OLAx-1... Oil+Air lubrication unit

for lubrication of spindle bearings, linear guides, rack pinions, chains, and assembly processes

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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: OLAx-1... Oil+Air lubrication unit for lubrication of spindle bearings, linear guides, rack pinions, chains, and assembly processes
Type / item number: OLA / OLA..-..
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 63000:2018

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, 29.02.2016

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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: OLAx-1... Oil+Air lubrication unit for lubrication of spindle bearings, linear guides, rack pinions, chains, and assembly processes
Type / item number: OLA / OLA..-..
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

EN IEC 63000:2018

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 UK legislation Supply of Machinery (Safety) Regulations 2008 No. 1597 and all other applicable Directives.

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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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- 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.

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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 electrical safety instructions

- Electrical devices must be kept in proper condition. This must be ensured by periodic inspections in accordance with the relevant applicable standards and technical rules. The type, frequency, and scope of the inspections must be determined in accordance with the risk assessment to be carried out by the operator. Work on electrical components may be performed only by qualified electricians. Connect the electrical power only in accordance with the valid terminal diagram and in observance of the relevant regulations and the local electrical supply conditions.
- Work on electrical components may be performed only in a voltage-free state and using tools suitable for electrical work. Do not touch cables or electrical components with wet or moist hands.
- Fuses must not be bridged. Always replace defective fuses with fuses of the same type.
- Ensure proper connection of the protective conductor for products with protection class I. Observe the specified enclosure rating.
- The operator must implement appropriate measures to protect vulnerable electrical devices from the effects of lightning during use. The electrical device is not furnished with a grounding system for the dissipation of the respective electric charge and does not have the voltage strength necessary to withstand the effects of lightning.

1.3 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.

1.4 Intended use

Supply of lubricants.
The product is intended solely for installation in another machine.
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.

1.5 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.

1.6 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.

1.7 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.

1.8 Prohibition of certain activities

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

1.9 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.

1.10 Safety markings on the product

No safety markings on the product

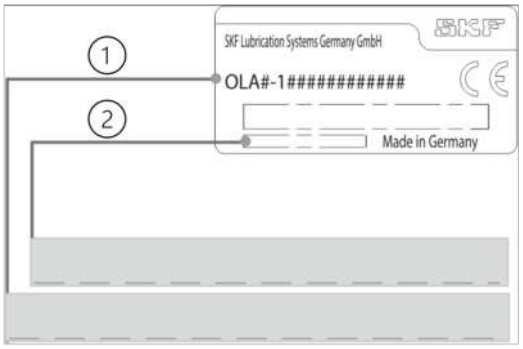
NOTE

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.

1.11 Note on the type plate

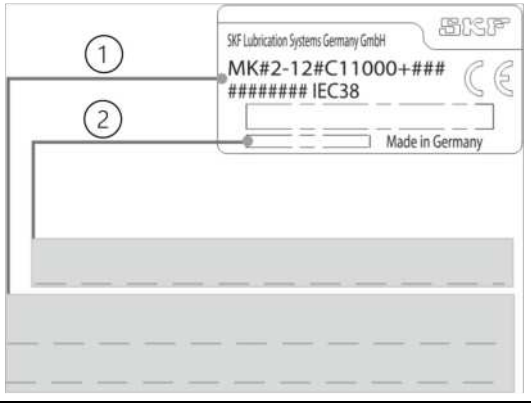
The type plate provides important data such as the type designation, order number, and sometimes regulatory characteristics. To avoid loss of this data in case the type plate becomes illegible, it should be entered in the manual.

Fig. 1



Type plate for Oil+Air lubrication unit

Fig. 2



Type plate for gear pump unit

Legend to Figures 1 and 2:

1 Type designation
2 Serial number

1.12 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)

1.13 Note on Low Voltage Directive

The protection objectives of the Low Voltage Directive 2014/35/EU are met in accordance with Annex I, No. 1.5.1 of the Machinery Directive 2006/42/EC.

1.14 Note on UKCA marking

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

1.15 Note on EAC marking

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

1.16 Note on China RoHS mark

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).

1.17 Emergency shutdown

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

1.18 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.

1.19 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.

1.20 Residual risks

Table 2

Residual risks

Residual risk	Possible in lifecycle	Avoidance / Remedy
Lubricant reservoir of the gear pump unit overflowing due to overfilling	B	• Perform filling of the lubricant reservoir carefully and stop once the “MAX” mark on the lubricant reservoir is reached
Risk of slipping due to contamination of floor by spilled or leaked lubricant	B C D E F G H K	• Exercise caution when filling and when closing the filler neck cap • Promptly apply suitable binding agents and remove the leaked or spilled lubricant • Follow statutory and company regulations for the handling of lubricants
Tearing/damage to supply, compressed air, and lubricant lines when installed on moving machine components.	B	• If possible, do not install on moving machine parts. Use flexible supply, compressed air, and lubricant lines
Lubricant spraying out due to faulty installation of fittings/threaded joints on lubricant lines	D	• Tighten all fittings/threaded joints with the appropriate torques. Use fittings/threaded joints and lubricant lines suitable for the indicated operating pressures. Check all fittings/threaded joints and lubricant lines for correct connection and damage before first start-up
Risk of burns from hot surfaces of a motor	F G	• Before removing the cap of the gear pump unit, disconnect the Oil+Air lubrication unit from the supply voltage. Motor surfaces may only be touched with appropriate gloves or after the motor has been shut off for an extended time.
Heating of the motor due to jamming of the motor	G	• Before removing the cap of the gear pump unit, disconnect the Oil+Air lubrication unit from the supply voltage. Allow the motor of the gear pump unit to cool down and remedy the cause
Electric shock (AC voltage design)	F	• Before any maintenance work, disconnect the Oil+Air lubrication unit from the supply voltage
Contamination of the environment with lubricant and components that have come into contact with lubricant	H K	Properly dispose of lubricants and components that have come into contact with lubricants. Follow the statutory and company regulations for the handling of lubricants.

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 respective application. The selection is made by the manufacturer or operator of the machine, preferably together with the lubricant supplier. Should you have little or no experience with the selection of lubricants for lubrication systems, please contact us. We will be pleased to support you in the selection of suitable lubricants and components for the construction of a lubrication system optimized for the respective application. Please observe the following points when selecting/using lubricants. You will avoid possible downtimes and damages to your machine or the lubrication system.

2.2 Material compatibility

Lubricants must generally be compatible with the following materials:

- Plastics: ABS, CR, FPM, NBR, NR, PA, PET, PMMA, POM, PP, PS, PTFE, PU, PUR

Metal steel, grey iron, brass, copper, aluminium

2.3 Temperature characteristics

The lubricant used must be suitable for the specific ambient temperature of the product. The viscosity required for proper operation of the product must not be exceeded in case of low temperatures nor fall below specification in case of high temperatures. Specified viscosity, see chapter Technical data.

2.4 Ageing of lubricants

Depending on the experience with the lubricant used, it should be checked at regular intervals to be determined by the operator whether the lubricant needs to be replaced due to ageing processes (bleeding). If there is any doubt as to the further suitability of the lubricant, it must be replaced before recommissioning. If you have no experience with the lubricant used, we recommend testing after only one week.

2.5 Avoidance of malfunctions and hazards

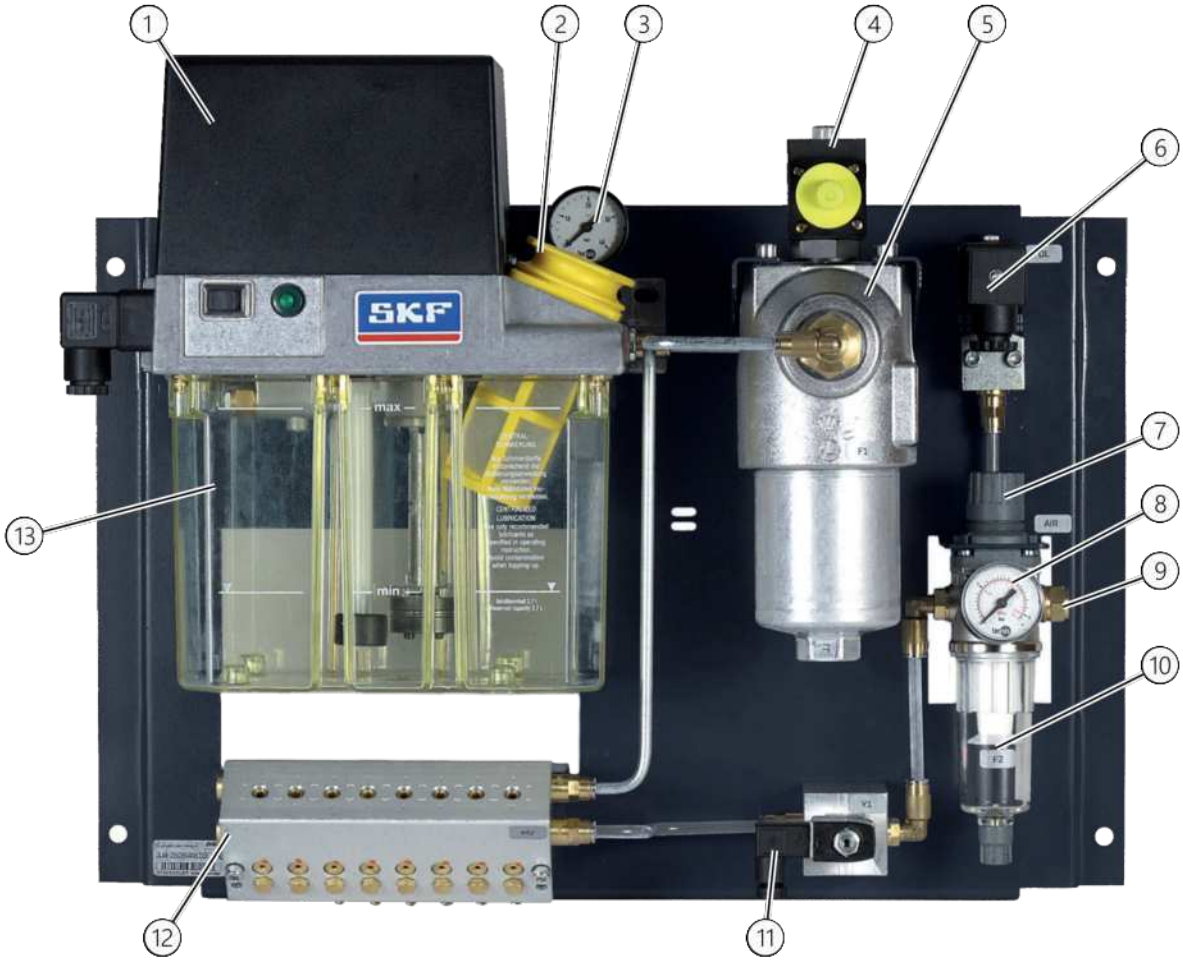
To avoid malfunctions or hazards, please observe the following:

- When handling lubricants, observe the relevant safety data sheets (SDS) and hazard designations on the packaging, if any.
- Due to the large number of additives, individual lubricants which meet the requirements for pumpability specified in the instructions may not be suitable for use in centralized lubrication systems.
- Always use SKF lubrication greases, if possible. These are optimally suited for use in lubrication systems.
- Do not mix lubricants. This may have unforeseeable effects on the characteristics and on the usability of the lubricant.
- The ignition temperature of the lubricant must lie at least 50 K over the maximum surface temperature of the components.

3 Overview, functional description

3.1 Overview

Fig. 3



Maximum configuration of the Oil+Air lubrication unit

Legend to Figure 3:

1	Gear pump unit without control unit (optionally with control unit)	2	Filler neck
3	Pressure gauge for oil pressure	4	Dirt indicator for oil filter (visual/electrical)
5	Oil filter housing with oil filter	6	Pressure switch for minimum air pressure
7	Compressed air regulating valve	8	Pressure gauge for the air pressure of the compressed air supply
9	Compressed air port	10	Compressed air filter and water separator
11	3/2 directional control valve	12	Oil+Air mixing valve with metering
13	Lubricant reservoir		

3.2 General

SKF Oil+Air lubrication units are total loss lubrication systems which are used in centralized lubrication for minimal quantity lubrication of oils. Oil+Air lubrication units are employed in a wide range of areas of application. A few areas of application for Oil+Air Lubrication units are:

- Rolling bearing lubrication
- Linear guide lubrication
- Chain lubrication
- Rack and pinion lubrication
- Lubrication for both chip-making and chipless machining methods
- Assembly and process oiling

3.3 How Oil+Air lubrication works

Oil+Air lubrication involves a metered volume of oil being drawn into streaks in a lubrication line by a continuous air flow (compressed air) and transported in the direction of the compressed air flow along the tube wall and to the lubrication point. The metering can be done in a number of ways, including by piston metering devices, injection oilers, micropumps, or an Oil+Air mixing valve with metering.

The metered volume of oil is supplied to the air flow in pulses, and is transported by the air flow into the connected feed line. The feed line between the metering device and the inlet to the lubrication point, which is at least 1 m long, creates a nearly continuous, finely metered flow of oil and supplies it to the lubrication point. The lubricant supplied to the lubrication point lubricates the friction partners, while the supplied compressed air is discharged into the environment virtually oil-free.

3.4 Fields of application

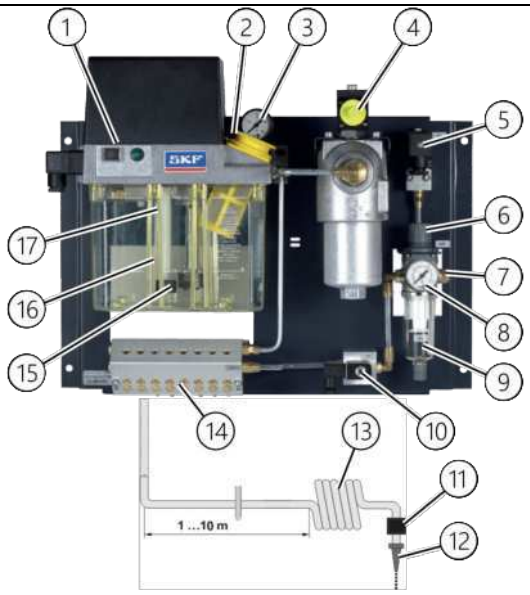
Oil+Air lubrication units supply a continuous, finely metered oil flow, which can be adapted to different operating conditions by changing the metered volume, the flow velocity of the compressed air, and the sequence of lubrication pulses. A prime application of Oil+Air lubrication is the lubrication of high-speed rolling bearings, such as in spindles for machine tools.

Additional applications include the lubrication of conveyor chains, where a cyclical lubricant feed is not possible due to the speed of the conveyor chain rotation.

In production processes for textile fibers, an Oil+Air lubrication unit can be used to apply extremely small lubricant volumes (for gripper lubrication).

3.5 Design

Fig. 4



Oil+Air lubrication unit

Legend to Figure 4:

1 Gear pump unit without control unit / pressure limiting valve / pressure-relief and residual-pressure valve / oil pressure switch (for required oil pressure)
2 Filler neck
3 Pressure gauge for oil pressure
4 Oil filter housing with oil filter / dirt indicator for oil filter, visual/electrical
5 Pressure switch for minimum air pressure
6 Compressed air regulating valve
7 Compressed air port
8 Pressure gauge for the air pressure of the compressed air supply
9 Air filter and water dispersion filter
10 3/2 directional control valve
11 Oil-streak sensor
12 Nozzle
13 Hose coil
14 Oil+Air mixing valve / metering device / air regulating valve
15 Gear pump with motor
16 Level switch
17 Lubricant reservoir

An Oil+Air lubrication unit can essentially be divided into sections for lubricant supply/lubricant metering, and for compressed air supply. The metering of the lubricant and the mixing of it with compressed air can be done either by an Oil+Air mixing valve with metering (metering of the lubricant and mixing of the compressed air in a single component) or with the aid of separate mixing valves combined with piston metering devices, injection oilers, or micropumps. In that case, the metering of the lubricant and the mixing of it with compressed air are done by separate components.

In the maximum configuration, an Oil+Air lubrication unit is comprised of the following components; see also

section 3.6.1Hydraulic diagram of an Oil+Air lubrication unit:

- Gear pump unit with or without a control unit (image shows a design without a control unit) with gear pump and electric motor (Fig. 4/1), lubricant reservoir (Fig. 4/17), with the set of valves required for pressure relief and pressure limitation, an oil pressure switch for electrical monitoring of the pressure build-up in the lubricant, a pressure gauge (Fig. 4/3) for visual monitoring of the pressure build-up in the lubricant, and a lubricant level switch to monitor the lubricant level
- Compressed air regulating valve (Fig. 4/6) with pressure gauge (Fig. 4/8) to regulate the compressed air, water separator with air filter (Fig. 4/9)
- Pressure switch (Fig. 4/5) to monitor the minimum air pressure
- Oil+Air mixing valve with metering (Fig. 4/14) for metering of the lubricant and mixing with the compressed air
- 3/2 directional control valve (Fig. 4/10) for opening and closing the flow of compressed air
- Oil filter (Fig. 4/4) with or without electrical/visual dirt monitoring (Fig. 4/4)

In the basic configuration, the components are arranged on a mounting plate and are delivered as a complete Oil+Air lubrication unit.

If required, other components can be integrated optionally into the Oil+Air lubrication unit, such as:

- Additional pressure switches to monitor the lubricant and compressed air
- Oil-streak sensors to monitor the conveying of the lubricant (as an oil streak) into the feed lines

3.6 Functional description

The following describes a lubrication cycle of an Oil+Air lubrication unit comprised of a gear pump unit and an Oil+Air mixing valve with metering; see section 3.6.1Hydraulic diagram of an Oil+Air lubrication unit.

When the electric motor is switched on, the lubricant is drawn out of the lubricant reservoir by the gear pump and fed through the main lubricant line, via the pressure relief valve and the pressure limiting valve, to the Oil+Air mixing valve, either directly or via the oil filter. The built-up oil pressure causes the lubricant in the Oil+Air mixing valve to be metered separately for each lubrication point. The compressed air supplied to the Oil+Air mixing valve conveys the metered volume of lubricant out of the mixing valve into the feed line and onward to the lubrication point. The air flow draws the lubricant out into a streak and conveys it along the tube wall toward the lubrication point.

The bearing is thus continuously supplied with a minimum flow of lubricant and air. The air flow introduced creates overpressure in the bearing assembly and prevents the ingress of contaminants. The compressed air leaves the lubrication point nearly free of oil.

When the electric motor is switched off, the pressure is relieved in the main lubricant line. In this process, the lubricant is moved from the spring chamber of the Oil+Air mixing valve into the lubrication chamber.

After the interval time, the Oil+Air lubrication unit is again ready for the next operating time.

To ensure perfect metering, it is recommended to set a delay time for the gear pump on the control unit or the machine control. The pump delay time is the period during which the gear pump motor continues to run after the working pressure is reached in the main lubricant line, in order to ensure that the lubrication chambers in the Oil+Air mixing valve are emptied completely. 5 seconds is recommended. Other delay times are possible depending on the layout of the Oil+Air lubrication system. The working pressure built up during an operating time is monitored by the electric oil pressure switch installed in the gear pump unit, and also visually using a pressure gauge if one is installed on the gear pump unit. The signal from the oil pressure switch is processed either directly by the machine control (in the case of a gear pump unit without control unit) or by the electronic control unit (gear pump unit with control unit).

An Oil+Air lubrication unit runs in cycles, which means each operating time is always followed by an interval time. The length of the set interval time is directly dependent on the lubricant requirement of the lubrication point.

A lubrication cycle consists of the operating time and the interval time. Note that the electric motor of the gear pump unit is approved for duty type S3 (periodic duty) and the minimum interval times and maximum motor running times must be observed during operation; see also section 8.3Setting the lubricant flow rate.

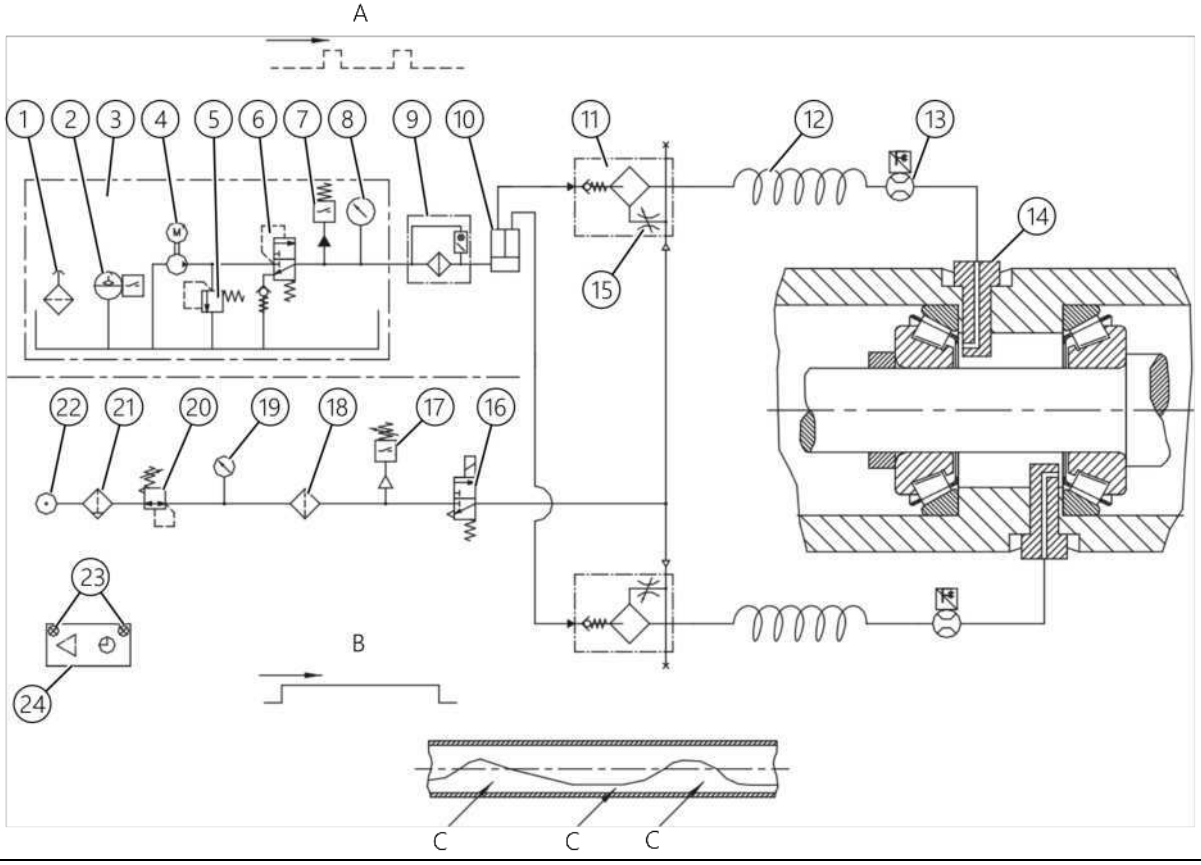
The interval time is controlled either directly by the machine control (in the case of a gear pump unit without control unit) or by the electronic control unit (gear pump unit with control unit).

The fill level in the lubricant reservoir is monitored by a level switch installed in the gear pump unit. The signal from the lubricant level switch is processed either directly by the machine control (in the case of a gear pump unit without control unit) or by the electronic control unit (gear pump unit with control unit).

The minimum air pressure set on the compressed air regulating valve is monitored by a pressure switch. The signal from the pressure switch is processed either directly by the machine control (in the case of a gear pump unit without control unit) or by the electronic control unit (gear pump unit with control unit).

3.6.1 Hydraulic diagram of an Oil+Air lubrication unit

Fig. 5



Oil+Air hydraulic diagram

Legend to Figure 5:

1	Filler neck	2	Level switch
3	Gear pump unit without control unit	4	Gear pump with motor
5	Pressure limiting valve	6	Pressure-relief and residual-pressure valve
7	Oil pressure switch (for the required oil pressure)	8	Pressure gauge for oil pressure
9	Oil filter housing with oil filter / dirt indicator for oil filter, visual/electrical	10	Lubricant metering device
11	Oil+Air mixing valve	12	Hose coil
13	Oil-streak sensor	14	Nozzle
15	Air regulating valve	16	3/2 directional control valve
17	Pressure switch for minimum air pressure	18	Additional air filter
19	Pressure gauge for the air pressure of the compressed air supply	20	Compressed air regulating valve
21	Air filter and water dispersion filter	22	Compressed air port
23	Control light	24	Control and monitoring
A	Oil pulses (metered)	B	Compressed air (continuous)
C	Oil streaks on the pipe walls (wall flow)		

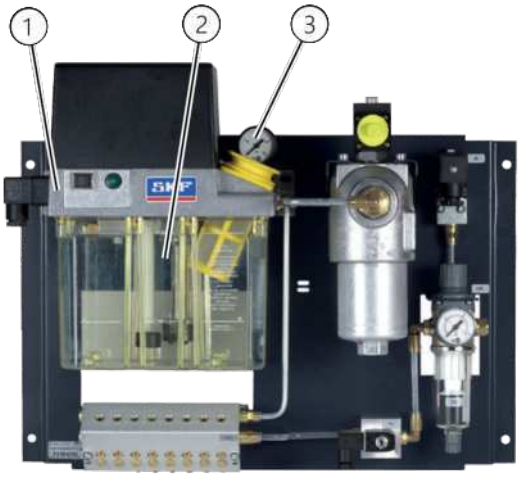
3.7 Description of components

The following sections describe the individual components:

- Gear pump unit with/without control unit
- Compressed air regulating valve
- Pressure switch for minimum air pressure

3.7.1 Gear pump unit

Fig. 6



Oil+Air lubrication unit

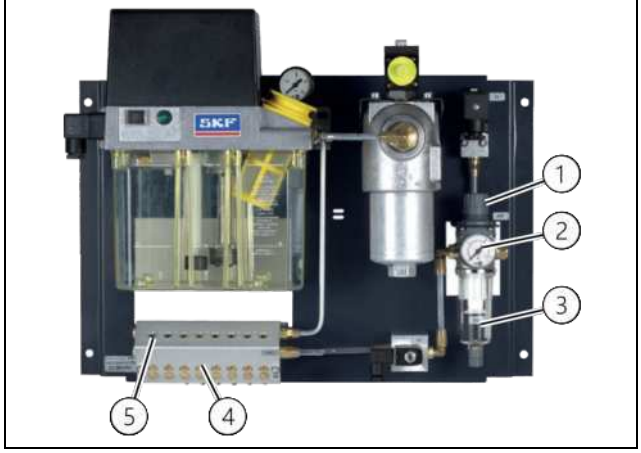
Legend to Figure 6:
1 Gear pump unit
2 Lubricant reservoir
3 Pressure gauge

The gear pump unit (Fig. 6/1) consists of the gear pump and an electric motor, the lubricant reservoir (Fig. 6/2), the set of valves required for pressure relief and pressure limitation, an oil pressure switch for electrical monitoring of the pressure build-up in the main lubricant line and a pressure gauge for visual monitoring of it (Fig. 6/3), and a level switch to monitor the lubricant level.

Gear pump units are available in model designs with or without a control unit. In the model design without a control unit, the gear pump unit (and thus the lubrication cycle) is controlled by the control unit of the machine that the Oil+Air lubrication unit is mounted on. In the model design with a control unit, the gear pump unit is equipped with an electronic control unit that controls the gear pump unit (and thus the lubrication cycle).
Details on the function and operation of the gear pump unit and the electronic control unit can be found in the assembly instructions for the gear pump unit and the operating instructions for the electronic control unit which are included in delivery of the Oil+Air lubrication unit.

3.7.2 Compressed air regulating valve

Fig. 7



Oil+Air lubrication unit

Legend to Figure 7:
1 Compressed air regulating valve
2 Pressure gauge
3 Water separator
4 Oil+Air mixing valve
5 LRS air adjustment screws

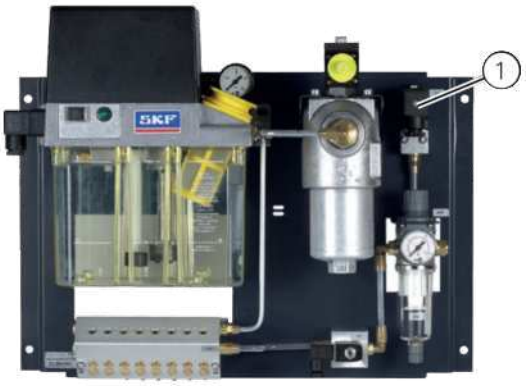
The compressed air regulating valve (Fig. 7/1) is used to set the air pressure of the compressed air supplied to the Oil+Air mixing valve and the feed line. The compressed air is used to transport the oil streak along the inner wall of the feed line, from the Oil+Air mixing valve (Fig. 7/4) through to the lubrication point. It is important to ensure uniform supply of the compressed air in order to ensure constant transport of the oil streak and consequently constant supply of lubricant to the lubrication point.

The air pressure is set manually. The set air pressure can be read directly on the pressure gauge (Fig. 7/2) built into the compressed air regulating valve (Fig. 7/1).

Optionally an air filter with an integrated water separator (Fig. 7/3) can be used.

3.7.3 Pressure switch for minimum air pressure

Fig. 8



Oil+Air lubrication unit

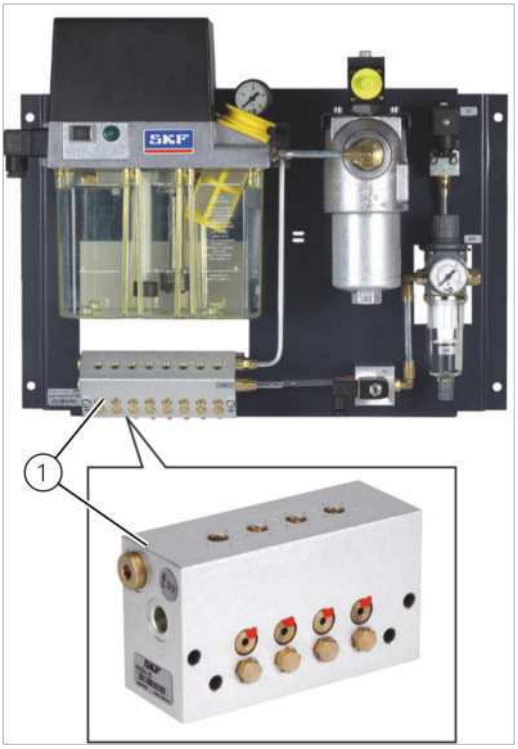
Legend to Figure 8:
1 Pressure switch

The pressure switch for the minimum air pressure (Fig. 8/1) continuously monitors the air pressure set on the compressed air regulating valve. As soon as the air pressure set on the compressed air regulating valve falls below the minimum value set on the pressure switch, an electrical signal is output by the pressure switch. This signal can be processed as a fault signal by the machine control or by the control unit of the gear pump unit.

It is necessary to monitor the minimum air pressure because there is a risk of underlubrication of the lubrication point if the compressed air supply is too low, because the lubricant can no longer be transported reliably to the lubrication point through the feed lines.

3.7.4 Oil+Air mixing valve with metering

Fig. 9



Oil+Air lubrication unit

Legend to Figure 9:
1 Oil+Air mixing valve MV20x

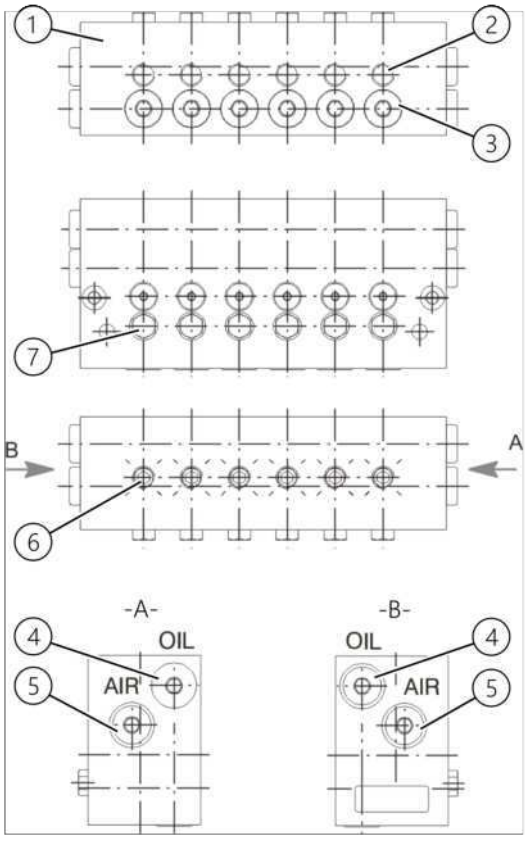
An MV20x Oil+Air mixing valve (Fig. 9/1) consists of a valve block in compact design with up to 8 lubrication line connections that are designed for metered volumes between 10 mm³ and 160 mm³ (in six increments).

If more lubrication line connections are required, more Oil+Air mixing valves can be connected in series. In the Oil+Air mixing valve, the lubricant is metered separately for each lubrication point and conveyed to the lubrication point by the air flow in the feed line.

The air adjustment screws (LRS) in the Oil+Air mixing valves can be used to adjust the required air flow separately for each lubrication point.

3.7.4.1 Illustration of the Oil+Air mixing valve with metering

Fig. 10



MV20x mixing valve with metering

Legend to Figure 10:
1 Oil+Air mixing valve with metering
2 Connection for feed lines
3 Plug screws for the oil metering mechanisms
4 Connection for the main lubricant line (right and left)
5 Connection for the air supply line (right and left)
6 Air adjustment screws (LRS)
7 Pressure measurement port (M5 thread)

4 Technical data

Table 3

Technical data

Designation	Unit	Value		
Mounting position		Vertical		
Ambient temperature	°C	+ 10 to + 40		
Enclosure rating		IP54		
Oil+Air lubrication unit				
Dimensions W x H x D with mounting plate	mm	Depends on the design (see documentation)		
Weight (filled)	kg	Depends on the design (see documentation)		
Number of lubrication point connections	-	1 ... 8 (> 8 on request)		
Gear pump unit				
Delivery rate [1)]	l/min	0.2		
Rated capacity of lubricant reservoir	liters	3 (2 and 6 on request)		
Material of lubricant reservoir	-	Polyamide (PA6)		
Max. operating pressure	bar	30		
Pressure-relief valve	-	Included		
Pumped medium	-	Mineral or synthetic oil, compatible with NBR elastomers		
Permiss. oil viscosity	mm2/s (cSt)	20 to 1500		
Motor		**Capacitor motor**		**DC motor**
Rated voltage	V	115 V AC	230 V AC	24 V DC
Rated frequency	Hz	50 / 60	50 / 60	
Rated current	A	1.06 / 1.36	0.53 / 0.68	1.6
Rated capacity	W	60	75	39
Duty type (per VDE 0530)	-	Standard design: S3, 20% duty cycle (1.25 ... 25 min) (e.g., with 1.25 min cycle time, the pump run time is 15 s, and the interval time is 1 min)		
Thermal switch	-	Built-in		
Oil+Air mixing valve with metering				
Number of lubrication point connections per Oil+Air mixing valve with metering				
• Series MV20x-x..	-	1 ... 8		
• Metering of Oil+Air mixing valve with metering				
• Series MV20	mm^3	10, 20, 30, 60, 100, 160		
Oil+Air outlet, feed line	-	M8x1, counterbore for solderless union for tube Ø 4 mm		
Oil connection	-	M10x1, counterbore for solderless union for tube Ø 6 mm		
Compressed air connection	-	M10x1, counterbore for solderless union for tube Ø 6 mm		
Working pressure	bar	3 ... 10, ideally 6 bar		
Air consumption (for feed line with internal diameter of 2.3 mm, ISO VG 32...100 oil)	Nl/h	1000 ... 1500		
Oil pressure switch (included in the gear pump unit)				
Function	-	NC contact (opens when oil level is too low - at min)		
Switching voltage range	V	10 to 25 AC / 10 to 36 DC		
Switched current (resistive load)	A	≤ 0.25		
Switching capacity (resistive load)	W / VA	≤ 3		
Nominal pressure	bar	NC contact (opens when oil level is too low - at min)		
Pressure switch for minimum air pressure (DL)				
Switching pressure	bar	0.3 to 5; set: 3		
Max. switching voltage	V (AC)	250		

Table 3

Technical data

Designation	Unit	Value
Max. switched current	A	5
Reset differential	%	≈15
Control unit	Type	IG54-20-S4-I
Rated voltage	V (AC)	115 / 230 (50/60 Hz) selectable
	V (DC)	24 (DC)
Pump run time limitation	s	60 (non-adjustable)
Interval time	min	Set: 10 (adjustable from 1 to 99 minutes)
Pump delay time	s	Set: 5 (adjustable from 0-99 seconds)
Prelubrication cycles	-	Set: 10 (adjustable from 0-99)
Air regulating valve		
Pressure range	bar	0.5 to 10
3/2 directional control valve (air) (Y1)		
Switching voltage	V	115 VAC, 60 Hz / 230 VAC, 50 Hz / 24 VDC
Switching capacity	W/VA	4
Pressure range	bar	0 to 10
Dirt indicator for oil (filter)		
Switching type		NC contact = alarm 100%; NO contact = pre-warning 75%
Max. switching voltage	V	24 (AC/ DC)
Max. switching capacity	W/VA	15
Switching capacity (resistive load)	A	1 (at 15 V AC/DC)
Opening pressure	bar	Δ 5 minus 10%
Oil filter (F1)		
Filter fineness	µm	3 or 10
Contaminant capture	g	6.3 g at Δp = 5 bar (3 µm) 5.2 g at Δp = 5 bar (10 µm)

[1)] Based on an oil viscosity of 140 mm2/s (cSt) at a back pressure of p = 5 bar

4.1 Type identification code

OLA x - 1 x x x x x x x x x x x x

Type designation

Number of metering points
1 = 1 metering point
2 = 2 metering points
3 = 3 metering points
up to
8 = 8 metering points

Gear pump unit

	Control unit	Control unit
A=	IG54	24 VDC
B=	IG54	230 VAC
C=	IG54	115 VAC
D=	None	24 VDC
E=	None	230 VAC
F=	None	115 VAC

Air filter / directional control valve
0 = without air filter, without valve
1 = without air filter, with 3/2 directional control valve, 24 V DC
2 = without air filter, with 3/2 directional control valve, 230 V AC, 50 Hz
3 = without air filter, with 3/2 directional control valve, 120 V AC, 60 Hz

4 = with 5 µm air filter, without valve
5 = with 5 µm air filter and 3/2 directional control valve, 24 V DC
6 = with 5 µm air filter and 3/2 directional control valve, 230 V AC, 50 Hz
7 = with 5 µm air filter and 3/2 directional control valve, 120 V AC, 60 Hz

Oil filter / monitoring

	Oil filter	Monitoring
X =	None	None
A =	3 µm	None
B =	3 µm	with
C =	10 µm	None
D =	10 µm	with

Pressure switch for minimum air pressure
A = without [1)]
B = 1-10 bar [2)]

Metering [3)]
X = metering point closed
1 = 0.01 cm^3
2 = 0.02 cm^3
3 = 0.03 cm^3
4 = 0.06 cm^3
5 = 0.10 cm^3
6 = 0.16 cm^3
A = 0.01 cm^3 with quick coupling
B = 0.02 cm^3 with quick coupling
C = 0.03 cm^3 with quick coupling
D = 0.06 cm^3 with quick coupling
E = 0.10 cm^3 with quick coupling
F = 0.16 cm^3 with quick coupling
O = no metering point available

[1)] Compressed air must be monitored by the customer
[2)] Preset to 3 bar
[3)] All the lubrication points of an Oil+Air mixing valve must be selected either with or without quick coupling

NOTE
Metering positions are from left to right from the perspective of the location of the type plate

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. 11

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 Oil+Air lubrication units 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 Oil+Air lubrication unit described here is 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 installing/setting up the Oil+Air lubrication unit, 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 tipping over

Oil+Air lubrication units must not be tipped over or thrown

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

The Oil+Air lubrication unit should be installed and commissioned according to the following sequence:

- Setup, attachment, and initial filling
- Electrical connection and settings
- Air supply line connection
- Lubrication line connection
- Lubrication line routing

6.2 Setup and attachment

The Oil+Air lubrication unit should be protected from humidity and vibration and should be mounted so that it is easily accessible, allowing all further installation work to be done without difficulty.

Ensure that there is sufficient air circulation to prevent excessive heating of the Oil+Air lubrication unit. For the maximum permissible ambient temperature, see "Technical data."

Ensure adequate space for refilling lubricant into the lubricant reservoir.

NOTE

See the technical data for an Oil+Air lubrication system in these assembly instructions or the leaflet. These documents can be downloaded from the homepage of SKF Lubrication Systems Germany GmbH.

The mounting position of the Oil+Air lubrication unit is vertical as shown in this documentation.

The fill level of the lubricant reservoir, pressure gauges, oil level glasses, and other visual monitoring equipment must be clearly visible.

Any assembly holes must be made according to the diagram on the following page.

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

- Existing supply lines must not be damaged by the assembly work.
- Other units must not be damaged by assembly work.
- The Oil+Air lubrication unit must not be installed within range of moving parts.
- The Oil+Air lubrication 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.

⚠ WARNING

Danger from hoisted loads

Do not step below a raised or suspended Oil+Air lubrication unit.

Fastening material to be provided by the customer:

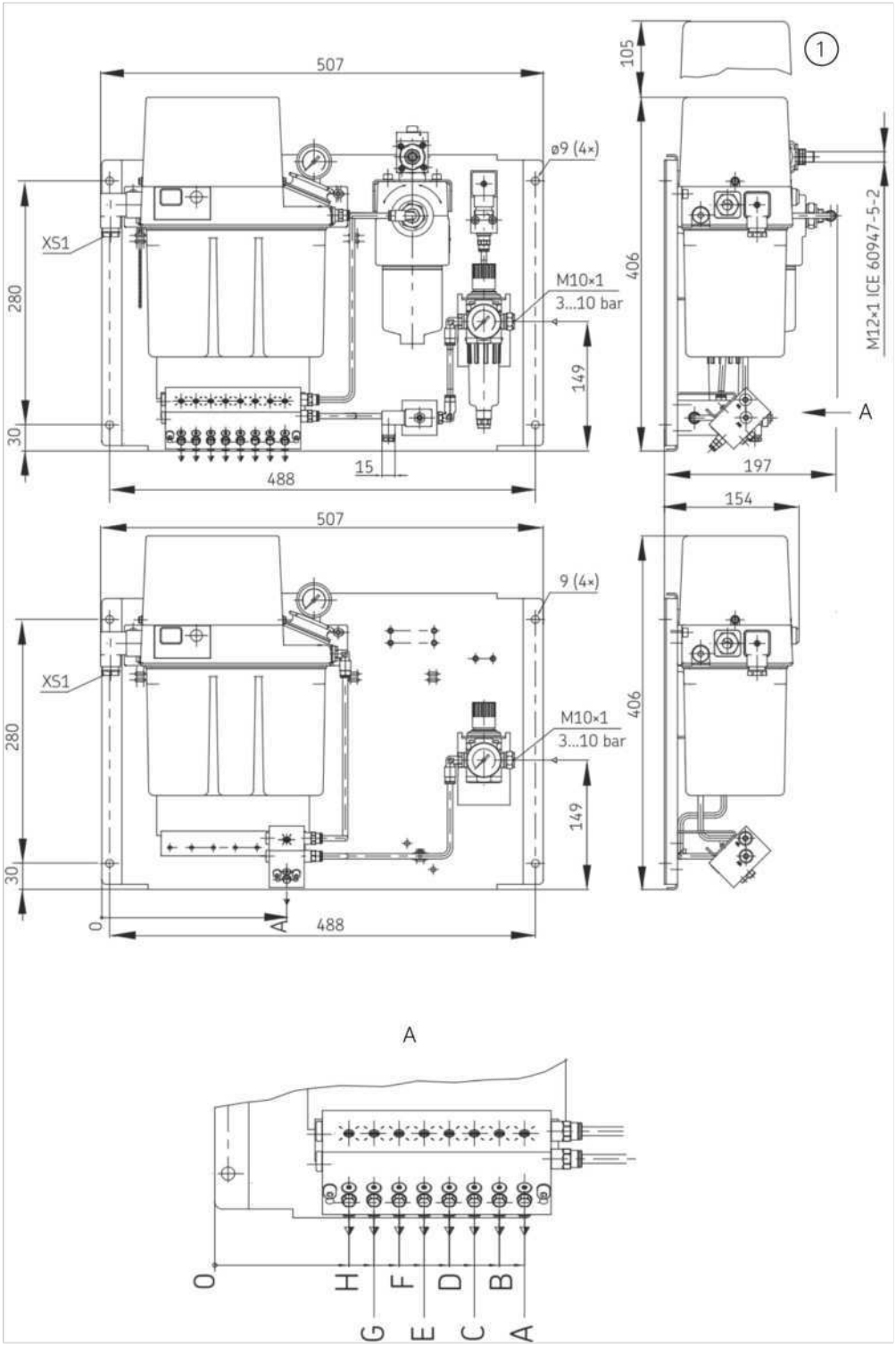
- Hexagon head bolts (4x) to ISO 4017-M8x25-8.8
- Washers (8x) to ISO 7090- 8-200-HV
- Hexagon nuts (4x) to ISO 4032-M8-8

6.3 Assembly drawing with minimum mounting dimensions

6.3.1 Minimum mounting dimensions

To ensure enough space for maintenance work and possible disassembly of the Oil+Air lubrication unit, ensure that the minimum mounting dimensions are maintained.

Fig. 12



Mounting dimensions of the Oil+Air lubrication units, with maximum and minimum configuration

Legend to Figure 12:
1 Clearance for lid mounting

Table 4

Minimum mounting dimensions

	Dimension	Value
A	Width	550 mm
B	Height	530 mm
C	Depth	220 mm

Table 5

Dimensions of the Oil+Air mixing valve with metering

Type	A	B	C	D	E	F	G	H
OLA1	212							
OLA2	209	192						
OLA3	205	188	171					
OLA4	201	184	167	150				
OLA5	197	180	163	146	129			
OLA6	206	189	172	155	138	121		
OLA7	202	185	168	151	134	117	100	
OLA8	210	193	176	159	142	125	108	91

6.3.2 Attachment of an Oil+Air lubrication unit

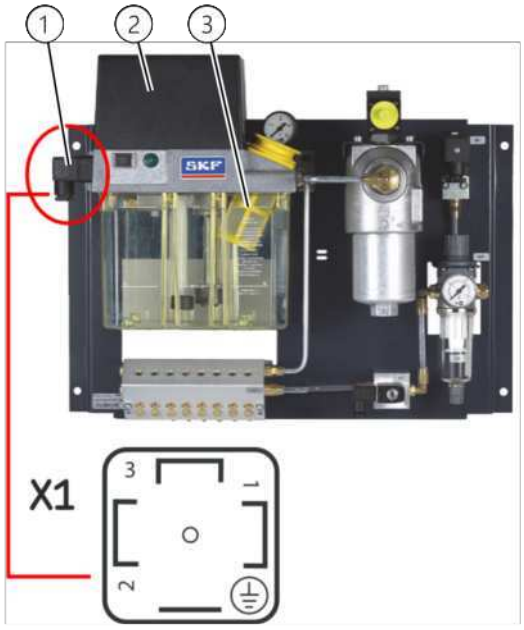
See also the figure in section 3.1"Overview"

1. Drill assembly holes (Ø 9 mm) in the mounting surface according to the assembly drawing (Fig. 1).
2. Clean the surface to remove drilling chips; prime the drilled holes if necessary.
3. Lift the Oil+Air lubrication unit using hoisting equipment and align it to the assembly holes.
4. Insert hexagon head bolts (4x) with matching washers through the mounting holes in the mounting plate.
5. Apply hexagon nuts (4x) with matching washers and tighten gently.
6. Align the Oil+Air lubrication unit horizontally and vertically.
7. Tighten the hexagon head screws to the following torque: **tightening torque 25 Nm**.
8. Remove the hoisting equipment.

6.4 Electrical connection

6.4.1 Electric motor connection

Fig. 13



Electrical connection (cable socket to DIN EN 175301-803-A)

Legend to Figure 13:
1 Rectangular connector
2 Cover cap

3 Gear pump unit

Oil+Air lubrication units in the standard model design contain gear pump units (Fig. 13/3) with electric motor drive. They are equipped either with an AC capacitor motor for 230 VAC 50/60 Hz, 115 VAC 50/60 Hz, or a DC motor for 24 VDC.

For all Oil+Air lubrication units, whether with or without a control unit, the motor is connected electrically via a rectangular connector (Fig. 13/1) in accordance with EN 175301-803-A (clamping range Ø 8 to 10 mm). In the design with a control unit, the motor is connected to the electronic control unit.

The connection wiring is in accordance with the electrical circuit diagrams in sections 6.5.5Terminal diagram 230/115 VAC with control unitand 6.5.2Terminal diagram 230/115 VAC without control unit. The electrical circuit diagram of the gear pump unit is also displayed inside the cover cap (Fig. 13/2) of the gear pump unit and can be accessed by removing the cover cap.

⚠ DANGER

Risk of death from electric shock

Electrical connections for the product may only be established by qualified and trained personnel authorized to do so by the operator. The local electrical operating conditions and local regulations (e.g., DIN, VDE) must be observed. Serious injury or death and property damage may result from improperly connected products.

⚠ DANGER

Risk of death from electric shock

The available line voltage (supply voltage) must match the specifications on the rating plate of the motor or the rating plate of the electrical components. Check the fuse protection of the electrical circuit. Use only fuses with appropriate amperage. Otherwise damage and injuries could result. Consult chapter 4Technical datafor the electrical characteristics of the electric motor, such as rated power, rated voltage, and rated current.

⚠ DANGER

Risk of death from electric shock

The protective earth conductor must always be connected. Ensure that the contact is secure and that the connector diameter is adequate and standard-compliant

NOTICE

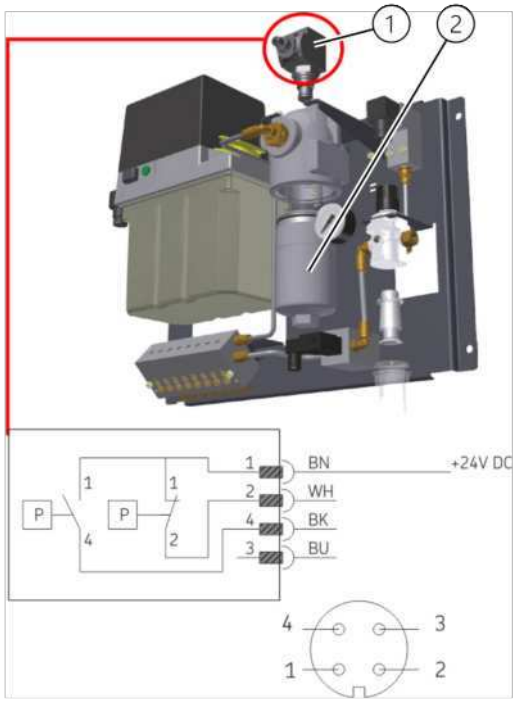
Avoid inductive, capacitive, or electro-magnetic couplings

When connecting the Oil+Air lubrication unit electrically, ensure that appropriate measures are taken to prevent interference between signals due to inductive, capacitive, or electro-magnetic couplings

Shielded cables must be used if electrical interference fields affect the signal transmissions despite separate routing of cables. Ensure that cables are arranged in an EMC-compliant manner.

6.4.2 Oil dirt indicator switch

Fig. 14



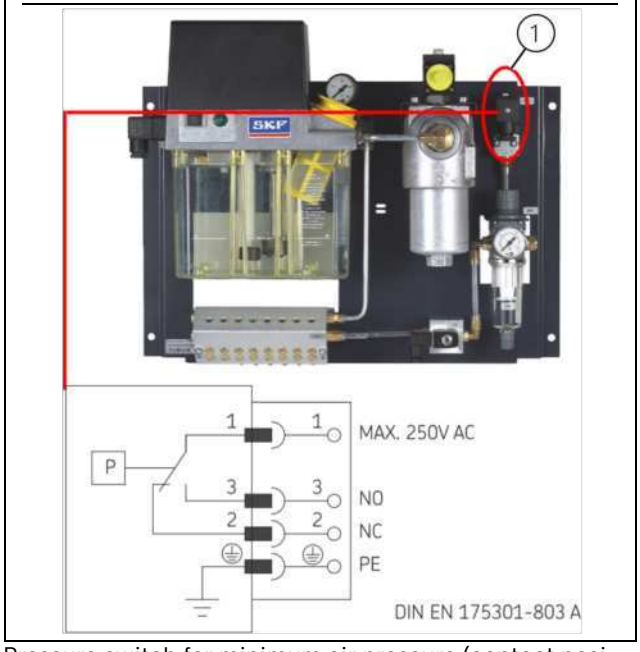
Oil dirt indicator

Legend to Figure 14:
1 Dirt indicator
2 Oil filter
BNbrown
WH white (100% alarm (NC))
BK black (75% pre-warning (NO))
BU blue (not connected)

Optionally, the Oil+Air lubrication unit can be fitted with an oil filter (Fig. 14/2) with a visual/electrical dirt indicator on it (Fig. 14/1)

6.4.3 Pressure switch for minimum air pressure (DL)

Fig. 15



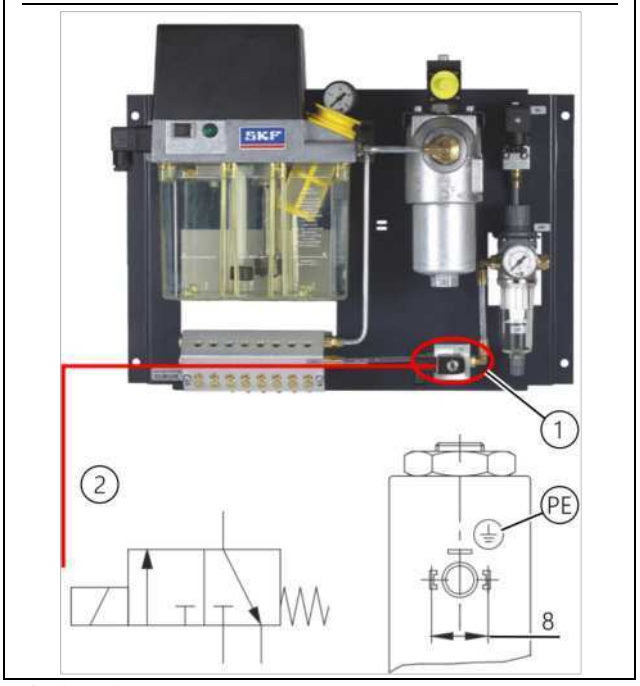
Pressure switch for minimum air pressure (contact position shown: switch depressurized (NC))

Legend to Figure 15:
1 Pressure switch for minimum pressure

Optionally, the Oil+Air lubrication unit can be fitted with a pressure switch for minimum air pressure (Fig. 15/1)

6.4.4 3/2 directional control valve for switching compressed air on and off

Fig. 16



3/2 directional control valve

Legend to Figure 16:
1 3/2 directional control valve
2 Hydraulic symbol

Optionally, the Oil+Air lubrication unit can be fitted with a 3/2 directional control valve (Fig. 16/1) for switching compressed air on and off

6.4.5 Inductive loads

In the case of electric switches with inductive loads, the inductivity of the switch must be low in order to keep wear on contact surfaces to a minimum. Otherwise, there is a risk of damaging the contact surfaces on the switch elements. Appropriate measures must be taken to protect the contacts of the switch elements.

Connect electrical switching devices such as the lubricant level switch, pressure switch, directional control valves, thermometer, etc. according to Figures 14, 15, and 16 and section 6.5.5Terminal diagram 230/115 VAC with control unit. In the case of designs with a control unit, the switching devices come pre-wired. See also section 6.5.2Terminal diagram 230/115 VAC without control unit.

6.5 Control and monitoring

Oil+Air lubrication units are available in designs with and without a control unit. An Oil+Air lubrication unit without an electronic control unit is controlled and monitored by the control of the machine that the Oil+Air lubrication unit is mounted on.

An Oil+Air lubrication unit with a control unit has an electronic control unit integrated into the gear pump unit (IG54-20-S4 I) which handles the control and monitoring of the Oil+Air lubrication unit.

NOTICE

Observe the accompanying documentation

For an Oil+Air lubrication unit with control unit, also consult the operating instructions for the control unit IZG54-20-S4-I. This is included in the accompanying documentation.

6.5.1 Oil+Air lubrication unit without control unit

Oil+Air lubrication units without an integrated electronic control unit are controlled by the control unit of the machine to which Oil+Air lubrication unit is connected. The machine control unit controls the pump run time, the pump delay time, and the interval time of the gear pump unit according to the lubricant required by the lubrication points.

The pump run time is the period between switching on the gear pump motor and establishment of the maximum oil pressure in the main lubricant line, monitored by an oil pressure switch. This period is also referred to as the monitoring time. The pump delay time is the period during which the gear pump motor continues to run after the maximum oil pressure is reached in the main lubricant line, in order to ensure that the lubrication chambers in the Oil+Air mixing valve are emptied completely. The pump run time plus the delay time is also called the operating time.

The interval time is the period between two operating times.

A lubricating cycle consists of the operating time and the interval time. When setting the interval time, the pump cycle time, and the pump delay time, comply with the S3 duty type permitted for the gear pump motor. Consult the accompanying documentation of the gear pump unit for information regarding the duty type.

The following are monitored:

- Pressure build-up in the main lubricant line (oil pressure build-up)
- Minimum air pressure of the compressed air supply
- Fill level in the lubricant reservoir

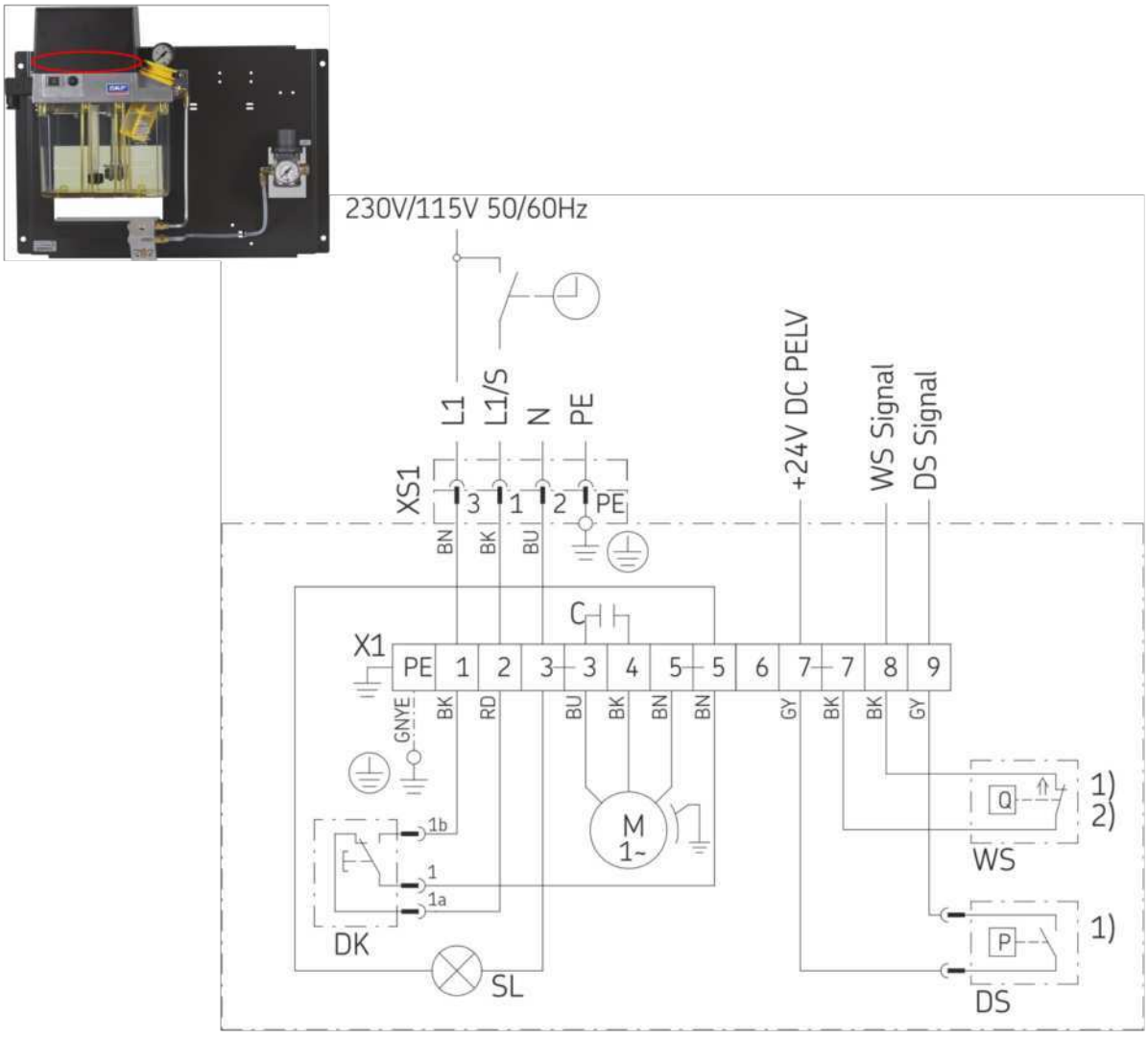
With regard to monitoring pressure build-up in the main lubricant line during a lubrication cycle, note that several seconds may pass after the gear pump motor is switched on before the oil pressure switch responds. A fixed monitoring time for oil pressure build-up is recommended so that the machine control unit waits until this time has elapsed to issue an error message if the required oil pressure is not reached. A period of approx. 60 seconds is recommended. The oil pressure switch responds once the required oil pressure has been reached. If the required oil pressure is not reached, the machine must be shut down to prevent underlubrication of the bearings.

To prevent underlubrication of the bearings, configure the monitoring of minimum air pressure of the supplied compressed air so that the machine is shut down if there is no air pressure or the pressure drops too low. Ensure that a time buffer is stored in the machine control unit to level out brief pressure fluctuations in the compressed air supply.

In order to prevent underlubrication of the bearings, monitoring of the minimum fill level of the lubricant reservoir must be configured in such a way that the machine is shut down if the fill level is too low.

6.5.2 Terminal diagram 230/115 VAC without control unit

Fig. 17



230 VAC/115 VAC, without control unit

Legend to Figure 17:

WS	Lubricant level switch
DS	Pressure switch
DK	Intermediate lubrication pushbutton
SL	Control light for pump operation
1)	Optional (WS/DS)
2)	Optional, contact closes at MINIMUM level

Plug connector XS1: DIN EN 175301-803A

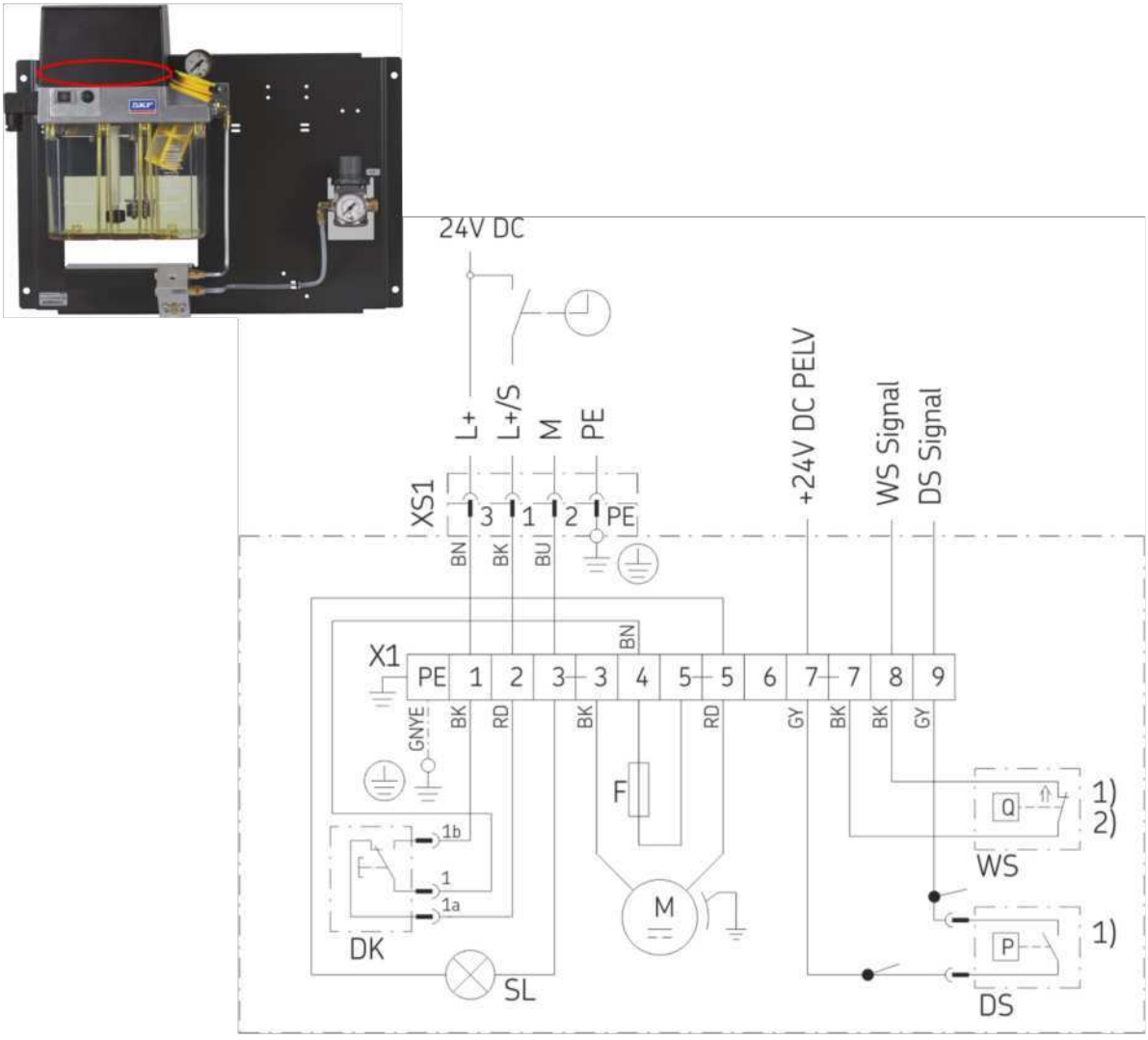
Table 6

Connector pin assignment for XS1, 230/115 VAC

PIN	Description
3	**L1** Machine main switch ON
1	**L1/S** Contact for pump operation
2	**N**
⏚	**PE** Protective earth

6.5.3 Terminal diagram 24 VDC without control unit

Fig. 18



24 VDC without control unit

Legend to Figure 18:

WS	Lubricant level switch
DS	Pressure switch
DK	Intermediate lubrication pushbutton
SL	Control light for pump operation
1)	Optional
2)	Optional, contact closes at MINIMUM level

Plug connector XS1: DIN EN 175301-803A

Table 7

Connector pin assignment for XS1, 24 VDC

PIN	Description
3	**L1** Machine main switch ON
1	**L+ S** Contact for pump operation
2	Ground (0 V)
⏚	**PE** Protective earth

6.5.4 Oil+Air lubrication unit with control unit

These Oil+Air lubrication units contain a programmable electronic control unit that can be used to control and monitor the Oil+Air lubrication unit. Electronic control units for Oil+Air lubrication units are designed as pulse generators, meaning that the interval time is set. Depending on the model design, the electronic control unit could allow configuration of the interval time, the pump delay time, and the number of prelubrication cycles. One cycle or multiple prelubrication cycles with short interval times can be triggered before starting up the machine, in order to provide an adequate quantity of lubricant for the bearings that require lubrication and/or to build up a fully developed oil streak in the feed line before the machine starts running.

The pump run time is 60 seconds and cannot be changed.

The monitoring units are connected electrically on the terminal strip of the electronic control unit of the gear pump unit. The control unit directly monitors the operation of the oil pressure switch, the pressure switch for minimum air pressure, and the lubricant level switch. Oil+Air lubrication units with an electronic control unit come with all the internal wiring fully connected.

Depending on the model design of the electronic control unit, a signal line for fault monitoring could be connected to the electronic control unit for connection to the machine control unit. The signal line comes out through a screwed gland mounted on the gear pump unit. Details on the functioning and operation of the gear pump unit and the electronic control unit can be found in the assembly instructions for the gear pump unit and the operating instructions for the electronic control unit. These instructions are included in delivery of the Oil+Air lubrication unit.

NOTE

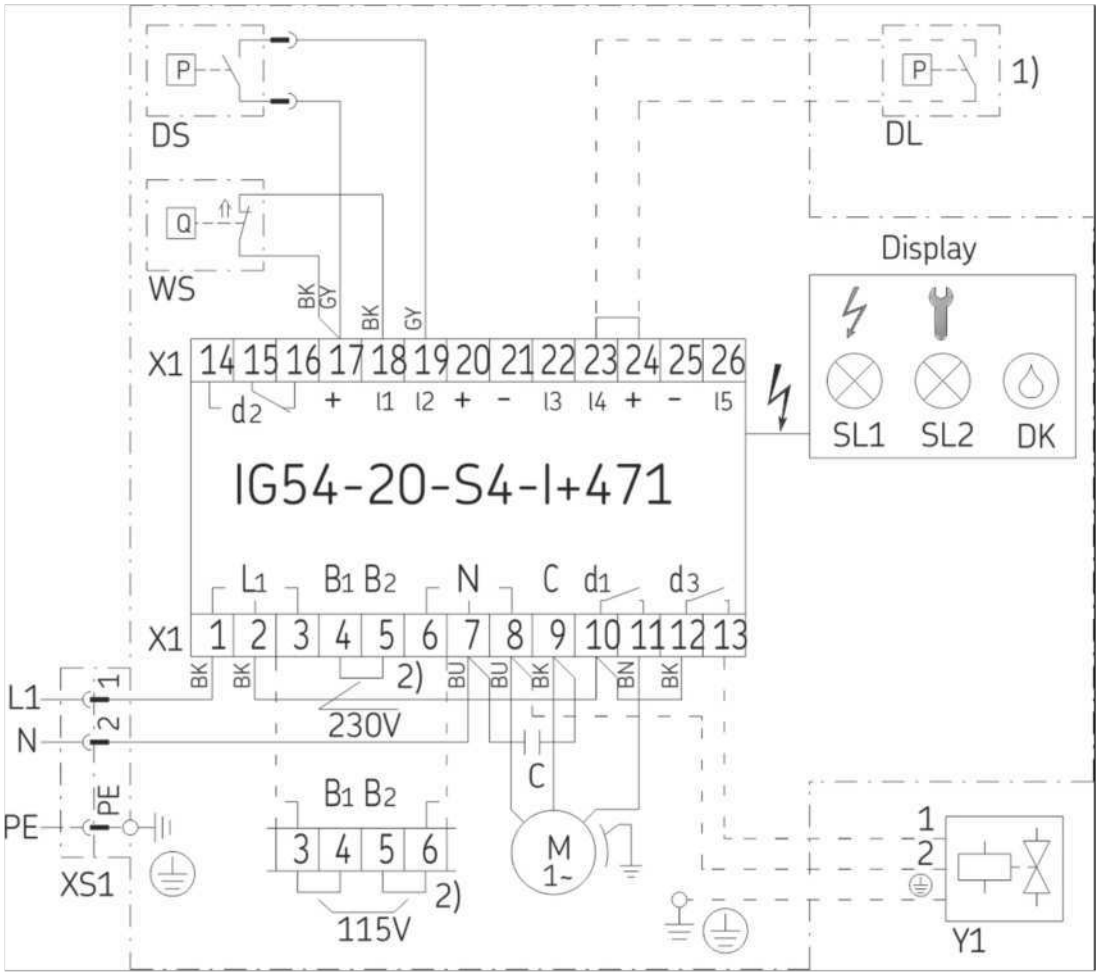
Before programming of the electronic control unit of an Oil+Air lubrication unit, consult the operating instructions for the control unit IG54-20-S4-I.

Depending on the model design, gear pump units of model design MKU (without control unit) or MKL (with control unit) are used in Oil+Air lubrication units. To find out which model design you have, see the type plate of the gear pump unit.

For further information about the gear pump unit, consult the assembly instructions. Both documents are included in delivery of an Oil+Air lubrication unit.

6.5.5 Terminal diagram 230/115 VAC with control unit

Fig. 19



230 VAC/115 VAC with control unit

Legend to Figure 19:

WS	Lubricant level switch
DL	Air pressure switch
DS	Pressure switch
SL1	Control light for operating voltage
SL2	Control light for fault or completion of prelubrication cycles
DK	Intermediate lubrication pushbutton
X1:16	Fault or completion of prelubrication cycles
X1:14	Normal operation
1)	Can be connected by the customer: pressure switch for minimum air pressure (DL), compressed-air valve (Y1)
2)	The control unit can be switched between 230 VAC and 115 VAC, but the pump motor cannot

Plug connector XS1: DIN EN 175301-803A

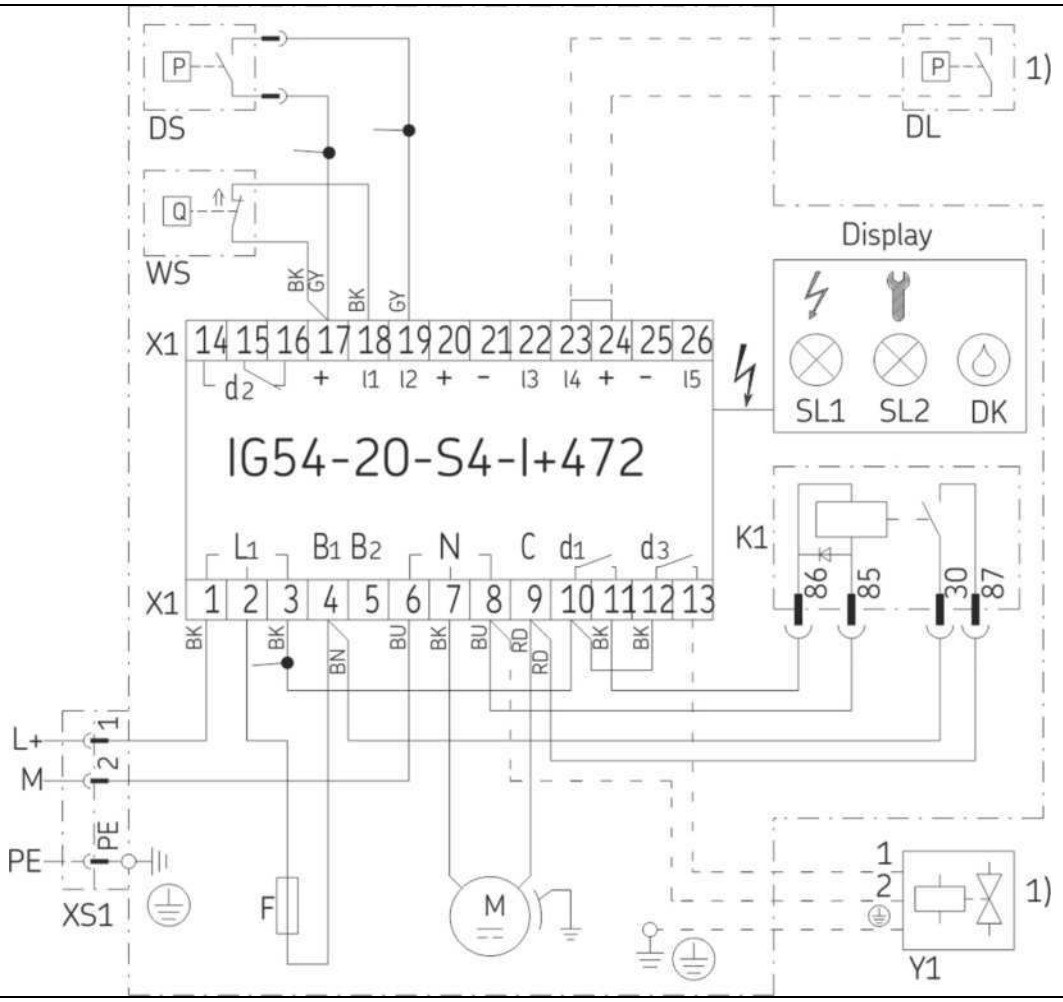
Table 8

Connector pin assignment for XS1, 230/115 VAC

PIN	Description
1	**L1** Machine main switch ON
2	**N**
⏚	**PE** Protective earth

6.5.6 Terminal diagram 24 VDC with control unit

Fig. 20



24 VDC with control unit

Legend to Figure 20:

WS	Lubricant level switch
DL	Air pressure switch
DS	Pressure switch
SL1	Control light for operating voltage
SL2	Control light for fault or completion of prelubrication cycles
DK	Intermediate lubrication pushbutton
K1	Pump motor relay
X1:16	Fault or completion of prelubrication cycles
X1:14	Normal operation
1)	Can be connected by the customer: pressure switch for minimum air pressure (DL), compressed-air valve (Y1)

Plug connector XS1: DIN EN 175301-803A

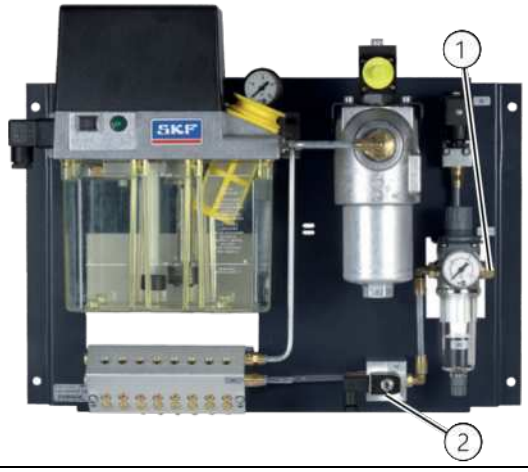
Table 9

Connector pin assignment for XS1, 24 VDC

PIN	Description
1	**L1** Machine main switch ON
2	**N**
⏚	**PE** Protective earth

6.6 Air supply line connection

Fig. 21



Compressed air connection

Legend to Figure 21:
1 Compressed air connection (M10x1)
2 3/2 directional control valve

The air supply line must be connected to the Oil+Air lubrication unit in such a way that no forces are transferred to the lubrication unit (stress-free connection).

⚠ WARNING

Connecting the main air valve

Ensure that the main air valve is closed before connecting the Oil+Air lubrication unit to the compressed air supply

NOTICE

Maintain the primary air pressure

The minimum primary air pressure specified for operation of an Oil+Air lubrication unit must be maintained

The compressed air must be dry and filtered. A water separator, preferably with semi-automated draining, is recommended for treatment of the compressed air.

Detailed requirements for compressed air are listed in Table 10.

The following applies to the required air flow rate: The higher the viscosity of the lubricant used, the higher the required air flow rate to transport the oil streak in the feed line.

Due to the higher adhesiveness of highly viscous lubricants on the walls of the feed line, higher air flow rates must be provided for.

The compressed air to be used must comply with at least quality class 3 as defined by ISO 8573-1.

Through the use of the appropriate compressed air quality class, compressed air preparation can be optimized. The connection for the air supply line (Fig. 21/1) is designed as an M10x1 connection thread with a counterbore for a solderless tube union in accordance with DIN3854/DIN3862 for tubes of Ø 6 mm. When assembling the air supply line, SKF recommends the use of the quick couplings listed under Accessories.

it is recommended to use a switch valve, such as a 3/2 directional control valve (Fig. 21/2), in the compressed air supply line, so that the compressed air supply can be switched on and off.

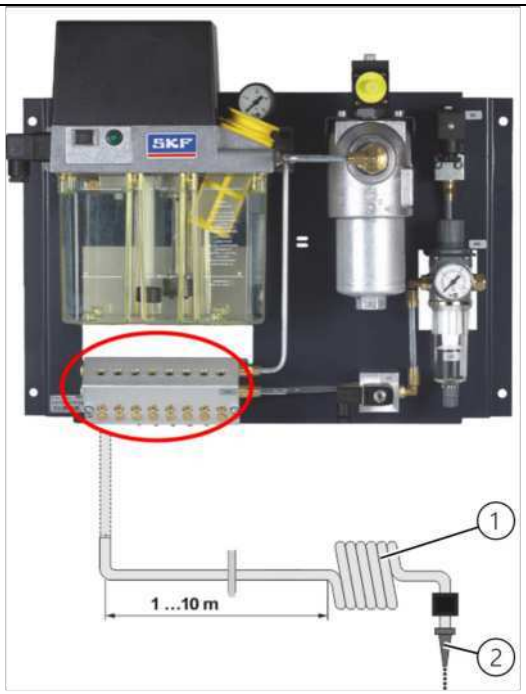
Table 10

Requirements for compressed air

Requirements	Values
Inlet pressure	Min. 3 bar
Continuous operating pressure	6 bar
Max. pressure	10 bar
Required air flow rate (line with 2.3 mm nominal diameter, and the recommended oil viscosity range)	1000 – 1500 Nl/h
Based on the compressed air quality classes defined by ISO 8573-1	
Particle content	Class 3
Maximum particle size	5 µm
Maximum particle content	5 mg/m³
Pressure dew point	Class 4 Maximum: +3 °C
Oil concentration	Class 3 Maximum: 1 mg/m³

6.7 Lubrication line connection

Fig. 22



Feed line fitting

Legend to Figure 22:
1 Hose coil
2 Nozzle

With Oil+Air lubrication units, the main lubricant line that connects the gear pump unit to the Oil+Air mixing valve is already fitted.

The feed line(s) are fitted according to Figure 22. The feed line from the Oil+Air mixing valve to the lubrication point must be connected to the Oil+Air lubrication unit in such a way that no forces can be transferred to the assembled lubrication unit (stress-free connection).

Feed lines made of transparent plastic are recommended so that the lubricant transport in the feed lines (oil streak formation) can be assessed visually. The requirements for the feed lines are summarized in Table 11.

Feed lines made of transparent plastic are available in rigid (unplasticized) and flexible (plasticized) designs, under the following order numbers (please state the length you require):

Plastic tubing, rigid:
- Order no. WVN715-RO4X0.85

Plastic tubing, flexible:
- Order no. WVN716-RO4X0.85

The connection for the feed line is designed either as an M8x1 connection thread with a counterbore for solderless pipe union to DIN3854/DIN3862 for 4 mm tube diameter, or with SKF quick coupling for 4 mm tube diameter.

Table 11

Requirements

Requirement	Values
Minimum length to the hose coil	1 m
Maximum length to the hose coil	10 m
Recommended feed line • WVN715-RO4X0.85 • WVN716- RO4X0.85	Ø 4x0.85 mm (wall thickness)

The feed lines may be routed with a rising or falling gradient. A hose coil (Fig. 22/2) that acts as a lubricant reservoir is installed about 0.3 m before the nozzle (Fig. 22/1). When the compressed air is turned off, the lubricant distributed in the hose coil collects in the lower arcs of the coil. This ensures that the bearing is supplied with lubricant again quickly when the compressed air is turned back on. The center axis of the hose coil should always be laid horizontally or with a maximum inclination of 30°.

Avoid changes in the cross-section of the feed 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.

SKF oil-streak sensors are recommended for monitoring the continuous lubricant flow in the feed lines. Oil-streak sensors allow monitoring of the oil-streak transport along the wall of the lubrication line between the Oil+Air mixing valve and the lubrication point.

Table 12

Order number - oil-streak sensor

Designation	Order No.
Oil-streak sensor for Ø 4 mm Lubrication line	GS4011-S50 (60-120 mm^3/h) GS4011-S20 (120-600 mm^3/h)

6.8 Bleeding the Oil+Air mixing valve MV20x

⚠ WARNING

Ensure depressurization

Depressurize the Oil+Air lubrication unit before starting work

The mixing valve must be bled when modifying or replacing it or its metering mechanisms. Note that only the Service department of SKF Lubrication Systems Germany GmbH may change the metering mechanisms for 10 mm^3 and 20 mm^3.

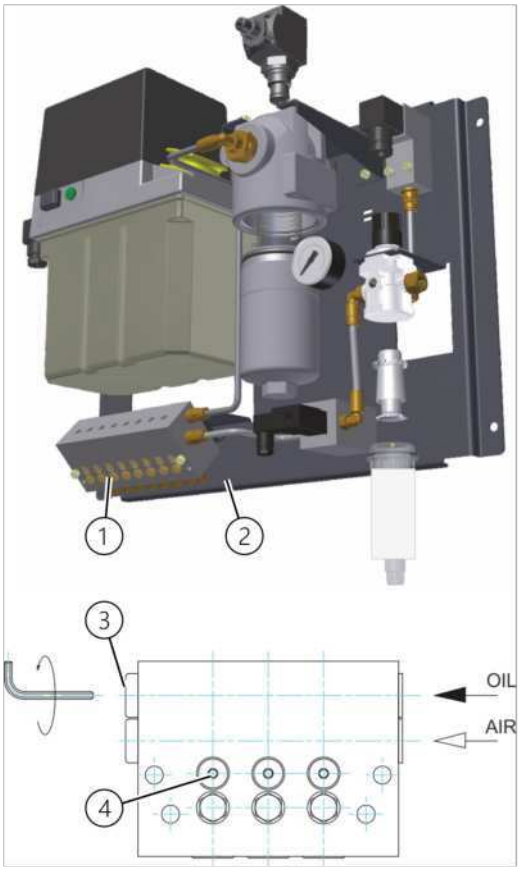
Larger metering mechanisms can also be replaced by the customer under the customer's own responsibility.

The metering mechanism/mixing valve must be bled in all cases.

To simplify the bleed process, the mixing valve should be removed from the mounting plate. In mounted position, the metering mechanisms are located on the bottom of the mixing valve.

6.8.1 Bleeding the main oil channel

Fig. 23



Bleeding the mixing valve (lower view shows the underside of the mixing valve)

Legend to Figure 23:
1 Mixing valve
2 Mounting plate
3 Plug screw
4 Check valve screw

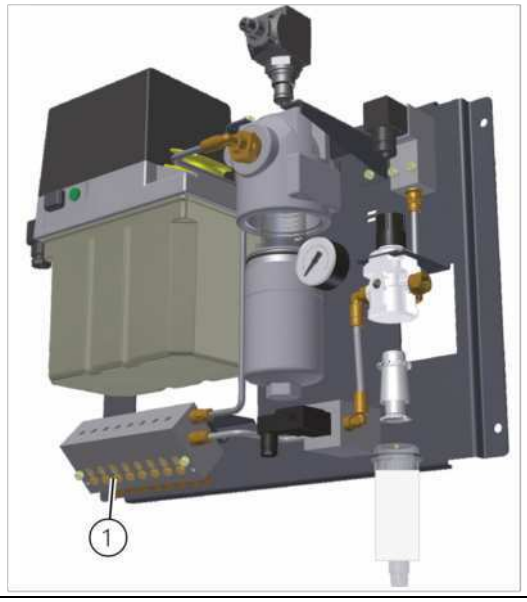
1. The customer must place a suitable oil pan under the mixing valve (Fig. 23/1) to catch the oil that comes out when bleeding
2. Depressurize the Oil+Air lubrication unit
3. Disconnect the compressed air feed (marked Air) from the mixing valve (Fig. 23/ 1). Leave the oil line connected to the main oil port (marked Oil) on the mixing valve (Fig. 23/1).
4. Remove the mixing valve (Fig. 23/1) from the mounting plate (Fig. 23/2) and position it with the check valve screw (Fig. 23/4) pointing up
5. Remove the plug screw (Fig. 23/ 3) (marked Oil) on the opposite side of the main oil port
6. Switch on the pump and run it to supply oil

NOTE
The oil now enters the mixing valve through the main oil port and discharges on the opposite side

7. Allow the pump to run until the oil coming out is free of bubbles
8. When the oil coming out of the main oil port is free of bubbles, keep the pump running and close the hole of the main oil port again with the plug screw (Fig. 23/3)
9. Switch off the pump
10. The bleeding of the main oil channel is now finished
11. After that, continue as described in section 1.1.2 Bleeding the oil outlets

6.8.2 Bleeding the oil outlets

Fig. 24

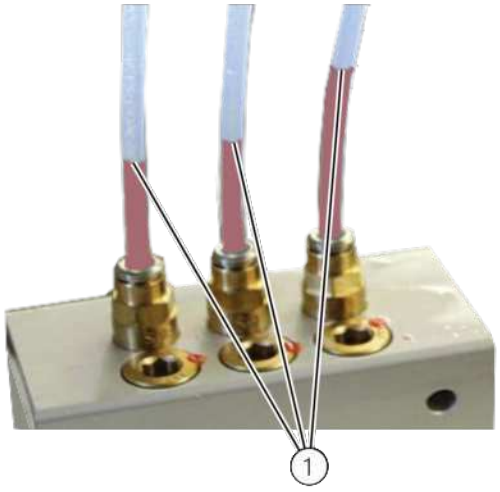


Bleeding the oil outlets

Legend to Figure 24:
1 Mixing valve

1. Leave the compressed air feed (marked Air) disconnected from the mixing valve (Fig. 24/ 1). Leave the oil line connected to the main oil port (marked Oil) on the mixing valve (Fig. 24/1).

Fig. 25



Bleeding the oil outlets (with plastic tubes about 20 cm long)

Legend to Figure 25:
1 Fill levels

NOTE
Different filling levels in the plastic tubes can result from different amounts of bleeding. The plastic tubes are simply used to show when bubble-free oil comes out of the mixing valve.

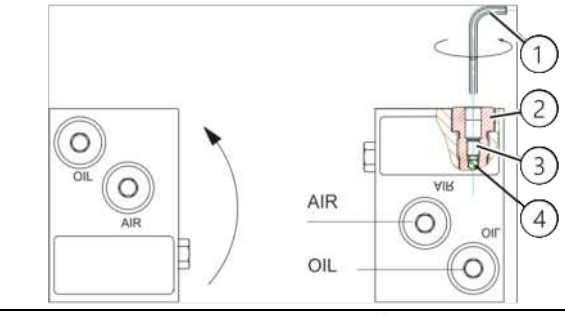
2. Turn the mixing valve is so that the outlet fittings are pointing up. Insert plastic tubes about 20 cm long into the outlet fittings. Different filling levels in the plastic tubes can result from different amounts of bleeding.
The plastic tubes are simply used to show when bubble-free oil comes out of the mixing valve.
3. Run the oil pump for several cycles (about 30 cycles) until oil comes out that is free of bubbles
4. Switch off the pump. The discharged oil must be collected
5. Remove the plastic tubes and attach the lubrication lines

NOTE
When step 1.1.2 Bleeding the oil outlets has been carried out and oil can be seen in the feed lines, the mixing valve can be put into regular operation. However, if no oil can be seen in the feed lines, continue with step 6.8.3Bleeding the metering mechanisms.

6.8.3 Bleeding the metering mechanisms

NOTICE
Adhere to the bleeding sequence
Before carrying out the bleeding process, steps 6.8.1Bleeding the main oil channel and 1.1.2 Bleeding the oil outlets must be carried out. Only then can you move on to the bleeding of the metering mechanisms.

Fig. 26



Bleeding the metering mechanisms (right-hand view rotated through 180°)

Legend to Figure 26:
1 Setscrew
2 Plug screw of the metering mechanism
3 Setscrew
4 Balls

1. Rotate the mixing valve up so the air in it can escape.
2. Place a hexagon wrench (size 2 mm) on the setscrew (Fig. 26/1) of the metering mechanism (Fig. 26/2)
3. Remove the setscrew (Fig. 26/3) and ball (Fig. 26/4) from the metering mechanism (Fig. 26/3)
4. Repeat the process on all metering mechanisms
5. Let the pump run in intermittent operation (temporarily pausing) until bubble-free oil comes out of all the metering mechanisms. In the relief phases, the pressure in the oil line must fall to <=1 bar.
6. Re-insert the balls (Fig. 26/4) and setscrews (Fig. 26/3) into the metering mechanisms (Fig. 26/2)
7. Use the hexagon wrench to tighten the setscrew (Fig. 26/3) to a torque of 1.5 Nm
8. Reinstall the mixing valve on the mounting plate
9. Reconnect the compressed air supply

6.9 General information on 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 pressure occurring in the lubrication unit used and the delivery volume of that lubrication unit. If possible, the main lubricant line should rise upward from the lubrication unit and be bleedable at the highest point on the lubrication line system.

The pipes, hoses, shut-off 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 supplied. 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 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.

NOTICE

Make sure there are no leaks on the lubrication line

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.

⚠ CAUTION

Make sure there are no leaks on the lubrication line

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.

NOTICE

Observe the safety data sheet

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

NOTICE
System malfunction from 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
Damage from mixing lubricants
Different lubricants must not be mixed together. Doing so can cause damage and require costly and complicated cleaning of the Oil+Air lubrication unit. 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.

Inspect all electrical, hydraulic, and pneumatic connections before first start-up of the Oil+Air lubrication unit.

NOTICE
Bubbles when lubricant is supplied
The lubricant may only be supplied without bubbles

The lubricant reservoir must be filled with clean lubricant without introducing bubbles. The Oil+Air lubrication unit pump unit should not be operated until about 15 min. after filling, in order to allow possible air pockets to escape. Air inclusions in the lubricant adversely affect the function of the devices and impair the reliability of lubricant supply, which can result in damage to the bearings that are being lubricated.

Table 13

Oils permitted

Requirement	Values
Recommended oil purity level	13/10 (ISO 4406) or Class 4 (NAS 1638)
Recommended ISO VG class	32 ... 100 based on 40 °C
Approved additives	EP additives
Prohibited additives	Solids

Proceed as follows for first start-up:
1. Check that the mounting plate and all connections are firmly in place.
2. Check that sufficient lubricant is present in the lubricant reservoir.
3. Check that compressed air is supplied.
4. Start the system.

Check the functioning of the Oil+Air lubrication unit as follows:
1. When the spindle is at a standstill, check whether signals are exchanged properly between the machine and the Oil+Air lubrication unit.

The described Oil+Air lubrication unit works automatically. The lubricant transport in the lubrication lines should, however, be subjected to regular visual inspection.

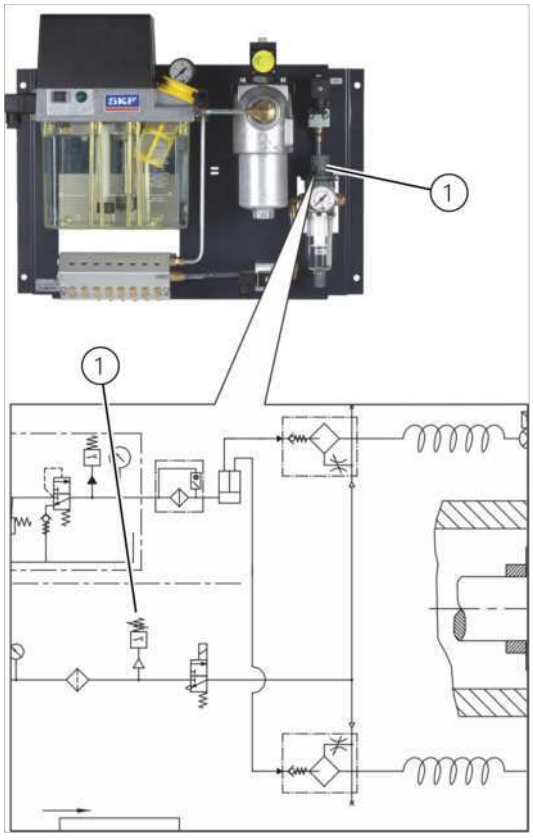
NOTICE
Contaminated lubricant
Only fill using clean lubricant and an appropriate device. Contaminated lubricants can result in severe system malfunction. Observe the instructions from the machine manufacturer regarding the lubricants that are to be used.

7.1.1 Setting up

NOTICE
Incorrect first start-up
To ensure proper functioning of the Oil+Air lubrication unit, it must be started up for the first time in accordance with the following procedure

Oil+Air mixing valve with metering MV20x

Fig. 27

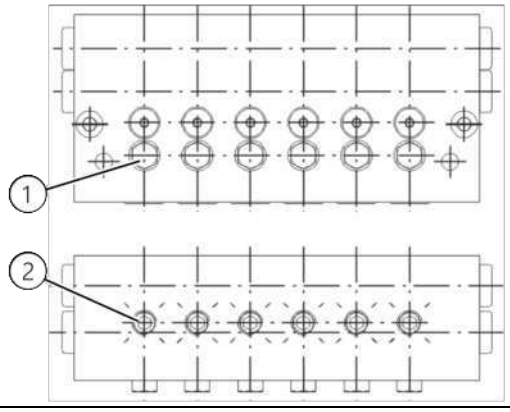


Oil+Air hydraulic diagram (detail)

Legend to Figure 27:
1 Compressed air regulating valve

1. Close the compressed air regulating valve (Fig. 27/1) to interrupt the feed of compressed air

Fig. 28



Oil+Air mixing valve with metering MV20x

Legend to Figure 28:
1 Pressure measurement port
2 Air adjustment screws (LRS)

2. Remove the plug screws from the pressure measurement ports (Fig. 28/1) on the Oil+Air mixing valve.
3. Switch on the power supply and run the gear pump unit until lubricant free of bubbles comes out of the openings of the pressure measurement ports.
4. Re-insert the plug screws.
5. Open the compressed air regulating valve (Fig. 27/1) and set a working pressure of at least 3 bar, up to a maximum of 10 bar (optimal: 6 bar).
6. Run the gear pump unit until a continuous oil streak forms in the feed lines and the lubricant comes out at the lubrication points.
7. If necessary, adjust the air flow rate using the air adjustment screws (Fig. 28/2) on the Oil+Air mixing valve or compressed air regulating valve (Fig. 27/1).

8 Operation

8.1 General

The described Oil+Air lubrication unit works automatically. The lubricant transport in the lubrication lines should, however, be subjected to regular visual inspection.

The lubricant level in the lubricant reservoir should be subjected to regular visual inspection. If the lubricant level is too low, lubricant needs to be added up to the maximum mark as described in section 6.5.1Oil+Air lubrication unit without control unit.

NOTE

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

NOTICE

System malfunction from 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

Damage from mixing lubricants

Different lubricants must not be mixed together. Doing so can cause damage and require costly and complicated cleaning of the Oil+Air lubrication unit. 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.

8.1.1 Oils permitted

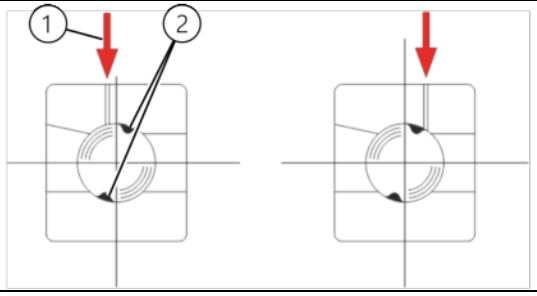
Table 14

Oils permitted

Requirement	Values
Recommended oil purity level	13/10 (ISO 4406) or Class 4 (NAS 1638)
Recommended ISO VG class	32 ... 100 based on 40 °C
Approved additives	EP additives
Prohibited additives	Solids

8.2 Feed of lubricant to the bearing

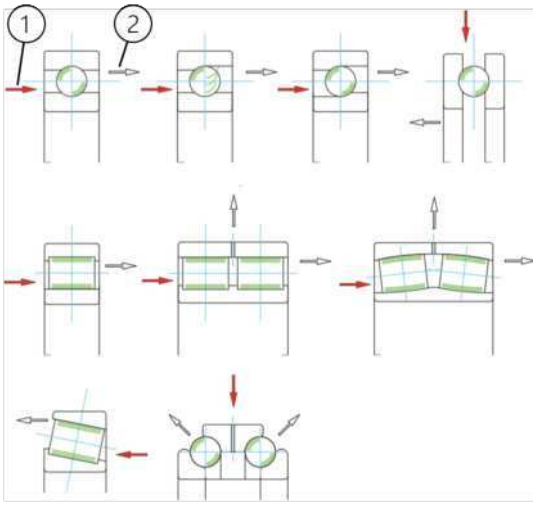
Fig. 29



Oil+Air hydraulic diagram (pressure zone)

Legend to Figure 29:
1 Oil+Air
2 Pressure zone

Fig. 30



Oil+Air hydraulic diagram

Legend to Figure 30:
1 Oil+Air
2 Exhaust air

The way the lubricant is fed to the bearing depends on the bearing type and the bearing assembly's design features. Examples of lubricant feed can be seen in Figures 29 and 30.

In case of single-row rolling bearings, it is possible for the lubricant to be introduced into the rolling bearing from the side. The nozzle should be at the level of the rolling bearing's inner ring. Under no circumstances should the Oil+Air flow be aimed directly at the cage of the rolling bearing.

If using rolling bearings that have a pumping effect in one direction (such as angular contact bearings), the lubricant must be fed in the direction of the pumping effect.

The lubricant should be introduced into the bearing assembly via a nozzle whose length depends on the bearing size. Suitable nozzles can be ordered from SKF Lubrication Systems Germany GmbH.

It is also possible to introduce the lubricant directly into the outer ring of the rolling bearing via a bore. In this case, make sure the lubricant is not introduced into the pressure zone of the rolling bearing between the rolling element and the bearing ring; see Figure 29.

In case of double-row cylindrical roller bearings, the lubricant should be introduced into the rolling bearing from the side at the level of the outer ring raceway. The lubricant is then distributed almost uniformly to both rows of rolling bearings; see Figure 30.

On rolling bearings with an outside diameter from 150 to 280 mm, it is recommended that a second nozzle be installed. In case of larger rolling bearing diameters, more nozzles should be used accordingly. A single nozzle is sufficient for most applications in which the lubricant is fed through the outer ring of a rolling bearing.

The air pressure indicated in the table "Requirements for compressed air" in section 6.5.5Terminal diagram 230/115 VAC with control unit in the assembly instructions is generally enough to reliably overcome the air vortex produced by rolling bearings.

If in individual cases a higher air pressure is required to reliably feed the lubricant, this does not impair the function of the Oil+Air lubrication unit as a whole. To prevent the formation of an oil sump in the lower part of the bearing, the lubricant fed to the rolling bearing and to the entire bearing point must be conveyed away again. For this purpose it is recommended to drill a drain hole in the lower part of the bearing point so that the lubricant can drain out. A rule of thumb for the diameter of the drain hole is 6 times the inlet cross-section, but at least one drain hole with a diameter of 5 mm.

8.3 Setting the lubricant flow rate

NOTICE

Underlubrication

The amount of lubricant required at a lubrication point is specified by the bearing or machine manufacturer. It must be ensured that the required quantity of lubricant is provided to the lubrication point. The lubrication point may otherwise not receive adequate lubrication, which can lead to damage and failure of the bearing.

The volume of lubricant fed to a bearing point by an Oil+Air lubrication unit depends on:

- The bearing type
- The geometric dimensions of the bearing
- The speed factor

The lubricant volume can be adapted as follows to suit the specific conditions:

- Changing the metering volume on an Oil+Air mixing valve with metering
- Reducing or extending the interval time of the gear pump unit

It is not possible to state a generally valid equation for the required lubricant volume per unit time for a bearing. For instance, bearings with a feeding action, like angular contact bearings, require a significantly greater volume of lubricant and bearings without a feeding action, like cylindrical roller bearings. The amount of lubricant required by a bearing is normally specified by the bearing or machine manufacturer. The amount of lubricant required is usually specified in mm³/h. If other units are being used, this specification must be converted accordingly. To set the Oil+Air lubrication unit, you can proceed as follows, in regard to selecting the metering of the Oil+Air mixing valve and determining the lubrication cycle time:

The aim of the calculation is to determine the number "**n**" of cycles per hour based on the selected metered volume "**d**" for the bearing and the amount of lubricant "$\mathbf{V_{oil}}$" required per hour by the bearing. The entire amount of lubricant required per hour by the bearing should be converted to as many cycles (working cycles) per hour as possible (note: observe the S3 duty type).

The metering for the lubrication point must be selected accordingly. Possible metering settings for Oil+Air mixing valves are listed in the following table.

Table 15

Possible metering for the Oil+Air mixing valve

Metered volume [mm³]	MV20x
10	x
20	x
30	x
60	x
100	x
160	x

The number of cycles per second is calculated using the following formula:

Table 16

Legend

Formula symbol	Unit symbol	Units and derived units
V		Volumetric flow per hour
V_{oil}	mm³/h	Amount of lubricant required by a bearing in mm3 per hour **Notice! There could be multiple lubrication points per bearing**
t_{PBT}	s	Pressure build-up time in seconds
t_{PDT}	s	Pump delay time in seconds
t_{PRT}	s	Pump run time in seconds
t_{int}	s	Interval time in seconds
$t_{C,S3}$	s	Cycle time in seconds
n	cycles/h	Number of cycles per hour
d	mm³/cycle	Metered quantity per cycle

$V_{oil} = n \cdot d$

The selected metered volume per cycle "*d*" depends on the metering volume in the Oil+Air mixing valve.

Example of a typical configuration:
Given: V_{oil} = 150 mm³/h
d = 30 mm³
Find: number of cycles per hour **[**cycles/h**]**

$$n = \frac{\dot{V}_{oil}}{d} = \frac{150}{30} = 5\ \frac{\text{Takte}}{\text{h}}$$

The calculated number of cycles per hour n (5 cycles per hour in this example) is used to determine the cycle time $\mathbf{t_{C,S3}}$.

$$t_{Z,S3} = \frac{60}{n}\ [\text{min}]$$

The cycle time $\mathbf{t_{C,S3}}$ is comprised of the pump run time $\mathbf{t_{PRT}}$ including the pump delay time $\mathbf{t_{PDT}}$, and the interval time $\mathbf{t_{int}}$.
The pump run time (including the pump delay time) and the interval time are derived on the basis of the specified duty type S3. The duty type for Oil+Air lubrication units for basic configurations is specified as S3, 20% duty cycle (1.25 ... 25 min).

Here, the duty cycle is the percentage of the cycle time $\mathbf{t_{C,S3}}$ during which the gear pump motor is switched on (pump run time incl. pump delay time), and the time range 1.25 ... 25 min is the range of selectable work cycle times $\mathbf{t_{C,S3}}$ in minutes.

$t_{C,S3} = (t_{PRT} + t_{PDT}) + t_{int}$

where

$t_{C,S3}$ = 1.25 ... 25 min

$t_{PRT} + t_{PDT} = 0.2 \cdot t_{C,S3}$ (0.2 = 20%)

$t_{int} = 0.8 \cdot t_{C,S3}$ (0.8 = 80%)

It follows that:

$t_{int} = t_{C,S3} - (t_{PRT} + t_{PDT})$

On the basis of the calculated cycle time $\mathbf{t_{C,S3}}$, these formulas can be used to work out the pump run time $\mathbf{t_{PRT}}$ (including the pump delay time $\mathbf{t_{PDT}}$) and the interval time $\mathbf{t_{int}}$ (duty cycle = 20% which equates to 0.2).

In the case of Oil+Air lubrication units without a control unit, the pump run time, pump delay time, and interval time are programmed in the machine control. In this case, the pump delay time could be programmed with 5 seconds, in which case the pump run time (the monitoring time for pressure build-up: see also section 6.5Control and monitoring) must be shortened by 5 seconds accordingly.

In the case of Oil+Air lubrication units with a control unit, the electronic control unit installed in the gear pump unit must be programmed accordingly.

The standard design of the electronic control unit for Oil+Air lubrication units allows the interval time to be programmed. The pump run time (the monitoring time) is permanently set to 60 seconds. The time of 60 seconds is sufficient for pressure build-up in the main lubricant line and therefore for reliable operation of the Oil+Air lubrication units. The pump delay time is permanently set to 5 seconds.

Consequently, given the duty type is S3 with 20% duty cycle and the total pump run time is $\mathbf{t_{PRT} + t_{PDT}}$ = 65 seconds, the minimum interval time $\mathbf{t_{int,min}}$ is as follows:

$t_{PRT} + t_{PDT} = 0.2 \cdot t_{C,S3}$

$$t_{Z,S3} = \frac{(t_{PLZ} + t_{PNLZ})}{0,2}$$

$$t_{Z,S3} = \frac{65\text{s}}{0,2} = 325\text{s} = 5,4\ \text{min}$$

$t_{int,\,min} = 0.8 \cdot 5.4$ min = 4.3 min

The calculated minimum interval time is 4.3 minutes and must be complied with in order to adhere to the permissible duty type S3 = 20% duty cycle.

The interval time is programmed on the electronic control unit in minutes, so the minimum interval time $\mathbf{t_{int,min}}$ is 5 minutes (rounded up), yielding a minimum working cycle time of 6 minutes (rounded down).

$t_{C,S3,\,min} = t_{int,\,min} + t_{PRT} + t_{PDT}$

$t_{C,S3,\,min}$ = 5 min + 1 min + 5 s

$t_{C,S3,\,min}$ = 6 min (rounded down)

The maximum number of cycles per hour is therefore 10 lubrication cycles.

$$n = \frac{60\ \text{min}}{6\ \text{min}} = 10\ \frac{\text{Takte}}{\text{h}}$$

This must be taken into account when configuring the lubrication Oil+Air lubrication units.

The electronic control units are available in special designs with a programmable pump delay time.

Adjustment of the interval time on the electronic control unit is described in the operating instructions for the electronic control unit. The operating instructions for the electronic control unit are included in the delivery of Oil+Air lubrication units with a control unit.

For more information about controlling an Oil+Air lubrication unit, see section 6.5Control and monitoring.

8.4 Adjusting the air flow rate

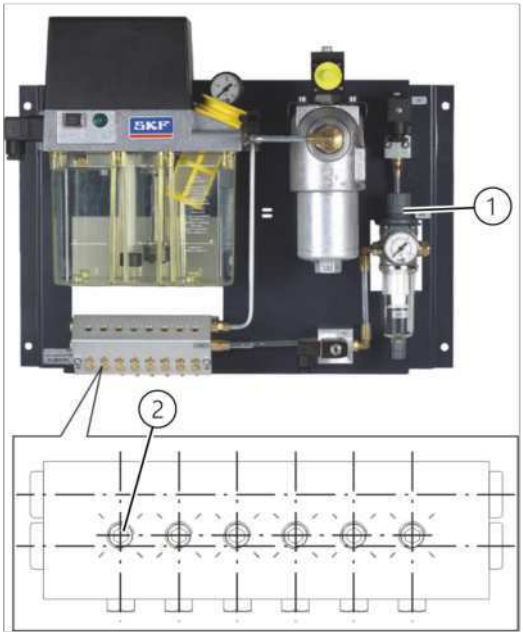
The required amount of air depends on the lubricant volumes to be conveyed, the number of feed lines, and the specific properties of the lubrication point. The working pressure of the compressed air must be set so that there is an adequate amount of air for reliable transport of the oil streak in every feed line, taking into account the pressure losses in the feed line and lubrication point.

The adjustment for the air flow rate is worked out empirically. The most important criterion is a visual inspection of the continuous and uniform flow of lubricant in the feed lines. The amount of compressed air required for proper transport of an oil streak in a feed line with an internal diameter of 2.3 mm ranges from about 1000 to 1500 Nl/h.

This value applies to all oils of viscosity class ISO VG 32 to ISO VG 100. Higher values must be assumed in the case of oils with a higher viscosity or oils with tackifier additives.

The air pressure has to be adjusted so that this amount of compressed air can be sent through every feed line, taking into account the pressure losses in the feed line and bearing. The air pressure available at the compressed air inlet (the connection to the air supply system) should be at least 3 bar and preferably 6 bar. In the case of quick-running roller bearings, a higher air pressure is required to overcome the back pressure from the bearings (vortexing). For reliable function of the Oil+Air lubrication unit, the air pressure at the nozzle (inlet to the bearing point) should not be less than 1.5 bar.

Fig. 31



Adjusting the air flow rate

Legend to Figure 31:
1 Compressed air regulating valve
2 Air adjustment screw

The working pressure of the Oil+Air lubrication unit is set using the compressed air regulating valve (Fig. 31/1). The air pressure should be between 3 and 10 bar. The air flow rate in the individual feed lines is set using the corresponding air adjustment screw (Fig. 31/2) on the Oil+Air mixing valve.

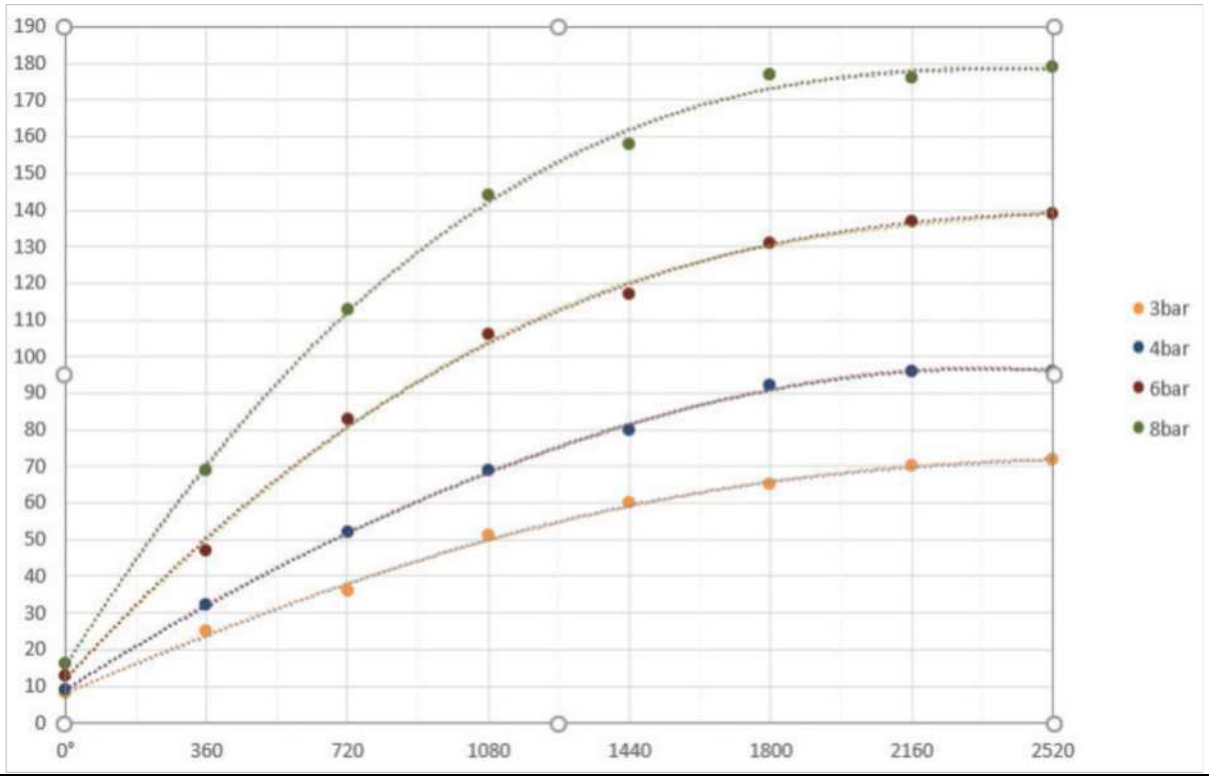
NOTE
It is not possible to completely close off a lubrication point outlet on the Oil+Air mixing valve using the air adjustment screw. A minimum air flow rate is always maintained. Changing the air flow rates in one feed line always affects the air flow rate in the other feed lines.

NOTICE
Underlubrication
In the event of faults in the air pressure build-up, the Oil+Air lubrication unit and the machine must be switched off, to prevent underlubrication of the lubrication point.

The y-axis of the chart in section 8.4.1Air flow rate in Nl/minshows the air flow rate in Nl/min to be expected when the air pressure is set accordingly, and the x-axis shows the opening angle of the air adjustment screw in degrees.

8.4.1 Air flow rate in Nl/min

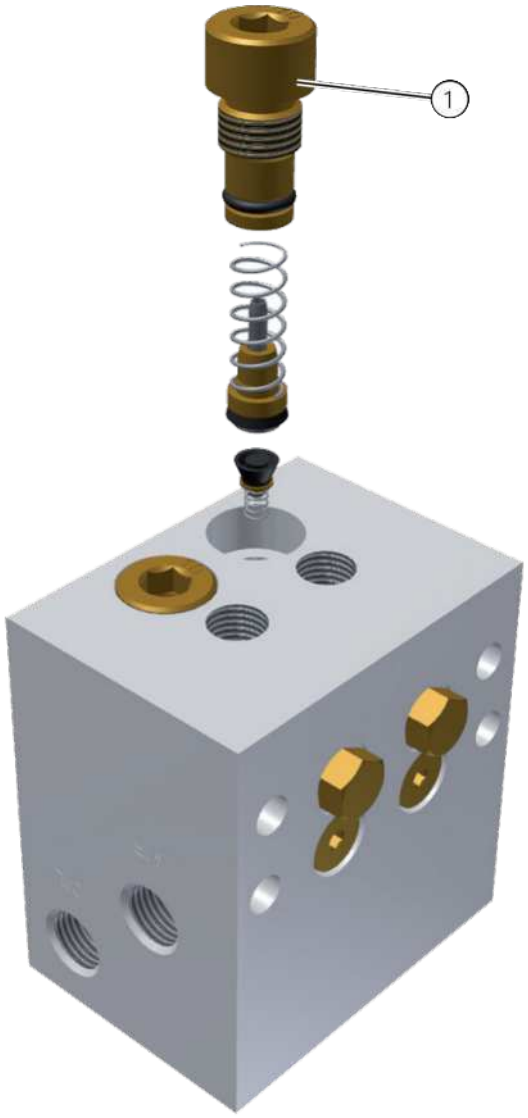
Fig. 32



Air flow rate in Nl/min

8.5 Changing metering on MV20x-1..

Fig. 33



Changing the metering mechanism

Legend to Figure 33:
1 Metering screw

To adjust the metering to the application at hand, the metering mechanism on the Oil+Air mixing valve MV20x-1. can be changed for each lubrication point. Note that only the Service department of SKF may change the metering mechanisms for 10 mm^3 and 20 mm^3.

The metering mechanisms for 30, 60, 100, and 160 mm^3 can be changed by replacing the metering screw (Fig. 33/1) as described below.

⚠ WARNING

Danger from pressurized unit

Depressurize the Oil+Air lubrication unit before starting work

1. Disconnect all connections on the Oil+Air mixing valve. Unscrew the Oil+Air mixing valve from the retainer on the base plate of the Oil+Air lubrication unit.
2. Place the Oil+Air mixing valve on a firm surface with the metering screws pointing upwards
3. Remove the metering screw (Fig. 33/1) using a 6 mm hexagon socket screw key. While unscrewing the metering screw, ensure that the internal components of the lubrication chamber do not fall out. See Figure 33 for the order of the internal components.
4. Lightly oil the O-rings of the new metering screw and then screw it into the metering point using a tightening torque of approx. 2+0.5Nm.

Metering screws are available with the following order numbers:

Table 17

Order numbers

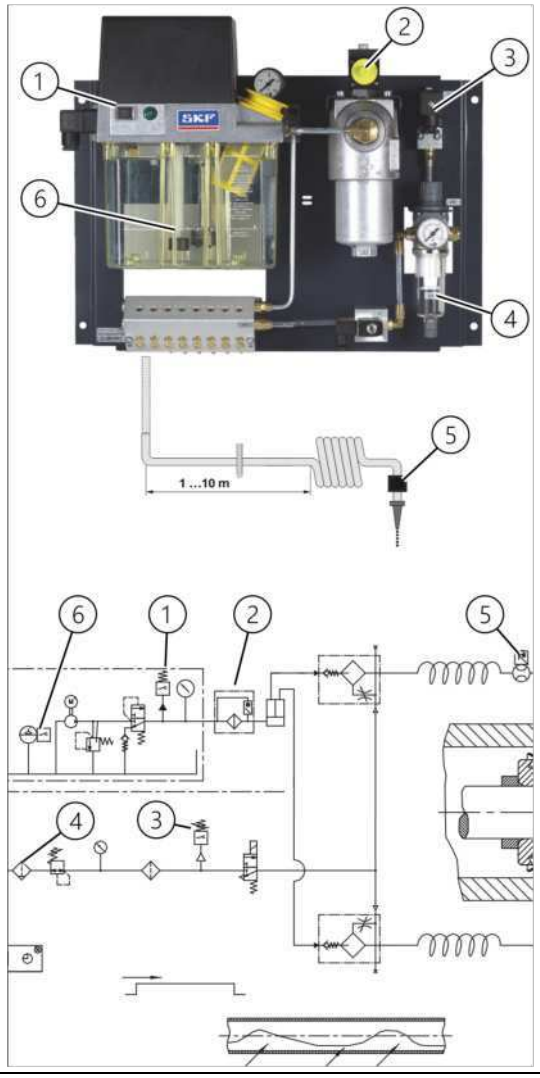
Metering screw	Order number
30 mm^3	MV202.13-K
60 mm^3	MV202.16-K
100 mm^3	MV202.20-K
160 mm^3	MV202.26-K

8.6 General notes

Oil+Air lubrication units should always be put into operation before the bearing points of the machine/system reach full load, and should remain in operation for some time after the end of production, until the bearing points have cooled down. This prevents moisture from the air and/or particles of dirt from getting into the bearing point. These points must be taken into account when programming the machine control or when integrating the control unit into the machine control. The monitoring facilities inside an Oil+Air lubrication unit are shown in Figure 1.

The following monitoring devices are shown:

Fig. 34



General notes

Legend to Figure 34:

1 Oil pressure switch for the required oil pressure (Fig. 34/1)
2 Oil filter (Fig. 34/2) with electrical/visual dirt monitoring (Fig. 34/2)
3 Pressure switch for the minimum air pressure (Fig. 34/3)
4 Air filter with water separator (Fig. 34/4)
5 Oil-streak sensor (Fig. 34/5)
6 Lubricant level switch in the lubricant reservoir (Fig. 34/6)

Oil-streak sensors expand the monitoring capabilities of an Oil+Air lubrication unit. Oil-streak sensors can be used to monitor the lubricant transport (by oil streaks) in the feed lines.

9 Maintenance

Careful and regular maintenance is required in order to detect and remedy possible faults in time. The operator must always determine the specific intervals according to the operating conditions, review them regularly, and adjust them where necessary. If necessary, copy the table for regular maintenance activities.

9.1 General

⚠ DANGER

Risk of death from electric shock

Performing work on products that have not been de-energized may result in serious injury or death. Assembly, maintenance, and repair work may only be performed by qualified technical personnel on products that have been de-energized. The supply voltage must be switched off before opening any of the product's components.

⚠ 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.

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.

If necessary, the product can be cleaned using mild cleaning agents that are compatible with the product's materials (non-alkaline, non-soap). For safety reasons, the product should be disconnected from the power supply and the hydraulic and/or compressed air supply.

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

It is not necessary to clean the interior of the product if it is operated normally and intercompatible lubricants are used.

The interior of the product must be cleaned if incorrect or contaminated lubricant is accidentally filled into the product. If this occurs, please contact the Service department of SKF Lubrication Systems Germany GmbH for assistance.

⚠ WARNING

Burns from hot surfaces

The hot surfaces of a motor could cause burns. Motor surfaces may only be touched with appropriate gloves or after the motor has been shut off for an extended time

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.

The maintenance intervals are determined depending on the specific conditions of the application. The criteria are machine-specific settings, ambient and operating conditions, the purity of the lubricant used, and the purity of the compressed air. Due to the application-specific conditions, the customer must define and adhere to the maintenance intervals.

The fill level in the lubricant reservoir must be checked by visual inspection at regular intervals. The checking intervals depend on the quantity of lubricant required by the bearings being lubricated. Due to the application-specific conditions, the customer must define and adhere to the checking intervals.

9.2 Maintenance and repair

The following maintenance and repair work must be performed on a regular basis:

- Check the oil filter and change it if needed
- Check the functioning of the automatic water separator
- Check the air filter and change it if needed
- Check the lubricant level in the lubricant reservoir
- Regularly inspect the system components for leaks
- Inspect electrical cables for damage
- Inspect electrical connections and contacts
- In case of malfunction notifications (on the customer's control), inspect the electrical connections
- Visually inspect the lubrication status of the bearing being lubricated

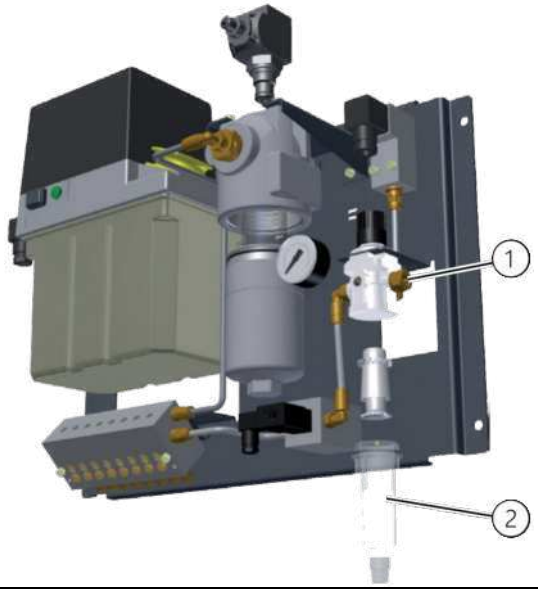
SKF Lubrication Systems Germany GmbH shall not be held liable for damages resulting from improperly performed assembly, maintenance or repair work on the product.

If you encounter problems or have any questions, please contact our sales and service centers or our representatives abroad.

A list with current addresses is available on the Internet at:
www.skf.com/lubrication

9.3 Cleaning the compressed air filter

Fig. 35



Changing the filter

Legend to Figure 35:
1 Compressed air port
2 Filter shell for the compressed air fine filter

Oil+Air lubrication units can be optionally fitted with a combined compressed air filter/water separator, which has the function of cleaning the compressed air of any contaminants and separating out any water contained in compressed air.

For water separation, the compressed air filter has an automatic condensate drain, which can be used to drain the collected condensate. The compressed air filter should be regularly checked by visual inspection. At least once a year, it should be cleaned and the filter cartridge should be changed. The frequency of checking and cleaning depends on the cleanliness of the compressed air used.

Proceed as follows:

⚠ WARNING

Pressurized lubrication unit

Before cleaning or changing the compressed air filter inside, the Oil+Air lubrication unit must be depressurized

1. Cut off compressed air supply from the customer (Fig. 35/1) to depressurize the Oil+Air lubrication unit
2. Once the Oil+Air lubrication unit is depressurized (check this!), release the filter shell of the compressed air fine filter (Fig. 35/2) by turning it counterclockwise.
3. Clean the filter housing
4. Change the filter cartridge
5. Install the components in reverse order

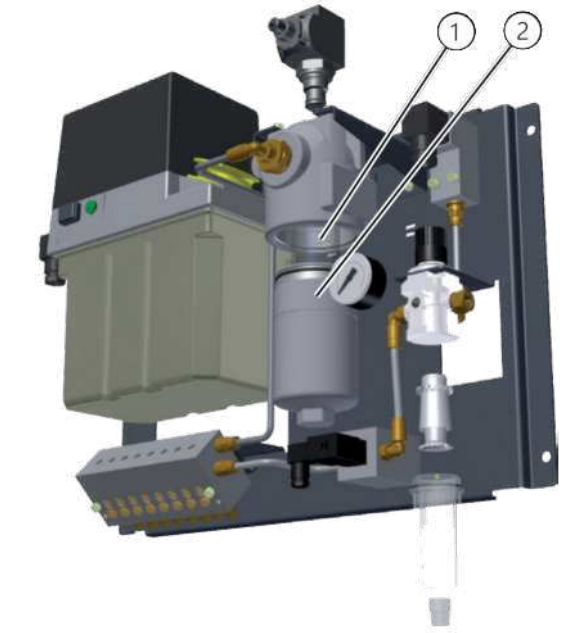
9.4 Cleaning the oil filter

⚠ WARNING

Pressurized lubrication unit

Before cleaning or changing the compressed air filter inside, the Oil+Air lubrication unit must be depressurized

Fig. 36



Changing the filter

Legend to Figure 36:
1 Oil filter strainer
2 Oil filter housing

1. To drain the lubricant in the oil filter housing (Fig. 36/2), place an oil pan under the oil filter housing. The distance between the pan and the oil filter housing must be large enough to allow you to undo the filter housing and remove the filter insert.
2. To clean the oil filter strainer (Fig. 36/1), undo and remove the oil filter housing (socket, SW 13 mm) by unscrewing counterclockwise
3. Remove the oil filter strainer and clean it with a suitable cleaning agent, or replace it with a new oil filter strainer
4. Clean the oil filter housing
5. Tighten the oil filter housing to a torque of max. 20 Nm

NOTE

Comply with the legal provisions and directives for the disposal of lubricants

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

11.1 General

Section 11.2Malfunctions and their resolutionprovides 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

Risk of death from electric shock

Performing work on products that have not been de-energized may result in serious injury or death. Assembly, maintenance, and repair work may only be performed by qualified technical personnel on products that have been de-energized. The supply voltage must be switched off before opening any of the product's components.

⚠ WARNING

Burns from hot surfaces

The hot surface of a motor may cause burns. Motor surfaces may only be touched with appropriate gloves or after the motor has been shut off for an extended time

⚠ 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

Performance of any other work

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

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.

11.2 Malfunctions and their resolution

Table 18

Fault analysis and rectification

Malfunction	Possible cause	Rectification
Motor fails to start when the operating voltage is applied	No operating voltage on motor	• Check the power supply connection • Check the power supply plug/cable and connect properly if necessary • Check the operating voltage on the motor • Check the fuse • Check the motor circuit breaker
	Pump or motor jammed	• Measure the motor current. If higher than permitted, dismantle the pump, crank by hand. If there is high resistance, replace the pump

Table 18

Fault analysis and rectification

Malfunction	Possible cause	Rectification
Motor runs with difficulty and at a low speed	Pump or motor is sluggish	• Measure the motor current. If higher than permitted, dismantle the pump, crank by hand. If there is high resistance, replace the pump
	Unsuitable lubricant (see chapter 4Technical data)	• Remove the lubricant from the entire system and dispose of lubricant properly; fill system with suitable lubricant
	Pressure too high, pressure limiting valve is jammed or defective	• Check the pressure limiting valve and replace if necessary
	Ambient temperature too low (see chapter 4Technical data)	• Maintain the correct ambient temperature
Pump does not convey lubricant; no pressure build-up	Pump or motor jammed	• Measure the motor current. If higher than permitted, dismantle the pump, crank by hand. If there is high resistance, replace the pump
	Incorrect direction of rotation of motor	• Check whether the direction of rotation corresponds to the direction indicated by the rotation arrow. Change direction of rotation if necessary
	Pressure limiting valve does not close	• Check the pressure limiting valve to make sure that its opening pressure is correct and that there is no contamination or damage. If opening pressure is incorrect and cannot be adjusted, or if the pressure limiting valve is damaged, replace the valve. Only use original SKF spare parts. • If contaminated, clean the pressure limiting valve
No pressure build-up in the main lubricant line	Air in the main lubricant line	Bleed the main lubricant line
	Main lubricant line leaky, or break in the line	Repair the main lubricant line
	Pressure limiting valve does not close	• Check the pressure limiting valve to make sure that its opening pressure is correct and that there is no contamination or damage. • If the opening pressure is incorrect or if the pressure limiting valve is damaged, replace the valve. Only use original SKF spare parts. • If contaminated, clean the pressure limiting valve
	Pressure-relief valve does not close	Clean or replace pressure-relief valve. Only use original SKF spare parts.
	Unsuitable lubricant (see chapter 4Technical data)	Remove the lubricant from the entire system and dispose of the lubricant properly. Fill the system with suitable lubricant
	Fill level too low	Top up lubricant

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

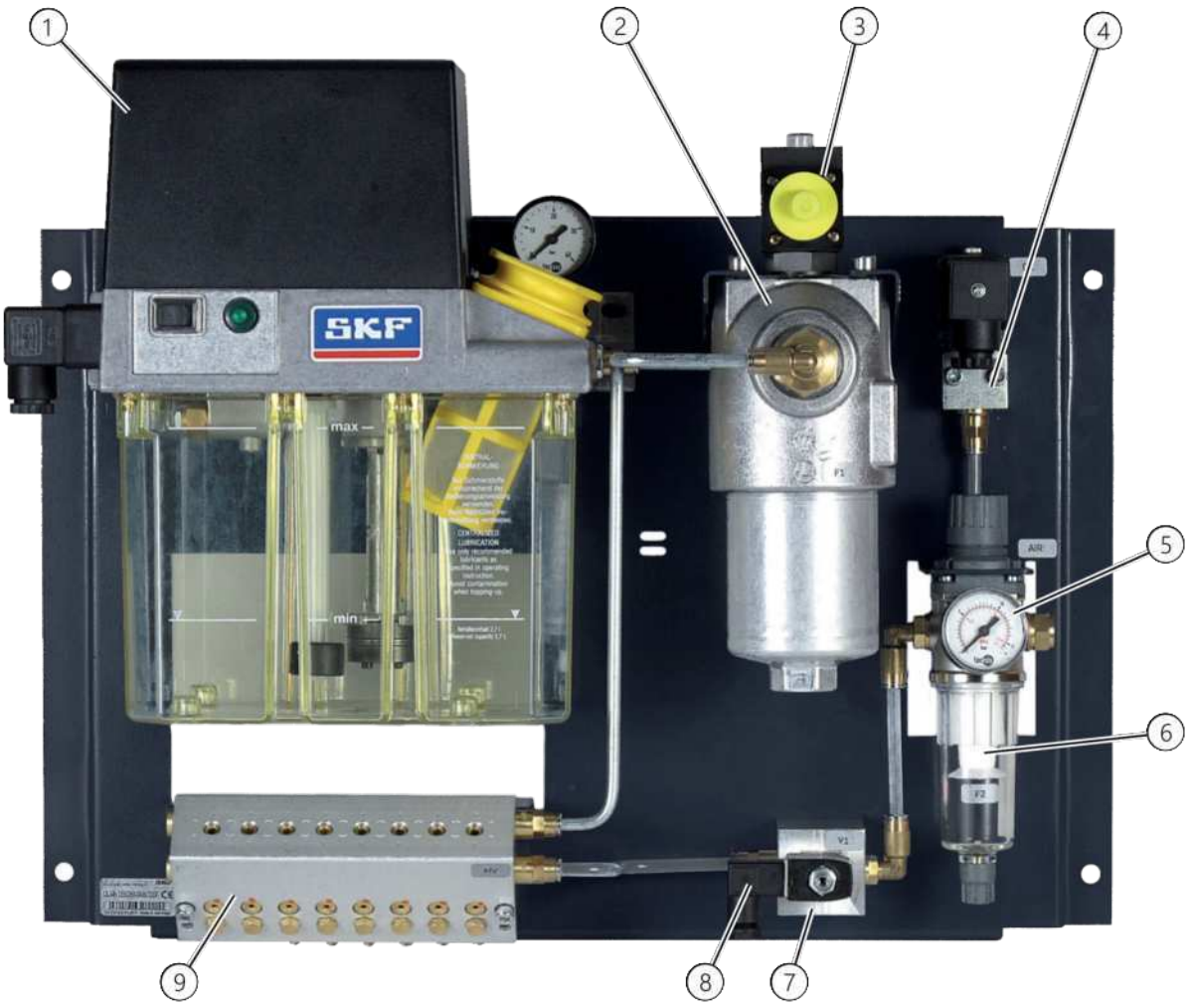
The waste producer/operator must dispose of the various types of waste in accordance with the applicable laws and regulations of the country in question.

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.

14.1 General

Fig. 37



Oil+Air lubrication unit

Table 19

Spare parts

On Fig.	Qty	Order no.	Designation
1	1	MKL2-12FC11000+428	Gear pump unit with IG54-20-S4-I control unit, for 230 V 50/60 Hz
1	1	MKL2-12FC11000+429	Gear pump unit with IG54-20-S4-I control unit, for 115V 50/60 Hz
1	1	MKL2-12FC11000+924	Gear pump unit with IG54-20-S4-I control unit, for 24 V DC
1	1	MKU2-12BC11000+428	Gear pump unit without control unit, for 230 V 50/60 Hz
1	1	MKU2-12BC11000+429	Gear pump unit without control unit, for 115V 50/60 Hz
1	1	MKU2-12BC11000+924	Gear pump unit without control unit, for 24 V DC

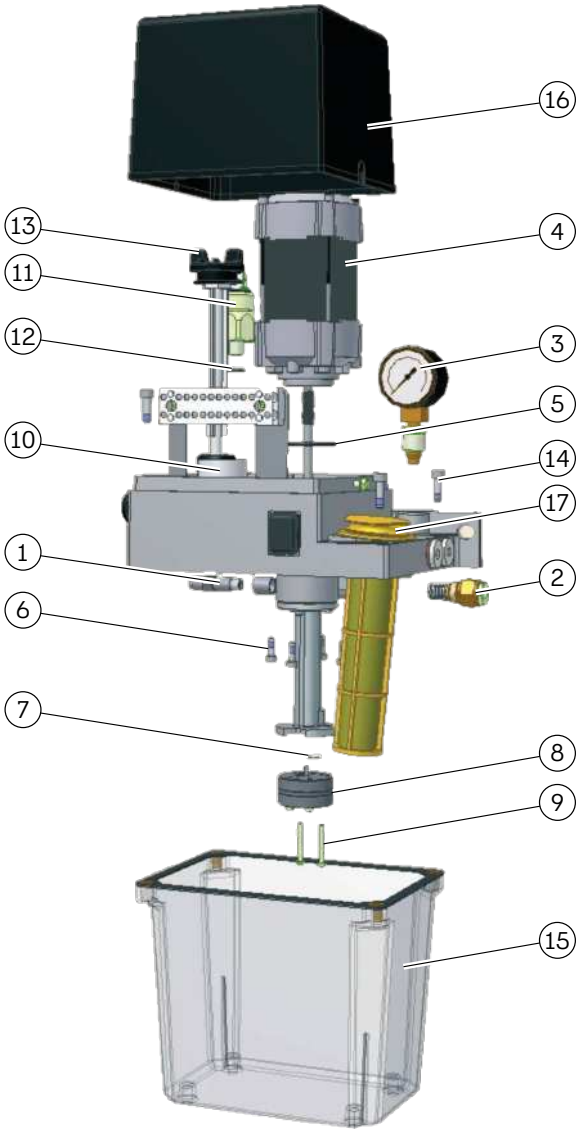
Table 19

Spare parts

On Fig.	Qty	Order no.	Designation
2	1	853-880-011	NG40 housing for oil filter
2	1	169-400-250	Filter element 10 µm for oil filter
2	1	169-400-260-V57	Filter element 3 µm for oil filter
3	1	176-200-009	Differential-pressure switch for oil filter (dirt monitoring)
4	1	176-271-001	Pressure switch, 3 bar to monitor the minimum air pressure
5	1	169-101-606	Pressure gauge for pressure-reducing valve
6	1	248-610.03	Packing ring G1/8 (to be ordered with pressure gauge)
6	1	231-900-028.U1	Compressed air regulating valve +5 µm filter , complete with air filter and water separator
6	1	231-900-028	Compressed air regulating valve without air filter or water separator
6	1	231-900-035	Water separator container for air filter
6	1	231-900-034	Filter insert 5 µm for air filter
7	1	221-296-027+263	3/2 directional control valve for 230 V 50Hz for compressed air
7	1	221-296-027+758	3/2 directional control valve for 120V 60Hz for compressed air
7	1	221-296-027+924	3/2 directional control valve for 24 V DC for compressed air
7	1	993-000-196	Valve body for 3/2 directional control valve
8	1	179-990-465	Coupler socket for 3/2 directional control valve
9	1	MV201-...	Oil+Air mixing valve with metering, 1-port
9	1	MV202-...	Oil+Air mixing valve with metering, 2-port
9	1	MV203-...	Oil+Air mixing valve with metering, 3-port
9	1	MV204-...	Oil+Air mixing valve with metering, 4-port
9	1	MV205-...	Oil+Air mixing valve with metering, 5-port
9	1	MV206-...	Oil+Air mixing valve with metering, 6-port
9	1	MV207-...	Oil+Air mixing valve with metering, 7-port
9	1	MV208-...	Oil+Air mixing valve with metering, 8-port
-	1	995-810-028	Documentation., complete, for Oil+Air unit

14.2 MKX gear pump unit

Fig. 38



MKX gear pump unit

Table 20

Spare parts

No.	Qty	Order no.	Designation
1	1	996-000-947	Pressure limiting valve 32 bar
2	1	MKU.U012	Pressure relief, compl.
3	1	MKU.U013	Pressure gauge (with restrictor)
4	1	MKU1.U5+924	Motor with shaft, 24 V DC
		MKU2.U2+XXX [1)]	Motor with shaft, 115 / 230 VAC
5	1	WVN501-32.2x3	O-ring for sealing between motor and lid
6	4	911-204-122	Cylinder screw for motor fastening

Table 20

Spare parts

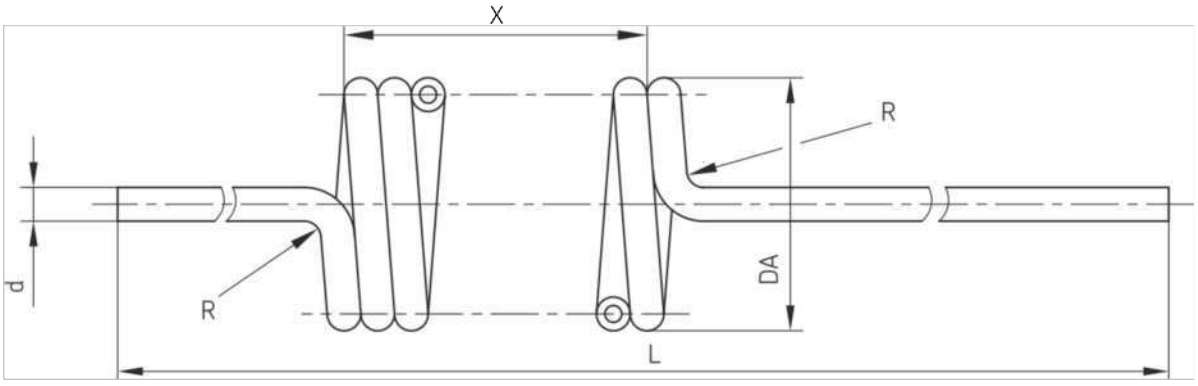
No.	Qty	Order no.	Designation
7	1	WVN501-5.28x1.78	O-ring for sealing between pump and flange pipe
8	1	ZP120-2	Gear pump with delivery rate 0.2 l/min.; 0.1 l/min. with 24 V DC
9	2	834-240-018	Screw M3×25 Tx10, fastening for ZP120-2
10	1	179-340-090	Capacitor 4 UF/450 V for 230 V AC (+428)
		179-340-091	Capacitor 16 UF/220 V for 115 V AC (+429)
11	1	176-112-020	Oil pressure switch 20 bar, functioning as NO contact
12	1	WVN501-10.5x1.5	O-ring seal for oil pressure switch
13		MKU.U016	Lubricant level switch, compl., for 3 liter oil unit, functioning as NC contact
14	1	911-205-181	Cylinder screw, reservoir fastening
15	6	BK3.U147	3 liter plastic reservoir with seal
16	1	898-660-052	Cap
17	1	MKU.U019	Filler neck assy
-	1	IG54-20-S4-I+XXX [2]	Control unit (not shown)
-	1	179-990-033	Cable socket (not shown)
-	1	179-990-206	Device protection fuse for 24 V DC units (not shown)

[1] Add the voltage code to the material number when ordering. 230 V AC (+428); 115 V AC (+429)
[2] Add the voltage code to the material number when ordering. 230/115 V AC (+471); 24 V DC (+472)

14.3 Accessories

Hose coils

Fig. 39



Hose coils

Legend to Figure 39:
X 5 turns
d Tube ø

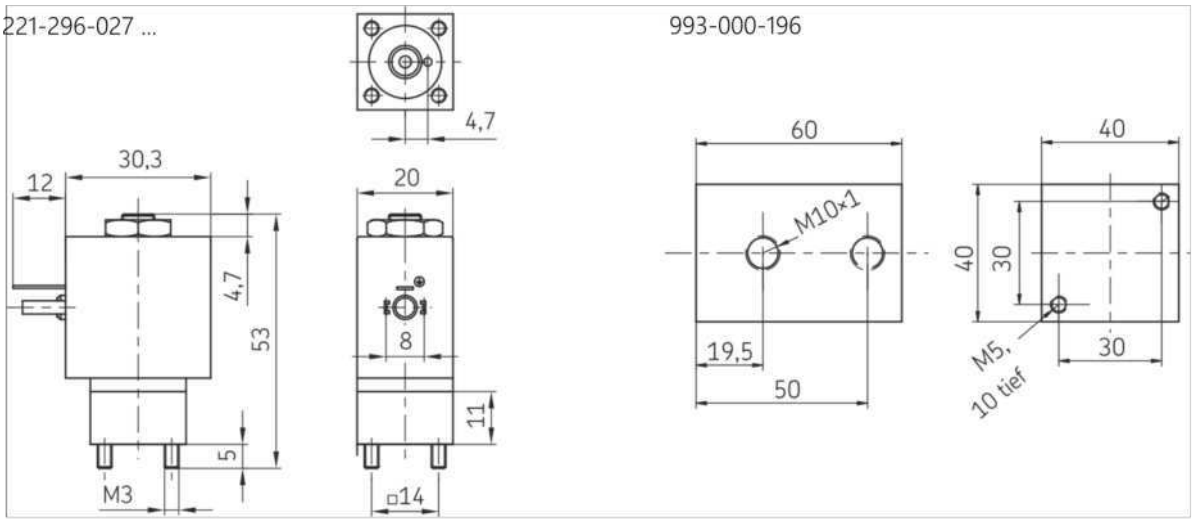
Table 21

Hose coils

Order no.	Tube ø [mm]	DA [mm]	L [mm]	R [mm]
828-090-004	4×0.85	30	2545	14
828-090-020	4×0.85	30	10545	14
828-090-021	4×0.85	30	4045	14

3/2 directional control valve

Fig. 40



3/2 directional control valve

Table 22

3/2 directional control valve

Design / designation	Order no.
230 V AC, 50 Hz	221-296-027+363
120 V AC, 60 Hz	221-296-027+758
24 V DC	221-296-027+924
Valve body	993-000-196

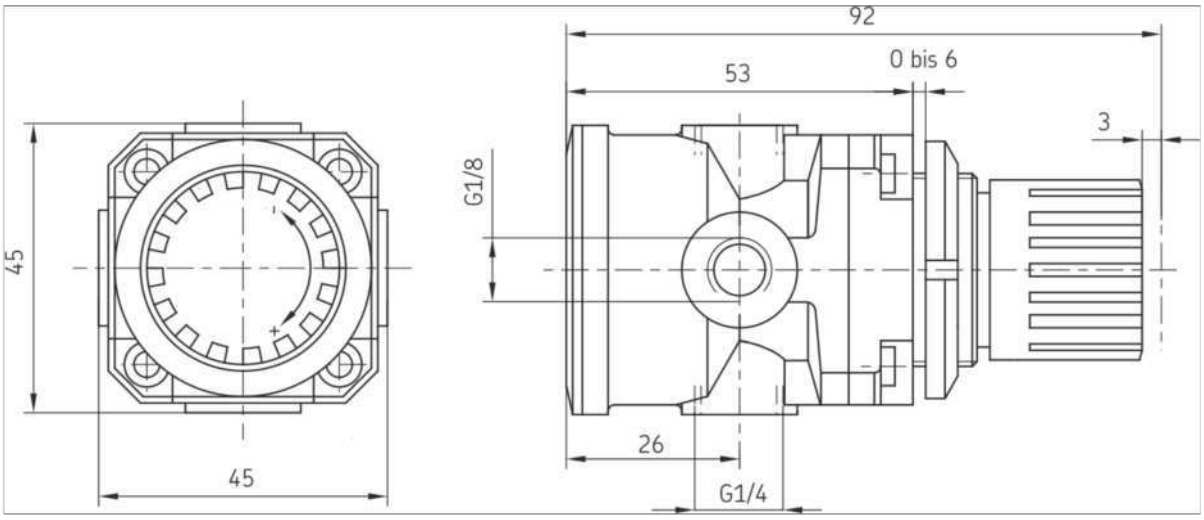
Table 23

Technical data

Designation	Value
Pressure range	0-10 bar
Mounting position	Any
Sealing material	FKM (FPM)
Ambient temperature	+55 °C
Electrical connection	DIN EN 175301-803 Form C, coupler socket type 2506

Compressed air regulating valve

Fig. 41



231-900-028

Table 24

Compressed air regulating valve

Designation	Order no.
Compressed air regulating valve	231-900-028

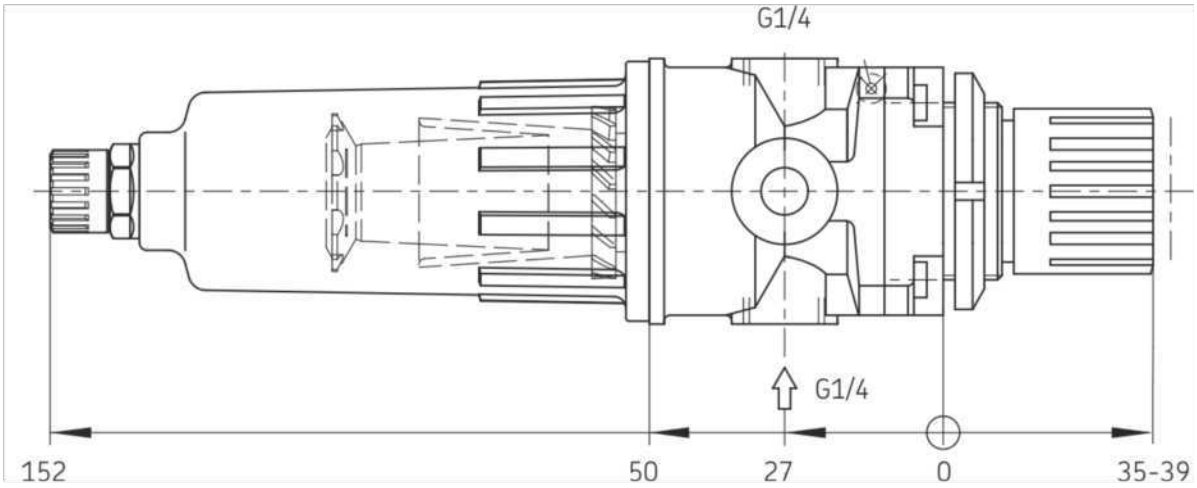
Table 25

Technical data

Designation	Value
Type	Diaphragm regulator
Max. primary pressure	0-16 bar
Secondary pressure	0.5-10 bar
Operating temperature	0-80 °C
Sealing material	NBR

Compressed air regulating valve incl. filter and water separator

Fig. 42



231-900-028.U1

Table 26

Compressed air regulating valve incl. filter and water separator

Designation	Order no.
Compressed air regulating valve incl. filter and water separator	231-900-028.U1

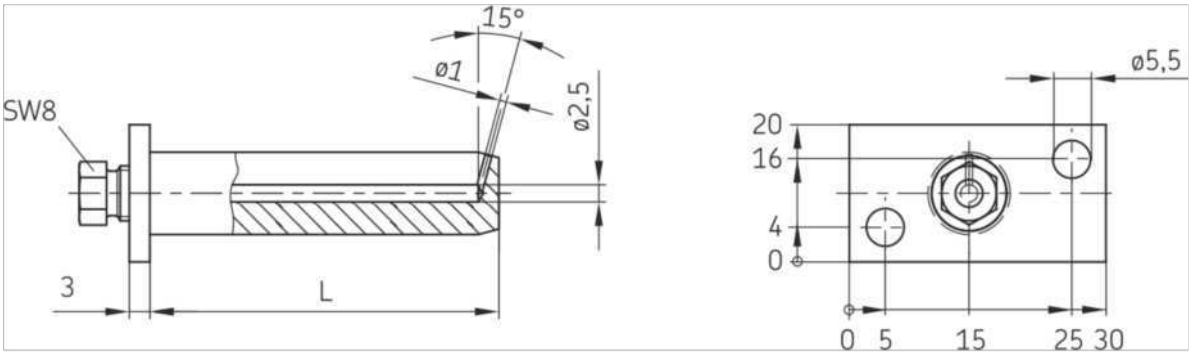
Table 27

Technical data

Designation	Value
Filter	5 µm

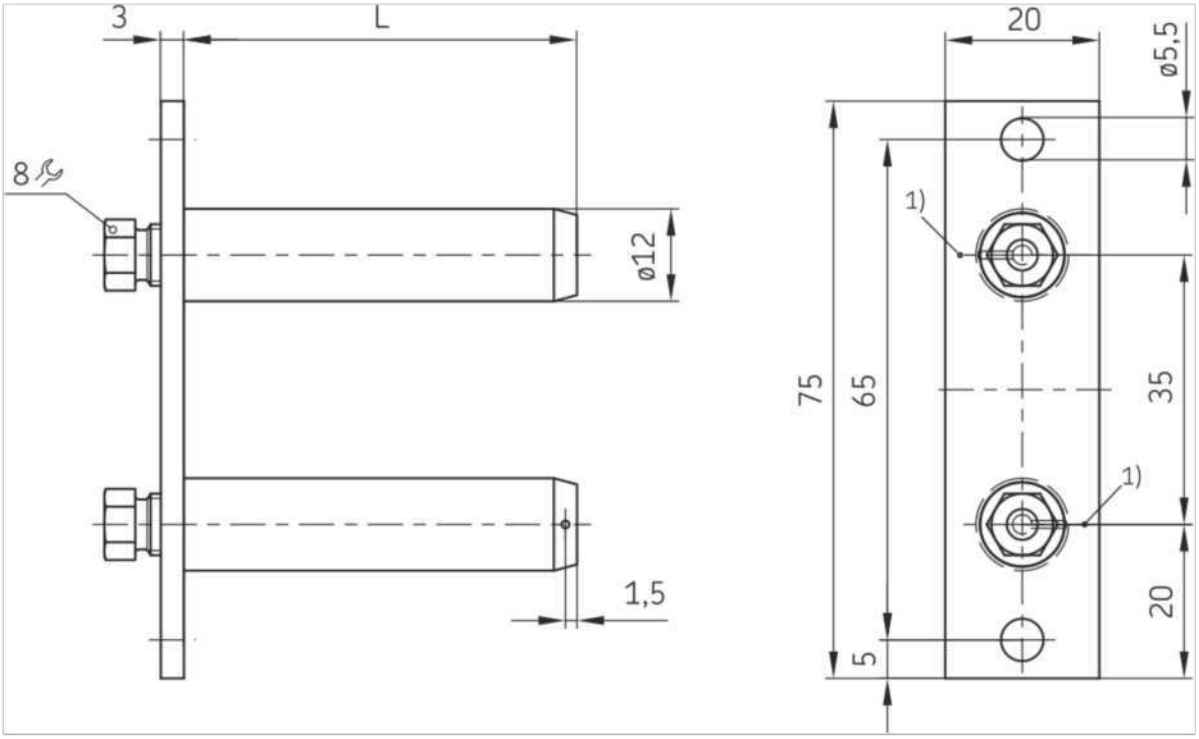
Nozzles

Fig. 43



169-000-101+xxx

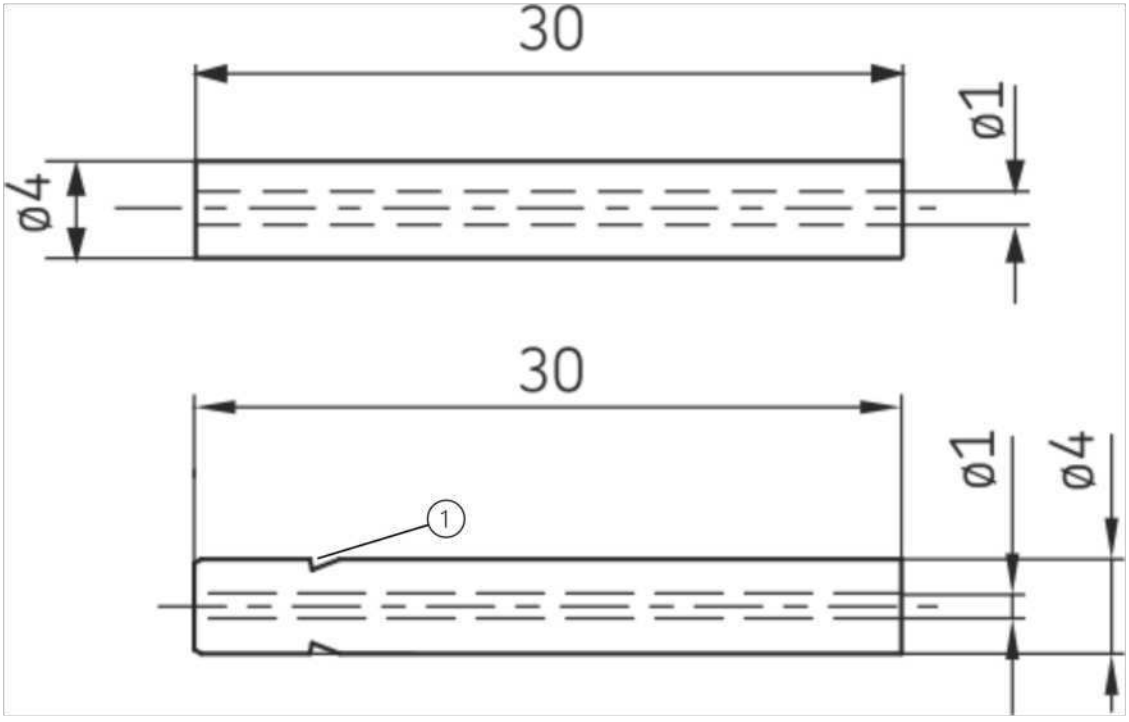
Fig. 44



169-000-102-xxx

[1)] Spray direction is indicated by marking

Fig. 45



P-89.29(-S3) / P-89.29-VS

Legend to Figure 45:

1 Claw groove

Table 28

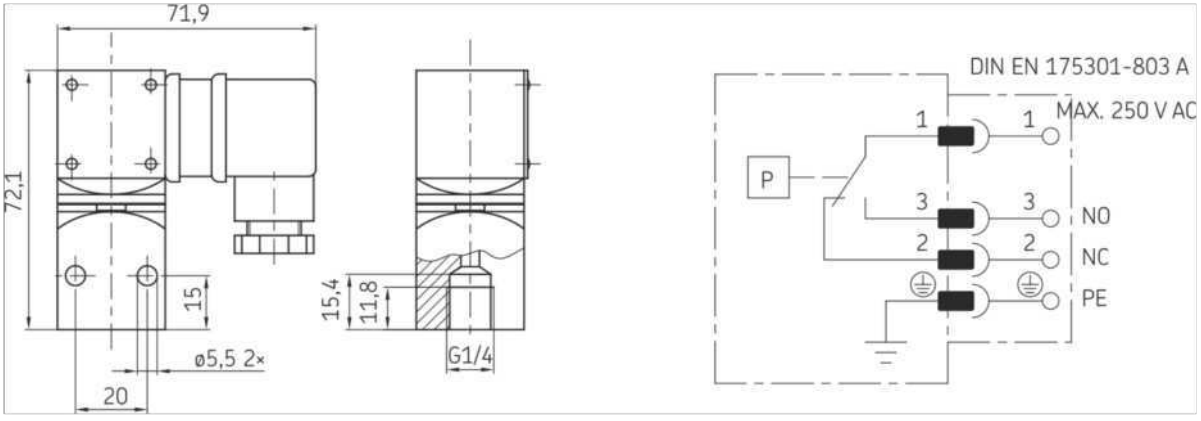
Nozzles

Designation	Order no.
Nozzle for tube ø4 mm, L=15–120 mm	169-000-101+xxx [1]
Double nozzle for tube ø4 mm, L=15–120 mm	169-000-102+xxx [1]
Nozzle for tube ø4 mm	P-89.29
Nozzle for tube ø4 mm, stainless steel	P-89.29-S3
Nozzle for tube ø4 mm, with claw groove for SKF quick couplings	P-89.29-VS

[1] Specify the desired length L for xxx

Pressure switch (minimum air pressure)

Fig. 46



176-271-001 (contact position shown in wiring diagram: switch depressurized)

Table 29

Pressure switch (minimum air pressure)

Designation	Order no.
Pressure switch (minimum air pressure)	176-271-001

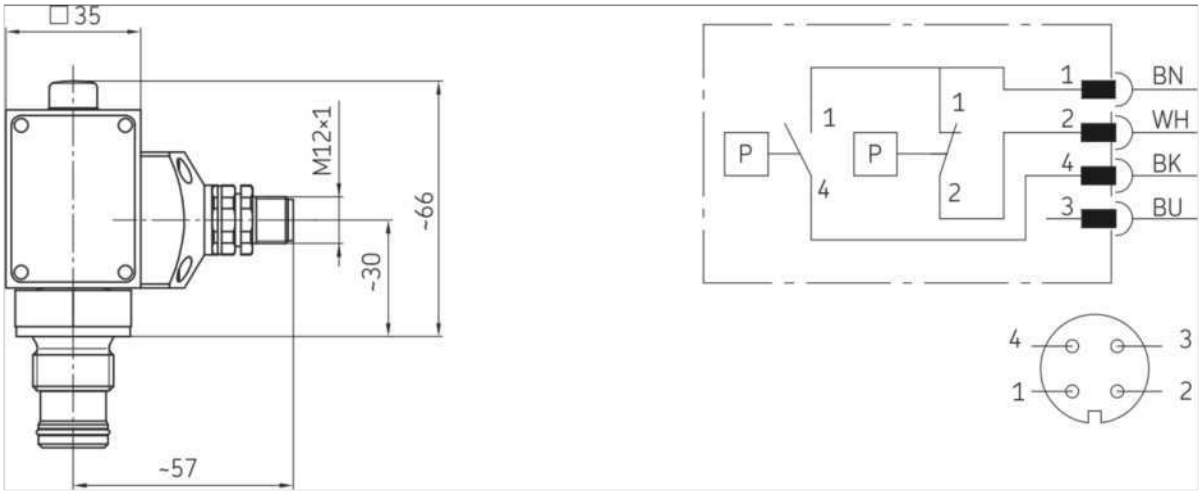
Table 30

Technical data

Designation	Value
Contact type	Changeover contact
Setting range	1-10 bar (preset to 3 bar)
Max. switching voltage	250 V AC
Max. switched current	5 A
Reset differential	15 %

Differential-pressure switch for dirt monitoring

Fig. 47



176-200-009

Legend to Figure 47:
BN = +24 V DC
WH = 100% alarm (NC)
BK = 75% pre-warning (NO)
BU = PIN 3 not assigned
Contact position shown: filter free

Table 31

Differential-pressure switch for dirt monitoring

Designation	Order no.
Differential-pressure switch for dirt monitoring	176-200-009

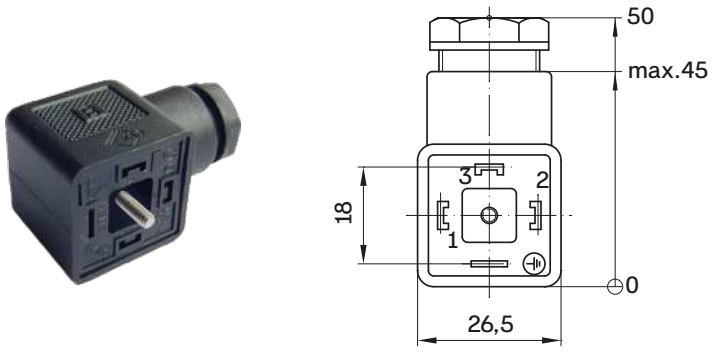
Table 32

Technical data

Designation	Value
Contact type	1×NC contact, 1×NO contact
Max. voltage	24 V AC/DC
Max. switching capacity	5 VA / W
Opening pressure	Δ5 bar -10 %
Max. operating pressure	420 bar

Rectangular connector

Fig. 48



179-990-033

Legend to Figure 48:
1 Screwed gland M16x1.5 for line diameter 6-10 (before clamping)

Table 33

Rectangular connector

Designation	Order no.
Cable socket to EN 175301-803A, line diameter 6–10 mm	179-990-033

Circular connector M12x1

Fig. 49

Circular connector M12x1

Table 34

Circular connector

No.	Designation	Order no.
A	Cable socket, straight, with molded cable	179-990-600
B	Cable socket, angled, with molded cable (5 m, 4×0.25 mm²)	179-990-601
C	Cable socket, straight	2360-00000316
D	Cable socket, angled	2360-00000317

NOTE
For other accessory parts, see the corresponding catalog

15 Appendix

15.1 China RoHS Table

Table 35

部件名称 (Part Name)	有毒害物质或元素 (Hazardous substances)					
	铅	汞	镉	六价铬	多溴联苯	多溴二苯醚
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr(VI))	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
用钢和黄铜加工的零件 (Components made of machining steel and brass)	X	0	0	0	0	0

本表格依据SJ/T11364的规定编制 (This table is prepared in accordance with the provisions of SJ/T 11364.)

0：	表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572 规定的限量要求以下。 (Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.)
X：	表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572标准规定的限量要求。 (Indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.)

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