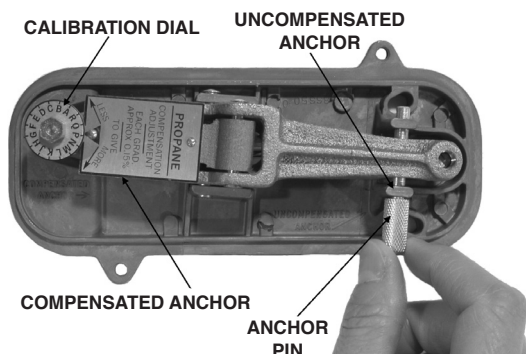


**FIGURE 8
REMOVING REGISTER CHANGE GEARS**

ON COMPENSATED FLOWMETERS WITH 600 SERIES REGISTER

1. Remove the two seal screws and cover from the temperature compensator. (See Figures 9 & 13). (Do not remove sealing wax at top of lever arm.)
2. Move anchor pin from "Compensated Anchor" to "Uncompensated Anchor." (Flowmeter readings will not be uncompensated.) (See Figure 9.)
3. Perform same LP-Gas flowmeter test procedure as outlined under CALIBRATION.
4. If necessary to change flowmeter calibration, refer to ON UNCOMPENSATED FLOWMETERS with 600 Series Register.
5. Move anchor pin to "Compensated Anchor" and operate flowmeter for at least 50 gallons before proceeding with calibration tests. (Flowmeter readings will now be temperature compensated.)
6. Perform same flowmeter test procedure used for uncompensated flowmeter. Temperature readings must be taken **at the prover only**. (Temperature at flowmeter is assumed to be 60°F.)
7. If necessary to adjust compensated registration, turn calibration dial located at the lower end of the Lever Arm (to turn adjustment, use wrench on hex hub of dial.) Turn clockwise "To Give More" or counterclockwise "To Give Less." Each dial graduation will change compensated delivery approximately 0.15%; that is, 34 cubic inches per 100 gallons.
8. Replace cover and seal screws.

ON COMPENSATED FLOWMETERS WITH 600 SERIES REGISTERS



**FIGURE 9
REMOVING ANCHOR PIN FOR CALIBRATION OF TEMPERATURE COMPENSATED FLOWMETER**

PREVENTATIVE MAINTENANCE SCHEDULE

For sustained accuracy of RSM LP-Gas Flowmeters, little maintenance is required other than to see that the proper conditions of operation are preserved. Once the flowmeter has been installed correctly, these conditions consist merely in guarding against foreign matter, such as vapor, sediment or water entering the measuring chamber. However, should any malfunction develop, do not dismantle the flowmeter until the cause of the trouble has first been determined. Refer to suggestions in "TROUBLESHOOTING."

**PREVENTATIVE MAINTENANCE SCHEDULE
General Maintenance**

The liquid passing through the measuring chamber must be free of grit and other forms of sediment to prevent unnecessary friction and to eliminate scoring of the piston and chamber walls. Evidence of trouble from this source will be found in under-registration of the flowmeter. Periodic cleaning and inspection of the flowmeter strainer will help to ensure maximum flow rate and to prevent possible damage of the flowmeter if clogged strainer ruptures.

Being an instrument that measures by volume, a flowmeter will record the passage of vapors as well as the liquid being measured, resulting in over-registration. This will not occur with proper Vapor Release and Differential Valve function and installation.

Incidental water will cause no damage to the flowmeter. Trouble from this source may be expected only when water is allowed to remain in the flowmeter.

REGISTRATION

Erratic registration is usually caused by vaporization of the product, faulty differential valve or vapor release valve function or installation (over-registration), or by dirt or pipe scale in the measuring chamber (under-registration). Clean the flowmeter, if necessary, as directed in MEASURING CHAMBER MAINTENANCE. If flowmeter continues to creep when outlet valve is closed, check differential valve seals.

When the flowmeter has a consistent error either more or less than is delivered, and no other cause in system function can be determined, calibration of the metering system is recommended.

STORAGE

Before placing in storage the flowmeter assembly must be flushed with a light lubricating oil of good quality to prevent corrosion from condensation.

REGISTER MAINTENANCE

Register parts are such that only minor field repairs are advisable. When a register is in need of service other than that for which instruction is given here, it should be returned to an authorized RSM distributor.

Loosen the two clamp screws on lower front of the 800 series register. Lift the register off.

Remove the two screws holding the 600 series register to the register cup. Lift the register off. On temperature compensated flowmeters remove the four screws holding the register to the compensator adapter housing. Lift the register off.

When one register is removed and another substituted: (1) Check the number of teeth on the "change gears" (See Figures 6 & 8). They must be the same as gears on the old register and on the same respective spindles. The number of teeth is stamped on each gear. To remove these gears, close the split end of the spindle slightly with a pair of pliers and pull off the gear. After putting on a gear, spread the end of the spindle slightly. (2) Make sure that the position of the "Gear Shifter" on the 800 series register is the same on the new register as on the old one.

Register masks are made of plastic and require special treatment. A water solution of non-abrasive soap is recommended for washing grease, oil, or dirt from the mask. It is then cleansed by rubbing gently with a soft cloth, in a manner similar to cleaning window glass, rinsing the plastic in clean water, and finally drying.

Scouring cleanser and similar material must not be used for cleaning masks, since they contain abrasives that scratch the surface.

The use of solvents, such as acetone, ethyl acetate, benzene, and ethylene dichloride, to brighten the surface is never recommended since these substances soften the surface of the plastic.

Sediment

Vapor

Water

**REGISTRATION
Erratic Registration**

**Consistent Over- or
Under-Registration**

STORAGE

**REGISTER
MAINTENANCE**

**To Remove Register From
Flowmeter or Temperature
Compensator**

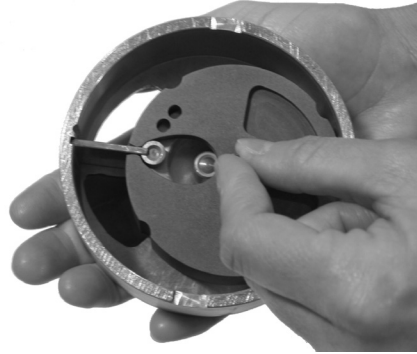
To Clean Register Masks



CAUTION!!

Perform all operations that involve opening **any part of the flowmeter outdoors, away from buildings and sources of ignition.**

Before opening any part of the flowmeter, close all valves between supply tank and flowmeter and loosen coupling at vapor release cover to relieve pressure on the flowmeter. All necessary replacement parts should be on hand.



**FIGURE 10
CHECKING PISTON FREEDOM**

To Remove and Disassemble

This operation is not difficult and may be performed by any competent mechanic. No special tools are required. No trouble need be expected, if these few simple but important directions are followed. Do not open the flowmeter until you have checked over all other possible causes of erratic registration. Refer to TROUBLESHOOTING.

1. Prepare a clean surface on which to place the parts as they are removed. (The parts are machined to close tolerances and should be handled with care.) Also check that a replacement gasket is on hand before opening the flowmeter.
2. Remove the flowmeter top taking care not to damage the gasket, if it is to be re-used.
3. Lift the measuring chamber from the flowmeter casing.
4. Remove the upper cylinder head by inserting a screwdriver in one of the slots provided, and prying it off. Be careful not to scratch or nick any part of the chamber.
5. Lift out the piston by its spindle. If care is taken to draw it straight, it should come out easily. Do not force it.
6. Remove the control roller from the lower cylinder head. If the diaphragm or seal pin requires replacement, they may be removed by pulling upward, using pliers if necessary.

To Clean the Measuring Chamber

The parts may be most easily cleaned of scale, embedded chips, heavy corrosion and other foreign matter, using gasoline and a coarse, stiff-bristle (not wire) brush. Do not use abrasives, such as emery cloth or sandpaper. When the piston is badly corroded, replace the whole chamber.

The sliding surfaces between the chamber and piston take on a burnished finish and wear little if any. The parts of the measuring chamber which may show wear after long periods of service are the diaphragm and the control roller. These parts will not require replacement until the accuracy of the flowmeter begins to fall at low rates of flow. To change these parts, merely substitute new parts for the old, when the flowmeter is disassembled for cleaning.

**To Remove
and Disassemble**

**To Clean the
Measuring Chamber**



CAUTION!!

Perform all operations that involve opening **any part of the flowmeter outdoors, away from buildings and sources of ignition.**

Before opening any part of the flowmeter, close all valves between supply tank and flowmeter and loosen coupling at vapor release cover to relieve pressure on the flowmeter. All necessary replacement parts should be on hand.

To Reassemble the Chamber in the Flowmeter

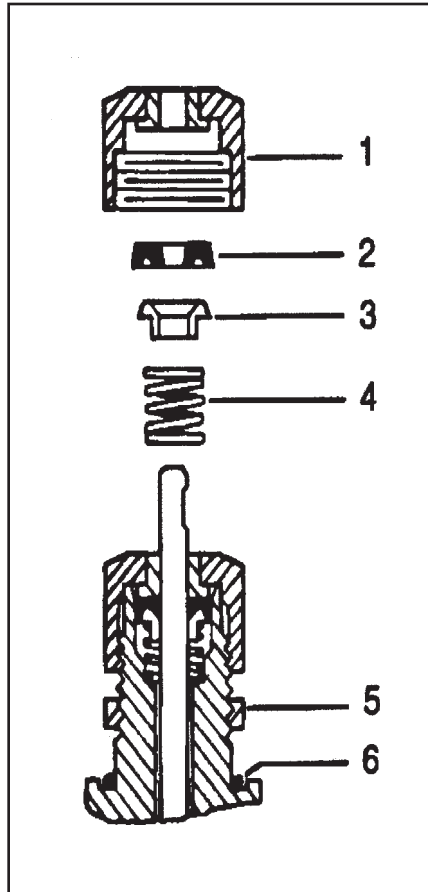
Before assembling the flowmeter, make sure all parts are clean. If possible, flush out the flowmeter body. Assemble the parts carefully; they should slide together easily without hammering or forcing. It is essential that all contact surfaces between the upper and lower cylinder heads and the cylinder, or between the measuring chamber and its seat in the casing, be clean and free from nicks.

1. Assemble the diaphragm and seal pin in the chamber, if replacement of these parts was necessary.
2. Place the control roller on its pin, and see that it will rotate freely.
3. Reinstall the piston, and oscillate it carefully by hand; it should move easily without binding. (See Figure 10.) If it sticks, do not force it, but remove it and locate the cause. Do not file down the roller as this will destroy the accuracy of the flowmeter.
4. Reinstall the upper cylinder head, and again oscillate the piston to make sure that it is free.
5. Before installing the measuring chamber in the casing, make sure that the seat is clean and free of nicks. Install the chamber, making sure that the dowel pin in the main casing enters the slot in the bottom cylinder head properly and allows the chamber to rest squarely on the seat. The top of the chamber should be flush with the gasket seal. (Refer to page 11, item 9.)

NOTE: Do not overtorque the bolts! Tighten in accordance with torque specifications inside the front cover of this manual.

GEAR TRAIN MAINTENANCE

1. Remove the register.
2. Remove stuffing box nut (1).
3. Remove shaft seal (2). Inspect top spindle to be sure it is free of nicks or burrs which might damage the new shaft seal when it is placed on spindle.
4. Replace shaft seal with new part. Be sure expander (3) and spring (4) are in position before inserting new seal.
5. Assemble nut (1) and tighten down all the way.



To Reassemble the Chamber in the Flowmeter

GEAR TRAIN MAINTENANCE



CAUTION!!

Perform all operations that involve opening **any part of the flowmeter outdoors, away from buildings and sources of ignition.**

Before opening any part of the flowmeter, close all valves between supply tank and flowmeter and loosen coupling at vapor release cover to relieve pressure on the flowmeter. All necessary replacement parts should be on hand.

To Replace Gear Train

1. Remove the register
2. Remove the star connection.
3. Remove the flowmeter top casing, with gear train assembly attached. Be careful to keep dirt out of the flowmeter, and avoid damage to the cover gasket. (A replacement gasket may be necessary.)
4. Unscrew the stuffing box nut.
5. Take off the clamp nut and remove the gear train assembly from the underside of the flowmeter top casing.
6. Install replacement gear train, making sure that the replacement has the same gear reduction.
7. Before reinstalling the top casing, inspect the gasket and replace it, if necessary. Next, position the driving arm of the gear train so that it will not rest on the piston spindle. Then reassemble the top casing on the main casing and secure it with the four cap screws.

VAPOR RELEASE MAINTENANCE

Servicing of the vapor release and strainer portion of the assembly consists only of occasional cleaning of the strainer, and when required, replacement of a collapsed float or servicing a sticking valve.

To Disassemble the Assembly:

1. Disconnect the tubing between the differential valve and the vapor release cover. (See Figure 12, Item 18)
2. Remove the cap screws on the vapor release cover, and lift off cover and float assembly.
3. If float is crushed or damaged, remove cotter pin and replace float.
4. Carefully inspect the valve sleeve for any resistance to smooth movement of the sleeve on the stem. Inspect all holes in the sleeve and the stem for foreign material which could cause sticking of the valve and obstruct the flow through the valve. If defective, replace sleeve and stem assembly.
5. Inspect the vapor release cover O-ring and O-ring groove.
6. Install the float and cover assembly and tighten cover bolts.

NOTE: Do not overtorque the bolts! Tighten in accordance with torque specifications inside the front cover of this manual.

To Replace Gear Train

VAPOR RELEASE MAINTENANCE

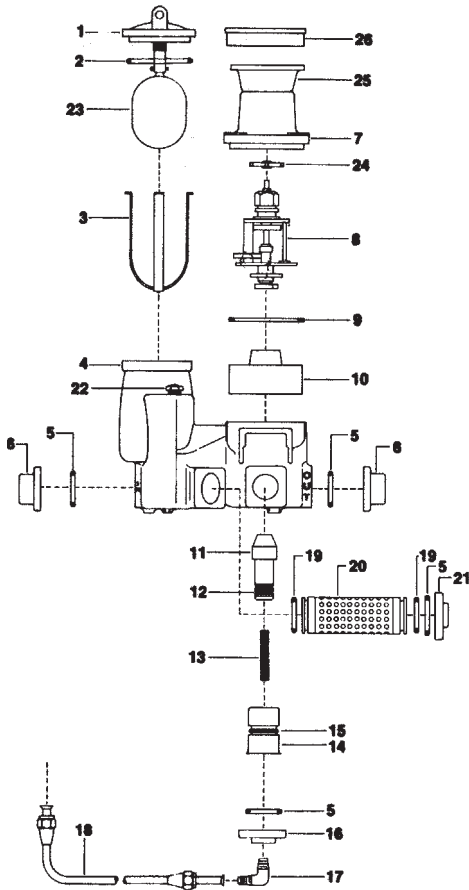
To Disassemble the Assembly



CAUTION!!

Perform all operations that involve opening **any part of the flowmeter outdoors, away from buildings and sources of ignition.**

Before opening any part of the flowmeter, close all valves between supply tank and flowmeter and loosen coupling at vapor release cover to relieve pressure on the flowmeter. All necessary replacement parts should be on hand.



- 1 – VAPOR RELEASE COVER
- 2 – O-RING ^{1 2}
- 3 – STRAP ASSEMBLY (**OBSOLETE 6/99**)
- 4 – MAIN CASING
- 5 – O-RING ^{1 2}
- 6 – FLANGE INLET AND OUTLET
- 7 – MAIN CASE COVER
- 8 – GEAR TRAIN
- 9 – GASKET ^{1 2}
- 10 – MEASURING CHAMBER ²
- 11 – DIFFERENTIAL VALVE PLUG
- 12 – U-CUPS ²
- 13 – SPRING
- 14 – SLEEVE
- 15 – O-RING ^{1 2}
- 16 – DIFFERENTIAL VALVE COVER
- 17 – ELBOW FITTING
- 18 – VAPOR RELEASE TUBE
- 19 – O-RING ^{1 2}
- 20 – STRAINER
- 21 – STRAINER ASSEMBLY COVER
- 22 – THERMOWELL
- 23 – FLOAT AND SLEEVE VALVE ASS'Y.
- 24 – STAR CONNECTION
- 25 – REGISTER CUP
- 26 – REGISTER ADAPTER

NOTES:

- ¹ General Maintenance Parts (minimum)
- ² Major Service (minimum)

**FIGURE 12
FLOWMETER PARTS EXPLODED**

STRAINER MAINTENANCE

1. Remove the four cap screws on the strainer cover, and lift off cover.
2. Remove the strainer assembly and clean it with compressed air. Inspect it for any breaks or other defects, and replace if necessary.
3. Reinstall the strainer in the housing and replace the cover.

STRAINER MAINTENANCE

DIFFERENTIAL VALVE MAINTENANCE

Faulty operation of this valve may be caused by defective valve seats, spring or O-ring. To disassemble this valve:

1. Remove connecting tube.
2. Remove four cover screws, cover and spring.
3. Insert a 1/4-20 x 4-inch screw with "T" handle into valve plug and pull from housing.
4. Inspect O-ring, U-cups and seats of valve plug and housing. Replace defective parts. Inspect I.D. of sleeve for roughness and smooth with fine emery cloth if necessary.

DIFFERENTIAL VALVE MAINTENANCE



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5. Replace U-cups on valve plug and insert into sleeve. Assemble spring. Push valve and sleeve into casing and press against spring. Valve plug should move to its closed position by spring force only. If valve remains partly open, locate cause and correct.
6. Replace cover and tubing and reconnect vapor vent line.

TEMPERATURE COMPENSATOR MAINTENANCE

The Compensator (Figures 9 & 13) is designed to give long and dependable service when properly installed. The unit has been thoroughly performance-tested prior to shipment, and in normal service requires no further lubrication.

Maintenance of the compensator should be limited to those operations outlined below. If it becomes apparent that the unit is in need of repair, the compensator should be returned to the nearest authorized RSM distributor.

To Remove Compensator

1. Remove the register.
2. Remove vapor line and connecting tube.
3. Remove bolts at the base of the compensator and lift the unit off.

To Replace Thermostat (Figure 13)

1. Remove two seal screws and take off "Neptune" cover.
2. Withdraw anchor pin after removing cotter pin.

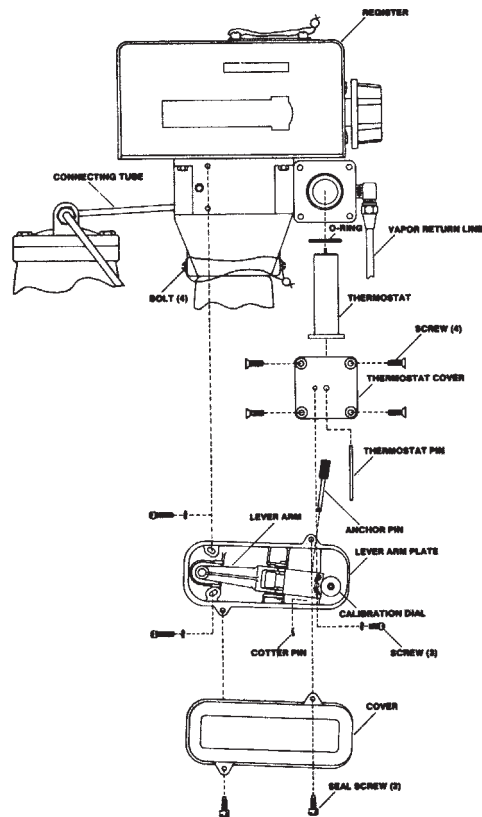


FIGURE 13
ATC COMPONENTS WITH
600 SERIES REGISTER

**TEMPERATURE
COMPENSATOR
MAINTENANCE**
To Repair Compensator

To Remove Compensator

To Replace Thermostat



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3. Remove three screws and take off lever arm plate.
4. Remove four screws and lift off thermostat cover being careful not to damage thermostat O-ring gasket.
5. Lift out thermostat.

TROUBLESHOOTING

1. Register Not Working When Liquid is Flowing

- a. Bypass around flowmeter not shut off.
- b. Ice inside register.
- c. Loose register or worn gear train.
- d. Register in need of repair.
- e. Sheared key on Change Gear — caused by ice in register or mechanically tight mechanism.
- f. Connector on top of gear train (and/or ATC) not properly installed — set screw may not be tightened on flat of 0.125" steel spindle.

2. Leakage at the Stuffing Box

- a. Worn shaft seal or spindle.

3. Chronic Leakage at the Main Case Gaskets

- a. Excessive line or shock pressure.
- b. Defective gasket or loose bolts.

4. Unsatisfactory Flow Rate or Complete Stoppage of Flow

- a. Obstruction in vapor vent line between differential pressure valve and vapor space in tank.
- b. Pump too small or inefficient. (The pump must have sufficient capacity and pressure to pump against higher heads than are normally found in gasoline or fuel oil installations. This is especially true when the delivery nears completion.)
- c. Pump vapor bound due to improper installation by bypass relief valve or a restriction in suction line. (Refer to "INSTALLATION.")
- d. Pump bypass stuck open or spring weak.
- e. High loss of head. (This is caused by too many valves and elbows and the length, diameter and condition of the delivery hose.)
- f. Pressure buildup in tank being filled. Condition becomes worse as delivery nears completion unless vapor return line (not recommended) is used or vapor space type filling is used.
- g. Blocked strainer, or piston in flowmeter stuck. Clean strainer and measuring chamber.
- h. Open valve in piping allowing liquid to circulate around pump.
- i. Worn pump.
- j. Vapor release valve fails to close, causing differential to remain closed or open slightly.
- k. Vent line connection to supply tank must be minimum 1/4" diameter. Any orifice or partially closed valve will result in malfunction of differential valve.

5. Under-Registration — Erratic

- a. Dirt in the measuring chamber.
- b. Badly worn control roller or diaphragm.
- c. Main casing distorted or damaged.
- d. Dirt under seat of measuring chamber (after cleaning).

TROUBLESHOOTING



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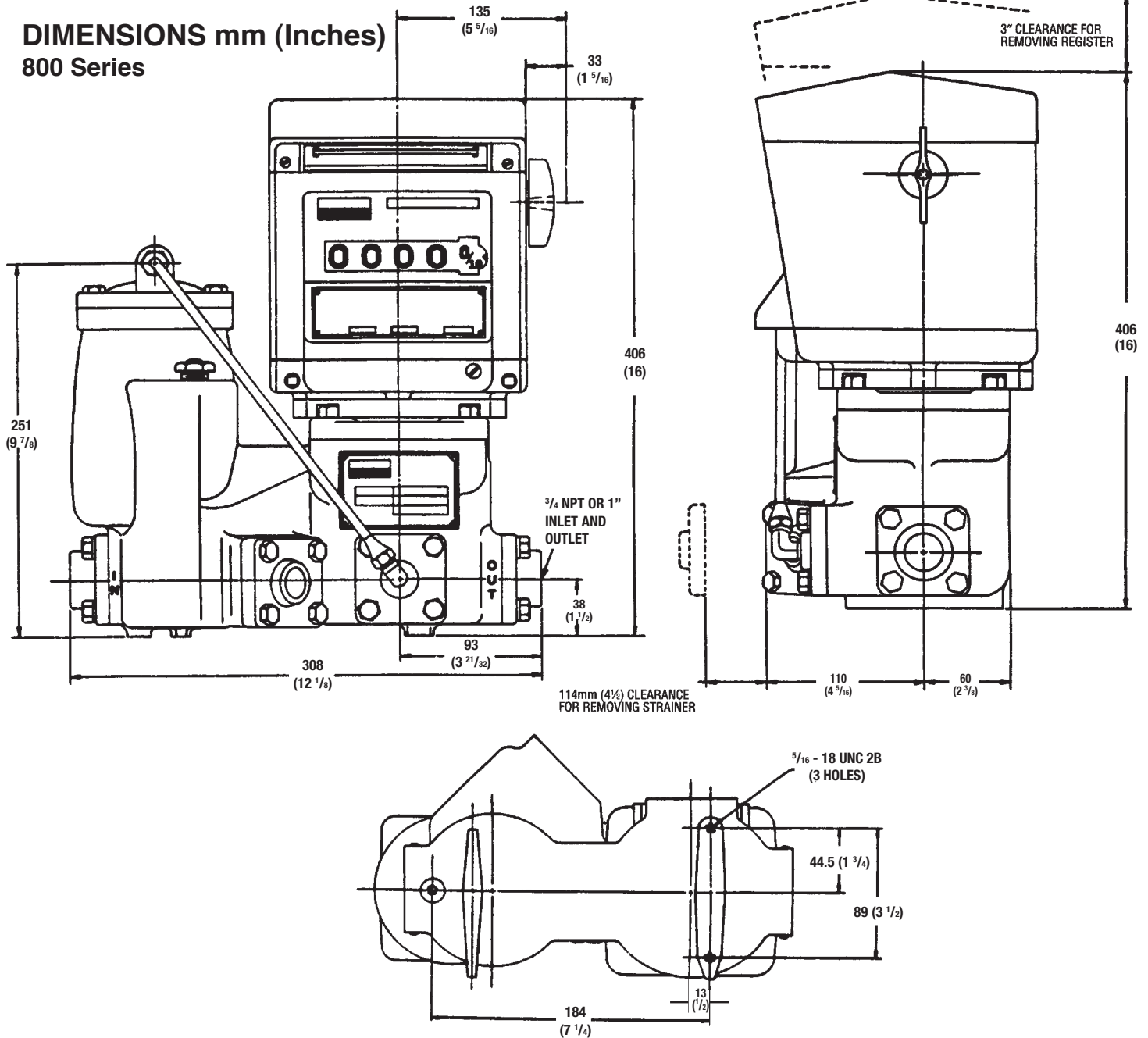
6. Over-Registration – Erratic

- Leaking O-ring on differential valve.
- Vapor release valve jamming, allowing vapor to pass through the flowmeter.
- Vent line from the vapor release valve plugged causing vapor to pass through the flowmeter.

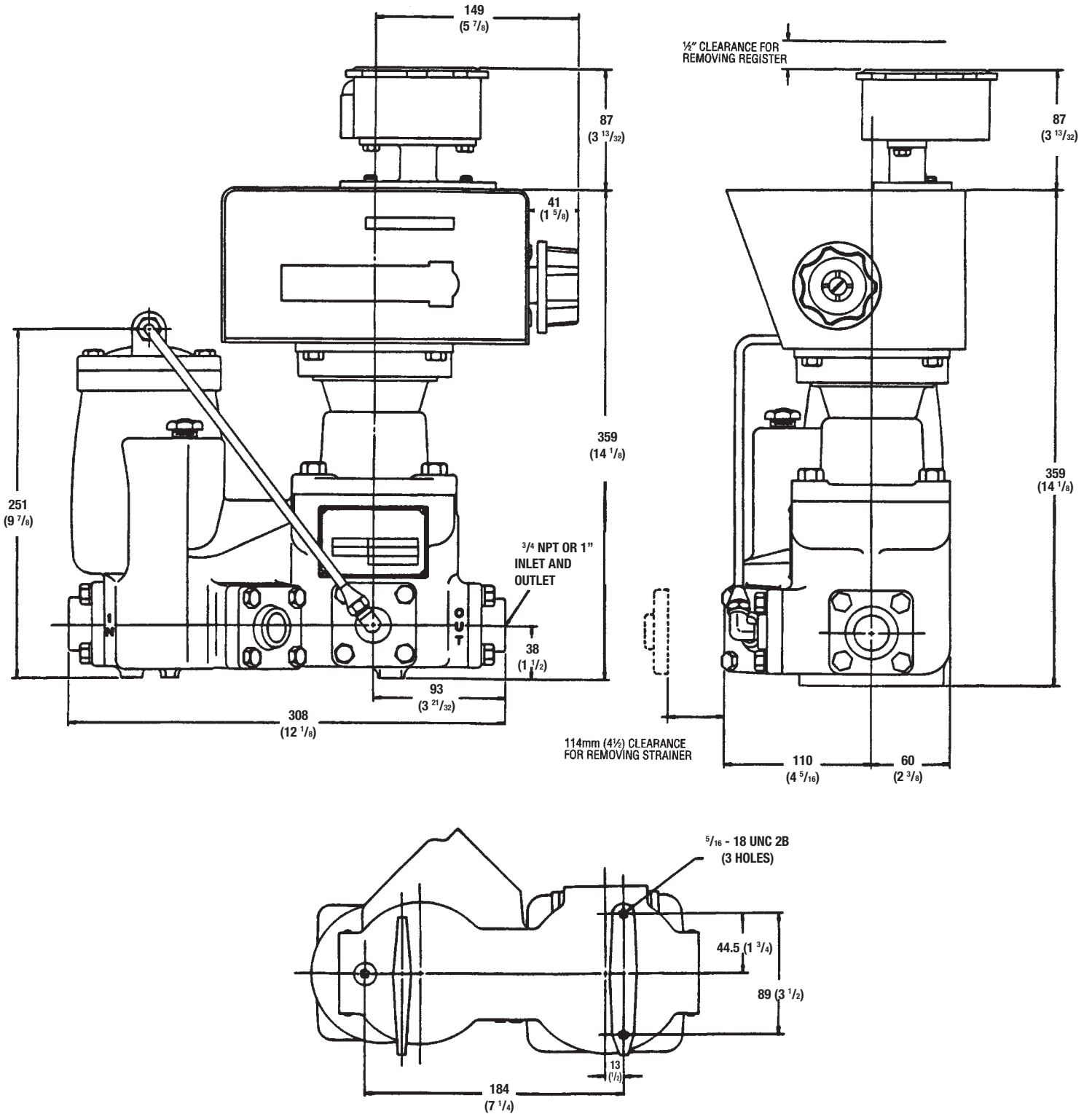
7. Consistent Over- or Under-Registration

- Flowmeter in need of calibration.

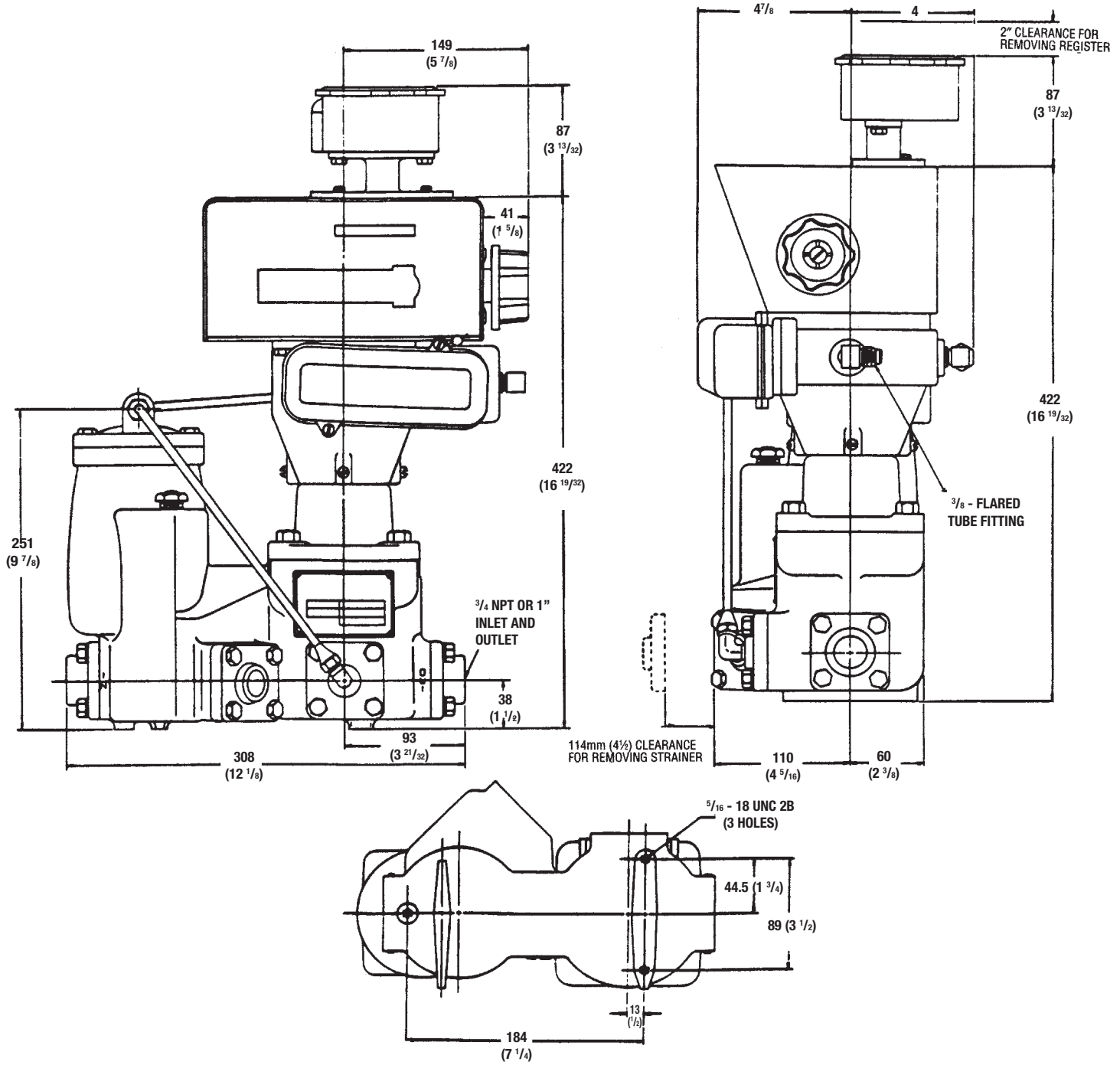
DIMENSIONS mm (Inches) 800 Series



DIMENSIONS mm (Inches)
600 Series



DIMENSIONS mm (Inches)
600 Series with ATC



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