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## 1. Packing Liquid

### 1.1. General

**By all means, the meter must be filled with the very same packing liquid which the meter was calibrated with! Otherwise major measurement errors will occur!**

The Gas Meter (which is shipped dry) must be approximately half-filled with a suitable so-called "Packing Liquid" before first use. The measuring drum which rotates in this packing liquid forms the actual measuring unit in conjunction with the liquid.

The packing liquid has two functions: Firstly, it seals off the active measuring chamber (= measuring chamber inside the measuring drum which is being filled with gas) and secondly, the level of the packing liquid inside the measuring chamber defines the volume of the measuring chamber. The latter function is the basis for calibration of the gas meter's measurement accuracy which is performed at the factory. Because of this, the measurement accuracy is directly dependent on the packing liquid level and so an incorrectly set level at time of installation is bound to cause incorrect measurements (see par. 2.4).

### 1.2. The mutual influence of packing liquid and gas

Irrespective of the chosen packing liquid, the packing liquid and the flowing gas inevitably affect each other with respect to **evaporation** and **dissolving**:

- 1) Absorption of evaporated particles of the packing liquid by the gas,
- 2) Dissolving of the gas in the packing liquid up to the saturation limit.

Generally valid figures and limit values for the mutual influence of gas and packing liquid cannot be stated, because they depend to a very great extent on the particular gas and its state. For example, when water is used as a packing liquid, a dry, warm gas absorbs significantly more evaporated water particles than a moist, cold gas.

The solubility of gases in the packing liquid also varies greatly. The gas can, of course, only dissolve in the packing liquid up to the saturation limit. A measuring error caused by solubility can be avoided if the gas can dissolve in the packing liquid up to the saturation limit during test operation before the experiments are subsequently carried out.

### 1.3. Selection of packing liquid

The criterion for choosing a packing fluid should be that any mutual influence between the packing fluid and the flowing gas should be as small as possible, or that the effects can be ignored. In most cases, water can be used as the packing fluid. No special requirements for the water are necessary - that means that normal clean tap water can be used.

When water is not suitable to be used as the packing fluid, oils or synthetic fluids can be used. Generally speaking, a thin-bodied fluid (ideal: viscosity of water) with a low vapour pressure (ideal: <0.1 mbar/hPa) should be selected. A thin-bodied fluid causes a small friction resistance of the rotating measuring drum only, and hereby a small pressure difference between gas inlet and outlet of the meter. This, in return, results in a better (more flat) calibration curve. A low vapour pressure reduces the (unavoidable) evaporation of the packing liquid. Hereby a better long term stability of the packing liquid level is obtained and thus more stable measuring results.

RITTER recommends and can supply the following alternatives:

- “**Pionier 4281**” is a medical paraffinic mineral White Oil containing aromates in trace elements. It is colourless, odourless, and clear.
- “**Silox**”, a silicone oil belonging to the group of polydimethyl siloxane. It is colourless and clear with a weak odour.
- “**CalRiX**”, which is a completely synthetic fluid on a fluorine base. It is almost totally inert, even to the most aggressive gases. It can also be used without difficulty under the most demanding and critical application situations. Further advantages of **CalRiX** are: low evaporation rate; a viscosity similar to that of water; 1.8 times the density of water and very low surface tension, which result in a more even rotation of the measuring drum; dry gases remain dry.

## 2. Installation

### 2.1. High-Pressure Gas Meters (> 1bar)

Before performing the initial set-up please read the general instructions in Point 4 and continue installation with point 2.2.

### 2.2. Positioning

Place the drum-type gas meter onto a solid, vibration-free support. Align the gas meter precisely horizontally by means of the integrated level (at top of casing) and the levelling feet.

### 2.3. Filling with the packing liquid

It is essential to use the very same packing liquid which the gas meter was calibrated with. This packing liquid is stated at the calibration certificate as well as at the calibration label at the gas meter.

**Using a different packing liquid other than that used with the calibration will cause a significant measuring error!**

#### Standard-Gas Meters:

Open the filling-level indicator located at the rear plate by turning the sealing screw 2 or 3 times anti-clockwise. Please pay attention, that the screw is not unscrewed out of the thread. Open the filling nozzle located at the rear plate by turning the sealing screw anti-clockwise until it is unscrewed. Pour the packing liquid into the gas meter through the filling nozzle.

#### High-pressure Gas Meters:

Loosen and remove the sealing screw of the filling nozzle (hexagonal screw). Pour the selected Packing Liquid into the Gas Meter via the filling nozzle. After setting the Packing Liquid level correctly as described in Point 2.4, replace the sealing screw and firmly tighten it with a spanner.

### 2.4. Quantity of packing liquid (Adjusting the packing liquid level)

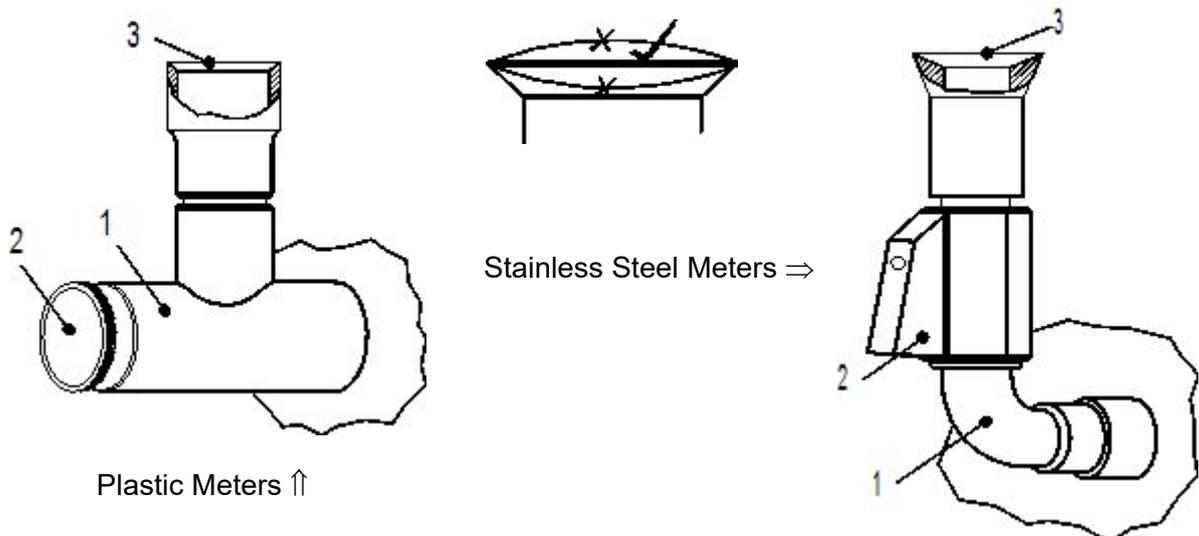
The amount of packing liquid depends on the gas meter size (type) and on the individual setting for each unit. The approximate quantity is shown in the data sheet enclosed with every gas meter. This quantity does not take into account individual differences based on the calibration performed in the factory.

Fine adjustment of the packing liquid level is of greatest significance to the measurement accuracy, **since the measurement accuracy/display depends directly on the packing liquid level and reacts very sensitively to an incorrectly set level!**

The correct packing liquid level is set as follows:

- For Gas Meters with the High Precision Packing Liquid Level Indicator (HPLI): please refer to the HPLI Data Sheet.
- For Gas Meters with the standard Packing Liquid Level Indicator (located at the rear plate of the Meter):

When the filling-level indicator (1) is opened by turning the sealing screw (2) with Plastic Meters (or stop cock (2) with Stainless Steel Meters), the rising pipe of the level indicator is connected to the packing liquid in the gas meter housing in accordance with the communicating pipes principle. When the level in the gas meter housing rises as a result of topping-up with packing liquid, the level in the level indicator rises in the same way. The correct packing liquid level is reached when the surface of the liquid column in the level indicator is flush with the upper edge of the level indicator (3) and forms neither a dome nor an indent (see middle picture below).



The liquid column can be read off (if water is used as the packing liquid) more easily by reducing the surface tension by adding a drop of detergent. If too much packing liquid has been added, it comes over the level indicator causing the level to adjust itself to a certain extent. Any resulting liquid dome at the upper edge of the level indicator must, however, be remedied by draining off liquid via the drainage nozzles.

A small tip for checking the packing liquid level following an extended downtime of the gas meter: Following an extended downtime, the liquid in the level indicator is mostly evaporated, whereas it is not in the inside of the (closed) housing. If the level indicator's screw plug is now opened, the packing liquid flows out of the housing into the level indicator. Even if the packing liquid level was previously correct inside the housing, packing liquid must now be added and the level re-adjusted. This can be avoided by filling the level indicator with packing liquid **before** the screw plug is opened (neither dome nor indent). If the level does not change **after** the screw plug is opened, the packing liquid level was and still is correct.

### **2.5. After filling and adjustment of the packing liquid**

- Close the filling-level indicator and filling nozzle by turning the respective sealing screws clockwise
- When the Meter is equipped with the HPLI:  
When closed, the HPLI can indicate a slightly lower filling level than it did after correct filling of the Meter. This can also occur during operation. This is system-related and does not indicate any error. The given correct filling level will only be indicated when the Meter is not in operation and simultaneously, when the HPLI is open and not connected to the gas supply so that it is pressure-free.

### **2.6. Grounding of Gas Meters made out of electrically conductive material (PE-el)**

Gas Meters with a casing and/or measuring drum made out of electrically conductive material (PE-el) must be grounded in order to discharge a potential static charge.

To do so the feeder clamp at a flange screw of the meter's rear plate must be connected to ground (earth).

### **2.7. Connection of gas pipe**

Connect the gas pipe to the inlet nozzle marked "gas-inlet" at the rear plate. Allow the meter to perform one or two revolutions in order to remove any possible air bubbles within the measuring drum. Then disconnect the gas pipe again and repeat the steps in paragraphs 2.3 and 2.4.

### **2.8. Moving of the filled meter**

If the Gas Meter has to be moved after having been filled (for example carried into another room), it must be kept in a horizontal position. This is to avoid Packing Liquid getting into the Gas Inlet. If this occurs, the Gas Meter should be tipped 90° forwards (the dial face would then point to the floor). The Packing Liquid can then flow out of the Gas Inlet again (and back into the Meter).

## **3. Measurement**

### **3.1. Determination of Flow Rate**

Due to their design, drum gas meters measure the volume of flowing gases and indicate the measured volume by means of a needle and counter. A flow rate cannot be measured directly and must be calculated via the measured volume per time unit. This can be done by software or external hardware. For this purpose RITTER supplies the data acquisition software "RIGAMO" or the "Electronic Display Unit" (EDU). Note: For both options, the gas meter must be equipped with a pulse generator.

When graphing a calculated flow rate, the corresponding curve will not be linear but wavy, even if the original gas flow rate was constant. This is physically unavoidable due to the design principle of drum gas meters:

The measuring drum of the drum gas meter consists of four individual chambers that are opened and closed cyclically. The preceding chamber must be closed before the following chamber opens.

On the one hand, this so-called "forced measurement" is the reason for the high measuring accuracy of drum gas meters, on the other hand, the opening/closing causes a slight pressure change inside the chamber. Furthermore, the surface tension of the packing liquid used causes an increase in pressure when a measuring chamber emerges from the liquid.

The resulting pressure change causes a change in the rotational speed of the measuring drum, which causes the described wavy curve of the volume flow.

This effect is called "periodic error of the drum gas meter".

The smaller the gas meter, the greater the effect; for a TG05 it can be  $\pm 20\text{-}30\%$ . The effect is avoided when using integer drum revolutions as a time base for the volume flow calculation.

The data acquisition software "RIGAMO" can be parameterised in such a way that the volume flow is calculated using integer drum revolutions and the periodic error is thus avoided.

With the "Electronic Display Unit" (EDU), the volume flow is calculated by means of a moving average, which reduces the periodic error.

### 3.2. Initial set-up of Measurement

For ease of reading at the end of measurement, the large Needle of the dial plate can be set manually to zero prior to each measurement. In the case of units with a totalizing roller-type counter (standard version), the counter reading must be noted. On the version with a resettable roller-type counter (optional), the counter can be set to zero with the reset button. The Needles can be set manually to zero on units with a totalizing Needle-type counter (optional).

The Gas Meter is then ready for Operation.

### 3.3. Check: Liquid level

Prior to each subsequent measurement, the fluid level must again be checked in accordance with paragraphs 2.3 and 2.4.

### 3.4. Check: Performance data

When taking measurements, pay attention to the performance data of the respective gas meter (refer to the attached data sheet). **The maximum pressure load is 50 mbar** for the standard drum-type gas meters made out of plastic and **500 mbar** with meters with a stainless steel casing!

### 3.5. Measurements with oxygen

The mixture of some gases with oxygen may cause an explosion. Therefore, before and after measuring with oxygen, ensure that no gas used in the previous measurement is still within the measuring drum or the inside of the housing. To exclude this danger of explosion, the gas meter has to be purged with an inert gas (e.g. nitrogen or any noble gas). The purging can be performed by operating the gas meter with an inert gas for at least five revolutions of the measuring drum (= five revolutions of the large Needle on the dial plate).

## 4. High-Pressure Gas Meters(> 1bar)

- The Gas Meters may only be used within the Over-Pressure and Temperature operating limits listed on the Meter label and in the Data Sheet.
- If the Gas Meter is placed in an elevated position, for example on a stand or similar, it must be firmly secured so that it cannot move or slip. This is to avoid personal injury or property damage due to the Meter falling. The feet of the Meter should be secured with tension clamps, screws or similar.
- The Gas Meters do not have an Over-Pressure Safety Valve installed. In order to completely avoid exceeding the admissible operating pressure (listed on the Meter label and in

the Data Sheet), an Over-Pressure Safety Valve must be installed in the connected gas pipes.

- In the event of Gas Meter disassembly, the Gas Meter must be pressure-free before disassembly begins.
- Only original parts should be used to rebuild the Gas Meter if it has been disassembled.
- Disassembly of the Meter, i.e. removal & replacement of the measuring drum, can alter the calibration results (please refer to Point 5.2).

## 5. Maintenance

### 5.1. General

All Ritter drum-type gas meters are maintenance-free.

Furthermore, no leakage from the gas meter casing can occur by use of a magnetic coupling between measuring drum and counter mechanism.

### 5.2. Cleaning of casing and measuring drum from sediments

When the measured gas carries particles, these particles will be scrubbed by the packing liquid and the rotation of the measuring drum during the measuring process. Thus, sediments may build-up at the bottom of the casing and inside of the measuring drum over the time. In order to clean the casing and measuring drum from these sediments, the casing should be flushed from time to time.

For doing this, the casing must be drained through the drainage faucet. Refill with clean water and add any detergent (if appropriate: dishwashing detergent) which does not attack the meter material. Repeat draining and refilling until no sediments are visible while draining the meter.

If the gas meter size is small enough, it is favourably to hold the meter "face down" and to shake the meter slightly when coming to the end of the draining process. Thus, potential sediments at the inside of the measuring drum are scrubbed in the best possible way.

### 5.3. Disassembly of the rear plate

The rear plate of the housing can be removed in order to allow the gas meter housing to be cleaned from the inside if required. When removing the plate, it is essential to ensure that the support secured onto the inner face of the housing rear plate and which engages in the measuring drum is not broken off and that the measuring drum is not damaged by this support.

However, after opening the gas meter housing and removing the measuring drum, it must be borne in mind that following refitting the measuring drum will very probably no longer be in exactly the same position as it was during calibration at the factory. This could result in a different calibration result.

We therefore recommend that you send your gas meter to the works for inspection, cleaning and recalibration if the measuring drum becomes dirty and in the event of measuring inaccuracies or other operational faults.

### 5.4. Trouble shooting

In the unlikely event of problems with the function of the meter, please contact your national distributor or the Ritter Company. In order to be able to be of assistance, we kindly ask you to check the following items and to collect the requested data **prior to your contact**:

- Serial number of the meter.
- Is the packing liquid level set correctly?
- What is the gas flow rate at which the problem occurs?
- What is the gas inlet pressure at this flow rate?
- What is the spread of the gas inlet pressure (min./max. pressure) at this flow rate?
- Is the gas meter outlet nozzle free to atmosphere?
- What is the approx. gas temperature?

Especially the data according to (d) and (e) are valuable information to find the reason for the problem(s).