

LPM-101

LP-Gas Flowmeter

Operation & Maintenance

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INTRODUCTION

The Model LPM-101 LP-Gas flowmeter is a compact meter consisting of all necessary components required for accurate measurement of liquid propane.

LPM-101 utilizes the proven oscillating piston design. This precise method of metering has been proven to be both accurate and dependable in thousands of installations. The rotational movement of the oscillating piston chamber is transferred through a gear train assembly, which in turn can operate various types of registration devices.

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, a pump bypass valve should be installed in a return line to the supply tank.

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 vertical clearance for removal of the register. 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.

When Installing

Secure the connecting piping to prevent strain on the flowmeter casing. Use 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 or local codes and practices.

NOTE: All isolated sections of the system MUST be equipped with a hydrostatic relief device to prevent damage. Failure to perform this precaution could result in serious injury or death from explosion/fire.

OPERATION

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

After starting the pump, slowly open outlet valve downstream of the flowmeter. Check the rate of flow after the system is filled; it should not exceed maximum indicated rate of flow 18 gpm (68 lpm).

Adjust the external pump bypass to deliver the maximum practical rate of flow for the least amount of pump pressure (see pump manufacturer's instructions).

Maximum working pressure on the system must not exceed 350 psi (24.13 bar). Avoid the use of small diameter hose and excessive pressures to achieve the desired flow rates; these may result in leakage and undue wear on the pump.

Although all flowmeters are carefully calibrated and tested after assembly and no changes should be necessary; field calibration is recommended after installation is complete.

MAINTENANCE

General Maintenance

For sustained accuracy of 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 TROUBLESHOOTING.)

Sediment - 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.

Vapor - Being an instrument that measures by volume, a flowmeter will record the passage of vapor as well as the liquid being measured. Over-registration will result.

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

Erratic Registration

Erratic registration is usually caused by vaporization of the product or by dirt or pipe scale in the measuring chamber (under-registration). Clean the flowmeter if necessary, as directed in MAINTENANCE.

Consistent Over- or Under- Registration

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

CALIBRATION

Test the flowmeter using a volumetric prover large enough to permit the flowmeter to operate for at least one minute at normal flow rate. Slip tube and rotary gauge reading are not sufficiently accurate for proving flowmeters. A detailed description of an LP-Gas test procedure may be found in the National Bureau of Standards Handbook 99, "Testing Liquefied Petroleum Gas Liquid-Measuring Devices".

If a gravimetric test method is used, the conversion to gallons must be on the basis of: (1) specific gravity determined at the time of the test (not an assumed value), and (2) the temperature of the product as it is passed through the flowmeter. The volumetric test method, however, is considered to yield more accurate results and is preferred. After performing the test procedure:

1. Determine the percentage of over-or under-delivery for each test conducted.
2. Remove the register screws and take off the register.
3. Note the numbers stamped on the "R" change gear (on register spindle) and on the "S" (or 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 down the chart. If the flowmeter is over-registering (delivering too little), select a new pair of gears farther up the chart.
5. Remove the old change gears and replace them with the new pair. Always place the change gear with the smaller number of teeth on the "R" register shaft and the gear with the greater number of teeth on the "S" flowmeter shaft. To remove change gears, 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.
6. Reinstall the register, run several gallons (liters) through the flowmeter, and retest.

MEASURING CHAMBER MAINTENANCE

CAUTION: Be sure meter is completely relieved of pressure before performing any internal maintenance. Pressure must be 0 psig (0 bar). Failure to properly depressurize and evacuate the system could result in serious injury or death from explosion/fire.

Perform the following outdoors, away from buildings and sources of ignition. Replacement gaskets should be on hand.

To Remove and Disassemble

This operation is not difficult and may be performed by any competent mechanic. No special tools are required 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 TROUBLE SHOOTING.)

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, it may need to be replaced.
2. Remove the main case cover taking care not to damage the gasket, if it is to be reused.
3. Lift the measuring chamber from the flowmeter casing.
4. Remove the top plate 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 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 burrished 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 fails at low rates of flow. To change these parts, merely substitute new parts for the old, when the flowmeter is disassembled for cleaning.

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 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. 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 top plate, 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 housing properly and allows the chamber to rest squarely on the seat. The top of the chamber should be flush with the gasket seal.

GEAR TRAIN MAINTENANCE

CAUTION: Be sure meter is completely relieved of pressure before performing any internal maintenance. Pressure must be 0 psig (0 bar). Failure to properly depressurize and evacuate the system could result in serious injury or death from explosion/fire.

Perform the following outdoors, away from buildings and sources of ignition. Replacement gaskets and seals should be on hand.

To Replace Gear Train Shaft Seal

1. Remove the register.
2. Remove the stuffing box nut.
3. Remove shaft seal. Inspect top of 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. Be sure expander and spring are in position before inserting new seal.
5. Assemble nut and tighten down all the way.

To Replace Gear Train

1. Remove the register.
2. Remove the flowmeter main case cover, with gear train assembly attached. Be careful to keep dirt out of flowmeter, and avoid damage to the cover gasket (a replacement gasket may be necessary).
3. Remove the stuffing box nut.
4. Take off the clamp nut and remove the gear train assembly from the underside of the flowmeter top casing.
5. Install replacement gear train, making sure that the replacement has the same gear reduction, new seal, and new gear train is orientated with anti-rotation pin. Both clamp nut and stuffing box nut should be torqued to 200 inch lbs.
7. Before installing the top casing, inspect the gasket and replace if necessary. Next, position the driving arm of the gear train so that it will not rest on the piston spindle. Then reassemble the main case cover on the main casing and secure it with the four cap screws.

CHANGE GEAR CHART

Gear calibration will be determined by adjusting the high flow result (averaged) to the closest corresponding set of change gears. If possible, adjustment should be made by bracketing the high and low flow tests.

Change Gear Combination		% Change in LPG Passed	
"R" Shaft Gear	"S" Shaft Gear	Gallons (43.5)	Liters (11.6/116.875)
Decreases Amount Registered (Indicated)			
34	35	2.32%	3.95%
33	34	2.23%	3.86%
32	33	2.14%	3.77%
31	32	2.04%	3.67%
30	31	1.93%	3.56%
29	30	1.81%	3.44%
28	29	1.69%	3.32%
27	28	1.56%	3.19%
26	27	1.42%	3.05%
25	26	1.26%	2.89%
24	25	1.10%	2.73%
23	24	0.92%	2.55%
22	23	0.72%	2.35%
21	22	0.50%	2.13%
20	21	0.26%	1.89%
19	20	0.00%	1.63%
18	19	-0.29%	1.34%

Example

Meter is under registering (pumping more LPG than is registered). The amount indicated on the register needs to be increased. Starting gears are R=33, S=35. By changing these gears to R=32, S=34, an increase in registration of +.19% is achieved (Difference between -.80% and -.99% is .19%)

Change Gear Combination		% Change in LPG Passed	
"R" Shaft Gear	"S" Shaft Gear	Gallons (43.5)	Liters (11.6/116.875)
34	36	-0.62%	1.01%
33	35	-0.80%	0.83%
32	34	-0.99%	0.64%
31	33	-1.19%	0.44%
30	32	-1.40%	0.23%
29	31	-1.63%	0.00%
28	30	-1.88%	-0.25%
27	29	-2.14%	-0.51%
26	28	-2.43%	-0.80%
25	27	-2.74%	-1.11%
24	26	-3.07%	-1.44%
23	25	-3.43%	-1.80%
22	24	-3.83%	-2.20%
21	23	-4.26%	-2.63%
20	22	-4.74%	-3.11%
19	21	-5.26%	-3.63%
Increases Amount Registered (Indicated)			

TROUBLESHOOTING

Complaint	Possible Cause
Register not working when liquid is flowing	Bypass around flowmeter not shut off
	Ice inside register
	Loose register or worn gear train
	Register in need of repair
	Sheared key on change gear caused by ice in register or mechanically tight mechanism
	Change gear has ridden up its shaft and not engaging the other change gear
Leakage at the stuffing box	Worn shaft seal or spindle
Chronic leakage at the main case gaskets	Excessive line or shock pressure
	Defective gasket or loose bolts
Unsatisfactory flow rate or complete stoppage of flow	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.)
	Pump vapor bound due to improper installation of bypass relief valve or a restriction in suction line. (Refer to "INSTALLATION")
	Pump bypass stuck open or spring weak
	High loss of head. (This is caused by too many valves and elbows and the length, diameter and condition of the delivery hose.)
	Pressure buildup in tank being filled. Condition becomes worse as delivery nears completion unless vapor space type filling is used.
	Piston in flowmeter stuck. Clean measuring chamber.
	Open valve in piping allowing liquid to circulate around pump
	Worn pump
Pump/motor not rotating in proper direction	
Under-registration - erratic	Dirt in the measuring chamber
	Badly worn control roller or diaphragm
	Main casing distorted or damaged
Consistent over- or under-registration	Flowmeter in need of calibration

