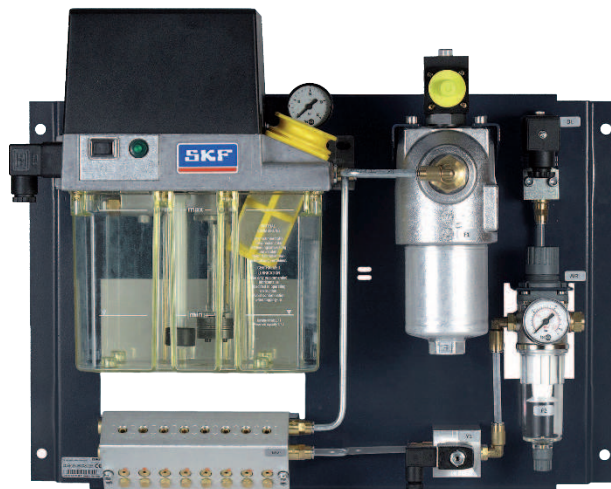


OLAx-1... Oil+Air Lubrication Unit

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

Assembly instructions acc. to EC Dir. 2006/42/EC
for partly completed machinery with associated operating instructions

EN



Version 04



Masthead

These assembly instructions with associated operating instructions according to EC Machinery Directive 2006/42/EC are an integral part of the described product and must be kept for future use.

The assembly instructions with associated operating instructions have been prepared in accordance with the established standards and rules for technical documentation VDI 4500 and EN 292.

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Subject to changes in contents and technical information.

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Documentation overview

Documentation associated with assembly instructions and operating instructions

Gear pump units for industrial machinery

951-170-005-EN



Gear pump units MKL and MKU are used are oil+air lubrication units depending on the design. See the rating plate for the version.

Universal control unit for industrial lubrication machinery (only on gear pump units with control unit)

951-180-001-EN



The documentation listed is included in the scope of delivery and must be used when installing and operating the oil+air lubrication unit.

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EC Declaration of Incorporation according to Machinery Directive 2006/42/EC, Annex II Part 1 B

The manufacturer SKF Lubrication Systems Germany GmbH , Berlin Motzener Strasse 35/37, DE - 12277 Berlin hereby declares that the partly completed machinery:

Designation: **Oil+Air Lubrication Unit**
 Type: **OLAx-1...**
 Part no.: OLA.-..
 Year of construction: See type identification plate

complies with the following basic requirements of the EC Machinery Directive 2006/42/EC at the time when first being launched in the market.

1.1.2 · 1.1.3 · 1.3.2 · 1.3.4 · 1.5.1 · 1.5.6 · 1.5.8 · 1.5.9 · 1.6.1 · 1.7.1 · 1.7.3 · 1.7.4

The special technical documents were prepared following annex II part B of this directive. Upon justifiable request, these special technical documents can be forwarded electronically to the respective national authorities. The person empowered to assemble the technical documentation on behalf of the manufacturer is the head of standardization; see manufacturer's address.

Furthermore, the following directives and harmonized standards were applied in the respective applicable areas:

2011/65/EU RoHS II
 2014/30/EU Electromagnetic compatibility | Industry

Standard	Edition	Standard	Edition	Standard	Edition
DIN EN ISO 12100	2011	DIN EN 60947-1	2011	DIN EN 61000-6-3	2011
Berichtigung	2013	DIN EN 60947-5-1	2010	Berichtigung	2012
DIN EN 809	2012	DIN EN 60034-1	2011	DIN EN 50581	2013
DIN EN 60204-1	2007	DIN EN 61000-6-2	2006		
Berichtigung	2010	Berichtigung	2011		

The partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of the EC Machinery Directive 2006/42/EC and any other applicable directives.

Berlin 2016/02/29

Jürgen Kreuzkämper
 Manager R&D Germany
 SKF Lubrication Business Unit



Richard Lindemann
 Manager Sustain Engineering Berlin
 Lubrication Business Unit



Explanation of symbols and signs

You will find these symbols, which warn of specific dangers to persons, material assets, or the environment, next to all safety instructions in these assembly and operating instructions. Please heed these instructions and proceed with special care in such cases. Please forward all safety instructions to other users.

Instructions attached directly to the equipment, such as rotation arrows and fluid connection labels, must be followed. Replace such signs if they become illegible.



You are responsible!

Please read the assembly and operating instructions thoroughly and follow the safety instructions.

Note: Not every symbol and corresponding information described in the Safety Information is necessarily used in these instructions.

Hazard symbols



General hazard
DIN 4844-2-W000



Electrical voltage/current
DIN 4844-2-W008



Hot surface
DIN 4844-2-W026



Danger of being drawn into machinery
BGV 8A



Slipping hazard
DIN 4844-2-W028

Safety signal words and their meaning

Signal word Meaning

Danger! Risk of serious injury or death

Warning! Danger of damage to property and the environment

Note! Provides additional information

Informational symbols



Note

- Prompts an action
- Used for itemizing
- ➔ Refers to other facts, causes, or consequences
- 👉 Provides additional information
- 🌍 Environmentally sound disposal

1. Safety instructions



The operator of the described product must ensure that the assembly instructions are read and understood by all persons tasked with the assembly, operation, maintenance, and repair of the product. The assembly instructions must be kept readily available.



Note that the assembly instructions form part of the product and must accompany the product if sold to a new owner.

The described product is manufactured in accordance with the generally accepted rules and standards of industry practice and with occupational safety and accident prevention regulations. Risks may, however, arise from its usage and may result in physical harm to persons or damage to other material assets. Therefore the product may only be used in proper technical condition and in observance of the assembly instructions. In particular, any

malfunctions which may affect safety must be remedied immediately.



In addition to the assembly instructions, statutory regulations and other general regulations for accident prevention and environmental protection must be observed and applied.

1.1 Intended use



All products from SKF Lubrication Systems Germany GmbH may be used only for their intended purpose and in accordance with the information in the product's assembly instructions.

The described product is for supplying centralized lubrication systems with lubricant and is intended for use in centralized lubrication systems. Any other use is deemed non-compliant with the intended use and could result in damage, malfunction, or even injury.

Hazardous materials of any kind, especially the materials classified as hazardous by CLP Regulation EC 1272/2008, annex 1, parts 2-5, may be filled into SKF centralized lubrication systems and components and delivered and/or distributed with the such systems and components only after consulting with and obtaining written approval from SKF.

The product described here is neither designed nor approved for use in conjunction with gases, liquefied gases, pressurized gases in solution, vapors, or such fluids whose vapor pressure exceeds normal atmospheric pressure (1013 mbar) by more than 0.5 bar at their maximum permissible temperature.

Unless specially indicated otherwise, products from SKF Lubrication Systems Germany GmbH are not approved for use in potentially explosive areas as defined in the ATEX Directive 2014/34/EU..

1.2 Authorized personnel

Only qualified technical personnel may install, operate, maintain, and repair the products described in the assembly instructions.

Qualified technical personnel are persons who have been trained, assigned, and instructed by the operator of the final product into which the described product is incorporated. Such persons are familiar with the relevant standards, rules, accident prevention regulations, and assembly 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.

1.3 Electric shock hazard

Electrical connections for the described product may only be established by qualified and trained personnel authorized to do so by the operator, and in observance of the local conditions for connections and local regulations (e.g., DIN, VDE). Significant bodily injury and property damage may result from improperly connected products.



Danger!

Performing work on an energized pump or product may result in serious injury or death.

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



Danger!

The protective earth conductor must always be connected. Ensure a sufficient, standards-compliant conductor cross-section and secure contact.

1.4 System pressure hazard



Danger!

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

1.5 Compressed air hazard

The oil+air mixing valves are operated with compressed air.



Danger!

The described product is pressurized during operation. The product must therefore be depressurized before starting assembly, maintenance, or repair work, or any system modifications or system repairs.

1.6 Warranty and liability

SKF Lubrication Systems Germany GmbH assumes no warranty or liability for the following:

- o Non-compliant usage
 - o Improper assembly, configuration, filling, disassembly, or improper operation
 - o Use of unsuitable or contaminated lubricants
 - o Maintenance and repair work performed improperly or not performed at all
 - o Use of non-original SKF components or spare parts
 - o Alterations or modifications performed without written approval from SKF Lubrication Systems Germany GmbH
- o Resulting from improper response to malfunctions
 - o Caused by independent modification of system components
 - o Non-compliance with the instructions for transport and storage

1.7 Existing residual risks

Residual risk	Remedy
Life cycle: Assembly	
Gear pump unit's lubricant reservoir overflows when overfilled	<ul style="list-style-type: none"> • Fill the lubricant reservoir carefully and stop filling once the "MAX" mark on the reservoir is reached
Risk of falling due to contamination of the floor with spilled or leaked lubricant	<ul style="list-style-type: none"> • Exercise caution when filling and when closing the filler socket cap • Promptly apply suitable binding agents and remove the leaked or spilled lubricant • Follow legal and operational requirements for lubricant handling
Tearing/damage to supply, compressed air, or lubricant lines when installed on moving machine components	<ul style="list-style-type: none"> • If possible, do not install on moving machine components; if this cannot be avoided, use flexible supply, compressed air, and lubricant lines.
Life cycle: Commissioning/operation	
Lubricant spraying out due to improperly installed fittings/screw unions on lubricant lines	<ul style="list-style-type: none"> • Tighten all fittings/screw unions with the appropriate torques. Use fittings/screw unions and lubricant lines suitable for the specified operating pressures. Prior to commissioning, check that all fittings/screw unions and lubricant lines are connected correctly and not damaged.
Risk of falling due to contamination of the floor with spilled or leaked lubricant	<ul style="list-style-type: none"> • Exercise caution when filling and when closing the filler socket cap • Promptly apply suitable binding agents and remove the leaked or spilled lubricant • Follow legal and operational requirements for lubricant handling

Residual risk	Remedy
Life cycle: Setup, retrofit	
Risk of falling due to contamination of the floor with spilled or leaked lubricant	<ul style="list-style-type: none"> • Exercise caution when filling and when closing the filler socket cap • Promptly apply suitable binding agents and remove the leaked or spilled lubricant • Follow legal and operational requirements for lubricant handling
Burn risk due to hot motor surfaces	<ul style="list-style-type: none"> • Before removing the cover of the gear pump unit, disconnect the oil+air lubrication unit from the power supply. The surfaces of a motor should only be touched with protective gloves or when motor is no longer hot.
Life cycle: Malfunctions, fault-finding	
Heating of the motor due to a motor jam	<ul style="list-style-type: none"> • Before removing the cover of the gear pump unit, disconnect the oil+air lubrication unit from the power supply. Let the motor of the gear pump unit cool down and then remedy the cause
Risk of falling due to contamination of the floor with spilled or leaked lubricant	<ul style="list-style-type: none"> • Exercise caution when filling and when closing the filler socket cap • Promptly apply suitable binding agents and remove the leaked or spilled lubricant • Follow legal and operational requirements for lubricant handling
Burn risk due to hot motor surfaces	<ul style="list-style-type: none"> • Before removing the cover of the gear pump unit, disconnect the oil+air lubrication unit from the power supply. The surfaces of a motor should only be touched with protective gloves or when motor is no longer hot.
Risk of falling due to contamination of the floor with spilled or leaked lubricant	<ul style="list-style-type: none"> • Exercise caution when filling and when closing the filler socket cap • Promptly apply suitable binding agents and remove the leaked or spilled lubricant • Follow legal and operational requirements for lubricant handling

Residual risk	Remedy
Life cycle: Maintenance, repair	
Electric shock (AC voltage design)	<ul style="list-style-type: none"> • Before performing maintenance work, disconnect the oil+air lubrication unit from the power supply.
Risk of falling due to contamination of the floor with spilled or leaked lubricant	<ul style="list-style-type: none"> • Exercise caution when filling and when closing the filler socket cap • Promptly apply suitable binding agents and remove the leaked or spilled lubricant • Follow legal and operational requirements for lubricant handling
Burn risk due to hot motor surfaces	<ul style="list-style-type: none"> • Before removing the cover of the gear pump unit, disconnect the oil+air lubrication unit from the power supply. The surfaces of a motor should only be touched with protective gloves or when motor is no longer hot.
Life cycle: Decommissioning, disposal	
Environmental pollution with lubricant and components that have been in contact with lubricant	<ul style="list-style-type: none"> • Properly dispose of lubricants and components that have been in contact with lubricant. Follow legal and operational requirements for lubricant handling
Risk of falling due to contamination of the floor with spilled or leaked lubricant	<ul style="list-style-type: none"> • Exercise caution when filling and when closing the filler socket cap • Promptly apply suitable binding agents and remove the leaked or spilled lubricant • Follow legal and operational requirements for lubricant handling

2. Lubricants

2.1 General information



All products from SKF Lubrication Systems Germany GmbH may be used only for their intended purpose and in accordance with the information in the product's assembly instructions.

Intended use is the use of the products for the purpose of providing centralized lubrication/ lubrication of bearings and friction points using lubricants within the physical usage limits which can be found in the documentation for the device, e.g. assembly instructions/operating instructions and the product descriptions, e.g. technical drawings and catalogs.

Hazardous materials of any kind, especially the materials classified as hazardous by CLP Regulation EC 1272/2008, annex 1, parts 2-5, may be filled into SKF centralized lubrication systems and components and delivered and/or distributed with the such systems and components only after consulting with and obtaining written approval from SKF.

No products manufactured by SKF Lubrication Systems Germany GmbH are approved for use in conjunction with gases, liquefied gases, pressurized gases in solution, vapors, or such fluids whose vapor pressure exceeds normal atmospheric pressure (1013 mbar) by more than 0.5 bar at their maximum permissible temperature.

Other media which are neither lubricant nor hazardous substance may only be fed into the products after consulting with and obtaining written approval from SKF Lubrication Systems Germany GmbH.

SKF Lubrication Systems Germany GmbH considers lubricants to be an element of system design which must be factored into the selection of components and the design of centralized lubrication systems. The lubricating properties of the lubricants are critically important in making these selections.

2.2 Selection of lubricants



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



Warning!

The amount of lubricant required at a lubrication point is specified by the bearing or machine manufacturer. It must be ensured that 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.

Selection of a lubricant suitable for the lubrication task is made by the machine/system manufacturer and/or the operator of the machine/system in cooperation with the lubricant supplier. When selecting a lubricant, the type of bearing/friction point, their expected load during operation, and the anticipated ambient conditions must be taken into account.

All economic and environmental aspects must also be considered.



If required, SKF Lubrication Systems Germany GmbH can help customers to select suitable components for feeding the selected lubricant and to plan and design their centralized lubrication system.

Please contact SKF Lubrication Systems Germany GmbH if you have further questions regarding lubricants. Lubricants can be tested in the company's laboratory for their suitability for pumping in centralized lubrication systems (e.g., "bleeding").

You can request an overview of the lubricant tests offered by SKF Lubrication Systems Germany GmbH from the company's Service department.

2.3 Approved lubricants



Warning!

Only lubricants approved for the product may be used. Unsuitable lubricants can lead to failure of the product and to property damage.



Warning!

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

The product described here can be operated using lubricants that meet the specifications in the technical data.

Note that in rare cases, there may be lubricants whose properties are within the permissible limit values but whose other characteristics render them unsuitable for use in centralized

lubrication systems. For example, synthetic lubricants may be incompatible with elastomers.

Oils with a viscosity lower than shown in Table 1 should be avoided, as their load-carrying capacity may not be sufficient at high bearing loads, which may reduce bearing service life.

Oils with solid additives cannot be used, as such oils may leave solid particle sediment within the oil circuit and thereby block the circuit's function. There is also a risk of solid particles creating a coating that critically reduces the bearing clearance.

Approved oils, Table 1

Requirement	Values
Recommended oil cleanliness code	13/10 (ISO 4406) or Class 4 (NAS 1638)
Recommended ISO VG class	32 to 100 based on 40 °C
Permitted additives	EP additives
Non-permitted additives	Solids

2.4 Lubricants and the environment



Warning!

Lubricants can contaminate the ground and watercourses. Lubricants must be properly used and disposed of. Observe the local regulations and laws regarding the disposal of lubricants.

It is important to note that lubricants are environmentally hazardous, flammable substances that require special precautionary measures

during transport, storage, and processing. Consult the safety data sheet from the lubricant manufacturer for information regarding transport, storage, processing, and environmental hazards of the lubricant that will be used.

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

2.5 Lubricant hazards



Danger!

Centralized lubrication systems must be leak-tight. 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.

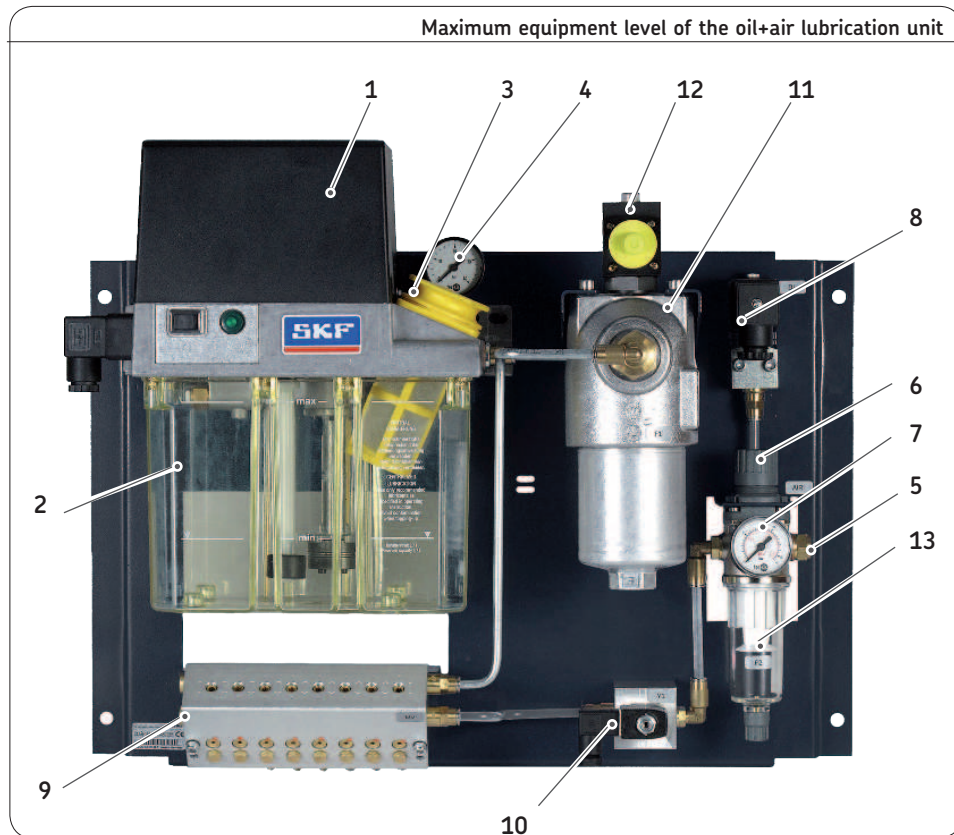
Lubricant leaking from centralized lubrication systems is a serious hazard. Leaking lubricant can create risks that may result in physical harm to persons or damage to other material assets.



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

Lubricants are a hazardous substance. The safety instructions on the lubricant's safety data sheet must be followed. The safety data sheet for a lubricant can be requested from the lubricant manufacturer

3. Overview



Components of oil+air lubrication unit	
Item	Description
1	Gear pump units without control unit (control unit optional)
2	Lubricant reservoir
3	Filler socket
4	Oil pressure gauge
5	Compressed air connection
6	Compressed air control valve
7	Pressure gauge for compressed air supply
8	Pressure switch for minimum pressure of compressed air
9	Oil+air mixing valve with metering
10	3/2 directional control valve
11	Oil filter housing with oil filter
12	Oil filter contamination indicator visual/electrical
13	Compressed air filter and water separator container

4. Assembly

4.1 General information

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 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 any 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/positioning the oil+air lubrication unit, remove the packaging material and any shipping braces (e.g., plugs). Keep the packaging material until you are sure that

there are no delivery discrepancies that need to be clarified.



Warning!

Do not tilt or drop
oil+air lubrication units

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 in the following order:

- o Setup, attachment, and initial filling
- o Electrical connection and settings
- o Connect compressed air line
- o Connect lubrication line
- o Lay lubrication line

4.2 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 the lubricant into the lubricant reservoir.



Consult these assembly instructions or the brochure for technical data about an oil+air lubrication system.

These documents are available for download on the homepage of SKF Lubrication Systems Germany GmbH.

The oil+air lubrication unit must be mounted vertically in accordance with the specifications of 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:

- o Existing supply lines must not be damaged by assembly work.
- o Other units must not be damaged by assembly work.
- o The piston pump unit must not be installed within range of moving parts.
- o The oil+air lubrication unit must be installed at an adequate distance from sources of heat.
- o Maintain safety clearances and comply with

local regulations for assembly and accident prevention.



Danger!

Do not step below a raised or elevated oil+air lubrication unit.

Fastening material to be provided by the customer:

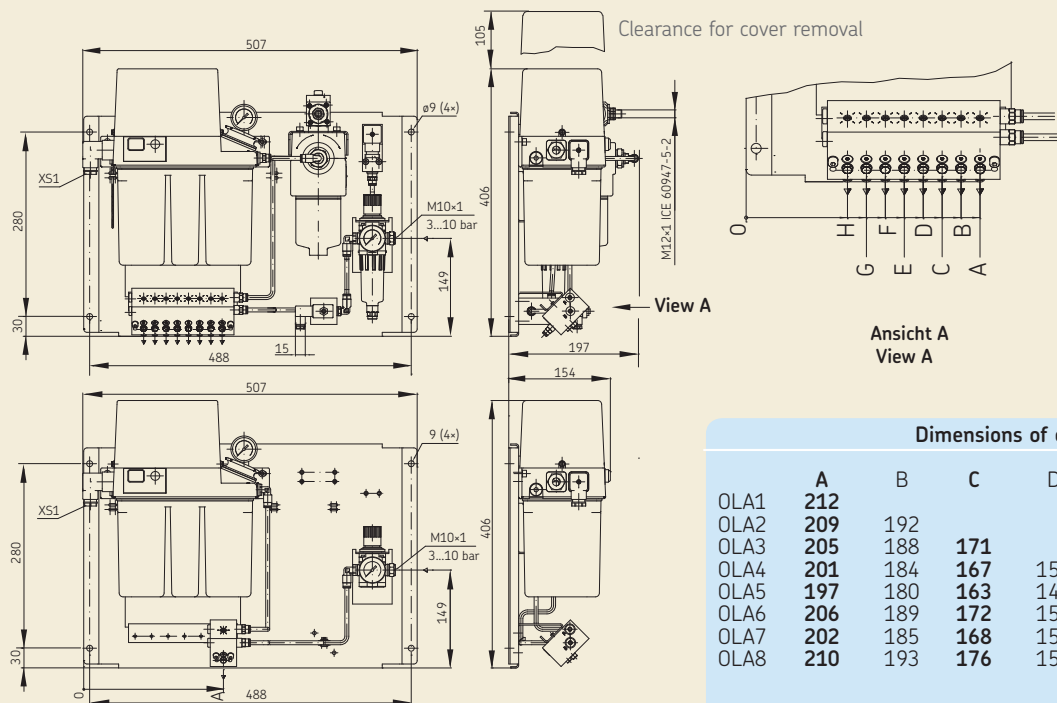
- o Hexagon head screws (4x) acc. to ISO 4017-M8x25-8.8
- o Washers (8x) acc. to ISO 7090- 8-200-HV
- o Hexagon nuts (4x) acc. to ISO 4032-M8-8

4.2.1 Minimum mounting dimensions

To ensure enough space for maintenance work and for any disassembly of the oil+air lubrication unit, ensure that the minimum mounting dimensions (Fig. 1) are maintained.

4.3 Assembly drawing with minimum dimensions

Mounting dimensions of oil+air lubrication units, maximum and minimum equipment levels, Fig. 1



Minimum mounting dimensions

A = width:	550 mm
B = height:	530 mm
C = depth:	220 mm

Ansicht A
View A

Dimensions of oil+air mixing valves with metering

	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

4.3.1 Attachment of an oil+air lubrication unit

☞ See Figure 1.

- Make assembly holes (\varnothing 9 mm) according to the assembly drawing (Fig. 1) at the mounting location
- Clean surface of drilling chips, and prime the holes if necessary
- Lift the oil+air lubrication unit using a hoist and align it with the mounting holes
- Insert hexagon head screws (4x) with washers through the fastening holes on the mounting plate
- Insert hexagon nuts (4x) with washers and tighten gently.
- Align the oil+air lubrication unit vertically and horizontally
- Tighten hexagon head screws with the following torque

Tightening torque 25 Nm

- Remove the hoist

4.4 Electrical connection

4.4.1 Electric motor connection

☞ See Figure 2.

In the standard design, oil+air lubrication units contain gear pump units (3) with an electric motor drive. They are equipped with either a permanent-split capacitor motor for 230 VAC 50/60 Hz, 115 VAC 50/60 Hz or a direct current motor for 24 VDC.

The electrical connection of the motor on an oil+air lubrication unit with or without a control unit is established using a rectangular connector (1) as per DIN EN 175301-803-A (clamping range \varnothing 8 - 10 mm). In the basic design with a control unit, the motor is connected to the electronic control unit.

The unit is wired according to the electrical circuit diagrams in sections 4.5.2 to 4.5.6.

The electrical circuit diagram of the gear pump unit is also affixed inside the unit's cover cap (2) and can be accessed by removing the cap.



Danger!

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



Danger!

The available mains voltage (supply voltage) must be in accordance with the specifications on the rating plate of the motor or of the electrical components. Check the fuse protection of the electrical circuit. Use only fuses with the appropriate amperage, else bodily injury and property damage may result. Consult Chapter 10 for the electrical characteristics

of the electric motor, such as rated power, rated voltage, and rated current.

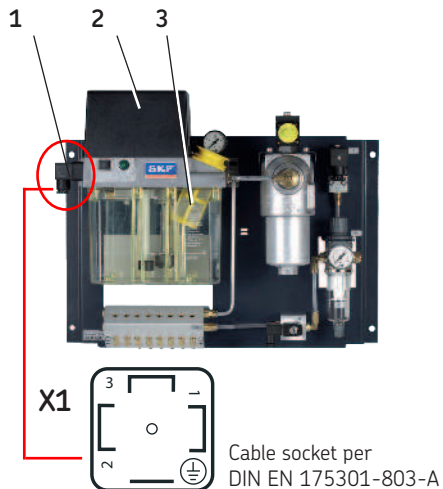


Warning!

On the oil+air lubrication unit's electrical connection, ensure that appropriate measures prevent interference between signals due to inductive, capacitive, or electromagnetic couplings.

Shielded cables must be used if electrical interference fields can distort signal transmissions despite separate laying of cables. Cables must be laid in an "EMC-compliant" manner.

Electrical connection, Fig. 2

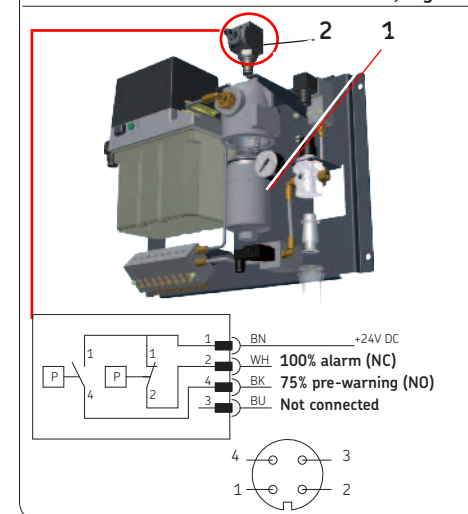


4.4.2 Oil contamination indicator switch

☞ See Figure 3.

The oil+air lubrication unit can optionally be equipped with an oil filter (1) with an associated visual/electrical contamination indicator (2).

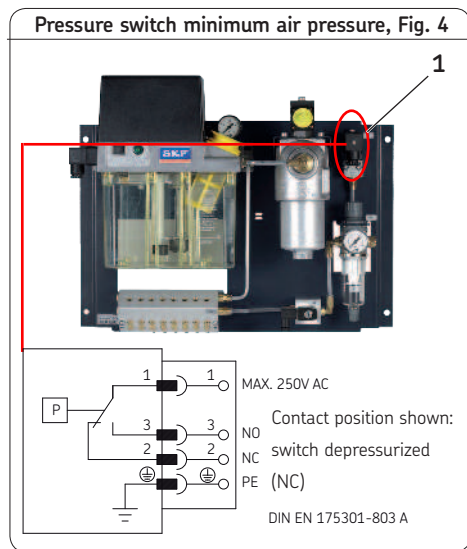
Oil contamination indicator, Fig. 3



4.4.3 Pressure switch for minimum air pressure (DL)

☞ See Figure 4.

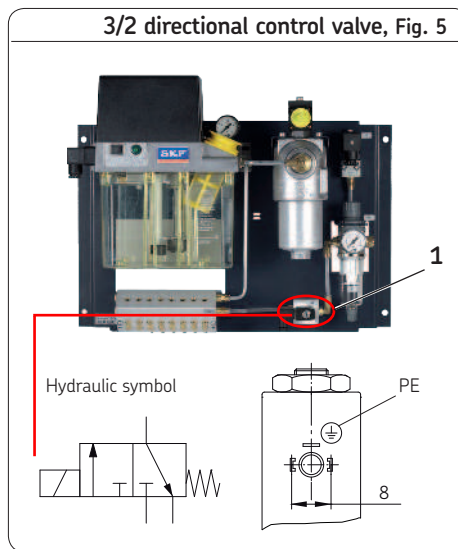
The oil+air lubrication unit can be optionally equipped with a pressure switch for minimum air pressure (1).



4.4.4 3/2 directional control valve for switching compressed air on and off

☞ See Figure 5.

The oil+air lubrication unit can be optionally equipped with a 3/2 directional control valve (1) for switching compressed air on and off.



4.4.5 Inductive loads

In the case of electric switches with inductive loads, the switches' inductivity 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 fill level switch, pressure switch, directional control valves, thermometer, etc. according to Figures 3-7. In case of designs with control units, the switching devices are supplied hard-wired (Figs. 8-9).

4.5 Control and monitoring

Oil+air lubrication units are available in designs with and without control units. The latter do not contain an electronic control unit. This type of oil+air lubrication unit is controlled and monitored by the control unit of the machine that the lubrication unit is mounted on.

An oil+air lubrication unit with control unit contains an electronic control unit (IG54-20-S4-I) that is integrated into the gear pump unit and controls and monitors the oil+air lubrication unit.

Warning!

For an oil+air lubrication unit with control unit, consult the operating instructions for control unit IZG54-20-S4-I, document number 951-180-001-EN. This is included in the accompany documentation.

4.5.1 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 that the lubrication unit is connected to. The machine control unit controls the pump's cycle time and delay time and the gear pump unit's interval time in accordance with the amount of lubricant required by the lubrication points.

The pump cycle time is the duration from when the gear pump motor is switched on until the maximum oil pressure is reached in the main lubricant line, which is monitored by a oil pressure switch. This period is also referred to as the monitoring time. The pump delay time is a period during which the gear pump motor continues to run after the maximum oil pressure is reached in the main lubricant line. This period ensures that the metering chambers in the oil+air mixing valve are completely emptied. The pump cycle and delay time is also referred to as the contact time.

The interval time is the period between two contact times.

A lubrication cycle consists of the contact time and the interval time.

Operating mode S3 on the gear pump motor is used to define the interval time, pump cycle time, and pump delay. Consult the documentation accompanying the gear pump unit for information about this operating mode.

The following are monitored:

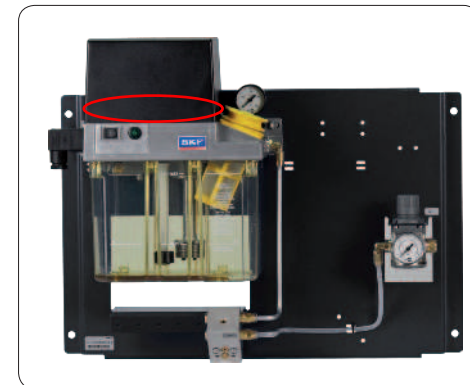
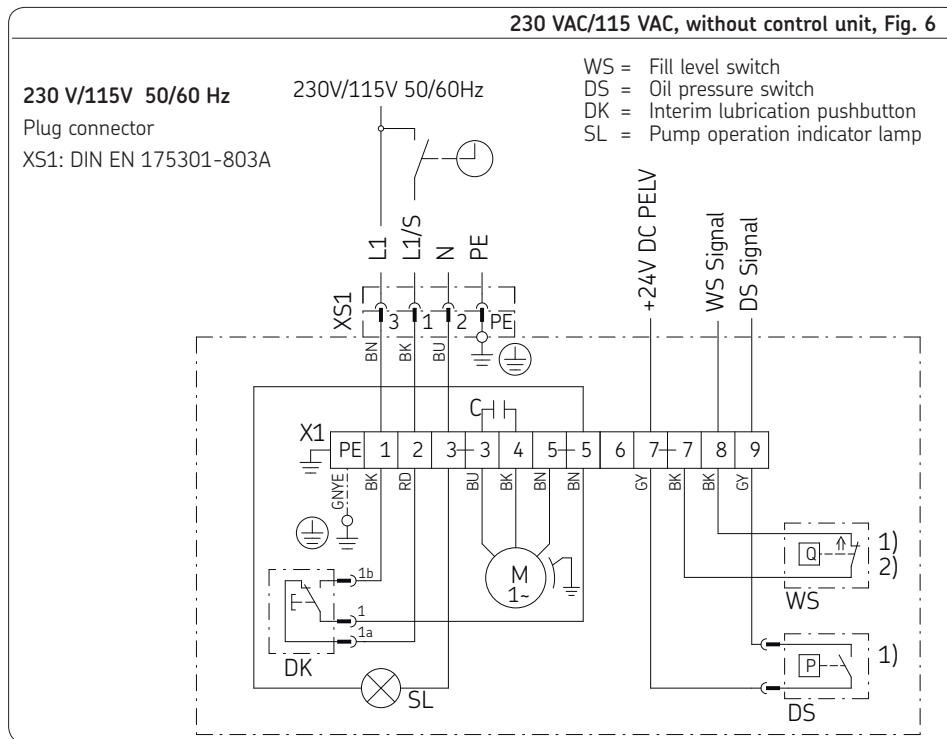
- o Pressure build-up in the main lubricant line (oil pressure build-up)
- o Minimum air pressure of compressed air supply
- o Fill level in lubricant reservoir

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 moni-

toring time for oil pressure build-up is recommended so that the machine control unit waits until this time has elapsed to issue a fault notification 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. In order to prevent underlubrication of the bearings, monitoring of the minimum air pressure of the compressed air supply must be configured in such a way that the machine is shut down if the required pressure is not reached or the pressure drops excessively. Ensure that a buffer time 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.

4.5.2 Connection diagram for 230/115 VAC without control unit



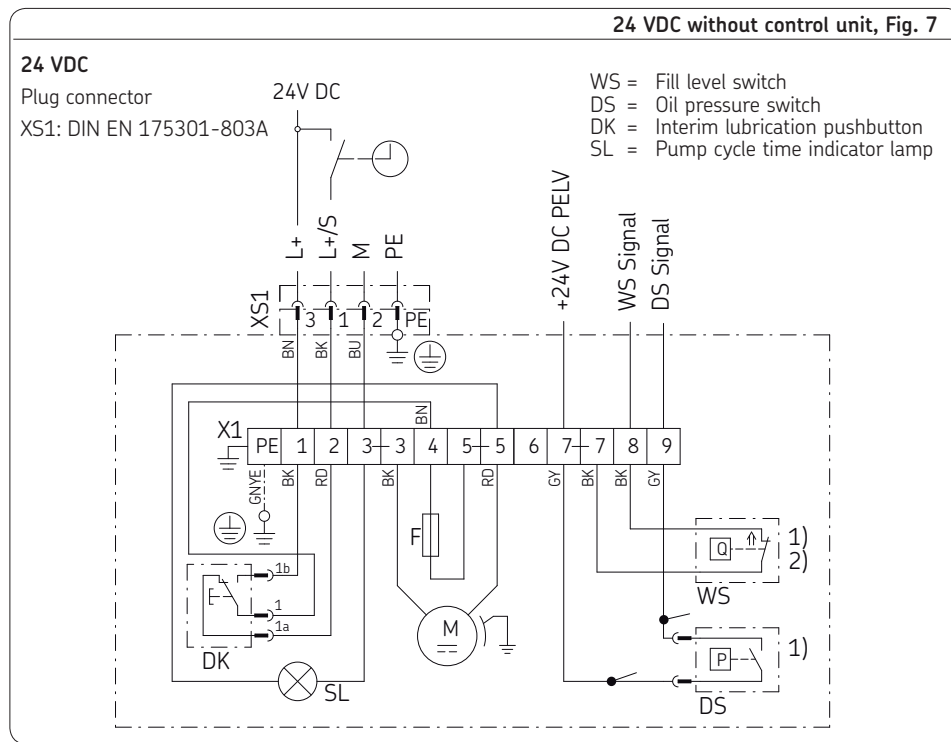
Connector pin assignment for XS1, 230/115 VAC

PIN	Description
3	L1 Main machine switch ON
1	L1/S Pump cycle contact
2	N
⊕	PE Protective earth

1) Optional

2) Optional, contact closes at MINIMUM fill level.

4.5.3 Connection diagram for 24 VDC without control unit



Connector pin assignment for XS1, 24 VDC

PIN	Description
3	Main machine switch ON
1	L+/S Pump operation contact
2	Ground (0 V)
⊕	PE Protective earth

- 1) Optional
- 2) Optional, contact closes at MINIMUM fill level.

4.5.4 Oil+air lubrication unit with control unit

Oil+air lubrication units with a control unit 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, i.e., the interval time is set. Depending on the model design, the electronic control unit allows configuration of the interval time, pump delay time, and the number of pre-lubrication cycles. One or more pre-lubrication cycles with short interval times can be triggered prior to 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 lubrication point line before the machine starts running.

The pump cycle time is 60 seconds and cannot be adjusted.

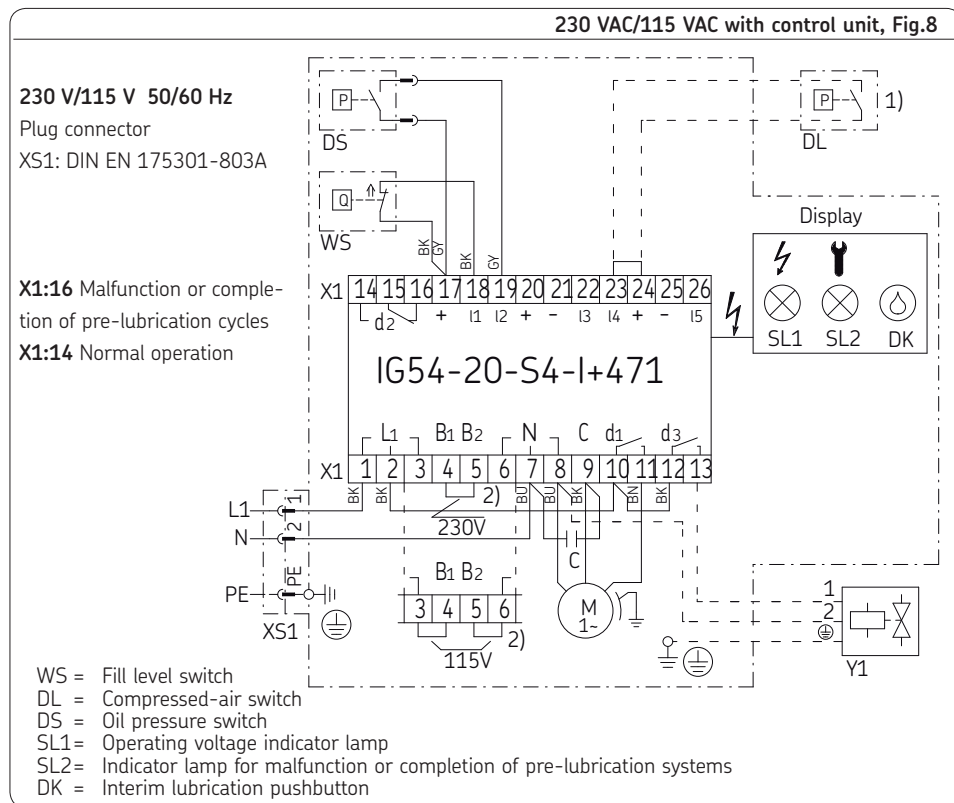
The electrical connection of the monitoring units is established at the terminal strip of the gear pump unit's electronic control unit. The control unit directly monitors the operation of the oil pressure switch, pressure switch for minimum pressure of compressed air, and fill level switch. Oil+air lubrication units with an electronic control unit are supplied with all internal wiring fully connected. Depending on the electronic control unit's model design, a signal line for fault monitoring can be connected to the electronic control unit for connection to the machine control unit. The signal line is run outwards via a cable fitting mounted on the gear pump unit.

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 the scope of delivery of an oil+air lubrication unit.

Warning!

To program the electronic control unit on an oil+air lubrication unit, consult the operating instructions for control unit IG54-20-S4-I, document number 951-180-001-EN. Depending on the model design of the oil+air lubrication unit, gear pump unit MKU (without control) or MKL (with control) are used. See the rating plate of the gear pump unit to identify the model design. For further information on the gear pump unit, consult the assembly instructions, document number 951-170-005-EN. Both documents are included in the scope of delivery of the oil+air lubrication unit.

4.5.5 Connection diagram for 230/115 VAC with control unit



Connector pin assignmen XS1, 230/115 VAC

PIN	Description
1	L1 Main machine switch ON
2	N
⊕	PE Protective earth

- 1) Connected by customer:
 Pressure switch for minimum pressure of compressed air (DL)
 Compressed-air valve Y1.
- 2) The control unit can be switched between 230 VAC and 115 VAC; the pump motor cannot be switched.

4.5.6 Connection diagram for 24 VDC with control unit

24 VDC with control unit, Fig. 9

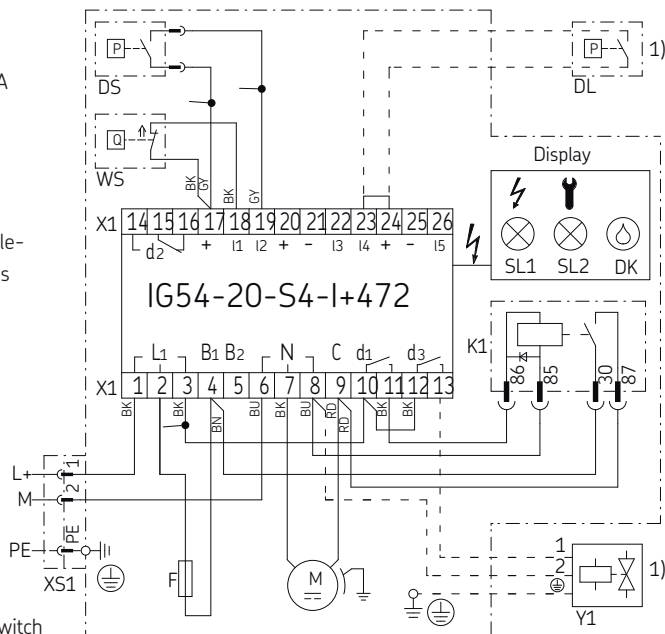
24 V DC

Plug connector

XS1: DIN EN 175301-803A

X1:16 Malfunction or completion of pre-lubrication cycles

X1:14 Normal operation



WS = Fill level switch
 DL = Compressed-air switch
 DS = Oil pressure switch
 SL1= Operating voltage indicator lamp
 SL2= Indicator lamp for malfunction or completion of pre-lubrication systems
 DK = Interim lubrication pushbutton
 K1 = Pump motor relay

Connector pin assignment for XS1, 24 VDC

PIN	Description
1	Main machine switch ON
2	Ground (0 V)
⊕	PE Protective earth

- 1) Connected by customer:
 Pressure switch for minimum pressure of compressed air (DL)
 Compressed-air valve Y1.

4.6 Compressed air line connection

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



Danger!

Ensure that the main air valve is closed before connecting the oil+air lubrication unit to the compressed-air supply.



Warning!

The specified minimum primary air pressure for operating the oil+air lubrication unit must be maintained.

The compressed air must be dry and filtered. A water separator, preferably with semi-automatic drainage, is recommended for the preparation of compressed air. Detailed requirements for the compressed air are listed in Table 2.

The following applies regarding the air volume required:

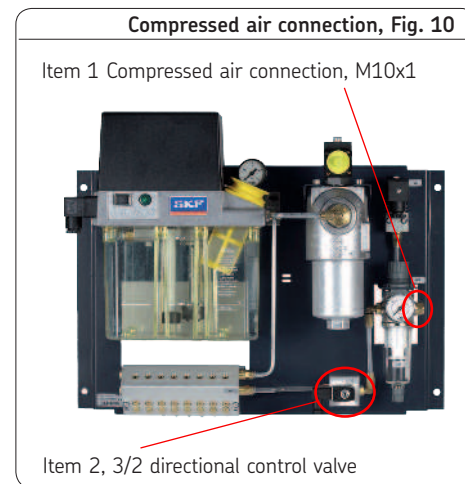
Higher-viscosity lubricant requires a larger volume of air to transport the oil streak in the lubrication point line.

Larger air volumes must be provided due to the greater adhesion of high-viscosity lubricants to the wall of the lubrication point line. The compressed air to be used must comply with at least quality class 3 as defined by DIN ISO 8573-1.

Compressed air preparation can be optimized by using compressed air of the appropriate quality class. The connection for the compressed air line (1) is designed as an M10x1 connection thread with a counterbore for a solderless tube union per DIN 3854/DIN 3862 for tube \varnothing 6 mm. SKF recommends the plug connectors listed under Accessories for installation of the compressed-air line:

A controllable valve, such as a 3/2 directional control valve (2) is recommended in the air in-

let line for compressed air so that the compressed air supply can be switched on and off.



Requirements for compressed air, Table 2

Requirement	Values
Inlet pressure Continuous operating pressure Max. pressure	Min. 3 bar 6 bar 10 bar
Air volume required (line with 2.3 mm internal diameter, recommended oil viscosity range)	1000 - 1500 NI/h
Based on quality classes of compressed air per DIN ISO 8573-1	
Particle content	Class 3
Maximum particle size	5 µm
Maximum particle content	5 mg/m ³
Pressure dew point	Class 4 Maximum: +3 °C
Oil concentration	Class 3 Maximum: 1 mg/m ³

4.7 Lubrication line connection

The main lubricant line connecting the gear pump unit with the oil+air mixing valve is already installed on oil+air lubrication units. Install the lubrication point line(s) as shown in Figure 11.

The lubrication point line leading 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 oil+air lubrication unit (stress-free connection).

Lubrication point lines made of transparent plastic are recommended so that the lubricant transport in the lubrication point lines (oil-shear formation) can be assessed visually. The requirements for the lubrication point lines are summarized in Table 3.

Lubrication point lines made of transparent plastic are available in rigid (unplasticized) and flexible (plasticized) designs with the following order numbers (please indicate desired length):

Rigid plastic tubing:

Order No. **WVN715-R04X0.85**

Flexible plastic tubing:

Order No. **WVN716-R04X0.85**

The connection for the lubrication point line is designed either as an M8x1 connection thread with a counterbore for a solderless thread union per DIN 3854/DIN 3862 for tube Ø 4 mm or with an SKF plug connector for tube Ø 4 mm.

Table 3

Requirement	Values
Minimum length to hose coil	1 m
Maximum length to hose coil	10 m
Recommended lubrication point line - WVN715-R04X0.85 - WVN716-R04X0.85	Ø 4 x 0.85 mm (wall thickness)

The lubrication point lines may be laid at an upward or downward angle. A hose coil (2) is installed approx. 0.3 m in front of the nozzle (1) and serves as a lubricant reservoir. After the compressed air is turned off, the lubricant distributed in the hose coil collects in the lower coils; this ensures that the bearing is supplied with lubricant again shortly after the compressed air is turned back on. The center axis of the hose coil should always be laid horizontally or up to a maximum inclination of 30°.

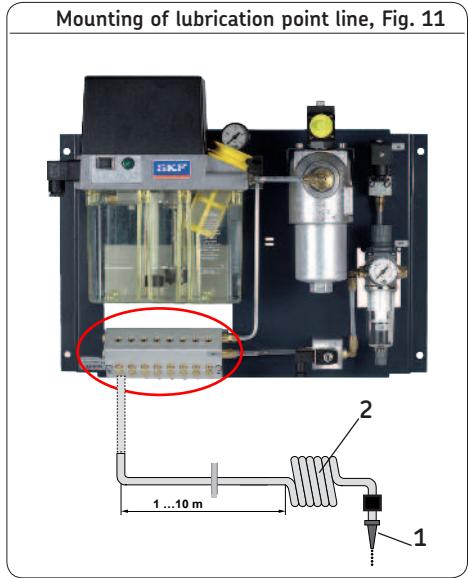
Avoid changes in the cross-section of the lubrication point line from small to large cross-sections in the direction of flow of the lubricant. Transitions from one cross-section to another should be smooth.

SKF oil-streak sensors are recommended for monitoring the continuous lubricant flow in the lubrication point lines. Oil-streak sensors allow monitoring of the oil-streak transport

along the course of the lubrication line between the oil+air mixing valve and the lubrication point.

Table 4

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)



4.8 Venting of the oil+air mixing valves MV20x

☞ See Fig. 12



DANGER!

Depressurize the oil+air lubrication device before starting work.

When modifying or replacing a mixing valve or its metering units, it must be vented. Note that only the Service department of SKF Lubrication Systems Germany may replace metering units 10 mm³ and 20 mm³. Larger metering units may be replaced by the customer under the customer's responsibility. In any case the mixing valve or metering unit concerned must be vented.

To simplify the venting procedure remove the mixing valve from the mounting plate. In the installation position the metering units are located on the bottom side of the mixing valve.

Venting of the main oil duct

- Position the oil collecting bin provided by the customer below the mixing valve. Collect the leaking oil with suitable means.
- Depressurize the oil+air lubrication device
- Disconnect the mixing valve **(1)** from the compressed air supply (marking Air)
- Remove the mixing valve **(1)** from the mounting plate **(2)**
- Remove closure screw **(3)**(marking Oil) on the opposite side of the main oil connection
- Switch pump on and let it supply oil

☞ Now the oil reaches the mixing valve through the main oil connection and leaks from the opposite side.

- Let pump supply until oil comes out free from bubbles
- Close the bore of the main oil duct with closure screw **(3)** again
- Switch pump off

Venting of the metering units

- Turn the mixing valve upward to allow the enclosed air to escape
- Position hex wrench (AF2) on threaded pin **(4)** of the first metering unit **(5)**
- Remove threaded pin **(6)** and balls **(7)** from the metering units **(5)**

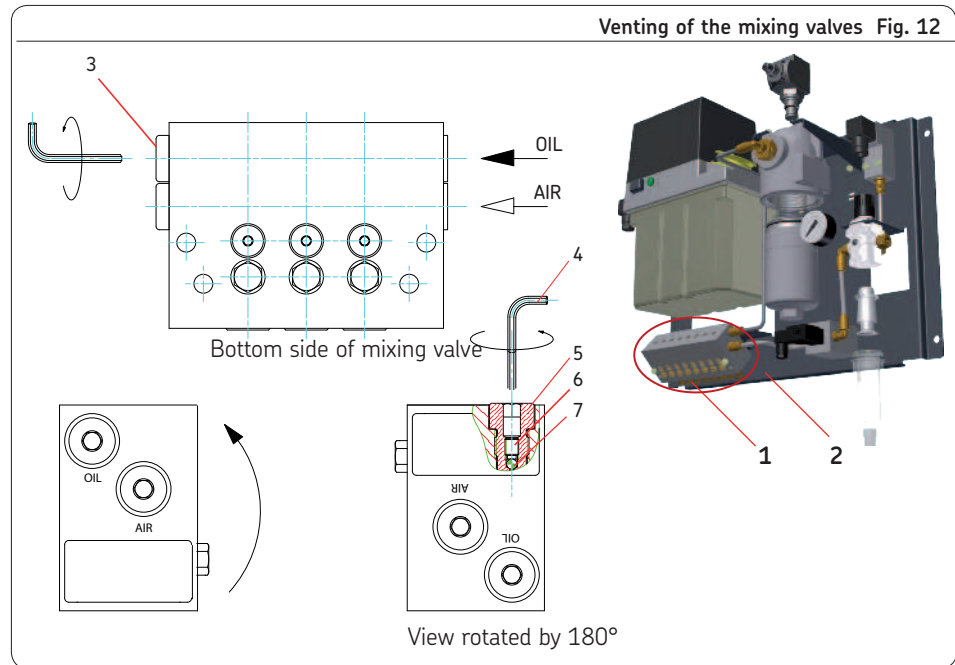
Repeat procedure for each metering unit

- Let pump run in the intermittent (temporarily suspended) operating mode until oil leaks

free from bubbles from all metering units.

☞ In the relief stages pressure in the oil line must compulsorily drop to <1.5 bar. As soon as bubble-free oil leaks from all metering units, switch off the pump and close all metering units again by means of the respective balls and threaded pins.

- Insert the respective balls (7) and threaded pins (6) into the metering units (5)
- Use a hexagon wrench to tighten the threaded pin (6) with a tightening torque of 1.5 Nm
- Reinstall the mixing valve (1) onto the mounting plate (2) again
- Reconnect the compressed air supply



4.9 General information for lubrication line laying

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

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

The pipes, hoses, shutoff valves, control valves, fittings, and so on must be suitable for the maximum operating pressure of the lubrication unit, the permitted temperatures, and the lubricants to be conveyed. The lubrication line system also needs to be protected from excessive pressure by means of a pressure-relief valve.

All components of the lubrication line system such as pipes, hoses, shutoff valves, control valves, fittings, etc., must be carefully cleaned before installation. No seals should protrude

inward in the lubrication line system, as this could hinder lubricant flow and introduce contaminants into the lubrication line system. Lubrication lines should always be arranged so that air pockets cannot form anywhere. Avoid changes in the cross-section of the lubrication line from small to large cross-sections in the direction of flow of the lubricant. Transitions from one cross-section to another should be smooth.

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



Warning!

Lubrication lines must be leak-tight. Lubricants can contaminate the ground and watercourses. Lubricants must be properly used and disposed of. Observe the local regulations and laws regarding the disposal of lubricants.



Danger!

Centralized lubrication systems must be leak-tight. 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.



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.

4.10 Notes on the CE marking

The CE marking is performed following the requirements stated in the applied standards:

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

Notes on the Low Voltage Directive 2014/35/EU

The protective regulations of the low voltage directive 2014/35/EU are complied with according to annex I, no. 1.5.1 of machinery directive 2006/42/EC.

Notes on the Pressure Equipment Directive 2014/68/EU

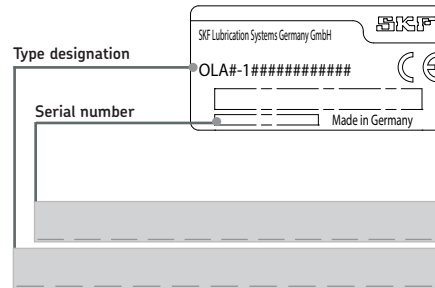
Due to its performance rates the product does not achieve the limit values fixed in article 4 (1)(a)(i) and is excluded from the scope of the pressure equipment directive 2014/68/EC article 4(3).

4.11 Note on the rating plate

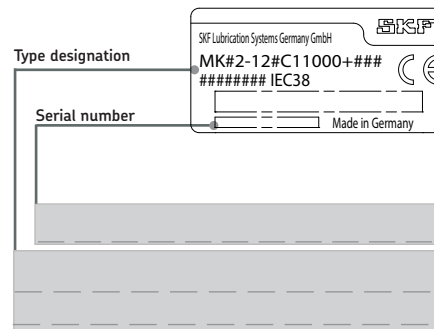
The rating plate on the gear pump unit provides important data such as type designation and serial number (or customer number). To avoid loss of this data in case the rating plate becomes illegible, these characteristics should be entered in the following table.

- Enter key data from rating plate in the following table.

4.11.1 Rating plate on oil+air lubrication unit



4.11.2 Rating plate on gear pump unit



OLAx-1...
Oil+Air Lubrication Unit

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

**Operating instructions associated
with assembly instructions**

1. Safety instructions

1.1 General information



The operator of the described product must ensure that the operating instructions are read and understood by all persons tasked with the assembly, operation, maintenance, and repair of the product.

In addition to the operating instructions, general statutory regulations and other regulations for accident prevention and environmental protection must be observed and applied.



Warning!

The information on lubricants listed in Chapter 2, "Lubricants," of the assembly instructions also applies without restrictions to these operating instructions.

2. Lubricants

3. Transport, delivery, and storage

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



Warning!

The product must not be tilted or dropped.

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

After receipt of the shipment, the product(s) must be inspected for damage and for completeness according to the shipping documents. Keep the packaging material until you are sure that there are no delivery discrepancies that need to be clarified.

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

3.1 Lubrication units

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

3.2 Electronic and electrical devices

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

3.3 General notes

- o The product(s) can be enveloped in plastic film to provide low-dust storage.
- o Store products on racks or pallets to protect them from damp floors.
- o Bright-finished metallic surfaces, especially wearing parts and assembly surfaces, must be protected using long-term anti-corrosive agents before storage.
- o At approx. 6-month intervals: Check for corrosion. If there are signs of corrosion, reapply anti-corrosive agents.
- o Drives must be protected from mechanical damage.

4. Assembly

4.1 Information on assembly

The assembly procedure for the oil+air lubrication unit is described in detail in the assembly instructions (Chapter 4) associated with these operating instructions.

5. Design and function

5.1 General information

Oil+air lubrication units are total-loss oil lubrication systems which are used in centralized lubrication to provide minimal quantity metering of oils. Oil+air lubrication units are employed in a wide range of applications.

Typical fields of application for oil+air lubrication units are:

- o Rolling bearing lubrication
- o Linear guide lubrication
- o Chain lubrication
- o Rack and pinion lubrication
- o Lubrication for cutting and non-cutting shaping
- o Assembly and process oiling

5.2 Principle of oil+air lubrication

In oil+air lubrication, a continuous stream of air (compressed air) separates a volumetrically metered quantity of oil into a streak in a lubrication line and transports it along the pipe wall to the lubrication point. Metering can be performed by piston distributor, injection oiler, micropump, an oil+air mixing valve with metering, etc.

The volumetrically metered quantity of oil is fed into the air stream in bursts and is transported by the air stream to the attached lubrication point line. A nearly continuous, finely metered oil flow is generated and fed to a lubrication point through a lubrication point line that is at least 1 m long between the metering device and the entrance to the lubrication point. The lubricant fed to the lubrication point lubricates the friction partners, while the compressed air is discharged into the surroundings nearly free of oil.

5.3 Fields of application

Oil+air lubrication units provide a continuous, finely metered flow of oil which can be tailored to different operating conditions by selecting the metered quantity, setting the velocity of compressed air stream and changing the lubricating cycle sequence. An excellent use of oil+air lubrication is the lubrication of high-speed rolling bearings, for example in spindles for machine tools.

Other applications include the lubrication of transport chain conveyors that do not support intermittent lubricant feeding due to their rotating speed.

In production processes for textile fibers, an oil+air lubrication unit can be used to apply minimal quantities of lubricant (gripper lubrication).

5.4 Design of an oil+air lubrication unit

☞ See Fig. 1 on p. 43 and Fig. 2 on p. 44.

An oil+air lubrication unit can be subdivided into areas for lubricant supply/lubricant metering and compressed air supply. The lubricant can be metered and the compressed air admixed either by an oil+air mixing valve with metering (lubricant is metered and compressed air is admixed in one component) or using separate mixing valves that are combined with piston distributors, injection oilers, or micro-pumps (lubricant is metered and the compressed air is admixed in separate components).

In the maximum equipment level, an oil+air lubrication unit consists of the following components (see Fig. 1):

- o Gear pump unit with or without control unit (Fig. 1 shows a design without control unit) with gear pump and electric motor **(1)**, lubricant reservoir **(2)**, the valve set required for pressure relief and regulation, a oil pressure switch for electrical monitoring of lubricant pressure build-up, a pressure gauge **(4)** for visual monitoring of lubricant pressure build-up, and a fill level switch for fill level monitoring.
 - o Compressed-air valve **(6)** with pressure gauge **(7)** for compressed air control, water separator with air filter **(13)**
 - o Pressure switch **(8)** for monitoring of minimum air pressure
 - o Oil+air mixing valve **(9)** for metering lubricant and admixing compressed air
 - o 3/2 directional control valve **(10)** for switching the compressed air stream on and off
 - o Oil filter **(11)** with or without electrical/visual contamination monitoring **(12)**
- The components in the basic design are arranged on a mounting plate and supplied as a complete oil+air lubrication unit.
- If necessary, additional components can optionally be integrated into the oil+air lubrication unit, for example:
- o Additional pressure switches for lubricant and compressed air monitoring
 - o Oil-streak sensors for monitoring lubricant transport (oil streak) in lubrication point lines

5.5 Functional description

☞ See Figure 2 on p. 44.

A lubricating cycle of an oil+air lubrication unit consisting of a gear pump unit and an oil+air mixing valve with metering is described below.

After the electric motor is switched on, the lubricant is drawn out of the lubricant reservoir (2) by the gear pump (16) and fed to the oil+air mixing valve (9) through the main lubricant line either directly via the pressure relief valve (18) and the pressure regulating valve (17) or via the oil filter. The oil pressure built up meters the lubricant in the oil+air mixing valve separately for each lubrication point. The compressed air fed to the oil+air mixing valve delivers the metered quantity of lubricant from the mixing valve into the lubrication point line and through to the lubrication point. During this process, the air stream separates the lubricant into a streak and transports it along the tube wall towards the lubrication point.

The bearing is thus continuously supplied with a minimal 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.

After the electric motor is switched off, the pressure is relieved in the main lubricant line. In this process, the lubricant is moved within the oil+air mixing valve (9) from the spring chamber into the metering chamber. The oil+air lubrication unit is ready for the next contact time after the interval time has elapsed.

To ensure proper metering, it is recommended that a delay time be set for the gear pump as specified by the control unit or the machine control unit. The pump delay time is a period during which the gear pump motor continues to run after the operating pressure is reached

in the main lubricant line. This period ensures that the metering chambers in the oil+air mixing valve are completely emptied. A delay time of 5 seconds is recommended; other times are possible based on the layout of the oil+air lubrication system. The operating pressure built up during a contact time is monitored by the electrical oil pressure switches (19) installed in the gear pump unit (1). If present, the operating pressure is also monitored visually by a pressure gauge installed on the gear pump unit (4). The signal from the oil pressure switch is evaluated either directly by the machine control unit (gear pump unit without control unit) or by the electronic control unit (gear pump unit with control unit).

An oil+air lubrication unit operates cyclically, i.e., a contact time is always followed by an interval time. The length of the set interval time is directly related to the amount of lubricant required by the lubrication point.

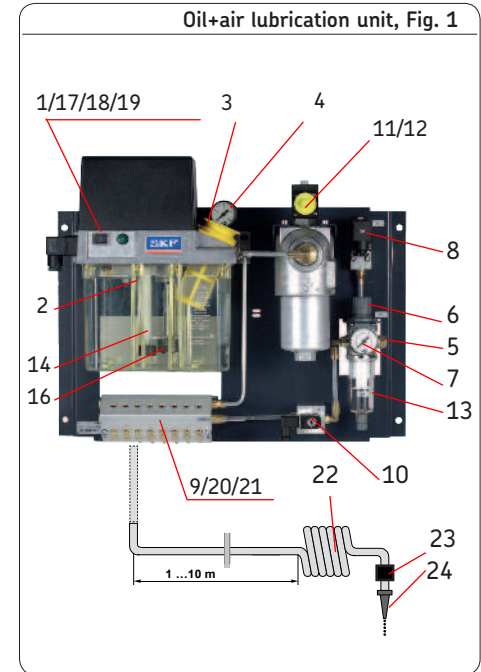
A lubrication cycle consists of the contact time and the interval time. Note that the electric motor of the gear pump unit is approved for operating mode S3 (intermittent operation) and that minimum interval times and maximum motor run times must be observed. See Chapter 6.4 for more information.

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

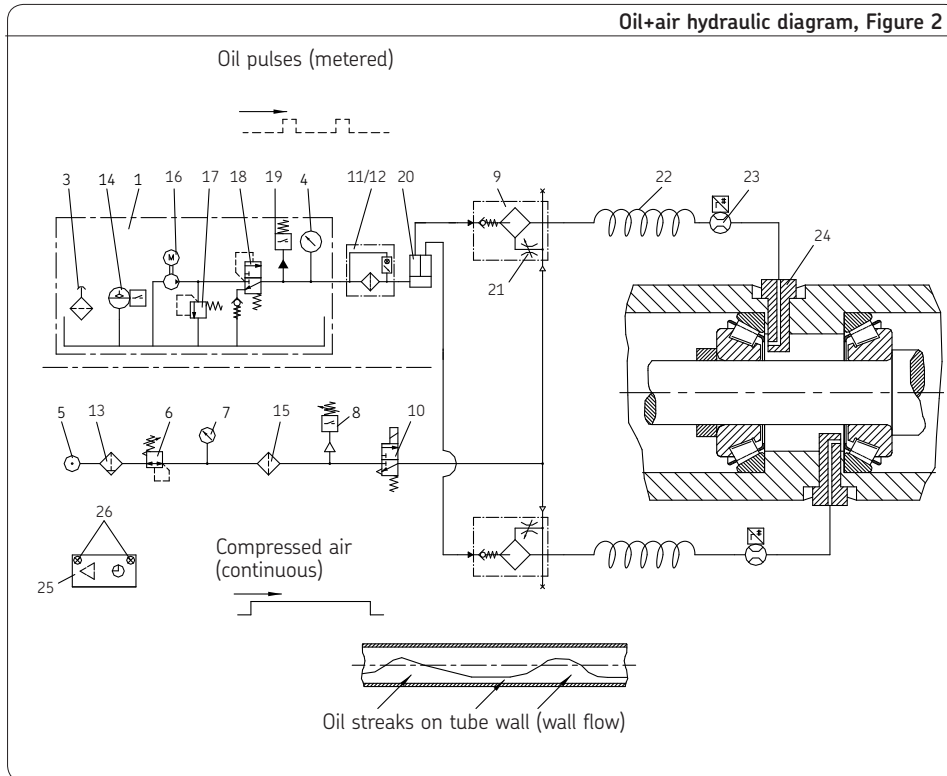
The fill level of the lubricant reservoir is monitored by a fill level switch (**14**) installed in the gear pump unit. The signal from the fill level switch is evaluated either directly by the machine control unit (gear pump unit without control unit) or by the electronic control unit (gear pump unit with control unit).

The minimum air pressure as set on the air

pressure regulating valve is monitored by a pressure switch (**8**). The signal from the pressure switch is evaluated either directly by the machine control unit (gear pump unit without control unit) or by the electronic control unit (gear pump unit with control unit).



5.5.1 Hydraulic diagram of an oil+air lubrication unit



Legend to Fig. 2

Item Description

- | Item | Description |
|------|--|
| 1 | Gear pump unit without control unit |
| 2 | Lubricant reservoir |
| 3 | Filler socket |
| 4 | Oil pressure gauge |
| 5 | Compressed air connection |
| 6 | Compressed air control valve |
| 7 | Pressure gauge for compressed air supply |
| 8 | Pressure switch for minimum air pressure |
| 9 | Oil+air mixing valve |
| 10 | 3/2 directional control valve |
| 11 | Oil filter housing with oil filter |
| 12 | Oil filter contamination indicator, visual/ electrical |
| 13 | Air filter and water separator container |
| 14 | Fill level switch |
| 15 | Additional air filter |
| 16 | Gear pump with motor |
| 17 | Pressure regulating valve |
| 18 | Pressure relief and residual-pressure valve |
| 19 | Oil pressure switch (for required oil pressure) |
| 20 | Lubricant distributor |
| 21 | Air restrictor |
| 22 | Hose coil |
| 23 | Oil-streak sensor |
| 24 | Nozzle |
| 25 | Control and monitoring |
| 26 | Indicator lamp |

5.6 Description of components

The individual components are described below.

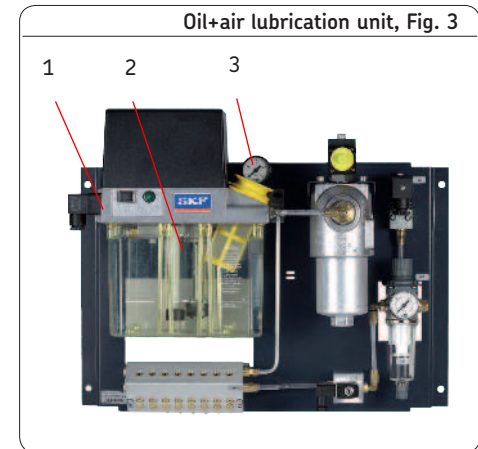
- o Gear pump unit with/without control unit
- o Air pressure regulating valve
- o Pressure switch for minimum air pressure

5.6.1 Gear pump unit

☞ See Figure 3.

The gear pump unit (1) consists of a gear pump, lubricant reservoir (2), the valve set required for pressure relief and regulation, a oil pressure switch for electrical monitoring of oil pressure build-up in the main lubricant line, a pressure gauge (3) for visual monitoring of oil pressure build-up in the main lubricant line, and a fill level switch for fill level monitoring. 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 thereby 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 thereby 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 instruc-

tions for the electronic control unit which are included in the scope of delivery of an oil+air lubrication unit.



5.6.2 Compressed air control valve

☞ See Figure 4.

The compressed air control valve (6) is used to set the air pressure of the compressed air fed to the oil+air mixing valve and the lubrication point line. The compressed air transports the oil streak on the inner wall of the lubrication point line, starting from the oil+air mixing valve (9), through the lubrication point line and to the lubrication point.

The compressed air must be fed uniformly to ensure constant transport of the oil streak, which ensures constant lubricant supply to the lubrication point.

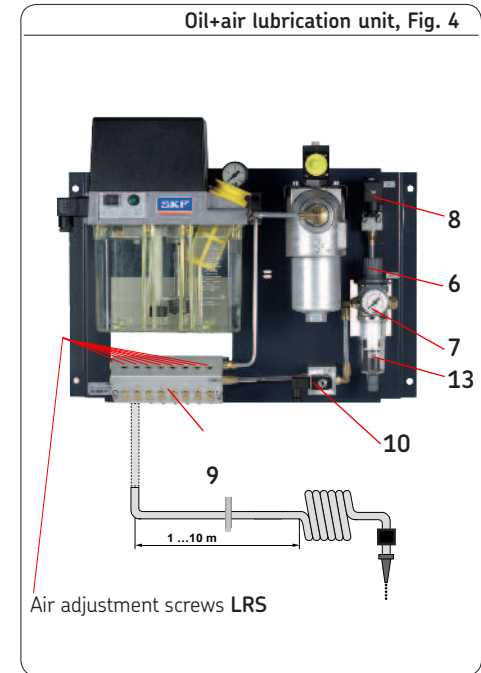
The air pressure is set manually and can be read directly on the integrated pressure gauge (7) on the compressed air control valve (6). An air filter with an integrated water separator (13) can optionally be used.

5.6.3 Pressure switch for minimum air pressure

☞ See Figure 4.

The pressure switch for minimum air pressure (8) is used to continuously monitor the air pressure set on the air pressure regulating valve. As soon as the air pressure set on the air pressure regulating valve falls below the minimum value set on the pressure switch, the pressure switch issues an electrical signal that can be evaluated as a malfunction notification by the machine control unit or the gear pump unit's control unit.

The minimum air pressure must be monitored, as insufficient compressed air supply carries a risk of underlubricating the lubrication point because the lubricant in the lubrication point lines is no longer reliably transported to the lubrication point.



5.6.4 Oil+air mixing valve with metering

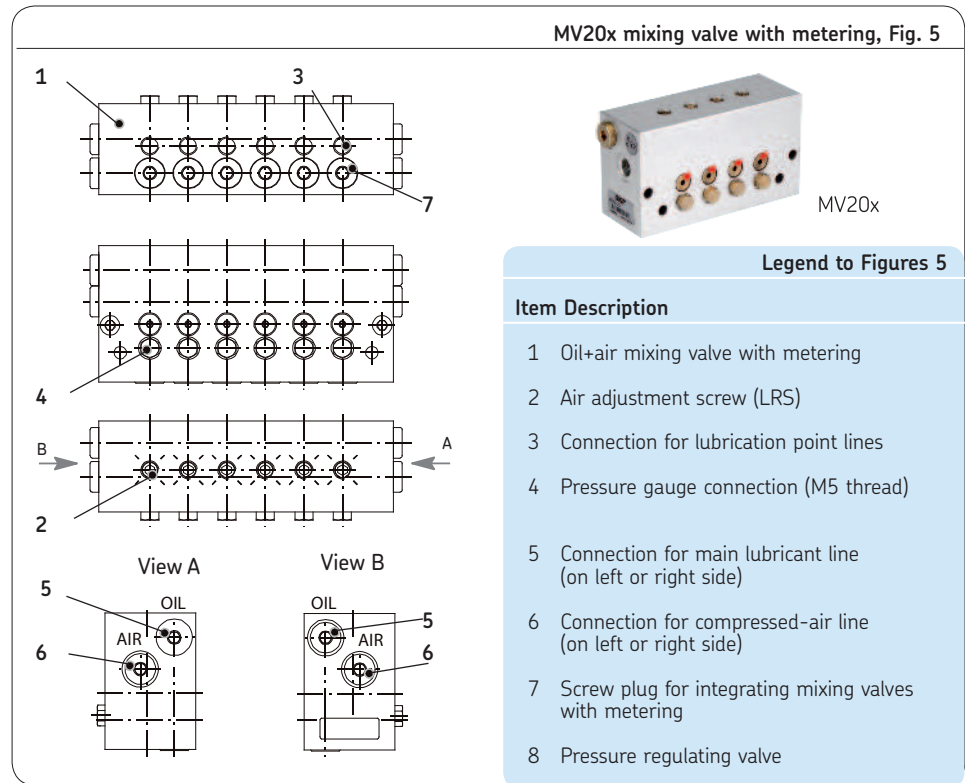
☞ See Figures 4 to 5.

An oil+air mixing valve MV20x (9) consists of a valve block in compact design with a maximum of 8 lubrication line connections that have been provided for metering volumes between 10 mm³ and 160 mm³ (six gradations).

If more lubrication line connections are needed, several 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 is then transported by the air flow into the lubricant feed line and up to the lubrication point.

The air adjusting screws (LRS) integrated in the oil+air mixing valves allow to separately adjust the air flow required for each lubrication point individually..

5.6.5 Illustration of oil+air mixing valve with metering



6. Operation

6.1 General information

The oil+air lubrication unit described here functions automatically. The lubricant transport in the lubrication lines should, however, be subjected to regular visual inspection. The lubricant fill level in the lubricant reservoir should be subjected to regular visual inspection. If the lubricant fill level is too low, lubricant needs to be added up to the maximum mark as described in the "Commissioning" chapter.



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



Warning!

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.



Warning!

Different lubricants must not be mixed together. Doing so can cause damage and require extensive 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.

6.2 Commissioning

All electrical, hydraulic, and pneumatic connections must be inspected before commissioning the oil+air lubrication unit.



Warning!

The lubricant may only be fed without bubbles.

The lubricant reservoir must be filled with clean lubricant without introducing bubbles. Allow **approximately 15 minutes to pass after filling the system before you operate** the oil+air lubrication unit. This allows any air bubbles to escape.

Air pockets in the lubricant adversely affect the function of the device and impair the reliability of lubricant delivery, which can result in damage to the lubrication points requiring lubrication.

Proceed as follows to commission the unit:

- Check that the mounting plate and all connections are firmly attached.
- Check whether the lubricant reservoir contains sufficient lubricant.
- Check whether compressed air is present.
- Start the system.

Check the function of the oil+air lubrication unit as follows:

- When the spindles are idle, check whether signals are transmitted properly between the machine and the oil+air lubrication unit.

The oil+air lubrication unit described here functions automatically. The lubricant transport in the lubrication lines should, however, be subjected to regular visual inspection.



Warning!

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.

6.2.1 Setting-up mode

☞ See Figures 2, 4, and 5



Warning!

The oil+air lubrication unit must be brought into service as described below in order to ensure proper functioning.

MV20x oil+air mixing valve with metering

- Close the air pressure regulating valve for compressed air (Figs. 2/4, item 6) to interrupt the compressed air supply.
- Remove screw plugs from the pressure gauge connections (Fig. 5, item 4) on the oil+air mixing valve.
- Switch on the power supply and run the gear pump unit until lubricant without bubbles is discharged at the openings of the pressure gauge connections.

- Reinsert the screw plugs.
- Open the air pressure regulating valve (Figs. 2/4, item 6) and set an operating pressure of at least 3 bar up to a maximum of 10 bar (6 bar being optimal).
- Run the gear pump unit until a continuous oil streak has formed in the lubrication point lines and the lubricant discharges at the lubrication points.
- If necessary, adjust the air flow rate using the air adjustment screws (Fig. 5, item 2) on the oil+air mixing valve (Figs. 2/4, item 6) or the air pressure regulating valve (Figs. 2/4, item 6).

6.3 Lubricant delivery to bearing

The way the lubricant is fed to the bearing depends on the bearing type and the bearing assembly's design features. Figures 6 and 7 provide examples of the lubricant feeding.

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 aligned directly with the cage of the rolling bearing.

If using rolling bearings that exert pumping force in one direction (e.g. angular contact bearings), the lubricant must be fed in the direction of pumping force.

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, it must be assured that the lubricant is not introduced into the pressure zone of the rolling bearing between the rolling element and the bearing ring (Fig. 6).

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 bearings (Fig. 7).

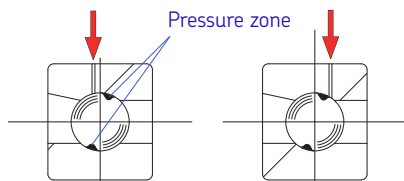
On rolling bearings with a with external dimensions from 150 to 280 mm, it is recommended that a second nozzle be installed, with a corresponding increase in case of larger rolling bearing diameters. A single nozzle is sufficient for most applications in which the lubricant is fed through the outer ring of a rolling bearing.

The air pressure indicated in Table 2 of the as-

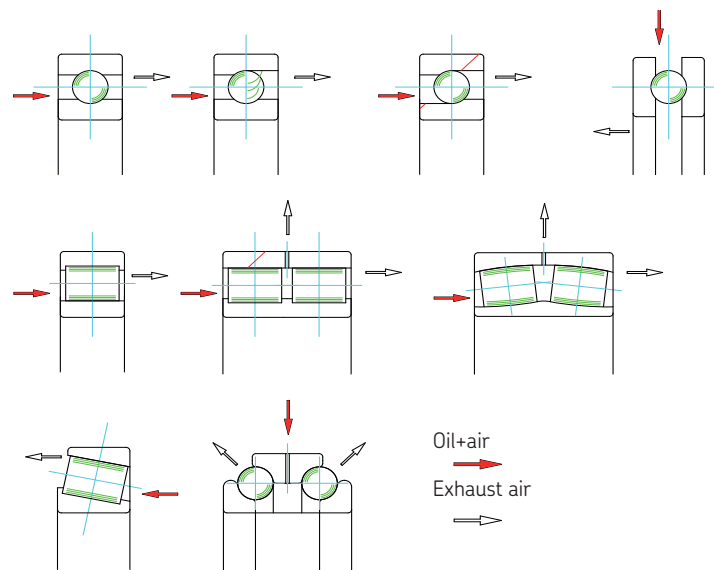
sembly instructions is generally sufficient to reliably overcome the air vortex that arises when using high-speed rolling bearings. If in individual cases a higher air pressure is required to reliably feed the lubricant, this does not impair the function of the entire oil+air lubrication unit.

The lubricant fed to the rolling bearing and the entire bearing assembly must be drained to prevent an oil sump from forming in the lower part of the bearing assembly. For this purpose, it is advisable to drill a drainage hole in the lower part of the bearing assembly so the lubricant can flow out. As a rule of thumb, the diameter of the drainage hole should be six times the inlet cross-section, with a minimum diameter of 5 mm.

Oil+air hydraulic diagram, Figure 6



Oil+air hydraulic diagram, Figure 7



6.4 Setting the lubricant flow rate



Warning!

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 quantity of lubricant an oil+air lubrication unit supplies to a bearing depends on:

- o Bearing type
- o Geometric dimensions of the bearing
- o Speed factor

The quantity of lubricant can be adjusted to the particular application by:

- o Changing the metering volume on the oil+air mixing valve with metering
- o Reducing or increasing the interval time of the gear pump unit.

There is no generally applicable formula for determining the quantity of lubricant per time unit that a bearing requires. For example, bearings with pumping action (e.g., angular contact bearings) require significantly more lubricant than bearings without pumping action (e.g., cylindrical roller bearings). The amount of lubricant required by a bearing is generally specified by the bearing or machine manufacturer. The amount of lubricant required is usually indicated in mm³/h; if other units are used, they must be converted accordingly. See the following for information about configuring the oil+air lubrication unit for the correct metering volume in the oil+air mixing valve and setting the lubrication cycle time.

The calculation is intended to determine both the number of pulses per second "n" based on the selected metering volume "d" for the bearing and the amount of lubricant required by the bearing "V_{oil}" per hour. The total amount of lubricant required by the bearing per hour

should be converted into as many pulses (working cycles) per hour as possible (be sure to follow operating mode S3).

Select the metering volume for the lubrication point accordingly. The available metering volumes for oil+air mixing valves are listed in Table 1.

Table 1

Available metering volume for oil+air mixing valve

Metered quantity [mm ³]	MV20x
10	x
20	x
30	x
60	x
100	x
160	x

The number of pulses per hour is calculated according to the following formula:

$$\dot{V}_{oil} = n \cdot d$$

The selected metered quantity per cycle "d" depends on the metering volume of the oil+air mixing valve.

Example for a typical configuration:

$$\text{Given: } \dot{V}_{oil} = 150 \text{ mm}^3/\text{h} \\ d = 30 \text{ mm}^3$$

Find: Number of cycles per hour [cycles/h]

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

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

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

The cycle time $t_{CT,S3}$ consists of the pump cycle time t_{PCT} , including the pump delay time t_{PDT} and the interval time $t_{INTERVAL}$:

Now, derive the pump cycle time (incl. pump delay time) and the interval time based on operating mode S3. The operating mode for basic designs of oil+air lubrication units is defined as S3, 20% ON-time (1.25 to 25 min). The ON-time is the time during which the gear pump motor is switched on as a percentage of the cycle time $t_{CT,S3}$ (pump cycle time, incl. pump delay time). The time range of 1.25

Table 2

Legend

Formula symbols	Unit symbols	Units and derived units
V		Volumetric flow per hour
\dot{V}_{oil}	mm ³ /h	Amount of lubricant required by a bearing in mm ³ per hour Note there can be multiple lubrication points per bearing
t_{PBT}	s	Pressure build-up time in seconds
t_{PDT}	s	Pump delay time in seconds
t_{PCT}	s	Pump cycle time in seconds
$t_{INTERVAL}$	s	Interval time in seconds
$t_{Z,S3}$	s	Cycle time in seconds
n	Cycles/h	Number of cycles per hour
d	mm ³ /cycle	Metered quantity per cycle

to 25 min is the range of selectable cycle times $t_{CT,S3}$ in minutes.

$$t_{Z,S3} = (t_{PCT} + t_{PDT}) + t_{INTERVAL}$$

with

$$t_{Z,S3} = 1,25 \dots 25 \text{ min}$$

$$t_{PCT} + t_{PDT} = 0,2 \cdot t_{Z,S3} \quad (0,2 \hat{=} 20\%)$$

$$t_{INTERVAL} = 0,8 \cdot t_{Z,S3} \quad (0,8 \hat{=} 80\%)$$

from this it follows:

$$t_{INTERVAL} = t_{Z,S3} - (t_{PCT} + t_{PDT})$$

On the basis of the calculated cycle time $t_{CT,S3}$, these formulas can be used to determine the pump cycle time t_{PCT} (incl. pump delay time t_{PDT}) and the interval time $t_{INTERVAL}$ (ON-time = 20% corresponds to 0.2).

On oil+air lubrication units without a control unit, the calculated pump cycle time, pump delay time, and interval time are programmed in the machine control unit. The pump delay time can be set as 5 seconds; the pump cycle time (monitoring

time for pressure build-up; see also Chapter 4.5.1 of the assembly instructions) must be reduced accordingly by 5 seconds.

On oil+air lubrication units with a control unit, the electronic control unit installed in the gear pump unit must be programmed in the same way.

The standard design of the electronic control unit for oil+air lubrication units allows the interval time to be programmed. The pump cycle time (monitoring time) is fixed at 60 seconds. The 60-second period is sufficient for pressure build-up in the main lubricant line and therefore provides for reliable operation of the oil+air lubrication units. The pump delay time is fixed at 5 seconds.

With operating mode S3, 20% ON-time and a total pump cycle time $t_{PCT} + t_{PDT} = 65$ seconds, the calculation yields the following minimum interval time $t_{INTERVAL,min}$:

$$t_{PCT} + t_{PDT} = 0,2 \cdot t_{Z,S3}$$

$$t_{Z,S3} = \frac{(t_{PCT} + t_{PDT})}{0,2}$$

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

$$t_{INTERVAL,min} = 0,8 \cdot t_{Z,S3}$$

$$t_{INTERVAL,min} = 0,8 \cdot 5,4 \text{ min} = 4,3 \text{ min}$$

The calculated minimum interval time is 4.3 minutes and cannot be lower than this figure and still maintain operating mode S3 = 20% ON-time.

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

$$t_{Z,S3,min} = t_{INTERVAL,min} + t_{PCT} + t_{PDT}$$

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

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

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

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

This must be taken into consideration when designing the oil+air lubrication units. The electronic control units are available in special designs with a programmable pump delay time.

Configuration of the interval time on the electronic control unit is described in its operating instructions. The operating instructions for the electronic control unit are included in the scope of delivery for an oil+air lubrication unit with a control unit.

Consult the "Control and monitoring" chapter for additional information on controlling an oil+air lubrication unit.

6.5 Setting the air flow rate

The amount of air required is based on the quantities of lubricant that will be fed, the number of lubrication point lines, and the specific characteristics of the lubrication point. The operating pressure of the compressed air must be set at a level that provides an air volume sufficient to reliably transport the oil streak, taking into account pressure losses in the lubrication point line and the lubrication point.

The setting for air flow rate is determined empirically. The most important criterion is visual observation of a continuous, uniform lubricant flow in the lubrication point lines. A lubrication point line with an internal diameter of 2.3 mm requires approximately 1,000 to 1,500 NI/h of compressed air to transport an oil streak properly.

This value applies to all oils of viscosity classes ISO VG 32 to ISO VG 100. Higher values apply to higher-viscosity oils and oils with bonding additives.

The air pressure must be set at a level sufficient to deliver this compressed air volume in each lubrication point line, taking into account pressure losses in the lubrication point line and the bearing assembly.

The available air pressure at the compressed air inlet (connection to compressed air supply) should be at least 3 bar, but preferably a minimum of 6 bar.

When using high-speed rolling bearings, higher air pressure is required in order to overcome bearing back pressure (air turbulence). To ensure reliable operation of the oil+air lubrication unit, the air pressure at the nozzle (inlet to the bearing) should not be below 1.5 bar

The operating pressure of the oil+air lubrication unit is set using the air pressure regulating valve for compressed air (item 6 in Fig. 4). The air pressure should be between 3 and 10 bar. The air flow rate in the individual lubrication point lines is set using the corresponding air adjustment screw (item 2 on Figs. 5) on the oil+air mixing valve.



The lubrication point outlet on the oil+air mixing valve cannot be completely closed using the air adjustment screw. A minimum air flow rate is always maintained. Changing the air flow rate for one lubrication point line always affects the air flow rate in the other lubrication point lines. In the event of malfunctions in pressure build-up, the oil+air lubrication unit and the machine must be switched off to prevent underlubrication of the lubrication point.

6.6 Changing metering on MV20x-1..

☞ See Figure 9.

To adjust the metering to the application at hand, metering on the MV20x-1.. oil+air mixing valve can be changed for each lubrication point. Note that only the Service department of SKF Lubrication Systems Germany GmbH may change the meterings 10 mm³ and 20 mm³. The meterings 30, 60, 100, and 160 mm³ can be changed by replacing the metering screw as described below.



Danger!

Depressurize the oil+air lubrication device before starting work.

- Disconnect all connections on the oil+air mixing valve. Unscrew the oil+air mixing valve from the retaining ring on the base-plate of the oil+air lubrication unit.
- Place the oil+air mixing valve on a firm surface with the metering screws pointing upwards.

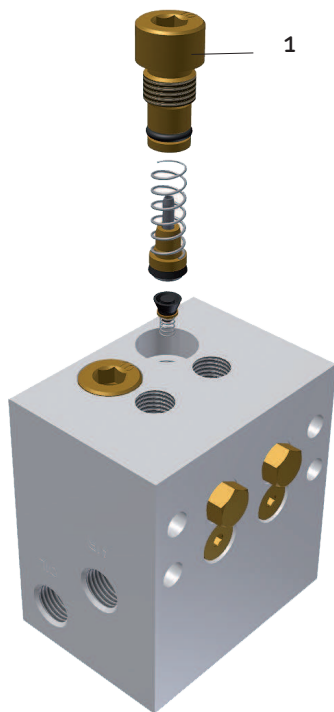
- Remove the metering screw (1) using a 6 mm hexagon socket screw key. While unscrewing the metering screw, ensure that the internal components of the metering chamber do not fall out. See Figure 8 for the order of the internal components.
- Lightly oil the O-rings of the new metering screw and then screw it into the metering point using a tightening torque of approx. 2+0,5 Nm.

Metering screws are available with the following order numbers:

Table 3

Metering screw for quantity	Order No.
30 mm ³	MV202.13-K
60 mm ³	MV202.16-K
100 mm ³	MV202.20-K
160 mm ³	MV202.26-K

Changing metering, Fig. 9



6.7 General notes

☞ See Figures 1 and 2.

Oil+air lubrication units should always be started before applying full load to the machine/system's bearings, and must remain running after production until the bearings have cooled. This prevents moisture and/or dirt particles from being drawn into the bearing. These issues must be taken into consideration when programming the machine control unit or integrating the control units into the machine control unit.

Figures 1 and 2 show the types of monitoring available in an oil+air lubrication units.

The following monitoring units are presented:

- o Fill level switch in the lubricant reservoir (14)
- o Oil Pressure switch for required oil pressure (19)

- o Oil-streak sensor (23)
- o Pressure switch for minimum pressure of compressed air (8)
- o Oil filter (11) with electrical/visual contamination indicator (12)
- o Air filter with liquid separator (13)

Oil-streak sensors offer enhanced monitoring capability for an oil+air lubrication unit. Using oil-streak sensors allows the lubricant transport (oil streak) in the lubrication point lines to be monitored.

7. Decommissioning and disposal

7.1 Temporary shutdown

The described product can be temporarily shut down by disconnecting the electrical, pneumatic, and/or hydraulic supply connections. The instructions in the "Assembly" chapter in these assembly instructions must be observed when doing so.

If the product is to be shut down for an extended period of time, follow the instructions in the Chapter "Transport, delivery, and storage" of these assembly instructions.

To recommission the product, follow the instructions in the "Assembly" and "Commissioning" chapters in these assembly instructions.

7.2 Permanent shutdown

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



Warning!

Lubricants can contaminate the ground and watercourses. Lubricants must be properly used and disposed of. Observe the local regulations and laws regarding the disposal of lubricants.



SKF Lubrication Systems Germany GmbH can take back the product and arrange for its legal disposal. Costs to the customer will be limited to SKF's incurred costs.

The parts are recyclable.

8. Maintenance and service

8.1 General information

**Danger!**

Working on products that have not been disconnected from the power supply can cause serious injury or death to persons. Installation, maintenance, and repair work may only be carried out by qualified technical personnel on products that have been disconnected from the power supply. Supply voltage must be switched off before opening any of the product's components.

**Danger!**

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 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 from the outset.

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 the product 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.

**Danger!**

The hot surface of a motor may cause burns. The surfaces of a motor should only be touched with protective gloves or when motor is no longer hot.



Dismantling of the product or individual parts thereof within the statutory warranty period is not permitted and voids any claims.



Only original spare parts from SKF Lubrication Systems Germany GmbH may be used. You must not carry out alterations to the product or use non-original spare parts or resources. Doing so invalidates the warranty.

8.2 Maintenance and repair

The required maintenance intervals depend on the particular conditions of usage. The criteria for these are machine-specific settings, ambient and operating conditions, as well as the purity of the lubricant and compressed air. Due to the particular conditions of usage, the customer is responsible for determining and observing the maintenance intervals on its own.

The fill level in the lubricant reservoir must be checked visually at regular intervals. The appropriate inspection intervals depend on the amount of lubricant required and the bearings requiring lubrication. Due to the particular conditions of usage, the customer is responsible for determining and observing the inspection intervals on its own.

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

- o Inspect oil filter and replace if necessary.
- o Inspect automatic water separator for proper function.
- o Inspect air filter and replace if necessary.
- o Inspect fill level in the lubricant reservoir.
- o Regularly inspect system components for leaks.
- o Inspect electrical cables for damage.
- o Inspect electrical connections and contacts.
- o Inspect electrical connections in case of malfunction notifications (on customer's control unit).
- o Visually inspect lubrication of the lubricated bearing.

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

8.2.1 Cleaning the compressed air filter

☞ See Figure 10.

Oil+air lubrication units can be optionally equipped with a combined compressed air filter/water separator that separates removes impurities from the compressed air and separates out the water in the compressed air. For water separation, the compressed air filter contains an automatic condensate drain which allows draining of collected condensate. The compressed air filter should be subjected to a visual check on a regular basis, and at least once a year it should be cleaned and its filter elements replaced. The purity of the compressed air determines how frequently the filter needs to be checked and cleaned.

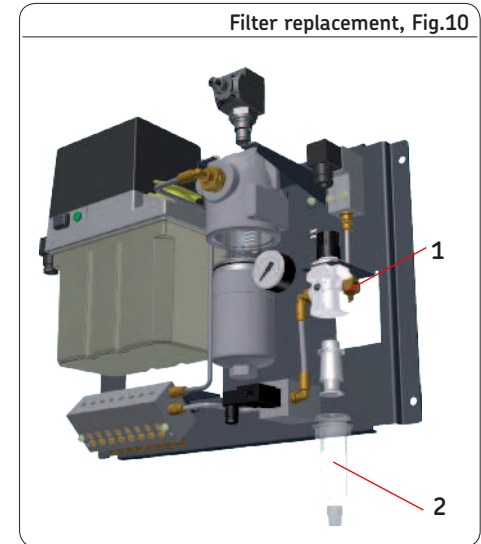
Proceed as follows.



Danger!

The oil+air lubrication unit must be depressurized before cleaning or replacing the compressed air filter element.

- Interrupt the customer-provided compressed air supply (1) to depressurize the oil+air lubrication unit.
- Once the oil+air lubrication unit has been depressurized, (**verify!**), unscrew the filter cup of the fine compressed air filter (2) by turning it counterclockwise.
- Clean filter housing.
- Replace filter element.
- Reinstall components in reverse order.



8.2.2 Cleaning the oil filter

☞ See Figure 11.



Danger!

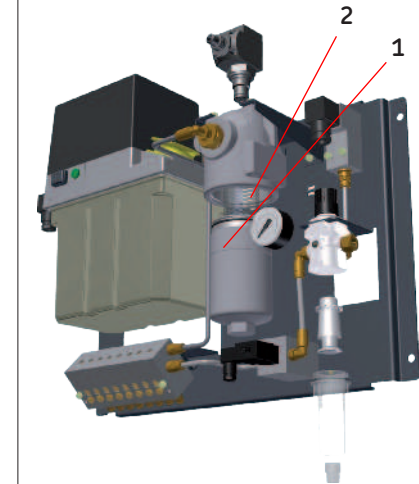
The oil+air lubrication unit must be depressurized before cleaning or replacing the oil filter element.

- To drain the lubricant in the oil filter housing (1), place an oil catch tank under the oil filter housing. Place the tank far enough away from the oil filter housing to permit loosening of the housing and removal of the filter element.
- To clean the oil filter strainer element (2), loosen and unscrew the oil filter housing (hexagon screw, WAF 13) by turning it counterclockwise.
- Remove the oil filter strainer element and clean it with appropriate cleaning agents or replace it with a new oil filter strainer element.



Observe the legal requirements and guidelines for disposal of lubricants.

Filter replacement, Fig. 11



9. Malfunctions

9.1 General information

Chapter 9.2 provides an overview of possible malfunctions and their causes. Contact the Service department of SKF Lubrication Systems Germany GmbH if you cannot remedy the malfunction.



Dismantling of the product or individual parts thereof within the statutory warranty period is not permitted and voids any claims.



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



Only original spare parts from SKF Lubrication Systems Germany GmbH may be used. You must not carry out alterations to the product or use non-original spare parts or resources. Doing so invalidates the warranty.



Danger!

Working on products that have not been disconnected from the power supply can cause serious injury or death to persons. Installation, maintenance, and repair work may only be carried out by qualified technical personnel on products that have been disconnected from the power supply. Supply voltage must be switched off before opening any of the product's components.



Danger!

The hot surface of a motor may cause burns. The surfaces of a motor should only be touched with protective gloves or when motor is no longer hot.



Danger!

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

9.2 Malfunctions and their remedies

Fault analysis and rectification, Table 4 (1 of 2)

Malfunction	Possible cause	Rectification
Motor fails to start when the operating voltage is applied	No operating voltage on motor	<ul style="list-style-type: none"> • Check mains connection. • Check mains plug/cable and connect properly if necessary. • Check operating voltage on motor. • Check fuse • Check motor circuit breaker.
	Pump or motor blocked	<ul style="list-style-type: none"> • Measure motor current. If current is impermissibly high, dismantle the pump and crank by hand; if resistance is high, replace the pump.
Motor runs with difficulty and at a low speed	Pump or motor sluggish	<ul style="list-style-type: none"> • Measure motor current. If current is impermissibly high, dismantle the pump and crank by hand; if resistance is high, replace the pump.
	Impermissible lubricant (see technical data)	<ul style="list-style-type: none"> • Remove lubricant from entire system and dispose of lubricant in the proper manner; fill system with suitable lubricant.
	Pressure too high, pressure regulating valve is jammed or defective	<ul style="list-style-type: none"> • Check pressure regulating valve and replace if necessary.
	Ambient temperature too low (see technical data)	<ul style="list-style-type: none"> • Increase ambient temperature.
Pump does not convey lubricant; no pressure build-up	Pump or motor blocked	<ul style="list-style-type: none"> • Measure motor current. If current is impermissibly high, dismantle the pump and crank by hand; if resistance is high, replace the pump.
	Incorrect rotational direction of motor	<ul style="list-style-type: none"> • Check whether rotational direction corresponds to direction indicated by arrow, change rotational direction if necessary.
	Pressure regulating valve does not close	<ul style="list-style-type: none"> • Check pressure regulating valve to make sure that cracking pressure is correct and that there is no contamination or damage. If cracking pressure is incorrect or if the pressure regulating valve is damaged, change the valve. Only use original SKF spare parts. • If contaminated, clean the pressure regulating valve.

Fault analysis and rectification, Table 4 (2 of 2)

Malfunction	Possible cause	Rectification
No pressure build-up in the main lubricant line	Air in the main lubricant line	<ul style="list-style-type: none"> • Vent main lubricant line.
	Main lubricant line leaky or break in line	<ul style="list-style-type: none"> • Repair main lubricant line.
	Pressure regulating valve does not close	<ul style="list-style-type: none"> • Check pressure regulating valve to make sure that cracking pressure is correct and that there is no contamination or damage. • If opening pressure is incorrect or if the pressure regulating valve is damaged, change the valve. Only use original SKF spare parts. • If contaminated, clean the pressure regulating valve.
	Pressure relief valve does not close	<ul style="list-style-type: none"> • Clean or replace pressure relief valve. Only use original SKF spare parts.
	Impermissible lubricant (see technical data)	<ul style="list-style-type: none"> • Remove lubricant from entire system and dispose of lubricant in the proper manner; fill system with suitable lubricant.
	Fill level too low	<ul style="list-style-type: none"> • Top up lubricant.

10. Technical data

Technical data, Table 5 (1 of 3)

Designation	Unit	Value		
Mounting position		Vertical		
Ambient temperature	°C	+ 10 to +40		
Protection class		IP54		
Oil+Air Lubrication Unit				
W x H x D dimensions with mounting plate	mm	Varies by design (see documentation)		
Weight (filled)	kg	Varies by design (see documentation)		
Number of lubrication point connections	-	1 to 8 (> 8 on request)		
Gear pump unit				
Delivery rate ¹⁾	l/min	0.2		
Rated capacity of reservoir	liter	3 (2 and 6 on request)		
Reservoir material	-	Polyamide (PA6)		
Max. operating pressure	bar	30		
Pressure relief valve	-	Included		
Pumped medium	-	Mineral or synthetic oil, compatible with NBR elastomers		
Permiss. oil viscosity	mm ² /s (cSt)	20 to 1500		
Motor	Type	Capacitor motor		Direct current motor
Rated voltage	V	115 VAC	230 VAC	24 VDC
Rated frequency	Hz	50/60	50/60	
Rated current	A	1.06/1.36	0.53/0.68	1.6
Rated output	W	60	75	39

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

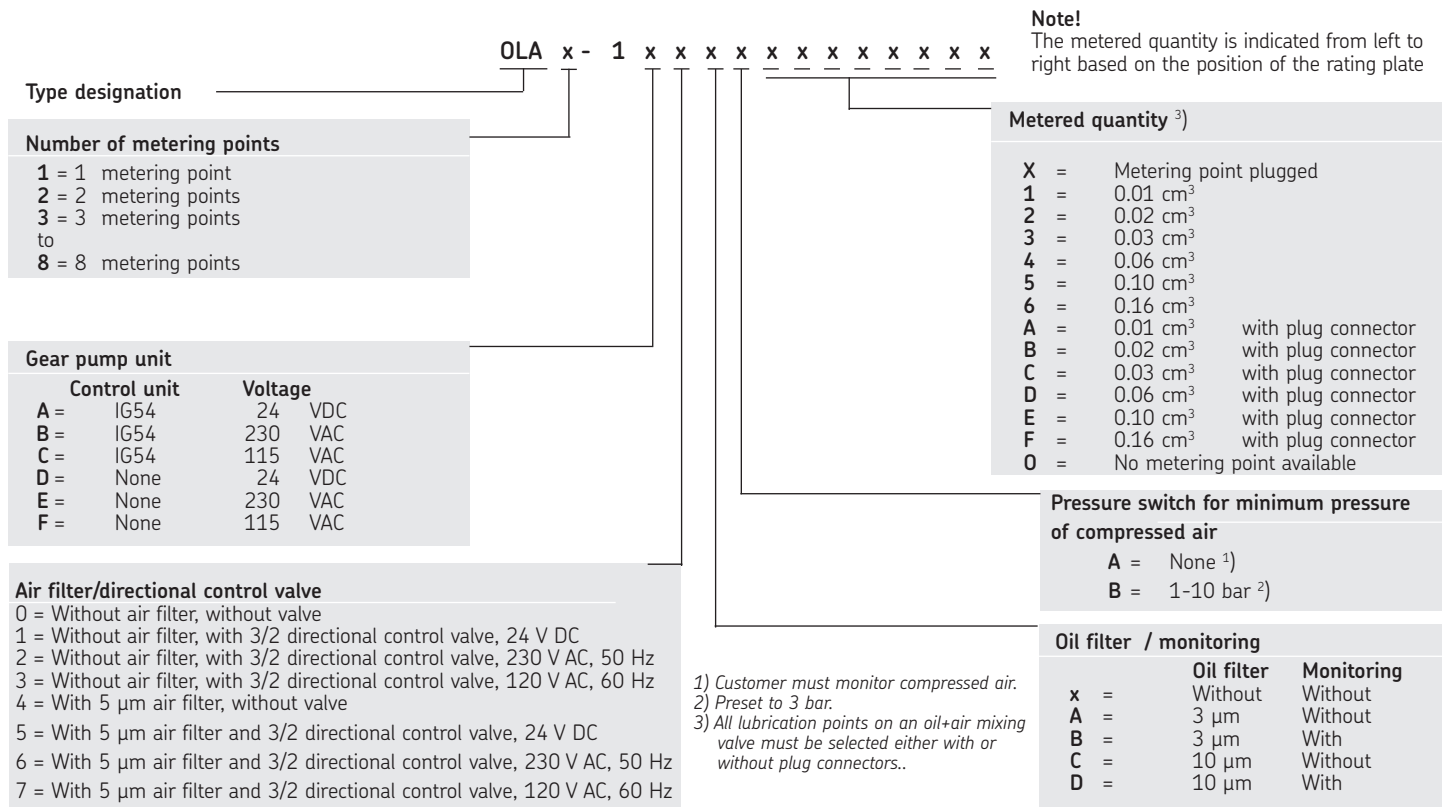
Technical data, Table 5 (2 of 3)

Designation	Unit	Value
Operating mode (per VDE 0530)	-	Standard design: S3, ON-time 20% (1.25 to 25 min) (e.g. with 1.25 min cycle time, pump operates for 15 s with 1 min interval time)
Thermal circuit breaker	-	Built-in
Oil+air mixing valve with metering		
Number of lubrication line connections per oil+air mixing valve with metering MV20x-x.. series	-	1 to 8
Quantity metered by oil+air mixing valve with metering MV20 series	mm ³	10, 20, 30, 60, 100, 160
Oil+air outlet lubrication point line	-	M8×1, counterbore for solderless tube union for tube \varnothing 4 mm
Oil inlet connection	-	M10×1, counterbore for solderless tube union for tube \varnothing 6 mm
Compressed air connection	-	M10×1, counterbore for solderless tube union for tube \varnothing 6 mm
Operating pressure	bar	3 to 10, 6 bar optimal
Air consumption (for lubrication point line with internal diameter of 2.3 mm, oil per ISO VG 32 to 100)	NI/h	1000 to 1500
Oil pressure switch (included in gear pump unit)		
Function	-	NO-contact (closes when rated pressure is reached)
Switching voltage range	V	10 to 25 AC / 10 to 36 DC
Switched current (resistive load)	A	≤ 1
Switching capacity (resistive load)	W/VA	≤ 10
Rated pressure	bar	20
Fill level switch (included in gear pump unit)		
Function	-	NC contact (opens when fill levels falls to minimum)
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

Technical data, Table 5 (3 of 3)

Designation	Unit	Value
Pressure switch for minimum air pressure (DL) Switching pressure Max. switching voltage Max. switched current Reset differential	bar V (AC) A %	0,3 to 5; set: 3 250 5 ≈15
Control unit Rated voltage Pump cycle time limit Interval time Pump delay time Prelubrication cycles	Type V (AC) V (DC) s min s -	IG54-20-S4-I 115/230 (50/60 Hz) selectable 24 (DC) 60 (non-adjustable) Set to 10 (adjustable from 1 to 99 minutes) Set to 5 (adjustable from 0-99 seconds) Set to 10 (adjustable from 0-99)
Air pressure regulating valve Pressure range	bar	0.5 to 10
3/2 directional control valve (air) (Y1) Switching voltage Switching capacity Pressure range	V W/VA bar	115 VAC, 60 Hz / 230 VAC, 50 Hz / 24 VDC 4 0 to 10
Oil (filter) contamination indicator Switching type Max. switching voltage Max. switching capacity Breaking capacity (resistive load) Opening pressure	V W/VA A bar	NC contact = alarm 100%; NO-contact = pre-warning 75% 24 (AC/DC) 15 1 (at 15 V AC/DC) Δ 5 minus 10%
Oil filter (F1) Filter fine unit Contaminant capture	μ m g	3 or 10 6.3 g at $\Delta p = 5$ bar (3 μ m) 5.2 g at $\Delta p = 5$ bar (10 μ m)

10.1 Order number coding



11. Spare parts

Oil+air lubrication unit, Fig. 12

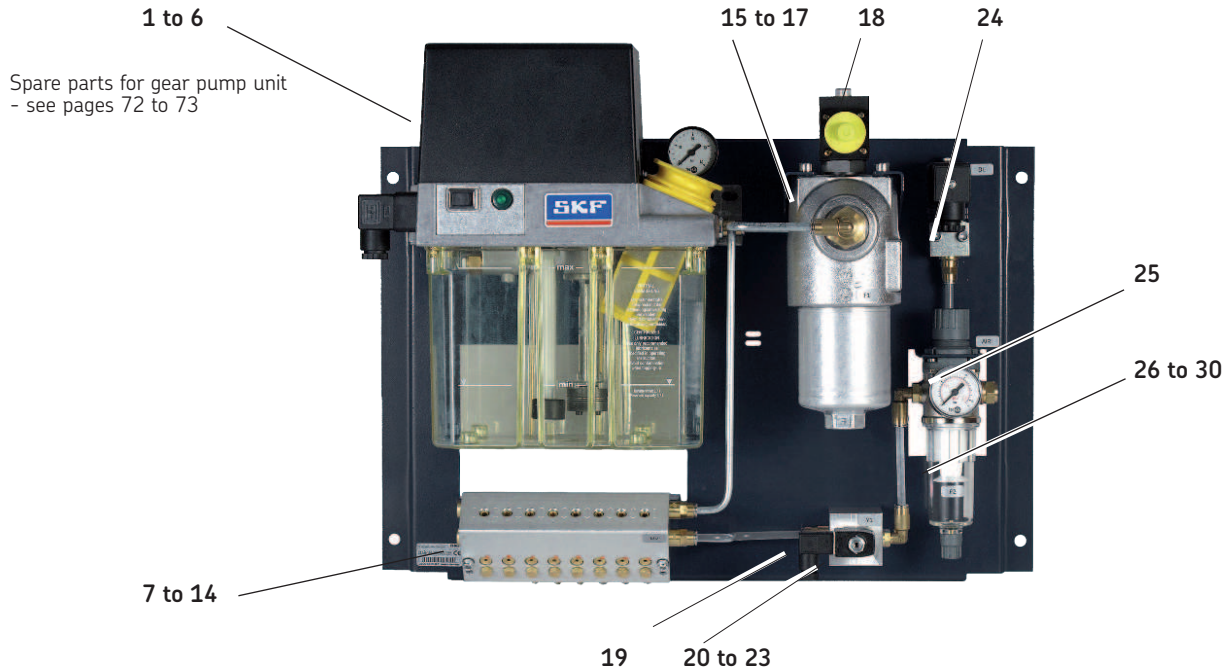


Table 6

Item	Quantity	Order No.	Designation
1	1	MKL2-12FC11000+428	Gear pump unit with IG54-20-S4-I control unit, for 230V 50/60Hz
2	1	MKL2-12FC11000+429	Gear pump unit with IG54-20-S4-I control unit, for 115V 50/60Hz
3	1	MKL2-12FC11000+924	Gear pump unit with IG54-20-S4-I control unit, for 24V DC
4	1	MKU2-12BC11000+428	Gear pump unit without control unit, for 230V 50/60Hz
5	1	MKU2-12BC11000+429	Gear pump unit without control unit, for 115V 50/60Hz
6	1	MKU2-12BC11000+924	Gear pump unit without control unit, for 24V DC
7	1	MV201-...	Oil+air mixing valve with metering, 1-port
8	1	MV202-...	Oil+air mixing valve with metering, 2-port
9	1	MV203-...	Oil+air mixing valve with metering, 3-port
10	1	MV204-...	Oil+air mixing valve with metering, 4-port
11	1	MV205-...	Oil+air mixing valve with metering, 5-port
12	1	MV206-...	Oil+air mixing valve with metering, 6-port
13	1	MV207-...	Oil+air mixing valve with metering, 7-port
14	1	MV208-...	Oil+air mixing valve with metering, 8-port
15	1	853-880-011	NG40 housing for oil filters
16	1	169-400-250	Filter element 10 µm for oil filters
17	1	169-400-260-V57	Filter element 3 µm for oil filters
18	1	176-200-009	Differential pressure switch for oil filters (contamination monitoring)
19	1	179-990-465	Connector socket for 3/2 directional control valve
20	1	221-296-027+263	3/2 directional control valve for 230V, 50Hz for air pressure
21	1	221-296-027+758	3/2 directional control valve for 120V, 60Hz for air pressure
22	1	221-296-027+924	3/2 directional control valve for 24V DC for air pressure
23	1	993-000-196	Valve body for 3/2 directional control valve
24	1	176-271-001	Pressure switch, 3 bar, for minimum pressure of compressed air
25	1	169-101-606	Pressure gauge for air pressure reducing valve
26	1	248-610.03	Sealing ring G1/8 (order for pressure gauge)
27	1	231-900-028.U1	Air pressure regulating valve +5 µm filter, complete with air filter and water separator
28	1	231-900-028	Air pressure regulating valve without air filter and water separator
29	1	231-900-035	Water separator container for air filter
30	1	231-900-034	Filter element 5µm for air filter
31	1	995-810-028	Complete documentation for oil+air unit

Gear pump unit MKX, Fig. 13

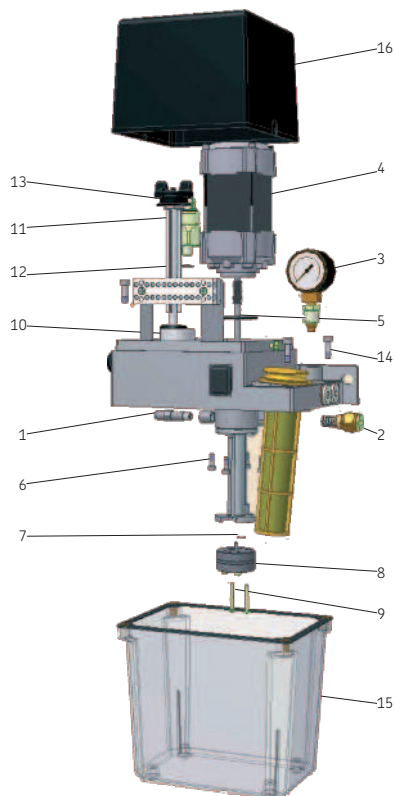


Table 6

Item	Quantity	Order No.	Designation
1	1	996-000-947	Pressure regulating valve 32 bar
2	1	MKU.U012	Pressure relief, complete
3	1	MKU.U013	Pressure gauge (with restrictor)
4	1	MKU1.U5+924 MKU2.U2+XXX ¹⁾	Motor with shaft, 24 V DC Motor with shaft, 115/230 VAC
5	1	WVN501-32.2x3	O-ring for sealing between motor and cover
6	4	911-204-122	Cheese-head screw for motor fastening
7	1	WVN501-5.28x1.78	O-ring for sealing between pump and flange pipe
8	1	ZP120-2	Gear pump, delivery rate 0.2 l/min, 0.1 l/min with 24 V DC.
9	2	834-240-018	Screw M3x25 Tx10, fastening for ZP120-2
10	1	179-340-090 179-340-091	Capacitor 4 UF/450 V for 230 V AC (+428) Capacitor 16 UF/220 V for 115 V AC (+429)
11	1	176-112-020	Oil pressure switch 20 bar, function NO-contact
12	1	WVN501-10.5x1.5	O-ring, seal for oil pressure switch
13	1	MKU.U016	Fill level switch, complete, for oil, 3-liter unit, NC contact function
14	6	911-205-181	Cheese-head screw, reservoir fastening
15	1	BK3.U147	3-liter plastic reservoir with seal
16	1	898-660-056	Cover
17	1	IG54-20-S4-I+XXX ²⁾	Control unit (not shown)
18	1	179-990-033	Cable socket (not shown)
19	1	179-990-206	Equipment protection for 24 V DC units (not shown)

1) When ordering, add the voltage key to the material number. 230 V AC (+428); 115 V AC (+429)

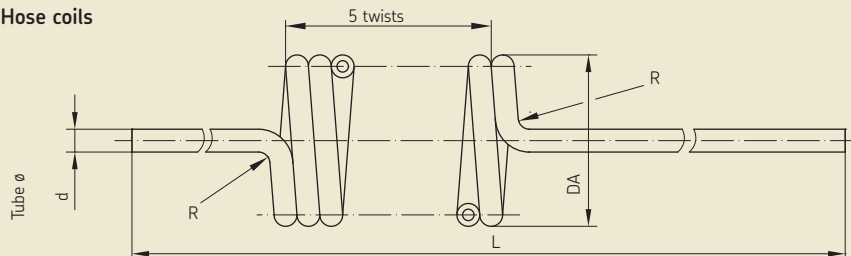
2) When ordering, add the voltage key to the material number. 230/115 V AC (+471); 24 V DC (+472)

12. Accessories

Hose coils

Order No.	Tube \varnothing [mm]	DA [mm]	L [mm]	R [mm]
828-090-004	4x0.85	30	2545	14
828-090-020	4x0.85	30	10545	14
828-090-021	4x0.85	30	4045	14

Hose coils



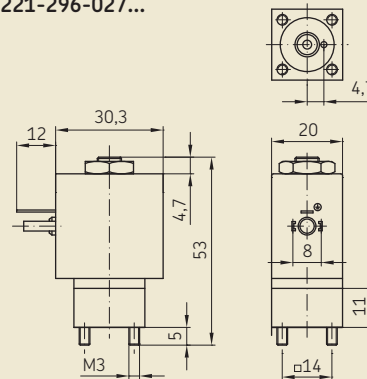
3/2 directional control valve

Order numbers

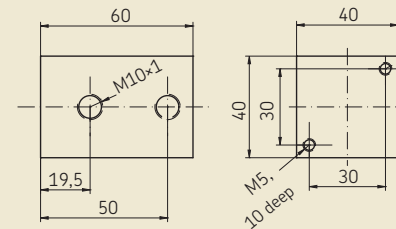
230 V AC, 50 Hz	221-296-027+363
120 V AC, 60 Hz	221-296-027+758
24 V DC	221-296-027+924
Valve body	993-000-196

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

221-296-027...



993-000-196 (valve body)



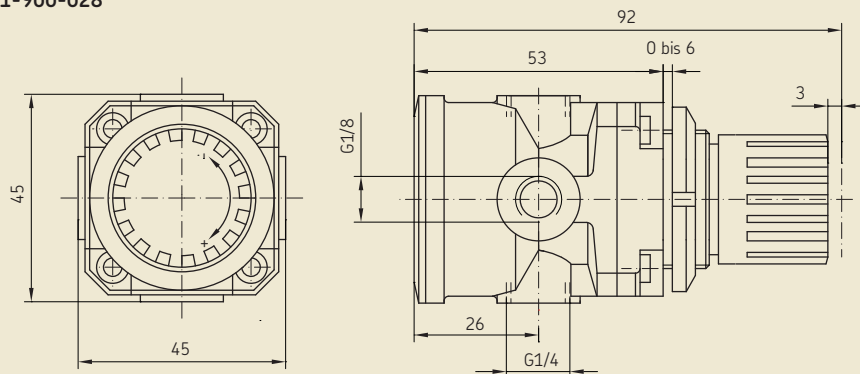
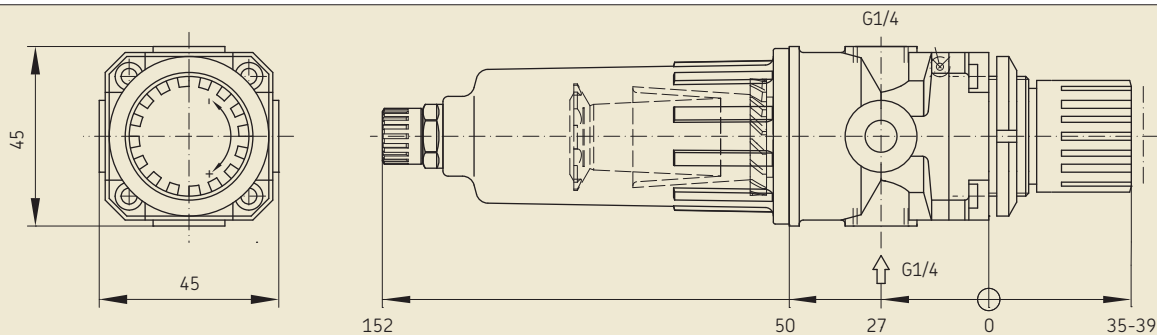
Air pressure regulating valve

Order No. **231-900-028**
 Type Diaphragm regulator
 Max. primary pressure 0-16 bar
 Secondary pressure 0.5-10 bar
 Operating temperature 0-80 °C

Sealing material NBR

Air pressure regulating valve incl. filter and water separator

Order No. **231-900-028.U1**
 Filter 5 µm

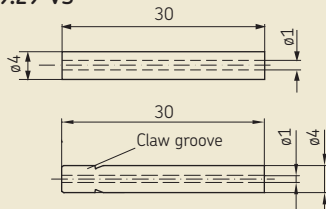
231-900-028**231-900-028.U1**

Nozzles

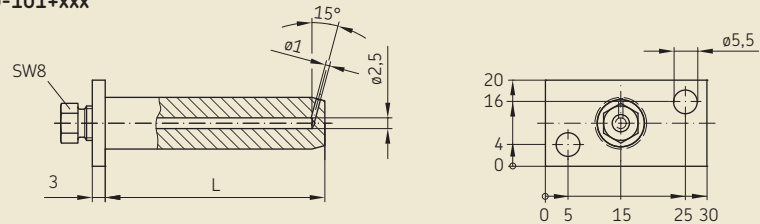
Order No.	Description
169-000-101+xxx ¹⁾	Nozzle for tube $\varnothing 4$ mm L=15–120 mm
169-000-102+xxx ¹⁾	Double nozzle for tube $\varnothing 4$ mm L=15–120 mm
P-89.29	Nozzle for tube $\varnothing 4$ mm, stainless steel
P-89.29-S3	Nozzle for tube $\varnothing 4$ mm, stainless steel
P-89.29-VS	Nozzle for tube $\varnothing 4$ mm, with claw groove for SKF plug connectors

¹⁾ Specify the desired length L for xxx

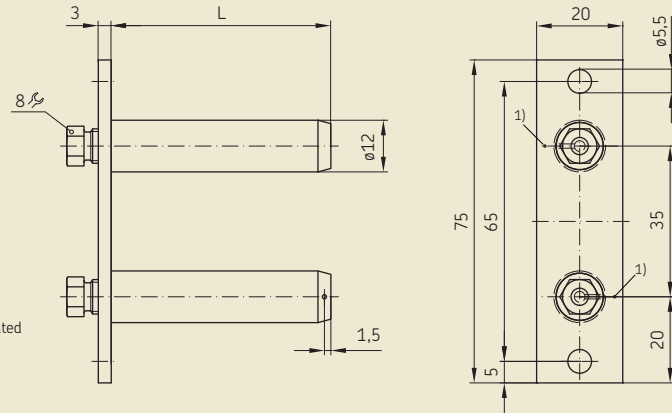
P-89.29(-S3)
P-89.29-VS



169-000-101+xxx



169-000-102-xxx

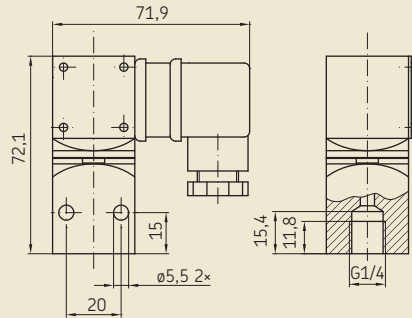


¹⁾ Spray direction is indicated
by marking

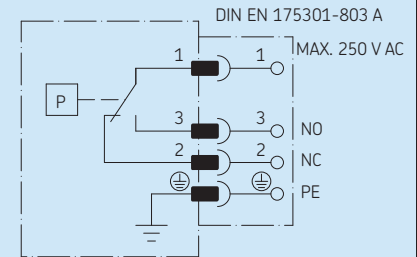
Pressure switch for minimum pressure of compressed air

Order No. **176-271-001**
 Contact type. Changeover
 Adjustment range 1-10 bar
 (preset to 3 bar)
 Max. switching voltage 250 V AC
 Max. switched current 5 A
 Reset differential. 15%

176-271-001



176-271-001 wiring diagram

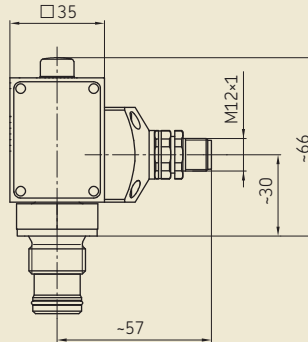


Contact position shown: Switch depressurized

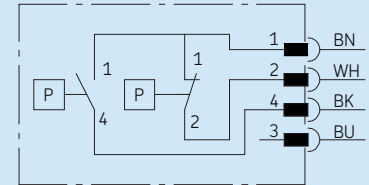
Differential pressure switch for contamination monitoring

Order No. **176-200-009**
 Contact type. 1×NC contact,
 1× NO-contact
 Max. voltage. 24 V AC/DC
 Max. switching capacity 15 VA/W
 Opening pressure Δ5 bar -10 %
 Max. operating pressure. 420 bar

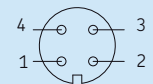
176-200-009



176-200-009 wiring diagram

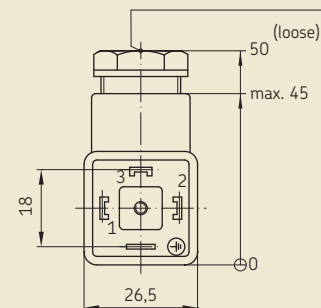


BN = +24 V DC
 WH = 100% alarm (NC)
 BK = 75% pre-warning (NO)
 BU = PIN 3 not assigned
 Contact position shown: filter free



Square connector

Order No.	Designation
179-990-033	Cable socket per DIN EN 175301-803A Cable diameter 6–10 mm

179-990-033**179-990-033**Cable gland M16x1.5
for cable diameter 6–10**Circular connector M12x1**

Order No.	Designation
179-990-371	Cable socket, straight (A)
179-990-600	Cable socket, straight, with molded cable (B)
179-990-372	Cable socket, angled (C)
179-990-601	Cable socket, angled, with molded cable (5 m, 4×0.25 mm ²) (D)

Circular connector

A



B



C



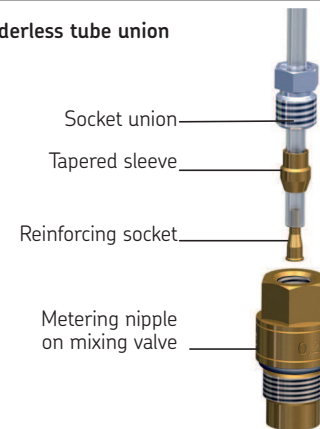
D



Tube unionsfor plastic tubing $\varnothing 4$ mm

Order No. Designation

404-003-VS	SKF plug connectors
404-612	Socket union for Solderless tube union
404-611	Tapered sleeve for solderless tube union
404-603	Reinforcing socket for solderless tube union

SKF plug connectors**Solderless tube union****Plugs for metering points**

Order No. Designation

404-011.U1	Screw plug with copper ring for solderless tube union
450-204-002	Locking pin for SKF plug connectors

Locking pin**Screw plug**

951-170-004-EN

Version 04

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