USER MANUAL

HK S TKV Analogue Power Meter

- Stainless steel design
- Pressures up to 350 bar
- Volume flow up to 190 l/min
- Temperature display up to 120°C
- Internal overpressure protection
- Can be used with all mineral oils
- Power supply not required
- Compact design

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INTRODUCTION

This volume flow meter is a robust industrial-grade inline gear flow meter that is available in an aluminium, brass or stainless steel design for the purpose of monitoring many different fluids.

Available in seven connection sizes from 1/4... 3 inches for flow ranges from (0.02...0.20 gal/min) 0.1...0.75 l/min to (20...300 gal/min) 100...1100 l/min. The devices are calibrated to a specific weight of 0.876 for oil or other oil-based fluids, 1.0 for water or other water-based fluids or 1.18 for phosphate ester fluids.

The volume flow meter is equipped with a 360° rotatable protective case/scale that allows it to be installed in any position without needing to consider the scale direction. As soon as the volume flow meter is permanently installed, the protective case/scale can be rotated 360° to make it easier to read.

In addition, the unique spring-loaded design of this volume flow meter reduces its sensitivity to viscosity and allows it to be installed in any position, including inverted, without losing any precision. An optional inverted scale is available for such applications.

The standard volume flow meter only works in one direction. If required, a bypass option with inverted flow is available for the mineral oil, phosphate ester and water-based fluids models. Please note that the volume flow is only measured in the direction of the arrow.

- Aluminium models are offered as robust, low-cost volume flow meters for monitoring non-corrosive, water-based or oil-based fluids. Oil-based fluids for operating pressures of up to 250 bar (3500 psi).
- Brass models are recommended for water monitoring applications or other systems where there are no corrosion inhibitors.
- Stainless steel models are used for monitoring hydraulic systems with operating pressures of up to 350 bar (6000 psi) or other corrosive, caustic fluids such as acetic acid. You can obtain further information from your technical consultant.

UNPACKING AND CHECKING THE PRODUCT

Perform the following steps once you receive the product:

If the product packaging is damaged, ask the shipping agent to be present when the product is unpacked. If the product is damaged and the shipping agent is not present, ask for an inspection by the representative of the shipping agent within 48 hours of delivery and lodge a complaint with the shipping agent. The purchaser has sole responsibility for lodging a complaint about any damage to the device caused during transport.

Open the shipping packaging carefully and follow all the instructions specified on the outside. Remove all the packaging materials and carefully remove the product from the packaging.

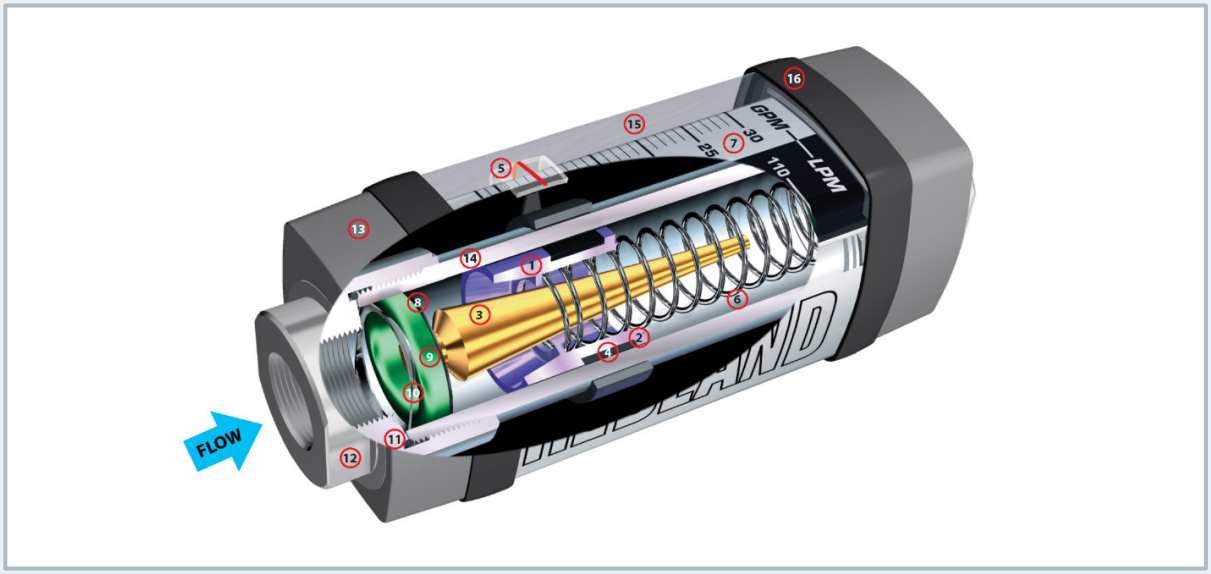
Retain the undamaged packaging and all the packaging materials for possible onward shipment or storage. Check the product and the relevant accessories visually for any physical damage such as scratches, loose or broken parts or other signs of damage that might have occurred during transport.

FUNCTIONAL PRINCIPLE

The volume flow meter is a float-type measuring device. A sharp-edged baffle **(1)** located in the piston assembly **(2)** forms an annular opening with the contoured measuring cone **(3).**

The piston assembly features a cylindrical PPS/ceramic magnet **(4)** that is coupled magnetically to an external display magnet **(5)** which moves in direct response to the movement of the piston. A calibrated spring **(6)** counteracts the flow in the forward direction.

These volume flow meters are the most readable products in their class. Vivid coloured indicators move across the linear display scale **(7)**, which contains numbers and markings in bold that are easy to read. The improved resolution virtually eliminates any parallax issues (reading errors caused by viewing from a different angle).



1	Baffle	9	Crossplate
2	Piston assembly	10	Locking spring washer
3	Measuring cone	11	O-ring seal (pressure seal)
4	Internal magnet (piston magnet)	12	Threaded connector
5	External magnet (display ring -	13	End cap
6	Spring	14	High-pressure casing (pressure
7	Display scale	15	Protective casing (scale protection)
8	Locking ring	16	Rubber protective seal (bumper)

Table 1: Volume flow meter components

INSTALLATION

Important information

CAUTION!

This product should be installed and maintained by technically qualified personnel who have been trained on this specific product.

CAUTION!

Read through the instructions before you install the device.

If you have any questions about installation or maintenance, call your local supplier to obtain further information.

CAUTION!

Volume flow meters for mineral oil are not recommended for water applications.

If the measuring device is to be used for both mineral oil and water, brass water meters are recommended. Please contact the manufacturer for customer-specific details.

CAUTION!

The volume flow meter may contain residual quantities of testing fluid when it is delivered. This fluid should be removed before installation as this fluid may be incompatible with some fluids or gases or dangerous.

Failure to follow this instruction may cause the device to be damaged!

CAUTION!

This volume flow meter is unidirectional. The volume only flows in one direction!

Any attempt to make fluids flow in the opposite direction to the flow arrow will cause the measuring device to act as a non-return valve. The flow will be stopped. The resulting increase in pressure will cause damage to the components inside the measuring device!

The volume flow meter is a device that is easy to install. However, the following measures are recommended to ensure it can be operated safely and without any faults:

- Align the pipeline precisely. The piping should be aligned precisely and be of the correct length. The high-pressure casing of the volume flow meter is able to withstand impacts and flow/pressure pulsations. However, the pipeline should be securely supported by external mounting brackets both before and after the measuring device in order to prevent the pipeline from any sagging that might shorten the useful life of the measuring device.
- Use a rigid form of mounting. If the inlet or outlet of the volume flow meter is to have a rigid mounting and the opposite connector is to be connected with a flexible hose, the opposite end of the flexible hose must be mounted with a rigid fixing.
- Use Teflon® tape to seal up the NPT threaded fitting.
- Fit screw connections. Fit a screw connection close to the inlet or outlet of the volume flow meter. This will make it quick and easy to remove or carry out an inspection during the regular maintenance work.
- Mount the volume flow meter either horizontally or vertically (flow arrow pointing upwards or to the side). If the volume flow meter needs to be mounted inverted, special inverted scales are available from the manufacturer.
- Make sure that the fluid flows in the direction of the flow arrow (Figure 1 / p. 7).
- Use at least one 74 µm filter. The measuring device will let through particles that would block most valves and flow meters. Systems that do not have any filtering should be equipped at least with a 74 µm filter.
- Most hydraulic systems already have much finer filtering.
- Dirt, iron filings or sealants, such as Teflon tape, may clog up the system and cause malfunctions. If the measuring device has jammed in one position, follow the cleaning and maintenance instructions.
- Do **not** use any thread lock agent as a thread seal!
- Do **not** install the volume flow meter near to any fittings that create turbulence, for example elbows, reducer parts, short-cut valves, etc. The volume flow meter does not require any flow straighteners or special lengths of straight inlet/outlet pipes to stabilise turbulent flow patterns. However, in order to guarantee maximum operational reliability, avoid fitting any elbows, valves and/or reducer parts in the immediate vicinity of the device.
- Do **not** install the volume flow meter in the vicinity of quick-acting valves. Quick-acting valves may generate high hydraulic pressure peaks. These pressure peaks may damage the internal components, which can cause inaccuracies or malfunctions.

- Unidirectional devices (such as this volume flow meter) must **not** be operated in the direction opposite to the one shown by the flow arrow. The piston acts like a non-return valve and blocks the flow in the opposite direction. This causes an excessive difference in pressure that may damage the internal components. The volume flow meter is also available in a modified version that offers a bypass function for the return flow in order to enable bidirectional flow.

Please note:
Volume flow meters are also available with a bypass function to allow reverse flow. Please contact the manufacturer's plant or the regional supplier for more details.

Installing the volume flow meter

1. Mount the volume flow meter so that the fluid flows in the direction of the flow arrow.

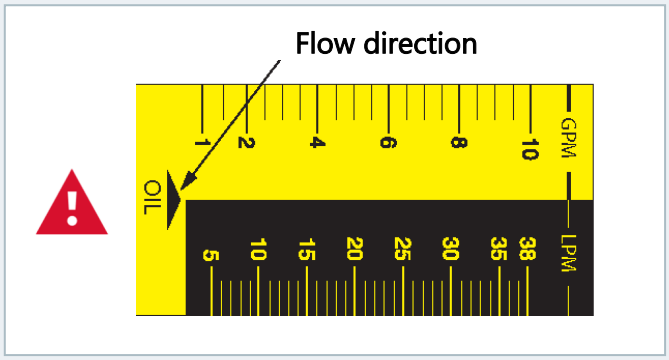
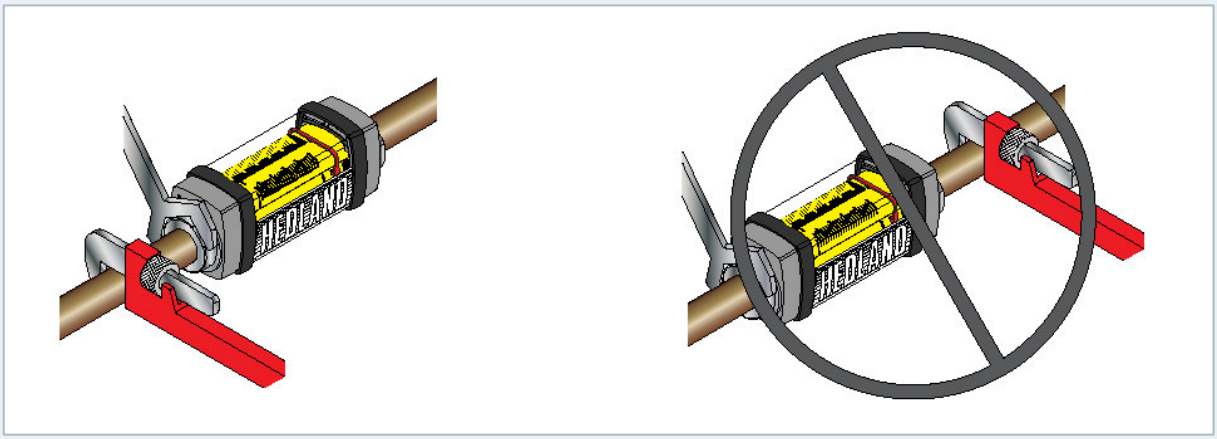


Figure 1: Flow direction arrow

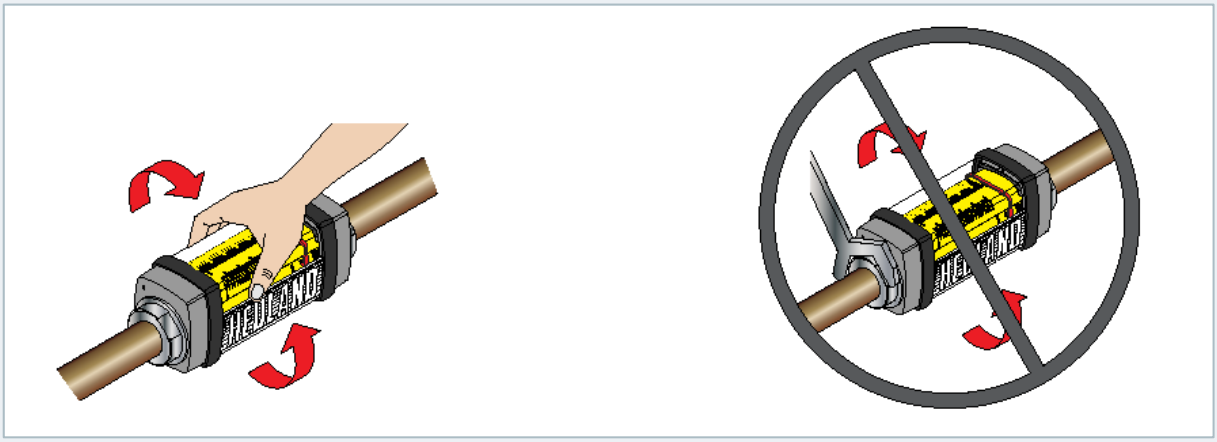
2. Choose an installation location that is suitable for inspection and product maintenance. To connect the volume flow meter to the pipeline system, place a flat spanner on the wrench flats of the volume flow meter next to the pipe connection that is to be installed.
    - Do **not** screw on the opposite end of the volume flow meter as this may cause leaks.



Attach the flat spanner on the same side on which the pipelines are tightened.

Never attach the flat spanner on the opposite side of the pipeline that is to be screwed on.

Figure 2: Installing the volume flow meter



Turn the volume flow meter by hand so that you can see the flow scale.

Never use a flat spanner to turn the protective casing in order to view the flow scale.

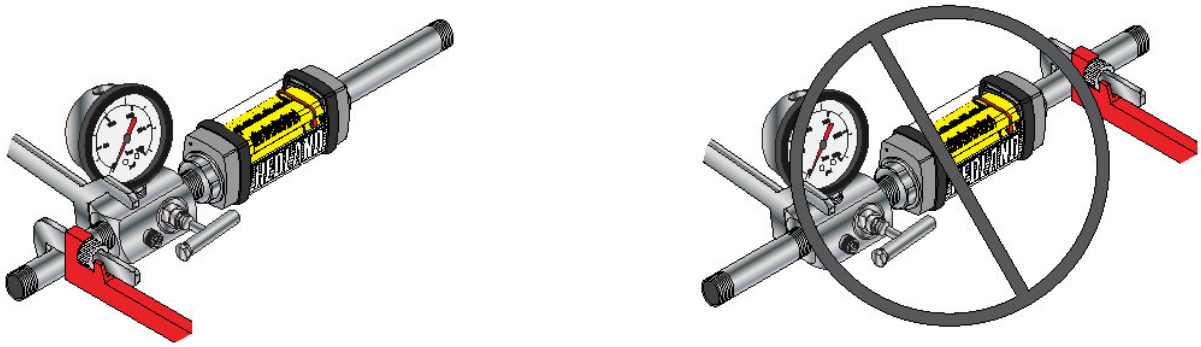
Figure 3: Turning the volume flow meter

Installing the power meter

1. Mount the power meter so that the fluid flows in the direction of the flow arrow. (*See Figure 1. Page 7*)

2. Install the power meter at any point in the hydraulic circuit, so that the volume flow, pressure and temperature displays can be read easily. To connect the power meter to the piping system, place a wrench on the valve block (wrench flat) on the inlet side.

    - Do **not** screw on the opposite end of the power meter as this may cause leaks. *(See Figure 4).*



Attach the wrench on the same side on the valve body on which the pipeline is tightened.

Never attach the wrench on the opposite side of the pipelines that are to be screwed on.

Figure 4 (schematic diagram): Mounting the power meter

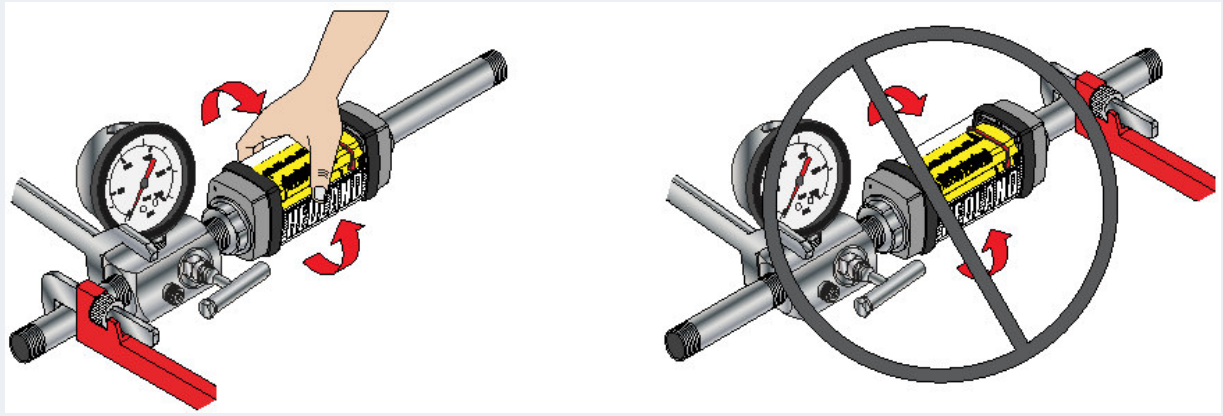
3. Use the plastic caps that are also supplied to seal off the power meter after use and keep it clean. Store it in a transport case.

    - Alternatively, use quick release couplings as a simple connection and to protect against any contamination when the power meter is not in use.

    - You will find schematic diagrams illustrating the mounting position during typical test procedures with the power meter under *("Conducting the power measurement" on page 11*).

Figure 5: Power meter in the transport case

4. Turn the premounted volume flow meter by hand after installation so that you can see the flow scale.



Turn the volume flow meter by hand so that you can see the display scale.

Never use a flat spanner to turn the volume flow meter when you want to see the display scale.

Figure 6 (schematic diagram): Turning the power meter

OPERATION

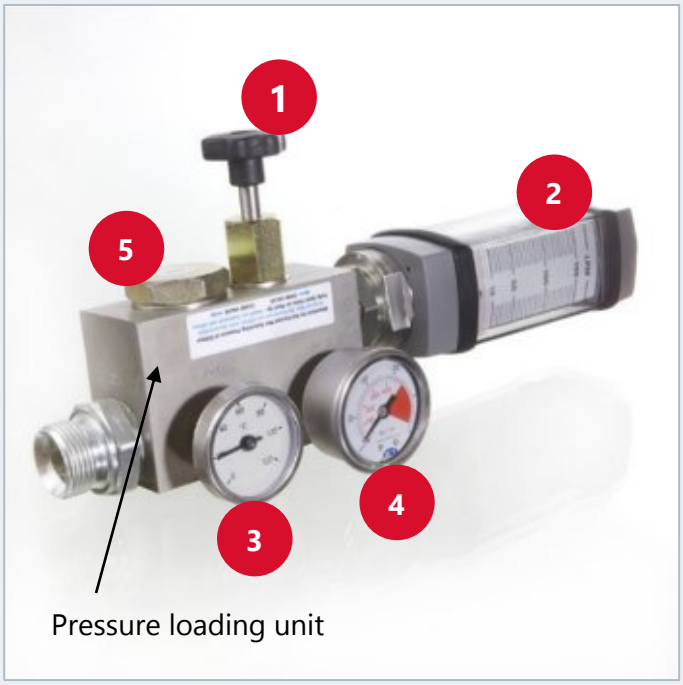
Information about the power meter

WARNING!

Always start with the load valve open.

Power meters are supplied with a closed load valve (1).

The load valve must be fully opened before the test in the hydraulic circuit is initiated. Turn the load valve handle anticlockwise to open the load valve fully. If the load valve is not opened fully, this may cause injuries to people and/or damage to the equipment.



Open the load valve
(free flow)

Close the load valve

Figure 7: Stainless steel power meter, 350 bar Type: HK S TKV Stainless steel

1	Loading valve (load valve)
2	Volume flow meter
3	Thermometer
4	Pressure gauge
5	Burst pressure protection

CONDUCTING THE POWER MEASUREMENT

CAUTION!

The information in this user manual is intended for general application only. All the information that is provided by the manufacturer and/or constructor of the hydraulic components of the machine, the hydraulic system, should be followed. Special systems may require special test procedures. This is why the documentation for the machine/hydraulic system should be consulted before conducting any measurements.

General information

The power meter is designed for measuring volume flow Q [l/min] and pressure p [bar].

The result of the power measurement is calculated from the product of the volume flow and pressure. When you use the power meter, the power P [kW] can be calculated using the following practical formula:

$$P = \frac{Q * p}{600}$$

Standard test condition

1. Install the power meter as described in one of the following test procedures.
2. Open the load valve fully by turning the handle anticlockwise.
3. Start the pump and set it to the nominal speed.
4. Use the load valve to regulate the pressure in accordance with the test procedure you want to carry out.
5. The power meter shows the flow rate, the set load pressure and the oil temperature.

CAUTION!

Be aware of the maximum permissible pressure of the hydraulic components in the hydraulic system!

Pump test

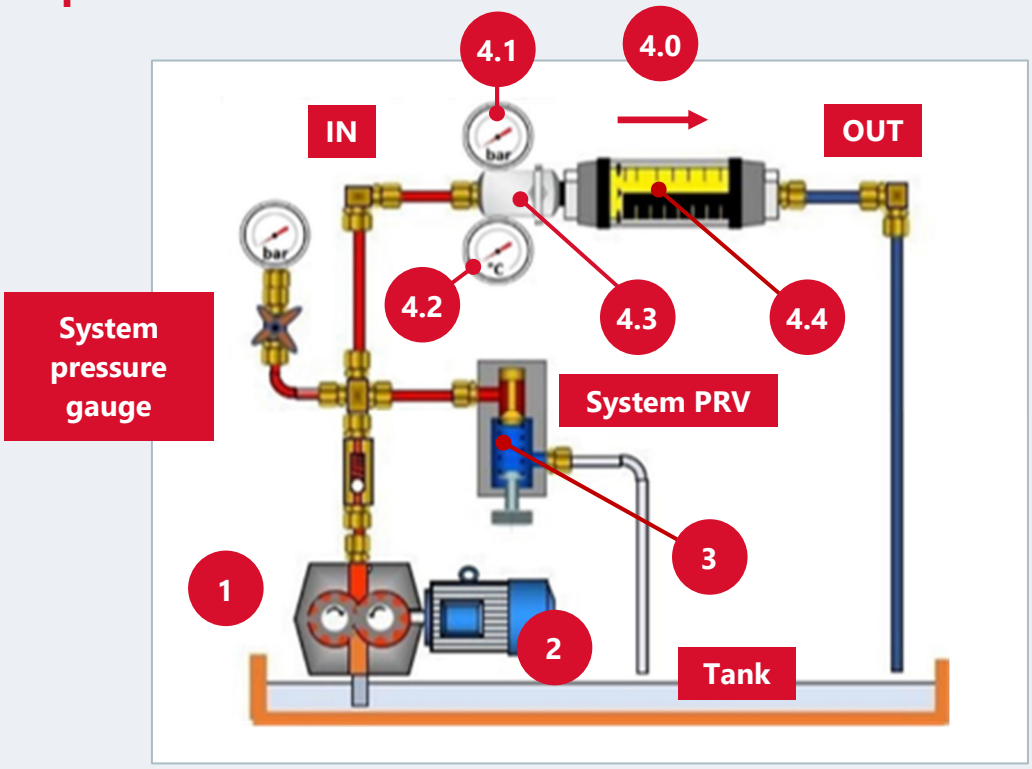


Figure 8: Schematic diagram of pump test

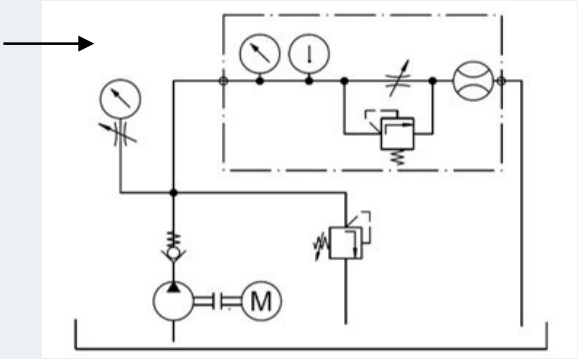


Figure 9: Hydraulic diagram of pump test

Test sequence

1. The power meter **(4)** is connected on the input side **(IN)** to the pressure line of the pump **(1)**, which is preferably safeguarded by means of a pressure relief valve **(3)**.
2. With a fully opened loading valve **(4.3)**, the hydraulic oil is returned to the tank on the output side **(OUT)**. Slowly closing the loading valve generates a steadily rising load pressure p that is displayed on the pressure gauge **(4.1)** in [bar].
3. The oil temperature **T** can be read off the thermometer **(4.2)** in [°C].

4. The volume flow **Q** of the pump is now displayed as a function of the load pressure **(4.1)** on the scale of the volume flow meter **(4.4)** in [l/min] (LPM).
5. The values that are read on the power meter (pressure, volume flow, temperature) can then be compared with the **p/Q characteristic curve** *(pump specification)* in the data sheet from the pump manufacturer and evaluated.
6. The power formula *(see page 11)* can then be used to calculate the hydraulic power **P** [kW] of the pump and demonstrate the current level of efficiency.

Please note:
*The pressure relief valve **(3)** must be set to the maximum permissible value, greater than the load pressure (see page 14-15). The documentation from the manufacturer of the hydraulic system/component should be noted here.*

Pressure relief valve test

Pressure relief valves (PRV) **(3)** *(see Figure 10)* often begin to open before the pump reaches its full power.

The oil that flows away via a PRV is lost power and heats up the hydraulic oil in the system unnecessarily.

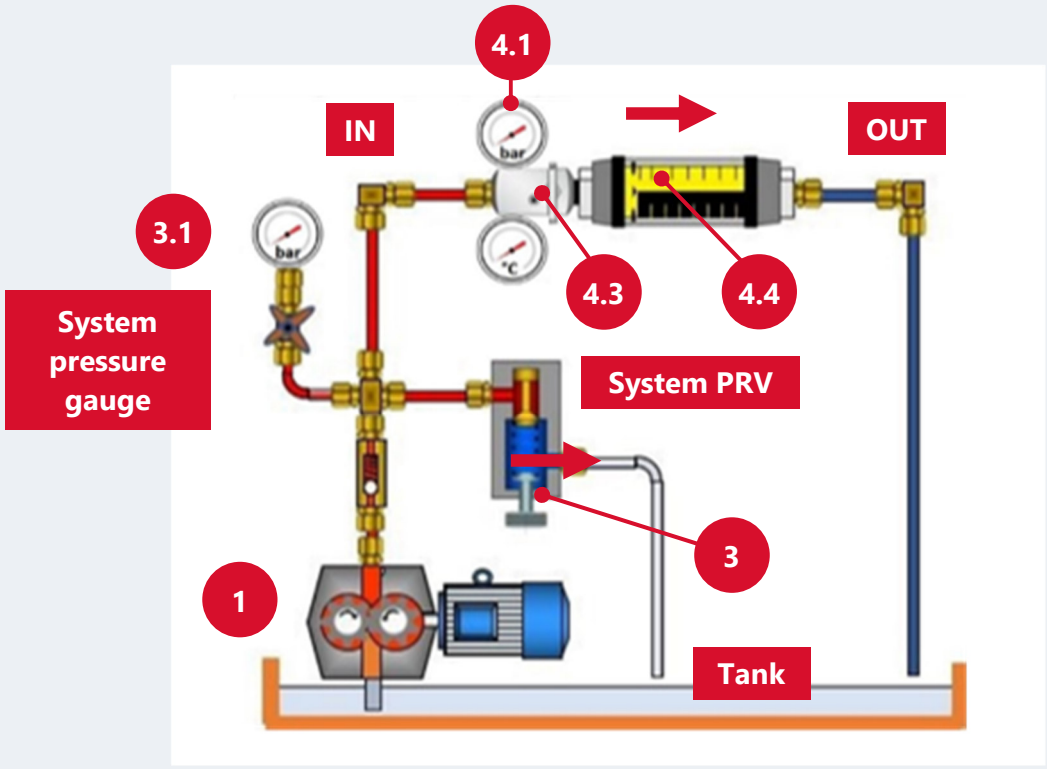


Figure 10: Schematic diagram of pressure relief valve test

Test sequence

1. The power meter **(4)** is connected on the input side **(IN)** to the pressure line of the pump **(1)**, which is safeguarded by means of a pressure relief valve (PRV) **(3)**.
2. With a fully opened loading valve **(4.3)**, the hydraulic oil is returned to the tank on the output side **(OUT)**. Please note the value displayed on the scale **(4.4)** of the volume flow meter [l/min] (LPM). Observe the pressure [bar] on the pressure gauge **(4.1).**
3. Slowly closing the loading valve **(4.3)** generates a steadily rising load pressure p that is displayed on the pressure gauge **(4.1)** / (**(3.1)** if present) in [bar].
4. The volume flow Q of the pump is now displayed as a function of the load pressure **(4.1)** on the scale of the volume flow meter **(4.4)** in [l/min] (LPM).
5. As the load pressure **(4.1)** starts to get close to the pressure that is currently set for the PRV **(3)**, some of the volume flow from the pump starts to flow into the tank via the PRV **(3)**.
6. The value displayed on the scale **(4.4)** of the volume flow meter reduces.
7. Increase the set value for the PRV **(3)**. Keep an eye on the scale **(4.4)**, the value displayed on the volume flow meter will increase roughly up to the value noted in step 2.
8. Repeat steps 3-6 above until the volume flow that is noted under step 2 is achieved as a function of the max. desired system pressure **(3.1)** / **(4.1)**.

Please note:
Note the specifications of the pump (slipping/leakage) and the performance of the pressure relief valve (early opening, p/Q characteristic curves).
In practice, the system PRV is generally set approx. 10-20 bar higher than the max. load pressure. The documentation from the manufacturer of the hydraulic system/component should be noted.

MAINTENANCE

WARNING!

Before you remove the power meter from the line, check that the hydraulic system has been depressurised. Failure to follow this instruction may cause serious physical injuries or death and/or material damage.

Pressure release

Before starting work:

- mobile hydraulic systems must be depressurised,
- vehicle drives must be shut down,
- hydraulic systems must be shut off,
- hydraulic accumulators must be shut off and relieved on the pressure side.

Please note:
Be careful of any residual pressures caused by trapped volumes of fluid, e.g. between valves and cylinders. They should be released by operating an adjusting lever or valve. The pressure release should be checked, e.g. using a pressure gauge.

Dismantling and cleaning the volume flow meter

1. Remove the power meter from the line. Remove any excess pipelines/screw connections from the power meter.

Please note! It is not necessary to remove the transparent dust protection casing (15) *(see Table 1, page 4)* from the power meter in order to remove the meter from the line. If you wish to remove the dust protection assembly from the volume flow meter, see "Removing the dust protection" on *page 17*.

2. Wipe down the whole of the surface of the volume flow meter thoroughly with a mild cleaning agent or isopropyl alcohol.

CAUTION!

Do not use any aromatic hydrocarbons, halogenated hydrocarbons, ketones or ester-based liquids to clean polycarbonate surfaces. Failure to follow this instruction may cause the power meter to be damaged.

3. Disconnect the volume flow meter **(2)** from the "*pressure loading unit*", see (*Figure 7 page 11)*
4. Remove the end caps **(13)** *(see Table 1, page 4)* from the volume flow meter and note down the order in which you dismantle things as a reference for when you reassemble them later on.
5. The internal parts are secured with a locking ring. Remove the locking ring and the internal parts that come into contact with media from the volume flow meter.

Please note:
If the internal parts do not slide freely out of the volume flow meter, use a wooden stick that is inserted into the outlet opening of the volume flow meter to slide out the parts.

6. Place all parts on a clean work surface. Clean and check all parts. Replace any parts that appear worn or damaged. Check the O-ring seal **(11)** *(see Table 1, page 4)* of the inlet connector for any damage and replace it if necessary.

CAUTION!

Replacing the spring, measuring cone and/or piston/magnet assembly may cause changes to the calibration of the volume flow meter.

7. Reinsert the spring, then the piston/magnet assembly and the locking ring in the volume flow meter.
8. Install the dosing cone/star plate assembly and the locking spring. Complete the installation by mounting the end cap.
9. Mount the volume flow meter back on the pressure loading unit.

Removing the dust protection casing

To remove the dust protection to clean or replace it, use a suitable tool to loosen the screw connection on the side of the measuring device and slide the end cap, the rubber protection bumper and the dust protection casing off the measuring device.

Make sure that the O-ring seal between the end cap and the pressure body is not damaged.

Reconnecting the magnetic coupling

This piston-type volume flow meter is less sensitive to impacts and vibrations than other float-type designs.

The magnetic coupling dispenses with the need for a mechanical connection, which may become worn or loose over the lifespan of the measuring device.

However, a pressure spike or sudden increase in volume flow may cause the piston magnet to move at such a high velocity that the piston magnet **(4)** and the external display ring **(5)** *(see Table 1, page 4)* become detached.

If this happens, use one of the following methods to reconnect the piston magnet and the external display ring:

Caution! The manufacturer's documentation for the hydraulic system must be followed.

- If the system allows it, change the volume flow from "min. to no flow rate" to "max. flow rate" so that the moving piston magnet (4) reconnects with the display ring (5) magnetically.
- In the case of heavily cyclical applications in which frequent decoupling can occur, please contact one of the technical service staff for further recommendations.

Maintaining the pressure loading unit

Loading valve

If the loading valve (1) *(see Figure 7, page 11)* does not build up any load pressure in the system, remove the load valve from the pressure loading unit. Check it for any foreign bodies and worn parts or seals. Check the burst pressure protection **(5)** *(see Figure 7, page 11).* Replace the defective burst pressure protection, see the "Replacing the safety disc" section on page 19

Volume flow meter

If no volume flow is displayed on the volume flow meter **(2)** (*see Figure 7, page 11*), this may indicate a clogged piston assembly **(2)** (*see Table 1, page 4*). Remove any material that might prevent the piston from sliding. Note the "*Reconnecting the magnetic coupling"* section on *page 18.* Note the "*Dismantling and cleaning the volume flow meter"* section on *page 1.*

If the volume flow meter still does not show any flow, return the measuring device to the factory for inspection.

Replacing the safety disc

Power meters of the type: *HK 7xx Sxx TKV* made from stainless steel are equipped with overload protection. This overpressure protection is located in the pressure loading unit. (*Burst pressure protection* **(5)**, see *Figure 7, page 11)*

The burst pressure protection breaks at a pressure of over 400 bar. Stainless steel volume flow meters are designed for an operating pressure of up to 350 bar and a safety factor of 3:1.

Burst pressure protection HANSA-FLEX article number: ***K-MEP2470***

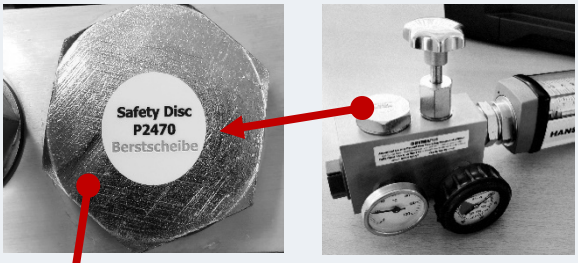


Figure 11: Power meter with burst pressure protection

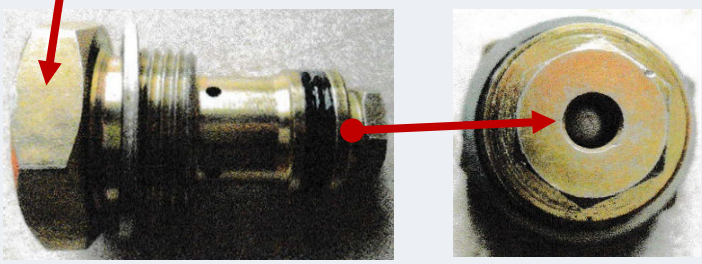


Figure 12: Locking screw

Figure 13: (Hex nut) screw-in part with safety disc

1. Remove the locking screw from the power meter (*see Figure 11/ 12)*
2. Remove the screw-in part from the locking screw
3. The safety disc is located in the bottom section of the screw-in part *(see Figure 13)* Undo the hex nut and replace the defective safety disc (P2470) Art. No. **K-MEP2470**. The safety disc deforms when the hex nut is tightened.

Make sure that the high-pressure seal fits correctly when it is remounted!

TECHNICAL DATA

Temperature range

Standard: -20°C to +116°C

Nominal pressure (safety factor 3:1)

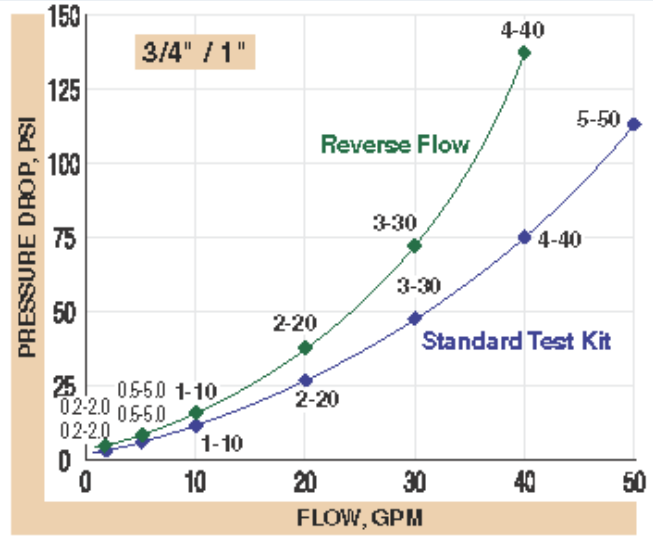
Please note: Pressure 10 PSI ~ 0.69 BAR

- Aluminium models (3500 psi) ~ 250 bar max.
- Stainless steel models, sizes ¼" and ½" (6000 psi) ~ 420 bar max.
- Stainless steel models, sizes ¾" and 1½" (5000 psi) ~ 350 bar max.

Drop in pressure

Please note: Pressure 10 PSI ~ 0.69 BAR; volume flow 1 gal/min ~ 3.78 l/min

The hydraulic system needs to have sufficient pressure to move the volume flow at the prescribed flow rate. This means that the system pressure needs to be able to overcome all pressure-reducing devices, including of the volume flow meter. The pressure drop curve (blue) applies to mineral oil and standard power meters of size 3/4" and 1"



Graph 1: p/Q characteristic curve for pressure drop (blue) for a standard ¾" and 1" power meter

Accuracy

+/- 2% on the full scale

Repeatability

+/- 1%

Thread

BSPP ISO1179

Pressure display

Pressure gauge with glycerine filling, connection on rear (NPT 1/8“)

Stainless steel model (0 - 6000 psi) 0 - 400 bar

Temperature display

Insertion thermometer without glycerine filling

Stainless steel model 0-120°C

Loading valve

Size ¾“ and 1“: Load valve (needle valve)

Stainless steel model produces a delta p of up to (6000 psi) ~ 414 bar

Medium

Suitable for all mineral oils

DIMENSIONS