

LUBRILEAN[®] Vario Super

Minimal Quantity Lubrication
Systems for internal lubrication

Operating Manual
Version 2



Imprint

The operating manual is part of the scope of supply of a SKF minimal quantity lubrication system LUBRILEAN® Vario Super.

The manual has been edited in conformity with applicable standards and rules for technical documentation.

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2 Information Concerning the EC Declaration of Conformity and the Manufacturer's Declaration

For the product designated below:

LUBRILEAN® Vario Super

we herewith certify 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...

- **Electromagnetic compatibility 89/336/EEC**

Notes

- (a) This declaration certifies the conformity with the directives listed, but does not entail an express assurance of properties.
- (b) The safety instructions in the documentation accompanying the product must be observed.
- (c) Taking into operation of the certified products is not allowed until evidence has been provided that the machinery, vehicle or similar item, into which the product is integrated, conforms to the regulations and requirements set forth by the applicable directives.
- (d) The operation of the products on non-standard line voltage as well as non-adherence to the installation instructions can affect the EMC properties and electrical safety.

We further declare that the above mentioned product:

- is meant for integration into a machine / for connection to other machinery according to the **EC Machinery Directive 98/37/EC, Annex II B**. Taking into service is not admissible until evidence has been provided that the machine in which this part is installed or to which this part is connected, conforms to the regulations set forth in the EC directive 98/37/EC.
- with reference to the **EC directive 97/23/EC concerning apparatus subjected to pressure** this product must only be used as intended and according to the notes in the documentation. Especially observe the following:

SKF products must not be used in conjunction with fluids, group I (hazardous fluids), according to the definition of article 2 paragraph 2 of the directive 67/548/EEC dtd. 27th June, 1967; and are not approved for application with such.

None of the products manufactured by SKF are approved for application in connection 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 admissible application temperature range.

Provided they are used as intended, the products supplied by us will not reach the limit values set forth in article 3, paragraph 1, numbers 1.1 to 1.3 and paragraph 2 of the directive 97/23/EC. Therefore they do not come under the requirements set forth in annex I of that directive. They are not labelled with the CE mark with reference to the directive 97/23/EC. They are classified by us to come under article 3, paragraph 3 of the directive.

SKF products must be used exclusively as intended. Use or taking into operation of the products in areas with potentially explosive atmospheres according to the ATEX directive 94/9/EC is not allowed, regardless of whether these entail gaseous atmospheres or dusty atmospheres.

If required, you may request the declaration of conformity or manufacturer's declaration for this product from our central contact address.

3 Notes Concerning this Manual

The SKF minimal quantity lubrication system LUBRILEAN® Vario Super has been made according to state-of-the-art technical regulations and conforms to the legislation on safe working practises and accident prevention. Still hazards may be involved in their use, which can lead to injury of operators or other persons or damage to the machine or other property. To ensure trouble-free operation and prevent hazard, we kindly ask you to read the present manual carefully and observe the notes contained in it.

Please, use the table of contents to locate the desired information promptly and successfully.

Please take note of the symbol shown below. It calls attention to special situations:



Text marked with this sign alerts to special hazard or work that must be performed with caution.

Please consider that this manual is an integral part of the device and should be handed to the new owner if the device is sold.

4 Applications



All products of SKF Lubrication Systems Germany AG may be used exclusively as intended and according to the rules set forth in the respective operating manual.

We expressly emphasize that dangerous materials of any type, especially materials which are classified as dangerous according to EC directive 67/548/EWG article 2, paragraph 2, may be stored and transported and/or distributed with SKF central lubrication systems and components only after consulting SKF Lubrication Systems Germany AG and receiving their written consent.

All products made by SKF are not released for use in connection with hot gases, liquefied gases, gases dissolved under pressure, steams or fluids with a steam pressure exceeding 0.5 bar above the normal atmospheric pressure (1013 mbar) at the admissible maximum temperature.

Unless expressly stated for a specific product, products made by SKF must not be used in areas with potentially explosive atmospheres.

The SKF minimal quantity lubrication system LUBRILEAN® Vario Super – short MQS system – has been designed for internal lubrication of cutting tools for metal cutting operations. Internal lubrication is the direct application of lubricant onto the point of friction between the tool reference plane and workpiece through the tool spindle or tool revolver.

Other use or use beyond this purpose is considered unintended. SKF will not accept liability for damages resulting from such unintended use.

If you wish to employ the MQS system LUBRILEAN® Vario Super for exterior lubrication as well, please consult us beforehand.

The SKF MQS system LUBRILEAN® Vario Super can be used for initial furnishing of machine tools and later supplementation of used machinery with existing cooling and lubrication agent supply. Thanks to the interior lubrication principle employed, these systems can also be used for the connection to tools with very small cooling duct diameters. Consult with SKF.



Only rotary joints designed for dry-running may be used for central lubrication.

For lubricating purposes you should use only the minimum-quantity lubrication system lubricants we offer, which were specially developed for such use.



Only lubricants released for use in connection with the MQS system may be supplied. Unsuitable lubricants could lead to lubrication system failure and might cause severe property damage and personal injury.

Further information concerning the lubricants are found in the chapter 7", page 10.

SKF cannot be held liable for damages resulting from use of lubricants other than those approved by SKF on the basis of their compatibility with the system and their supply properties.

5 Safety Instructions

Please observe the following safety instructions, to ensure trouble-free functioning of the MQS system and prevent damage.

5.1 Application of MQS systems

The MQS system LUBRILEAN® Vario Super must only be used in technically perfect condition, as intended and with due regard for safety and hazards. The operating manual must be observed.



Any type of fire, in the form of open flames, smouldering cigarettes etc., must not come near the spraying beam or come into rooms in which the aerosol concentration exceeds the explosion limit. The aerosol must not be sprayed onto hot surfaces.

The processing spaces supplied with the aerosol must be equipped with extraction and suitable filtering adapted to the kind of lubricant employed.

In case of failure, the MQS system LUBRILEAN® Vario Super must be separated from the compressed air supply as soon as possible, e. g. by operation of the quick-action coupling at the compressed air supply connection, unless this would pose some other danger.

Especially errors that could affect safety must be resolved without delay. For remedy of errors please contact a SKF service station (see chapter 15, page 34).

The safety mechanisms, if provided for, must not be damaged, dismantled, or in any way made inoperable, nor must they be replaced by parts which have not been expressly approved by SKF.

Unauthorized modifications to the MQS system and use of spare parts and aids that have not been approved are not allowed and void the warranty.

Worn-out MQS systems must be made inoperable and disposed of properly.

5.2 Personnel

The installation, electrical connection and all interventions such as repairs, component replacement, etc. may be carried out only by adequately qualified and instructed personnel.



If the MQS system has been connected improperly, substantial property damage or personal injury may be the consequence.

Qualified personnel has been trained, instructed and specifically ordered by the owner to perform the work. Due to their training and experience, these persons are familiar with the applicable standards, regulations, accident prevention rules and operating conditions. They are authorised to perform the respective tasks and capable of identifying and avoiding possible hazards. The definition of what is a trained specialist and the prohibition of use by unqualified personnel are set forth in DIN VDE 0105 or IEC 364.

5.3 Working on the MQS system



DANGER, FATAL INJURY

Repair work must only be performed after a trained specialist has disconnected the MQS system from power.



DANGER, FATAL INJURY

Working on MQS systems which have not been disconnected properly from power, can lead to personal injury.



Working on systems under pressure could lead to personal injury.

Before performing any work on the MQS system, be sure to disconnect the system from electrical voltage and from the compressed air supply.

The general rules and safety regulations for work with compressed air-operated machines and devices must be observed.

5.4 Lubricants

Spraying lubricants other than those approved of by SKF or with SKF minimum-quantity lubrication systems is prohibited.



Do not spray people or animals with aerosol. The aerosol must not get into the eyes of persons and may in no case be inhaled directly.



We like to call attention to the fact that spraying of lubricants or lubricant containing substances may cause health-damaging effects.



Uncontrolled spraying of lubricants or lubricant containing substances may lead to mixtures of lubricant and air that may constitute an explosive concentration.

6 Transport, Delivery, Storage




The MQS system is packed as standard and in accordance with the requirements of the country of destination as well as DIN ISO 9001. Transport packages must be labelled with the note "Do not throw!".

There are no limitations for transport by surface, air or sea.

Upon receiving the package, please check the items for possible damage, and ensure the package is complete by checking the supply papers. Keep the packaging material until any and all problems have been clarified.

In general, the pump should be stored in a dry and dust-free environment. The storage temperatures can be found in the specifications.

7 Lubricants

-  **Only lubricants released for use in connection with the MQS system may be supplied. Unsuitable lubricants could lead to lubrication system failure and might cause severe property damage and personal injury.**
-  **We like to call attention to the fact that spraying of lubricants or lubricant containing substances may cause health-damaging effects.**
-  **Uncontrolled spraying of lubricants or lubricant containing substances may lead to mixtures of lubricant and air that may constitute an explosive concentration.**

The lubricants approved for use with the SKF MQS system LUBRILEAN® Vario Super have been especially selected to meet the chemical and physical properties required to satisfy the MQS technology. For this reason only lubricants provided by SKF may be used (see Table 1). You should consult SKF in advance if you want to use any other lubricants.

The lubricants listed in Table 1 are compatible with each another so that the laborious task of cleaning of the container is not necessary if the lubricant is changed.

We would be glad to answer any further questions you might have about the lubricants.



Do not mix different lubricants unless you have the express consent of SKF to do so. Otherwise damage may occur and unforeseeable hazards arise; a laborious internal cleaning of the system would become unavoidable.

SKF cannot be held liable for damages of any kind, which are traceable to improper use of lubricants or use of lubricants other than those approved by SKF on the basis of their compatibility with the system and their supply properties as well as those supplied by SKF.

Keep in mind that oils and greases are generally considered environmentally hazardous and combustible substances and that their transport, storage and processing require that special safety measures be taken. Also observe the safety datasheet of the respective lubricant.

Table 1. Recommended Lubricants

Designation	Composition	Properties	Range of application
LubriOil	Fatty acid ester with additives	Viscosity: 47mm ² /s at 40°C Density: 0.92 g/cm ³ at 20°C	All-purpose applications
LubriFluid F100	Synthetic polyhydric ester based on natural fatty oil derivatives with oxidation inhibitors	Viscosity: 25mm ² /s at 40°C Density: 0.84 g/cm ³ at 20°C	Specially made for small tools and difficult lubrication tasks on aluminium, steel and nonferrous metals

8 Design and Function

8.1 Principle of minimum-quantity lubrication

Minimum-quantity lubrication system lubrication involves a loss or consumption lubrication, i.e. the lubricant is used up almost completely during processing so that treatment of the lubricant in a circulation system is not required. An air current with finely distributed oil drops, so-called aerosol, lubricates the friction spots between the tool and the chips running off in the chip grooves. The minimum-quantity lubrication system assures effective lubrication of cutting processes using smallest amounts of lubricant. The arduous task of cleaning and disposing large amounts of lubricant and cooling lubricant is, if necessary at all, made much easier.

8.2 Active Principle of Aerosol

The SKF MQS system LUBRILEAN® Vario Super here described, with reference to the size and distribution of the lubricant drops, generates a very homogeneous aerosol with very small drops.

The oil drops are very light because of their small size, which in turn results in a very low moment of inertia. These small drops of oil can be transported over long stretches through lines and deflections without them being deposited due to the moment of inertia. Additionally, the transport of the aerosol through rotating spindles and tools is unproblematic for the minimum-quantity lubrication systems even at very high rotational speeds, since the effect of centrifugal force on the oil drops is very low.

8.3 Design of the system

Figure 1 shows the principle design of the MQS system LUBRILEAN® Vario Super. The key components are described in more detail in the following sections.

8.3.1 Aerosol generator and lubricant reservoir

The heart of the SKF MQS system LUBRILEAN® Vario Super is the compressed air aerosol generator integrated into the lubricant reservoir. The reservoir at the same time serves for storage and as a pressure accumulator during operation.

The aerosol generator unit is comprised of several different aerosol generators that can be combined. These generators and a valve system controlling the air volume required to generate the aerosol (see following section), allow to generate aerosols with most diverse lubricant concentration. Thus, for different tools, the required supply volume can be ensured to accommodate the cross-sectional and geometrical properties of the tool.

8.3.2 Main air valve

The main air valve separates all subsequent units of the MQS system from the compressed air supply. No aerosol is produced when the main air valve is closed. When the valve is closed, the lubricant reservoir is vented, if the aerosol can flow out unhindered through the aerosol lines.

The main air valve is controlled by the machine control system via a multi-pole control line.

8.3.3 Valve isle

The air volume required to generate aerosol is controlled by means of four valves which are integrated in a valve isle.

Three of these valves control the composition of the aerosol, while the fourth valve can be used to supply additional air to increase the transport speed for of the aerosol (additional air valve - see following section).

The valves are directly controlled by the machine control system via a multi-pole control line. By combining the operation of the different valves, the lubricant concentration of the aerosol can be adapted to the processing task at hand.

The respective switching conditions of the valves are indicated by LEDs on the valve isle. When an LED is on, the valve is being energised, that is, it is open.

8.3.4 Additional air valve

Using the additional air valve, air may be added to the aerosol, ensuring sufficient flow speed of the aerosol even if very little lubricant is required (e. g. for tools with very small cooling channel diameter). The air added by this valve does not flow through the aerosol generator (also refer to the functional diagram, chapter 8.4, page 16).

8.3.5 Pressure switch

This pressure switch is used to monitor the pressure difference between the reservoir's interior and the primary pressure. If the differential pressure drops below a certain value set ex works, because a tool with a very small cooling channel cross section is used, the compressed air supply is shut-off and no further aerosol produced. Aerosol which has already been produced drains off. Aerosol generation continues when the differential pressure rises again. This process is referred to as pressure differential control or "intermittent".

Pressure differential control is active when voltage is applied to the pressure switch. If the pressure switch remains voltageless, pressure differential control is shut off.

More information concerning the pressure switch is found in the respective operating manual.

8.3.6 Pressure gauge

The system features two pressure gauges.

The pressure gauge, pos. 7 in Figure 1, indicates the current primary pressure applied to the MQS system by the compressed air supply system; the pressure gauge, pos. 8 in Figure 1, indicates the interior vessel pressure.

If the MQS system operates intermittently, the pointer of the pressure gauge, pos. 8, alternates between two values. This type of indication is system inherent and does not indicate an error condition.

8.3.7 Filling level indicator and monitoring

The lubricant volume in the reservoir is continuously indicated by a spy glass with scale. Depending on the version, the filling level may be monitored by means of sensors, while critical lubricant supply levels may be reported to the machine control system.

When the reservoir is overfilled (filling level higher than "Maximum"), the excessive lubricant must be drained (see chapter 12.3, page 31), since aerosol can otherwise not be generated.

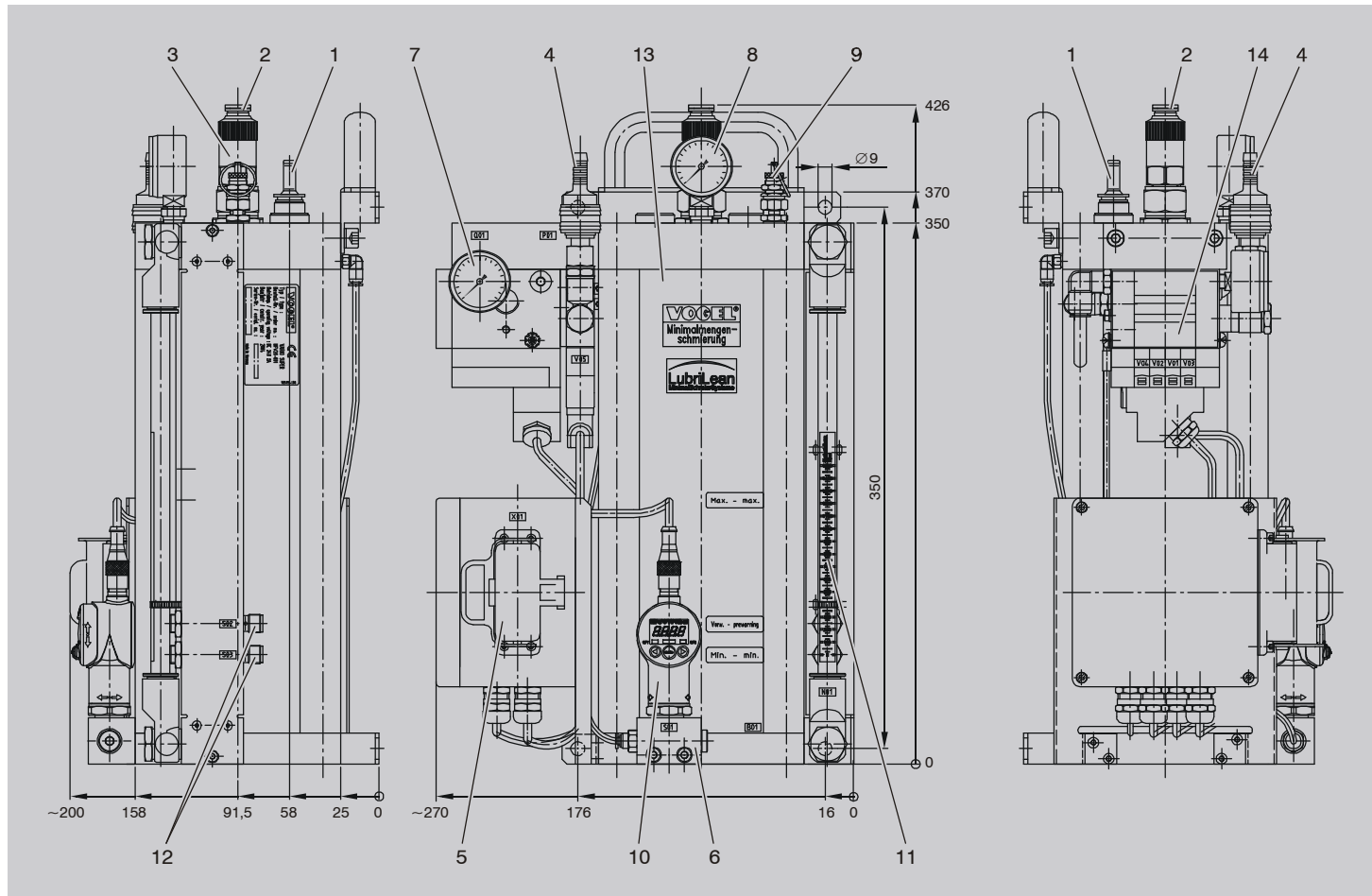
8.3.8 Pressure limiting valve and other safety measures

As a safety device, a pressure limiting valve is installed in the cover flange of the reservoir (pos 9, Figure 1); it limits the interior vessel pressure if the pressure to max. 12 bar. Manual operation of the safety valve depressurises the aerosol generator.

As a further safety measure, the thread of the filling opening is provided with a groove. This ensures that the excess pressure can build down if the cover is accidentally removed from the pressurised vessel. The same applies to the plug screws for the alternative output connections. However, these screws have bores that ensure the pressure will build down as soon as the screw is loosened somewhat.

Figure 1. Design of the MQS system LUBRILEAN® Vario Super (subject to change)

- | | |
|--|--|
| 1 Aerosol outputs | 9 Pressure limiting valve |
| 2 Filling opening | 10 Pressure switch |
| 3 Non-return valve | 11 Filling level indicator |
| 4 Air supply connection | 12 Connections for filling level monitoring |
| 5 Electrical supply connection | 13 Reservoir |
| 6 Drain screw | 14 Valve isle |
| 7 Pressure gauge for primary pressure | |
| 8 Pressure gauge for interior vessel pressure | |



8.4 Function

The MQS system LUBRILEAN® Vario Super is operated with compressed air. Figure 2 shows a function diagram.

The compressed air passes the main air valve and reaches the valve isle, where the air volume required for the respective lubricant volume is set. Next the air flows into the lubricant reservoir, in which the operating pressure - also referred to as interior vessel pressure - builds up. Subjected to this pressure, lubricant flows from the reservoir through the lubricant supply line to the aerosol generator unit, where the aerosol is generated with the aid of the incoming air. The aerosol is then transported by the air through one or several aerosol lines to the tool or lubricating point connected

The MQS system LUBRILEAN® Vario Super is controlled by the machine tool, which, upon specification of the customised tool-specific M commands, outputs the required control signals to the MQS system.

The valves of the valve isle are operated on the basis of these signals, thus achieving the required aerosol composition. Additionally, the main air valve and the additional air valve are controlled by the machine control system.

Also, the differential pressure control of the MQS system may be activated or deactivated as needed.

Differential pressure control is an operating mode of the MQS system, in which the pressure difference between the primary air supply pressure and the interior vessel pressure is monitored. If the differential pressure drops below a certain value set ex-works because a tool with a very small cooling line cross section is used, the compressed air supply is shut-off and no further aerosol produced. Aerosol which has already been produced drains off. Aerosol generation continues when the differential pressure rises again. This process is referred to as "intermittent operation" and is clearly detectable by operating noises.

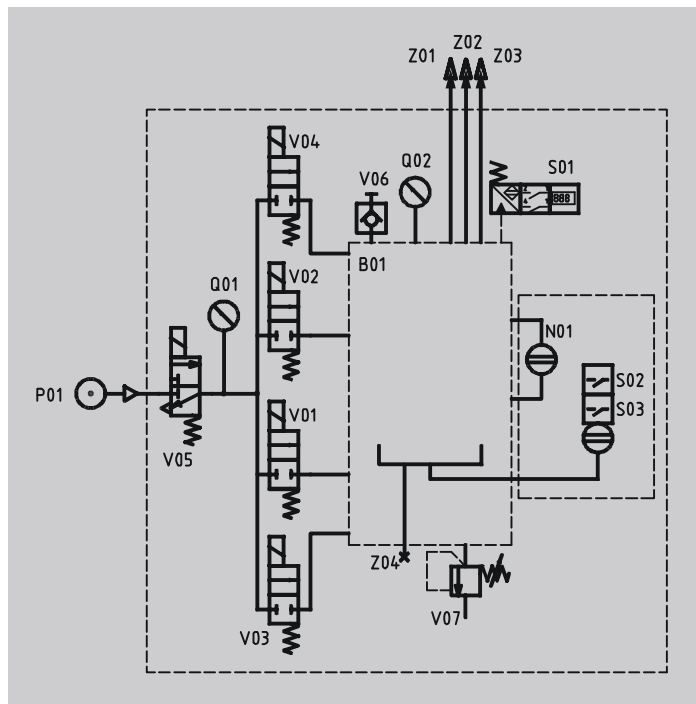


Figure 2. Function diagram of the MQS system LUBRILEAN® Vario Super


Explanations:

- B01** - Reservoir
- N01** - Filling level indicator
- P01** - Compressed air connection
- Q01** - Pressure gauge, primary pressure, indicates in bar
- Q02** - Pressure gauge, interior vessel pressure, indicates in bar
- S01** - Pressure switch
- S02/03** - Capacitive level monitoring switch
- V01-V03** - Valves controlling the aerosol composition
- V04** - Additional air valve
- V05** - Main air valve
- V06** - Filling coupling
- V07** - Pressure limiting valve
- X01** - Electric connection
- Z01-Z03** - Aerosol outputs
- Z04** - Drain screw

9 Installation

The MQS system should be installed and operated the first time in the following sequence:

- Setup,
- First filling,
- Connection of aerosol and compressed air lines,
- Electrical connections and settings,
- Software configuration in the machine control system,
- Test run


 **The system may be installed and connected only by adequately qualified and instructed personnel. The notes contained in these operating instructions, the local installation conditions as well as the notes of the machine manufacturer must be observed.**

9.1 Setup

The MQS system LUBRILEAN® Vario Super should be installed protected from moisture and vibration, but should be readily accessible, to ensure all further installation work can be completed without problems. All optical monitoring elements must be readily visible and all operating elements easily accessible.


The system must not be installed in the vicinity of heat sources or be operated at ambient temperatures outside the temperature limits indicated. Locations subject to rapidly and strongly changing temperatures are also unsuitable.

The MQS system should be set up in the immediate vicinity of the machine. We recommend installation of the system directly on the machine housing. The installation dimensions are set forth in the respective customer drawing.


 **The system must be installed vertically for faultless operation. It must never be installed upside-down or in horizontal position.**

9.2 Connection of aerosol lines

The MQS system LUBRILEAN® Vario Super has three aerosol outlets designed as plugged connections for hoses with an outside diameter of 12 mm.

 **Only pneumatic hoses which are resistant to the lubricants used and that will withstand an operating pressure of least 10 bar may be used.**

Generally, only one pressure outlet will be used. The two alternative outlets are closed by plug screws.

 **Before loosening or unscrewing the plug screws, the reservoir must be depressurised.**

The lubricant volume that will be supplied at the tool in the form of an aerosol depends - among other factors - on the existing line and duct cross-sections of the aerosol path between the MQS system and the escape openings at the tool.

Follow the following rules in order to prevent aerosol and pressure losses during transport.

- The lubricant supply line should not have any sizable section changes, narrow passes, hindrances or sharp edges, since the lubricant could partially condense and settle at these points and thus would no longer be available for lubrication purposes.
- The cross-section of the aerosol lines leading up to the tool should be large enough to ensure transport of a sufficient lubricant volume. However, in the area of the tool, the duct diameter should be < 8 mm, since a higher flow rate is preferable here.
- The main aerosol line should be kept as short as possible. With increasing aerosol line length, the pressure and aerosol losses will increase due to condensation of lubricant. Additionally, the reaction time for changes in aerosol composition will lengthen with increasing distance between MQS system and machine.
- The aerosol lines should be laid out as straight as possible; be sure to avoid “sharp bends”, since the lubricant may condense and settle at such points. If deflections can not be avoided, they should have a radius of at least 200 mm.
- The main aerosol line, if at all possible, should not change cross-section. If cross section changes are unavoidable, the transitions should be made as smooth as possible. A transition angle of $< 15^\circ$ is ideal.
- All junctures should be smooth and have no holes or projecting edges. This applies especially to the transition area between the tool and tool holding fixture.
- Where possible, the aerosol lines should not be subjected to vibration and shock.
- The aerosol line should follow a continual ascent to the machine. Downward bends are to be avoided, since lubricant could accumulate in these areas, e.g. if the machine is at a standstill.
- If it is impossible to lay the aerosol lines without any downward bends, it is necessary to blow out the accumulated lubricant with the tool removed from time to time. Observe the safety instructions.
- The aerosol should be supplied in axial direction for spindles or rotating tools. Radial supply, especially at high spindle speeds can lead to “centrifuging” of the lubricant, that is, the aerosol will decompose. This applies especially when small, high-speed tools are used.
- Only tools suitable for minimum quantity lubrication should be used to machine parts. Only this way, sufficient lubricant supply will be guaranteed during processing.
- The outlet of the cooling duct bore hole on the tool should not lie only on the tool reference plane for full-spray lubrication, as is usually the case with many tools. Optimal results are not attained when such tools are used, whereas minimum-quantity lubrication systems can achieve much better results. Because of the considerably lower operating pressure of minimum-quantity lubrication systems in comparison to full-spray lubrication, the point between the tool and the workpiece is insufficiently lubricated.

9.3 Rotary joint and spindle

The following notes apply to the rotary joints and spindles of the machine tools:



Only rotary joints designed for dry running may be used. The low amounts of lubricant used in minimum-quantity lubrication do not suffice for adequate lubrication of the rotary joint.

Disregarding this fact could lead to considerable damage to the machine tool. Please contact the machine manufacturer and ask whether the rotary joint of the machine tool is suitable for dry-running.



Rotary joints and spindles with integrated non-return valves must be modified.

Non-return valves are often built into rotary joints and spindles by the machine tool manufacturer. These non-return valves must be removed since it cannot be assured that they would open completely because of the low operating pressure of the minimum-quantity lubrication system. Sufficient lubrication of the cutting process can therefore not be ensured.

Please contact the machine tool manufacturer and ask how the non-return valves can be removed.

If you have additional questions concerning installation of the MQS system, please contact a SKF service station (see chapter 15, page 34).

9.4 First filling



Only the lubricants provided by SKF may be used. Please note, that SKF will not accept liability for damages resulting from use of lubricants other than those approved in writing for their compatibility with the system and their supply properties.



The lubricant reservoir must be depressurised before draining it of lubricant. The interior vessel pressure can be checked at the pressure gauge (pos. 8 in Figure 1) upstream of the filling coupling.

It is recommended to fill the container before connecting the compressed air supply when the system is put to use for the first time. If the system is already connected to the compressed air supply, ensure that the container is depressurised before filling it.

To depressurise the reservoir, first close the main valve and then separate the MQS system from the air supply line. Check the interior vessel pressure at the pressure gauge (pos. 8 in Figure 1) upstream of the filling coupling.

Also wait until the pressure has built down toward the connected tool via the aerosol outlets, unless this path has been shut off by a ball cock or similar device. If the latter is the case, the pressure will build down via the relief setting of the main valve only.

Note that the valves must be opened by the machine control system. Check whether the pressure has been completely released by briefly actuating the pressure limiting valve. While doing so, check the pressure gauge.

Once you are certain that the pressure has been completely relieved, you can open the inlet opening with a suitable tool.

Notice:

There is a seal ring underneath the screw.

Use a funnel to fill the reservoir with lubricant to the maximum level marking.

When the reservoir is overfilled (filling level higher than "Maximum"), the excessive lubricant must be drained (see chapter 12.3, page 31), since aerosol can otherwise not be generated.



Close the filling opening tightly after filling.

Ensure that the seal ring is in the correct position before you screw in the plug screw.

Tighten the plug screw, but do not use force; otherwise the seal could be damaged.

By means of visual inspection check for tightness during operation.

9.5 Connecting compressed air



Ensure that the main air valve is closed before connecting the MQS system to the compressed air supply. The main air valve is closed if there is no active signal on PIN 3.

The MQS system LUBRILEAN® Vario Super has an NG8 coupling socket for hoses with an inner diameter of 7-8 mm for connection to the compressed air supply.

For the compressed air to be used, please observe the requirements outlined in Table 2. The customer must ensure that the air purity required for aerosol generation is reached and that any moisture in the air is separated.

The MQS system LUBRILEAN® Vario Super can operate with an admission pressure of as low as 4 bar. However, the system reaches its peak performance only with an inlet pressure of 6 bar.



The MQS system LUBRILEAN® Vario Super must only be operated at an admission pressure of max. 10 bar. Higher pressures are dangerous for both people and the machine.



The maximum admissible aerosol concentration with a view to the ignition and explosion hazard depends on the lubricant employed and must be observed. If in doubt, be sure to contact the lubricant supplier.

Table 2. Compressed Air Requirements

Requirements	Values
Maximum inlet pressure	10 bar
Minimum inlet pressure *	4 bar
Compressed air quality class according to ISO 8573-1	5
Maximum particle size	40 μm
Maximum particle density	10 mg/m^3
Maximum pressure dew point	+7 $^{\circ}\text{C}$
Maximum lubricant concentration	25 mg/m^3

* depends on cooling duct diameter of tool (counter pressure)

9.6 Electrical connection



The unit must be connected electrically by adequately qualified and instructed personnel, exclusively. The notes contained in these operating instructions, the local installation conditions as well as the notes of the machine manufacturer must be observed.

Electrical connection of the MQS system is achieved by a ten-pole connector (Figure 3, Table 4). The requirements upon the supply voltage are outlined in Table 3.

Depending on the application conditions, diverse connections may be achieved. In the following, the options are outlined briefly.

For operation of the MQS system the operating voltage must be connected to PIN 1 (+ 24 V DC) and 2 (0 V DC). Additionally, voltage must always be present at the main air valve V05. This is guaranteed by switching the main air valve parallel to the supply voltage of the unit. To close the main air valve, and thereby, to depressurise the lubricant reservoir, only the operating voltage then needs to be switched off.


PIN 3 (valve V01) and 8 (pressure switch S01) are used to start the aerosol generation. When both connections are activated simultaneously, pressure differential control is automatically activated (for an explanation see chapter 8.4, page 16). This is recommended for tools with cooling channel diameters from 0.8 mm to 2.0 mm. If no voltage is applied to PIN 8 (pressure switch S01), the differential pressure control remains deactivated.

If a relatively high lubricant volume and air flow are required, e. g. when larger tools are used, PIN 4 (valve V022) and 5 (valve V03) as well as PIN 6 (additional air valve V04) may be activated additionally. Which valves can be operated in such situations and which supply volume may then be expected, is outlined in Table 5 in chapter 10, page 26.

Table 3. Operating Voltage Requirements

Requirements	Values
Operating voltage	24 V DC +/- 10%
Residual ripple*	<2%

Table 4. Connector

Figure 3. Connector	PIN configuration			
	PIN 1	+ 24 V DC	PIN 6	V04 (additional air)
	PIN 2	- 0 V	PIN 7	not used
	PIN 3	V01	PIN 8	S01 (pressure switch)
	PIN 4	V02	PIN 9	not used
	PIN 5	V03	PIN 10	not used

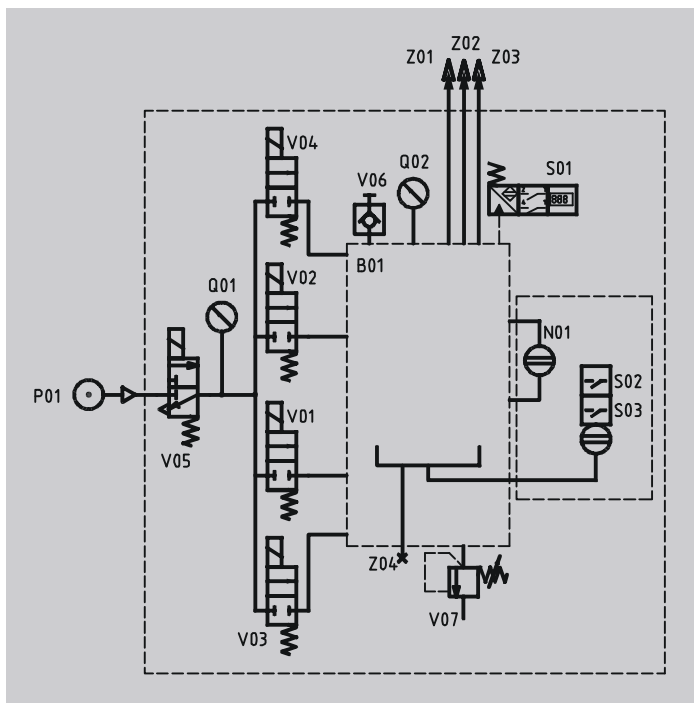


Fig. 4. Function diagram of the MQS system LUBRILEAN® Vario Super

Explanations:

- B01** - Reservoir
- N01** - Filling level indicator
- P01** - Compressed air connection
- Q01** - Pressure gauge, primary pressure, indicates in bar
- Q02** - Pressure gauge, interior vessel pressure, indicates in bar
- S01** - Pressure switch
- S02/03** - Capacitive level monitoring switch
- V01-V03** - Valves controlling the aerosol composition
- V04** - Additional air valve
- V05** - Main air valve
- V06** - Filling coupling
- V07** - Pressure limiting valve
- X01** - Electric connection
- Z01-Z03** - Aerosol outputs
- Z04** - Drain screw

10 Setting the parameters

10.1 General information

The settings of the MQS system LUBRILEAN® Vario Super depends on a series of factors such as the current primary pressure, the length of the aerosol lines, the type and size of the tool, the cooling duct cross section and the processing procedures. Because of this it is impossible to specify binding setting parameters for the respective processing situations here.

The setting parameters listed in Table 5 are guiding values and allow first orientation.

We recommend ascertaining and optimising the necessary settings for your application by undertaking test runs in order to attain the best results for your processing procedures.

After long periods of machine standstill or a change of tools, temporary inconsistencies in the aerosol supply to the lubricating point as well as oil mist may arise. However during operation the lubricant supply stabilises and the oil mist disappears.

10.2 Effects of Inlet Pressure

The MQS system LUBRILEAN® Vario Super draws the power it needs for aerosol production from the compressed air supplied to the system.

The systems are ready for operation and produce an aerosol adequate for most lubrication tasks at an inlet pressure of as low as 4 bar. The supply may, however, not suffice for the lubricating point on tools with cooling duct diameters below 0.8 mm.

The system reaches its peak performance only with an inlet pressure of > 6 bar.

10.3 Operation of the Additional Air Valve

The additional air can be used to increase the amount of air for aerosol transport. Note that the lubricant concentration in the aerosol decreases because it is enriched with air.

Table 5. Setting the Parameters

Tool geometry		Control of the valves and the pressure switch 0 – no signal, valve closed, 1 – signal applied, valve opened					Lubricant volume in ml/h at a primary air pressure of			
Diameter of cooling duct	Surface of cooling duct	Valves controlling the aerosol composition			Additional air V04	Main air V05	Pressure switch S01	4 bar	6 bar	8 bar
		V01	V02	V03						
0.8	0.5	1	0	0	0	1	1	3	4	5
1	0.8	1	0	0	0		1	5	6	7
2	3.1	1	0	0	0		0	6	7	8
		1	0	0	0		1	22	23	28
3	7.1	0	1	0	0		1	24	25	26
		0	0	1	0		1	30	33	38
5	19.6	0	1	0	0		0	28	30	32
		0	1	1	1		0	50	70	100
7	38.5	0	0	1	0		0	65	75	120
		0	1	1	0		0	110	130	190

* The volumes indicated may differ in actual operation, since it is not possible to take into account the on-site influences of the aerosol line, rotary joint, spindle, tool connection and tool speed
Lubricant volumes apply to static operation (spindle stopped) ($\pm 20\%$)

10.4 Procedures for Setting Parameters

The following instructions will help you find the correct settings for the MQS system and your particular application.

1. Select a basic setting from Table 5 and program the machine control system accordingly.
2. Switch the MQS system on via the machine control system.
3. When the spindle is at a standstill, check whether the aerosol can flow unhindered through the duct system of the machine tool. This can be seen best if the tool is removed from the tool holding fixture. The aerosol must emerge visibly from the duct system.
4. Clamp the tool in the tool holding fixture and hold an oil-free workpiece surface approx. 1 - 3 mm below the tool at the outlet duct. If no lubricant film forms on the surface, there is a fault in the duct system of the tool. Please check the tool and the tool holder.
5. Adapt the aerosol mixture and amount for the processing procedure until you achieve the desired result.
6. Store the ascertained settings in the machine control unit so that you can call them up again when necessary.



If the MQS system is adjusted improperly, tools or workpieces may be damaged.




11 First Operation

The first operation of the MQS system involves a functional check and setting of the operating parameters.


Proceed as follows for first operation:

- Ensure that the control cabinet housing and all its connections are firmly in place before the first operation.
- Check that a sufficient amount of lubricant is in the lubricant reservoir.
- Check that compressed air is present.
- Set the operating parameters as described in the preceding chapter.
- Start the system.

12 Maintenance



-  **Maintenance work may be carried out only by qualified and trained specialists instructed to do so.**
-  **Maintenance work may be carried out only after a trained specialist has disconnected the MQS system from power. Working on systems connected to electrical voltage could lead to personal injury.**
-  **The lubricant reservoir may be pressurised. Before installation work, repair or maintenance work it must be depressurised.**

The SKF MQS system LUBRILEAN® Vario Super requires little maintenance. However, in order to ensure faultless functioning and to prevent dangers from arising, check all connections and functions regularly.

-  **All work going beyond the descriptions in this manual must only be performed by an authorised service partner of SKF.**

SKF LUBRICATION SYSTEMS GERMANY AG assumes no liability for damages which accrue from improper maintenance work on the MQS system.

12.1 Filling with lubricant

-  **Only the lubricants provided by SKF may be used. Please note, that SKF will not accept liability for damages resulting from use of lubricants other than those approved in writing for their compatibility with the system and their supply properties.**
-  **The lubricant reservoir must be depressurised before draining it of lubricant. The interior vessel pressure can be checked at the pressure gauge (pos. 8 in Figure 1) upstream of the filling coupling.**

To depressurise the reservoir, first close the main valve and then separate the MQS system from the air supply line. Check the interior vessel pressure at the pressure gauge (pos. 8 in Figure 1) upstream of the filling coupling.

Also wait until the pressure has built down toward the connected tool via the aerosol outlets, unless this path has been shut off by a ball cock or similar device. If the latter is the case, the pressure will build down via the relief setting of the main valve only.

Note that the valves must be opened by the machine control system. Check whether the pressure has been completely relieved by briefly actuating the safety valve. While doing so, check the pressure gauge.

If you are certain that the pressure has been completely released, you can now screw on the inlet with a suitable tool.

Notice:

There is a seal ring underneath the screw.

Use a funnel with integrated screen to fill the reservoir with lubricant to the maximum level marking.

When the reservoir is overfilled (filling level higher than "Maximum"), the excessive lubricant must be drained (see chapter 12.3, page 31), since aerosol can otherwise not be generated.



Close the filling opening tightly after filling.

Ensure that the seal ring is in the correct position before you screw in the plug screw.

Tighten the plug screw, but do not use force; otherwise the seal could be damaged.

By means of visual inspection check for tightness during operation.

12.2 Changing the lubricant

If you want to change the lubricant, please drain the previously used lubricant before adding the new lubricant. Read the following chapter for information on draining the lubricant.



Do not mix different lubricants unless you have the express consent of SKF to do so. Otherwise damages could arise, and a laborious cleaning of the system's interior might become unavoidable.

Thereafter, fill in the new lubricant as described in the preceding section.

12.3 Draining lubricant



The lubricant reservoir must be depressurised before draining it of lubricant. The interior vessel pressure can be checked at the pressure gauge (pos. 8 in Figure 1) upstream of the filling coupling.

To depressurise the reservoir, follow the instructions in section 12.129.

To drain lubricant, loosen the drainage screw on the bottom of the container with a suitable tool.

Please observe the legal directives for the disposal of lubricants.



Be sure to close the drain valve after draining the lubricant.

12.4 Cleaning

12.4.1 Exterior cleaning

If necessary the MQS system can be cleaned with mild, material-safe (non-alkaline, no soap) cleaning agents.

For safety reasons, we recommend to disconnect the MQS system from the compressed air supply and the electrical voltage, and to depressurise the reservoir as outlined in section 12.1, page 29.

If possible, leave hoses and cables connected while cleaning and close any openings to prevent cleaning agents from entering the interior of the MQS system.

12.4.2 Interior cleaning

Interior cleaning is not necessary in normal operation if compatible lubricants are used.

If unsuitable or dirty lubricant has been used, the interior of the lubricant reservoir must be cleaned. Please contact us if this situation arises. Never attempt to clean the interior of the MQS system yourself.



Removal of the lubricant reservoir or other function elements of the MQS system is not allowed and voids the guarantee. Also, hazards, e. g. from escaping lubricant may ensue.

Sensitive components are installed inside the lubricant reservoir. Improper disassembly could lead to malfunctions or system failure.

13 Failures

The following prerequisites must be met for the MQS system to function faultlessly:

- The system has been connected correctly,
- Compressed air with sufficient primary pressure (at least 4 bar) is supplied,
- The connector is plugged in and fastened correctly,
- The machine tool is switched on.

If, however, failures nevertheless arise, they can usually be quickly remedied as long as there is no functional failure of the system.

Table 6 contains an overview of problems which you can remedy yourself. You should contact us if the problem can not be rectified by taking the measures described here.

Table 6. Failures and their remedy

Problem	Possible cause	Remedy
The system does not produce any aerosol.	Use of lubricant not approved of by SKF.	Use only lubricants which have been approved by SKF.
	The system is not activated correctly by the machine tool control.	Check the connector and the supply line up to the machine control system. Check the control operation with the aid of the LEDs at the valve isle and at the main air valve. If no signals are transmitted or the indication is wrong, please contact our customer service.
	The system is defective or damaged DO NOT OPERATE IT!.	Contact our customer service.

Table 6 cont. Failures and their remedy

Problem	Possible cause	Remedy
The aerosol does not reach the tool.	The aerosol transport lines are bent, blocked or have excessive changes in cross sections.	Observe the instructions for layout of aerosol lines in chapter 9.2, page 18
	If a shut-off valve is installed at the spindle inlet, e. g. a ball cock it may not receive a control signal or the signal may be faulty.	Inform the manufacturer of the machine tool. Have the control and the electrical connections checked.
	Inside the spindle, a non-return valve is installed in the lubricant supply area.	The non-return valve must be removed. Observe the notes in chapter 9.2, page 18
	The spindle is unsuitable (e.g. rough transitions, too narrow cross section).	Use a suitable spindle, ask the manufacturer of your machine tool.
	The rotary joint is unsuitable.	Observe the notes in chapter 9.2, page 18
	The tool holding fixture is not tight.	Use only tool holding fixtures which are suitable for minimum-quantity lubrication.
	The tool has an unsuitable lead-in and a very small cooling duct	Use only tools suitable for minimum-quantity lubrication systems.
	For small tools: the inlet pressure is too low.	Increase the inlet pressure.
Despite sufficient aerosol on the tool, processing is faulty.	The tool has an unsuitable outlet bore hole.	Use only tools suitable for minimum-quantity lubrication systems.
	The section parameters are not adapted to processing with minimum-quantity lubrication.	Change the section parameters.
The system does not operate intermittently and the interior vessel pressure is equal to the system pressure.	The pressure switch for pressure differential control is defective or misadjusted.	Contact our service department. Correct the setting if required (Observe the operating instructions for the pressure switch).

14 Decommissioning

14.1 Temporary Shut-Down

You should disconnect the entire system from the compressed air supply and depressurise the reservoir for a temporary standstill of the MQS system. Also, the system must be separated from the supply voltage and properly secured against power-up or direct contact.

It is recommended to drain the lubricant for longer standstill times.

14.2 Final Taking out of Service

If you want to put the MQS system out of service permanently, please comply with the legal regulations for disposal of contaminated components.

The system can also be taken back by SKF for disposal if the costs are covered.

15 Service

Please contact our sales offices or our international representatives if you have any questions or problems.

You can find a list with current addresses on the Internet at:

- www.skf.com/schmierung

16 Specifications

Table 7. Specifications

Designation	Unit	Value
System		
Exterior dimensions H x W x D	mm	426 x 270 x 200
Increase of the box volume due to projecting add-on pieces (without connections)	mm	-
Empty weight	kg	9
Connections		
Compressed air connection	-	Coupler socket NG8 for inner hose diameter of 7-8 mm
Aerosol outlets		
Number	-	3 (optional)
Version	-	connector for pipe diameter 12 mm
Calibration of hoses	-	outside
Material	-	Polyamid
Diameter	mm	12
Power requirements		
Compressed air		
Primary air pressure, max.	bar	10
Primary pressure, min.	bar	4 (dependent on cooling channel diameter of tool, e.g. on counter pressure)
Air consumption	l/min	10 - 500 (dependent on primary air pressure and cooling channel diameter)
Electrical connection		
Operating voltage	V DC	24
Current consumption	A	2
Level Monitoring		
Version	-	capacitive switch
Switching voltage	V DC	24
Switching current, max.	A	0.2

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