



# **LPG Flow Meter Installation and Operation Manual**

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*The following symbols are used throughout this manual to alert you to important safety hazards and precautions:*



*Notice: indicates a special comment or instruction.*



*Warning: Indicates the presence of a hazard that can cause severe personal injury or property damage if not observed carefully.*



This manual provides instructions and guidelines. The remarks and warnings inform the operator of the hazards involved in working with Yenen meters.

Reading these instructions and preventing hazardous situations is strictly in the hands of the operator of the equipment. Neglecting this responsibility is not within the control of Yenen.

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## 1.0 About this manual



This manual provides instructions and guidelines. The remarks and warnings inform the operator of the hazards involved in working with Yenen meters.

Reading these instructions and preventing hazardous situations is strictly in the hands of the operator of the equipment. Neglecting this responsibility is not within the control of Yenen.

This installation and operation manual is intended for LPG dispenser makers and field service personnel. It provides basic understanding of installing and maintaining Yenen LPG flow meters. It is not all inclusive. Therefore operators of Yenen LPG meters should both be trained and authorized by Yenen or should have prior dispenser assembly and service experience.

### 1.1 Accuracy requirements

Depending on local regulations, standards and codes, accuracy requirements differ from country to country. Proper understanding of these local regulations is essential before assembling and servicing meters and dispensers.

Yenen meters comply with the Measuring Instruments Directive 2004/22/EC (MID), which states the following for auto gas (LPG) dispensers:

- Accuracy class 1.0.
- Environmental class M2/E1
- Maximum permissible error 1.0%

### 1.2 Safety precautions



Only trained and qualified personnel familiar with handling liquids under pressure, such as LPG, may service Yenen equipment.



ALWAYS disconnect and lock power supply before starting to service the meter and other hydraulic parts.

- Make sure that all necessary safety precautions have been taken. Make sure that proper ventilation, fire prevention, evacuation and fire procedures are provided.
- Provide easy access to fire extinguishers. Understand and adapt all local safety codes.
- Read this manual as well as other available literature and drawings.
- See appendix A: DOs and DON'Ts

In the event of a gas leak:

1. Stop the leak by closing the nearest valve or shut-off device.
2. Use protective clothing to prevent cold burns.
3. Prevent accidental ignition.
4. Beware that LPG is heavier than air and therefore seeks lower level.
5. Evacuate all people from the danger zone.
6. Ensure that the area is safe before resuming the operation. If in doubt, notify the local fire department.

In the event of a gas fire:

1. Stop the leak if it is within safe reach.
2. Notify the local fire department if it is a large fire that cannot be controlled safely.
3. In case of a small, contained fire, use the appropriate extinguisher. If in doubt, notify the local fire department.



### 1.3 Yenex LPG meters

The Yenex LPG flow meter is used in a hydraulic set for LPG measuring systems, such as dispensers for auto gas. The meter is a liquid measuring device. This volume-measuring device operates with four pistons. The flow measurement is performed by positive displacement of four cylinder volumes by oscillating piston movement.

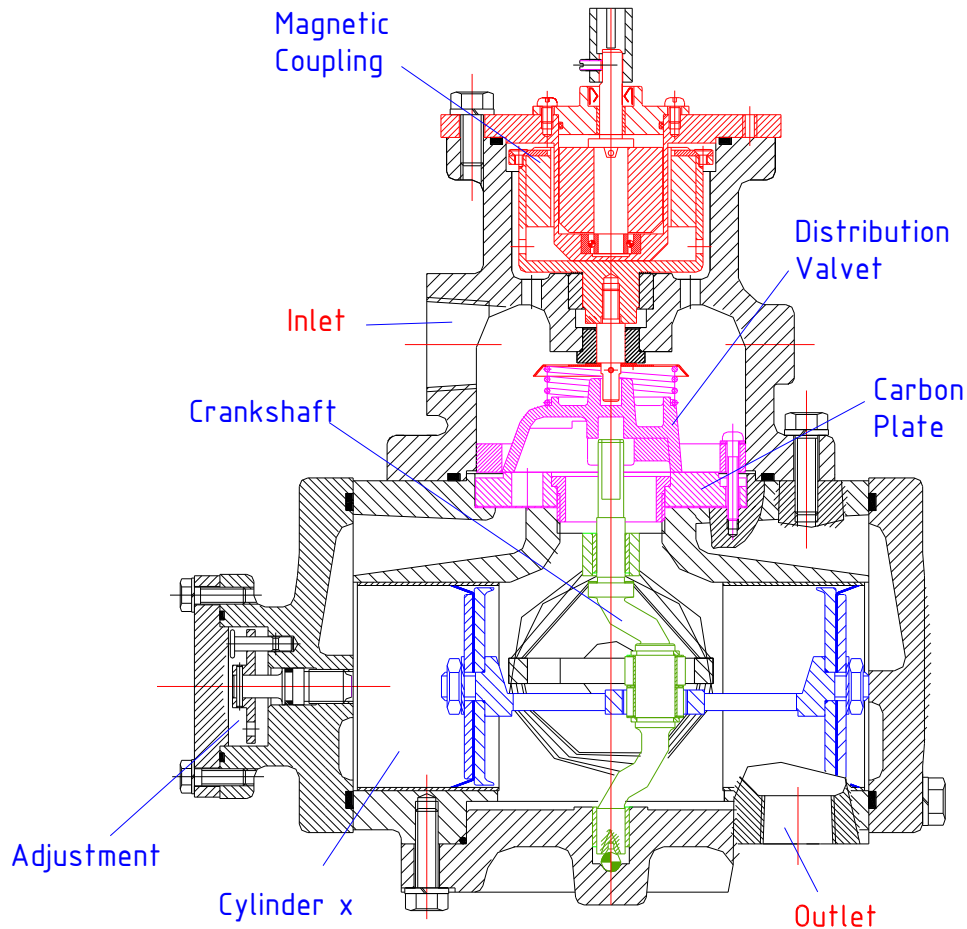


Figure 1: Cross-section drawing of Yenex LPG Flow meter

LPG (liquid) passes through four cylinders transforming flow energy into a piston motion. Fluid displacement happens simultaneously. As fluid enters, another portion of the fluid is being submitted into a cylinder through the distribution valve. At the same time, the fluid ahead of it is being displaced out of the meter through the outlet.

Four pistons in the cylinders are grouped in pairs and each pair is attached to a crankshaft generating a rotation of the crankshaft.

Since the volume of the cylinder is known (0.125 liter) and the same amount of fluid passes through the meter during each revolution, the exact volume of liquid passing through the flow meter is known also. One full revolution is equivalent to a measured volume of 0.5 liter.

The rotary motion of the crankshaft is transferred outside the flow meter through the magnetic coupling. The rotations are transferred through a pulse generator to an electronic register or directly to a mechanical register.

The pistons are metal round discs covered with larger teflon gaskets. There is no metal-to-metal



contact inside the cylinder. This prevents wear on moving parts, which means no internal leaks and hence the accuracy remains consistent.

The crankshaft is fixed between a steel ball bearing at the bottom and a steel journal bearing at the top. These bearings do not require lubrication and therefore no maintenance is required.

The magnetic coupling is an exclusive feature in the Yenen meter, which makes mechanical seals redundant. The magnetic coupling connects the internal crankshaft through a unique design to the shaft outside the meter.

Yenen carefully selected all the materials to suit the metering requirements and operational conditions. All these features are designed to ensure long lasting and high accuracy as well as low maintenance requirements and high dependability of the meter.

## 1.4 Documentation

Together with each meter you find an accuracy report. This is a Yenen report compiled during the tests and calibration of the meter.

Each meter has a unique serial number to identify each meter. The serial number is related to a date code: YYMM9999. For example a meter with serial number 01101234 is manufactured in October 2001 with serial number 1234.

Record the meter serial number and model number as it will be required when calling for service or spare parts.

## 2.0 Installation of the meter



This section is intended for LPG dispenser makers. It provides basic understanding of installing Yenen flow meters in LPG measuring units. It is not all inclusive. Therefore operators of Yenen LPG meters should both be trained and authorized by Yenen or should have prior dispenser assembly experience.



Only trained and qualified personnel familiar with handling liquids under pressure, such as LPG, may service Yenen equipment.

## 2.1 Meter specifications

### Mechanical specifications:

Recommended flow rate:	6–60 liters per minute
Recommended temperature range:	-40°C to +60°C
Connection sizes:	Inlet: 1"Rp Outlet: ¾" NPT Pressure relief valve: ¼"NPT Spare port: ¼" NPT
Pressure ratings:	Test pressure: 60 Bar Design pressure:: 25 Bar Working pressure:17.8 Bar
Water volume:	2.4 liters
Weight:	33 kg

### Material specifications:

Main body	Nodular cast iron GGG35.3
Upper body	Nodular cast iron GGG35.3
Side cover	Nodular cast iron GGG35.3
Crankshaft	Nodular cast iron GGG50

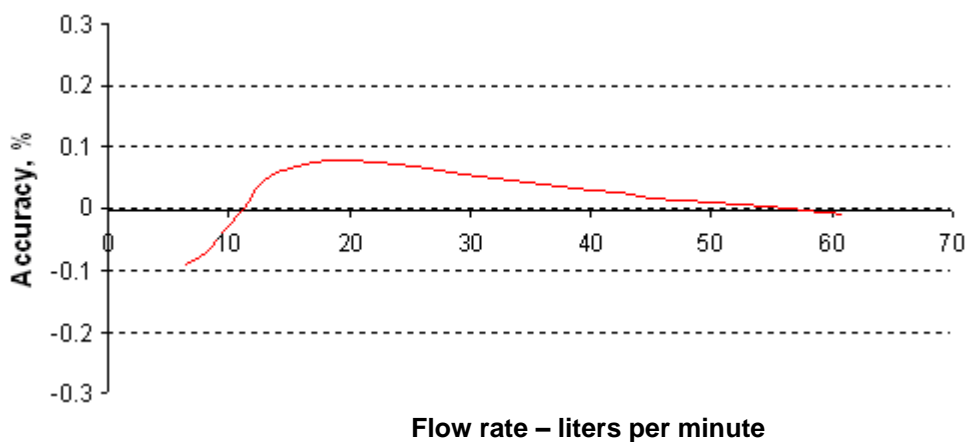


Piston arm	Nodular cast iron GGG50
O-rings	Nitril rubber NBR70
Piston gaskets	Teflon

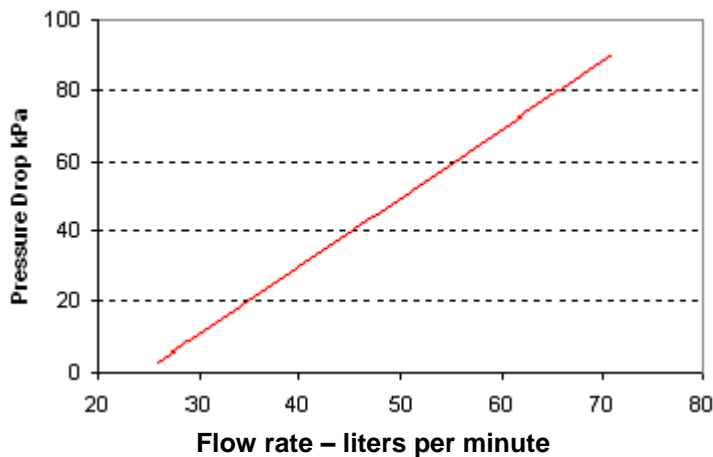
#### Accuracy specifications (according to OIML R117):

Accuracy class:	1.0
Environmental class:	M2/E1
Liquid:	LPG, Butane, Propane
Accuracy:	Better than $\pm 0.5\%$
Adjustment range:	+ and - 0.5% in steps of 0.05%

#### Accuracy curve:



#### Pressure drop curve:



## 2.2 Installation requirements



Make sure that all internal pressure is relieved before installing or servicing LPG hydraulic systems. See section 2.6.1.



When in doubt, contact Yenen for assistance.



Meters are calibrated with LPG and sealed before shipping. Removing a seal wire may require recalibration. Check with the regulatory agency for further details.



- Make sure that all necessary safety precautions have been taken. Make sure that ventilation, fire prevention, fire procedures and evacuation paths are provided.
- Provide easy access to fire extinguishers. Understand and adapt all local safety codes.
- Read this manual as well as other available literature and drawings.
- See appendix A: DOs and DON'Ts
- Install the meter and accessories in conformity with all applicable regulations and safety codes.
- During normal operation, observe the pressure ratings of the meter. Install pressure relief valves to discharge any overpressure due to thermal expansion. Failure to observe this may result in damage to the equipment and in serious personal injury.
- The meter is packaged in a Volatile Corrosion Inhibitor (VCI) bag. The VCI bag prevents corrosion, even in the presence of moisture. Naturally, it protects the outside of the meter rather than the internal parts, but when kept on stock for a longer period the meter is preserved much better.
- Meter connections are protected with plastic caps. These should remain in place until piping is attached. It is of vital importance for functionality and accuracy that dirt, dust and other debris does not enter the meter. Ensure that the entire piping system is free from dirt, dust and debris, as this may affect the functionality and accuracy of the meter as well. Flush all material with a liquid, which is compatible with the meter before assembly. Install filters in the hydraulic system and keep the work area clean.
- Place the meter on a frame or platform with service in mind. Four M10 x 1.5 bolts should be used to fasten the bottom of cover the meter to a frame. Do not hang the meter on connecting piping. Make sure that the adjustment cover is easily accessible. It should not be blocked by other components.
- See appendix B for torque table.
- Meters and measuring systems should be calibrated. The MID regulations state the conditions of such calibration. Beware of local codes and regulations.
- 20-micronic filter (or better) should be placed before the meter inlet. The filter is a critical part in preserving the meter accuracy – also see 2.4.
- Water should not enter the meter as it may compromise the accuracy. Water and frozen water may damage the meter. Water in the storage tank should be removed as much as possible.
- Minimize air and vaporization problems by following the manufacturer's recommendations in installing pumps.



## 2.3 Meter dimensions

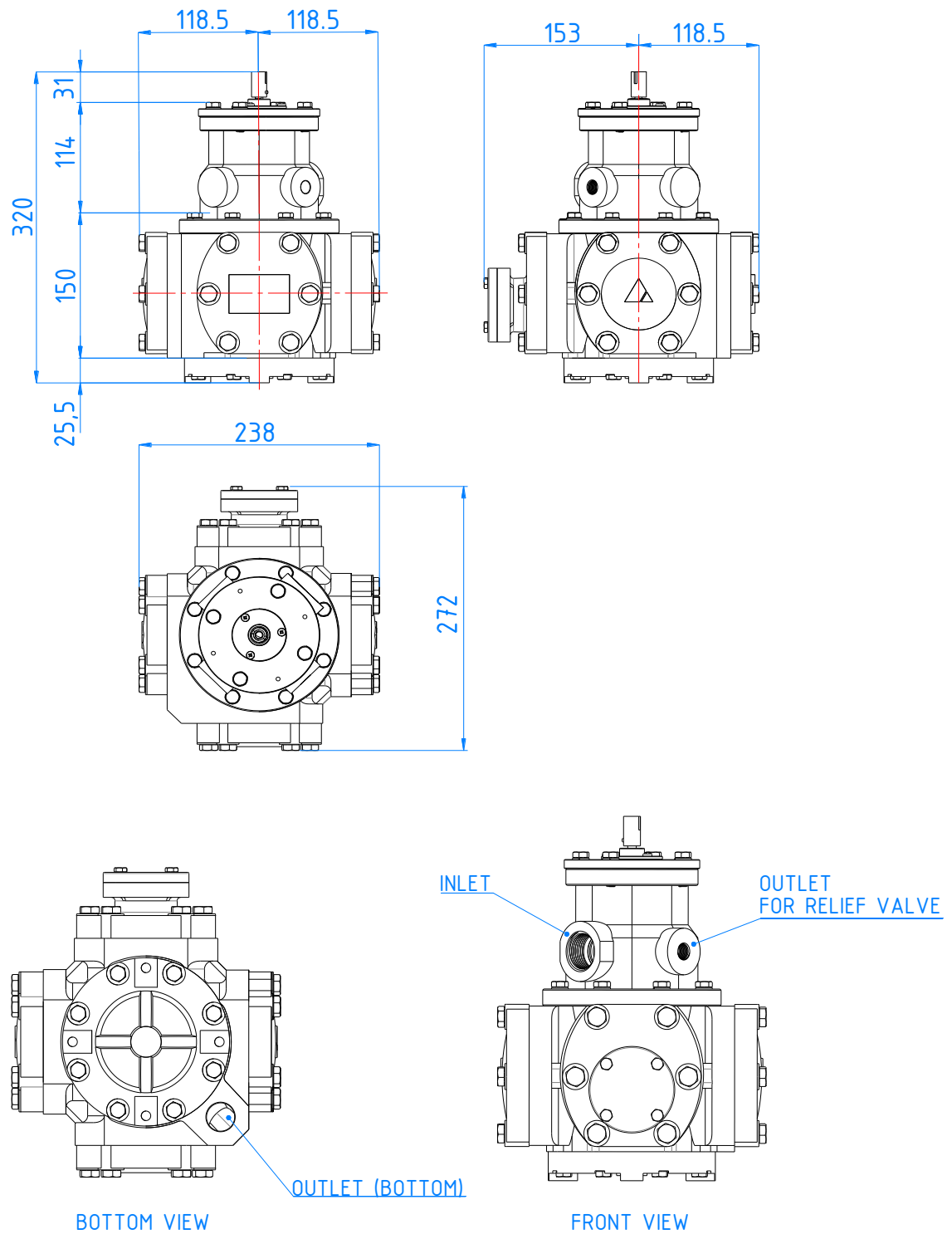


Figure 2: Flowmeter General Dimensions



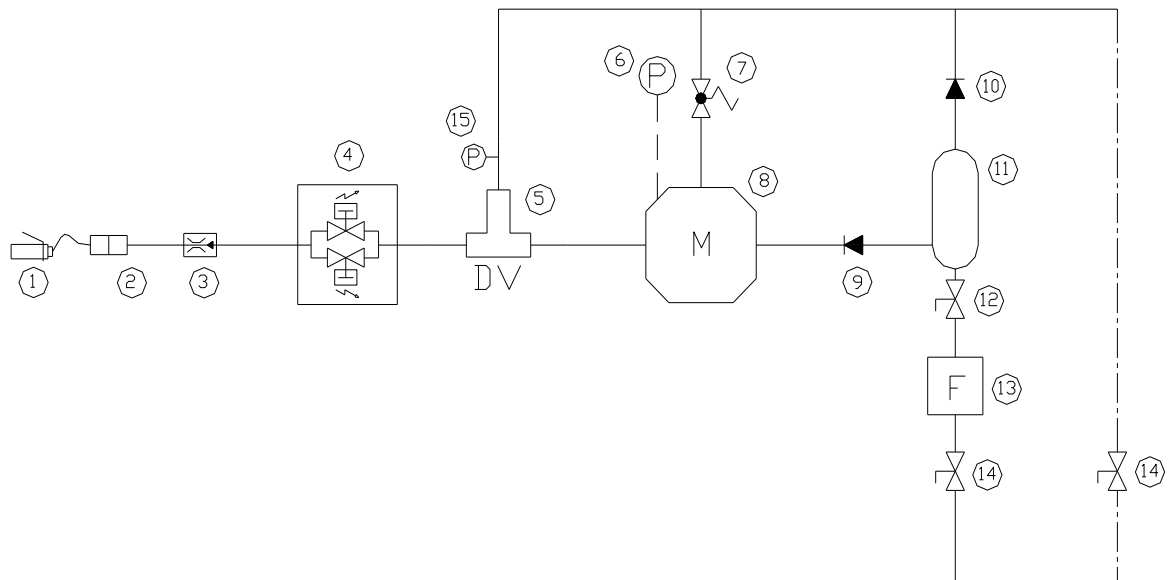


## 2.4 Hydraulic part of LPG measuring systems

The hydraulic part of an LPG measuring system is a closed system. Unless permitted by (local) regulations, there is no venting to the atmosphere. Overpressure in the system should be relieved back to the vapor space of the supply tank through a vapor return line. Relief valves should be installed in situations where gas can be trapped.

The vapor return line should not be connected to other return lines or by-pass lines.

The pressure line is connected from the pump to the dispenser inlet. Typically a 20-micronic filter (or better) should be placed before the vapor eliminator. The filter is a critical part in preserving the meter accuracy. Depending on the gas quality the filter should be replaced regularly. Especially in the first month of operation the filter should be checked (and replaced) at least twice a month.



1. Nozzle
2. Break-away coupling
3. Differential valve
4. Meter
5. Pressure relief valve
6. Check valve
7. Check valve
8. Gas eliminator
9. Ball valve
10. Filter
11. Ball valve
12. Pressure gauge

*Figure 3: Typical hydraulic set for 1-nozzle, 1-pump systems*

The vapor eliminator separates vapor and LPG as only LPG should enter the metering unit. Back check valves at the outlets of the vapor eliminator prevent re-entering of LPG. From a weights and measures point of view this is especially important for the connection to the meter.

Systems with two or more nozzles (two single nozzle dispensers or double nozzle dispensers) operating on a single supply line should avoid unregistered deliveries. In other words, with one nozzle in operation, the other nozzle should not be able to deliver product. This can be prevented with a



block valve.



## 2.5 Meter startup and operation

Make sure that all necessary safety precautions have been taken. Make sure that proper ventilation, fire prevention, fire procedures and evacuation paths are provided.

- Open the vapor line.
- Check all connections with a soap solution for leaks.
- Admit liquid slowly into the system by opening the ball valve of the supply line. As there may still be some air or nitrogen in the system it is important to control the flow to prevent damage to the meter. Make sure that the meter does not run faster than 25% of its rated flow. Air or nitrogen should be eliminated gradually and carefully.
- After air or nitrogen is removed and the system is full with LPG it can run within its specified parameters.
- Perform this sequence at first start up and after internal pressure has been relieved (also see 2.6.1).



Most systems use an above ground or submersible pump. Make sure that the pump can operate against closed valves or with limited flow.

## 2.6 Meter maintenance



Make sure that all internal pressure is relieved before disassembly or inspection of any part of the hydraulic system. Failing to follow this instruction may lead to severe personal injury or property damage.



ALWAYS disconnect and lock power supply before starting to service the meter and other hydraulic parts.

### 2.6.1 Procedure for relieving internal pressure



Unless permitted by (local) regulations, relieving internal pressure should not be done to the atmosphere. Check local regulations, standards and codes for the permitted procedure of degassing LPG hydraulics.

This procedure describes purging the hydraulic system with nitrogen:

- Record the totalizer readings from the dispenser in coordination with the station manager.
- Open the front and rear panel of the dispenser. The rear panel should be opened as well to ensure proper ventilation.
- Remove the plug from the dispenser test port.
- Connect the nozzle of the dispenser to the maintenance port in the dispenser cabinet.





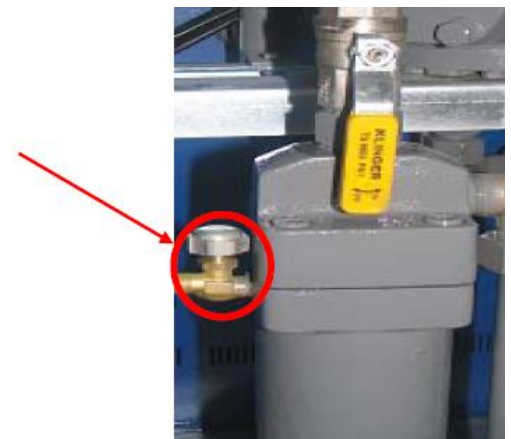
- Connect the nitrogen tube to the purge valve.
- If the hydraulic set is not equipped with a purge valve system, connect the nitrogen tube to the nearest releasing ball valve on liquid line.
- On the liquid line, close the inlet ball valve of the hydraulic set.



- Slowly open the nitrogen line on the nitrogen tube and regulate the pressure.
- The pressure value has to be higher than tank pressure with approximately 2-3 bars.
- Run roughly 10 liters of nitrogen through the system to flush all LPG back to the storage tank.
- Close the ball valve of the vapor return line and purge valve.
- Disconnect the nitrogen line from the purge valve.
- Keep all ball valves closed.



- Open the purge valve for relieving the nitrogen into the atmosphere.
- Wait 20 minutes after degassing the nitrogen for a complete ventilation of the work space.



Make sure to keep all ball valves closed during work progress.



## 2.6.2 General maintenance

Yenen developed several spare part kits for maintaining the meter. Partial or other repairs should not be attempted as this may jeopardize the safety and accuracy of the meter.



Only trained, qualified and certified personnel familiar with handling liquids under pressure, such as LPG, may service Yenen equipment

Installation details of the spare part kits are provided with the kit itself. With the meter disassembled it is recommended that you perform a visual inspection of the entire meter:

- Check the o-rings. O-rings should be smooth. Cracked, worn or dry o-rings need to be replaced. Also, scratched o-rings may cause inaccuracy of the meter.
- Check the gaskets. Gaskets should be firm, but flexible. Cracked, worn or torn gaskets need to be replaced. Scratched gaskets may cause internal leaks, which causes the meter to be inaccurate.
- Check fasteners and threads. There should be no debris in threads. Fasteners, such as bolts and screws, should be straight and clean. Fasteners that are bent, rusted or have pulled threads should be replaced. If such fasteners are found, it is recommended to examine the housing and covers for such damage also.
- Check the paint. When removing fasteners the coating may be damaged. To prevent corrosion re-apply coating and paint.



### 2.6.3 Changing rotation direction of the meter

Default from factory Yenen meters rotate anti-clock wise or clock wise if so specified at the time of order. Several pulse generators may require alternative direction. The drawing below explains how the change the rotation direction.



The distribution valve is one of the most critical parts of the meter. Incorrect installation of the distribution valve will affect the accuracy of the meter.



The distribution valve has a precision polished surface. Even the slightest scratch or unevenness will cause inaccuracy of the meter.

Recalibration after re-assembly of the meter is recommended.

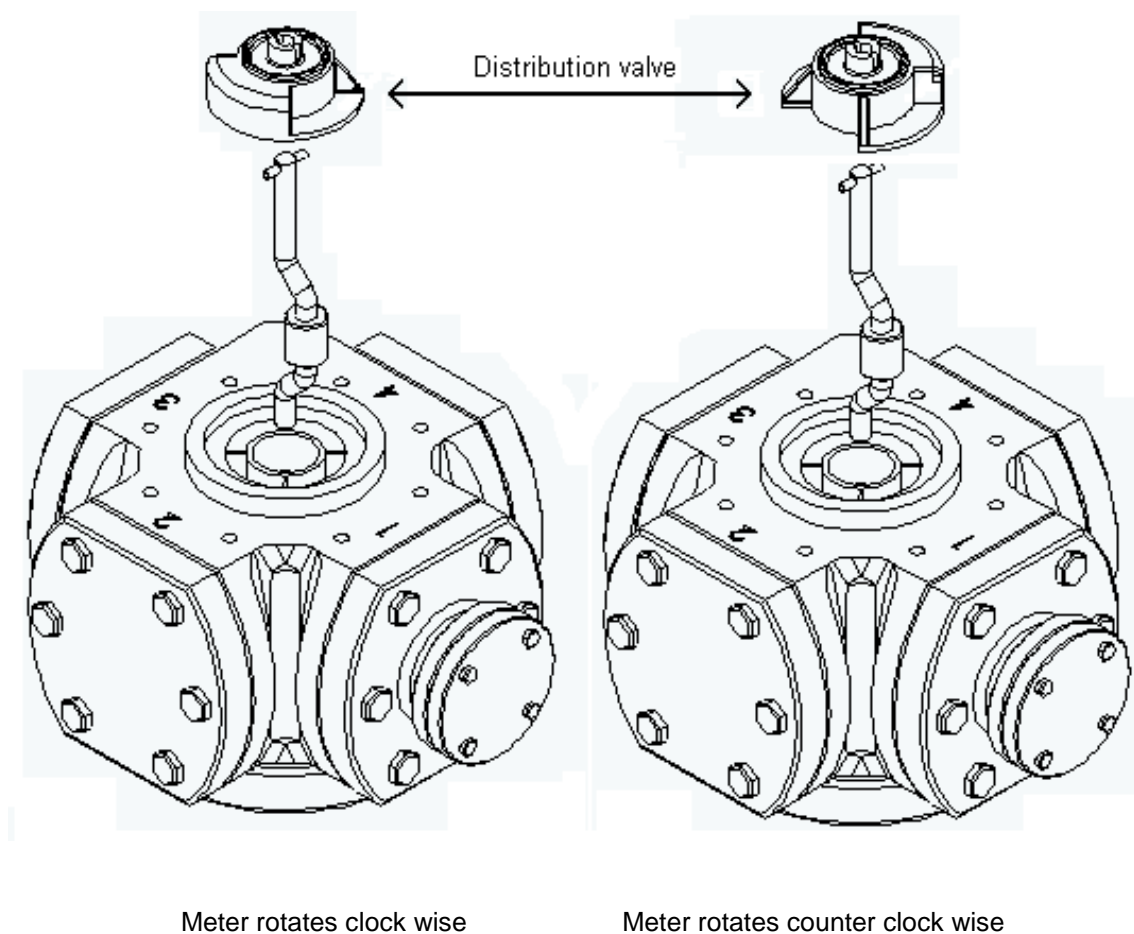


Figure 4: Rotation direction

To change the rotation direction (*default from factory is CCW*):

1. Unbolt the upper body
2. Face the inlet towards you
3. Remove the upper body
4. Lift the distribution valve from the carbon plate and rotate the distribution valve 180°
5. Reposition the distribution valve fitting it onto the crankshaft
6. Adjoin the upper body with the inlet towards you
7. Bolt the upper body tightly to the main body.



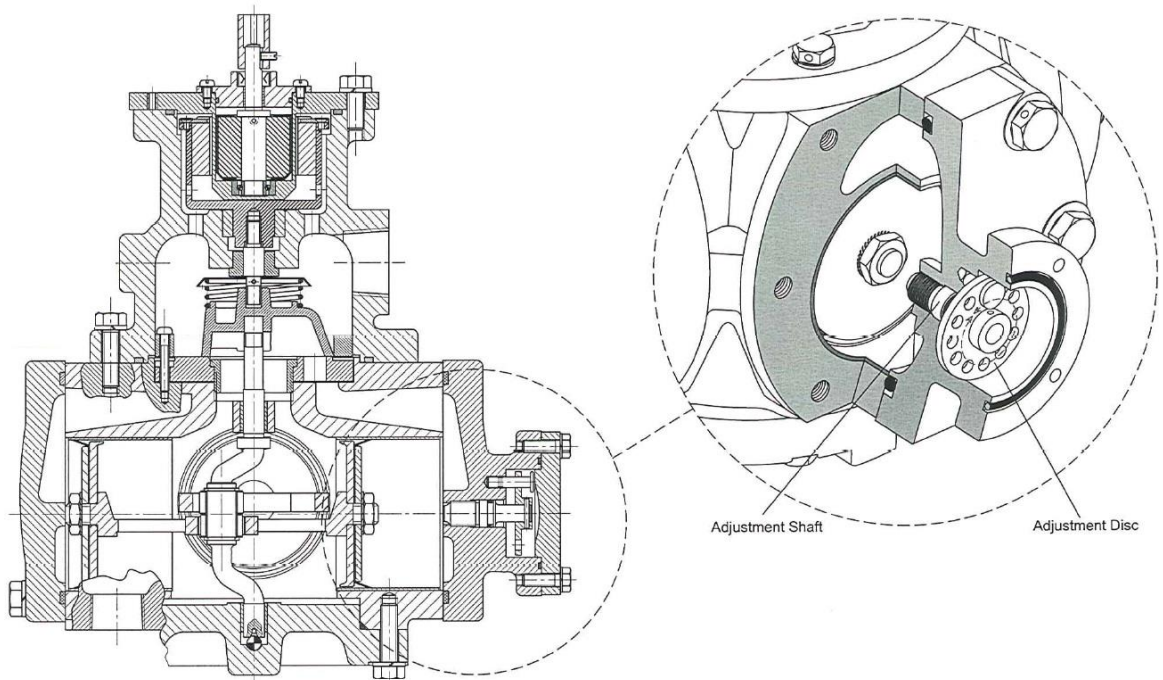
## 2.6.4 Adjusting the accuracy

The meter needs to be adjusted if it does not meet the accuracy requirements stated by the authorities.



The meter is sealed against forbidden modification or removal of parts. Only trained and qualified personnel certified by the authorities may break and reseal dispensers

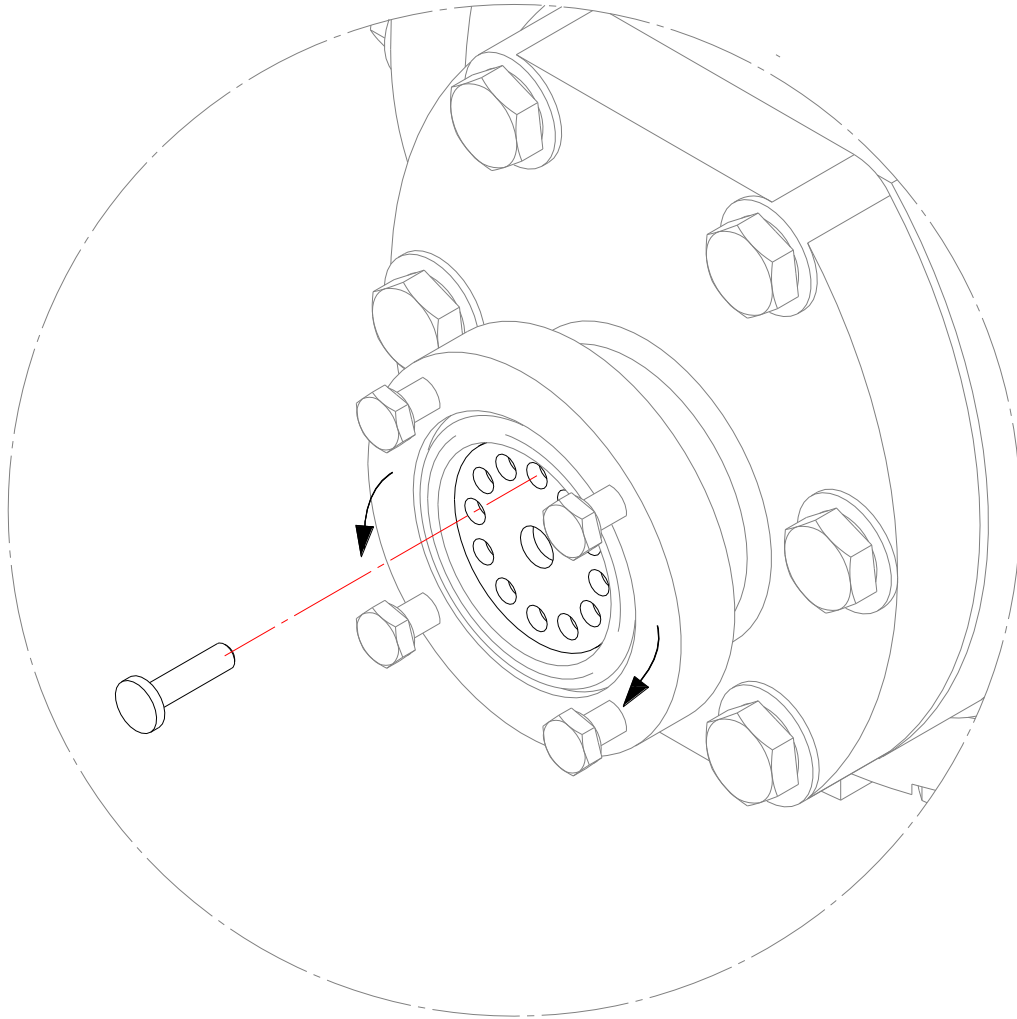
- Remove the seal.
- Unbolt the adjustment cover on the flow meter



*Figure 5 Adjustment disc with shaft*

- Calibration is accomplished with a series of holes at the adjustment disc. The disc contains 12 holes. To increase the quantity delivered, move the disc left or counter clockwise. Turning the disc right or clockwise will decrease the volume delivered. Moving the disc one hole in either direction will increase or decrease the quantity delivered with approximately 0.05%.





*Figure 6 Turning disc for fine adjusting*

### **3.0 Rules to consider during transportation and shipping**

- Flow meter should not be removed from its packing during transportation and storage packaging.
- Be careful about the directional arrows on the meter box during the transportation.
- Do not place heavy objects on the flow meter package.
- Flow meter must be protected from water and moisture during transportation.



## Appendix A – DOs and DON'Ts

### DOs and DON'Ts CHECK LIST

# DO...

- **DO** discuss the project and procedures with station manager or operator before performing service on a dispenser.
- **DO** evaluate the hazards at the working area and use your safety training and experience in determining any precautions to be implemented.
- **DO** locate and be familiar with fire extinguishers in the area prior to beginning any LPG related work on the forecourt.
- **DO** be aware of vapors and other hazardous conditions.
- **DO** disconnect and lock power before starting to service the meter and other hydraulic parts.
- **DO** know the associated hazardous location classifications.
- **DO** use safety cones, barricades, barrier tape or a vehicle to isolate work area and protect the technician.
- **DO** wear appropriate safety clothing including brightly colored vests, goggles and gloves.
- **DO** be aware of and monitor your work area surroundings.
- **DO** connect the nozzles on dispenser carefully.
- **DO** take totalizer readings and record it in coordination with station manager or operator.





# DON'T...

- **DON'T** allow unauthorized individuals near the dispenser or work area when degassing and disassembling of the dispensers.
- **DON'T** leave dispenser doors open after maintenance is complete.
- **DON'T** allow smoking, flame or spark-producing devices near the work area.
- **DON'T** place tools or equipment outside the barricaded work area.
- **DON'T** place tools or equipment outside the barricaded work area.
- **DON'T** remove safety cones, barricades, barrier tape or the service vehicle until work is completed.
- **DON'T** leave the station unless the station manager or operator signed the report.



## Appendix B – Torque table

Dimension	Location	Torque (kgf-m)	Tool
M6 Bolt (8.8)*	Adjustment cover	1.42	10 metric wrench
M6 Bolt (8.8)*	Magnetic flange, upper body, lower cover	3.36	13 metric wrench
M10 Bolt (8.8)*	Side covers and adjustment side cover	6.72	17 metric wrench
M10 Nut	Piston arms	6.72	17 metric wrench
1/4" NPT plug	Upper body	3	6 allen wrench
1/4" NPT connections <ul style="list-style-type: none"> <li>Hydraulic connectors</li> <li>Solenoid valves</li> <li>Purge valves</li> <li>Check valve</li> <li>Manometer</li> <li>Safety relief valve</li> </ul>	Common connections on the hydraulic set.	3	17-19 metric wrench
3/4" NPT connections <ul style="list-style-type: none"> <li>Hydraulic connectors</li> <li>Break Away</li> <li>Access Flow Valve</li> <li>Nozzle</li> <li>Differential Valve</li> <li>PN40 Ball Valve</li> </ul>	Common connections on the hydraulic set.	11.5	32-36 metric wrench
1" Rp connection Yenen inlet check valve for flow meter	Inlet of the flow meter	13.5	50 metric wrench
M12 (8.8)*	Yenen inlet check valve to gas separator.	8.66	19 metric wrench

\* Quality specification to EN 20898-2



For tightness, apply 2 – 3 drops of Loxeal – Italy 58.11 (or equivalent suitable for LPG) directly on male threaded connections prior to fastening.



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