Piston Pump with/without Lubricant Reservoir

Product series:
P.., PE.., PEU.., PEW..
PFW.., PFPW..
PPU.., PHU.., PW..
204-.., 205-..

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Read these instructions before installation or start-up of the product and keep them readily available for later consultation!

Original EC Declaration of Incorporation in accordance with Directive 2006/42/EC, Appendix II Part 1 B

The manufacturer hereby declares at its sole responsibility that the partly completed machinery conforms to the essential health and safety requirements of the Machinery Directive 2006/42/EC, Annex I, marked in the Annex to the EC Declaration of Incorporation as applicable and fulfilled at the time of placing on the market.
The special technical documents were prepared following Annex VII part B. Upon justifiable request, these special technical documents can be forwarded electronically to the respective national authorities. The authorized company for the compilation of the technical documentation is the manufacturer.

Designation:	Piston pump with/without lubricant reservoir, for use in centralized lubrication systems
Type / item number:	P.., PE.., PEU.., PEW.. PFW.., PFPW.. PPU.., PHU.., PW.. 204-.., 205-..
Year of manufacture:	See type plate

Furthermore, the following directives and standards were applied in the respective applicable areas:
2011/65/EU: RoHS II
2014/30/EU: Electromagnetic Compatibility

EN ISO 12100:2010	EN 60204-1:2018	EN 809+A1/AC:2010	EN IEC 63000:2018
EN IEC 61000-6-1-:2019	EN IEC 61000-6-2:2019	EN IEC 61000-6-3:2007+A1:2011	EN IEC 61000-6-4:2019
EN IEC 60947-5-2:2020			

The partly completed machinery must not be put into service until it has been established that the machinery into which it is to be incorporated is in compliance with the provisions of the Machinery Directive 2006/42/EC and all other applicable Directives.
Berlin, 14.09.2021

Jürgen Kreutzkämper	Richard Lindemann
Manager, R&D	Manager, SE
Germany	Berlin

Manufacturer: SKF Lubrication Systems Germany GmbH, Motzener Strasse 35/37, 12277 Berlin, Germany

Original UK Declaration of incorporation according to the Supply of Machinery (Safety) Regulations 2008 No. 1597 Annex II

The manufacturer hereby declares under sole responsibility that the partly completed machinery complies with the essential health and safety requirements of UK legislation Supply of Machinery (Safety) Regulations 2008 No. 1597 Annex I, marked in the Annex to the EC Declaration of Incorporation as applicable and fulfilled at the time of placing on the market.
The special technical documents were prepared following Annex VII part B. Upon justifiable request, these special technical documents can be forwarded electronically to the respective national authorities. The authorized company for the compilation of the technical documentation is SKF (U.K.) Limited, 2 Canada Close, Banbury, Oxfordshire, OX16 2RT, GBR.

Designation:	Piston pump with/without lubricant reservoir, for use in centralized lubrication systems
Type / item number:	P.., PE.., PEU.., PEW.. PFW.., PFPW.. PPU.., PHU.., PW.. 204-.., 205-..
Year of manufacture:	See type plate

Furthermore, the following regulations and standards were applied in the respective applicable areas:
Supply of Machinery (Safety) Regulations 2008 No. 1597

- Electromagnetic Compatibility Ordinance 2016 No. 1091
- The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 No. 3032

EN ISO 12100:2010	EN 60204-1:2018	EN 809+A1/AC:2010	EN IEC 63000:2018
EN IEC 61000-6-1-:2019	EN IEC 61000-6-2:2019	EN IEC 61000-6-3:2007+A1:2011	EN IEC 61000-6-4:2019
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Berlin, 14.09.2021

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Manager, R&D	Manager, SE
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Appendix to Declaration of Incorporation in accordance with 2006/42/EC, Annex II, No. 1 B

Description of the essential health and safety requirements according to 2006/42/EC, Annex I, which have been applied and fulfilled:

Table 1

Appendix to Declaration of Incorporation

No.:	Essential health and safety requirement	Applicable:	Fulfilled:
1.1	Principles		
1.1.2	Principles of safety integration	Yes	Yes
1.1.3	Materials and products	Yes	Not completely fulfilled [1)]
1.1.5	Design of machinery to facilitate its handling	Yes	Yes
1.1.6	Ergonomics	Yes	Not completely fulfilled [2)]
1.2	Control systems		
1.2.1	Safety and reliability of control systems	Yes	Yes
1.2.3	Starting	Yes	Yes
1.2.6	Failure of the power supply	Yes	Yes
1.3	Protection against mechanical hazards		
1.3.1	Risk of loss of stability	Yes	Yes
1.3.2	Risk of break-up during operation	Yes	Not completely fulfilled [3)]
1.3.4	Risks due to surfaces, edges or angles	Yes	Yes
1.3.7	Risks related to moving parts	Yes	Yes
1.3.9	Risks of uncontrolled movements	Yes	Yes
1.5	Risks due to other hazards		
1.5.1	Electricity supply	Yes	Yes
1.5.6	Fire	Yes	Yes
1.5.8	Noise	Yes	Yes
1.5.13	Emissions of hazardous materials and substances	Yes	Yes
1.5.15	Risk of slipping, tripping, or falling	Yes	Not completely fulfilled [4)]
1.6	Servicing		
1.6.1	Machinery maintenance	Yes	Yes
1.6.2	Access to operating positions and servicing points	Yes	Not completely fulfilled [5)]
1.6.4	Operator interventions	Yes	Yes
1.7	Information		
1.7.1	Information and warnings on the machinery	Yes	Yes
1.7.1.1	Information and information devices	Yes	Yes
1.7.2	Warning of residual risks	Yes	Yes
1.7.3	Marking of machinery	Yes	Yes
1.7.4	Operating instructions/assembly instructions	Yes	Yes
1.7.4.1	General principles for the drafting of operating instructions/assembly instructions	Yes	Yes
1.7.4.2	Contents of the operating instructions/assembly instructions	Yes	Yes
1.7.4.3	Sales literature	Yes	Yes

[1)] The product is designed for operation with non-hazardous media. The owner-operator must check whether the lubricant used has certain hazardous effects (such as sensitization). The installation of a drip pan could be required.

[2)] The integrator must ensure that the pump is integrated into the machine in such a way that it can be filled and operated ergonomically.

[3)] The operator must protect the system against excessive pressure. For this purpose, the system must be provided with a pressure limiting valve with suitable opening pressure.

[4)] Not relevant to the partly completed machinery.

[5)] The integrator must ensure that the pump is integrated into the machine in such a way that it can be operated without danger.

Masthead

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- North America -
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Lincoln Industrial
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MO. 63134 USA

- South America -
SKF Argentina Pte. Roca 4145,
CP 2001 Rosario, Santa Fe

Warranty
The instructions contain no statements regarding the warranty or liability for defects. That information can be found in our General Terms of Payment and Delivery.

Training
We conduct detailed training in order to enable maximum safety and efficiency. We recommend taking advantage of this training. For further information, contact your authorized SKF dealer or the manufacturer.

Table of contents

Safety alerts, visual presentation, and layout

While reading these instructions, you will encounter various symbols, illustrations, and text layouts intended to help you navigate and understand the instructions. Their meaning is explained below.

Safety alerts:
Activities that present specific hazards (to life and limb or possible damage to property) are indicated by safety alerts. Always be sure to follow the instructions given in the safety alerts.

⚠ DANGER
These safety alerts indicate an imminent danger. Ignoring them will result in death or serious injury

⚠ WARNING
These safety alerts indicate potentially imminent danger. Ignoring them could result in death or serious injury

⚠ CAUTION
These safety alerts indicate potentially imminent danger. Ignoring them could result in minor injury

NOTICE
These safety alerts indicate a potentially harmful situation. Ignoring them could result in damage to property or malfunctions

Illustrations:
The illustrations used depict a specific product. For other products, they may have the function of a diagram only. This does not alter the basic workings and operation of the product.

Text layout:
- **First-order bulleted lists:** Items on a bulleted list start with a solid black dot and an indent.
  - **Second-order bulleted lists:** If there is a further listing of subitems, the second-order bulleted list is used.

1 **Legend:** A legend explains the numbered contents of an illustration, presented as a numbered list. Items in a legend start with a number (with no dot) and an indent.
  - **Second-order legend:** In some cases, the numbered contents of an image represent more than just one object. A second-order legend is then used.

1. **Instruction steps:** These indicate a chronological sequence of instruction steps. The numbers of the steps are in bold and are followed by a period. If a new activity follows, the numbering starts again at "**1.**"
  - **Second-order instruction steps:** In some cases, it is necessary to divide up a step into a few substeps. A sequence of second-order instruction steps is then used.

1. Safety instructions

1.1 General safety instructions

- Putting the products into operation or operating them without having read the instructions is prohibited. The operator must ensure that the instructions are read and understood by all persons tasked with working on the product or who supervise or instruct such persons. Retain the instructions for further use.
- The product may only be used in awareness of the potential dangers, in proper technical condition, and according to the information in this manual.
- Any faults that could affect safety must be remedied according to responsibility. The supervisor must be notified immediately in case of malfunctions outside one's individual scope of responsibility.
- Unauthorized modifications and changes can have an unpredictable effect on safety and operation. Unauthorized modifications and changes are therefore prohibited. Only original SKF spare parts and SKF accessories may be used.
- Any unclear points regarding proper condition or correct assembly/operation must be clarified. Operation is prohibited until issues have been clarified.
- The components used must be suitable for the intended use and the applicable operating conditions, e.g. max. operating pressure and ambient temperature range, and must not be subjected to torsion, shear, or bending.

1.2 General behaviour when handling the product

- Familiarize yourself with the functions and operation of the product. The specified assembly and operating steps and their sequences must be observed.
- Keep unauthorized persons away.
- Wear personal protective equipment always.
- Precautionary operational measures and instructions for the respective work must be observed.
- In addition to these Instructions, general statutory regulations for accident prevention and environmental protection must be observed.
- Precautionary operational measures and instructions for the respective work must be observed. Uncertainty seriously endangers safety.
- Safety-related protective and safety equipment must not be removed, modified or affected otherwise in its function and is to be checked at regular intervals for completeness and function.
- If protective and safety equipment has to be dismantled, it must be reassembled immediately after finishing the work, and then checked for correct function.
- Remedy occurring faults in the frame of responsibilities. Immediately inform your superior in the case of faults beyond your competence.
- Never use parts of the centralized lubrication system or of the machine as standing or climbing aids.

1.3 Intended use

Supply of lubricants.
Spare parts should only be used to replace faulty components of identical construction.
Contactless recording of objects.
Use is only permitted within the scope of commercial or economic activity by professional users, in compliance with the specifications, technical data, and limits specified in this manual.

1.4 Persons authorized to use the product

Operator
A person who is qualified by training, knowledge and experience to carry out the functions and activities related to normal operation. This includes avoiding possible hazards that may arise during operation.

Specialist in electrics
Person with appropriate professional education, knowledge and experience to detect and avoid the hazards that may arise from electricity.

Specialist in mechanics
Person with appropriate professional education, knowledge and experience to detect and avoid the hazards that may arise during transport, installation, start-up, operation, maintenance, repair and disassembly.

1.5 Foreseeable misuse

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

- Use of non-specified consumables, contaminated lubricants, or lubricants with air inclusions.
- Use of C3 versions in areas with aggressive, corrosive substances (e.g., high salt load).
- Use of plastic parts in areas with high exposure to ozone, UV light, or ionizing radiation.
- Use to supply, convey, or store hazardous substances and mixtures as defined in the CLP Regulation (EC 1272/2008) or GHS with acute oral, dermal, or inhalation toxicity or substances and mixtures that are marked with hazard pictograms GHS01-GHS06 and GHS08.
- Use to supply, convey, or store Group 1 fluids classified as hazards as defined in the Pressure Equipment Directive (2014/68/EU) Article 13 (1) a).
- Use to supply, convey, or 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.
- Use without proper securing against excessively high pressures, in the case of pressurized products.
- Use outside of the technical data and limits specified in this manual.

1.6 Referenced documents

In addition to this manual, the following documents must be observed by the respective target group:
- Company instructions and approval rules

If applicable:
- Safety data sheet of the lubricant used
- Project planning documents
- Supplementary information regarding special designs of the pump. This you will find in the special system documentation.
- Instructions for other components for setting up the centralized lubrication system.

1.7 Prohibition of certain activities

- Replacement of or modifications to the pistons of the pump elements
- Repairs or modifications to the drive

1.8 Painting plastic components and seals

The painting of any plastic components and seals of the products described is prohibited. Completely mask or remove plastic components before painting the main machine.

1.9 Safety markings on the product

No safety markings on the product

NOTE

In accordance with the results of the workstation risk assessment, additional labels (e.g., warnings, safety signs, prohibition signs, or labels in accordance with CLP/GHS) are to be attached by the operator if necessary.

1.10 Note on the type plate

The type plate provides important data such as the type designation, order number, and sometimes regulatory characteristics. To avoid loss of this data in case the type plate becomes illegible, it should be entered in the manual.

1.11 Notes on CE marking

CE marking is effected following the requirements of the applied directives requiring a CE marking:

- 2006/42/EG Machinery Directive
- 2014/30/EC Electromagnetic Compatibility
- 2011/65/EU Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS II)

1.12 Note on UKCA marking

The UKCA conformity marking confirms the product's conformity with the applicable legal provisions of Great Britain.

1.13 Note on EAC marking

The EAC conformity marking confirms the product's conformity with the applicable legal provisions of the Eurasian customs union.

1.14 Note on China RoHS marking

The China RoHS mark confirms that there is no danger to persons or the environment from the regulated substances contained within for the intended period of use (year number shown in the circle).

1.15 Emergency shutdown

This is done by a course of action to be defined by the operator.

1.16 Assembly, maintenance, fault, repair

Prior to the start of this work, all relevant persons must be notified of it. At a minimum, the following safety measures must be taken before any work is done:
- Unauthorized persons must be kept away
- Mark and secure the work area
- Cover adjacent live parts
- Dry any wet, slippery surfaces or cover them appropriately
- Cover hot or cold surfaces appropriately

Where applicable:
- Depressurize
- Isolate, lock and tag out
- Check to ensure live voltage is no longer present
- Ground and short-circuit

The product should be protected as much as possible from humidity, dust, and vibration, and should be installed so that it is easily accessible. Ensure an adequate distance from sources of heat or cold. Any visual monitoring devices present, such as pressure gauges, min./max. markings, or oil level gauges must be clearly visible. Observe the mounting position requirements.

Drill required holes only on non-critical, non-load-bearing parts of the operator's infrastructure. Use existing holes where possible. Avoid chafe points. Immobilize any moving or detached parts during the work. Adhere to the specified torques.

If guards or safety devices need to be removed, they must be reinstalled immediately following conclusion of work and then checked for proper function.

Check new parts for compliance with the intended use before using them.

Avoid mixing up or incorrectly assembling disassembled parts. Label parts. Clean any dirty parts.

1.17 First start-up, daily start-up

Ensure that:
- All safety devices are fully present and functional
- All connections are properly connected
- All parts are correctly installed
- All warning labels on the product are fully present, visible, and undamaged
- Illegible or missing warning labels are immediately replaced

1.18 Residual risks

Table 2

Residual risks

Residual risk	Possible in lifecycle	Avoidance / Remedy
Parts tipping/falling during transport, e.g., on an incline.	A	• Secure parts against tipping/falling during transport (e.g., using belts, straps, ropes, etc.).
Falling of hoisted parts/tools.	B	• Personnel are not permitted to stand under hoisted parts. Unauthorized persons must be kept away. Secure hoisted parts using suitable lifting gear (e.g., using belts, straps, ropes, etc.).
Falling of parts inadequately secured to the machine.	B	• Mount the product only on machine parts with sufficient load-carrying capacities. Be mindful of the weight. Comply with the specified torques. If no torques are specified, use those specified for thread size 8.8 ➔ See literature from the screw manufacturer.
Personnel slipping due to floor contamination with spilled or leaked lubricants.	B C E G H K	• Exercise caution when connecting hydraulic connections on the product. • Promptly apply suitable binding agents and then remove the spilled or leaked lubricant. • Follow operational instructions for handling the lubricants and contaminated parts.
Tearing or damage to lines when installed on moving machine components.	B	• Installing the pump on moving machine components should be avoided whenever possible. In cases where mounting the pump in this way cannot be avoided, flexible hose lines must be used.
Incorrect mounting position. • Foreign objects fall into the motor's air inlet. • Borehole to drain condensation water at a level above the lowest point on the motor.	B	• Install an appropriate canopy over the air inlet. Use a different mounting position only if the formation of condensation water is excluded. Remove any condensation water with a suitable suction device.
Lubricant spraying out due to faulty component fitting, or incorrect connection of lines.	B C	• Tighten all components securely or using the specified torques. • Use hydraulic screw unions and lines suitable for the indicated pressures, and check them for proper connection and for damage prior to first start-up.
Strong heating of the motor, or motor fault, due to jamming.	G	• Switch off the pump. Let parts cool off; remedy the cause.
Environmental contamination by lubricants and wetted parts.	K	• Dispose of contaminated parts according to the applicable legal/company rules.

Table 2

Residual risks

Residual risk	Possible in lifecycle	Avoidance / Remedy
Personal injury, property damage due to spilled, leaked lubricant.	B C D F G H K	• Be careful when connecting or disconnecting the lubricant lines. Use only hydraulic screw unions and lubrication lines suitable for the specified pressure. Do not mount lubrication lines on moving parts or chafe points. If this cannot be avoided, use anti-kink coils and/or conduits.
Fire hazard or damage to the pump from operation with damaged electrical components, such as power cables and plugs.	B C D E F G H	• Inspect electrical components for damage prior to initial use and then at regular intervals. Do not install cables on moving parts or chafe points. If this cannot be avoided, use anti-kink coils and/or conduits.
Loss of electrical protective function due to incorrect assembly of the electrical components after a repair.	G	• An electrical safety check in accordance with ISO 60204-1 must be performed after the replacement of electrical components.
Damage to the pump from failure to comply with the permissible cyclic duration factor.	C D	• Operate the pump only within the permissible cyclic duration factor.

Lifecycle phases: 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 selected specifically for the relevant application. The manufacturer or operator of the machine should ideally make the selection in consultation with the supplier of the lubricant. If you have no or little experience in selecting lubricants for lubrication systems, please contact us. We would be happy to assist you in selecting suitable lubricants and components to build a lubrication system optimized for your particular application. Consider the following points when selecting/using lubricants. This will spare you potential downtime and damage to the machine or lubrication system.

2.2 Material compatibility

The lubricants must generally be compatible with the following materials:

- Plastics: ABS, CR, FPM, NBR, NR, PA, PET, PMMA, POM, PP, PS, PTFE, PU, PUR
- Metals: steel, gray cast iron, brass, copper, aluminum

2.3 Temperature properties

The lubricant used must be suitable for the specific ambient temperature of the product. The viscosity approved for proper functioning must neither be exceeded at low temperatures nor fall too low at high temperatures. For the approved viscosity, see the “Technical data” chapter.

2.4 Aging of lubricants

Based on past experience with the lubricant used, checks should be conducted at regular intervals defined by the operator, to determine whether the lubricant needs to be replaced due to aging processes (oil separation). In case of doubt regarding the continued suitability of the lubricant, it must be replaced before the system is started up again. If you do not yet have any experience with the lubricant used, we recommend conducting a check after just one week.

2.5 Avoidance of faults and hazards

To avoid faults and hazards, please observe the following:

- When handling lubricants, observe the relevant safety data sheet (SDS) and any hazard labeling on the packaging.
- Due to the large number of additives, some lubricants that meet the pumpability requirements specified in the manual are not suitable for use in centralized lubrication systems.
- Whenever possible, always use SKF lubrication greases. They are ideal for use in lubrication systems.
- Do not mix lubricants. This can have unpredictable effects on the properties and usability of the lubricant.
- Use lubricants containing solid lubricants only after technical consultation with SKF.
- The lubricant’s ignition temperature has to be at least 50 kelvin above the maximum surface temperature of the components.

2.6 Solid lubricants

Solid lubricants may only be used after prior consultation with SKF. When solid lubricants are used in lubrication systems, the following rules generally apply:

Graphite:

- Maximum graphite content 8%
- Maximum grain size 25 µm (preferably in lamellar form)

MoS2:

- Maximum MoS2 content 5%
- Maximum grain size 15 µm

Copper:

- Lubricants containing copper are known to lead to coatings forming on pistons, bore holes, and mating surfaces. This can result in blockages in the centralized lubrication system.

Calcium carbonate:

- Lubricants containing calcium carbonate are known to lead to very heavy wear on pistons, bore holes, and mating surfaces.

Calcium hydroxide:

- Lubricants containing calcium hydroxide are known to harden considerably over time, which can lead to failure of the centralized lubrication system.

PTFE, zinc, and aluminum:

- For these solid lubricants, it is not yet possible to define any limit values for use in lubrication systems on the basis of existing knowledge and practical experience.

3. Overview, functional description

3.1 Overview

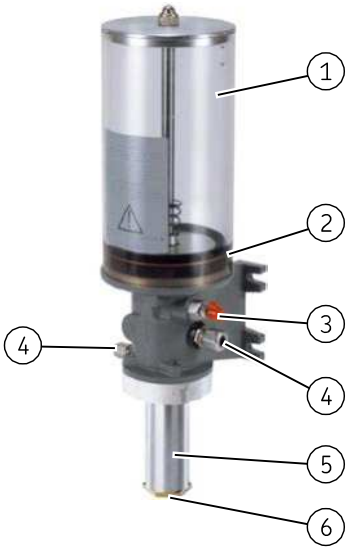
In the following you will find an overview of the most important equipment features of the pump

Fig. 1

PEF-99-... / PEU-99-...

Legend to Figure 1:
1 Level switch
2 Filler socket
3 Reservoir
4 Compressed air port
5 Piston pump housing
6 Lubrication line connection

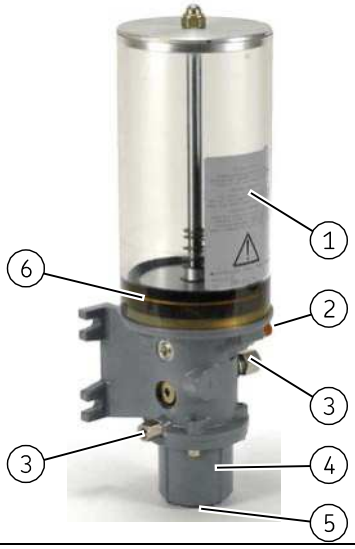
Fig. 2



PFH-23-2 / PFH-23-22

Legend to Figure 2:
1 Reservoir
2 Follower piston
3 Filling piston
4 Lubrication line connection (1x PFH-23-2 / 2x PFH-23-22)
5 Piston pump housing
6 Hydraulic connection

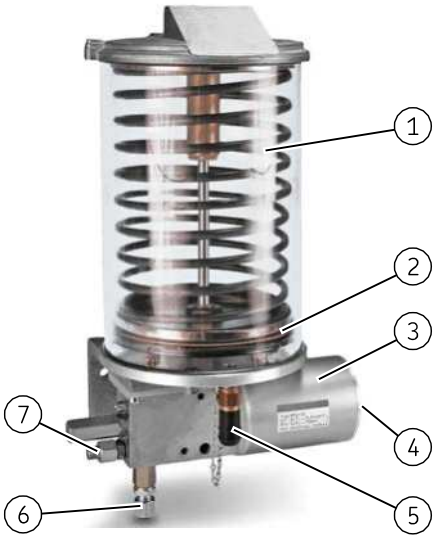
Fig. 3



PFP-23-2 / PFP-23-22

Legend to Figure 3:
1 Reservoir
2 Filler coupling
3 Lubrication line connection (1x PFP-23-2 / 2x PFP-23-22)
4 Piston pump housing
5 Compressed air port
6 Follower piston

Fig. 4



PPU-x... / PHU-x...

Legend to Figure 4:
1 Reservoir
2 Follower piston
3 Piston pump housing
4 Compressed air/hydraulics connection
5 Filler coupling
6 Lubrication line connection
7 Overflow valve (blowout disc)

3.2 Model designs

Piston pumps with/without lubricant reservoir are lubricant supply pumps that are operated mechanically (manually), hydraulically or pneumatically. Piston pumps with/without lubricant reservoir are used to supply oils, fluid greases, or greases in centralized lubrication systems with piston metering devices or progressive metering devices.

See the technical documentation for technical details on piston pumps with/without lubricant reservoir.

NOTE
If no documentation is available, you can request it directly from SKF Lubrication Systems Germany GmbH

The most important technical specifications for piston pumps with/without lubricant reservoir are listed in section 4.

3.3 Piston pumps for piston metering device systems

The manually, pneumatically or hydraulically actuated piston of the piston pump feeds the lubricant drawn from a separate lubricant reservoir or a reservoir mounted on the piston pump into the piston metering device system through the pressure relief valve and to the piston metering devices.

3.3.1 Lubrication cycle sequence

The sequence of a lubrication cycle depends on the type of piston metering devices in use. Piston metering devices are differentiated into prelubrication metering devices and relubrication metering devices. Piston metering devices designed as prelubrication metering devices deliver the metered quantity of lubricant at the same time that pressure is built up in the lubricant line. Piston metering devices designed as relubrication metering devices supply the metered quantity of lubricant after the pressure relief procedure in the lubricant line.

3.3.2 Lubrication cycle of prelubrication metering device

After the delivery piston is actuated (manually, pneumatically or hydraulically), the lubricant is fed through the lubricant line to the prelubrication metering devices via the pressure relief valve. The pressure built up in the centralized lubrication system meters the lubricant separately for each lubrication point and feeds it to the consuming points. After the working stroke, the actuating piston of the piston pump is returned to its normal position. In the process, it draws lubricant into the suction chamber. After pressure has been relieved in the lubricant line, the lubricant is shifted within the prelubrication metering device from the spring chamber into the metering chamber. The centralized lubrication system is ready for the next lubrication cycle.

3.3.3 Lubrication cycle of relubrication metering device

After the delivery piston is actuated (manually, pneumatically or hydraulically), the lubricant is fed through the lubricant line to the relubrication metering devices via the pressure relief valve. The pressure built up in the centralized lubrication system feeds the lubricant into the storage chamber of the relubrication metering devices. After the working stroke, the actuating piston of the piston pump is returned to its normal position and pressure is relieved in the centralized lubrication system, which meters the lubricant within the relubrication metering device and delivers to the lubrication point (relubrication effect). After the lubricant has been completely expelled to the lubrication point, the centralized lubrication system is ready for the next lubrication cycle.

3.3.4 Connected load

Since every working stroke of the piston pump triggers a new lubrication procedure, be sure that the connected load of the centralized lubrication system is a maximum of 2/3 of the delivery volume of the piston pump in order to ensure the necessary reserves for pressure build-up in the centralized lubrication system.

The connected load can be roughly calculated as follows:
Sum of all volumes from the centralized lubrication system's metering devices + 25 % of that value (safety margin) + 1 cm^3 per meter of main line (expansion loss, only for hose lines) + Compressibility loss per meter of main line acc. to Table 3 (only for centralized lubrication systems for grease supply).

Table 3

Compressibility loss in pipes conducting grease, in cm^3/m

Pipe 6 x 0.7	Pipe 8 x 0.7	Pipe 10 x 0.7
0.17	0.34	0.58

3.3.5 Piston pumps for progressive metering device systems

Piston pumps for progressive metering device systems differ from piston pumps for piston metering device systems in that they do not have a pressure relief valve. In these piston pumps, the lubricant drawn from a separate or attached lubricant reservoir is fed to the progressive metering devices via the pressure regulating valve in the piston pump. The progressive metering devices in turn distribute the lubricant to the individual lubrication points.

Piston pumps for progressive metering device systems can be actuated several times in sequence if the lubricant quantity of a piston stroke is not sufficient to fill the entire centralized lubrication system.

4. Technical data

Table 4

Technical data (model designs)

Type designation		P-26-2	P-27-2	P-36-3	P-37-3
Type of actuation		manual	manual	hydraulic	hydraulic
Pressure relief valve		Yes	Yes	Yes	Yes
Pressure relief valve		-	-	-	-
Delivery rate		7 cm^3/stroke	7 cm^3/stroke	7 cm^3/stroke	7 cm^3/stroke
Operating pressure P2		25 bar [1)]	25 bar [1)]	15 - 35 bar	15 - 35 bar
Operating pressure P1		-	-	15 - 35 bar	15 - 35 bar
Wall mounted		Yes	-	Yes	-
Reservoir mounted		-	Yes	-	Yes
Reservoir size		-	-	-	-
Lubricant	Grease NLGI Grade	-	-	-	-
	Oil viscosity	15 - 150 mm^2/s	15 - 150 mm^2/s	15 - 150 mm^2/s	15 - 150 mm^2/s

Table 5

Technical data (model designs)

Type designation		P-66-2	P-67-2	P-76-2	P-77-2
Type of actuation		manual	manual	hydraulic	hydraulic
Pressure relief valve		Yes	Yes	Yes	Yes
Pressure relief valve		-	-	-	-
Delivery rate		30 cm^3/stroke	30 cm^3/stroke	30 cm^3/stroke	30 cm^3/stroke
Operating pressure P2		25 bar [1)]	25 bar [1)]	15 - 35 bar	15 - 35 bar
Operating pressure P1		-	-	15 - 35 bar	15 - 35 bar
Wall mounted		Yes	-	Yes	-
Reservoir mounted		-	Yes	-	Yes
Reservoir size		-	-	-	-
Lubricant	Grease NLGI Grade	-	-	-	-
	Oil viscosity	15 - 150 mm^2/s	15 - 150 mm^2/s	15 - 150 mm^2/s	15 - 150 mm^2/s

Table 6

Technical data (model designs)

Type designation	P-86-2	P-276	P-289	PF-289
Type of actuation	pneumatic	hydraulic	pneumatic	pneumatic
Pressure relief valve	Yes	Yes	Yes	Yes
Pressure relief valve	-	-	-	-
Delivery rate	30 cm^3/stroke	50 cm^3/stroke	10 cm^3/stroke	10 cm^3/stroke
Operating pressure P2	25 bar	20 - 35 bar	4.9 x P1 bar	4.8 x P1 bar
Operating pressure P1	6.5 - 15 bar	35 – 150 bar [2)]	3.5 - 10 bar	3.5 - 10 bar
Wall mounted	Yes	Yes	-	-
Reservoir mounted	-	-	-	-
Reservoir size	-	-	1.8 l	1.8 l

Table 6

Technical data (model designs)

Type designation		P-86-2	P-276	P-289	PF-289
Lubricant	Grease NLGI Grade	-	-	-	00.000
	Oil viscosity	15 - 150 mm²/s	15 - 620 mm²/s	15 - 620 mm²/s	-

Table 7

Technical data (model designs)

Type designation		PW-289	P-886	P-887	PFE 4-2 [3]
Type of actuation		pneumatic	pneumatic	pneumatic	manual
Pressure relief valve		Yes	Yes	Yes	manually operated
Pressure relief valve		-	-	-	-
Delivery rate		10 cm³/stroke	30 cm³/stroke	30 cm³/stroke	4 cm³/stroke
Operating pressure P2		4.8 x P1 bar	25 bar	25 bar	80 bar [1]
Operating pressure P1		3.5 - 10 bar	4 - 10 bar	4 - 10 bar	-
Wall mounted		-	Yes	-	-
Reservoir mounted		-	-	Yes	-
Reservoir size		1.8 l	-	-	-
Lubricant	Grease NLGI Grade	-	-	-	00.000
	Oil viscosity	15 - 620 mm²/s	15 - 150 mm²/s	15 - 150 mm²/s	-

Table 8

Technical data (model designs)

Type designation		205-650-3 [3]	204-150-3 [3]	204-550-3 [3]	204-650-3 [3]
Type of actuation		Mechanical	Mechanical	Mechanical	Mechanical
Pressure relief valve		Yes	No	No	No
Pressure relief valve		-	-	-	-
Delivery rate		1.6 cm³/stroke	0.1 cm³/stroke	0.4 cm³/stroke	1.6 cm³/stroke
Operating pressure P2		20 bar	40 bar	40 bar	20 bar
Operating pressure P1		-	-	-	-
Wall mounted		Yes	Yes	Yes	Yes
Reservoir mounted		-	-	-	-
Reservoir size		-	-	-	-
Lubricant	Grease NLGI Grade	-	-	-	-
	Oil viscosity	15 - 150 mm²/s	15 - 150 mm²/s	15 - 150 mm²/s	15 - 150 mm²/s

Table 9

Technical data (model designs)

Type designation	PHU 5	PPU 5	PPU 35	PHU 35	PFP 298
Type of actuation	hydraulic	pneumatic	pneumatic	hydraulic	pneumatic
Pressure relief valve	No	No	No	No	No
Pressure relief valve	-	-	-	-	-

Table 9

Technical data (model designs)

Type designation		PHU 5	PPU 5	PPU 35	PHU 35	PFP 298
Delivery rate		0.1 - 0.5 cm^3/stroke	0.1 - 0.5 cm^3/stroke	0.7 - 3.5 cm^3/stroke	0.7 - 3.5 cm^3/stroke	2 x 1.4 cm^3/stroke
Operating pressure P2		160 bar	160 bar	160 bar	160 bar	120 - 280 bar
Operating pressure P1		20 - 50 bar	4.5 - 10 bar	4.5 - 10 bar	2 - 50 bar	5 - 50 bar
Wall mounted		Yes	Yes	Yes	Yes	-
Reservoir mounted		-	-	-	-	-
Reservoir size		-	-	-	-	1.5 l
Lubricant	Grease NLGI Grade	2	2	2	2	2
	Oil viscosity	-	-	-	-	-

[1] Achievable pressure depends on manual force exerted

[2] For pressures above 35 bar, install a pressure regulating valve at the end of the system

[3] Mounting position: pressure connection on top

5. Delivery, returns, storage

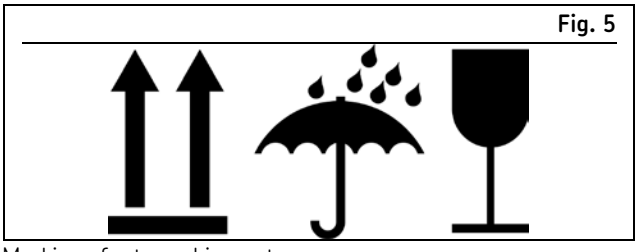
5.1 Delivery

After receipt of the shipment, it must be inspected for any shipping damage and for completeness according to the shipping documents. Immediately inform the transport carrier of any shipping damage. The packaging material must be preserved until any discrepancies are resolved.

5.2 Return shipment

Before return shipment, all contaminated parts must be cleaned. If this is not possible or practical, e.g. if it would impede fault detection in the case of complaints, the medium used must always be specified. In the case of products contaminated with hazardous substances as defined by GHS or CLP regulations, the safety data sheet (SDS) must be sent with the product and the packaging must be labelled in accordance with GHS/CLP. There are no restrictions for land, air, or sea transport. The choice of packaging should be based on the specific product and the stresses to be expected during transport (e.g., necessary anti-corrosion measures in the case of shipment by sea). In the case of wooden packaging, the applicable import regulations and the IPPC standards must be observed. Required certificates must be included in the shipping documents. The following information, as a minimum, must be marked on the packaging of return shipments.

Fig. 5



Marking of return shipments

5.3 Storage

The following conditions apply to storage:

- Dry, low-dust, vibration-free, in closed rooms
- No corrosive, aggressive substances at the storage location (e.g., UV rays, ozone)
- Protected against animals (insects, rodents)
- If possible, keep in the original product packaging
- Protected from nearby sources of heat or cold
- In the case of large temperature fluctuations or high humidity, take appropriate measures (e.g., heating) to prevent the condensation of water
- Before usage, check products for damage that may have occurred during storage. This applies in particular to parts made of plastic (due to embrittlement).

5.4 Storage temperature range

For parts not filled with lubricant, the permitted storage temperature is the same as the permitted ambient temperature range (see “Technical data”).

5.5 Storage conditions for products filled with lubricant

For products filled with lubricant, the permitted storage temperature range is:

minimum	+ 5 °C	[+41 °F]
maximum	+ 35 °C	[+95 °F]

If the storage temperature range is not maintained, the following steps for replacing the lubricant may not lead to the desired result under certain circumstances.

5.5.1 Storage period up to 6 months

Filled products can be used without implementing additional measures.

5.5.2 Storage period between 6 and 18 months

Pump:

- Connect the pump to a power source
- Switch on the pump and run it until lubricant comes out of every outlet without air bubbles
- Disconnect the pump from the power source
- Remove and dispose of the lubricant that came out

Lines:

- Remove pre-installed lines
- Ensure that both ends of the line are open
- Fill the lines completely with fresh lubricant

Metering devices:

NOTE

Due to the large number of different metering devices, no universally valid statement can be made regarding the removal of the old lubricant and correct bleeding after filling with new lubricant. The instructions can be found in the technical documentation of the specific metering device used.

5.5.3 Storage period more than 18 months

To prevent faults, the manufacturer should be consulted before start-up. The basic procedure for removal of the old lubrication filling corresponds to that for storage periods between 6 and 18 months.

6. Assembly

6.1 General

Only qualified technical personnel may install, operate, maintain, and repair the piston pumps with/without lubricant reservoir described in the assembly instructions. Qualified technical personnel are persons who have been trained, assigned and instructed by the operator of the final product into which the described piston pumps with/without lubricant reservoir 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 piston pumps with/without lubricant reservoir, the packaging material and any shipping braces (e.g., plugs) must be removed. The packaging material must be preserved until any discrepancies are resolved.

NOTICE

Damage from incorrect handling of the pump

- Do not tilt or drop the product

During all assembly work on machinery, observe the local accident prevention regulations as well as the applicable operating and maintenance specifications

6.2 Assembly

Piston pumps with/without lubricant reservoir should be protected from humidity and vibration and should be mounted so that they are easily accessible, allowing all further installation work to be done without difficulty and allowing the piston pumps to be filled easily.
Ensure that there is sufficient air circulation to prevent excessive heating of the piston pump. For the maximum permissible ambient temperature, see chapter 4. Technical data.

NOTE

For product-specific technical data, see the relevant documentation. If no documentation is available, you can request it directly from SKF Lubrication Systems Germany GmbH

Consult the technical documentation for the mounting position.

The fill level in the lubricant reservoir and all other visual indicators must be clearly visible.

Ensure sufficient clearance for operation of the hand lever on manually operated piston pumps.

Drill the assembly holes for mounting the piston pump as specified in the technical documentation.

If no documentation is available, the dimensions and location of the fastening holes on the connecting flange can be determined by taking measurements.

NOTE

If no documentation is available, you can request it directly from SKF Lubrication Systems Germany GmbH

Attach the piston pump to the intended mounting location using appropriate fastening materials (e.g., bolts, washers, and nuts)

NOTICE

Malfunction or damage due to improper installation

During assembly and especially when drilling, always pay attention to the following:

- Existing supply lines must not be damaged by assembly work
- Other units must not be damaged by assembly work
- The feed pump unit must not be installed within range of moving parts.
- The feed pump unit must be installed at an adequate distance from sources of heat
- Maintain safety clearances and comply with local regulations for assembly and accident prevention

6.3 Compressed air connection (pneumatically operated piston pump)

The compressed air line must be connected to the piston pump in such a way that no forces can be transferred to the assembled piston pump (stress-free connection).

⚠ DANGER

Damage and injury due to improper connection of the compressed air supply

- Ensure that the main air valve is closed before connecting the piston pump to the compressed air supply

NOTICE

Damage due to excessive pressure

- The maximum primary air pressure indicated for operation of the piston pump must not be exceeded

The compressed air to be used here must comply with at least quality class 5 as defined by ISO 8573-1:

- Max. particle size 40 µm
- Max. particle density 10 mg/m³
- Pressure dew point 7°C
- Water content max. 7,800 mg/m³
- Residual oil content max. 25 mg/m³

Through the use of the appropriate compressed air quality class, compressed air preparation can be optimized and machine downtime and higher maintenance costs avoided.

The pneumatic connection is established via the connector labeled P1 on the piston pump's housing.

See the technical documentation for more information about the compressed air connection.

NOTE

If no documentation is available, you can request it directly from SKF Lubrication Systems Germany GmbH

6.4 Hydraulic connection (hydraulically operated piston pump)

The hydraulic line must be connected to the piston pump in such a way that no forces can be transferred to the assembled piston pump (stress-free connection)

⚠ DANGER

Damage and injury due to improper connection of the hydraulic supply

- Ensure that the hydraulic supply is depressurized before connecting the piston pump to the hydraulic supply

NOTICE

Damage due to excessive hydraulic pressure

- The maximum hydraulic oil pressure indicated for operation of the piston pump must not be exceeded

The hydraulic connection is established via the connector labeled P1 on the piston pump's housing.

See the technical documentation for more information about the hydraulic connection.

NOTE

If no documentation is available, you can request it directly from SKF Lubrication Systems Germany GmbH

6.5 Lubrication line connection

The lubrication line must be connected to the piston pump in such a way that no forces can be transferred to the assembled piston pump (stress-free connection)

NOTICE

Damage due to incorrect selection of fittings

During assembly, always pay attention to the following:

- The fittings used to connect the lubrication line should be rated for the maximum operating pressure of the lubrication unit
- If they are not, the lubrication line system needs to be protected from excessive pressure by means of an overpressure valve

For operating pressures up to 45 bar as can occur especially in single-line piston metering systems, SKF fittings for solderless lubrication line screw unions can be used (double tapered sleeves or tapered sleeves).

For operating pressures up to 250 bar as can occur especially in progressive centralized lubrication systems, SKF cutting-sleeve screw unions 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 Lubrication line routing

When routing the main lubricant lines and the feed 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 lubrication unit used and the displacement of that lubrication unit. If possible, the main lubricant line should rise upward from the lubrication unit and be ventable at the highest point on the lubrication line system.

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 pipes, tubes, shutoff valves, directional control valves, fittings, etc. that will be used must be designed for the maximum operating pressure of the lubrication unit, the permissible temperatures, and the lubricants that will be fed. The lubrication line system also needs to be protected from excessive pressure by means of an overpressure valve.

All components of the lubrication line system such as pipes, hoses, shut-off 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 lines should always be arranged so that air inclusions cannot form anywhere. Avoid changes in the cross-section of the lubrication line from small to large cross-sections in the flow direction 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 lines must have smooth transitions. Sudden changes of direction should be avoided if possible.

⚠ DANGER

Lubricant coming out
Risk of contamination of waterways and soil

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

⚠ DANGER

Lubricant coming out
Risk of slipping and injury

Centralized lubrication systems must always be free of leaks. Leaking lubricant is hazardous due to the risk of slipping and injury. Beware of any lubricant leaking out during assembly, operation, maintenance, or repair of centralized lubrication systems. Leaks must be sealed off without delay.

Lubricant leaking from centralized lubrication systems is a serious hazard. Leaking lubricant can create risks that may result in physical harm to persons or damage to other material assets.

NOTE

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

The safety data sheet for a lubricant can be requested from the lubricant manufacturer.

7. First start-up

NOTE
Before the reservoir unit is commissioned, all electrical, hydraulic and pneumatic (if present) connections must be inspected

After assembling the piston pump and arranging the lubrication lines, commission the centralized lubrication system by following these steps:
- Filling the lubricant reservoir
- Venting the centralized lubrication system
- Checking the function of the centralized lubrication system

7.1 Filling with lubricant

NOTE
Observe the instructions from the machine manufacturer regarding the lubricants that are to be used

NOTICE

Faults due to contaminated lubricant
Only fill using clean lubricant and an appropriate device. Contaminated lubricants can result in severe system malfunction. The lubricant reservoir must be filled without introducing bubbles.

NOTICE

Faults due to incorrect handling of lubricants
Different lubricants must not be mixed together. Doing so can cause damage and require costly and complicated cleaning of the reservoir unit/centralized lubrication system. It is recommended that an indication of the lubricant in use be attached to the lubricant reservoir in order to prevent accidental mixing of lubricants.

The lubricant may only be fed without bubbles. The lubricant reservoir must be filled with clean lubricant without introducing bubbles.

1. Remove the cap from the lubricant reservoir
2. Fill lubricant up to the maximum mark
3. Close the filling hole again

Then vent the piston pump and the centralized lubrication system

7.2 Venting the centralized lubrication system

NOTICE

Damage due to bubbles in the lubricant
The lubricant may only be fed without bubbles. Air pockets in the lubricant adversely affect the function of the centralized lubrication system and impair the reliability of lubricant delivery, which can result in damage to the lubrication points requiring lubrication

The process of bleeding the air from the centralized lubrication system can be facilitated by:
- Opening the ends of the main lines until bubble-free lubricant discharges
- Filling long lubricant line sections before connecting

The centralized lubrication system is vented as follows:
1. Disconnect the main lubricant lines from the piston pump. Operate the piston pump until the lubricant emerging from the outlet is free of bubbles. Reinstall the main lubricant lines.
2. Disconnect main lubricant line from master metering device. Operate the piston pump until the lubricant emerging from the main lubricant line is free of bubbles. Reinstall the main lubricant line.
3. Disconnect lubricant branch lines from master metering device. Operate the piston pump until bubble-free lubricant discharges from all outlets of the master metering device. Reinstall the lubricant branch lines.
4. Finally, check that the entire centralized lubrication system functions properly.

8. Operation

The described product functions automatically. The lubricant transport in the lubrication lines should, however, be subjected to regular visual inspection.

The lubricant fill level in the lubricant reservoir, if present, should likewise be subjected to regular visual inspection. If the lubricant fill level is too low, top up to the maximum mark as described in the "First start-up" chapter.

During operation, observe the following instructions to provide for trouble-free operation of the centralized lubrication system:

- Check the lubricant transport in the lubrication lines at regular intervals
- Inspect the lubrication of the lubrication points at regular intervals
- Perform a visual check of the lubricant fill level in the lubricant reservoir at regular intervals (including on piston pumps with fill level monitoring)

9. Maintenance and repair

⚠ WARNING

Danger from pressurized centralized lubrication systems

Centralized lubrication systems are pressurized during operation. Centralized lubrication systems must therefore be depressurized before starting assembly, maintenance, or repair work, or any machine modifications or machine repairs.

NOTICE

Observe the warranty period

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

NOTICE

Nullification of warranty

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

SKF Lubrication Systems Germany GmbH products are low-maintenance. However, all connections and fittings must be regularly inspected for proper seating to ensure proper function and to prevent hazards from arising.

10. Cleaning

10.1 Basics

Cleaning should be carried out in accordance with the operator's own company rules, and cleaning agents and devices and the personal protective equipment to be used should likewise be selected in accordance with those rules. Only cleaning agents compatible with the materials may be used for cleaning. Completely remove any cleaning agent residue left on the product and rinse with clear water. Unauthorized persons must be kept away. Use signage to indicate wet areas.

10.2 Interior cleaning

The interior normally does not need to be cleaned. The interior of the product must be cleaned if incorrect or contaminated lubricant accidentally enters the product. Please contact our Service department.

10.3 Exterior cleaning

Do not allow any cleaning fluid to enter the interior of the product during cleaning.

⚠ WARNING

Risk of fatal electric shock

Cleaning work may only be performed on products that have been de-energized first. When cleaning electrical components, be mindful of the IP enclosure rating.

⚠ WARNING

Serious injury from contact with or inhalation of hazardous substances

Wear personal protective equipment. Observe the safety data sheet (SDS) of the hazardous substance. Avoid contaminating other objects or the environment during cleaning.

If products have ultrasonic sensors, the active sensor surface must be cleaned with a cloth when it becomes contaminated.

11. Faults, causes, and remedies

Table 10 provides an overview of possible malfunctions and their causes. Contact the Service department of SKF Lubrication Systems Germany GmbH if you cannot remedy the malfunction.

⚠ DANGER

Electric shock

Performing work on products that have not been de-energized may result in serious injury or death

Disconnect the product from the power supply before any work on electrical components. Assembly, maintenance, and repair work may only be performed on products that have been de-energized by qualified technical personnel. The supply voltage must be switched off before opening any of the product's components.

⚠ DANGER

Pressure

Damage and injury from working on pressurized system components

Centralized lubrication systems are pressurized during operation. Centralized lubrication systems must therefore be depressurized before starting assembly, maintenance, or repair work, or any system modifications or system repairs.

NOTE

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

NOTE

All assembly, maintenance, and repair work beyond this scope must be performed by the Service department of SKF Lubrication Systems Germany GmbH only.

NOTE

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

Table 10

Fault analysis and rectification:

Malfunction	Possible cause	Rectification
Power transmission from the actuating mechanism to the piston pump is interrupted	• Driver pin is broken	• Disassemble the piston pump in observance of the safety instructions and replace the broken components.
	• Seal in the actuating cylinder is defective	
	• Return spring is broken	
Piston pump does not deliver medium No pressure build-up	• Too little lubricant in lubricant reservoir	• Top up lubricant; check float switch, if installed
	• Wrong lubricant	• Remove lubricant from entire system and dispose of lubricant properly; fill system with suitable lubricant and vent system
	• Air in the system	• Vent the system until lubricant without bubbles discharges at the lubrication points
	• Pressure regulating valve does not work	• Check the pressure regulating valve for contamination and damage, clean or replace as necessary [1)]
	• Pressure relief valve does not close	• Check the pressure relief valve for contamination and damage, clean or replace as necessary [1)]
	• Discharge or suction valves do not close	• Remove and inspect the valves, clean or replace as necessary [1)]

[1)] Depressurize the centralized lubrication system and depressurize the actuating cylinder for pneumatically or hydraulically operated piston pumps

12. Repairs

⚠ WARNING

Risk of injury

At a minimum, the following safety measures must be taken before any repairs:

- Unauthorized persons must be kept away
- Mark and secure the work area
- Depressurize the product
- Isolate the product, and lock and tag it out
- Check to ensure live voltage is no longer present
- Ground and short-circuit the product
- Cover any adjacent live parts

13. Shutdown, disposal

13.1 Temporary shutdown

Temporary shutdowns should be done by a course of action to be defined by the operator.

13.2 Permanent shutdown, disassembly

Permanent shutdown and disassembly of the product must be planned properly by the operator and conducted in compliance with all applicable laws and regulations.

13.3 Disposal

The waste producer/operator must dispose of the various types of waste in accordance with the applicable laws and regulations of the country in question.

14. Spare parts

Spare parts may be used exclusively for replacement of identical defective parts. Modifications with spare parts on existing products are not allowed.

15. Appendix

15.1 China RoHS Table

Table 11

Notes

Notes

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