

# Oil + Air-Lubrication System

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

Product line:

OLAxx-...

## Owner's Manual - Containing Installation, Operation and Maintenance Instructions

(Original installation instructions in accordance with EC-Machinery Directive 2006/42/EC)

Version 05

**WARNING:**

Read this owner's manual before installing, operating or maintaining the product. Failure to follow the instructions and safety precautions in this owner's manual could result in serious injury, death, or property damage. Keep for future reference.



## Masthead

This owner's manual - containing installation, operation and maintenance instructions complies with EC-Machinery Directive 2006/42/EC and is an integral part of the described product. It must be kept for future use.

This owner's manual - containing installation, operation and maintenance instructions was created in accordance with the valid standards and regulations on documentation, VDI 4500 and EN 292.

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## Information concerning the EC Declaration of Incorporation

For the product(s) designated below:

### Oil-Air Lubrication System

Product line:

OLAxx-...

SKF herewith certifies that it conforms to the pertinent safety requirements set forth in the following Council Directive(s) for the harmonisation of the laws of the Member States...

- **Machinery Directive 2006/42/EC**
- **Electromagnetic compatibility 2014/30/EU**
- **RoHS Directive 2011/65/EU**

SKF further declares that the above mentioned product is meant for integration into a machinery / for connection to other machinery according to the **EC-Machinery Directive 2006/42/EC, Appendix II Part B**. Starting up the product is not permissible until it is assured that the machinery, vehicle or the like in which the product was installed meets the provisions and requirements of the regulations set forth in the EC Directive 2006/42/EC.

#### Notes:

- (a) This declaration certifies conformity with the aforementioned directive(s), but does not contain any assurance of properties.
- (b) The safety instructions in the owner's manual must be observed.
- (c) The certified product must not be started up until it is confirmed that the equipment, machinery, vehicle or the like in which the product was installed meets the provisions and requirements of the national directives to be applied. This is in particular important for the implementation of the Use of Work Directive.
- (d) Operation of the products on non-standard main voltage as well as nonobservance of installation instructions can affect the EMC properties and electrical safety.

#### Notes on the Low Voltage Directive 2014/35/EU

The protective regulations of the Low Voltage Directive 2014/35/EU are fulfilled according to annex I (1.5.1) of Machinery Directive 2006/42/EC.

#### Notes on the Pressure Equipment Directive 2014/68/EU

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

The EC Declaration of Incorporation is part of the product documentation. This document is delivered with the product.

## Safety information in owner's manual

### Meaning of symbols and corresponding information

In this owner's manual, the symbols and words shown on this page are meant to communicate a particular risk to persons, material assets, or the environment.

Be sure all persons exposed to these risks read this manual. Keep it near the equipment for future reference.

#### Hazard symbols

Symbole	Standard	Use
	DIN 4844-2 W000	General risk of injury or damage
	DIN 4844-2 W008	Voltage
	DIN 4844-2 W026	Hot surface
	DIN 4844-2 W028	Slip hazard

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

- ) Rotational direction arrow
- ) Fluid connection label

#### Keywords in safety informations and their meanings

Keyword	Use
Danger!	Indicates a danger of injury to persons
Caution!	Indicates a danger of damage to property or the environment
Notice!	Indicates additional information

Read this Owner's Manual before installing, operating or maintaining the product. Failure to follow the instructions and safety precautions in this owner's manual could result in serious injury, death, or property damage. Keep for future reference.

**Note:** Not every symbol and corresponding information described in the Safety Information is used in this owner's manual.

#### Information symbols

Symbol	Use
	Prompts you to take action
•	Indicates other issues, causes or circumstances
)	Used for bulleted lists
➔	Provides additional information
	Prompts you to take action

## 1. Safety information



These instructions must be read and understood by all persons who are involved with the installation, operation, maintenance, and repair of the product. These instructions must be kept close to the equipment for future reference.



Note that these installation instructions is an integral part of the product. It must be handed over to the new operator of the product if the product is sold.

The described product was manufactured in accordance with all generally acknowledged regulations pertaining to technology, occupational safety, and accident prevention. However, dangers that can cause physical injury to persons or damage to other material assets might still occur during the use of the product. This product should only be operated if it has been installed in accordance with these instructions and is safe to operate. In particular, malfunctions that might affect the safety of the product must be rectified immediately.



In addition to the information provided in the installation instructions, all generally applicable regulations on accident prevention and the environment must be observed.

### 1.1 Intended use



All SKF Lubrication Systems Germany GmbH products must only be used for their intended purpose and in accordance with the specifications of the installation instructions for the product in question.

The described product is for supplying centralized lubrication systems with lubricant and is intended for use in centralized lubrication systems. Any other use of this product constitutes improper use.

Hazardous materials of any kind, especially the materials classified as hazardous by CLP Regulation EC 1272/2008 may only be used to fill SKF centralized lubrication systems and components and delivered and/or distributed with the same after consulting with and receiving written approval from SKF.

None of the products manufactured by SKF Lubrication Systems Germany GmbH can be used with gases, liquefied gases, gases dissolved under pressure, steams or fluids that will reach a steam pressure of more than 0.5 bar above the normal atmospheric pressure (1013 mbar) in the permissible application temperature range.

Unless otherwise noted, products of SKF Lubrication Systems Germany GmbH must not be used in conjunction with explosive atmospheres according to the ATEX-Directive 94/9/EC.

### 1.2 Authorized personnel

The products described in the installation instructions may only be installed, operated, maintained, and repaired by qualified experts. Qualified experts are persons who have been trained, instructed, and familiarized with the end product into which the described product is installed. These persons are considered capable of such tasks due to their education, training, and experience with valid standards, conditions, accident prevention regulations, and installation measures. They should be able to carry out the required tasks and to recognize - and thus avoid - any dangers that might otherwise occur.

A definition of what constitutes a qualified person and who are unqualified persons are stipulated in DIN VDE 0105 and IEC 364.

### 1.3 Danger relating to electric current

The electrical connection for the described product may only be established by qualified, instructed persons who have been authorized by the operator or owner to carry out this task. All local electrical operating conditions and regulations such as DIN and VDE must be observed. Improperly connected products can result in considerable damage to property and serious injury to persons.

**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 experts on products that have been disconnected from the power supply. The supply voltage must be turned off before any product components are opened.

### 1.4 Danger relating to system pressure

**Danger!**

Centralized lubrication systems are under pressure when they are being operated. Such systems must therefore be depressurized before starting installation, maintenance, or repair work and before making any changes to the system.

### 1.5 Danger relating to compressed air

**Danger!**

The described product may be under pressure when it is being operated. The product must therefore be depressurized before starting installation, maintenance, or repair work and before making any changes to the system.

The oil+air metering units are operated with compressed air.

### 1.6 Warranty and liability

SKF Lubrication Systems Germany GmbH assumes no warranty and liability if one of the following circumstance should occur:

- ) Not intended use
- ) Improper installation/disassembly or improper operation of the product
- ) Use of contaminated lubricants or lubricants which are not approved
- ) Improper maintenance or repairing of the product
- ) Using of unoriginal SKF Lubrication Systems Germany GmbH spare parts
- ) Making alterations or modifications to the product, which are not approved and signed by SKF Lubrication Systems Germany GmbH
- ) Non-observance of the advices about transport and storage

## 2. Lubricants

### 2.1 General information



All SKF Lubrication Systems Germany GmbH products must only be used for their intended purpose and in accordance with the specifications of the installation instructions for the product in question.

The intended use of this product is for the centralized lubrication/lubrication of bearings and wear points with lubricants. All physical limitations of use stipulated in the documentation of the product such as the owner's manual, technical drawings and catalogues must be observed.

Note that hazardous substances of any kind and - in particular - the substances that are classed as hazardous in accordance with EC-Directive 67/548/EC Article 2, Paragraph 2 may only be inserted into and conveyed/distributed by centralized lubrication systems and components following consultation with SKF Lubrication Systems Germany GmbH and with the express written permission of the company.

Products manufactured by SKF Lubrication Systems Germany GmbH are not approved for use in conjunction with gases, liquefied gases, gases dissolved under pressure, vapours, and fluids with a vapour pressure of more than 0.5 bar above

normal atmospheric pressure (1013 mbar) at the maximum permitted temperature.

Should there be a need to use the product to convey media other than lubricants or hazardous substances, this must be discussed with SKF Lubrication Systems Germany GmbH first and the company must give express written permission.

In the opinion of SKF Lubrication Systems Germany GmbH, lubricants constitute a design element that must be considered when selecting components and designing centralized lubrication systems. The lubrication properties of the lubricants in question must be considered.

### 2.2 Selection of lubricants



You must observe the machinery manufacturer's information on the lubricants to be used in the machinery.



#### **Caution!**

The manufacturer of the bearing or machinery to be lubricated will specify the lubricant requirements for each point to be lubricated. You must make sure that the required quantity of lubricant is provided to the relevant lubricating point. If a lubricating point is insufficiently lubricated, the bearing may become damaged or jammed.

While the machinery/bearing manufacturer usually specifies lubricants, it is the owner/operator (or maintenance person) who must finally select the appropriate lubricant, with the help of the lubricant supplier. When selecting a lubricant, the type of bearing/wear point, the stresses and strains to be expected during operation, and anticipated ambient conditions must be taken into account. All financial/economic aspects must also be considered.



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

If you have further questions, you can contact SKF Lubrication Systems Germany GmbH. We can test lubricants in our own laboratory to establish their suitability for conveyance (e.g. 'oil separation' behaviour) in centralized lubrication systems. You can request an overview of lubricant tests offered by SKF Lubrication Systems Germany GmbH from our Service department.

### 2.3 Approved lubricants



#### Caution!

Only lubricants that have been approved by SKF for use with the product may be used. Unsuitable lubricants can cause product malfunctions and damage to property.



#### Caution!

Different lubricants must not be mixed together. Doing so can cause damage and require extensive cleaning of the products/centralized lubrication system. To prevent confusion, we recommend that you attach information indicating the lubricant to be used on the lubricant reservoir.

The described product can be operated with lubricants that comply with the specifications in the technical data.

Note that some lubricants may have properties that lie within the permitted limit values and yet not be suitable for use in centralized lubrication systems for other reasons. For example, some synthetic lubricants are not compatible 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.

**Table 1: Permitted oils**

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

### 2.4 Lubricants and the environment



#### Caution!

Lubricants can contaminate the ground and watercourses. Lubricants must be used and disposed of properly. Country specific regulations and laws on the use and disposal of lubricants must be observed.

Note that lubricants are harmful to the environment and flammable; their transportation, storage, and processing are subject to special precautionary measures. For specifications on transportation, storage, processing, and dangers to the use and the environment for the lubricant, refer to the material safety data sheet provided by or available from the lubricant manufacturer. You can ask the manufacturer of the lubricant for the material safety data sheet.

## 2.5 Danger relating to lubricants



### **Danger!**

Centralized lubrication systems must be leak-tight. Leaking centralized lubrication systems can cause a slip hazard. When performing installation, maintenance, and repairs test the centralized lubrication system for leaks. Leaky parts of the centralized lubrication system or components of the lubrication equipment have to be sealed immediately.

Leaking centralized lubrication systems or components of the lubrication equipment are a source of danger in relation to slip hazard and the risk of injury. These dangers can cause physical injury to persons or damage to other material assets.



Lubricants are hazardous substance. Refer to safety precautions in the lubricant manufacturer's material safety data sheet.

You can ask the manufacturer of the lubricant for the material safety data sheet.

## 3. Design and function

### 3.1 General information

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

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

### 3.2 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 metering unit, 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 oil flow is generated by a lubrication point line that is at least 1 m long between the metering device and the entrance to the lubrication point. This oil flow exits the lubrication point line as fine oil droplets and is fed to the lubrication point. The oil droplets fed to the lubrication point lubricate the friction partners, while the compressed air is discharged into the surroundings nearly free of oil.

### 3.3 Fields of application

Oil + air lubrication systems 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 high-speed transport chain conveyors that do not support intermittent lubricant feeding due to their high rotating speed. In production processes for textile fibers, an oil + air lubrication system can be used to apply minimal quantities of lubricant (gripper lubrication).

### 3.4 Design

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

The basic design of an oil + air lubrication system consists of the following components (Fig. 1):

- ) Compact unit with or without control unit (Fig. 1 shows compact unit without control unit) and with gear pump (1), lubricant reservoir (2), the valve set required for pressure relief and regulation, a pressure switch for electrical monitoring of oil pressure build-up, a pressure gauge (4) for visual monitoring of oil pressure build-up, and a fill level switch for fill level monitoring.
- ) Pressure control valve with pressure gauge (6) for compressed air control

- ) Pressure switch (8) for monitoring of minimum air pressure
- ) Oil + air metering unit (9) for metering oil and admixing compressed air

The components in the basic design are arranged on a mounting plate and supplied as a complete oil + air lubrication system.

If necessary, additional components can optionally be integrated into the oil + air lubrication system, for example:

- ) Oil filters (with or without electrical contamination monitoring)
- ) Air filters (with or without electrical contamination monitoring)
- ) Additional pressure switches for lubricant and compressed air monitoring
- ) Flow sensors for monitoring lubricant transport in lubrication lines
- ) Flow sensors for monitoring lubricant transport (oil streak) in lubrication point lines

For detailed information about the components installed in a special oil + air lubrication system, see the documentation of the oil + air lubrication system.



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

### 3.5 Description of components

Figure 1 shows an oil + air lubrication system; Figures 2 and 3 show the various oil + air metering units. Figure 4 shows the hydraulic diagram of an oil + air lubrication system.

#### Compact unit without control unit (1)

The compact unit without control unit (1) consists of a gear pump, lubricant reservoir (2), the valve set required for pressure relief and regulation, a pressure switch for electrical monitoring of oil pressure build-up in the main lubricant line, a pressure gauge (4) for visual monitoring of oil pressure build-up in the main lubricant line, and a fill level switch for fill level monitoring.

Compact units are available in model designs with or without a control unit. In the model design without a control unit, the compact unit (and thereby the lubrication interval) is controlled by the control unit of the machine that the oil + air lubrication system is mounted on. In the model design with a control unit, the compact unit is equipped with an electronic control unit that controls the compact unit (and thereby the lubrication interval).

Details on the function and operation of the compact unit and the electronic control unit can be found in the assembly instructions for the compact unit and the operating instructions for the electronic control unit which are included in the scope of delivery of the oil + air lubrication system.

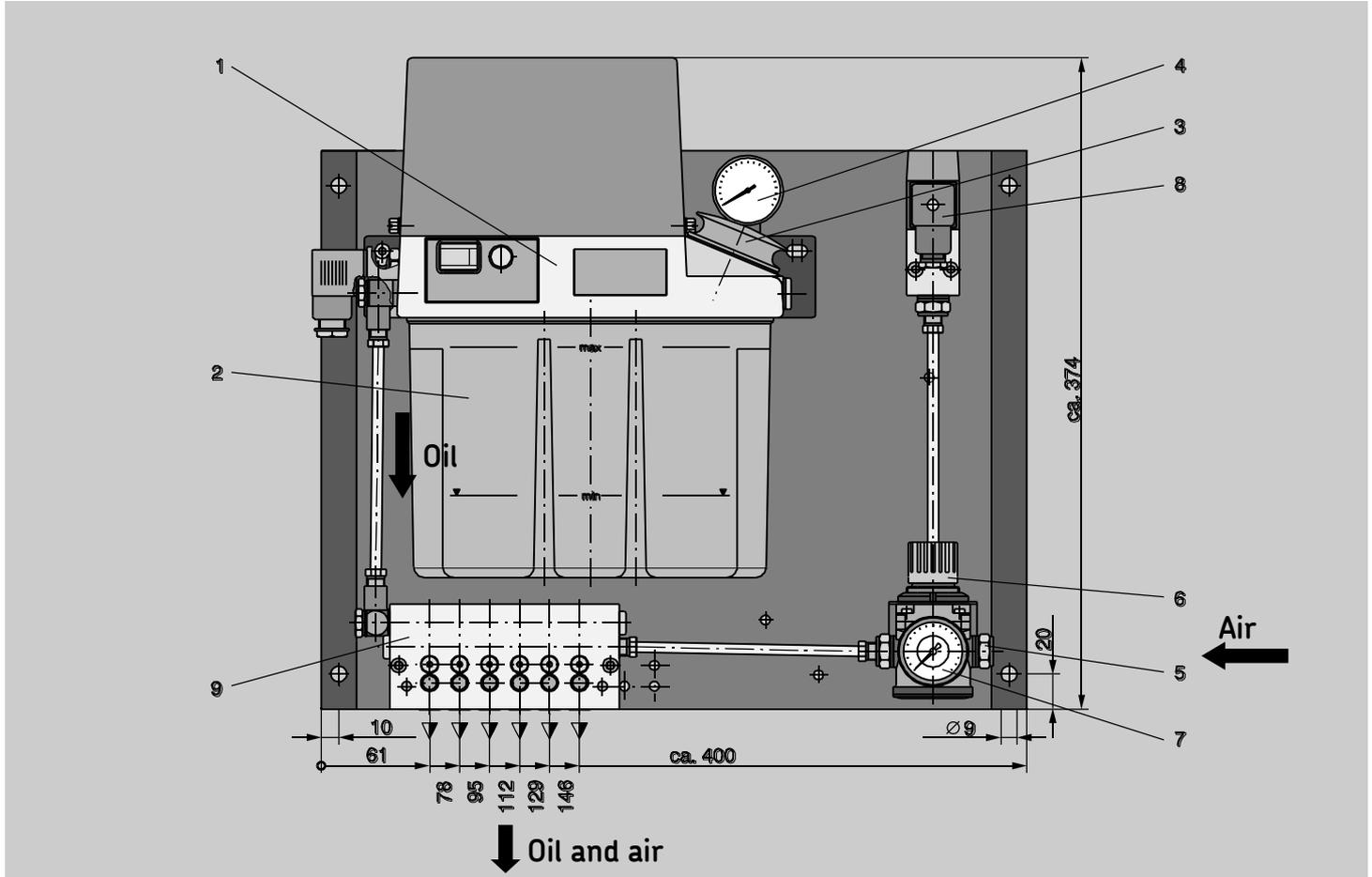
#### Compressed air control valve (6)

The compressed air control valve (6) is used to set the air pressure of the compressed air fed to the oil + air metering unit and the lubrication point lines. The compressed air transports the oil streak on the inner wall of the lubrication point line, starting from the oil + air metering unit, 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 can optionally be used.

**Figure 1. Design of an electrically driven oil + air lubrication system (schematic diagram, subject to change)**

- 1 Compact 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 metering unit**

Figure 1: Design of an electrically driven oil + air lubrication system



**Pressure switch for minimum air pressure (8)**

The pressure switch for minimum air pressure (8) is used to continuously monitor the air pressure set on the pressure control valve. As soon as the air pressure set on the pressure control 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 compact 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.

**Figure 2: MV20X-20 oil + air metering unit (schematic diagram, subject to change)**

**9 Oil + air metering unit**

**10 Air adjustment screws**

**11 Connection for lubrication point lines**

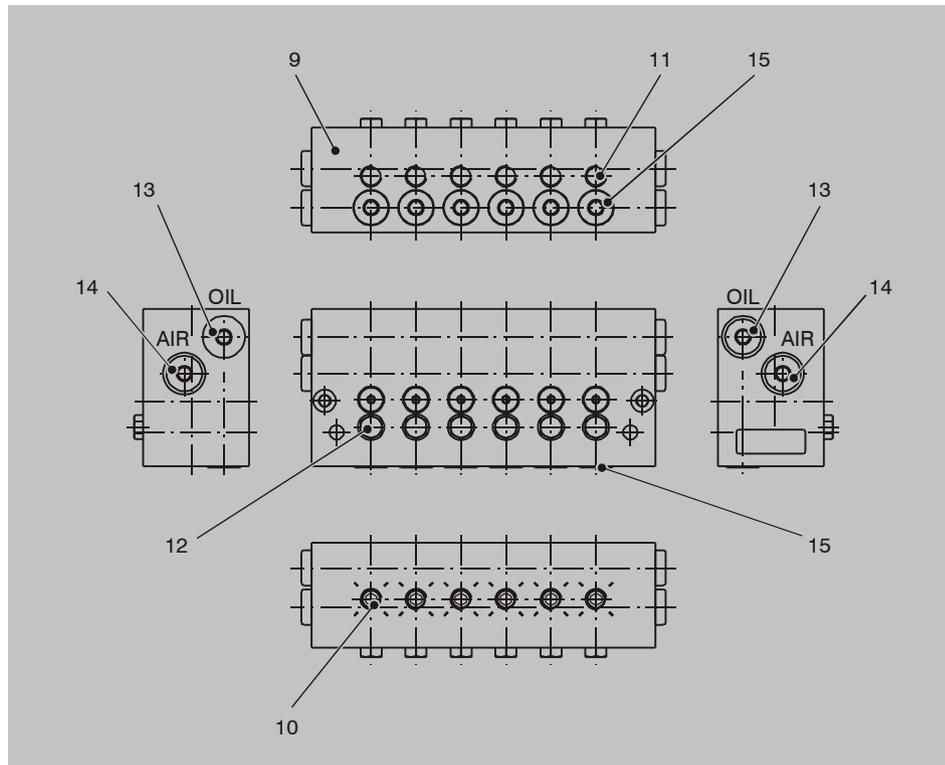
**12 Pressure gauge connection (M5 thread)**

**13 Connection for main lubricant line (on left or right side)**

**14 Connection for compressed air line (on left or right side)**

**15 Screw plug for integrating metering units**

**Figure 2: MV20X-20 oil + air metering unit**



### Oil + air metering unit (9)

Oil + air metering units are available in two different model designs which differ in terms of available metered quantities of lubricant (see Table 5, Chap. 6.4). The MV20X-20 model design (Fig. 2) is designed for metered quantities between 10 mm<sup>3</sup> and 160 mm<sup>3</sup> (six gradients). The MV50X model design (Fig. 3) supports metered quantities of 2 mm<sup>3</sup> and 6 mm<sup>3</sup>.

An oil + air metering unit (Fig. 2 and 3) consists of a valve block in compact design with a maximum of six (MV50X) or a maximum of eight (MV20X-20) lubrication line connections. Multiple oil + air metering units can be connected in series if more lubrication line connections are required. In the oil + air metering unit, the lubricant is separately metered for each lubrication point and transported by the air stream into the lubrication point line and through to the lubrication point. The air stream required for each lubrication point can be set individually using the air regulating screws in the oil + air metering units.

### Figure 3: MV50X oil + air metering unit (schematic diagram, subject to change)

9 Oil + air metering unit

10 Air adjustment screws

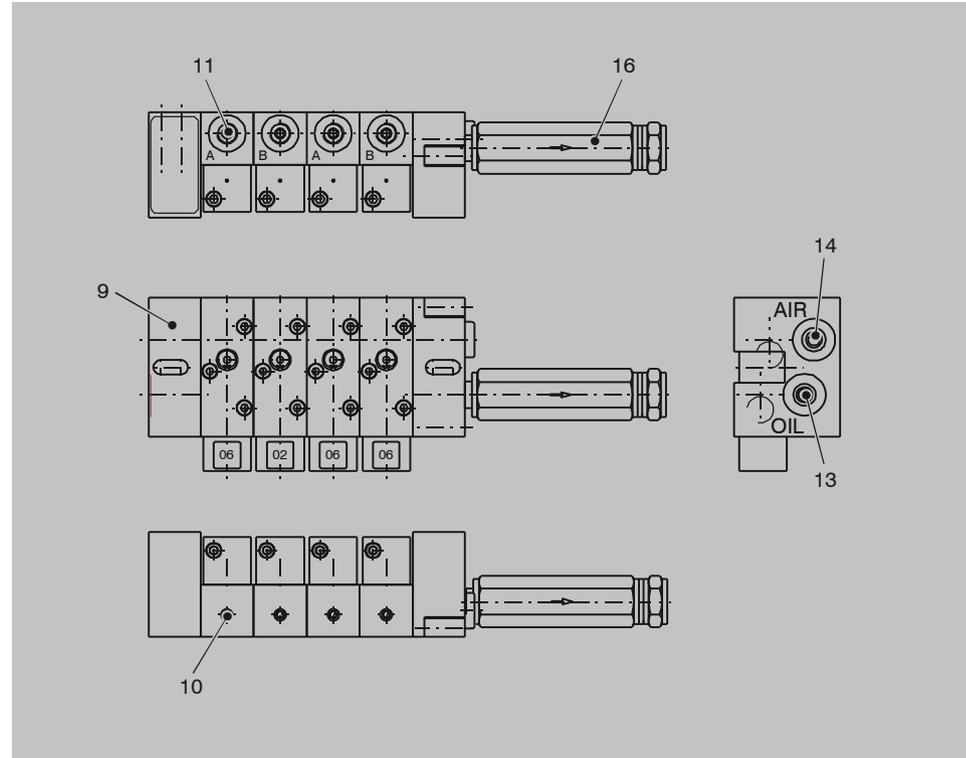
11 Connection for lubrication point lines

13 Connection for main lubricant line (on left or right side)

14 Connection for compressed air line (on left or right side)

16 Pressure-regulating valve

Figure 3: MV50X oil + air metering unit



The oil + air metering units of the MV50X series contain an externally mounted pressure-regulating valve (Item 16, Fig. 3) with a cracking pressure of 23 bar. The pressure-regulating valve is necessary in order to ensure automatic venting of the main lubricant line (supply of lubricant from compact unit to oil + air metering unit) and the oil + air metering unit under operating conditions.

The pressure-regulating valve is connected to the compact unit's return connection via a return line to feed discharged lubricant back into the lubricant reservoir. Venting is performed automatically at the start of each lubricating cycle (start-up of the compact unit) and ensures bubble-free supply of lubricant to the MV50X oil + air metering unit. If multiple oil + air metering units are connected in series, the pressure-regulating valve must always be positioned after the last metering point (starting from the main lubricant line connection of the oil + air metering unit).

**Caution!**

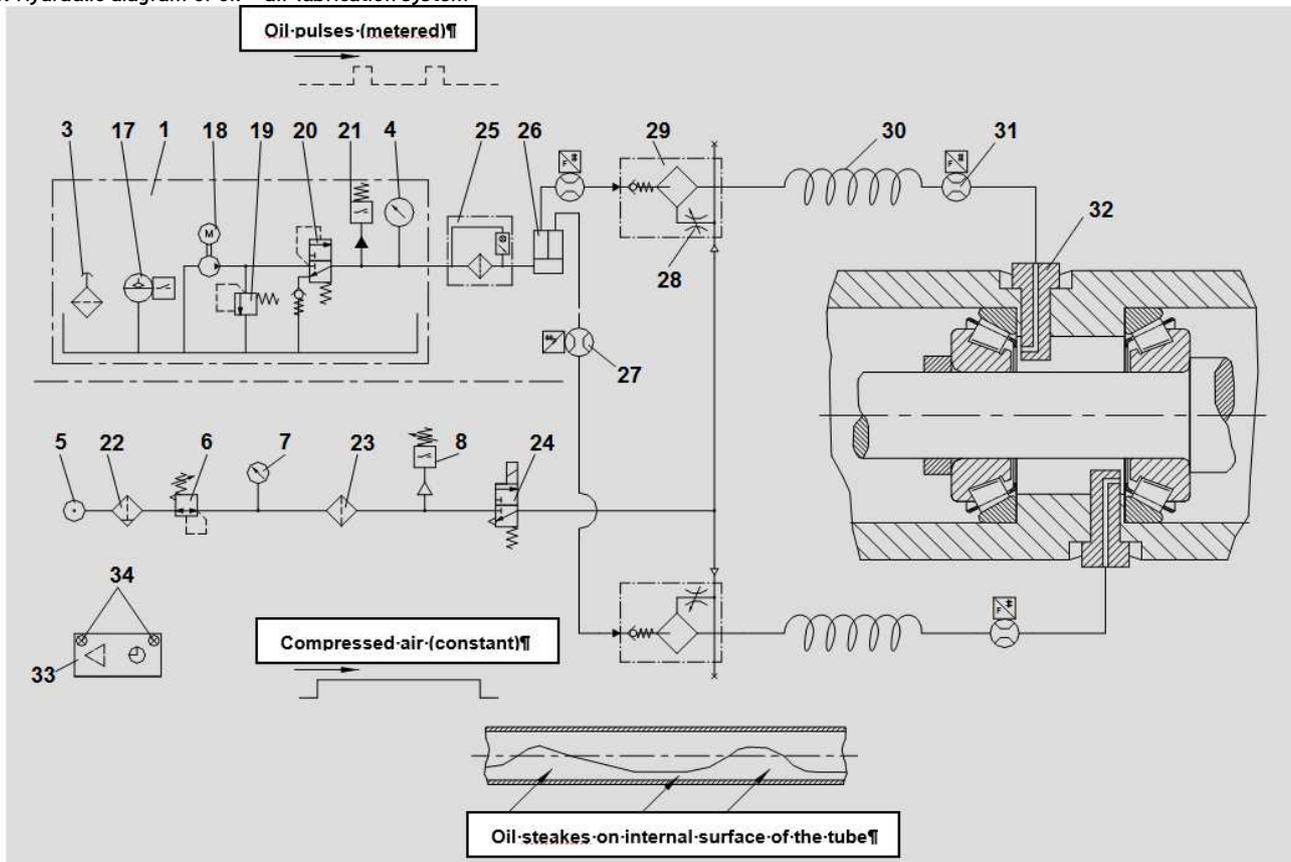
On oil + air metering units of the MV50X series, only one pressure-regulating valve (23 bar) can be installed after the last metering point.

Oil + air metering units of series MV50X and MV20X-20 can be combined and utilized together in an oil + air lubrication system. This allows the system to cover the entire potential metering range from 2 mm<sup>3</sup> to 160 mm<sup>3</sup>.

**Figure 4. Hydraulic diagram of an oil + air lubrication system (schematic diagram, subject to change)**

- 1 Compact unit
- 3 Filler socket
- 4 Oil pressure gauge
- 5 Compressed air connection
- 6 Pressure reducing valve
- 7 Air pressure gauge
- 8 Pressure switch (for compressed air)
- 17 Fill level switch
- 18 Gear pump with motor
- 19 Pressure-regulating valve
- 20 Pressure relief and residual-pressure valve
- 21 Pressure switch (for required oil pressure)
- 22 Air filter with liquid separator
- 23 Air filter (microfilter)
- 24 3/2 directional control valve
- 25 Oil filter with contamination indicator
- 26 Lubricant distributor
- 27 Flow sensor
- 28 Air restrictor
- 29 Mixing valve
- 30 Hose coil
- 31 Oil-streak sensor
- 32 Nozzle
- 33 Control and monitoring
- 34 Indicator lamps

Figure 4: Hydraulic diagram of oil + air lubrication system



### 3.6 Function

A lubricating cycle of an oil + air lubrication system consisting of a compact unit and an oil + air metering unit is described below.

After the electric motor is switched on, the lubricant is drawn out of the lubricant reservoir by the gear pump and fed through the main lubricant line to the oil + air metering unit via the pressure relief valve and the pressure-regulating valve. The oil pressure built up meters the lubricant in the oil + air metering unit separately for each lubrication point. The compressed air fed to the oil + air metering unit delivers the metered quantity of lubricant from the valve block 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 pipe wall towards the lubrication point. At the lubrication point, the lubricant is fed to the bearing/friction partners as fine droplets. 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 metering unit from the spring chamber into the metering chamber.

The oil + air lubrication system is ready for the next lubricating cycle.

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 metering unit 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 the lubricating cycle is monitored by the electrical pressure switches installed in the compact unit. If present, the operating pressure is also monitored visually by a pressure gauge installed on the compact unit. The signal from the pressure switch is evaluated either directly by the machine control unit (compact unit without control unit) or by the electronic control unit (compact unit with control unit).

An oil + air lubrication system operates cyclically, i.e., a lubricating cycle 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.

Note that the electric motor of the compact 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 (compact unit without control unit) or by the electronic control unit (compact unit with control unit).

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

The minimum air pressure as set on the pressure control valve is monitored by a pressure switch. The signal from the pressure switch is evaluated either directly by the machine control unit (compact unit without control unit) or by the electronic control unit (compact unit with control unit).

### 3.7 Models and designations

Table 2 explains the order number key for oil + air lubrication systems with MV20X-20 and MV50X oil + air metering units. The order number is located on the rating plate of the oil + air lubrication system.

**Table 2: Order number key**

Example designation	OLA	04	-	2	3	0	01	+	428
Designation									
Number of oil + air connections									
Control unit design									
Reservoir capacity									
Filter design									
Design number									
Voltage key									

Control unit:	0	- None	5	- IG54-20
	2	- IG38-30	9	- Other
Reservoir capacity:	0	- None	3	3 liters
	1	- Less than 2 liters	6	- 6 liters - plastic
	2	- 2 liters	7	- 6 liters - metal
			8	- > 6 liters - metal
Filter:	0	- None	2	- Air filter
	1	- Oil filter	3	- Oil and air filter
Number of oil + air connections	01-30	MV20X-20, max. 8 lubrication line connections MV50X, max. 6 lubrication line connections Oil + air metering units can be combined and connected in series		
Design number:	01-99	Two-digit sequence number (specified by SKF)		
Voltage key	Specification of motor voltage and frequency			
	+428	- 230 V, 50/60 Hz		
	+429	- 115 V, 50/60 Hz		

## 4. Installation instructions

Oil + air lubrication systems described in the installation instructions may only be installed by qualified experts. Qualified experts are persons who have been trained, instructed, and familiarized with the end product into which the described oil + air lubrication system is to be installed. These persons are considered capable of such tasks due to their education, training, and experience with valid standards, conditions, accident prevention regulations, and operating measures. They are entitled to carry out the required tasks and to recognize - and thus avoid - any dangers that might otherwise occur.

A definition of what constitutes a qualified person and who are unqualified persons are stipulated in DIN VDE 0105 and IEC 364.

Before installing/positioning the oil + air lubrication system, remove the packaging material and any transportation safety devices such as sealing plugs. Keep the packaging material until you are sure that there are no delivery discrepancies that need to be clarified.



### Caution!

Oil + air lubrication systems must not be tipped up or dropped.

Country specific accident prevention regulations and the operating and maintenance instructions of the operator must be observed when carrying out all installation work on machineries.

### 4.1 Positioning and mounting

Oil + air lubrication systems should be mounted in a way that protects it from humidity and vibrations. It should also be easily accessible so that all other installation work can be carried out without problems. Make sure that there is a sufficient amount of circulating air to prevent the excessive heating of the oil + air lubrication system. For information on the maximum permitted ambient temperature, see the technical data at the end of this owner's manual.

Sufficient space must be provided for topping up the lubricant reservoir with lubricant.



For the product-specific technical data on a specific oil + air lubrication system, see the relevant documentation. If no documentation is available, you can directly request the documentation from SKF Lubrication Systems Germany GmbH.

The oil + air lubrication system must be mounted vertically in accordance with the specifications of the documentation.

Pressure gauges, oil level glasses, and other visual monitoring equipment must be clearly visible.

Installation holes for the attachment of the oil + air lubrication system to the wall must be made in accordance with the stipulations of the section 'Mounting dimensions'.



### Caution!

During installation work - and particularly when drilling - the following points must be observed:

- ) Existing supply lines must not be damaged by the installation work.
- ) Other units must not be damaged by the installation work.
- ) The oil + air lubrication system must not be mounted within the radius of activity of moving parts so it will not interfere with or be stuck by moving parts.
- ) The oil + air lubrication system must be installed a sufficient distance away from sources of heat, so that the maximum ambient temperature of 40°C is not exceeded.
- ) Country specific installation and accident prevention regulations must be observed.

## 4.2 Mounting dimensions

Oil + air lubrication systems are intended for wall mounting. They are attached to the intended mounting location using appropriate fastening materials (e.g., bolts, washers, and nuts).

For the dimensions and location of the fixing holes, see the documentation of the oil + air lubrication system. If no documentation is available, the dimensions and location of the fixing holes for mounting the unit can be determined by taking measurements.



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

## 4.3 Electrical connection

### 4.3.1 Electrical connection motor

In the standard design, oil + air lubrication systems contain compact units. Compact units are driven by electric motors. The electric motors are capacitor motors designed for 115 / 230 V 50 / 60 Hz single-phase alternating current.



### Danger!

Electrical connections for the compact unit 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 strictly observed. Significant bodily injury and property damage may result from an improperly connected compact unit.

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

**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 prescribed amperage, as bodily injury and property damage may otherwise result.

Details on the electrical connection of the motor to the power supply, especially terminal and connector pin assignment, can be found in the documentation for the oil + air lubrication system.



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

The electrical circuit diagram of the compact unit is affixed inside the unit's cover cap and can be accessed by removing the cap. This diagram is affixed in such a way that it cannot be removed.

### 4.3.2 Inductive loads

In the case of switches with inductive loads, they must be low-inductive in order to keep wear on contact areas to a minimum. Otherwise, there is a danger of damaging the contact surfaces of the switch elements. Appropriate measures should be used to protect the contacts of the switch elements.

The connection of electrical switching devices such as the fill level switch, pressure switch, control valves, thermometer, etc. is to take place in accordance with the specifications in the documentation of the oil + air lubrication system.



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

## 4.4 Control and monitoring

Oil + air lubrication systems are available in designs with and without control units. The latter do not contain an electronic control unit. This type of oil + air lubrication system is controlled and monitored by the control unit of the machine that the system is mounted on. An oil + air lubrication system with a control unit contains an electronic control unit that is integrated into the compact unit and controls and monitors the system.

### 4.4.1 Oil + air lubrication systems without control unit

Oil + air lubrication systems without an integrated electronic control unit are controlled by the control unit of the machine that the system is connected to. The machine control unit controls the pump's cycle time and delay time and the compact 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 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 metering unit 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 lubricating cycle consists of the contact time and the interval time.

Operating mode S3 for the gear pump motor is used to define the interval time and the gear pump's cycle time and delay time. Consult the documentation of the oil + air lubrication system for information about this operating mode.

The following are monitored:

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

With regard to monitoring pressure build-up in the main lubricant line during a lubricating cycle, note that several seconds may pass after the gear pump motor is switched on before the oil pressure switch responds. A fixed monitoring time for oil pressure build-up is recommended so that the machine control unit waits until this time has elapsed to issue 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 time buffer is stored in the machine control unit to level out brief pressure fluctuations in the compressed air supply.

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

#### 4.4.2 Oil + air lubrication systems with control unit

Oil + air lubrication systems with a control unit contain a programmable electronic control unit that can be used to control and monitor the system. Electronic control units for oil + air lubrication systems are designed as pulse generators, i.e., they set the interval time. Depending on the model design, the electronic control unit allows configuration of the interval time, pump delay time and the number of pre-lubricating cycles. One or more pre-lubricating 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 compact unit's electronic control unit. The control unit directly monitors the operation of the oil pressure switch, air pressure switch and fill level switch. Oil + air lubrication systems 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 run outwards to connect to the machine control unit via a cable fitting mounted on the compact unit.

Details on the function and operation of the compact unit and the control unit can be found in the assembly instructions for the compact unit and the operating instructions for the electronic control unit which are included in the scope of delivery of an oil + air lubrication system.



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

## 4.5 Compressed air line connection

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



### Danger!

Before connecting the oil + air lubrication system to the compressed air supply, make sure that the main air valve is closed.



### Caution!

The specified minimum primary air pressure for operating the oil + air lubrication system 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 3. 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:

**Table 3: Requirements for compressed air**

Requirement	Values
Inlet pressure	min. 3 bar max. 10 bar
Air volume required (line with 2.3 mm internal diameter, recommended oil viscosity range)	1000 - 1500 l/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 <sup>3</sup>
Pressure dew point	Class 4 maximum: +3 °C
Oil concentration	Class 3 maximum: 1 mg/m <sup>3</sup>

Compressed air preparation can be optimized and machine downtime and high maintenance costs avoided by using compressed air of the appropriate quality class.

The connection for the compressed air line is designed as an M10x1 pipe thread with a counter-bore for a solderless pipe union per DIN 3854/DIN 3862 for pipe Ø 6 mm. The following fittings are required to install the compressed air line:

Compressed air line, metal tubing Ø 6 mm:

- **406-001 Double tapered sleeve**
- **406-002 Socket union**

Compressed air line, plastic tubing Ø 6 mm:

- **406-603 Reinforcing socket**
- **406-611 Tapered sleeve**
- **406-612 Socket union**

A switch valve, e.g., a 3/2 directional control valve (Fig. 4, item 24), is recommended in the air inlet line for compressed air so that the compressed air supply can be switched on and off.

## 4.6 Lubrication line connection

The main lubricant line connecting the compact unit with the oil + air metering unit is already installed on oil + air lubrication systems.

Install the lubrication point line(s) as shown in Figure 5.

The lubrication point line leading from the oil + air metering unit to the lubrication point must be connected to the oil + air lubrication system in such a way that no forces can be transferred to the assembled oil + air lubrication system (stress-free connection).

Lubrication point lines made of transparent plastic are recommended so that the lubricant transport in the lubrication point lines (oil streak formation) can be assessed visually. The requirements for the lubrication point lines are summarized in Table 4.

**Table 4: Requirements for lubrication point lines**

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

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

Rigid plastic tubing:

- **WVN715-R04X0.85**

Flexible plastic tubing:

- **WVN716-R04X0.85**

The connection for the lubrication point line is designed as an M8x1 pipe thread with a counter-bore for a solderless pipe union per DIN 3854/DIN 3862 for pipe ∅ 4 mm. The following fittings are required to install the lubrication point line:

Lubrication point line, plastic tubing ∅ 4 mm:

- **404-603 Reinforcing socket**
- **404-611 Tapered sleeve**
- **404-612 Socket union**

The lubrication point lines can be laid in a rising or falling position. A hose coil (30) is installed approx. 0.3 m in front of the nozzle (32) and serves as a lubricant reservoir. After the compressed air is switched off, the lubricant distributed in the hose coil collects in the lower bends of the coil. This ensures that the bearing is quickly supplied with lubricant once the compressed air is switched on again. The center line of the hose coil should be laid horizontally or inclined at a max. angle of 30°.

Avoid changes in the cross-section of the lubrication point line from small to large cross-sections in the direction of flow. When the cross-section does change, the transition should be gradual.

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

Order number for oil-streak sensor:

- **GS4011-S20 for lubrication point line ∅ 4 mm**
- **GS6011-S20 for lubrication point line ∅ 6 mm**

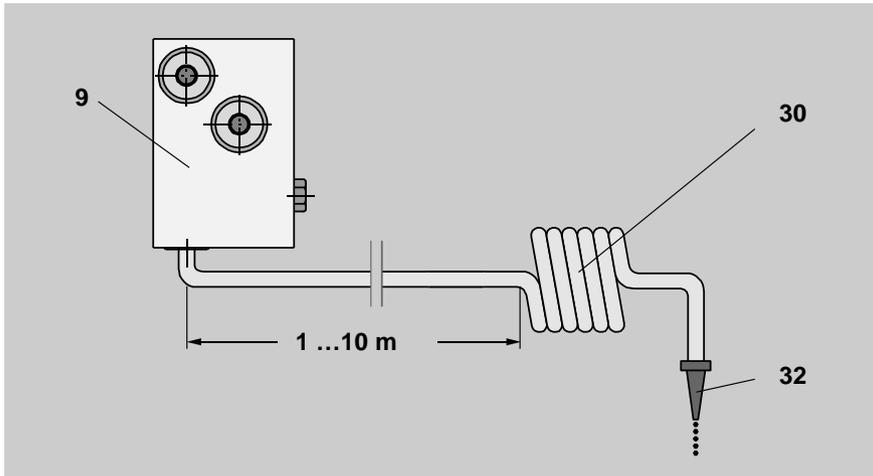


Figure 5: Assembly structure for lubrication point line

- 9 Oil + air metering unit
- 30 Hose coil
- 32 Nozzle

## 4.7 General information about laying of lubrication line

The following information should be observed for the laying of the main lubrication lines and lubricating point lines in order to ensure that the entire centralized lubrication system works smoothly.

The main lubrication line should be dimensioned in accordance with the maximum pressure and conveyance volume to which the lubrication unit is exposed. Where possible, the main lubrication line should climb from the lubrication unit and enable deaeration at the highest point of the lubrication line system.

Lubricant distributors at the end of the main lubricant line should be mounted so that the distributor outlets point upwards. If lubricant distributors have to be positioned below the main lubricant line for system design reasons, they should not be so placed at the end of the main lubrication line.

The pipes, hoses, cut-off 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. In addition, the lubrication system must be protected against excessively high pressure by means of a pressure relief valve.

All components of the lubrication line system – including pipes, hoses, cut-off valves, control valves, fittings, and so on – must be carefully cleaned before installation. No seals on lubrication line systems should protrude inwards in a way that disrupts the flow of the lubricant and could allow contaminants to enter the lubrication line system.

Lubrication lines must be laid in a way that prevents air pockets from forming anywhere on the system. Cross section changes to the lubrication line from a small to a large cross section in the direction of flow of the lubricant are to be avoided. 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, corner valves, or check valves. Unavoidable cross section changes in lubrication lines must have smooth transitions. Wherever possible, sudden changes of direction are to be avoided.



### Caution!

Lubrication lines must be leak-tight. Lubricants can contaminate the ground and watercourses. Lubricants must be used and disposed of properly. Country specific regulations and laws on the use and disposal of lubricants must be observed.



### Danger!

Centralized lubrication systems must be leak-tight. Leaking centralized lubrication systems are a source of danger in relation to slip hazard and the risk of injury. When making installation, maintenance, and repair work test the centralized lubrication system for leaks. Leaky parts of the centralized lubrication system or components of the lubrication equipment have to be sealed immediately.

Leaking centralized lubrication systems or components of the lubrication equipment are a source of danger in relation to slip hazard and the risk of injury.

These dangers can cause physical injury to persons or damage to other material assets.



Lubricants are hazardous substance. Refer to safety precautions in the lubricant manufacturer's material safety data sheet.

You can ask the manufacturer of the lubricant for the material safety data sheet.

## 4.8 Venting oil+air mixing valves MV20x-20



### **Danger!**

Depressurize the oil+air lubrication unit before starting work.

The mixing valve must be vented during initial operation, when modifying or replacing it or its metering units. Note that only the Service department of SKF Lubrication Systems Germany GmbH may change the metering units for 10 mm<sup>3</sup> and 20 mm<sup>3</sup>. Larger metering units can also be changed by the customer under its own responsibility. The metering unit/mixing valve must be vented in all cases.

To simplify the venting process, the mixing valve must be removed from the mounting plate. In mounted position, the metering units are located on the bottom of the mixing valve.

### **Venting the main oil duct**

- Place an oil receiver tank (supplied by customer) under the mixing valve. Collect leaking oil with appropriate agents.
- Depressurize the oil+air lubrication device.
- Separate the compressed air feed (marked Air) from the mixing valve (1).
- Remove the mixing valve (1) from the mounting plate (2).
- Remove the screw plug (3) (marked Oil) on the opposite side of the main oil port.
- Switch on the pump and allow it run until it pumps oil.  
The oil now enters the mixing valve through the main oil port and discharges on the opposite side.
- Allow the pump to run until oil without bubbles discharges.
- Close the borehole on the main oil duct again with the screw plug (3).
- Shut off the pump.

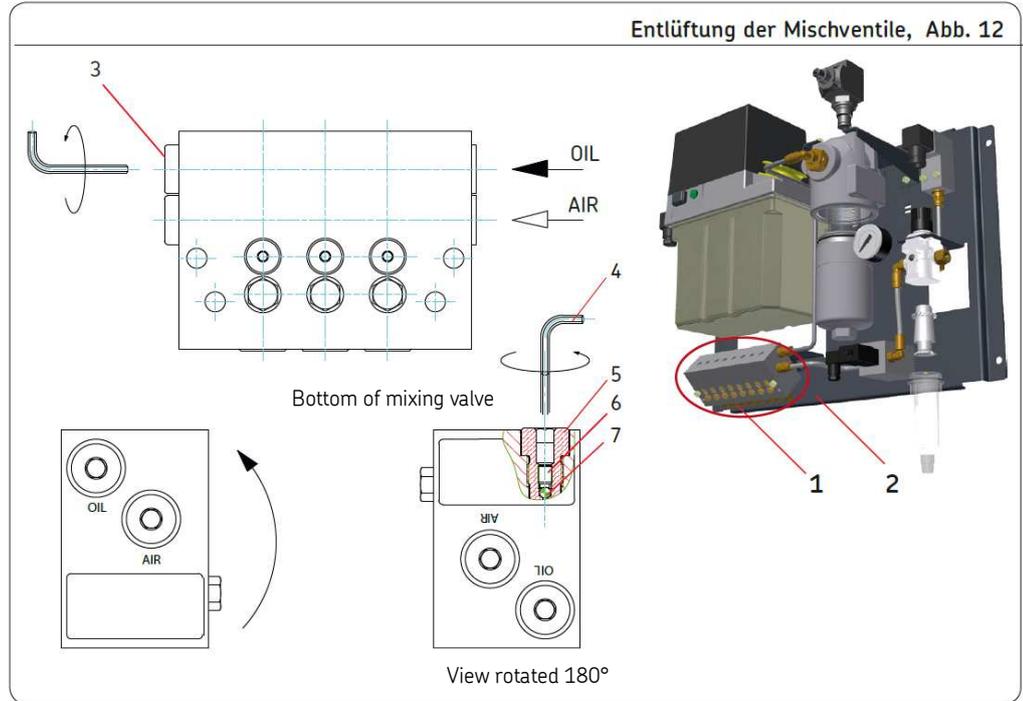
### **Venting the metering units**

- Rotate the mixing valve upwards to enable the air contained therein to escape.
  - Apply the hexagon wrench (WAF 2) to the threaded pin (4) of the 1st metering unit (5).
  - Remove the threaded pins (6) and balls (7) from the metering units (5).
  - Repeat the process on all metering units.
  - Let the pump run in intermittent (temporarily pausing) operation until oil without bubbles discharges from all metering units.
- In the relief phases, the pressure in the oil line must fall to < 1.5 bar.  
After bubble-free oil discharges at all metering units, switch off the pump and close the metering units again using the respective balls and threaded pins.
- Insert balls (7) and threaded pins (6) into the respective metering units (5).
  - Use the hexagon wrench to tighten the threaded pin (6) with a torque of 1,5Nm.
  - Reinstall the mixing valve (1) on the mounting plate (2).

## 5. Transport, delivery and storage

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- Reconnect the compressed air supply.



## 5. Transport, delivery and storage

### 5.1 Transport

SKF Lubrication Systems Germany GmbH products are packaged in accordance with the regulations of the recipient country and in accordance with DIN ISO 9001. Our products must be transported with care. Products must be protected against mechanical influences such as impacts. Transport packaging must be labelled with the information 'Do not drop!'.



#### Caution!

The product must not be tipped up or dropped.

There are no restrictions relating to land, air, or sea transportation.

### 5.2 Delivery

Following receipt of the shipment, the product or products must be checked for damage and the shipping documents should be used to make sure that the delivery is complete. Keep the packaging material until you are sure that there are no delivery discrepancies that need to be clarified.

### 5.3 Storage

The following conditions apply to the storage of SKF Lubrication Systems Germany GmbH products.

#### 5.3.1 Storage of lubrication units

- ) Ambient conditions: Dry, dust-free environment; storage in well-ventilated, dry area
- ) Storage time: 24 months max.
- ) Permitted air humidity: < 65%
- ) Warehouse temperature: 10 - 40°C
- ) Light: Direct sunlight/UV radiation must be avoided; nearby sources of heat must be screened

#### 5.3.2 Storage of electronic and electrical devices

- ) Ambient conditions: Dry, dust-free environment; storage in well-ventilated, dry area
- ) Storage time: 24 months max.
- ) Permitted air humidity: < 65%
- ) Warehouse temperature: 10 - 40°C
- ) Light: Direct sunlight/UV radiation must be avoided; nearby sources of heat must be screened

### 5.3.3 Storage - general information

- ) Ensure that no dust gets into stored products by wrapping them in plastic film
- ) Store products on racks or pallets to protect them from damp floors
- ) Before placing products into storage, protect uncoated metal surfaces - and drive parts and mount surfaces in particular - from corrosion using long-term corrosion protection
- ) At 6-monthly intervals: Check products for corrosion. If signs of corrosion are found, remove the corrosion that has already resulted and improve the corrosion protection measures.
- ) Drives must be protected against mechanical damage

## 6. Operation

### 6.1 General information

The oil + air lubrication system 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 likewise 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.



#### **Caution!**

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.



#### **Caution!**

Different lubricants cannot be mixed, as mixing may result in damage and necessitate costly and complicated cleaning of the compact unit/the oil + air 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.

### 6.2 Commissioning

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

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

Air pockets in the lubricant adversely affect the device's operation and the reliable delivery of lubricant, which can result in damage to the bearings requiring lubrication.

## 6. Operation

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### 6.2.1 Setting-up mode

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

#### MV20X-20 oil + air metering unit

- ) Close the pressure control valve for compressed air (item 6 in Fig. 1) to interrupt the compressed air supply
- ) Remove screw plugs from the pressure gauge connections (item 12 in Fig. 3) on the oil + air metering unit (item 9 in Fig. 1).
- ) Switch on the power supply and run the compact unit until lubricant without bubbles is discharged at the openings of the pressure gauge connections.
- ) Reinsert the screw plugs.
- ) Open the pressure control valve for compressed air (item 6 in Fig. 1) and set the operating pressure (min. 3 - 10 bar, preferably 6 - 10 bar).
- ) Run the compact unit until a continuous oil streak has formed in the lubrication point lines and fine lubricant droplets discharge at the nozzles.
- ) If necessary, adjust the air flow rate using the air adjustment screws on the oil + air metering unit (item 10 in Fig. 2 and 3) or the pressure control valve for compressed air (item 6 in Fig. 1)

#### MV50X oil + air metering unit

The oil + air metering units of the MV50X series contain an externally mounted pressure-regulating valve (item 16, Fig. 3) with a cracking pressure of 23 bar. The pressure-regulating valve is necessary in order to ensure automatic venting of the main lubricant line (supply of lubricant from compact unit to oil + air metering unit) and the oil + air metering unit.

The pressure-regulating valve is connected to the compact unit's return connection via a return line to feed discharged lubricant back into the lubricant reservoir. Venting is performed automatically at the start of each lubricating cycle (start-up of the compact unit) and ensures bubble-free supply of lubricant to the MV50X oil + air metering unit.

The air pressure must be set at a level sufficient to deliver the 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.

Ensure that continuous oil streaks are formed in the lubrication point lines.

### 6.3 Lubricant delivery to bearing

The way in which lubricant is delivered to the bearing depends on the type of bearing and the bearing assembly's design features. Figure 7 shows recommended examples for lubricant delivery.

With single-row rolling bearings, the lubricant can be introduced into the bearing from the side. The nozzle should be located at the level of the inner ring of the rolling bearing. The oil + air stream must never be aimed directly at the rolling bearing's ball cage.

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

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

It is also possible to deliver the lubricant directly into the outer ring of the rolling bearing through a bore hole. In this case, ensure that the lubricant does not feed into the rolling bearing's pressure zone between the ball ring and outer ring (Fig. 6).

## 6. Operation

With 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).

With rolling bearings with an outer diameter of 150 to 280 mm, it is recommended that a second nozzle be installed. In case of larger rolling-bearing outer diameters, additional nozzles should be installed accordingly.

If the lubricant is fed through the outer ring of a rolling bearing, a single nozzle is sufficient for most applications.

The air pressure indicated in Table 3 is generally sufficient to reliably overcome the air vortex that arises when using high-speed rolling bearings.

Higher air pressures needed to reliably feed lubricant in individual cases do not impair the function of the overall oil + air lubrication system.

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.

**Figure 6: Lubricant delivery through outer ring**

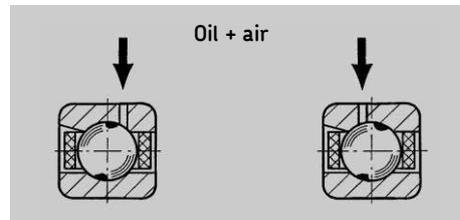
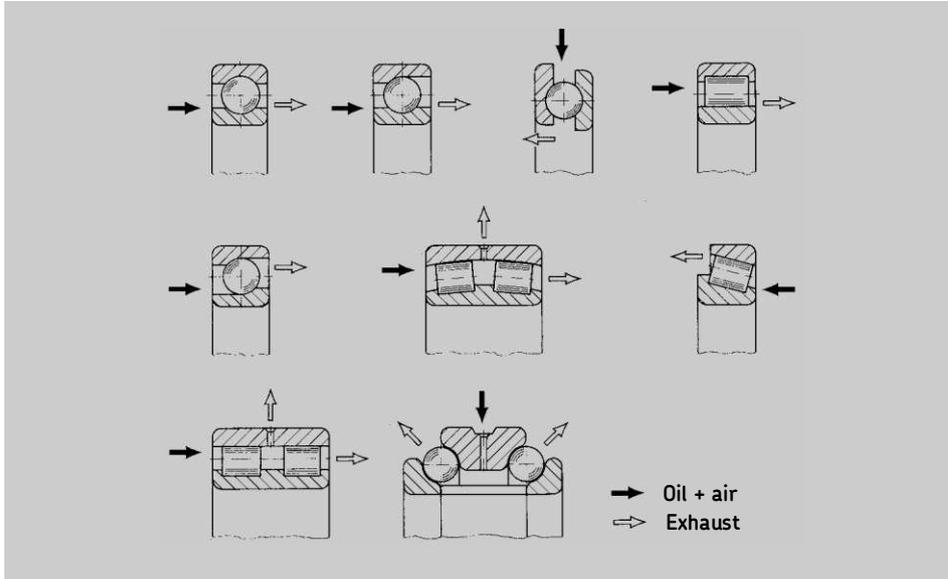


Figure 7: Lubricant delivery on various types of ball bearings



## 6.4 Setting the lubricant flow rate



### Caution!

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 system supplies to a bearing depends on:

- ) Bearing type
- ) Geometrical dimensions of the bearing
- ) Speed factor

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

- ) Changing the metering volume on the oil + air metering unit
- ) Reducing or increasing the interval time (lubricating cycle sequence) of the compact 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  $\text{mm}^3/\text{h}$ ; if other units are used, they must be converted accordingly. See the following for information about configuring the oil + air lubrication system for the correct metering volume in the oil + air metering unit and setting the lubrication interval 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  $V_{\text{oil}}$  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 metering units are listed in Table 5.

**Table 5: Available metering volumes for oil + air metering units**

Metered quantity in $\text{mm}^3$	MV20X-20	MV50X
2	-	X
6	-	X
10	X	-
20	X	-
30	X	-
60	X	-
100	X	-
160	X	-

## 6. Operation

The number of pulses per second is calculated using the following formulas:

$$V_{\text{oil}} \left[ \frac{\text{mm}^3}{\text{h}} \right] = n \left[ \frac{\text{Cycles}}{\text{h}} \right] \cdot d \left[ \frac{\text{mm}^3}{\text{Cycle}} \right]$$

$$n \left[ \frac{\text{Cycles}}{\text{h}} \right] = \frac{V_{\text{oil}} \left[ \frac{\text{mm}^3}{\text{h}} \right]}{d \left[ \frac{\text{mm}^3}{\text{Cycle}} \right]}$$

Symbols:

- n:** number of cycles per hour  
**Voil:** amount lubricant required by bearing (note that there can be multiple lubrication points per bearing)  
**d:** metered quantity per cycle

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

Example for a typical configuration:

$$V_{\text{oil}} = 150 \text{ mm}^3$$

$$d = 30 \text{ mm}^3$$

$$n = \frac{150 \left[ \frac{\text{mm}^3}{\text{h}} \right]}{30 \left[ \frac{\text{mm}^3}{\text{Cycle}} \right]} = 5 \left[ \frac{\text{Cycles}}{\text{h}} \right]$$

The calculated number of cycles per hour n (5 cycles per hour in this example) is used to determine a working cycle  $T_{\text{WC,S3}}$ .

$$T_{\text{WC,S3}} = \frac{60}{n} \text{ [min]}$$

The working cycle time  $T_{\text{WC,S3}}$  consists of the pump cycle time  $T_{\text{PCT}}$ , including the pump delay time  $T_{\text{PDT}}$  and the interval time  $T_{\text{INTERVAL}}$ . 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 systems is defined as S3, 20% ON-time (1.25 to 25 min). The ON-time is the time during which the gear pump is switched on as a percentage of the working cycle time  $T_{\text{WC,S3}}$  (pump cycle time, incl. pump delay time). The time range of 1.25 to 25 min is the range of selectable working cycle times  $T_{\text{WC,S3}}$  in minutes.

$$T_{\text{WC,S3}} = (T_{\text{PCT}} + T_{\text{PDT}}) + T_{\text{Interval}}$$

with

$$T_{\text{WC,S3}} = 1,25 \dots 25 \text{ min}$$

$$T_{\text{PCT}} + T_{\text{PDT}} = 0,2 \cdot T_{\text{WC,S3}}$$

$$T_{\text{Interval}} = 0,8 \cdot T_{\text{WC,S3}}$$

It follows that:

$$T_{\text{Interval}} = T_{\text{WC,S3}} - (T_{\text{PCT}} + T_{\text{PDT}})$$

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

On oil + air lubrication systems 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 4.4.1) must be reduced accordingly by 5 seconds.

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

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The standard design of the electronic control unit for oil + air lubrication systems 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 system. 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  $T_{INTERVAL,min}$ :

$$T_{PCT} + T_{PDT} = 0,2 \cdot T_{WC,S3}$$

$$T_{WC,S3} = \frac{(T_{PCT} + T_{PDT})}{0,2}$$

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

$$T_{Interval,min} = 0,8 \cdot T_{WC,S3}$$

$$T_{Interval,min} = 0,8 \cdot 5,4 \text{ min} = 4,3 \text{ min}$$

The calculated minimum interval time is 4.3 minutes. The interval time 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  $T_{INTERVAL,min} = 5$  minutes (rounded up), yielding a minimum working cycle time of 6 minutes.

$$T_{WC,S3} = T_{Interval,min} + T_{PCT} + T_{PDT}$$

$$T_{WC,S3} = 5 \text{ min} + 1 \text{ min} + 5s$$

$$T_{WC,S3} = 6 \text{ min (rounded down)}$$

The maximum number of cycles per second is therefore 10 lubricating 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 system.

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 system with a control unit.

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

## 6. Operation

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### 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 system, 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 system is set using the pressure control valve for compressed air (item 6 in Fig. 1). 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 10 in Fig. 2 and 3) on the oil + air metering unit (item 9 in Fig. 1).

#### **Note:**

The lubrication point outlet on the oil + air metering unit 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 system and the machine must be switched off to prevent underlubrication of the lubrication point.

## 6.6 General notes

Oil + air lubrication systems 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.

Figure 4 shows the types of monitoring available in an oil + air lubrication system.

The following monitoring units are presented:

- ) Fill level switch in the lubricant reservoir (17)
- ) Pressure switch for required oil pressure (21)
- ) Flow sensor (27)
- ) Oil-streak sensor (31)
- ) Pressure switch for air pressure (8)
- ) Oil filter with visual contamination indicator (25)
- ) Air filter with liquid separator (22)
- ) Air filter (microfilter) (23)

Flow sensors and oil-streak sensors offer enhanced monitoring capability for an oil + air lubrication system. Using oil-streak sensors allows the lubricant transport (oil streak) in the lubrication point lines to be monitored. Flow sensors allow monitoring of the oil flow in the main lubricant line (from the compact unit to the oil + air metering unit).

## 7. Shutdown

### 7.1 Temporary shutdown

You can temporarily shut down the described product by disconnecting the electrical, pneumatic, and/or hydraulic supply connections. For more information, see the section 'General information' in this installation instructions.

If you wish to shut down the product temporarily, refer also to the instructions in the section 'Transport, delivery, and storage' of this owner's manual.

When placing the product back into operation, refer to the information in the sections 'Installation' and 'Startup' of this owner's manual.

### 7.2 Permanent shutdown

All country specific legal guidelines and legislation on the disposal of contaminated equipment must be observed when shutting down the product for the final time.



#### **Caution!**

Lubricants can contaminate the ground and watercourses. Lubricants must be used and disposed of properly. Country specific regulations and laws on the use and disposal of lubricants must be observed.

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

## 8. Maintenance



### Danger!

To prevent chance of serious injury or death, disconnect the product from main power supply before working on it. Installation, maintenance, and repair work may only be carried out by qualified experts on a product that is not connected to a power supply.



### Danger!

Centralized lubrication systems are under pressure when they are being operated. Centralized lubrication systems must therefore be depressurized before starting installation, maintenance, or repair work and before making any changes to the system.



### Danger!

The described product may be under pressure when it is being operated. The product must therefore be depressurized before starting installation, maintenance, or repair work and before making any changes to the system.

SKF Lubrication Systems Germany GmbH products are low-maintenance. However, to ensure that they function properly and to avoid risks right from the startup, all joints and connections should be checked to make sure that they are properly fitted. If necessary, you can clean the product using gentle, material-appropriate cleaning agents (no alkalis, no soap). For safety reasons, the product should be disconnected from the hydraulic and/or compressed air supplies before cleaning.

During cleaning, it is important to make sure that no cleaning agent enters the inside of the product.

If the system is operated normally with intercompatible lubricants, the inside of the product does not need to be cleaned.

If you accidentally fill the product with an incorrect or contaminated lubricant, the inside of the product does have to be cleaned. If this occurs, contact SKF Lubrication Systems Germany GmbH Services for more information on cleaning procedures



You must not dismantle the product or parts of the product during the warranty period. Doing so invalidates all warranty claims.



Only original SKF Lubrication Systems Germany GmbH spare parts 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.

SKF Lubrication Systems Germany GmbH is not liable for damage caused by improper installation, maintenance, or repair work.

## 9. Faults

Table 6 gives an overview of possible malfunctions and their causes. If you are unable to rectify the malfunction, please contact SKF Lubrication Systems Germany GmbH Service.



You must not dismantle the product or parts of the product during the warranty period. Doing so invalidates all warranty claims.



All other work relating to installation, maintenance, and repair must only be carried out by SKF Lubrication Systems Germany GmbH Service.



Only original SKF Lubrication Systems Germany GmbH spare parts may be used. It is prohibited for the operator to make alterations to the product or to use non-original spare parts and resources.

**Table 6: Fault analysis and rectification**

Malfunction	Possible cause	Rectification
Motor fails to start when the operating voltage is applied	No operating voltage on motor	Check mains connection. Check mains plug/cable and connect properly if necessary. Check operating voltage on motor. Check fuse. Check motor circuit breaker.
	Pump blocked	Measure motor current. If current is impermissibly high: Dismantle pump, crank by hand: If resistance is high, replace the pump.
	Motor jammed	Measure motor current. If current is impermissibly high: Dismantle motor, crank by hand: If resistance is high, replace the motor.
Motor runs with difficulty and at a low speed	Sluggish pump	Measure motor current. If current is impermissibly high: Dismantle pump, crank by hand: If resistance is high, replace the pump.
	Sluggish motor	Measure motor current. If current is impermissibly high: Dismantle motor, crank by hand: If resistance is high, replace the motor.
	Impermissible lubricant (see technical data)	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	Check pressure-regulating valve and replace if necessary.
	Ambient temperature too low (see technical data)	Increase ambient temperature.

**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 experts on products that have been disconnected from the power supply. The supply voltage must be turned off before any product components are opened.

**Danger!**

Hot surfaces of an electrical motor can cause burn injuries. The surfaces of a motor should only be touched with protective gloves or when motor is no longer hot.

**Danger!**

Centralized lubrication systems are under pressure when they are being operated. Centralized lubrication systems must therefore be depressurized before starting installation, maintenance, or repair work and before making any changes to the system.

**Table 6 (cont.): Fault analysis and rectification**

Malfunction	Possible cause	Rectification
Pump does not convey lubricant; no pressure build-up	Pump blocked	Measure motor current. If current is impermissibly high: Dismantle pump, crank by hand: If resistance is high, replace the pump.
	Motor jammed	Measure motor current. If current is impermissibly high: Dismantle motor, crank by hand: If resistance is high, replace the motor.
	Incorrect rotational direction of motor	Check whether rotational direction corresponds to direction indicated by arrow, change rotational direction if necessary.
	Pressure-regulating valve does not close	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.
No pressure build-up in the main lubricant line	Air in the main lubricant line.	Vent main lubricant line.
	Main lubricant line leaky or break in line	Repair main lubricant line.
	Pressure-regulating valve does not close	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.
	Pressure relief valve does not close	Clean or replace pressure relief valve. Only use original SKF spare parts.
	Impermissible lubricant (see technical data)	Remove lubricant from entire system and dispose of lubricant in the proper manner; fill system with suitable lubricant.
	Fill level too low	Top up lubricant.

## 10. Technical data

Designation	Unit	Values
<b>Oil + air lubrication system</b>		
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 connections	-	1 to 24 (> 24 on request)
<b>Compact unit</b>		
Delivery rate <sup>1)</sup>	l/min	0.2
Ambient temperature	°C	+10 to +40
Rated capacity of reservoir	liter	2, 3, 6
Reservoir material	-	Plastic, metal
Pressure-regulating valve	bar	30
Pressure relief valve	-	Included
Protection class	-	IP54
Pumped medium	-	Mineral or synthetic oil, NBR and FPM-compatible
Permitted oil viscosity <sup>2)</sup>	mm <sup>2</sup> /s (cSt)	20 to 1500
<b>Motor</b>	Type	Capacitor motor
Rated voltage	V	115 and 230
Rated current	A	1,06 / 1,36 and 0,53 / 0,68
Rated frequency	Hz	50 / 60
Rated output	W	60 / 75
Rated speed	RPM	2600 / 3050
Operating mode (per VDE 0530)	-	Standard design: S3, 20% (1.25 to 25 min) (e.g., with 1.25 min duty cycle time, run time is 15 s with 1 min interval time)
Thermal circuit breaker	-	built-in
<b>Oil + air metering unit</b>		
Number of lub. point connec. per oil + air metering unit	-	1 to 8
MV20X-20 series	-	1 to 6
MV50X series	-	1 to 6
Metering volume of oil + air metering unit		
MV20X-20 series	mm <sup>3</sup>	10, 20, 30, 60, 100, 160
MV50X series	mm <sup>3</sup>	2, 6

1.) Based on an oil viscosity of 140 cSt (mm<sup>2</sup>/s) at a back pressure of p = 5 bar

2.) Permitted range of oil viscosity depends on back pressure and delivery rate

## 10. Technical data (cont.)

Designation	Unit	Values
Oil + air outlet lubrication line	-	M8x1, counterbore for double tapered sleeve pipe union for pipe $\varnothing 4$
Oil inlet connection	-	M10x1, counterbore for double tapered sleeve pipe union for pipe $\varnothing 6$
Compressed air inlet connection	-	M10x1, counterbore for double tapered sleeve pipe union for pipe $\varnothing 6$
Operating pressure	bar	3 to 10
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
<b>Pressure switch for oil (contained in compact unit)</b>		
Function	-	NO-contact
Switching voltage, max.	V AC/DC	42
Switched current, max.	A	2.5
Switching capacity, max.	VA	100
Switching pressure	bar	20
<b>Level switch (contained in compact unit)</b>		
Function	-	NC contact (opens when oil level falls)
Switching voltage, max.	V AC	250
Switched current, max.	A	0.7
Switching capacity, max.	VA	50
<b>Pressure switch for minimum air pressure</b>		
Switching pressure	bar	1 to 10; set: 3
Switching capacity	-	Ohm load: 6A at 24 VDC and 0.5A at 220 VAC inductive load: 6A at 24 VDC and 3A at 220 VAC
<b>Control unit</b>	Type	IG54-20-S4-I
Rated voltage	V	110 - 120 or 220 - 240
Rated frequency	Hz	50 or 60
Contact rating, max.:	-	250 V, 5 A
Pump cycle time limit	s	60 (non-adjustable)
Interval time	min	1 - 99 (adjustable)
Pump delay time	s	5 (non-adjustable)

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**Order No. 951-170-010**

**SKF reserves the right to make content and technical changes!**

Last change: 21.07.2017

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### **Important product usage Information**

All SKF Lubrication Systems Germany GmbH products may only be used as intended and as described in the installation instructions. If the installation instructions are delivered with your product, read them carefully and follow them.

Not all lubricants can be conveyed with centralized lubrication systems. If required, SKF Lubrication Systems Germany GmbH can check the lubricant selected by the user to make sure that it is suitable for conveyance in centralized lubrication systems. All lubrication systems and components that are manufactured by SKF Lubrication Systems Germany GmbH are not approved for use in conjunction with gases, liquefied gases, gases dissolved under pressure, vapours, and fluids with a vapour pressure of more than 0.5 bar above normal atmospheric pressure (1013 mbar) at the maximum permitted temperature.

Hazardous materials of any kind, especially the materials classified as hazardous by CLP Regulation EC 1272/2008 may only be used to fill SKF centralized lubrication systems and components and delivered and/or distributed with the same after consulting with and receiving written approval from SKF.

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