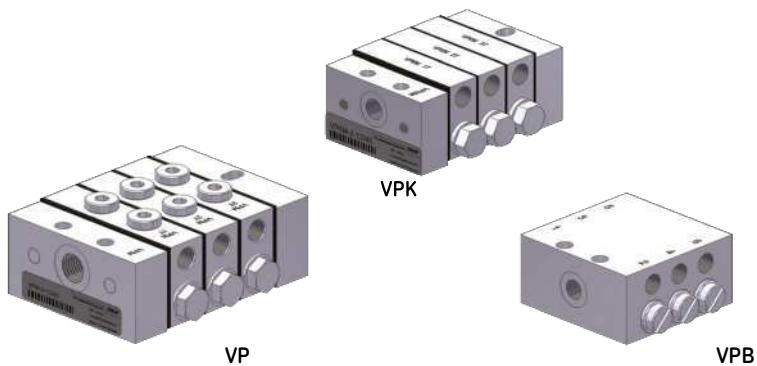


Progressive metering devices of the series VP, VPK, VPB

Component Lifecycle Manual
(CLM)

EN



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Masthead

Manufacturer

SKF Lubrication Systems Germany GmbH

Address of manufacturer plants

Headquarters

Walldorf Plant

Heinrich-Hertz-Str. 2-8

69190 Walldorf

Germany

Tel.: +49 (0) 6227 33-0

Fax: +49 (0) 6227 33-259

Berlin Plant

Motzener Straße 35/37

12277 Berlin

Germany

Tel. +49 (0)30 72002-0

Fax +49 (0)30 72002-111

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SKF conducts detailed training in order to enable the maximum safety and efficiency.

SKF recommends taking advantage of this training. For information, contact the relevant SKF service address.

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Explanation of symbols and signs

You will find these symbols, which warn of specific dangers to persons, material assets, or the environment, next to all safety instructions in these operating instructions.

Please heed these instructions and proceed with special care in such cases. "Please forward all safety instructions to other users."

| Warning level | | Consequence | Probability |
|---|-----------------------|------------------------|-------------|
|  | DANGER | Death / serious injury | Immediate |
|  | WARNING | Death / serious injury | Possible |
|  | CAUTION | Minor injury | Possible |
| | IMPORTANT NOTE | Property damage | Possible |

| Information symbols within the text | |
|-------------------------------------|---|
| Symbol | Meaning |
| ● | Prompts an action |
| ○ | Used for itemizing |
| ☞ | Refers to other facts, causes, or consequences |
| → | Provides additional information within procedures |

| Symbols used | |
|---|---|
| Symbol | Meaning |
|  | Note |
|  | Electrical component hazard, electric shock hazard |
|  | Slipping hazard |
|  | Hazard from hot components |
|  | Hazard from hot surface |
|  | Risk of being drawn into machinery |
|  | Crushing hazard |
|  | Danger from suspended load |
|  | Pressure injection hazard |
|  | Explosion-proof component |
|  | Electrostatic sensitive components |
|  | Wear personal safety equipment (goggles) |
|  | Secure (lock) the closing device against accidental starting of the machine |
|  | Environmentally sound disposal |

Instructions placed on a unit, machine, or equipment, such as:

○ Rotation arrows

○ Fluid connection labels

must be followed and kept in fully legible condition.

Read the component manual thoroughly and follow the safety instructions.

Abbreviations and conversion factors

Abbreviations

| | |
|--------------|----------------------|
| re | regarding |
| approx. | approximately |
| °C | degrees Celsius |
| cu.in | cubic inch |
| dB (A) | sound pressure level |
| i.e. | that is |
| etc. | et cetera |
| poss. | possibly |
| °F | degrees Fahrenheit |
| fl.ou. | fluid ounce |
| fpsec | feet per second |
| gal. | gallon |
| if necessary | if necessary |
| hp | horsepower |
| usually | usually |
| in. | inch |
| incl. | including |
| K | Kelvin |
| kg | kilogram |
| kp | kilopond |
| kW | kilowatt |
| l | liter |
| lb. | pound |
| max. | maximum |
| min. | minimum |
| min | minute |
| ml | milliliter |
| mm | millimeter |
| mph | miles per hour |
| N | Newton |
| Nm | Newton meter |

| | |
|--------|-----------------------|
| oz. | ounce |
| psi | pound per square inch |
| RH | relative humidity |
| s | second |
| sq.in. | square inch |
| etc. | et cetera |
| e.g. | for example |
| > | greater than |
| < | less than |
| ± | plus or minus |
| ∅ | diameter |

Conversion factors

| | | |
|--------------|----------------------|----------------------------|
| Length | 1 mm | 0.03937 inch |
| Area | 1 cm ² | 0.155 sq.in. |
| Volume | 1 ml | 0.0352 fl.oz. |
| | 1 l | 2.11416 pints (US) |
| Mass | 1 kg | 2.205 lbs |
| | 1 g | 0.03527 oz. |
| Density | 1 kg/cm ³ | 8.3454 lb./gal. (US) |
| | 1 kg/cm ³ | 0.03613 lb./cu.in. |
| Force | 1 N | 0.10197 kp |
| Speed | 1 m/s | 3.28084 fpsec. |
| | 1 m/s | 2.23694 mph |
| Acceleration | 1 m/s ² | 3.28084 ft./s ² |
| Pressure | 1 bar | 14.5 psi |
| Temperature | °C | (°F-32) x 5/9 |
| Power | 1 kW | 1.34109 hp |

1. Safety instructions

1.1 General safety instructions

- The operator must ensure that the instructions are read by all persons tasked with working on the product or who supervise or instruct such persons. The operator must also ensure that the staff fully understands the content of the instructions. Putting the products into operation or operating them without having read the instructions is prohibited.
- Retain the instructions for further use.
- The products described here were manufactured according to the state of the art. Risks may, however, arise from non-compliant usage and may result in personal injury or damage to material assets.
- Any malfunctions which may affect safety must be remedied immediately. In addition to these instructions, the statutory regulations for accident prevention and environmental protection must be observed.

1.2 General behavior when handling the product

- The product may only be used in awareness of the potential dangers, in proper technical condition, and according to the information in this manual.
- Familiarize yourself with the functions and operation of the product. The specified assembly and operating steps and their sequences must be observed.
- Any unclear points regarding proper condition or correct assembly/operation must be clarified. Operation is prohibited until issues have been clarified.
- Unauthorized persons must be kept away.
- Wear personal protective equipment.
- All safety regulations and in-house instructions relevant to the particular activity must be observed.
- Responsibilities for different activities must be clearly defined and observed. Uncertainty seriously endangers safety.
- Protective and safety mechanisms must not be removed, modified, nor disabled during operation and must be checked for proper function and completeness at regular intervals.
- If protective and safety mechanisms must be removed, they must be reinstalled immediately following conclusion of work and then inspected for proper function.
- Any malfunctions that occur must be resolved according to responsibility. The supervisor must be notified immediately in case of malfunctions outside one's individual scope of responsibility.
- Never use any part of the centralized lubrication system as a stand or step or for climbing.

1.3 Intended use

On VP and VPK progressive metering devices, the number of cycles should be kept as low as possible by selecting high-volume progressive metering device sections. A maximum value of 200 cycles/min should not be exceeded. This also reduces pressure losses and noise levels.

In case of an installation on moving machine parts or in case of strong vibrations (e.g., on pressing machines), the piston position of the progressive metering device should not correspond with the direction of movement of the machine part.

VP, VPK, and VPB progressive metering devices are classified as a component according to the VDMA Position Paper "Umsetzung der Maschinenrichtlinie 2006/42/EG in Zentralschmiertechnik" (implementation of the Machinery Directive 2006/42/EC in centralized lubrication systems).

Any other or additional usage of VP, VPK, or VPB progressive metering devices is deemed non-compliant with the intended use and

could result in damage, malfunction, or even injury.

The progressive metering devices are designed for positively driven distribution of lubricants (oils/greases) in a centralized lubrication system.

The maximum inlet volumetric flow of the progressive metering devices is as follows
Series:

VP 1000 cm³/min

VPK 500 cm³/min

VPB 400 cm³/min.

On all series, the maximum permissible operating pressure for oil is 200 bar and 300 bar for grease.

The inlet and outlet fittings and their connecting lines must be designed for these parameters.

The technical requirements for the installation of the VP, VPK, and VPB progressive metering devices are set out in Chapter 6. These requirements must be complied with. The same applies to the technical data in Chapter 4.

When designing a progressive metering device, pay attention to the number of cycles (strokes).

1.4 Foreseeable misuse

Any usage of the product other than as specified in this manual is strictly prohibited. Particularly prohibited are:

- Use outside the specified operating temperature range
- Use of non-specified equipment
- Use without a pressure regulating valve
- Use in areas with aggressive, corrosive substances (e.g., high ozone loads)
- Use in areas with damaging radiation (e.g., ionizing radiation)
- Use to feed, forward, or store hazardous substances and mixtures as defined in Annex I Part 2-5 of the CLP Regulation (EC 1272/2008) that are marked with hazard pictograms GHS01-GHS 09

- Use to feed / forward / store gases, liquefied gases, dissolved gases, vapors, or fluids whose vapor pressure exceeds normal atmospheric pressure (1013 mbar) by more than 0.5 bar at their maximum permissible operating temperature
- Use in an explosion protection zone

1.5 Painting plastic components

The painting of all plastic components and seals of the products described here is prohibited.

Completely remove or mask affected components before painting the main machine.

1.6 Modifications to the product

Unauthorized modifications and changes can have an unpredictable effect on safety. Unauthorized modifications and changes are therefore prohibited.

1.7 Prohibition of certain activities

The following activities must be performed only by employees of the manufacturer or authorized persons due to possibly undetectable sources of error or due to statutory requirements:

1.8 Inspections prior to delivery

The following tests were performed prior to delivery:

- Safety and functional tests

1.9 Referenced documents

In addition to this manual, the following documents must be observed by the respective target group:

- Operational instructions, approval rules
- The safety data sheet of the lubricant used

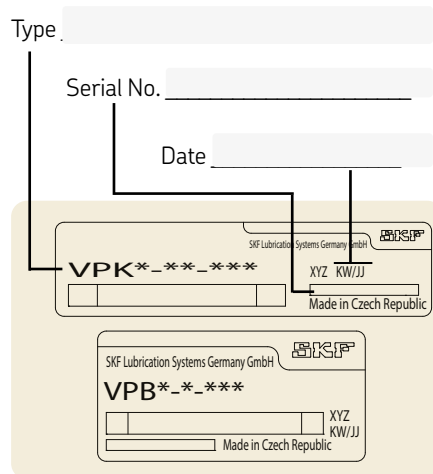
If necessary:

- Project planning documents
- Instructions from suppliers of purchased parts
- Instructions for other components for setting up the centralized lubrication system
- Other relevant documents for integration of the product into the main machine, system

1.10 Note on the type plate

The type plate provides important data such as the type designation, order number, etc.

To avoid loss of this data in case the type plate becomes illegible, these characteristics should be entered in the manual.



1.11 Note on Pressure Equipment Directive 2014/68/EU

Due to its performance characteristics, the product does not reach the limit values defined in Article 4, Paragraph 1, Subparagraph (a) item (i) and is, pursuant to Article 4, Paragraph 3, excluded from the scope of Pressure Equipment Directive 2014/68/EU.

1.12 Persons authorized to use the product

1.12.1 Operator

A person competent due to training, knowledge, and experience to execute the functions and activities associated with normal operation; this also includes the avoidance of possible hazards that may arise during operation.

1.12.2 Qualified mechanic

A person with appropriate technical training, knowledge, and experience who can recognize and avoid the hazards that may occur during transport, assembly, first start-up, operation, maintenance, repair, and dismantling

1.12.3 Qualified electrician

A person with appropriate technical training, knowledge, and experience who can recognize and avoid hazards that may result from electricity

1.13 Instruction of outside fitters

Before commencing work, the operator must inform outside fitters of the operational safety regulations, applicable accident prevention regulations, and the functions of the main machine and its protective devices.

1.14 Provision of personal protective gear

The operator must provide personal protective gear appropriate for the location and intended application.

1.15 Operation

The following must be observed during first start-up and operation:

- All information within this manual and all information within the referenced documents
- All laws and regulations that the operator must observe

1.16 Emergency shutdown

Shut down the product in an emergency by:

- Switching off the main machine in which the product is integrated
- If necessary, pressing the on/off switch on the main machine

1.17 Transport, assembly, maintenance, malfunction, repair, shutdown, disposal

- All relevant persons must be informed of the activity prior to the start of this work. Precautionary operational measures, work instructions must be observed.
- Transport only with suitable transport and lifting gear on suitable paths.
- Maintenance and repair work can be subject to restrictions at low or high tempera-

- tures (e.g., altered flow properties of the lubricant). Maintenance and repair work should therefore preferably be performed at room temperature.
- Prior to performing work, the product and the machine in which the product will be integrated must be de-energized, depressurized, and secured against unauthorized activation.
 - Take appropriate measures to ensure that moving, detached parts are immobilized during the work and that no limbs can be pinched by unintended movements.
 - Assemble the product only outside the operating range of moving parts, at an adequate distance from sources of heat or cold. Other units of the machine, the vehicle must not be damaged or impaired in their function by the installation.
 - Dry any wet, slippery surfaces or cover appropriately.
 - Cover hot or cold surfaces appropriately.
 - Work on electrical components may be performed only by qualified electricians. Note possible waiting times for discharge.
 - Do not touch cables or electrical components with wet or moist hands.
 - Drill required holes only on non-critical, non-load-bearing parts. Use existing boreholes. Do not damage lines or cables when drilling.
 - Observe any possible wearing spots. Protect components appropriately.
 - All components used must be designed for:
 - The maximum operating pressure
 - The maximum/minimum ambient temperature.
 - No parts may be subjected to torsion, shear, or bending.
 - Check parts for contamination before use and clean if necessary.
 - Lubrication piping should be filled with lubricant prior to assembly. This simplifies subsequent venting of the system.
 - Adhere to the specified torques. Use a calibrated torque wrench when tightening.
 - Avoid mixing up/incorrectly assembling disassembled parts. Label parts.

1.18 First start-up, daily startup

Ensure that:

- All safety mechanisms are fully present and functional.
- All connections are properly connected.
- All parts are correctly installed.

1.19 Cleaning

There is a fire hazard from the use of flammable cleaning agents. Use only non-flammable cleaning agents that are suitable for the intended purpose.

- Do not use corrosive cleaning agents.
- Do not use steam-jet equipment or high-pressure cleaners. This may damage electrical components.
Observe the IP protection class.
- Mark wet areas accordingly.

1.20 Residual risks

| Residual risk | Possible in lifecycle | Avoidance / Remedy |
|--|-----------------------|--|
| Personal injury / property damage due to falling of hoisted parts | A, B, C, G, H, K | Unauthorized persons must be kept away; nobody is allowed to be present below hoisted parts. |
| Personal injury/property damage due to tilting or falling product due to non-compliance with specified torques | B, C, G | Adhere to the specified torques. Secure the product only to components with a sufficient load-carrying capacity. If no torques are specified, use those specified for the screw size for screws of strength class 8.8. |
| Personal injury / property damage due to spilled, leaked lubricant | B, C, D, F, G, H, K | Be careful when connecting or disconnecting the lubricant piping. Use only hydraulic fittings and lubrication piping suitable for the specified pressure. Do not install lubrication piping on moving parts or wearing spots. If this cannot be avoided, use flexible hose lines or anti-kink coils and/or conduits. |
| Lifecycles: A = Transport, B = Assembly, C = First start-up, D = Operation, E = Cleaning, F = Maintenance, G = Malfunction, repair, H = Shutdown, K = Disposal | | |

2. Lubricants

2.1 General information

Lubricants are used specially for specific applications. To fulfill the task, lubricants must meet various requirements to varying degrees. The most important requirements for lubricants are:

- Reduction in friction and wear
- Corrosion protection
- Noise reduction
- Protection against contamination/ingress of foreign matter
- Cooling (primarily for oils)
- Durability (physical/chemical stability)
- Compatible with as many materials as possible
- Economic and environmental aspects

2.2 Selection of lubricants

SKF Lubrication Systems considers lubricants to be an element of system design. The selection of a suitable lubricant should reasonably be made during the design of the machine and forms the basis for planning the centralized lubrication system.

The manufacturer/operator of the machine should preferably make the selection with the supplier of the lubricant on the basis of the requirements profile of the specific task.

If you have no or little experience selecting lubricants for centralized lubrication systems, please contact SKF.

We gladly assist our customers in the selection of suitable components for feeding the selected lubricant and in the planning and design of a centralized lubrication system.

This will spare you potentially costly downtime due to damage to the machine/system

and/or damage to the centralized lubrication system.



Only lubricants specified for the product may be used (see “Technical data” chapter). Unsuitable lubricants may lead to failure of the product.



Do not mix lubricants. This can have unpredictable effects on the usability and this function of the centralized lubrication system.



Due to the large number of possible additives, it is possible that individual lubricants that meet the required specifications according to the manufacturer's data sheet are not suitable for use in centralized lubrication systems (e.g., incompatibility between synthetic lubricants and materials). To avoid this, always use lubricants that have been tested by SKF.

2.3 Material compatibility

The lubricants must generally be compatible with the following materials:

- Steel, gray cast iron, brass, copper, aluminum
- NBR, FKM (FPM), ABS, PA, PU

It is possible for lubricants to be tested in the company's laboratory for their suitability for pumping in centralized lubrication systems (e.g., "bleeding").

Please contact SKF if you have further questions regarding lubricants.

An overview of the lubricants we have tested is available on request.

2.4 Aging of lubricants

In case of extended machine downtime, check before re-commissioning that the lubricant is still suitable for use in terms of chemical and physical signs of aging. We recommend performing this inspection after one week of machine downtime.

In case of doubt regarding the suitability of the lubricant, replace it before putting back into operation and, if necessary, perform an initial lubrication manually.

3. Overview/functional description

3.1 Overview of progressive metering devices

Fig. 1 Type and size

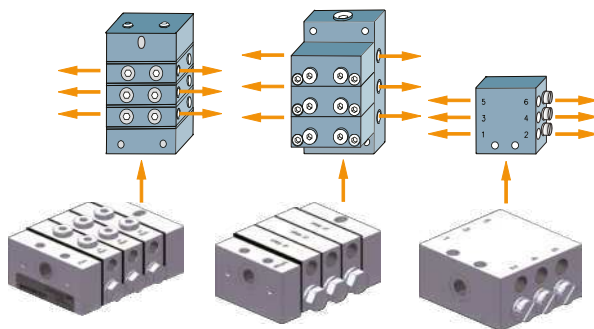
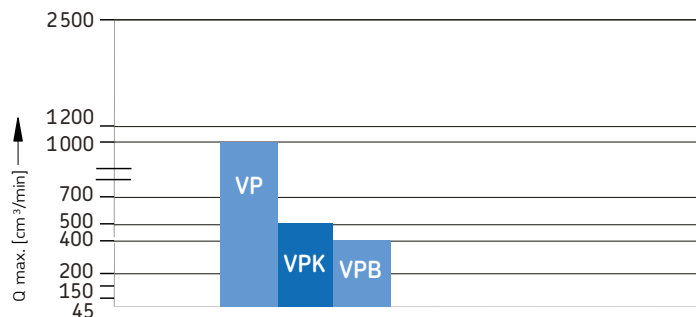


Figure 1 shows the VP, VPK, VPB, series of SKF progressive metering devices with their inlet volumetric flow data.

3.2 Information on volume data

In progressive metering devices, the nominal volume is indicated per stroke. This is calculated from the piston diameter and the maximum possible stroke of the particular metering piston, the maximum stroke. The maximum achievable piston capacity is typically used as the nominal volume when configuring a progressive metering device, though the movement of the piston is influenced by various factors such as:

- Differences in back pressures at the outlets, for example due to long tubing lengths or connected roller bearings or shaft bearings.

3. Overview/functional description

- Stroke frequency (dynamics)
- Working temperature, viscosity fluctuations due to strong temperature changes

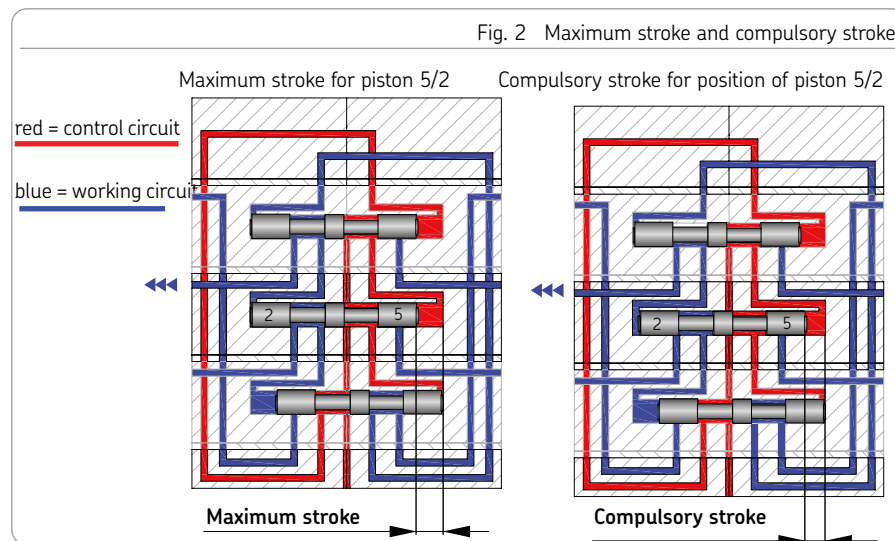
The maximum stroke and thus the piston capacity/metered quantity can reduce due to these factors.

The minimum piston stroke, also referred to as the compulsory stroke, is determined by the position of the control bores in the progressive metering device and the control edges on the metering piston. If only the compulsory stroke is performed, the metered quantity at the affected outlet is reduced, which also increasing the effective number of piston strokes. The theoretically determined number of piston strokes can therefore deviate from the actual measured value. This must be considered when evaluating pulses on progressive metering devices with a mounted piston detector.

The ratio of piston capacity per progressive metering device outlet determines the

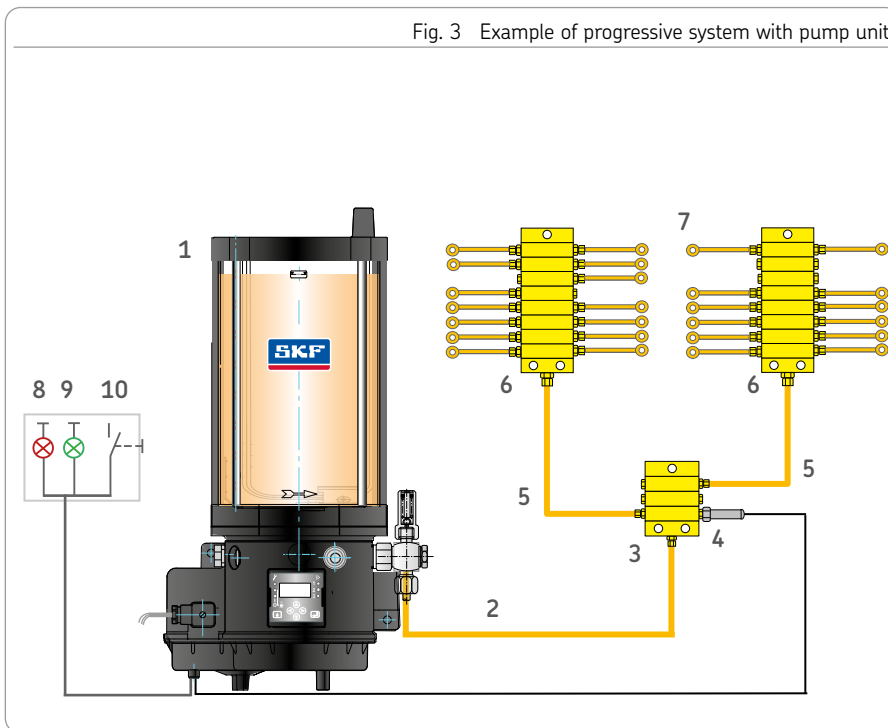
distribution ratio of the quantity of lubricant supplied to the progressive metering device. This distribution ratio is usually constant under all operating conditions.

Figure 2 shows the piston positions of a progressive metering device section at maximum stroke and at compulsory stroke (minimum stroke).



3.3 Overview of a general progressive system

Fig. 3 Example of progressive system with pump unit



Legend to Fig. 3

Progressive system with function monitoring

- 1 Pump unit with:
Pressure regulating valve
- Control unit
- Fill level control
- 2 Main lubricant line
- 3 Main metering device (VP)
- 4 Function monitoring (piston detector)
- 5 Lubricant branch lines
- 6 Secondary metering device (VPK)
- 7 Lubrication point lines
- 8 External fault indicator light
- 9 External pump operation monitoring
- 10 Pushbutton for intermediate lubrication

3.3.1 Functional description of a general progressive system

A general progressive metering device system consists of the following components:

- o Pump unit with pump element and pressure regulating valve
- o Possibly function monitoring (piston detector)
- o Main lubricant line
- o Main and possible secondary metering device
- o Branch and lubricant lines

When the pump motor is turned on, the lubricant pump delivers lubricant from its lubricant reservoir to the lubricant outlet. The pump element attached to the outlet delivers the lubricant further, into the downstream main line. The lubricant flows through the main line to the progressive metering device, where it is distributed according to the metered quantity required by the lubrication point being supplied. In progressive systems with a main metering device and secondary metering device,

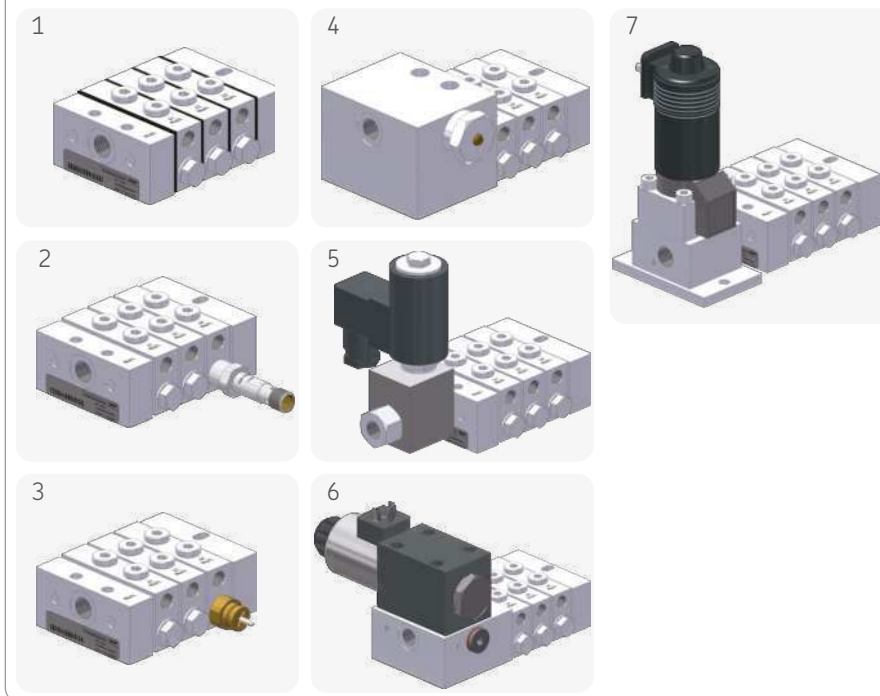
the lubricant coming from the pump unit is delivered to the main metering device. The main metering device distributes the lubricant to the secondary metering devices according to their individual volume requirements. From there, the lubricant flows to the lubrication points. Depending on the pump design with control unit, the following configuration, monitoring, and connections options are available:

- o Interval time and pump cycle time can be adjusted independently, including on monitored systems
- o Recording of remaining intervals and remaining lubrication times
- o Data backup in case of voltage failure
- o Non-volatile memory with PIN code protection
- o Connectivity for piston detectors to monitor the metering device function
- o Connectivity for an external fault indicator light

- o Connectivity for external fault pump operation monitoring
- o Connectivity for an external pushbutton to trigger an intermediate lubrication
- o Internal fill level monitoring; the lubrication cycle stops and fault notification is displayed if the level falls below minimum
- o Fault memory

3.4 Overview of VP progressive metering device series

Fig. 4 VP progressive metering device series



Legend to Fig. 4

- 1 VP progressive metering device, basic design for oil and grease, without attachments, without monitoring
- 2 VP with piston detector for oil or grease, monitoring types P2 and P3 (electric monitoring)
- 3 VP with cycle indicator for oil or grease, monitoring type ZY (visual monitoring)
- 4 VP with flow limiter for oil, attachment 07
- 5 VPG with 2/2 directional solenoid valve for oil, attachment 13 with 2/2 directional control valve, de-energized metering device relieved, only for VPG
- 6 VP with 4/2 and 3/2 directional solenoid valve for oil, attachments 08; 09; 14
- 7 VP with 2/2 directional solenoid valve for grease, attachment 15 with 2/2 directional control valve, de-energized, continuity to progressive metering device closed

The VP sectional progressive metering device is available in the designs VPM (metric threaded connectors) and VPG (inch threaded connectors).

With their progressive metering device sections (metering sections), VPM and VPG cover a nominal volume per outlet and cycle of 0.1 cm³ (twin section) to 1.2 cm³ (single section).

The inlet of the progressive metering device is located at an inlet section. The outlets are at the downstream progressive metering device sections. The delivery ducts are sealed by elastic seals (plates). An end section is located downstream of the last progressive metering device section.

All sections are interconnected with tie-rods. They seal the progressive metering device assembly.

The volumetric flow fed via a tube is forcibly distributed in a predetermined ratio to the outlets, i.e., to the lubrication points or the downstream progressive metering devices.

Pistons aligned in series meter the lubricant for two opposite outlets each and control the function of the neighboring piston. This way, the function of the sectional progressive metering device can be checked by monitoring any piston by means of a cycle indicator or piston detector.

Check valves integrated standard offer high functional reliability (at high or differing back pressures). They also provide accurate metering and safe blocking behavior, even for internal and external consolidation of lubricant outlets.

Progressive metering devices distribute a lubricant quantity delivered by a pump to multiple outlets. The individual metering device sections determine the quantity distribution. The different output quantities within a metering device are achieved by using various progressive metering device sections or consolidating two or more outlets.

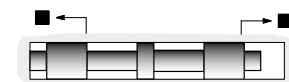
For the VPM and VPG sectional progressive metering devices, sections for two outlets

(T = twin) or for one outlet (S = single) are available. In case of single sections, the two opposite outlets are connected internally, whereby one outlet is closed. Each section is equipped with a lateral and an upper outlet per side. Only one outlet can be connected at a time. The second outlet must be blocked by either a plug screw, a blockage indicator, or a lubricant nipple. If necessary, crossporting bars can also be connected to the upper outlets.

A progressive metering device of the series VP consists of at least three to a maximum of ten progressive metering device sections.

Fig. 5 Consolidation of outlets

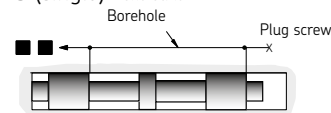
T (twin) = two outlets



Example:

| | |
|-------------|------------|
| 2T = 0.2 cm | per outlet |
| 3T = 0.3 cm | per outlet |
| 6T = 0.6 cm | per outlet |

S (single) = one outlet

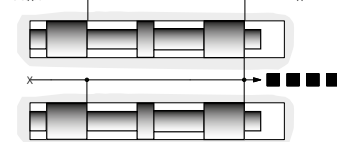


Example:

| | |
|-------------|---------------------------|
| 2S = 0.4 cm | per cycle from one outlet |
| 3S = 0.6 cm | per cycle from one outlet |
| 6S = 1.2 cm | per cycle from one outlet |

C (crossporting)

Consolidation of the four piston displacements to form one outlet



Example:

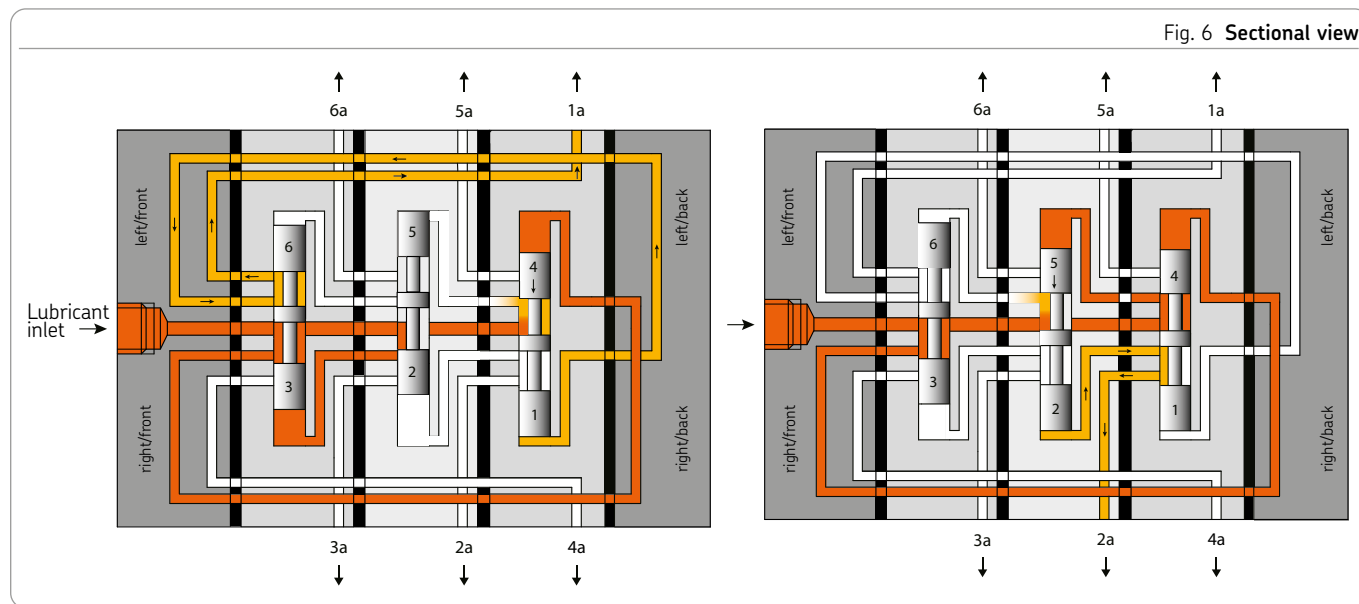
| | | |
|-----|----------|---------------------------|
| 2SC | = 0.8 cm | per cycle from one outlet |
| 2SC | | |

3.4.1 Functioning of a VP progressive metering device

The task of the progressive metering device is to consecutively distribute specified portions of the pressure-fed lubricant (grease or oil) to the connected lubrication points. The lubricant continues to discharge as long as it is pressure-fed to the progressive metering device. The specified portions are generated through the piston movement. Two lubricant outlets on the two end positions of the piston travel are allocated to each piston.

A progressive metering device contains between 3 and 10 pistons. If lubricant is pressure-fed, the pistons of a progressive metering device move sequentially to their end position. The piston movement displaces a portion of the lubricant that is upstream of the piston to the downstream outlet. A piston can start moving only after the upstream piston has been moved to its end position. If all pistons are in their left or right end position, internal connecting bores in the progressive metering device ensure that the pistons continue running reliably as defined. When all pistons have been moved once to the left end position as well as to the right

end position, all connected lubrication points have been supplied once with the preset lubricant quantity. The portions for both outlets are determined by the diameter and the travel of the piston. The selection of the required portion is made during the design of the progressive metering device. Retrofitting of the progressive metering device also changes all portions.

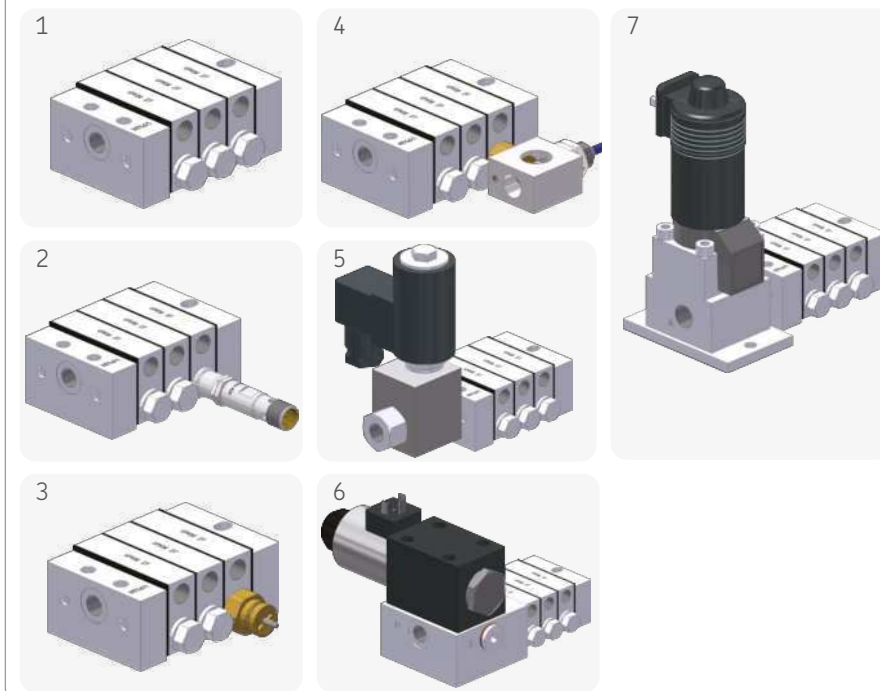


Piston lobe 4 is under pump pressure; piston lobe 1 has discharged to outlet 1a. The connection of main line to piston lobe 5 has been released due to movement of piston 1/4.

Piston lobe 5 has been actuated and piston lobe 2 delivers via outlet 2a. Piston lobe 6 is actuated next, etc.

3.5 Overview of VPK progressive metering device series

Fig. 7 VPK progressive metering device series



Legend to Fig. 7

- 1 VPK progressive metering device, basic design for oil and grease, without attachments, without monitoring
- 2 VPK with piston detector for oil or grease, monitoring types P2 and P3 (electric)
- 3 VPK with cycle indicator for oil or grease, monitoring type ZY (visual monitoring)
- 4 VPK with proximity switch for oil and grease, monitoring type ZS (electric monitoring)
- 5 VPKG with 2/2 directional solenoid valve for oil, attachment 13, only for VPG
- 6 VPK with 4/2 and 3/2 directional solenoid valve for oil, attachments 08; 09; 14
- 7 VPK with 2/2 directional solenoid valve for grease, attachment 15 with 2/2 directional control valve, de-energized, continuity to progressive metering device closed

The VPK sectional progressive metering device is available in the designs VPKM (metric threaded connectors) and VPKG (inch threaded connectors). With their metering sections, VPKM and VPKG cover a nominal volume per outlet and cycle of 0.05 cm^3 (twin section) to 0.6 cm^3 (single section). The inlet of the progressive metering device is located at an inlet section. The outlets are at the downstream progressive metering device sections. The delivery ducts are sealed by elastic seals (plates). An end section is located downstream of the last progressive metering device section.

All sections are interconnected with tie-rods. They seal the progressive metering device assembly.

The volumetric flow fed via a tube is forcibly distributed in a predetermined ratio to the outlets, i.e., to the lubrication points or the downstream progressive metering devices. Pistons aligned in series meter the lubricant for two opposite outlets each and control the function of the neighboring piston. This way,

the function of the sectional progressive metering device can be checked by monitoring any piston by means of a cycle indicator or piston detector.

Optional integrated check valves integrated offer high functional reliability (at high or differing back pressures). They also provide accurate metering and safe blocking behavior, even for internal and external consolidation of lubricant outlets.

Progressive metering devices distribute a lubricant quantity delivered by a pump to multiple outlets. The individual metering device sections determine the quantity distribution. The different output quantities within a metering device are achieved by using various progressive metering device sections or consolidating two or more outlets.

For main metering device/secondary metering device systems, check valves must be used on the metering device outlets of the main metering device.

For the VPKM and VPKG sectional progressive metering devices, progressive lubricant

metering device sections for two connections (T = twin) or for one connection (S = single) are available. In case of single sections, the two opposite outlets are connected internally, whereby one outlet is closed.

For the VPK progressive metering device, it is also possible to consolidate two neighboring outlets after the progressive metering devices have been completely installed.

A progressive metering device of the series VPK consists of at least three to a maximum of ten metering sections.

3.5.1 Functioning of a VPK progressive metering device

The task of the progressive metering device is to consecutively distribute specified portions of the pressure-fed lubricant (grease or oil) to the connected lubrication points.

The lubricant continues to discharge as long as it is pressure-fed to the progressive metering device. The specified portions are generated through the piston movement. Two lubricant outlets on the two end positions of the piston travel are allocated to each piston.

The number of pistons within a progressive metering device is variable from 3-10. If lubricant is pressure-fed, the pistons of a progressive metering device move sequentially to their end position. The piston movement displaces the lubricant upstream of the piston towards the downstream outlet. The piston movement can only start if the upstream piston has reached its end position. If all pistons are in their left or right end position, internal connecting bores in the progressive

metering device ensure that the pistons continue running reliably as defined.

If all pistons have moved once to the left end position as well as to the right end position, all connected lubrication points have been supplied once with the preset lubricant quantity.

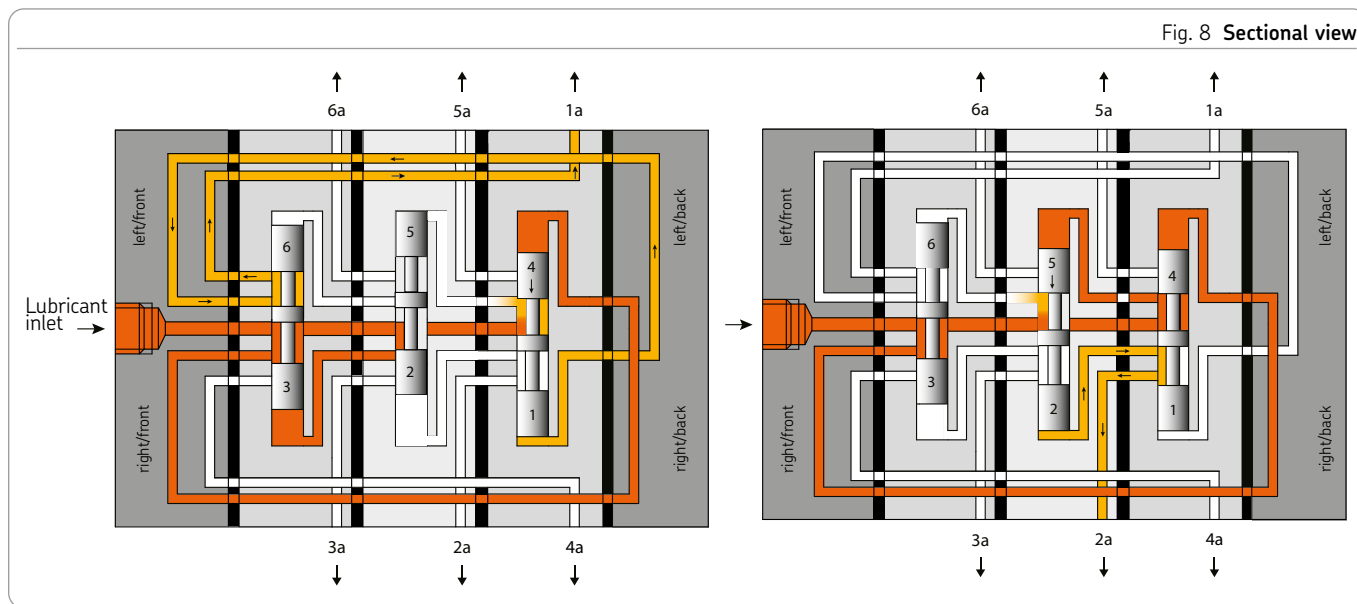
The portions for both outlets are determined by the diameter and the distance traveled by the piston.

The selection of the required portion is made during the design of the progressive metering device. A subsequent change of the portions is only possible through modification of the progressive metering device / replacement of the progressive metering device section.

Information on the design

The general criteria for the design of progressive metering devices also apply without restrictions to the sectional progressive metering devices. The most important criterion is the number of cycles (stroke rate). It should be kept as low as possible by selecting sections with a sufficiently high volume. A maximum value of 200 cycles/min should not be exceeded.

This also reduces pressure losses and noise levels. In case of an installation on moving machine parts or in case of strong vibrations (e.g. on pressing machines), the piston position of the progressive metering device should not correspond with the direction of movement of the machine part.

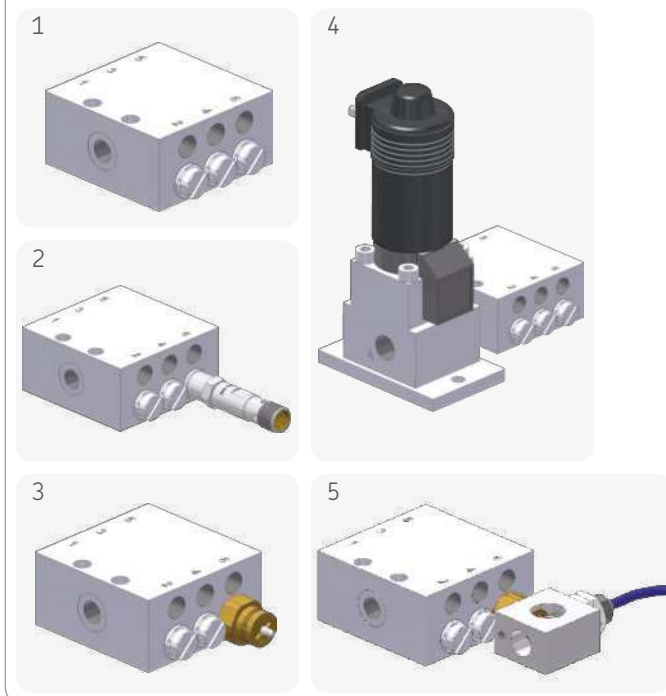


Piston lobe 4 is under pump pressure; piston lobe 1 has discharged to outlet 1a. The connection of main line to piston lobe 5 has been released due to movement of piston 1/4.

Piston lobe 5 has been actuated and piston lobe 2 delivers via outlet 2a. Piston lobe 6 is actuated next, etc.

3.6 Overview of VPB progressive metering device series

Fig. 9 VPB progressive metering device series



Legend to Fig. 9

- 1 VPB progressive metering device, basic design
for oil and grease, without attachments,
without monitoring
- 2 VPB with piston detector
for oil or grease, monitoring types P2 and
P3 (electric monitoring)
- 3 VPB with cycle indicator
for oil or grease, monitoring type ZY
(visual monitoring)
- 4 VPB with 2/2 directional solenoid valve
for grease, attachment 15 with
2/2 directional control valve,
de-energized, continuity to progressive
metering device closed
- 5 VPB with proximity switch
for oil and grease, monitoring type ZS
(electric monitoring)

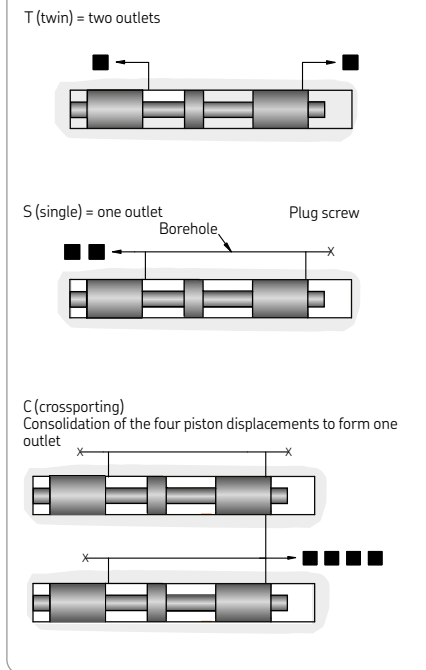
The VPB block metering device, which belongs to the progressive metering device range, is available in the designs VPBM (metric threaded connectors) and VPBG (inch threaded connectors).

VPBM and VPBG block metering devices are set to a non-adjustable nominal volume per outlet and cycle of 0.20 cm^3 . The volumetric flow fed via a tube is forcibly distributed in a predetermined ratio to the outlets, i.e. to the lubrication points or downstream progressive metering devices. Pistons aligned in series meter the lubricant for two opposite outlets each and control the function of the neighboring piston. This way, the function of the block metering device can be checked by monitoring any piston by means of a cycle indicator or piston detector.

Attachable check valves offer high functional reliability (at high or differing back pressures such as in grease systems). They also provide accurate metering and safe blocking behavior, even for internal and external consolidation of lubricant outlets.

Block metering devices distribute a quantity of lubricant delivered by a pump to multiple outlets at the same volumetric ratio. Different output quantities within a progressive metering device are achieved by consolidating two or more outlets. For grease systems with a main metering device and secondary metering device, check valves must be used on the metering device outlets of the main metering device. Opposite outlets can be consolidated by removing a blind screw. Additionally, optional crossporting bars can be attached to consolidate neighboring outlets.

Fig. 10 Consolidation of volumes



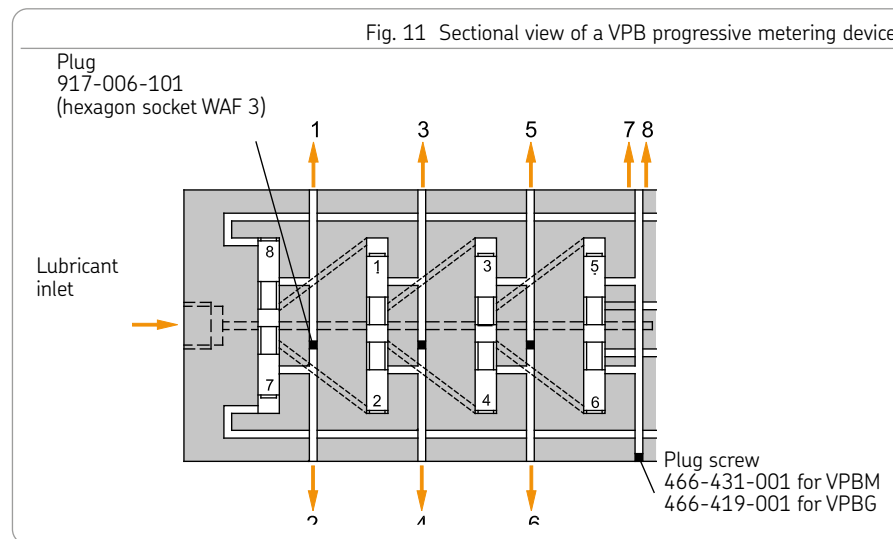
3.6.1 Functioning of a VPB progressive metering device

The task of the progressive metering device is to consecutively distribute specified portions of the pressure-fed lubricant (grease or oil) to the connected lubrication points. The lubricant continues to discharge as long as it is pressure-fed to the progressive metering device. The specified portions are metered by the piston movement. Two lubricant outlets on the two end positions of the piston travel are allocated to each piston. If lubricant is pressure-fed, all pistons of a progressive metering device move sequentially to their end position. The piston movement displaces a portion of the lubricant that is upstream of the piston to the downstream outlet. A piston can start moving only after the upstream piston has been moved to its end position. If all pistons are in their left or right end position, internal connecting bores in the progressive metering device ensure that the pistons continue running reliably as defined. When all pistons have been moved once to the left end position as well as to the right end position, all connected lubrication points have been supplied once with the

preset lubricant quantity. The metered volumes for both outlets are determined by the diameter and the travel of the piston. The selection of the required metered volume is made during the design of the progressive

metering device. A subsequent change of the portions is only possible through modification of the progressive metering device.

Fig. 11 Sectional view of a VPB progressive metering device



3.7 Design and functional description of piston detectors

3.7.1 Piston detector design

The universal piston detector 234-13163-9 and the bipolar piston detector 234-11454-1 are position sensors that, together with a pressure-resistant adapter, are screwed into the progressive metering device.

Through the closed adapter, the sensors detect the metering device piston without coming into direct contact with it. Hydraulic pressure spikes therefore do not act directly on the front sensor surface of the piston detectors.

There are different adapters depending on the progressive metering device series. These differ in terms of thread size and clearance. They are specifically tailored to the respective progressive metering device type and piston type.

The piston detectors automatically detect the clearance between the metering device piston and the piston sensor following several metering device strokes and adjust themselves automatically.

The universal piston detector automatically detects the customer's plug/cable assignment, 2-wire design or 3-wire design (with cable break protection).

The universal piston detector can be used for new lubrication systems. If replacing parts, it is not suitable for use in vehicle applications with a KFAS, KFBS or KFGS lubrication pump due to the undefined pin assignment. The bipolar piston detector should be used in this case.

The bipolar piston detector is available only in a two-wire design. The signal voltage can be applied to either pin 1 or pin 4.

3.7.2 Function

When the piston detector is actuated (piston stroke), a yellow LED lights up and indicates correct functioning of the piston detector.

The piston detector can be replaced subsequently during operation. However, the adapter must not be removed while removing the previous piston detector! Problems cannot occur in the stopper pressure range of the sensor surface/progressive metering device.

4. Technical data

4.1. Volume data for VP progressive metering device sections

4.1.1 Basic design of VP progressive metering device

Volume data for VP progressive metering device sections, Table 1

Max. inlet volume flow 1000 cm³/min

| Nominal volume | Minimum volume ¹⁾ | | |
|-----------------------------|--|-------------------|-----------------------------|
| (at maximum stroke) | (at compulsory stroke, design value only under difficult conditions) | | |
| Volume per cycle and outlet | Volume per cycle and outlet | Number of outlets | Description of the sections |
| [cm ³] | [cm ³] | | |
| 0.10 | 0.05 | 2 | 1T |
| 0.20 | 0.14 | 2 | 2T |
| 0.30 | 0.19 | 2 | 3T |
| 0.40 | 0.25 | 2 | 4T |
| 0.50 | 0.30 | 2 | 5T |
| 0.60 | 0.35 | 2 | 6T |
| 0.20 | 0.10 | 1 | 1S |
| 0.40 | 0.28 | 1 | 2S |
| 0.60 | 0.38 | 1 | 3S |
| 0.80 | 0.50 | 1 | 4S |
| 1.00 | 0.60 | 1 | 5S |
| 1.20 | 0.70 | 1 | 6S |

1) See explanation in Chapter 3.2, Information on volume data.

VP progressive metering device, basic design, Table 2

| | | |
|--|---|--|
| Type | | hydraulically controlled |
| Mounting position | | Any |
| Ambient temperature range | | -25 to + 90 °C |
| - with cycle indicator | | -20 to + 70 °C |
| - with piston detector | | -25 to + 85 °C |
| Progressive metering device sections | | See Table 1 |
| Used outlets, internal connection | | 3 to 20 |
| Used outlets, external connection | | 1 to 19 |
| Inlet thread | | |
| VPM (metric thread) | | M14x1.5 |
| VPG (inch thread) | | G1/4 |
| Outlet thread | | |
| VPM (metric thread) | | M10x1 |
| VPG (inch thread) | | G1/8 |
| Material | | |
| Inlet plate, separator plate and end plate | | Steel, tinned/nitrile-butadiene rubber |
| Sections | | Steel, galvanized |
| Hydraulic system | | |
| Operating pressure max.: | | Oil 200 bar, grease 300 bar |
| Volume per outlet and cycle | | See Table 1 |
| Lubricant | Mineral oils, greases based on mineral oil, environmentally friendly and synthetic oils and greases | |
| Dynamic viscosity | > 12 mm ² /s | |
| Worked penetration | ≥ 265 x 0.1 mm (up to NLGI Grade 2) | |

4.1.2 VP progressive metering device with piston detector

VP with piston detector, Table 3

VP progressive metering device

For further technical data, see the VP basic design

Piston detector -see Technical Data, Chapter 4.4.

4.1.3 VPG progressive metering device with 2/2 directional solenoid valve for oil, attachment 13

VP with 2/2 directional solenoid valve, attachment 13, Table 4

| | |
|---|---------------------------------|
| VP progressive metering device | |
| For further technical data, see the VP basic design | |
| Thread connection: | Inlet: G1/4" |
| Ambient temperature range | - 15 to + 75 °C |
| Hydraulic system | |
| Operating pressure max. | Oil 150 bar |
| Lubricant | Mineral oils and synthetic oils |
| Dynamic viscosity | 20-1000 mm ² /s |
| Electrical system | |
| Directional solenoid valve | |
| (When ordering, please state voltage, type of current, and frequency) | |
| Valve function | 2/2 directional solenoid valve |
| Type/operation | Pusher/solenoid |
| Basic position | De-energized open (NO) |
| Voltages | 24 V DC |
| Rated current | 1.3 A at 24 V DC ¹⁾ |
| ON-time | 100% ON-time |
| Protection class | IP 65 |
| Electrical connection | Plug / DIN 43650 |

1) Other operating voltage on request

4.1.4 VPG progressive metering device with 2/2 directional solenoid valve for grease, attachment 15

VP with 2/2 directional solenoid valve, attachment 15, Table 5

| | |
|---|--------------------------------|
| VP progressive metering device | |
| For further technical data, see the VP basic design | |
| Thread connection: | Inlet: G1/4" |
| Ambient temperature range | - 25 to + 80 °C |
| Hydraulic system | |
| Operating pressure max. | Grease 300 bar |
| Lubricant | Greases up to NLGI Grade 2 |
| Electrical system | |
| Directional solenoid valve | |
| Valve function | 2/2 directional solenoid valve |
| Type/operation | Spherical seat valve |
| Basic position | De-energized closed (NC) |
| Voltages | 24 V DC |
| Rated current | 0.67 A |
| Rated output | 16 W |
| ON-time | 100% ON-time (at max. +35°C) |
| Protection class | IP 65 |
| Electrical connection | Plug / DIN DIN 43650-AF3 |

4.1.5 VPG progressive metering device with 4/2 or 3/2 directional solenoid valve for oil, attachments 08; 09; 14

VP with 4/2 and 3/2 directional solenoid valve, attachments 08; 09; 14, Table 6

| | |
|---|---------------------------------|
| VP progressive metering device | |
| For further technical data, see the VP basic design | |
| Thread connection: | Inlet: G1/4" |
| Ambient temperature range | - 15 to + 75 °C |
| Hydraulic system | |
| Operating pressure max. | Oil 150 bar |
| Lubricant | Mineral oils and synthetic oils |
| Dynamic viscosity | 20-1000 mm ² /s |
| Electrical system | |
| Directional solenoid valve | |
| (When ordering, please state voltage, type of current, and frequency) | |
| Valve function | See Chapter 6.3.6 |
| Type/operation | Pusher/solenoid |
| Basic position | De-energized open (NO) |
| Voltages | 24 V DC |
| Rated current | 1.3 A at 24 V DC ¹⁾ |
| ON-time | 100% ON-time |
| Protection class | IP 65 |
| Electrical connection | Plug / DIN 43650 |

1) Other operating voltage on request

4.1.6 VP progressive metering device with flow limiter

VP with flow limiter, Table 7

| | |
|---|----------------------------------|
| VP progressive metering device | |
| For further technical data, see the VP basic design | |
| Type | 2 directional flow control valve |
| Mounting position | Any |
| Ambient and lubricant temperature range | 0 to 100 °C |
| Material | Steel, galvanized |
| Weight | 0.26 kg |
| Hydraulic system | |
| Viscosity | 20 - 600 mm ² /s |
| Nominal volumetric flow | See plug-in nozzles table |
| Operating pressure | 5 to 200 bar |
| Required differential pressure between inlet p ₁ and outlet p ₃ | ≥ 5 bar |

1) The values in the table are based on a differential pressure of 20 bar and viscosity of 300 mm²/s. Other differential pressures or viscosities result in slightly different delivery rates. These can be determined precisely using the charts for delivery quantities and correction factors for the pressure (see brochure 1-3028-EN).

Accessories – Table of plug-in nozzles for flow limiters, Table 8

| Nominal volumetric flow ¹⁾ [l/min] | Plug-in nozzle Ø mm | Order No. |
|--|------------------------|--------------|
| 0.081 | 0.50 | 24-0455-2574 |
| 0.115 | 0.55 | 24-0455-2575 |
| 0.150 | 0.60 | 24-0455-2576 |
| 0.207 | 0.65 | 24-0455-2577 |
| 0.252 | 0.70 | 24-0455-2578 |
| 0.290 | 0.75 | 24-0455-2579 |
| 0.345 | 0.80 | 24-0455-2580 |
| 0.411 | 0.85 | 24-0455-2581 |
| 0.468 | 0.90 | 24-0455-2582 |
| 0.559 | 0.95 | 24-0455-2583 |
| 0.650 | 1.00 | 24-0455-2584 |
| 0.730 | 1.05 | 24-0455-2585 |
| 0.794 | 1.10 | 24-0455-2586 |
| 0.884 | 1.15 | 24-0455-2587 |
| 0.978 | 1.20 | 24-0455-2588 |
| 1.087 | 1.25 | 24-0455-2589 |

1) At a dynamic viscosity of 300 mm²/s and 20 bar differential pressure; see brochure 1-3028-EN

4.2. Volume data for VPK progressive metering device sections

4.2.1 Basic design of VPK progressive metering device

Volume data for VPK progressive metering device sections,
Table 9

| Max. inlet volume flow 500 cm ³ /min | | | |
|--|--|-------------------|-----------------------------|
| Nominal volume | Minimum volume ¹⁾ | | |
| (at maximum stroke) | (at compulsory stroke, design value only under difficult conditions) | | |
| Volume per cycle and outlet | Volume per cycle and outlet | Number of outlets | Description of the sections |
| [cm ³] | [cm ³] | | |
| 0.05 | 0.04 | 2 | 05T |
| 0.10 | 0.08 | 2 | 1T |
| 0.20 | 0.14 | 2 | 2T |
| 0.30 | 0.18 | 2 | 3T |
| 0.10 | 0.08 | 1 | 05S |
| 0.20 | 0.16 | 1 | 1S |
| 0.40 | 0.28 | 1 | 2S |
| 0.60 | 0.36 | 1 | 3S |
| 1) See explanation in Chapter 3.2, Information on volume data. | | | |

Basic design of VPK progressive metering device, Table 10

| | | |
|--|---|--|
| Type | | hydraulically controlled |
| Mounting position | | Any |
| Inlet and outlet threads | | M10x1 |
| VPKM (metric thread) | | M10x1 |
| VPKG (inch thread) | | G1/8 |
| Ambient temperature range | | -25 to + 90 °C |
| - with cycle indicator | | -20 to + 70 °C |
| - with piston detector | | -25 to + 85 °C |
| Progressive metering device sections | | See Table 10 |
| Used outlets, internal connection | | 1 to 19 |
| Material | | |
| Inlet plate, separator plate and end plate | | Steel, tinned/nitrile-butadiene rubber |
| Sections (piston plates) | | Steel, galvanized |
| Hydraulic system | | |
| Operating pressure max.: | | Oil 200 bar, grease 300 bar |
| Volume per outlet and cycle | | See Table 9 |
| Lubricant | Mineral oils, greases based on mineral oil, environmentally friendly and synthetic oils and greases | |
| Dynamic viscosity | ≥ 12 mm ² /s | |
| Worked penetration | ≥ 265 x 0.1 mm (up to NLGI Grade 2) | |

4.2.2 VPK progressive metering device with piston detector

VPK with piston detector, Table 11

VPK progressive metering device

For further technical data, see VPK basic design

Piston detector -see Technical Data, Chapter 4.4.

4.2.3 VPK progressive metering device with proximity switch

VPK with proximity switch, Table 12

VPK progressive metering device

For further technical data, see VPK basic design

**Note!**

Proximity switch, can only be used with (NAMUR) switching amplifier!

| | |
|-------------------|--|
| Internal thread | M12x1 |
| Design | PVC, with 2 m cable, 2x 0.34 mm ² |
| Rated voltage | 8.2 V DC |
| Power consumption | conducting > 2.2 mA blocking < 1.0 mA |
| Protection class | IP 67 |
| Output function | Contact normally closed (NC) |

4.2.4 VPKG progressive metering device with 2/2 directional solenoid valve for oil, attachment 13

VPKG with 2/2 directional solenoid valve, attachment 13, Table 13

| | |
|---|---------------------------------|
| VPKG progressive metering device | |
| For further technical data, see VPK basic design | |
| Thread connection: | Inlet: G1/8" |
| Ambient temperature range | - 15 to + 75 °C |
| Hydraulic system | |
| Operating pressure max. | Oil 150 bar |
| Lubricant | Mineral oils and synthetic oils |
| Dynamic viscosity | 20-1000 mm ² /s |
| Electrical system | |
| Directional solenoid valve | |
| (When ordering, please state voltage, type of current, and frequency) | |
| Valve function | 2/2 directional solenoid valve |
| Type/operation | Pusher/solenoid |
| Basic position | De-energized open NO |
| Voltages | 24 V DC |
| Rated current | 1.3 A at 24 V DC ¹⁾ |
| ON-time | 100% ON-time |
| Protection class | IP 65 |
| Electrical connection | Plug / DIN 43650 |

1) Other operating voltage on request

4.2.5 VPKG progressive metering device with 2/2 directional solenoid valve for grease, attachment 15

VPK with 2/2 directional solenoid valve, attachment 15, Table 14

| | |
|--|--------------------------------|
| VPK progressive metering device | |
| For further technical data, see VPK basic design | |
| Thread connection: | Inlet: G1/4" |
| Ambient temperature range | - 25 to + 80 °C |
| Hydraulic system | |
| Operating pressure max. | Grease 300 bar |
| Lubricant | Greases up to NLGI Grade 2 |
| Electrical system | |
| Directional solenoid valve | |
| Valve function | 2/2 directional solenoid valve |
| Type/operation | Spherical seat valve |
| Basic position | De-energized closed NC |
| Manual actuation | Yes |
| Voltages | 24 V DC |
| Rated current | 0.67 A |
| Rated output | 16 W |
| ON-time | 100% ON-time (at max. +35°C) |
| Protection class | IP 65 |
| Electrical connection | Plug / DIN DIN 43650-AF3 |

4.2.6 VPK progressive metering device with 4/2 and 3/2 directional solenoid valve for oil, attachments 08; 09; 14

**VPK 4/2 and 3/2 directional solenoid valve, attachments 08; 09; 14,
Table 15**

| | |
|---|--------------------------------------|
| VPK progressive metering device | |
| For further technical data, see VPK basic design | |
| Thread connection: | Inlet: VPKM 10x1 VPKG G1/8" |
| Ambient temperature range | - 15 to + 75 °C |
| Hydraulic system | |
| Operating pressure max. | Oil 150 bar |
| Lubricant | Mineral oils and synthetic oils |
| Dynamic viscosity | 20-1000 mm ² /s |
| Electrical system | |
| Directional solenoid valve | |
| (When ordering, please state voltage, type of current, and frequency) | |
| Valve function | 4/2 (3/2) directional solenoid valve |
| Type/operation | Pusher/solenoid |
| Basic position | 4/2 open P > A 3/2 open B > T |
| Voltages | 24 V DC 1) |
| ON-time | 100% ON-time |
| Protection class | IP 65 |
| Electrical connection | Plug / DIN 43650 |
| 1) Other operating voltage on request | |

4.3. VPB volume data for progressive metering device outlets

Volume data for VPB progressive metering device outlets, Table 16

Max. inlet volume flow 400 cm³/min

| Nominal volume | Minimum volume ¹⁾ | | |
|-----------------------------|--|--|--|
| (at maximum stroke) | (at compulsory stroke, design value only under difficult conditions) | | |
| Volume per cycle and outlet | Volume per cycle and outlet | | |
| [cm ³] | [cm ³] | | |
| 0.20 | 0.13 | | |

¹⁾ See explanation in Chapter 3.2, Information on volume data.

4.3.1 Basic design of VPB progressive metering device

Progressive metering device VPB, basic design, Table 17

| | |
|-----------------------------|---|
| Type | hydraulically controlled |
| Mounting position | Any |
| Ambient temperature range | - 25 to + 110 °C |
| - with cycle switch | -15 to + 75 °C |
| Inlet thread | |
| VPBM (metric thread) | M10x1 |
| VPBG (inch thread) | G1/8" |
| Outlet thread | |
| VPM (metric thread) | M10x1 |
| VPG (inch thread) | G1/8" |
| Material | Steel, galvanized, optional stainless |
| Hydraulic system | |
| Operating pressure max.: | Oil 200 bar, grease 300 bar |
| Volume per outlet and cycle | See Table 16 |
| Lubricant | Mineral oils, greases based on mineral oil, environmentally friendly and synthetic oils and greases |
| Dynamic viscosity | > 12 mm ² /s |
| Worked penetration | ≥ 265 x 0.1 mm (up to NLGI Grade 2) |

4.3.2 VPB progressive metering device with piston detector

VPB with piston detector, Table 18


VPB progressive metering device

For further technical data, see VPB basic design

Piston detector -see Technical Data, Chapter 4.4.

4.3.3 VPB progressive metering device with proximity switch

VPK with proximity switch, Table 19

| | |
|--|--|
| VPK progressive metering device | |
| For further technical data, see VPK basic design | |
| Note! | |
|  Proximity switch, can only be used with (NAMUR) switching amplifier! | |
| Internal thread | M12x1 |
| Design | PVC, with 2 m cable, 2x 0.34 mm ² |
| Rated voltage | 8.2 V DC |
| Power consumption | conducting > 2.2 mA blocking < 1.0 mA |
| Protection class | IP 67 |
| Output function | Contact normally closed (NC) |

4.3.3 VPB progressive metering device with 2/2 directional solenoid valve for grease, attachment 15

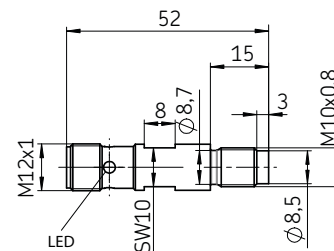
VPB with 2/2 directional solenoid valve, attachment 15, Table 20

| | |
|--|--------------------------------|
| VPB progressive metering device | |
| For further technical data, see VPB basic design | |
| Thread connection: | Inlet: G1/4" |
| Ambient temperature range | - 25 to + 80 °C |
| Hydraulic system | |
| Operating pressure max. | Grease 300 bar |
| Lubricant | Greases up to NLGI Grade 2 |
| Electrical system | |
| Directional solenoid valve | |
| Valve function | 2/2 directional solenoid valve |
| Type/operation | Spherical seat valve |
| Basic position | De-energized closed (NC) |
| Manual actuation | Yes |
| Voltages | 24 V DC |
| Rated current | 0.67 A |
| Rated output | 16 W |
| ON-time | 100% ON-time (at max. +35°C) |
| Protection class | IP 65 |
| Electrical connection | Plug / DIN DIN 43650-AF3 |

4.4 Piston detectors

| General data | | Designation |
|------------------------|------|---|
| Field of application | | Lubricant metering devices |
| Ambient temperature | [°C] | -40+85 |
| Principle of operation | | Piston detector/position sensor |
| Material | | Housing: Stainless steel; plug: PEI |
| Mounting type | | Mountable flush in associated adapter |
| Tightening torque | [Nm] | 7 ±0.5 |
| Circuit state display | LED | Yellow/lights up on damping |
| Electrical connection | | M12x1 plug-in connection, gold-plated contact |

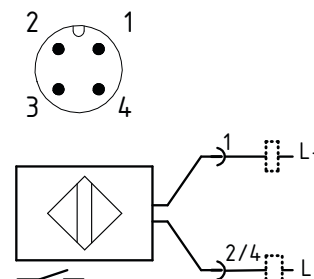
Dimension drawing





| Sensing range | | |
|---|-----------|---|
| Sensing distance | [mm] | 2.6 condition on delivery |
| Effective sensing distance (Sr) | [mm] | 2.6 ±10% |
| Sensing distance after 3x 0....4.2 mm strokes | [mm] | 3.3 ±20%, tracked |
| Hysteresis | [% of Sr] | ≤ 20 / ≤ 25, tracked |
| Accuracy/deviations | | |
| Switching point | [% of Sr] | ±10% |
| Reproducibility | [% of Sr] | ±10% |
| Permiss. operating pressure with associated adapter | [bar] | Identical to permiss. operating pressure of the progressive metering device in which the sensor with adapter is installed |

Universal piston detector

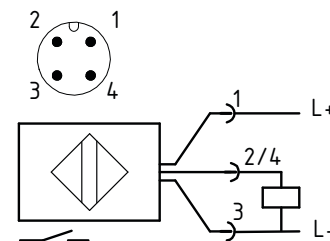
Connector pin assignment without cable break protection 2-wire DC PNP/NPN



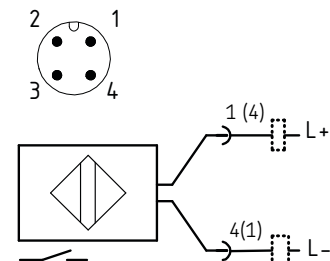
| Electrical data | | Universal piston detector | Bipolar piston detector |
|---|------|---|--|
| Design | | 3-wire DC PNP 2-wire DC PNP/NPN | 2-wire DC PNP/NPN |
| Operating voltage | [V] | 10-36 DC, supply class 2 per cULus | |
| Power consumption | [mA] | < 5 | |
| Safety class | | III | |
| Polarity reversal protection | | Yes | Reversible |
| Output function | | NO-contact | |
| Voltage drop | [V] | 3.5 | 4.5 |
| Minimum load current | [mA] | 5 | |
| Residual current | [mA] | < 0.8 | |
| Current-carrying capacity | [mA] | 100 | |
| Short-circuit-proof | | Yes | |
| Overload-proof | | Yes | |
| Switching frequency | [Hz] | 10, with damping surface Ø 4mm to 7 Hz | |
| Protection class | [IP] | IP65 / IP68 / IP69K; with cable box screwed on properly | |
| Visual differentiation The bipolar piston detector is equipped with a black marking ring. | |  |  |

Universal piston detector

Connector pin assignment with cable break protection 3-wire DC PNP

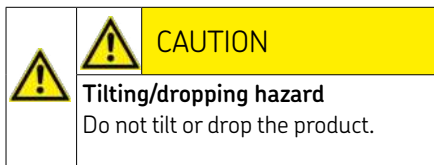


Bipolar piston detector



5. Delivery, returns, and storage

SKF Lubrication Systems Germany GmbH products are packaged in accordance with standard commercial practice according to the regulations of the recipient's country and DIN ISO 9001. During transport, safe handling must be ensured and the product must be protected from mechanical effects such as impacts. The transport packaging must be marked "Do not drop!"



There are no restrictions for land, air, or sea transport.

After receipt of the shipment, the product(s) must be inspected for damage and for completeness according to the shipping docu-

ments. The packaging material must be preserved until any discrepancies are resolved.

SKF Lubrication Systems Germany GmbH products are subject to the following storage conditions:

5.1 Lubrication units

- o Ambient conditions: dry and dust-free surroundings, storage in well ventilated dry area
- o Storage time:
 - Unfilled: max. 24 months
 - Filled: max. 12 months
- o Permissible humidity: < 65%
- o Storage temperature: + 10 - +40°C
Light: Avoid direct sun or UV exposure and shield nearby sources of heat

5.2 General notes

- o The product(s) can be enveloped in plastic film to provide low-dust storage.
- o Protect against ground moisture by storing on a shelf or wooden pallet.
- o Bright-finished metallic surfaces, especially wearing parts and assembly surfaces, must be protected using long-term anti-corrosive agents before storage.
- o At approx. 6-month intervals:
- o Check for corrosion. If there are signs of corrosion, reapply anti-corrosive agents.
- o Drives must be protected from mechanical damage.

6. Assembly

6.1 General information

Only qualified technical personnel may install, operate, maintain, and repair the progressive metering devices described in the lifecycle manual. Qualified technical personnel are persons who have been trained, assigned, and instructed by the operator of the final product into which the progressive metering devices are incorporated.

Such persons are familiar with the relevant standards, rules, accident prevention regulations, and operating conditions as a result of their training, experience, and instruction. They are qualified to carry out the required activities and in doing so recognize and avoid potential hazards.

The definition of qualified personnel and the prohibition against employing non-qualified personnel are laid down in DIN VDE 0105 and IEC 364.

Before assembling/setting up the product, the packaging material and any shipping braces (e.g., plugs) must be removed. The packaging material must be preserved until any discrepancies are resolved.



IMPORTANT NOTE

Environmental pollution

Lubrication lines must always be free of leaks. Lubricants can contaminate soil and waterways. Lubricants must be used and disposed of properly. Observe the local regulations and laws regarding the disposal of lubricants.

6.2 Installation information

Progressive metering devices of series VP, VPK, and VPB are designed for positively driven distribution of lubricants (oils/greases) in a centralized lubrication system. The progressive metering devices can be used in the context of the technical specifications given in the chapter "Technical data." They can be mounted in any alignment. In case of installation on moving machine parts or in case of strong vibrations (e.g., on pressing machines), the piston position of the progressive metering device must not correspond with the direction of movement of the machine part.

To prevent flow resistance, ensure that both the customer's supply line and the output lines are sufficiently large.

Changing the number of sections and/or metering rate of individual sections while retaining the same quantity of grease supply changes all lubrication quantities of the outlets.



The progressive metering device should be installed in an easily accessible position that protects it from humidity and vibration.

The minimum installation dimensions should be adhered to so that all other components can be connected later without problems.

During assembly and during any drilling work, always pay attention to the following:

- o Before installing the progressive metering device, ensure that all holes, fittings, and connecting lines in contact with the progressive metering device are clean and free of metal chips.
- o Existing supply lines must not be damaged by assembly work.
- o Other units must not be damaged by assembly work.

- o The progressive metering device must not be installed within range of moving parts.
- o The progressive metering device must be installed at an adequate distance from sources of heat.
- o Maintain safety clearances and comply with local regulations for assembly and accident prevention.

| | |
|---|---|
|  |  WARNING |
| | Supply lines or moving parts When drilling the assembly holes, you must be careful of any supply lines or other units, as well as of other hazards such as moving components. Maintain safety clearances and comply with local regulations for assembly and accident prevention. |

IMPORTANT NOTE

Follow the safety instructions on the lubricant's safety data sheet.

IMPORTANT NOTE

Observe technical data (Chapter 4).

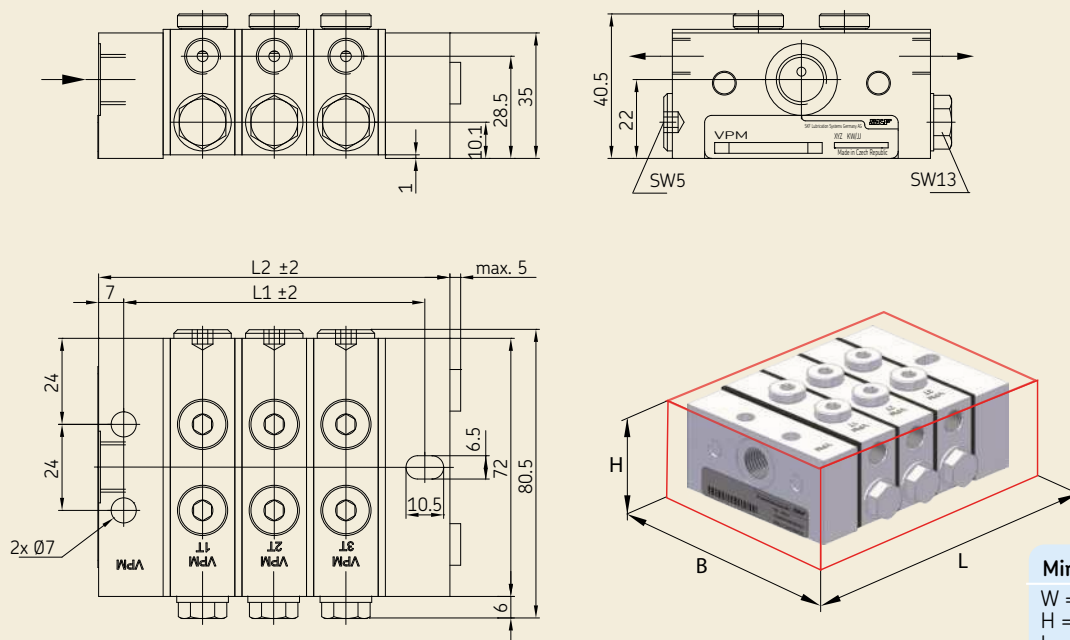
6.2.1 Minimum mounting dimensions

To ensure enough space for maintenance work and for any disassembly of the product, ensure that the minimum mounting dimensions listed below (Figs. 15 and 38) are maintained.

6.3 VP port dimensions, assembly holes, and minimum mounting dimensions

6.3.1 VP in basic design

Fig. 12 VP progressive metering device in basic design



VP dimensions

| Thread connection | | | | | |
|-------------------|--|----------------------------|---------|-------|--------|
| VPM | Inlet: | M14×1.5 | Outlet: | M10×1 | |
| VPG | | G1/4" | | G1/8" | |
| Type | Number of progressive metering device sections | Number of possible outlets | L1 | L2 | Weight |
| | | | [mm] | [mm] | [kg] |
| VPM-3 / VPG-3 | 3 | 6 | 84 | 98 | 1.73 |
| VPM-4 / VPG-4 | 4 | 8 | 104 | 118 | 2.1 |
| VPM-5 / VPG-5 | 5 | 10 | 124 | 138 | 2.47 |
| VPM-6 / VPG-6 | 6 | 12 | 144 | 158 | 2.84 |
| VPM-7 / VPG-7 | 7 | 14 | 164 | 178 | 3.21 |
| VPM-8 / VPG-8 | 8 | 16 | 184 | 198 | 3.58 |
| VPM-9 / VPG-9 | 9 | 18 | 204 | 218 | 3.95 |
| VPM-10/VPG-10 | 10 | 20 | 224 | 238 | 4.32 |

6.3.2 VP tightening torques

| | |
|--|-----------------|
| The specified torques must be observed during assembly and repair. | |
| Tie-rod (starter plate) (M8) | 2.5 Nm ± 0.1 Nm |
| Nut for tie-rod (M8) | 50 Nm ± 1.0 Nm |
| Outlet fittings | |
| Type of fitting | |
| Sealing with O-ring | 10 Nm ± 1.0 Nm |
| Sealing with EOlasic ring | 10 Nm ± 0.1 Nm |
| Sealing with copper or aluminum ring | 15 Nm ± 1.5 Nm |
| Sealing by sealing edge, with Loctite 243 | 15Nm ± 1.5 Nm |
| Sealing with Conical nipple ¹⁾ | 15Nm ± 1.5 Nm |
| 1) Minimum of 9 Nm at drying time of > 1h sufficient | |

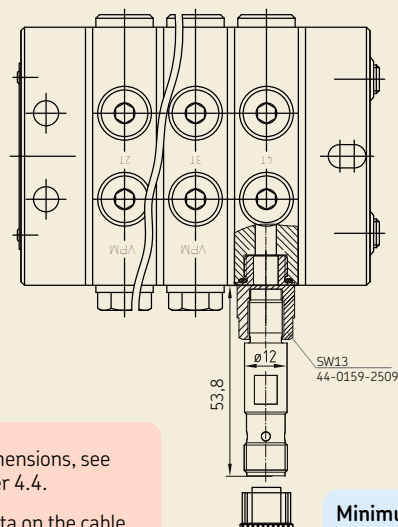
IMPORTANT NOTE

Inlet and outlet fittings - see Chapter 12.1.

6.3.3 VP with piston detector for oil or grease

Monitoring types P2 / P3 (electric monitoring)

Fig. 13 VP progressive metering device with piston detector



Note!

For piston detector dimensions, see Technical Data, Chapter 4.4.

Additional technical data on the cable sockets can be found in brochure "Electrical Plug and Socket Connectors," brochure No. 1-1730-EN.

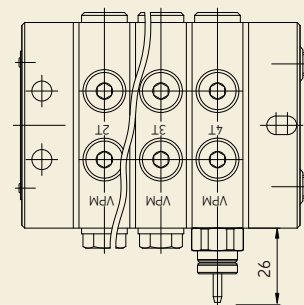
Minimum mounting dimensions

| | |
|------------|----------|
| W = width: | 160 mm |
| H = height | 45 mm |
| L = Length | L2+10 mm |

6.3.4 VP progressive metering device with cycle switch

for oil or grease, monitoring type ZY

Fig. 14 VP progressive metering device with cycle indicator



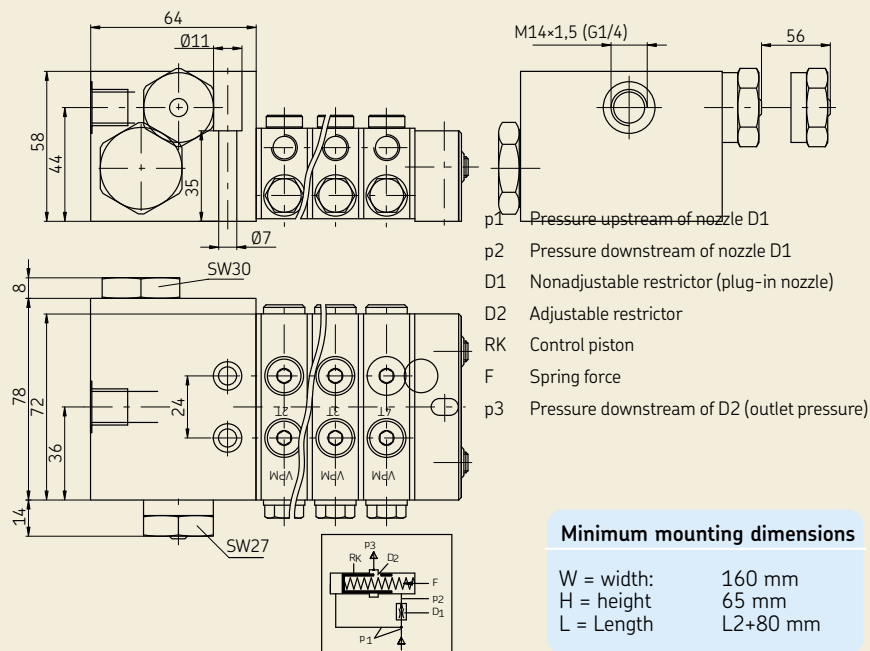
Minimum mounting dimensions

| | |
|------------|----------|
| W = width: | 130 mm |
| H = height | 45 mm |
| L = Length | L2+10 mm |

6.3.5 VP progressive metering device with flow limiter

for oil, attachment 07

Fig. 15 VP progressive metering device with flow limiter



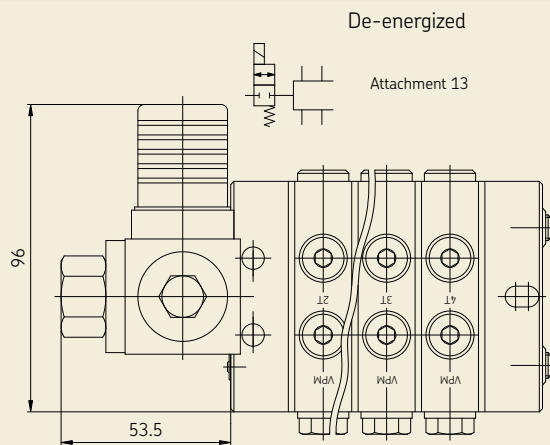
Functioning of the flow limiter

The flow limiter installed on the VP progressive metering device has two restrictors installed in series (**D₁**, **D₂**). Restrictor **D₁** is an interchangeable plug-in nozzle which, as a nonadjustable restrictor, determines the rated volumetric flow. The nonadjustable restrictor **D₁** is available in different nozzle sizes (see table). Restrictor **D₂**, on the other hand, is adjustable and has a variable nozzle size depending on the position of control piston **RK**. Displacement of the control piston (**RK**) against the spring force (**F**) automatically changes the flow resistance of restrictor **D₂** in such a way that the differential pressure at nonadjustable restrictor **D₁** remains constant, as does the volumetric flow as a result.

6.3.6 VPG progressive metering device with 2/2 directional solenoid valve

for oil, attachment 13, 2/2 directional solenoid valve, de-energized, progressive metering device relieved, only design VPG

Fig. 16 VPG progressive metering device with 2/2 directional solenoid valve



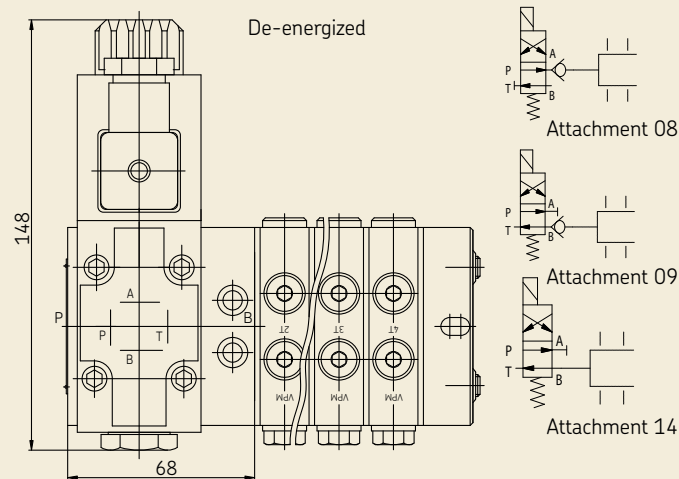
Minimum mounting dimensions

| | |
|-------------|----------|
| W = width: | 110 mm |
| H = height: | 135 mm |
| L = Length: | L2+80 mm |

6.3.7 VP progressive metering device with 4/2 or 3/2 directional solenoid valve

for oil, attachments 08; 09; 14

Fig. 17 VP progressive metering device with 4/2 and 3/2 directional solenoid valve



Note

For attachment 09 and attachment 14, the plug screw and the corresponding sealing ring must be ordered separately.

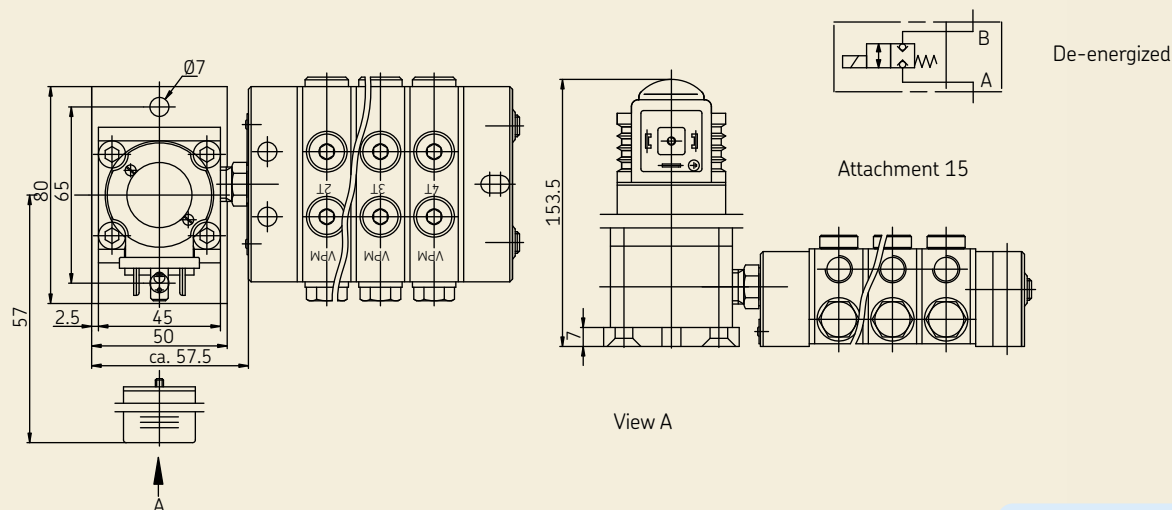
Minimum mounting dimensions

| | |
|-------------|----------|
| W = width: | 200 mm |
| H = height: | 185 mm |
| L = Length: | L2+90 mm |

6.3.8 VP progressive metering device with 2/2 directional solenoid valve

for greases, attachment 15 with 2/2 directional solenoid valve, de-energized, continuity to progressive metering device closed

Fig. 18 VP progressive metering device with 2/2 directional solenoid valve



Note!
Additional technical data on the cable sockets can be found in brochure "Electrical Plug and Socket Connectors," brochure No. 1-1730-EN.

Note!
Progressive metering device and directional solenoid valve are delivered separately. They are assembled by the customer.

Minimum mounting dimensions

| | |
|------------|----------|
| W = width: | 120 mm |
| H = height | 170 mm |
| L = Length | L2+60 mm |

6.3.9 Assembly of the VP progressive metering device

– See Chapter 6.3.1, Figure 15

IMPORTANT NOTE

In case of installation on moving machine parts or in case of strong vibrations (e.g., on pressing machines), self-locking screws or a locking adhesive should be used for installation of the progressive metering device.

- Check the parallelism of the surface on which the component is to be installed. Stress-free installation of the component must be ensured.
- Check for any fouling on the threaded holes for progressive metering device installation and on the surface on which the component is to be installed, and clean if needed.

The progressive metering device is installed using 3x M6 screws. If M6 threaded holes are used to fasten the unit,

the screws must have a minimum length of 40 mm.

Fastening material to be provided by the customer:

- o Hexagon head screws (3x) according to EN ISO 4017, M6x45–8.8
- Drill assembly holes (M6) according to assembly drawing (Fig. 14) and the conditions on the surface.
- Clean surface to remove drilling chips.
- Place the progressive metering device on the surface and roughly align it.
- Pass hexagon head screws (3x) according to EN ISO 4017, M6x45–8.8 through fixing holes on the progressive metering device and apply the screws to the M6 threads of the surface.
- Gently tighten hexagon head bolts (3x).

- Align the progressive metering device and tighten the hexagon socket head cap screws diagonally with a torque of 9 Nm
- Apply outlet fittings or SKF quick disconnect couplings to the threads of the outlet bores and tighten with the prescribed torque (Chapter 6.3.2).

6.3.10 Changing VP progressive metering device sections

-see Figure 22

IMPORTANT NOTE

Absolute cleanliness is required when changing one or more progressive metering device sections!

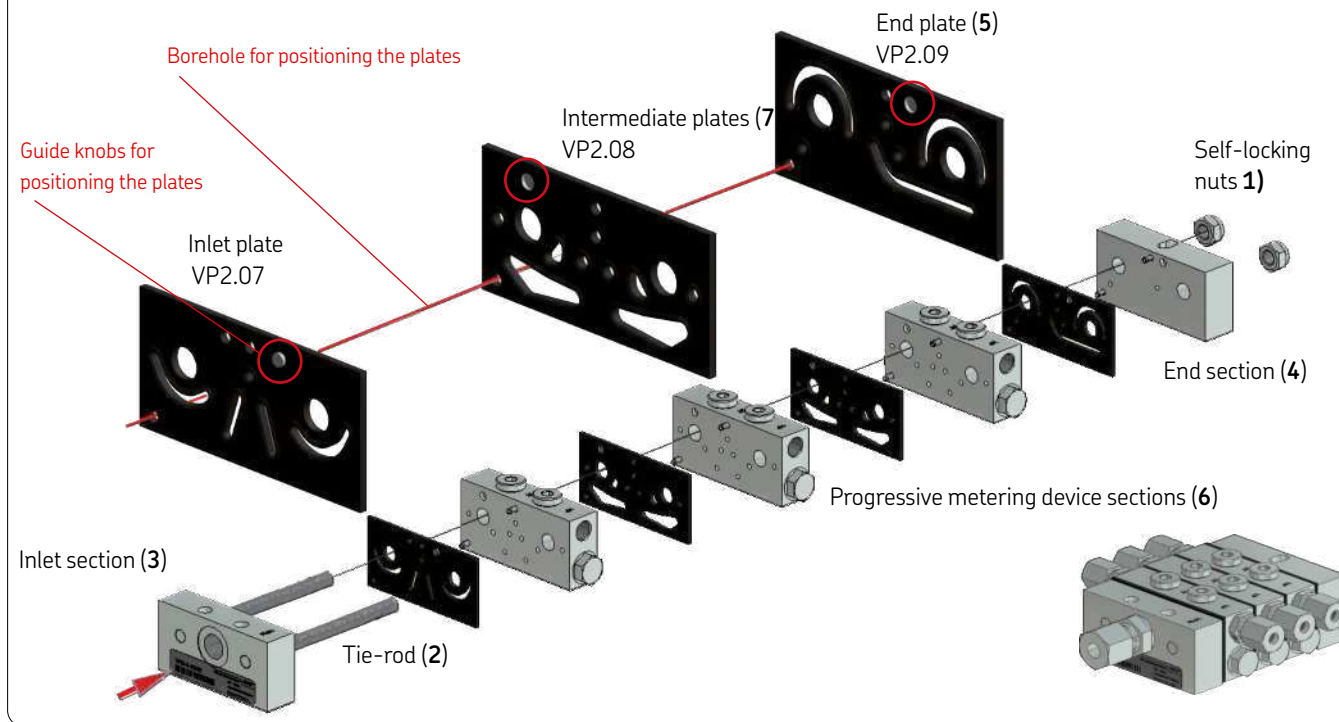
The progressive metering device must be cleaned thoroughly prior to the retrofitting procedure, and the workspace must be free of contaminants and dust.

The progressive metering device has already been disassembled, inlet and outlet fittings and mounting screws must already be removed.

Intermediate plates are located between the progressive metering device sections. They connect the mating boreholes within the sections while also sealing the system against outside influences. Different plates belong to the inlet, progressive metering device, and end section.

- Clean any contamination from progressive metering device, place on a clean installation surface or clamp into a vice in a stress-free position.
- Loosen and remove both self-locking nuts (1) from the tie-rods (2).
- ☞ If the tie-rod (2) comes out too when unscrewing the self-locking nuts (1), first remove the self-locking nut from the tie-rod. The tie-rod's thread must not be damaged in the process. In place of the self-locking nut, install two nuts and position them against each other. Apply locking adhesive at the other end of the tie-rod and then use the locknuts to screw the tie-rod into the inlet section (3) with a torque of 2.5 Nm. Then remove the locknuts.
- Carefully loosen the end section (4) with end plate (5) from the progressive metering device sections (6) and
- and intermediate plates (7) and remove them from the tie-rods (2).
- ☞ While performing the following installation of the new progressive metering device sections (6) and intermediate plates (7), be sure that they are mounted in the correct position (see Fig. 22, assembly knobs).
- Carefully insert new progressive metering device sections (6) with new intermediate plates (7) into the tie-rods.
- Carefully insert the end plate (5) with end section (4) into the tie-rods and align the inlet section, metering sections, intermediate plate, and end plate as well as the end section to one another.
- Apply self-locking nuts (1) to tie-rods (2) and tighten alternately up to a torque of 20 Nm each.
- Reinstall the progressive metering device and check that it is properly sealed.

Fig. 19 Assembly of a three-port VP progressive metering device



6.3.11 Connecting outlets on the VPM

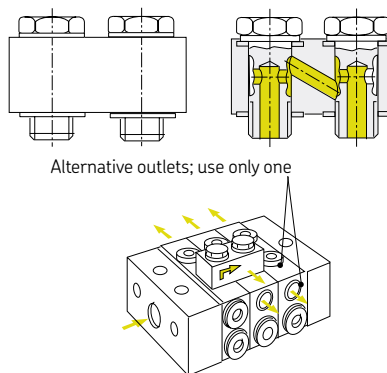
In the VPM series, the progressive metering device sections have two outlets on each side, one on the side and one on the top, however only one may be used. The second outlet must always be kept closed. Outlets can only be subsequently consolidated by using a VP-C crosssporting bar that is screwed in the upper alternative outlets. Any odd number of outlets can be achieved with the help of single sections without additional crosssporting bars.

IMPORTANT NOTE

Use only one outlet, either outlet top or side.
Crosssporting is possible in both directions.

Fig. 20 Attachment of a VPM crosssporting bar

Crosssporting bars, design complete with banjo bolt and sealing rings.
Order No. for VP-C



6.3.12 Modification of a piston detector



WARNING




System pressure

Pressure must not be applied to the progressive metering device section during the retrofitting described below. Depressurize the progressive metering device.

Retrofitting of the piston detector from a right-sided attachment to left-sided attachment is described below. The steps are identical for reverse retrofitting from left to right.

- Depressurize the lubrication system and progressive metering device.
- If possible, place a drip pan for the discharging lubricant below the progressive metering device.
- Loosen electrical power lead.

- Loosen plug screw (1) (left) and remove with O-Ring (2) (hexagon socket screw key WAF 5).
- Loosen piston detector (3) (right) (WAF 10), loosen adapter for piston detector (3a) (WAF 17), and remove together with O-ring (4).
- Carefully push piston (5) out of the left side of the progressive metering device section (6) using an arbor ($\varnothing 6$ mm).
-  During subsequent insertion of the piston (5), ensure that it does not bend and that its O-ring is not sheared off.
- Turn piston (5) 180° and carefully insert into the right side of the progressive metering device section (6).
- Install the plug screw (1) with O-ring (2) on the right side.
- Apply adapter for piston detector (3a) with new O-ring (4) on the left side of the module housing.
- Tighten adapter with the prescribed torque.
VP WAF 17= **20*1Nm**
- Install the piston detector (3) finger-tight on the left side.

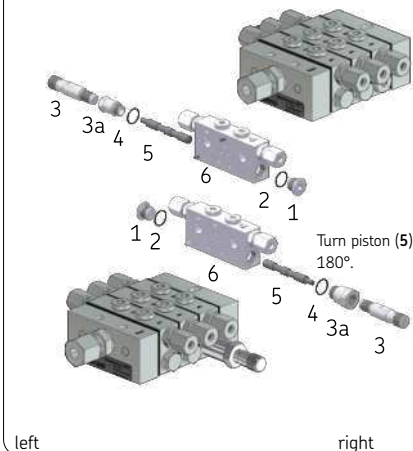


Avoid uncontrolled tightening of the piston detector, as this could cause damage.

Maintain tightening torque of 7 ± 0.5 Nm.

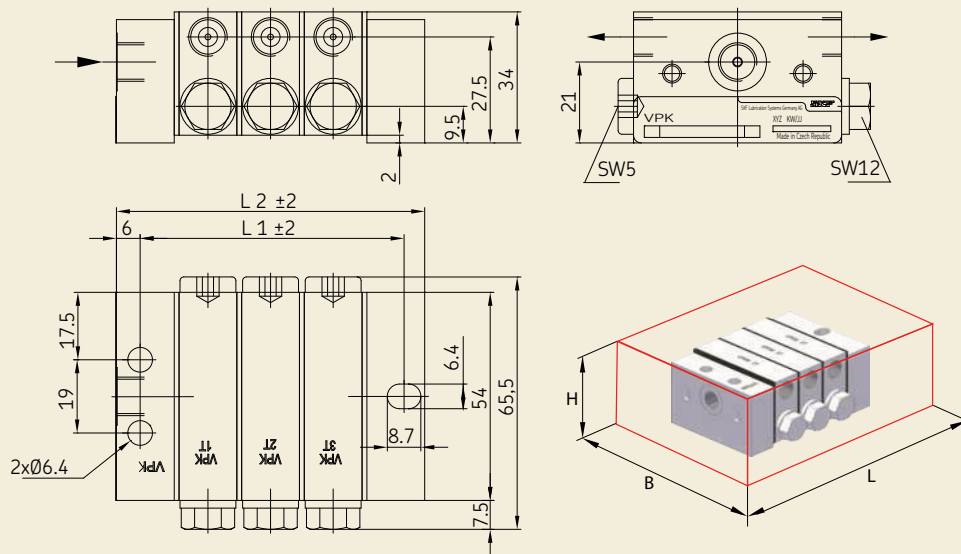
- Tighten piston detector (3) with a torque of 7 ± 0.5 Nm.
- Connect electrical power lead.

Fig. 21 Modification of piston detector



6.4 VPK in basic design

Fig. 22 VPK progressive metering device in basic design



Minimum mounting dimensions

| | |
|------------|----------|
| W = width: | 80 mm |
| H = height | 40 mm |
| L = Length | L2+10 mm |

6.4.1 VPK tightening torques

VPK dimensions

| Thread connection | | | | | |
|-------------------------------|--|----------------------------|---------|-------|--------|
| VPKM | Inlet: | M10x1 | Outlet: | M10x1 | |
| VPKG | | G1/8" | | G1/8" | |
| Type | Number of progressive metering device sections | Number of possible outlets | L1 | L2 | Weight |
| | | | [mm] | [mm] | [kg] |
| VPKM-3 / VPKG-3 ¹⁾ | 3 | 6 | 68.4 | 79.9 | 0.99 |
| VPKM-4 / VPKG-4 | 4 | 8 | 84.6 | 96.1 | 1.18 |
| VPKM-5 / VPKG-5 | 5 | 10 | 100.8 | 112.3 | 1.38 |
| VPKM-6 / VPKG-6 | 6 | 12 | 117.0 | 128.5 | 1.57 |
| VPKM-7 / VPKG-7 | 7 | 14 | 133.2 | 144.7 | 1.77 |
| VPKM-8 / VPKG-8 | 8 | 16 | 149.4 | 160.9 | 1.96 |
| VPKM-9 / VPKG-9 | 9 | 18 | 165.6 | 177.1 | 2.16 |
| VPKM-10/VPKG-10 | 10 | 20 | 181.8 | 193.3 | 2.35 |

1) This progressive metering device must be installed with check valves.

IMPORTANT NOTE

Inlet and outlet fittings - see Chapter 12.2.

The specified torques must be observed during assembly and repair.

| | |
|------------------------------|-----------------|
| Tie-rod (starter plate) (M6) | 2.5 Nm ± 0.1 Nm |
| Nut for tie-rod (M6) | 12 Nm ± 1.0 Nm |

Inlet and outlet fittings

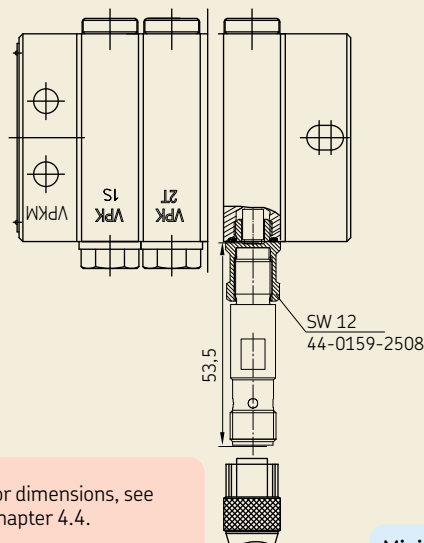
| Type of fitting | |
|---|----------------|
| Sealing with O-ring | 10 Nm ± 1.0 Nm |
| Sealing with EOlasic ring | 10 Nm ± 0.1 Nm |
| Sealing with copper or aluminum ring | 15 Nm ± 1.5 Nm |
| Sealing by sealing edge, with Loctite 243 | 15Nm ± 1.5 Nm |
| Sealing with Conical nipple ¹⁾ | 15Nm ± 1.5 Nm |

1) Minimum of 9 Nm at drying time of > 1h sufficient

6.4.2 VPK with piston detector for oil or grease

Monitoring types P2 and P3 (electric monitoring)

Fig. 23 VPK progressive metering device with piston detector



Note!
For piston detector dimensions, see
Technical Data, Chapter 4.4.

Additional technical data on the cable
sockets can be found in brochure
"Electrical Plug and Socket Connec-
tors," brochure No. 1-1730-EN.

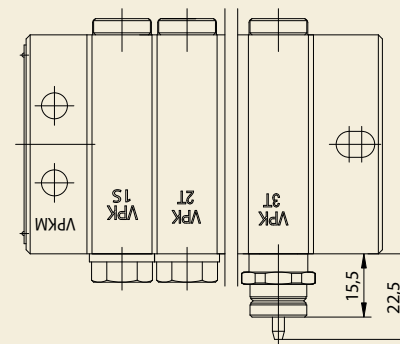
Minimum mounting dimensions

| | |
|------------|----------|
| W = width: | 140 mm |
| H = height | 40 mm |
| L = Length | L2+10 mm |

6.4.3 VPK progressive metering device with cycle switch

for oil or grease, monitoring type ZY

Fig. 24 VPK progressive metering device with cycle indicator

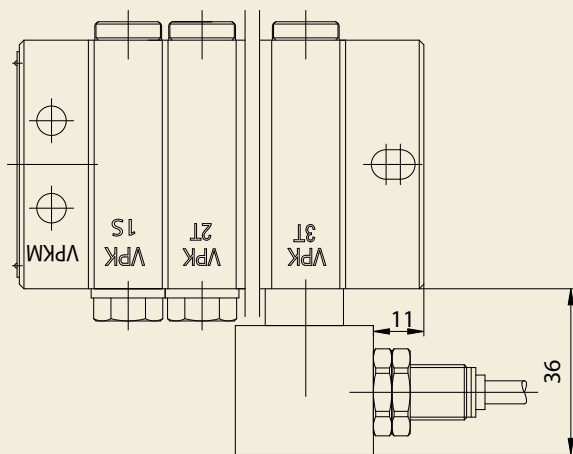


Minimum mounting dimensions

| | |
|------------|----------|
| W = width: | 110 mm |
| H = height | 40 mm |
| L = Length | L2+10 mm |

6.4.4 VPK progressive metering device with proximity switch for oil or grease, monitoring type ZS (electric monitoring)

Fig. 25 VPK progressive metering device with proximity switch



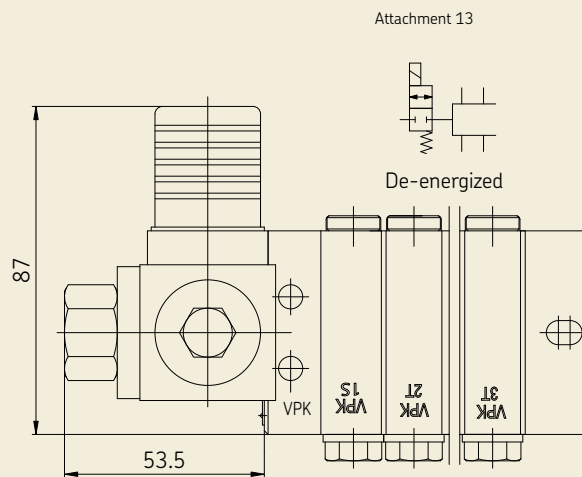
Minimum mounting dimensions

| | |
|------------|----------|
| W = width: | 120 mm |
| H = height | 40 mm |
| L = Length | L2+50 mm |

6.4.5 VPKG progressive metering device with 2/2 directional solenoid valve

for oil, attachment 13, 2/2 directional solenoid valve, de-energized, progressive metering device relieved, only design VPKG

Fig. 26 VPKG progressive metering device with 2/2 directional solenoid valve



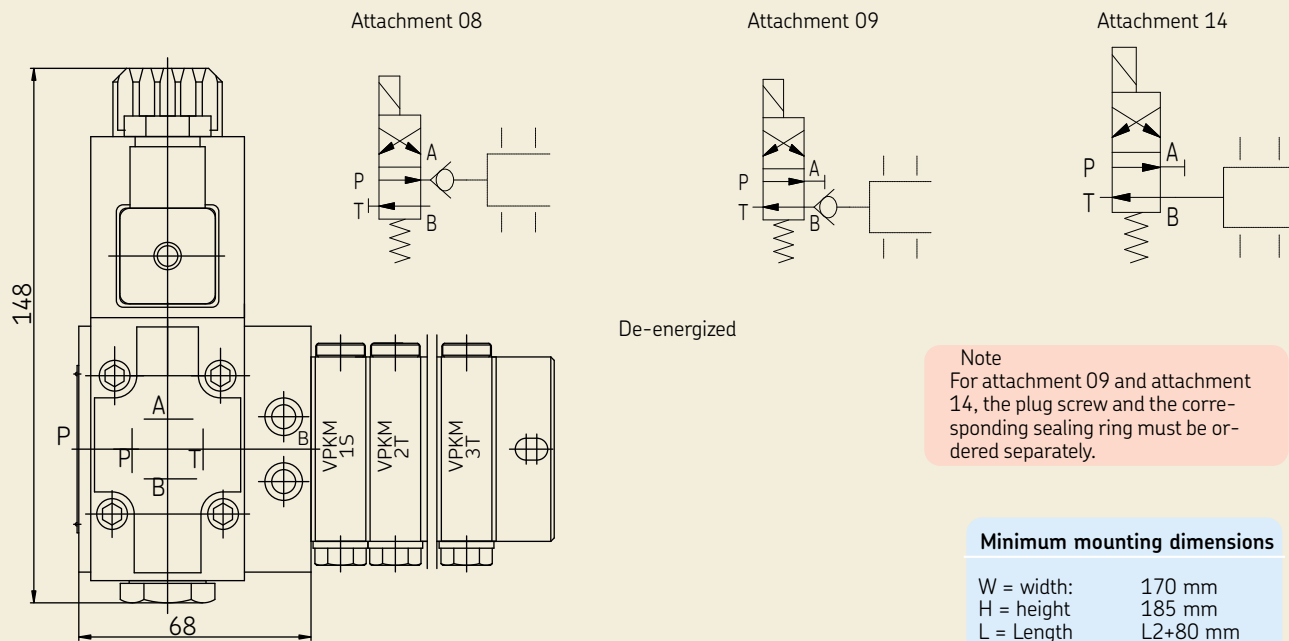
Minimum mounting dimensions

| | |
|------------|----------|
| W = width: | 100 mm |
| H = height | 130 mm |
| L = Length | L2+70 mm |

6.4.6 VPK progressive metering device with 4/2 or 3/2 directional solenoid valve

for oil, attachments 08; 09; 14

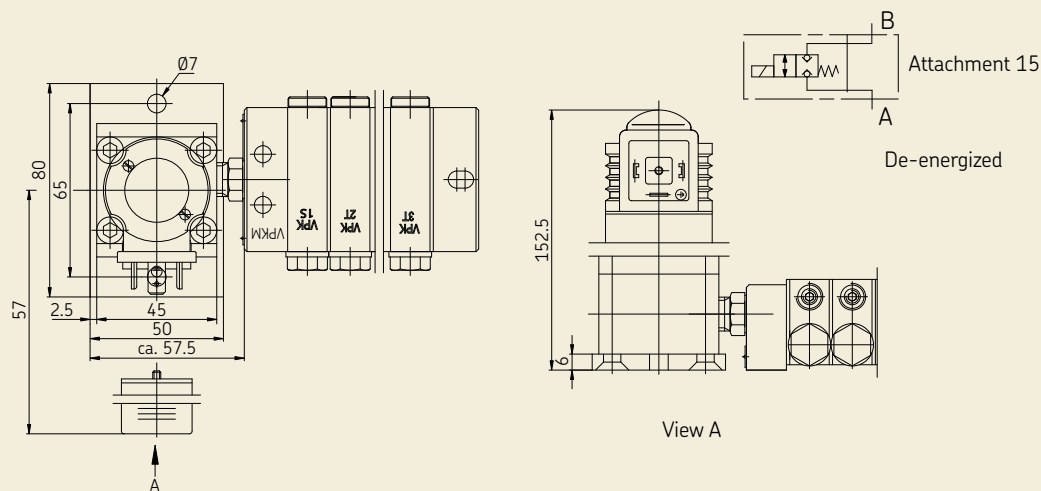
Fig. 27 VPK progressive metering device with 4/2 and 3/2 directional solenoid valve



6.4.7 VPK progressive metering device with 2/2 directional solenoid valve

for greases, attachment 15 with 2/2 directional solenoid valve, de-energized, continuity to progressive metering device closed

Fig. 28 VPK progressive metering device with 2/2 directional solenoid valve



Note!

Additional technical data on the cable sockets can be found in brochure "Electrical Plug and Socket Connectors," brochure No. 1-1730-EN.

Note!

Progressive metering device and directional solenoid valve are delivered separately. They are assembled by the customer.

Minimum mounting dimensions

| | |
|------------|----------|
| W = width: | 100 mm |
| H = height | 160 mm |
| L = Length | L2+60 mm |

6.4.8 Assembly of the VPK progressive metering device

IMPORTANT NOTE

In case of installation on moving machine parts or in case of strong vibrations (e.g., on pressing machines), self-locking screws or a locking adhesive should be used for installation of the progressive metering device.

- Check the parallelism of the surface on which the component is to be installed. Stress-free installation of the component must be ensured.
- Check for any fouling on the threaded holes for progressive metering device installation and on the surface on which the component is to be installed, and clean if needed.

The progressive metering device is installed using 3x M6 screws. If M6 threaded holes are used to fasten the unit,

the screws must have a minimum length of 40 mm.

Fastening material to be provided by the customer:

- o Hexagon head screws (3x) according to EN ISO 4017, M6x45-8.8
- Drill assembly holes (M6) according to assembly drawing (Fig. 23) and the conditions on the surface.
- Clean surface to remove drilling chips.
- Place the progressive metering device on the surface and roughly align it.
- Pass hexagon head screws (3x) according to EN ISO 4017, M6x45-8.8 through fixing holes on the progressive metering device and apply the screws to the M6 threads of the surface.

- Gently tighten hexagon head bolts (3x).
- Align the progressive metering device and tighten the hexagon socket head cap screws diagonally with a torque of 9 Nm
- Apply outlet fittings or SKF quick disconnect couplings to the threads of the outlet bores and tighten with the prescribed torque (Chapter 6.4.1).

6.4.9 Changing VPK progressive metering device sections

-see Figure 32

IMPORTANT NOTE

Absolute cleanliness is required when changing one or more progressive metering device sections!

The progressive metering device must be cleaned thoroughly prior to the retrofitting procedure, and the workspace must be free of contaminants and dust.

The progressive metering device has already been disassembled, inlet and outlet fittings and mounting screws must already be removed.

Intermediate plates are located between the progressive metering device sections. They connect the mating boreholes within the sections while also sealing the system against outside influences. Different plates belong to the inlet, progressive metering device, and end section.

- Clean any contamination from progressive metering device, place on a clean installation surface or clamp into a vice in a stress-free position.

- Loosen and remove both self-locking nuts (1) from the tie-rods (2).

☞ If the tie-rod (2) comes out too when unscrewing the self-locking nuts (1), first remove the self-locking nut from the tie-rod. The tie-rod's thread must not be damaged in the process. In place of the self-locking nut, install two nuts and position them against each other. Apply locking adhesive at the other end of the tie-rod and then use the locknuts to screw the tie-rod into the inlet section (3) with a torque of 2.5 Nm. Then remove the locknuts.

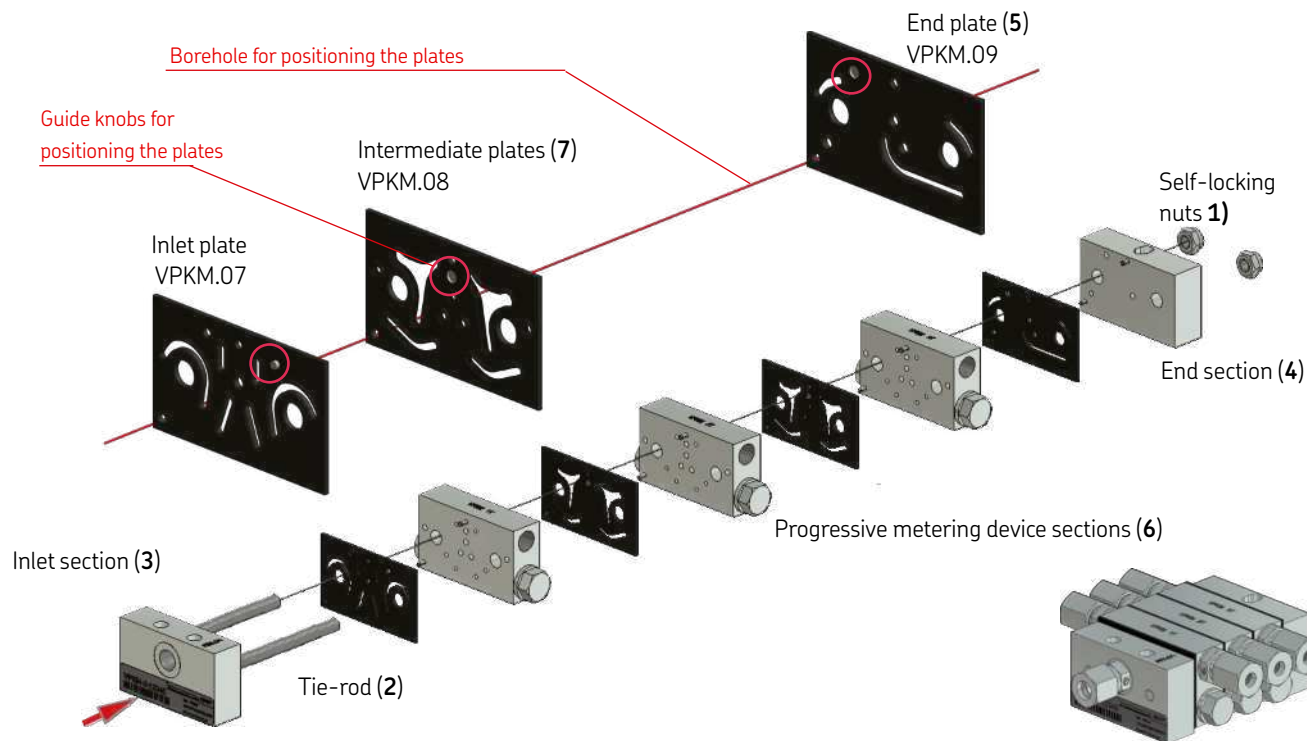
- Carefully loosen the end section (4) with end plate (5) from the progressive metering device sections (6)

and intermediate plates (7) and remove them from the tie-rods (2).

☞ While performing the following installation of the new progressive metering device sections (6) and intermediate plates (7), be sure they are mounted in the correct position (see Fig. 21, assembly knobs).

- Carefully insert new progressive metering device sections (6) with new intermediate plates (7) into the tie-rods.
- Carefully insert the end plate (5) with end section (4) into the tie-rods and align the inlet section, metering sections, intermediate plate, and end plate as well as the end section to one another.
- Apply self-locking nuts (1) to tie-rods (2) and tighten alternately up to a torque of 12 Nm each.
- Reinstall the progressive metering device and check that it is properly sealed.

Fig. 29 Assembly of a three-port VPK progressive metering device



6.4.10 Consolidation of multiple outlets (crossporting)

Twin sections of a progressive metering device have a plug for crossporting. The volumetric flow of an outlet can be consolidated with other outlets as desired by removing the corresponding plug.

This way, two or more outlets of an entire progressive metering device side can be combined as long as there is no single section in-between. The single section completes the group formation; a new group can only be formed behind the single section. Should it later be necessary to separate the quantity of two neighboring outlets, for example due to an additional lubrication point, then this can be done without difficulty. The plug 917-006-101 merely needs to be screwed back in and the previously closed outlet connected to the lubrication point. Crossportings are typically necessary when:

- If individual sections on progressive metering devices of series VPKM need to be replaced with sections with different metering;
- A progressive metering device is to be supplemented with additional sections;
- A progressive metering device is to be cleaned/repared, then they must be disassembled and later consolidated again.

When increasing/reducing the number of sections, the two tie-rods (stud bolts) that hold the sections and plates together must always be replaced.

IMPORTANT NOTE

Two neighboring outlets are consolidated from the end section towards the inlet section.

IMPORTANT NOTE

The progressive metering device section behind the inlet section must not be closed.

Always ensure that plug 917-006-101 has been removed before screwing in plug screw 466-431-001; otherwise, the progressive metering device may jam.

IMPORTANT NOTE

Outlets of a progressive metering device that are not needed must not be closed because this will cause the progressive metering device to block. Consolidate unneeded outlets as described with a neighboring outlet or connect them to the pump via the return line. Changing the number of sections and/or metering rate of individual sections while retaining the same quantity of grease supply changes all lubrication quantities of the outlets.

With crossporting, two or more outlets of an entire progressive metering device side can be combined as long as there is no single section in-between. The single section completes the group formation; a new group can only be formed behind the single section. Two neighboring outlets are consolidated from the end section towards the inlet section.

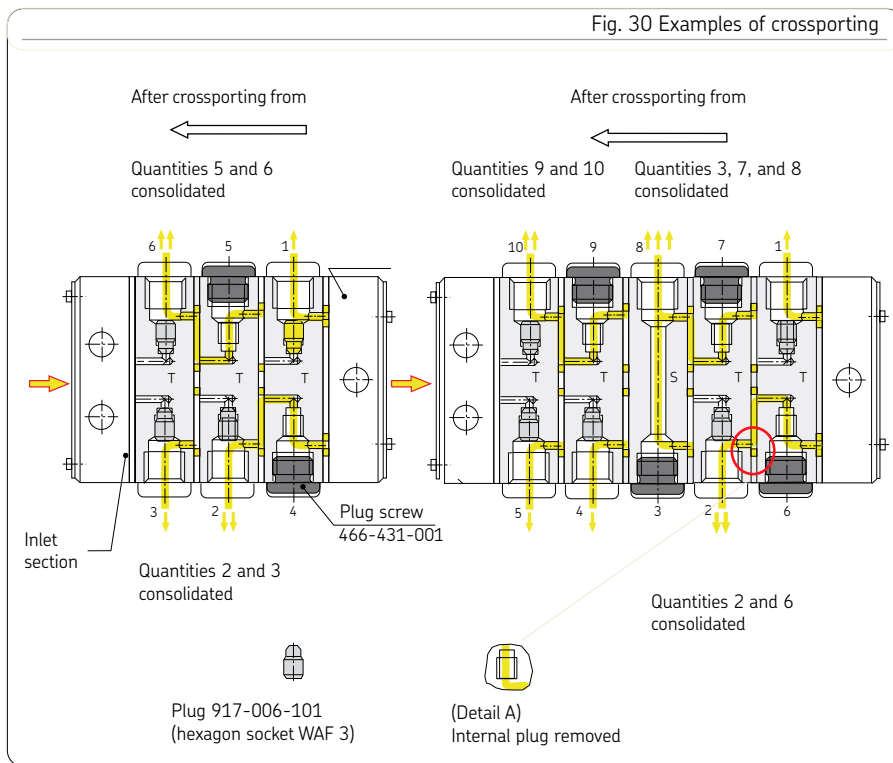
Procedure:

- Unscrew the appropriate plug
 - 917-006-101 using a hexagon socket screw key (WAF 4).
 - Close the outlet borehole with a plug screw.
- ☞ The quantity from both outlets will then flow out of the outlet neighboring the inlet section.


IMPORTANT NOTE

The progressive metering device section behind the inlet section must not be closed!

Fig. 30 Examples of crossporting



6.4.11 Modification of a piston detector

| | |
|--|---|
| |  WARNING |
| | System pressure Pressure must not be applied to the progressive metering device section during the retrofitting described below. Depressurize the progressive metering device. |

Retrofitting of the piston detector from a right-sided attachment to left-sided attachment is described below. The steps are identical for reverse retrofitting from left to right.

- Depressurize the lubrication system and progressive metering device.
- If possible, place a drip pan for the discharging lubricant below the progressive metering device.
- Loosen electrical power lead.
- Loosen plug screw (1) (left) and remove with O-Ring (2) (hexagon socket screw key WAF 5).
- Loosen and remove piston detector (3) (right) (WAF 14).
- Loosen adapter for piston detector (3a) (WAF 12) and remove with O-ring (4).
- Carefully push piston (5) out of the left side of the progressive metering device section (6) using an arbor (\varnothing 6 mm).
- ☞ During subsequent insertion of the piston (5), ensure that it does not bend and that its O-ring is not sheared off.
- Turn piston (5) 180° and carefully insert into the right side of the progressive metering device section (6).
- Install the plug screw (1) with O-ring (2) on the right side.
- Tighten adapter with the prescribed torque.
VPK WAF 12= **15•1Nm**
- Install the piston detector (3) finger-tight on the left side.

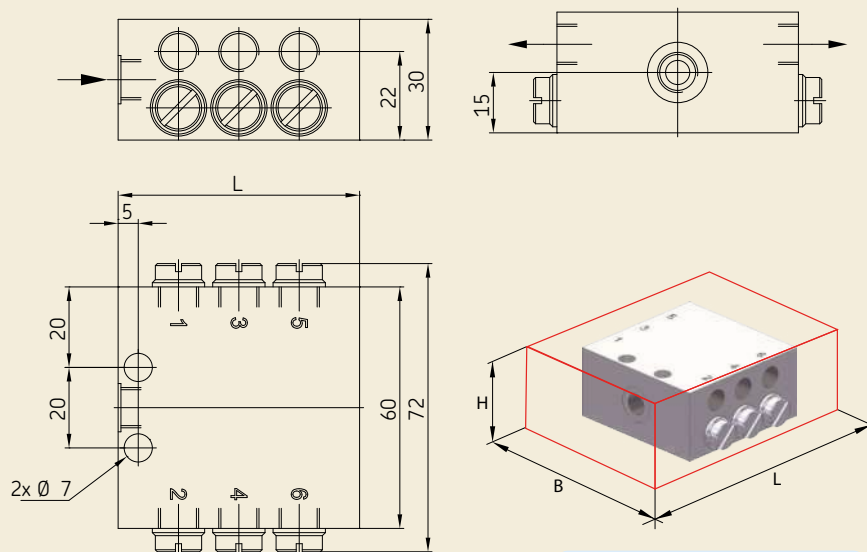


Avoid uncontrolled tightening of the piston detector, as this could cause damage.
 Maintain tightening torque of 7 ± 0.5 Nm.

- Tighten the piston detector (3) with new O-ring (4) with a torque of 7 ± 0.5 Nm
- Connect electrical power lead.

6.5 VPB in basic design

Fig. 31 VPB progressive metering device in basic design



Minimum mounting dimensions

| | |
|------------|----------|
| W = width: | 80 mm |
| H = height | 35 mm |
| L = Length | L2+10 mm |

VPB dimensions

| Thread connection | | | | | |
|-------------------------------|--|----------------------------|---------|-------|--------|
| VPBM | Inlet: | M10x1 | Outlet: | M10x1 | |
| VPBG | | G1/8" | | G1/8" | |
| Type | Number of progressive metering device sections | Number of possible outlets | L | | Weight |
| | | | [mm] | | [kg] |
| VPBM-3 / VPBG-3 ¹⁾ | 3 | 6 | 60 | | 0.75 |
| VPBM-4 / VPBG-4 | 4 | 8 | 75 | | 0.90 |
| VPBM-5 / VPBG-5 | 5 | 10 | 90 | | 1.10 |
| VPBM-6 / VPBG-6 | 6 | 12 | 105 | | 1.30 |
| VPBM-7 / VPBG-7 | 7 | 14 | 120 | | 1.50 |
| VPBM-8 / VPBG-8 | 8 | 16 | 135 | | 1.70 |
| VPBM-9 / VPBG-9 | 9 | 18 | 150 | | 1.90 |
| VPBM-10/VPBG-10 | 10 | 20 | 165 | | 2.1 |

1) This progressive metering device must be installed with check valves.

6.5.1 VPB tightening torques

The specified torques must be observed during assembly and repair.

| Inlet and outlet fittings | |
|--|----------------|
| Type of fitting | |
| Sealing with O-ring | 10 Nm ± 1.0 Nm |
| Sealing with EOlasic ring | 10 Nm ± 0.1 Nm |
| Sealing with copper or aluminum ring | 15 Nm ± 1.5 Nm |
| Sealing by sealing edge, with Loctite 243 | 15Nm ± 1.5 Nm |
| Sealing with Conical nipple ¹⁾ | 15Nm ± 1.5 Nm |
| 1) Minimum of 9 Nm at drying time of > 1h sufficient | |

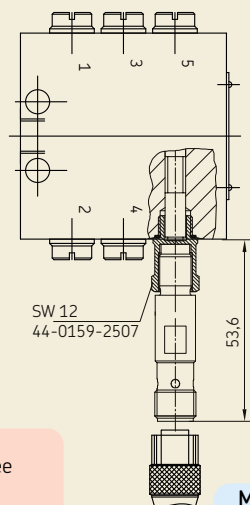
IMPORTANT NOTE

Inlet and outlet fittings - see Chapter 12.3.

6.5.2 VPB with piston detector for oil or grease

Monitoring types P2 and P3 (electric monitoring)

Fig. 32 VPB progressive metering device with piston detector



Note!

For piston detector dimensions, see Technical Data, Chapter 4.4.

Additional technical data on the cable sockets can be found in brochure "Electrical Plug and Socket Connectors," brochure No. 1-1730-EN.

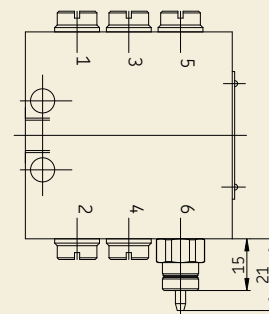
Minimum mounting dimensions

| | |
|-------------|---------|
| W = width: | 140 mm |
| H = height: | 35 mm |
| L = Length: | L+10 mm |

6.5.3 VPB progressive metering device with cycle switch

for oil or grease, monitoring type ZY

Fig. 33 VPB progressive metering device with cycle indicator



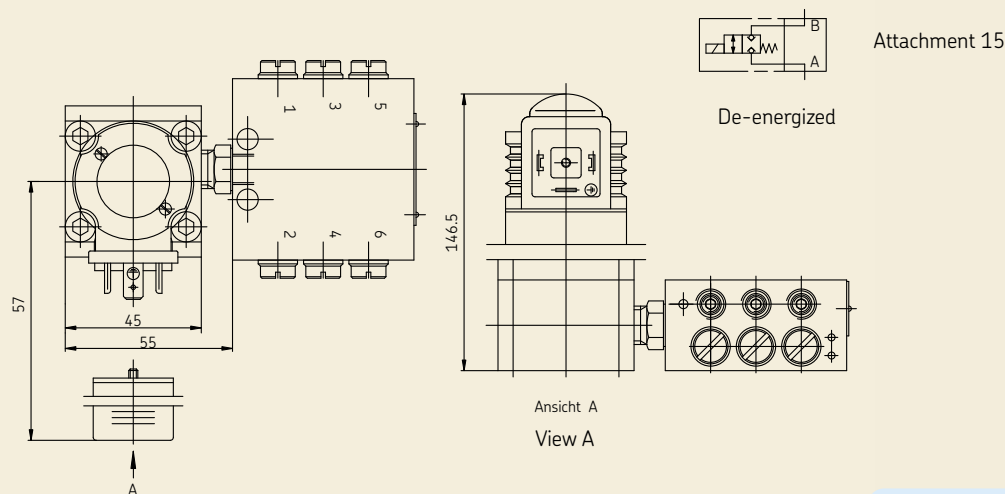
Minimum mounting dimensions

| | |
|-------------|---------|
| W = width: | 110 mm |
| H = height: | 35 mm |
| L = Length: | L+10 mm |

6.5.4 VPB progressive metering device with 2/2 directional solenoid valve

for greases, attachment 15 with 2/2 directional solenoid valve, de-energized, continuity to progressive metering device closed

Fig. 34 VPB progressive metering device with 2/2 directional solenoid valve



Note!
Additional technical data on the cable sockets can be found in brochure "Electrical Plug and Socket Connectors," brochure No. 1-1730-EN.

Note!
Progressive metering device and directional solenoid valve are delivered separately. They are assembled by the customer.

Minimum mounting dimensions

| | |
|------------|---------|
| W = width: | 100 mm |
| H = height | 155 mm |
| L = Length | L+10 mm |

6.5.5 Assembly of the VPB progressive metering device

– See Chapter 6.5.1, Figure 34

IMPORTANT NOTE

In case of installation on moving machine parts or in case of strong vibrations (e.g., on pressing machines), self-locking screws or a locking adhesive should be used for installation of the progressive metering device.

- Check the parallelism of the surface on which the component is to be installed. Stress-free installation of the component must be ensured.
- Check for any fouling on the threaded holes for progressive metering device installation and on the surface on which the component is to be installed, and clean if needed.

The progressive metering device is installed using 3x M6 screws. If M6 threaded holes are used to fasten the unit,

the screws must have a minimum length of 40 mm.

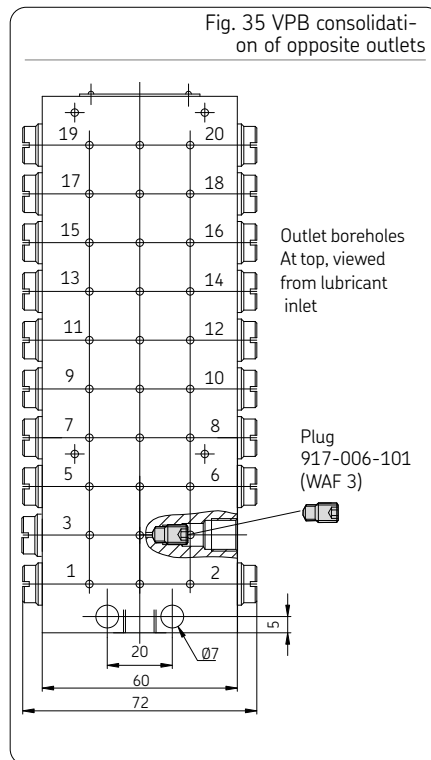
Fastening material to be provided by the customer:

- o Hexagon head screws (3x) according to EN ISO 4017, M6x40–8.8
- Drill assembly holes (M6) according to assembly drawing (Fig. 23) and the conditions on the surface.
- Clean surface to remove drilling chips.
- Place the progressive metering device on the surface and roughly align it.
- Pass hexagon head screws (3x) according to EN ISO 4017, M6x40–8.8 through fixing holes on the progressive metering device and apply the screws to the M6 threads of the surface.
- Gently tighten hexagon head bolts (3x).
- Align the progressive metering device and tighten the hexagon socket head cap screws diagonally with a torque of 9 Nm

- If necessary, apply outlet fittings or SKF quick disconnect couplings to the threads of the outlet bores and tighten with a torque of 25 Nm.

6.5.6 Consolidation of opposite outlets

It is possible to subsequently connect two opposite outlets internally by removing a plug from the right outlet borehole and closing one of the two outlets.



6.5.7 Consolidation of multiple outlets (crossporting)

Fig. 36 VPB possible crossporting variations

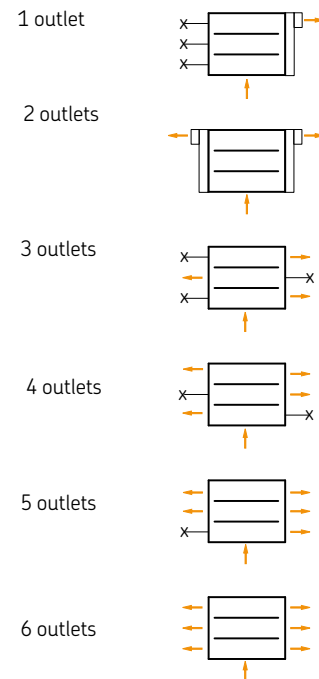


Fig. 37 VPB bridge designs (crossporting)

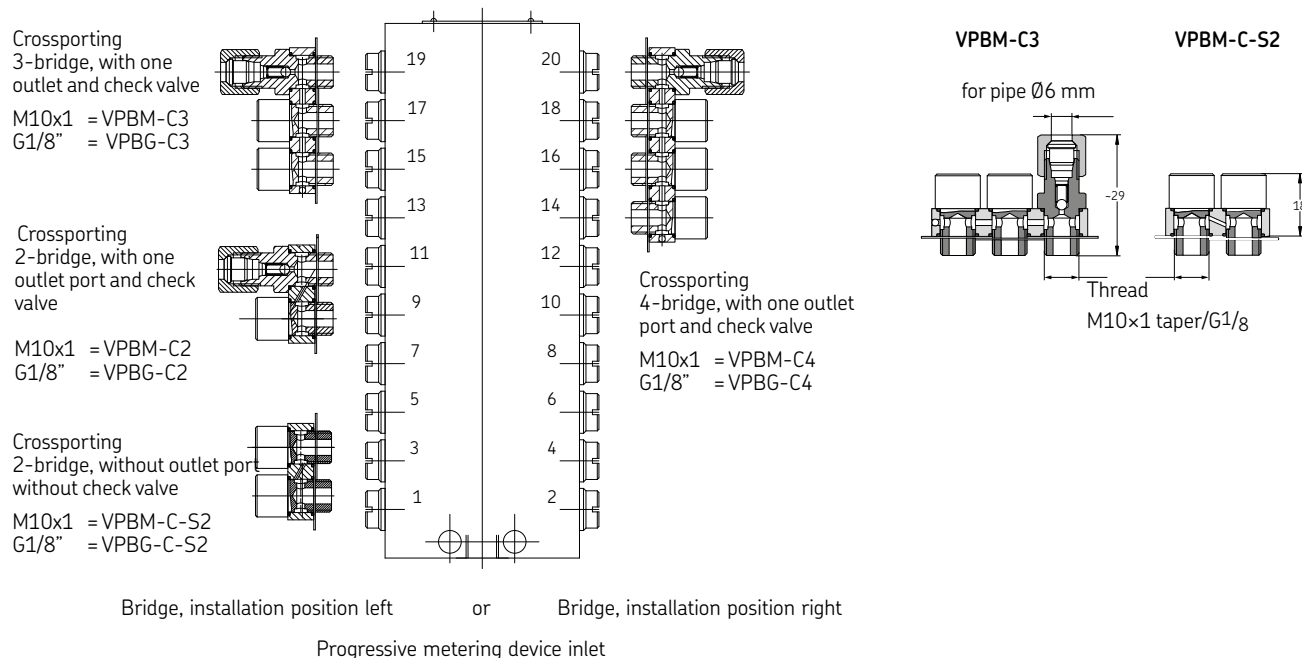
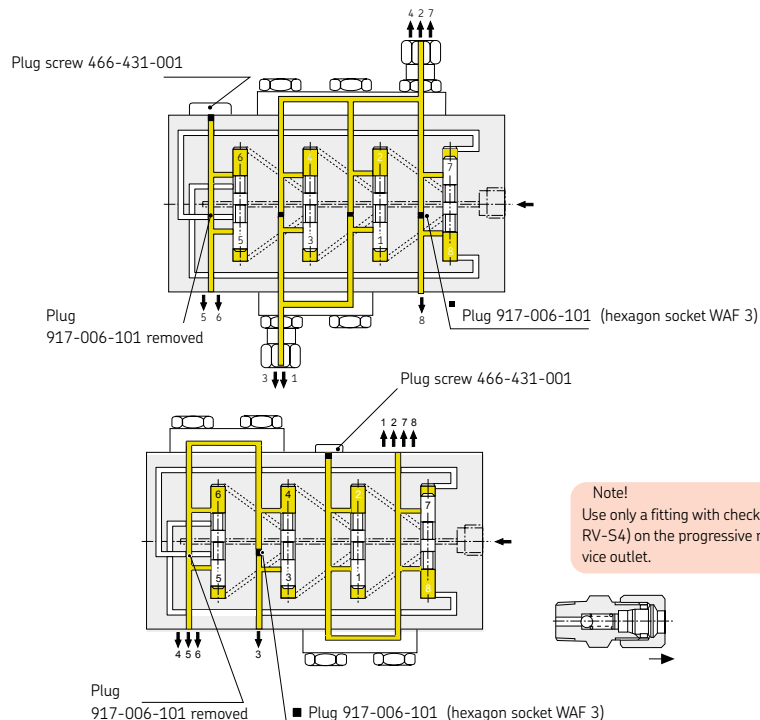


Fig. 38 VPB functional diagram of bridge designs (crossporting)



6.6 Lubrication line connection

IMPORTANT NOTE

Outlets of a progressive metering device that are not needed must not be closed because this will cause the progressive metering device to block.

Consolidate unneeded outlets with a neighboring outlet or connect them to the pump via the return line.



CAUTION



Risk of slipping


Exercise caution when handling lubricants; immediately bind and remove any leaked lubricants.



The customer must take appropriate precautions to ensure that no contamination enters the lubricant and thus the progressive metering device.

Connect the lubricant piping in such a way that no forces are transferred to the product (stress-free connection).


All components of the centralized lubrication

 must be designed for:

- The maximum pressure that occurs
- The permissible temperature range
- The delivery volume and the lubricant to be fed

Secure the centralized lubrication system against excessive pressure using an appropriate pressure regulating valve.

Observe the following assembly information

 safe and trouble-free operation.

- Use only clean components and prefilled lubrication lines.
- The main lubricant line should be arranged ascending and be ventable at the highest point. Lubrication piping should

always be arranged so that air inclusions cannot form anywhere.

- Install lubricant metering devices at the end of the main lubricant line such that the outlets of the lubricant metering devices point upwards.
- If the system configuration requires that the lubricant metering devices be arranged below the main lubricant line, they should not be placed at the end of the main lubricant line.
- The flow of lubricant should not be impeded by the incorporation of sharp bends, angle valves, flap valves, seals protruding inward, or

- changes in cross-section. Unavoidable changes in the cross-section in lubrication piping must have smooth transitions.
- Use only grounded steel pipelines.
- For higher operating pressures up to 250 bar, SKF compression fittings conforming to DIN 2353 can be used. If using fittings from other manufacturers, pay careful attention to the assembly instructions and technical specifications provided by the manufacturer.

6.6.1 Mounting process

-see Figure 40

- Deburr the connecting end of the lubrication line (1).
- Loosen the union nut (2) and cutting sleeve (3) from the threaded socket (4).
- Screw the threaded socket into the progressive metering device outlet (4) and tighten.
- Insert the lubrication line (1) into the union nut (2) and cutting sleeve (3).
- Insert the lubrication line (1), union nut (2), and cutting sleeve (3) into the threaded socket (4).
- Apply the union nut (2) to the thread of the threaded socket (4) and gently tighten the union nut (2) by hand.

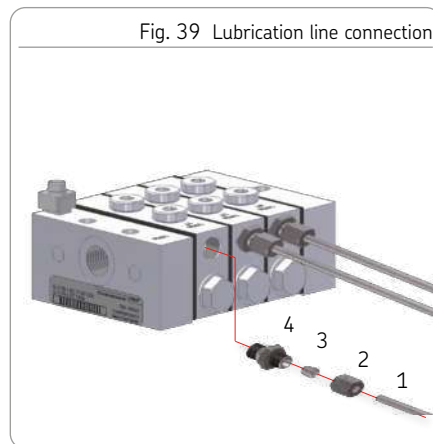
- Tighten the union nut (2) with an open-end wrench.

Tightening torque:

VP Chapter 6.3.2

VPK Chapter 6.4.1

VPB Chapter 6.5.1



6.7 Assembly of the lubrication lines using quick disconnect couplings

☞ -See Figure 41 and Fig. 42

The SKF quick disconnect couplings are available in designs for metal or plastic pipes. With the design for metal tubes, there is a further choice available between tube versions with and without claw groove. The claw groove securely fastens the tube in the plug connectors, which prevents the metal tube from slipping out of the SKF quick disconnect coupling. Both designs, for metal and plastic pipes, have a locking claw. The locking claw of the collet secures the tube in the SKF quick disconnect coupling, which prevents the tube from accidentally slipping out, at least in the case of the design for plastic tubes.

- Cut the connecting tube (1) to the correct length with a tube cutter (see Accessories).

☞ In the following installation of the tube, a noticeable resistance must be overcome when passing through the first O-ring (2),

the locking claw (5) of the collet (4). If a claw groove is not used, fix the pipe using appropriate fastening hardware (e.g., mounting clips) to prevent the tube from slipping out of the SKF quick disconnect coupling.

- Manually insert the tube (1) fully into the collet (4) of the SKF quick disconnect coupling until it clears the first O-ring (2) and the locking claw (5) of the collet (4) and reaches the mechanical stop (3).

☞ **To remove the metal tube (1)**, press the collet (4) inward into the SKF quick disconnect coupling. The metal tube (1) can now be pulled out of the collet (4) of the SKF quick disconnect coupling. **To remove the plastic tubing (1)**, press the collet (4) inward into the SKF quick disconnect coupling. To do this, also press the plastic pipe (1) inward into the SKF plug connector fitting, which re-

leases the collet (4) from the plastic pipe (1). The plastic tube (1) can now be pulled out of the collet (4) of the SKF quick disconnect coupling. Before reassembling, shorten the end of the plastic tube by at least 7 mm to ensure that the locking claw (5) of the collet (4) functions properly.

Fig. 40 Quick disconnect coupling for metal tube

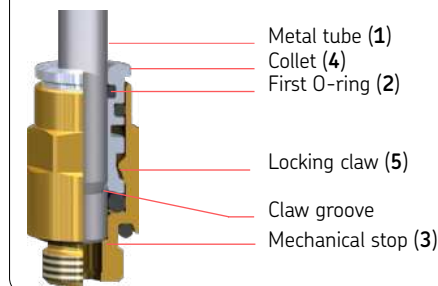
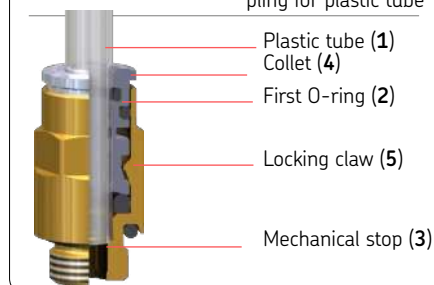


Fig. 41 Quick disconnect coupling for plastic tube



6.9 Lubrication line arrangement

When arranging the main lubricant lines and lubrication point lines, observe the following instructions in order to ensure that the entire centralized lubrication system functions smoothly.

The main lubricant line must be dimensioned in accordance with the maximum operating pressure occurring in the pump unit used and the displacement of that pump unit. If possible, the main lubricant line should rise upward from the pump unit and be ventable at the highest point on the lubrication line system.

Lubricant metering devices at the end of the main lubricant line must be installed such that the outlets of the metering devices point upwards. If the system configuration requires that the lubricant metering devices be arranged below the main lubricant line, they should not be placed at the end of the main lubricant line.

The tubes, hoses, shutoff valves, directional control valves, fittings, etc. that will be used must be designed for the maximum operating pressure of the pump unit, the permissible temperatures, and the lubricants that will be delivered. The lubrication line system also needs to be protected from excessive pressure by means of a pressure-limiting valve.

All components of the lubrication line system such as tubes, hoses, shutoff valves, directional control valves, fittings, etc. must be carefully cleaned before assembly. No seals in the lubrication line system should protrude inwards in a way that disrupts the flow of the lubricant and could allow contaminants to enter the lubrication line system.

Lubrication piping should always be arranged so that air pockets cannot form anywhere. Avoid changes in the cross-section of the lubrication line from small to large cross-sections in the direction of flow of

the lubricant. When the cross-section does change, the transition should be gentle.

The flow of lubricant in the lubrication lines should not be impeded by the incorporation of sharp bends, angle valves, or flap valves. Unavoidable changes in the cross-section in lubrication piping must have smooth transitions. Sudden changes of direction should be avoided if possible.

Note!

For further requirements for installation, see DIN 20066.



6.10 Electrical connection



Connect the power cables in such a way that no forces are transferred to the product (stress-free connection).



See the electrical data for the inductive NAMUR sensor, Chapter 4, Technical Data

Only attachments and monitoring equipment approved by SKF for the progressive metering devices may be installed.

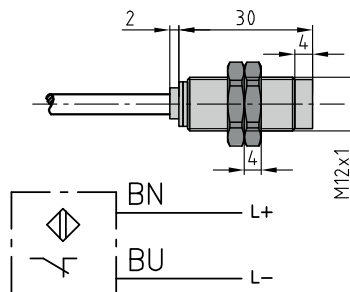
6.10.1 Connecting the inductive NAMUR sensor (VPK)

-see Figure 43

☞ See electrical data for VPK, page 39

- Connect inductive NAMUR sensor according to terminal diagram in Figure 43.

Fig. 42 Connecting inductive NAMUR sensor



Spare parts

| Designation | Order number |
|--------------|--------------|
| NAMUR sensor | 177-300-075 |

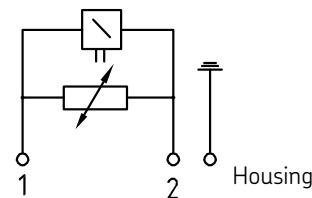
6.10.2 Connecting directional solenoid valves

-see Figure 44

- See electrical data for directional solenoid valves, VP page 35; VPK page 40 and VPB page 43.

- Connect directional solenoid valve according to terminal diagram in Figure 44.

Fig. 43 Connecting directional solenoid valves



Spare parts

| Designation | Order number |
|--------------------------------|-----------------|
| For grease | |
| 2/2 directional solenoid valve | 161-110-031+924 |
| 3/2 directional solenoid valve | 161-140-050+924 |
| For oil | |
| VPG | VPG-VEN+924 |
| VPM | VPM-VEN+924 |

7. First start-up

IMPORTANT NOTE

Only fill using clean lubricant and an appropriate device. Contaminated lubricants lead to system malfunctions. The lubricant reservoir of the pump unit must be filled without introducing bubbles.

7.1 Venting a grease progressive system

–see Figure 42

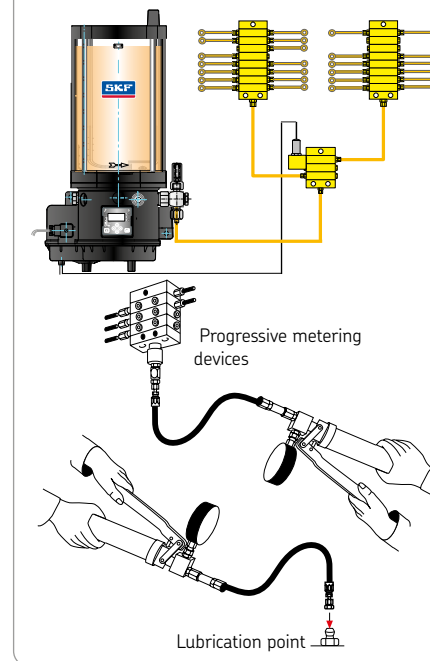
The progressive metering devices are subjected to functional monitoring using oil at the factory. It is possible that oil will discharge from the progressive metering device at the start of commissioning. The venting process starts at the main metering device and proceeds to the lubrication points, then from the secondary metering devices to the lubrication points.

- Connect the hand lever grease gun or lubricating device to the progressive

metering device inlet or, if present, to the emergency lubricant nipple attached to the progressive metering device.

- Actuate the hand lever grease gun or lubricating device until bubble-free lubricant discharges at all progressive metering device outlets.
- Use a hand lever grease gun or lubricating device to perform a flow check on or fill all lubrication points that will be connected.
- Completely fill lubrication lines with grease and connect to the progressive metering device outlets.
- Actuate the grease lubrication pump, hand lever grease gun, or lubricating device until bubble-free lubricant discharges at the end of the lubrication lines.

Fig. 44 Example of a progressive system



7.2 Venting an oil progressive system

-see Figure 40

A requirement for venting an oil progressive system is that the system has already been fully assembled.

- Slightly loosen the main lubrication line on the hand pump or pump unit, actuate the pump/pump unit until bubble-free oil discharges at the main lubrication line.
- Retighten the main lubrication line at the pump.
- Slightly loosen the main lubrication line on the main metering device, actuate the pump/pump unit until bubble-free oil discharges at the main metering device.
- Retighten the main lubrication line at the main metering device.
- Slightly loosen the main lubrication lines of the main metering device at the outlets, actuate the pump/pump unit until bubble-free oil discharges at the outlets.
- Retighten the lubrication line at the main metering device.
- Repeat venting at the secondary lubrication lines, secondary metering devices, and lubrication lines.
- An additional venting as described below is necessary if problems occur while venting the progressive metering devices (air still in the device, too little lubricant discharge).

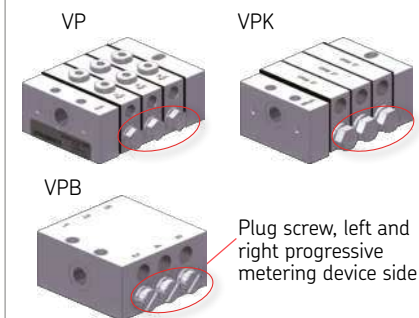
VP and VPK progressive metering devices:

- Loosen the right and left plug screws **at the last metering section** as viewed from the progressive metering device outlet.
- Actuate the pump/pump unit until bubble-free oil discharges at the plug screws.
- Retighten the left and right plug screws.

VPB progressive metering devices:

- Loosen the right and left plug screws **at the first metering piston** as viewed from the progressive metering device outlet.
- Actuate the pump/pump unit until bubble-free oil discharges at the plug screws.
- Retighten the left and right plug screws.

Fig. 45 Position of plug screws



To ensure safety and functionality, the person specified by the operator is required to perform the following inspections. Any detected deficiencies must be resolved immediately. The correction of deficiencies must be done exclusively by a specialist competent and authorized to do so.

Checklist for first start-up



7.3 Inspections before first start-up

| | YES | NO |
|--|--------------------------|--------------------------|
| Electrical connection (inductive NAMUR sensor) established correctly | <input type="checkbox"/> | <input type="checkbox"/> |
| Mechanical connection established correctly | <input type="checkbox"/> | <input type="checkbox"/> |
| The performance characteristics for the aforementioned connections match the specifications in "Technical data." | <input type="checkbox"/> | <input type="checkbox"/> |
| All components such as lubrication piping and progressive metering device are correctly mounted. | <input type="checkbox"/> | <input type="checkbox"/> |
| Product is protected by a suitable pressure relief valve. | <input type="checkbox"/> | <input type="checkbox"/> |
| No apparent damage, contamination, or corrosion | <input type="checkbox"/> | <input type="checkbox"/> |
| Any dismantled protective and monitoring equipment is fully reinstalled and functional | <input type="checkbox"/> | <input type="checkbox"/> |
| Equipotential bonding fully present, properly connected, and electrically continuous | <input type="checkbox"/> | <input type="checkbox"/> |
| No accumulated dust present | <input type="checkbox"/> | <input type="checkbox"/> |

7.4 Inspections during first start-up

| | | |
|---|--------------------------|--------------------------|
| No unusual noises, vibrations, moisture accumulation, odors present | <input type="checkbox"/> | <input type="checkbox"/> |
| No undesired discharge of lubricant at connections (leakage) | <input type="checkbox"/> | <input type="checkbox"/> |
| Lubricant is fed without bubbles | <input type="checkbox"/> | <input type="checkbox"/> |
| The bearings and friction points requiring lubrication receive the planned lubricant volume | <input type="checkbox"/> | <input type="checkbox"/> |



8. Operation

| | |
|---|--|
|  | CAUTION |
|  | <p>Explosion hazard</p> <p>The product and its equipotential bonding connection must be connected to the equipotential bonding of the main machine.</p> |

SKF products operate automatically.

The activities required during normal operation are limited primarily to checking the connections and cleaning of the exterior of the product if contaminated.

9. Cleaning

| | |
|---|---|
|  | WARNING |
|  | <p>Electric shock</p> <p>Perform cleaning work only on products that have been de-energized and depressurized.</p> <p>Do not touch cables or electrical components with wet or moist hands.</p> <p>Use steam-jet equipment or high-pressure cleaners only in accordance with the IP protection class of the pump. Otherwise, electrical components may be damaged.</p> |



Cleaning, required personal protective gear, cleaning agents, and equipment are in accordance with the current operating rules of the operator.

9.1 Cleaning agents

Only cleaning agents compatible with the materials can be used for cleaning (see Section 2.3 for materials).



Always completely remove residue of the cleaning agent on the product and rinse with clear water. This prevents the formation of alkaline deposits.

7

8

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9.2 Exterior cleaning

- Mark and secure wet areas.
- Unauthorized persons must be kept away.
- Thoroughly clean all external surfaces with a moist cloth.

9.3 Interior cleaning

The interior normally does not need to be cleaned.

The interior of the product must be cleaned if incorrect or contaminated lubricant is accidentally filled.

Please contact SKF Customer Service.

9.4 Cleaning the NAMUR sensor

If the active sensor surface becomes contaminated, it must be cleaned with a cloth.

10. Maintenance

10.1 General information

SKF progressive metering devices are maintenance-free. All connections and fittings must be regularly inspected for proper seating to ensure proper function. If necessary, the product can be cleaned using mild cleaning agents that are compatible with the product's materials (non-alkaline, non-soap).

Do not allow any cleaning agent to enter the interior of the product during cleaning. It is normally not necessary to clean the interior of the product.

The interior of the product must be cleaned if incorrect or contaminated lubricant is accidentally filled into the product.

Contact the SKF Service department if this occurs.

IMPORTANT NOTE

Dismantling of the product or individual parts thereof within the statutory warranty period is prohibited and voids any claims.

IMPORTANT NOTE

Only original SKF spare parts may be used. Unauthorized alterations to products and the use of non-original spare parts and accessories are prohibited and nullify the statutory warranty.

IMPORTANT NOTE

Use only clean lubricant. The purity of the lubricants used is the decisive factor in the service life of the progressive metering device and the lubricated machinery elements.

SKF shall not be held liable for damages resulting from improperly performed assembly, maintenance, or repair work on the product.

11. Malfunctions, causes, and remedies



The following tables provide an overview of possible malfunctions and their causes. Contact the SKF Service department if you cannot remedy the malfunction.

IMPORTANT NOTE

Dismantling of the progressive metering device is prohibited and voids any claims. Defective progressive metering devices must be replaced. Only SKF Service is capable of repairing them.

IMPORTANT NOTE

Only original SKF spare parts may be used. Unauthorized alterations to products and the use of non-original spare parts and accessories are prohibited.

| | |
|---|--|
|  |  WARNING |
| | System pressure Lubrication systems are pressurized during operation. Lubrication systems must therefore be depressurized before starting assembly, maintenance or repair work, or any system modifications or system repairs. |

IMPORTANT NOTE

Outlets of a progressive metering device that are not needed must not be closed because this will cause the progressive metering device to block. Unneeded outlets must be consolidated with a neighboring outlet or connected to the pump via the return line.

11.1 Prior to beginning troubleshooting

The only condition that can cause a properly configured progressive metering device to jam/clog is the entry of contaminants into the lubricant lines or an insufficient quantity of lubricant.

Preventing contaminants from entering during work or when refilling the lubricant reservoir thus first and foremost requires a clean work environment.

The progressive metering device outlet is typically equipped with a fitting with check valve. Do not replace this with another connector because this may cause problems in the progressive metering device's operation. Each outlet of the progressive metering device can supply each bearing/each secondary metering device with a different, precalculated quantity of grease. Therefore, the position of each lubricant line to the progressive metering device outlet should be noted prior to starting work.

11.2 Progressive metering device and system malfunctions

| Malfunction | Cause | Remedy |
|------------------------------------|--|--|
| No lubricant at lubrication points | <ul style="list-style-type: none"> o Main metering device or secondary metering device is defective <ul style="list-style-type: none"> - Can be detected if no grease can be pressed through the distributor after removing all union nuts or fittings at the outlets. o Check the flow in the main metering device and secondary metering device <ul style="list-style-type: none"> - Sequentially remove union nuts or fittings at the outlets; check valves may be built into the outlet fittings. - Trigger intermediate lubrication. - The progressive metering device is functioning properly if significant grease discharge is seen at all outlets. - Replace the progressive metering device if grease does not discharge at all outlets. <p>Note! The metering and arrangement of sections on the new progressive metering device must be identical to the disassembled (defective) metering device.</p> | <ul style="list-style-type: none"> • Replace the progressive metering device - Loosen all fittings, mark lines, secure against outside influences • Install a new progressive metering device • Install lubrication lines in the correct order as marked previously • Only use original SKF spare parts! • Perform start-up and functional inspection. |
| | <ul style="list-style-type: none"> o Defective or blocked secondary feed line | <ul style="list-style-type: none"> • Detach feed line, identify cause of blockage, replace secondary feed line if necessary |

| Malfunction | Cause | Remedy |
|------------------------------------|---|---|
| Insufficient lubricant discharge | <ul style="list-style-type: none"> o Air cushion in main metering device or secondary metering device | <ul style="list-style-type: none"> • Perform venting on the secondary metering device discharging too little lubricant. <p>Grease progressive system - see Chapter 7.2.1 Oil progressive system - see Chapter 7.2.2</p> |
| No lubricant at lubrication points | <ul style="list-style-type: none"> o Damaged lubricant line, detectable only by visual inspection and significant lubricant discharge. | <ul style="list-style-type: none"> • Replace the lubricant line • Use only grease-filled SKF original spare lines on grease progressive systems. Perform start-up and functional inspection. • Visual inspection for mechanical damage • Pinching and sharp bends are blocking the grease flow |
| | <ul style="list-style-type: none"> o Visual inspection o Check the lubricant supply | <ul style="list-style-type: none"> • Check grease supply in the lubricant reservoir, refill if necessary. • Start-up, functional inspection • Trigger interim lubrication. |
| | <ul style="list-style-type: none"> o Defective lubrication point o Defective bearing o Bearing bush twisted | <ul style="list-style-type: none"> • Check bearing for mechanical damage or contamination. • Check bearing for proper function (move the machine and check for bearing noise). • Use a high-pressure grease gun to make the bearing move freely. If this is not possible, the bearing must be repaired or replaced by technical personnel • Install all lines and fittings that were removed during troubleshooting. • Perform start-up and functional inspection. |

| Malfunction | Cause | Remedy |
|---------------------------------------|---|--|
| System malfunction | <ul style="list-style-type: none"> o Piston detector on main metering device has indicated that the system is not working. | <ul style="list-style-type: none"> • Loosen both lubrication lines on the last metering section of the main metering device, switch on the lubrication system, and check whether lubricant discharges without bubbles. If lubricant discharges without bubbles, tighten both lubrication lines and repeat the procedure on all secondary metering devices, starting from the closest progressive metering device. Vent the possibly defective progressive metering device again; replace in the event of reoccurrence. • If all progressive metering devices function properly, check the electrical connection of the piston detector and the piston detector itself for proper function. |
| No pressure build up in the main line | o Pressure relief valve does not close | <ul style="list-style-type: none"> • Clean or replace pressure relief valve. Only use original SKF spare parts. |
| | o Unsuitable lubricant (see technical data) | <ul style="list-style-type: none"> • Remove lubricant from entire system and dispose of lubricant in the proper manner; fill system with suitable lubricant |
| | o Fill level too low | <ul style="list-style-type: none"> • Top up lubricant |
| | o Pump element is defective | <ul style="list-style-type: none"> • Inspect pump element and replace if necessary |

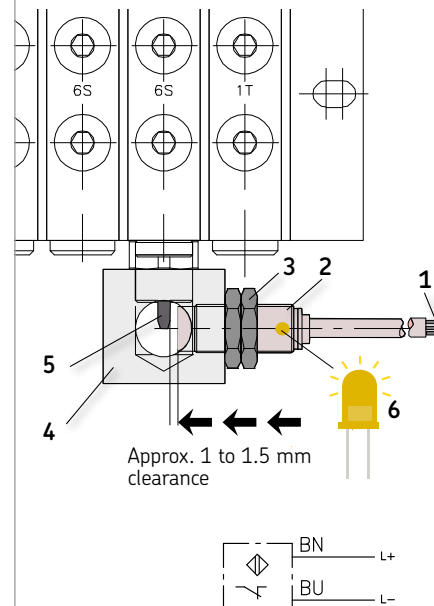
12. Repairs

12.1 Replacing inductive NAMUR sensor

–see Figure 44

- Check that the new inductive NAMUR sensor (2) matches the documentation and the intended use.
- Take safety measures as specified in the warning at the beginning of this Chapter.
- Disconnect cable end (1) of the defective NAMUR sensor (2) from the customer's terminal strip.
- Loosen locknuts (2x 3) from the sensor holder (4).
- Unscrew defective NAMUR sensor (2) from the sensor holder (4).
- Apply new NAMUR sensor (2) to the sensor holder (4) and screw in gently.
- Disconnect cable end (1) of the sensor (2) on the customer's terminal strip.
- Apply pressure to progressive metering device until the plunger rod (5) has extended.
- Turn on computer's power supply then screw the NAMUR sensor (2) into the sensor holder (4) until the control diode (6) of the sensor (2) lights up (clearance to plunger rod approx. 1-1.5 mm)
- Secure NAMUR sensor (2) to the sensor holder (4) using both locknuts (3).

Fig. 46 Replacing inductive NAMUR sensor



13. Shutdown and disposal

13.1 Temporary shutdown


The described product can be temporarily shut down by disconnecting the hydraulic supply connections. Observe the instructions in the chapter "Assembly" while doing so. If the product is to be shut down for an extended period of time, follow the instructions in chapter "Transport, delivery, and storage."

To recommission the product, follow the instructions in the Chapter "Assembly."

13.2 Shutdown and disposal

If the product will be permanently shut down, the local regulations and laws regarding the disposal of contaminated equipment must be observed.

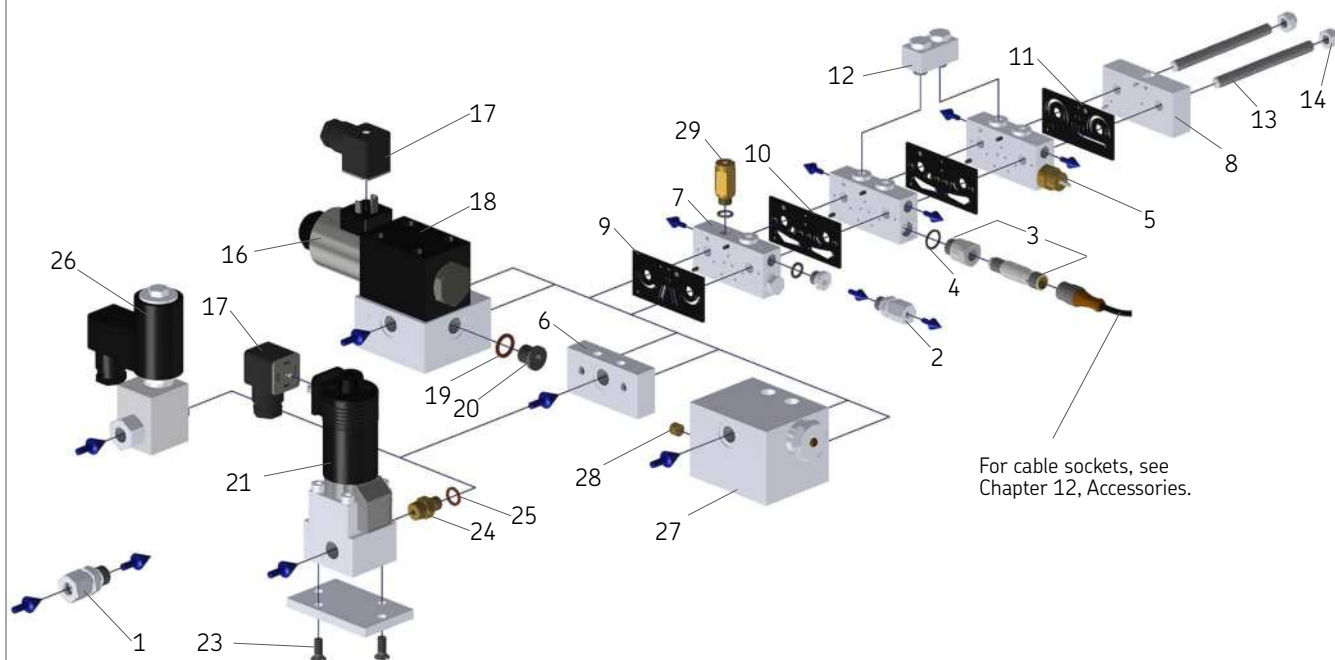
The product can also be returned to SKF Lubrication Systems Germany GmbH for disposal, in which case the customer is responsible for reimbursing the costs incurred. The parts are recyclable.

| | |
|---|--|
|  | IMPORTANT NOTE |
| | <p>Environmental pollution</p> <p>Lubricants can contaminate soil and waterways. Lubricants must be used and disposed of properly. Observe the local regulations and laws regarding the disposal of lubricants.</p> |

14. Spare parts

14.1 Spare parts – VPG (inch thread) and VPM (metric thread)

Fig. 47 VP spare parts



Inlet fittings – VPG (inch thread) and VPM (metric thread)

| Item | Designation | Group | VPG | VPM |
|------|---|--------------|--------------------|--------------------|
| | | [LL] [L] [S] | Order No. | Order No. |
| 1 | Straight connector for pipe Ø 6 mm ¹⁾ | L | - | 406-413 |
| | Straight connector for pipe Ø 6 mm ¹⁾ | S | 406-413W | - |
| | Straight connector for pipe Ø 8 mm ¹⁾ | L | 408-403W | - |
| | Straight connector for pipe Ø 8 mm ¹⁾ | S | - | 408-413 |
| | Straight connector for pipe Ø 10 mm ¹⁾ | L | 410-403W | 410-403 |
| | Straight connector for pipe Ø 12 mm ¹⁾ | L | 412-423W | 412-423 |
| | | | | |
| | Straight connector, design E02, for pipe Ø 6 mm | | 471-006-161 | 471-006-351 |
| | Straight connector, design E02, for pipe Ø 8 mm | | 471-008-161 | 471-008-351 |
| | Straight connector, design E02, for pipe Ø 10 mm | | 471-010-161 | 471-010-351 |
| | Straight connector, design E02, for pipe Ø 12 mm | | 471-012-161 | - |
| | | | | |
| | Quick disconnect coupling, Ø 6 mm | | 406-054-VS | - |
| | Elbow connector according to DIN2353, for pipe Ø 8 mm, tapered ¹⁾ | L | 408-405W | |
| | Elbow connector according to DIN2353, for pipe Ø 10 mm, tapered ¹⁾ | L | 410-405W | 410-405 |
| | Banjo fitting for pipe Ø 6 mm ¹⁾ | S | 445-516-061 | - |
| | Banjo fitting for pipe Ø 8 mm ¹⁾ | L | 445-516-081 | - |
| | Banjo fitting for pipe Ø 10 mm ¹⁾ | L | 445-516-101 | 445-535-101 |
| | 1) Solderless screw connection with cutting ring according to DIN 2353 | | | |
| | LL series = very light series, L series = light series, S series = heavy series | | | |

Outlet fittings – VPG (inch thread) and VPM (metric thread)

| Item | Designation | Group | VPG | VPM |
|--|---|--------------|--------------------|-----------------------|
| | | [LL] [L] [S] | Order No. | Order No. |
| 2 | Straight connector for pipe Ø 4 mm, tapered ¹⁾ | LL | - | 404-403 |
| | Straight connector for pipe Ø 4 mm ¹⁾ | LL | 404-403W | - |
| | Straight connector for pipe Ø 6 mm, tapered ¹⁾ | LL | - | 406-423 |
| | Straight connector for pipe Ø 6 mm ¹⁾ | L | 406-403W | 406-403 |
| | Straight connector for pipe Ø 8 mm, tapered ¹⁾ | LL | 408-423W | 441-008-511 |
| | Straight connector for pipe Ø 10 mm, tapered ¹⁾ | L | 410-443W | - |
| | | | | |
| | Straight connector, design E02, for pipe Ø 4 mm ¹⁾ | | 471-004-191 | 471-004-311 |
| | Straight connector, design E02, for pipe Ø 6 mm ¹⁾ | | 471-006-192 | 471-006-311 |
| | | | | |
| | Straight quick disconnect coupling, Ø 4 mm | | 404-040-VS | 404-006-VS |
| | Straight quick disconnect coupling, Ø 4 mm tapered | | - | 451-004-518-VS |
| | Straight quick disconnect coupling, Ø 6 mm | | 456-004-VS | 406-004-VS |
| | Straight quick disconnect coupling, Ø 6 mm tapered | | 406-423W-VS | 451-006-518-VS |
| ¹⁾ Solderless screw connection with cutting ring according to DIN 2353 LL series = very light series, L series = light series, S series = heavy series | | | | |

Outlet fittings – VPG (inch thread) and VPM (metric thread)

| Item | Designation | Group | VPG | VPM |
|------|---|--------------|-------------|----------------|
| | | [LL] [L] [S] | Order No. | Order No. |
| 2 | Outlet fitting for pipe Ø 4 mm, with check valve | | VPG-RV | VPM-RV4 |
| | Outlet fitting for pipe Ø 6 mm, with check valve | | VPG-RV6 | VPM-RV6 |
| | Outlet fitting for pipe Ø 8 mm, with check valve | | VPG-RV8 | VPM-RV8 |
| | Outlet fitting for pipe Ø 10 mm, with check valve | | - | VPM-RV10 |
| | Banjo fitting for pipe Ø 4 mm | LL | 445-519-041 | - |
| | Banjo fitting for pipe Ø 6 mm | L | 445-519-061 | 445-531-061 |
| | Banjo fitting for pipe Ø 6 mm | LL | | 445-531-062 |
| | Quick disconnect coupling for pipe Ø 4 mm, with banjo fitting | | 504-108-VS | 504-102-VS |
| | Quick disconnect coupling for pipe Ø 4 mm, tapered, with banjo fitting | | - | 445-531-048-VS |
| | Quick disconnect coupling for pipe Ø 6 mm, with banjo fitting | | 506-108-VS | 506-140-VS |
| | Quick disconnect coupling for pipe Ø 6 mm, tapered, with banjo fitting | | | 445-531-068-VS |
| | LL series = very light series, L series = light series, S series = heavy series | | | |

Monitoring – VPG (inch thread) and VPM (metric thread)

| Item | Designation | VPG | VPM |
|------|--|---------------|-----------|
| | | Order No. | Order No. |
| 3 | Bipolar piston detector kit, 2-pin ¹⁾ | 24-0159-6021 | |
| | Universal piston detector kit, 3-pin ¹⁾ | 24-0159-6025 | |
| 4 | Associated sealing ring | WVN532-12×1.5 | |

¹⁾ A kit includes the respective sensor with adapter and O-ring.

Progressive metering device sections – VPG (inch thread) and VPM (metric thread)

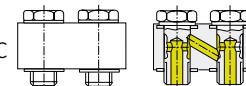
| Item | Designation | VPG | VPM |
|------|---|---------------|---------------|
| | | Order No. | Order No. |
| 5 | Progressive metering device section 2T with cycle indicator right | VPG-K-2T-ZY-R | VPM-K-2T-ZY-R |
| | Progressive metering device section 3T with cycle indicator right | VPG-K-3T-ZY-R | VPM-K-3T-ZY-R |
| | Progressive metering device section 4T with cycle indicator right | VPG-K-4T-ZY-R | VPM-K-4T-ZY-R |
| | Progressive metering device section 5T with cycle indicator right | VPG-K-5T-ZY-R | VPM-K-5T-ZY-R |
| | Progressive metering device section 6T with cycle indicator right | VPG-K-6T-ZY-R | VPM-K-6T-ZY-R |
| | Progressive metering device section 2T with cycle indicator left | VPG-K-2T-ZY-L | VPM-K-2T-ZY-L |
| | Progressive metering device section 3T with cycle indicator left | VPG-K-3T-ZY-L | VPM-K-3T-ZY-L |
| | Progressive metering device section 4T with cycle indicator left | VPG-K-4T-ZY-L | VPM-K-4T-ZY-L |
| | Progressive metering device section 5T with cycle indicator left | VPG-K-5T-ZY-L | VPM-K-5T-ZY-L |
| | Progressive metering device section 6T with cycle indicator left | VPG-K-6T-ZY-L | VPM-K-6T-ZY-L |
| | Progressive metering device section 2S with cycle indicator right | VPG-K-2S-ZY-R | VPM-K-2S-ZY-R |
| | Progressive metering device section 3S with cycle indicator right | VPG-K-3S-ZY-R | VPM-K-3S-ZY-R |
| | Progressive metering device section 4S with cycle indicator right | VPG-K-4S-ZY-R | VPM-K-4S-ZY-R |
| | Progressive metering device section 5S with cycle indicator right | VPG-K-5S-ZY-R | VPM-K-5S-ZY-R |
| | Progressive metering device section 6S with cycle indicator right | VPG-K-6S-ZY-R | VPM-K-6S-ZY-R |
| | Progressive metering device section 2S with cycle indicator left | VPG-K-2S-ZY-L | VPM-K-2S-ZY-L |
| | Progressive metering device section 3S with cycle indicator left | VPG-K-3S-ZY-L | VPM-K-3S-ZY-L |
| | Progressive metering device section 4S with cycle indicator left | VPG-K-4S-ZY-L | VPM-K-4S-ZY-L |
| | Progressive metering device section 5S with cycle indicator left | VPG-K-5S-ZY-L | VPM-K-5S-ZY-L |
| | Progressive metering device section 6S with cycle indicator left | VPG-K-6S-ZY-L | VPM-K-6S-ZY-L |

Progressive metering device sections – VPG (inch thread) and VPM (metric thread)

| Item | Designation | VPG | VPM |
|----------|--|-------------|-------------|
| | | Order No. | Order No. |
| 6 | Inlet section | VPG-E | VPM-E |
| 7 | Progressive metering device section 1T | VPG-K-1T-PS | VPM-K-1T-PS |
| | Progressive metering device section 2T | VPG-K-2T-PS | VPM-K-2T-PS |
| | Progressive metering device section 3T | VPG-K-3T-PS | VPM-K-3T-PS |
| | Progressive metering device section 4T | VPG-K-4T-PS | VPM-K-4T-PS |
| | Progressive metering device section 5T | VPG-K-5T-PS | VPM-K-5T-PS |
| | Progressive metering device section 6T | VPG-K-6T-PS | VPM-K-6T-PS |
| | Progressive metering device section 1S | VPG-K-1S-PS | VPM-K-1S-PS |
| | Progressive metering device section 2S | VPG-K-2S-PS | VPM-K-2S-PS |
| | Progressive metering device section 3S | VPG-K-3S-PS | VPM-K-3S-PS |
| | Progressive metering device section 4S | VPG-K-4S-PS | VPM-K-4S-PS |
| | Progressive metering device section 5S | VPG-K-5S-PS | VPM-K-5S-PS |
| | Progressive metering device section 6S | VPG-K-6S-PS | VPM-K-6S-PS |
| | Plug for twin section | 917-006-101 | 917-006-101 |

Progressive metering device components – VPG (inch thread) and VPM (metric thread)

| Item | Designation | VPKG | | VPKM |
|------|---|-----------|--|-------------|
| | | Order No. | | Order No. |
| 8 | Outlet section | | | VPM-A |
| 9 | Inlet plate | | | VP2.07 |
| 10 | Intermediate plate | | | VP2.08 |
| 11 | End plate | | | VP2.09 |
| 12 | Connection fitting (crossporting bars, design complete with banjo bolt and sealing rings) | | | VP-C |
| 13 | Tie-rod for 3 progressive metering device sections, length 98±0.5 mm | | | VP.173 |
| | Tie-rod for 4 progressive metering device sections, length 118±0.5 mm | | | VP.174 |
| | Tie-rod for 5 progressive metering device sections, length 138±0.5 mm | | | VP.175 |
| | Tie-rod for 6 progressive metering device sections, length 158±0.5 mm | | | VP.176 |
| | Tie-rod for 7 progressive metering device sections, length 178±0.5 mm | | | VP.177 |
| | Tie-rod for 8 progressive metering device sections, length 200±0.5 mm | | | VP.178 |
| | Tie-rod for 9 progressive metering device sections, length 220±0.5 mm | | | VP.179 |
| | Tie-rod for 10 progressive metering device sections, length 240±0.5 mm | | | VP.180 |
| 14 | Hexagon nut | | | DIN985-M8-6 |



Progressive metering device components – VPG (inch thread) and VPM (metric thread)

| Item | Designation | VPG | | VPM |
|------|--|------------------|--|--------------------|
| | | Order No. | | Order No. |
| 15 | Starter plate for 4/2 and 3/2 directional solenoid valve | 44-0711-2265 | | 44-0711-2266 |
| 16 | 4/2 directional solenoid valve, 24 V DC | 161-140-050+924 | | |
| 17 | Coupler socket according to DIN EN175301-803A | 179-990-033 | | |
| 18 | Fixing bolt for directional control valve | DIN912-M5×45-8.8 | | |
| 19 | Sealing ring | 508-108 | | DIN7603-A14×18-AL |
| 20 | Plug screw | DIN908-R1-4-5.8 | | DIN908-M14×1.5-5.8 |
| 21 | 2/2 directional solenoid valve for grease, 24 V DC | 161-110-031+924 | | |
| 22 | Adapter plate | 44-1503-2366 | | 44-1503-2366 |
| 23 | Screws for adapter plate | DIN936-M6×16-4.8 | | |
| 24 | Inter-screw connection | 853-750-024 | | 402-116-351 |
| 25 | Sealing ring | - | | DIN7603-A14×18-CU |
| 26 | 2/2 directional solenoid valve for oil, 24 V DC, incl. rectangular connector | VPG-VEN+924 | | VPM-VEN+924 |
| 27 | Starter plate with flow limiter | 24-1883-2272 | | 24-1883-2273 |

Plug-in nozzle table

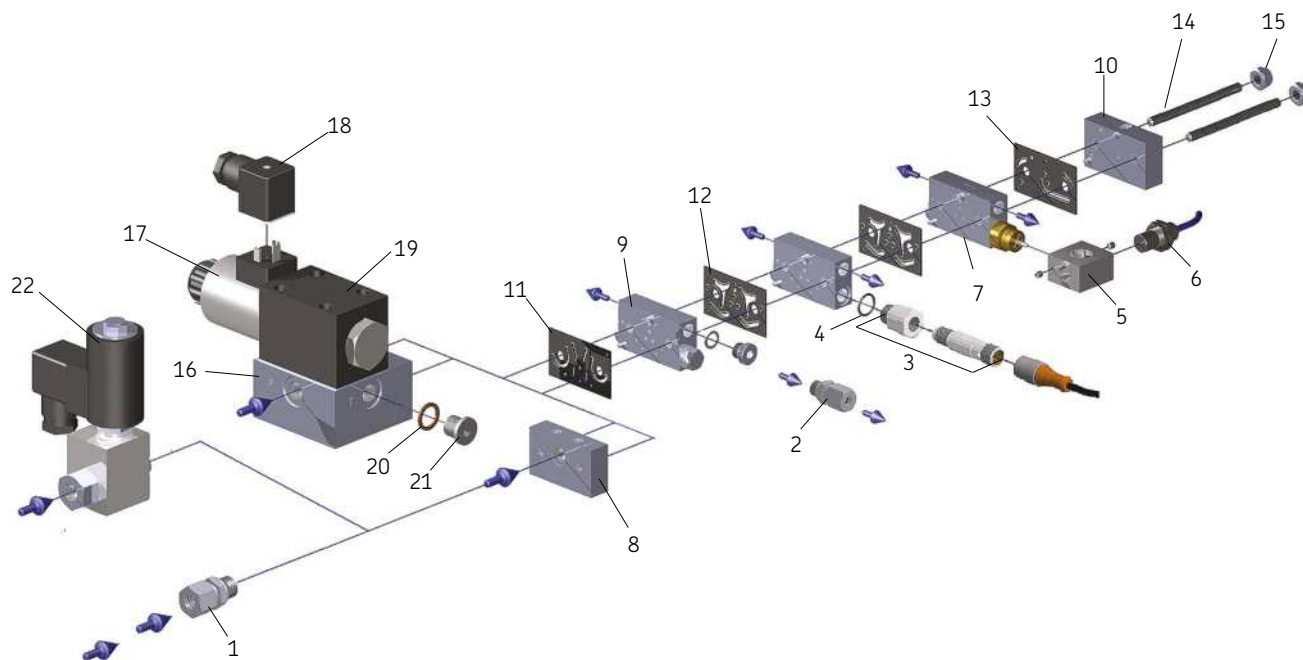
| Item | Nominal volumetric flow [l/min] | Nozzle index | Nozzle diameter [mm] | Plug-in nozzle Order No. |
|------|------------------------------------|--------------|-------------------------|-----------------------------|
| 28 | 0.08 | 050 | 0.50 | 24-0455-2574 |
| | 0.12 | 055 | 0.55 | 24-0455-2575 |
| | 0.15 | 060 | 0.60 | 24-0455-2576 |
| | 0.21 | 065 | 0.65 | 24-0455-2577 |
| | 0.25 | 070 | 0.70 | 24-0455-2578 |
| | 0.29 | 075 | 0.75 | 24-0455-2579 |
| | 0.35 | 080 | 0.80 | 24-0455-2580 |
| | 0.41 | 085 | 0.85 | 24-0455-2581 |
| | 0.47 | 090 | 0.90 | 24-0455-2582 |
| | 0.56 | 095 | 0.95 | 24-0455-2583 |
| | 0.65 | 100 | 1.00 | 24-0455-2584 |
| | 0.73 | 105 | 1.05 | 24-0455-2585 |
| | 0.79 | 110 | 1.10 | 24-0455-2586 |
| | 0.88 | 115 | 1.15 | 24-0455-2587 |
| | 0.98 | 120 | 1.20 | 24-0455-2588 |
| | 1.09 | 125 | 1.25 | 24-0455-2589 |

Overpressure indicator

| Item | Opening pressure [bar] | VPG Order No. | VPM Order No. |
|------|---------------------------|-------------------|-------------------|
| 29 | 50 | VPG-UE50-3 | VPM-UE50-3 |
| | 100 | VPG-UE100-3 | VPM-UE100-3 |
| | 150 | VPG-UE150-3 | VPM-UE150-3 |
| | 200 | VPG-UE200-3 | VPM-UE200-3 |

14.2 Spare parts – VPK

Fig. 48 VPK spare parts/ exploded view



Inlet fittings – VPKG (inch thread) and VPKM (metric thread)

| Item | Designation | Group | VPKG | VPKM |
|------|---|--------------|--------------------|--------------------|
| | | [LL] [L] [S] | Order No. | Order No. |
| 1 | Straight connector according to DIN2353, for pipe Ø 6 mm ¹⁾ | L | 406-403W | 406-403 |
| | Straight connector according to DIN2353, for pipe Ø 6 mm, tapered ¹⁾ | LL | - | 406-423 |
| | Straight connector according to DIN2353, for pipe Ø 8 mm, tapered ¹⁾ | LL | 408-423W | 441-008-511 |
| | Straight connector according to DIN2353, for pipe Ø 10 mm, tapered ¹⁾ | L | 410-443W | - |
| | Straight connector, design E02, for pipe Ø 6 mm | | 471-006-192 | 471-006-311 |
| | Straight quick disconnect coupling, for pipe Ø 6 mm | | 406-423W-VS | 406-004-VS |
| | Straight quick disconnect coupling, for pipe Ø 6 mm, tapered | | 406-423W | 451-006-518-VS |
| | Elbow connector according to DIN2353, for pipe Ø 6 mm, tapered ¹⁾ | L | 406-405W | 406-405 |
| | Elbow connector according to DIN2353, for pipe Ø 6 mm, tapered ¹⁾ | LL | - | 406-425 |
| | Elbow connector according to DIN2353, for pipe Ø 8 mm, tapered ¹⁾ | LL | 408-425W | 408-425 |
| | Elbow connector for quick disconnect coupling for pipe Ø 6 mm, tapered ¹⁾ | | 506-511-VS | 506-510-VS |
| | Banjo fitting according to DIN2353, for pipe Ø 6 mm ¹⁾ | L | 445-519-061 | 445-531-061 |
| | Banjo fitting according to DIN2353, for pipe Ø 6 mm ¹⁾ | LL | - | 445-531-062 |
| | Banjo fitting for quick disconnect coupling, for pipe Ø 6 mm | | 506-108-VS | 506-140-VS |
| | Banjo fitting for quick disconnect coupling, for pipe Ø 6 mm, tapered | | - | 455-531-068-VS |
| | 1) Solderless screw connection with cutting ring according to DIN 2353 LL series = very light series, L series = light series, S series = heavy series | | | |

Outlet fittings – VPKG (inch thread) and VPKM (metric thread)

| Item | Designation | Group | VPKG | VPKM |
|------|---|--------------|-------------|----------------|
| | | [LL] [L] [S] | Order No. | Order No. |
| 2 | Straight connector for pipe Ø 4 mm, tapered ¹⁾ | L | - | 404-403 |
| | Straight connector for pipe Ø 4 mm ¹⁾ | LL | 404-403W | - |
| | Straight connector for pipe Ø 6 mm, tapered ¹⁾ | LL | - | 406-423 |
| | Straight connector for pipe Ø 6 mm ¹⁾ | L | 406-403W | 406-403 |
| | Straight connector for pipe Ø 8 mm, tapered ¹⁾ | LL | 408-423W | 441-008-511 |
| | Straight connector for pipe Ø 10 mm, tapered ¹⁾ | L | 410-443W | - |
| | Straight connector, design E02, for pipe Ø 4 mm ¹⁾ | | 471-004-191 | 471-004-311 |
| | Straight connector, design E02, for pipe Ø 6 mm ¹⁾ | | 471-006-192 | 471-006-311 |
| | Straight quick disconnect coupling for pipe Ø 4 mm | | 404-040-VS | 404-006-VS |
| | Straight quick disconnect coupling for pipe Ø 4 mm, tapered ¹⁾ | | - | 451-004-518-VS |
| | Straight quick disconnect coupling for pipe Ø 6 mm | | 456-004-VS | 406-004-VS |
| | Straight quick disconnect coupling for pipe Ø 6 mm, tapered ¹⁾ | | 406-423W-VS | 451-006-518-VS |
| | 1) Solderless screw connection with cutting ring according to DIN 2353 LL series = very light series, L series = light series, S series = heavy series | | | |

Outlet fittings – VPKG (inch thread) and VPKM (metric thread)

| Item | Designation | Group | VPKG | VPKM |
|------|---|--------------|-------------------|-----------------------|
| | | [LL] [L] [S] | Order No. | Order No. |
| 2 | Outlet fitting for pipe Ø 6 mm, with check valve | | VPKG-RV6 | VPKM-RV-S4 |
| | Quick disconnect coupling fitting for pipe Ø 6 mm, with check valve | | - | VPKM-RV-VS |
| | Banjo fitting for pipe Ø 4 mm ¹⁾ | LL | 445-519-041 | - |
| | Banjo fitting for pipe Ø 6 mm ¹⁾ | L | 445-519-061 | 445-531-061 |
| | Banjo fitting for pipe Ø 6 mm ¹⁾ | LL | - | 445-531-062 |
| | Quick disconnect coupling for pipe Ø 4 mm, with banjo fitting | | 504-108-VS | 504-102-VS |
| | Quick disconnect coupling for pipe Ø 4 mm, tapered, with banjo fitting | | - | 455-531-048-VS |
| | Quick disconnect coupling for pipe Ø 6 mm, with banjo fitting | | 506-108-VS | 506-140-VS |
| | Quick disconnect coupling for pipe Ø 6 mm, tapered, with banjo fitting | | - | 455-531-068-VS |
| | 1) Solderless screw connection with cutting ring according to DIN 2353 LL series = very light series, L series = light series, S series = heavy series | | | |

Monitoring – VPKG (inch thread) and VPKM (metric thread)

| Item | Designation | VPKG | VPKM |
|------|--|-----------------|-----------|
| | | Order No. | Order No. |
| 3 | Bipolar piston detector kit, 2-pin ²⁾ | 24-0159-6022 | |
| | Universal piston detector kit, 3-pin ²⁾ | 24-0159-6024 | |
| 4 | Associated sealing ring | 96-9120-0062 | |
| 5 | Proximity switch housing | VPKM.13 | |
| | Screws for housing fitting | DIN914-M4×6-45H | |
| 6 | NAMUR proximity switch | 177-300-075 | |

²⁾ A kit includes the respective sensor with adapter and O-ring.

Progressive metering device components – VPKG (inch thread) and VPKM (metric thread)

| Item | Designation | VPKG | VPKM |
|------|---|----------------|----------------|
| | | Order No. | Order No. |
| 7 | Progressive metering device section 2T with cycle indicator right | VPKG-K-2T-ZY-R | VPKM-K-2T-ZY-R |
| | Progressive metering device section 3T with cycle indicator right | VPKG-K-3T-ZY-R | VPKM-K-3T-ZY-R |
| | Progressive metering device section 2T with cycle indicator left | VPKG-K-2T-ZY-L | VPKM-K-2T-ZY-L |
| | Progressive metering device section 3T with cycle indicator left | VPKG-K-3T-ZY-L | VPKM-K-3T-ZY-L |
| | Progressive metering device section 2S with cycle indicator right | VPKG-K-2S-ZY-R | VPKM-K-2S-ZY-R |
| | Progressive metering device section 3S with cycle indicator right | VPKG-K-3S-ZY-R | VPKM-K-3S-ZY-R |
| | Progressive metering device section 2S with cycle indicator left | VPKG-K-2S-ZY-L | VPKM-K-2S-ZY-L |
| | Progressive metering device section 3S with cycle indicator left | VPKG-K-3S-ZY-L | VPKM-K-3S-ZY-L |
| 8 | Inlet section | VPKG-E | VPKM-E |
| 9 | Progressive metering device section 05T | VPKG-K-05T-PS | VPKM-K-05T-PS |
| | Progressive metering device section 1T | VPKG-K-1T-PS | VPKM-K-1T-PS |
| | Progressive metering device section 2T | VPKG-K-2T-PS | VPKM-K-2T-PS |
| | Progressive metering device section 3T | VPKG-K-3T-PS | VPKM-K-3T-PS |
| | Progressive metering device section 05S | VPKG-K-05S-PS | VPKM-K-05S-PS |
| | Progressive metering device section 1S | VPKG-K-1S-PS | VPKM-K-1S-PS |
| | Progressive metering device section 2S | VPKG-K-2S-PS | VPKM-K-2S-PS |
| | Progressive metering device section 3S | PKG-K-3S-PS | VPKM-K-3S-PS |
| | Plug for twin section | 917-006-101 | 917-006-101 |

Progressive metering device components – VPKG (inch thread) and VPKM (metric thread)

| Item | Designation | VPKG | VPKM |
|-----------|---|-----------|-------------|
| | | Order No. | Order No. |
| 10 | Outlet section | | VPKM-A |
| 11 | Inlet plate | | VPKM.07 |
| 12 | Intermediate plate | | VPKM.08 |
| 13 | End plate | | VPKM.09 |
| 14 | Tie-rod for 3 progressive metering device sections, length 80+0.3 mm | | VPKM.93 |
| | Tie-rod for 4 progressive metering device sections, length 96.5+0.3 mm | | VPKM.94 |
| | Tie-rod for 5 progressive metering device sections, length 113.5+0.3 mm | | VPKM.95 |
| | Tie-rod for 6 progressive metering device sections, length 128+0.5 mm | | VPKM.96 |
| | Tie-rod for 7 progressive metering device sections, length 144+0.5 mm | | VPKM.97 |
| | Tie-rod for 8 progressive metering device sections, length 162+0.5 mm | | VPKM.98 |
| | Tie-rod for 9 progressive metering device sections, length 178+0.5 mm | | VPKM.99 |
| | Tie-rod for 10 progressive metering device sections, length 194+0.5 mm | | VPKM.100 |
| 15 | Hexagon nut | | DIN985-M6-8 |

Attachments – VPKG (inch thread) and VPKM (metric thread)

| Item | Designation | VPKG | VPKM |
|------|---|------------------|------------------|
| | | Order No. | Order No. |
| 16 | Starter plate for 4/2 and 3/2 directional solenoid valve | 44-0711-2263 | 44-0711-2264 |
| 17 | 4/2 directional solenoid valve, 24 V DC, without items.20, 21 | 161-140-050+924 | 161-140-050+924 |
| | 3/2 directional solenoid valve, 24 V DC, without items.20, 21 | 161-140-050+924 | 161-140-050+924 |
| 18 | Cable socket with protection circuit, 3m PUR cable and LED | 179-990-416 | 179-990-416 |
| 19 | Fixing bolt for directional control valve | DIN912-M5×45-8.8 | DIN912-M5×45-8.8 |
| 20 | Sealing ring | 504-019 | 504-019 |
| 21 | Plug screw | 95-0018-0908 | DIN908-M10×1-5.8 |
| 22 | 2/2 directional solenoid valve, 24 V DC | VPKG-VEN+924 | – |

14.3 Spare parts – VPB

Inlet fittings – VPBG (inch thread) and VPBM (metric thread)

| Item | Designation | Group | VPBG | VPBM |
|--|--|--------------|-------------------|-----------------------|
| | | [LL] [L] [S] | Order No. | Order No. |
| 1 | Straight connector according to DIN2353, for pipe Ø 6 mm ¹⁾ | L | 406-403W | - |
| | Straight connector according to DIN2353, for pipe Ø 6 mm, tapered ¹⁾ | LL | - | 406-423 |
| | Straight connector according to DIN2353, for pipe Ø 8 mm, tapered ¹⁾ | LL | 408-423W | 441-008-511 |
| | Straight connector according to DIN2353, for pipe Ø 10 mm, tapered ¹⁾ | L | 410-443W | 410-443 |
| | Straight quick disconnect coupling for pipe Ø 6 mm | | 406-423-VS | 451-006-518-VS |
| 1) Solderless screw connection with cutting ring according to DIN 2353 | | | | |

Outlet fittings – VPBG (inch thread) and VPBM (metric thread)

| Item | Designation | Group | VPBG (G1/8) | VPBM (M10x1) |
|------|--|--------------|-------------|----------------|
| | | [LL] [L] [S] | Order No. | Order No. |
| 2 | Straight connector for pipe Ø 4 mm, tapered ¹⁾ | L | - | 404-403 |
| | Straight connector for pipe Ø 4 mm ¹⁾ | LL | 404-403W | - |
| | Straight connector for pipe Ø 6 mm ¹⁾ | L | 406-403W | 406-403 |
| | Straight connector for pipe Ø 8 mm, tapered ¹⁾ | LL | 408-423W | 441-008-511 |
| | Straight connector for pipe Ø 10 mm, tapered ¹⁾ | L | 410-443W | - |
| | Straight quick disconnect coupling for pipe Ø 4 mm, tapered | | 404-040-VS | 451-004-518-VS |
| | Straight quick disconnect coupling for pipe Ø 6 mm, tapered | | 406-423W-VS | 451-006-518-VS |
| | Plug screw | | | 466-431-001 |
| | | | 466-419-001 | |
| | 1) Solderless screw connection with cutting ring according to DIN 2353 | | | |

Monitoring

| Item | Designation | VPB |
|--|--|---------------------|
| | | Order No. |
| 4 | Bipolar piston detector kit, 2-pin ¹⁾ | 24-0159-6028 |
| | Universal piston detector kit, 3-pin ¹⁾ | 24-0159-6023 |
| | Associated sealing ring | WVN501-10x1 |
| 1) A kit includes the respective sensor with adapter and O-ring. | | |

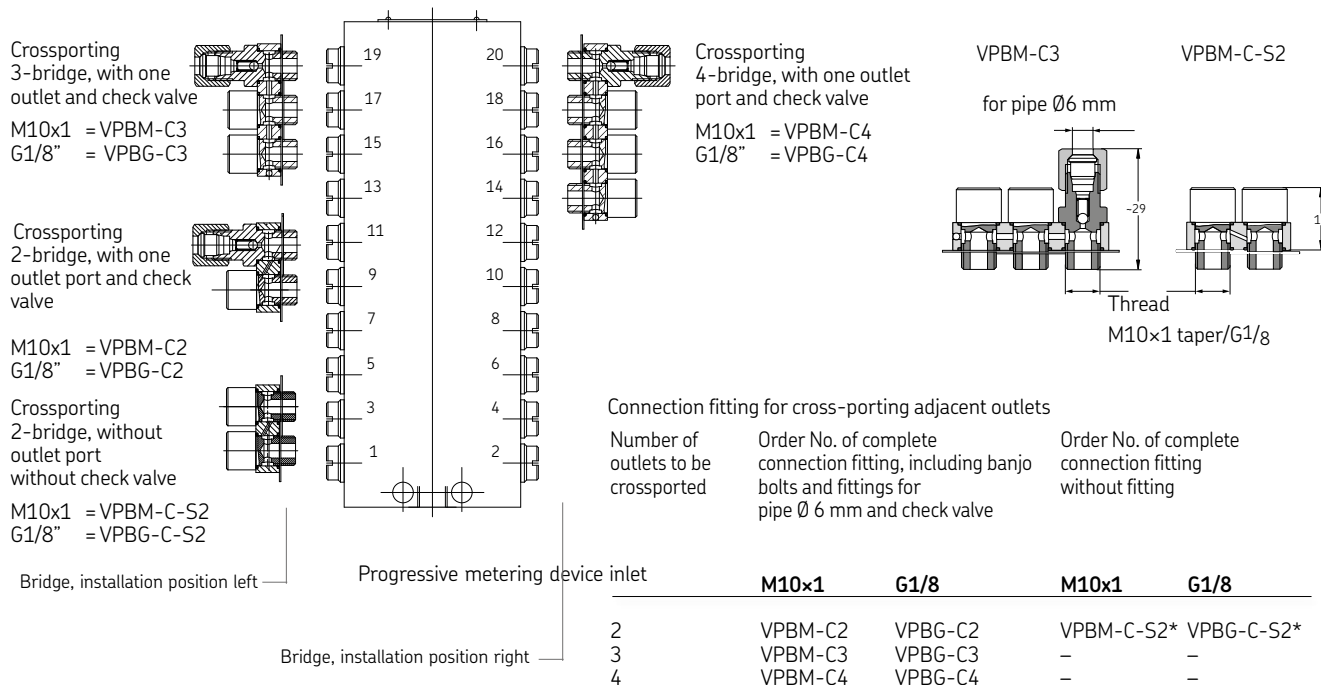
Attachments

| Item | Designation | VPB |
|-----------|--|------------------------|
| | | Order No. |
| 17 | 2/2 directional solenoid valve, 24 V DC, | 161-110-031+924 |
| 18 | Cable socket with protection circuit, 3m PUR cable and LED | 24-1882-2019 |
| 19 | Interscrew connection G1/4 to M10x1 | 44-0159-2282 |
| 20 | Sealing ring | 504-019 |
| | Plug screw | DIN908-M10x1-5.8 |

15. Accessories

15.1 VPB bridge designs (crossporting)

Fig. 49 VPB bridge designs (crossporting)

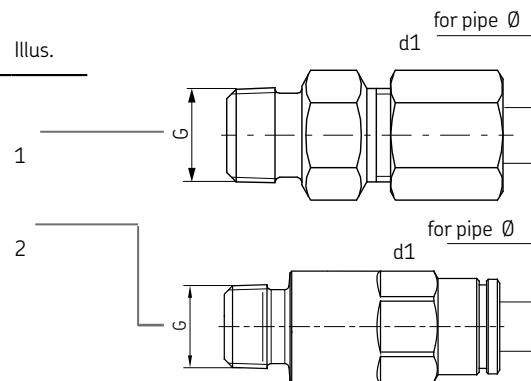


15.2 VPB check valves

Fig. 50 VPB check valves


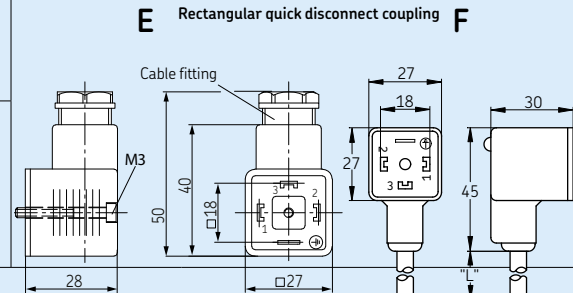
Check valves

| | Tube | | Opening pressure | Pressure, max. | |
|--|------|--------------|------------------|----------------|--------|
| Order No. | ød1 | G | [bar] | [bar] | Illus. |
| for direct screwing into a progressive metering device outlet. | | | | | |
| VPKG-RV | 6 | R1/8 taper. | 3 | 100 | 1 |
| VPKM-RV-S4 | 6 | M10×1 taper. | 2 | 100 | |
| for quick disconnect coupling | | | | | |
| VPKG-RV4-VS | 4 | R1/8 taper. | 3 | 300 | 2 |
| VPKG-RV-VS | 6 | G1/8 | 3 | 300 | |
| VPKM-RV-VS | 6 | M10×1 taper. | 3 | 300 | |



15.3 Cable sockets

Fig. 51 Cable sockets

| Designation | Order No. | Weight [g] | Illustration |
|---|--|---------------|---|
| Cable sockets M12x1, 4-pin design, without LED | | |  <p>For other cable sockets and technical data, please refer to brochure No. 1-1730-EN, "Electrical Plug and Socket Connectors."</p> |
| A | Circular connector, straight , without cable diameter 4–6 mm, 4-pin, max. 0.75 mm ² | 2360-00000316 | |
| B | Circular connector, straight , with 5-m integrally extruded cable, 4-pin, 4x0.25 mm ² | 179-990-600 | |
| B | Circular connector, straight , with 10-m integrally extruded cable, 4-pin, 4x0.25 mm ² | 179-990-603 | |
| C | Circular connector, angled , without cable diameter 4–6 mm, 4-pin, max. 0.75 mm ² | 2360-00000317 | |
| D | Circular connector, angled , with 5-m integrally extruded cable, 4x0.25 mm ² | 179-990-601 | |
| E | Rectangular quick disconnect coupling without cable, according to DIN EN175301-803-A, poles 3+PE, maximum conductor cross-section 4x1.5 mm ² | 179-990-033 |  <p>E Rectangular quick disconnect coupling F</p> |
| F | Rectangular quick disconnect coupling with 3 m cable, according to DIN EN175301-803-A, poles 2+PE, maximum conductor cross-section 3x0.75 mm ² with polarity reversal protection and LED status display | 179-990-416 | |

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Version 08

SKF Lubrication Systems Germany GmbH
Heinrich-Hertz-Straße 2-8
DE - 69190 Walldorf
Tel. +49 (0)62 27 33-0
Fax +49 (0)62 27 33-259
www.skf.com/lubrication

