

FF and FB Multiline pump units

for use in progressive centralized lubrication systems

Assembly instructions

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

EN



Version 06



Multiline pump units in the series FF and FB

Imprint

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

These original assembly instructions with associated operating instructions have been prepared in accordance with the established standards and rules for technical documentation.

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Subject to changes in contents and technical information.

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EC Declaration of Incorporation acc. to Machinery Directive 2006/42/EC, Appendix II Part 1 B

The manufacturer, SKF Lubrication Systems GmbH, Hockenheim Plant, 2. Industriestrasse 4, DE - 68766 Hockenheim, hereby declares the conformity of the partly completed machinery

Designation: Multiline pumps units
 Type: **FF */ FB***
 Item number: 773-*; 769-*; 767-* without 767-030-*
 Year of manufacture: See rating plate

with the essential protection requirements of Machinery Directive 2006/42/EC at the time of placing on the market.

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

The technical documentation described in Annex VII, part B of this Directive has been prepared. We undertake to transmit, in response to a reasoned request by the national authorities, the special documents for this partly completed machine. The Head of Technical Standards is the authorized representative for the technical documentation. See the manufacturer information for the address.

Furthermore, the following Directives and (harmonized) standards were applied in the applicable areas:

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

Standard	Edition	Standard	Edition	Standard	Edition	Standard	Edition
DIN EN ISO 12100	2011	DIN EN 60947-1	2011	DIN EN 61000-6-3	2011	DIN EN 61000-6-1	2007
Correction	2013	DIN EN 60947-5-1	2010	Correction	2012	DIN EN 61000-6-4	2011
DIN EN 809	2012	DIN EN 60034-1	2011	DIN EN 50581	2013		
DIN EN 60204-1	2007	DIN EN 61000-6-2	2006	DIN EN 61131-2	2008		
Correction	2010	Correction	2011				

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

Hockenheim, 2016,04,25

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Explanation of symbols and signs

You will find these symbols, which warn of specific dangers to persons, material assets, or the environment, next to all safety instructions in these operating instructions.

Please heed these instructions and proceed with special care in such cases. Please forward all safety instructions to other users.

Instructions placed directly on the machines/grease lubrication pump units, such as:

- Arrow indicators
- Labels for fluid connections must be followed and kept in fully legible condition.



You are responsible!

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

Hazard symbols



General hazard
DIN 4844-2-W000



Electrical voltage/current
DIN 4844-2-W008



Hot surface
DIN 4844-2-W026



Danger of being drawn into machinery
BGV 8A



Slipping hazard
DIN 4844-2-W028



Warning of potentially explosive atmosphere
DIN 4844-2-W021

Indicators used with safety instructions and their meaning

Indicator	Use
Danger!	danger of bodily injury
Warning!	danger of damage to property and the environment
Note!	provides additional information

Informational symbols



Note



Prompts an action



Used for itemizing



Points out other facts, causes, or consequences



Provides additional information

Assembly instructions in accordance with Machinery Directive 2006/42/EC, Annex VI

The assembly instructions fulfill the Machinery Directive indicated above with regard to partly completed machinery. Partly completed machinery, which includes the product described herein, is only intended to be incorporated into or assembled with other machinery or other partly completed machinery or equipment, thereby forming machinery to which the above-mentioned Directive applies.

1. Safety instructions



The operator of the described product must ensure that the assembly instructions are read and understood by all persons assigned with the assembly, operation, maintenance, and repair of the product. The assembly instructions must be kept ready to hand.



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

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



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

1.1 Intended use

Pump units of SKF's FF and FB series are used to supply centralized lubrication systems in vehicles, systems and machines. They deliver mineral oils or environmentally friendly oils from ISO VG 46 and greases up to NLGI Grade 3. The technical data specifications in Chapter 10 of the operating instructions must be adhered to. Only media approved for these types of pump units may be used. Unsuitable media may result in pump unit failure and potentially severe bodily injury and property damage. The use of synthetic and biodegradable oils or greases requires prior approval from SKF Lubrication Systems Germany GmbH. Any other usage is deemed non-compliant with the intended use.

1.2 Authorized personnel

Only qualified technical personnel may install, operate, maintain, and repair the products described in the assembly instructions. Qualified technical personnel are persons who have been trained, assigned and instructed by the operator of the final product into which the described product is incorporated. Such persons are familiar with the relevant standards, rules, accident prevention regulations, and assembly conditions as a result of their training, experience, and instruction. They are authorized to identify and perform necessary actions while avoiding any risks which may arise. The definition of qualified personnel and the prohibition against employing non-qualified personnel are laid down in DIN VDE 0105 and IEC 364.

1.3 Electric shock hazard

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



Danger!

Work on products that have not been de-energized may result in bodily injury.

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

1.4 System pressure hazard



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

1.5 Hydraulic pressure hazard



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

Depending on the model design, the product may be able to be operated hydraulically.

2. Lubricants

2.1 General information



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

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

Hazardous materials of any kind, especially the materials classified as hazardous by CLP Regulation EC 1272/2008 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.

No products manufactured by SKF Lubrication Systems Germany GmbH are approved for use in conjunction with gases, liquefied gases, pressurized gases in solution, vapors, or such

fluids whose vapor pressure exceeds normal atmospheric pressure (1013 mbar) by more than 0.5 bar at their maximum permissible temperature.

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

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



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



Warning!

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

Selection of a lubricant suitable for the lubrication task is made by the machine/system manufacturer and/or the operator of the machine/system in cooperation with the lubricant supplier.

The bearings/friction points that require lubrication, their expected load during operation, and the expected ambient conditions are taken into account during selection, with consideration of economic and environmental aspects.



SKF Lubrication Systems Germany GmbH

Systems Germany GmbH supports customers

in the selection of suitable components for feeding the selected lubricant and in the planning and design of a centralized lubrication system.

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

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

2.3 Approved lubricants



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



Different lubricants cannot be mixed, as mixing may result in damage and necessitate costly and complicated cleaning of the product/lubrication system. It is recommended that an indication of the lubricant in use be attached to the lubricant reservoir in order to prevent accidental mixing of lubricants.

The product described here can be operated using lubricants that meet the specifications in the technical data. Depending on the product design, these lubricants may be oils, fluid greases, or greases.

Oils and base oils may be mineral, synthetic, and/or rapidly biodegradable. Consistency agents and additives may be added depending on the operating conditions.

Note that in rare cases, there may be lubricants whose properties are within permissible limit values but whose other characteristics

render them unsuitable for use in centralized lubrication systems. For example, synthetic lubricants may be incompatible with elastomers.

2.4 Lubricants and the environment



Lubricants can contaminate soil and bodies of water. Lubricants must be properly used and disposed of. Observe the local regulations and laws regarding the disposal of lubricants.

It is important to note that lubricants are environmentally hazardous, flammable substances which require special precautionary measures during transport, storage, and processing.

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

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

2.5 Lubricant hazards



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

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



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

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

3. Overview

Fig. 1 Components of the FF and FB units



Components of the unit

Item Description

- | | |
|---|---|
| 1 | Fill level control/fill level switch
Ultrasonic sensor |
| 2 | Lubricant reservoir |
| 3 | Pump element with ring connection |
| 4 | Pump motor with electrical connection |
| 5 | Filler socket |

4. Assembly

4.1 Setup and attachment

The product should be protected from humidity and vibration, and should be mounted so that it is easily accessible, allowing all further installation work to be done without difficulty. Make sure there is adequate air circulation to prevent the product from overheating. For the maximum permissible ambient temperature, see "Technical data."

The mounting position of the product is vertical as shown in the assembly drawing. Pressure gauges, oil level glasses, temperature gauges, and other visual monitoring equipment must be easy to see.

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

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

4.1.1 Assembly of FF and FB pump unit

The FF and FB multiline pump units must be installed on a level surface. The pump's base plate must not be under stress. Sufficient space must be provided during installation for later service and maintenance work (see pages 17 and 19).

When the reservoir is empty and its lid is removed, the agitator of the lubrication pump should be visible, so that the functioning and direction of rotation of the pump can be checked by switching the pump on briefly. In the case of pumps with electrical grease- or oil level monitoring, the clearance required above the pump can be up to 400 mm, depending on the height of the reservoir. The installed pump elements are set for full stroke, with the ring pieces with the check valve (1) pointing upwards. The cap nut (WAF 24) (2) keeps the ring piece pressed against the screw socket (3). If you want to point the ring piece in a different direction, loosen the cap nut and tighten it again with given Torque, see Operating instructions, Fig. 8.4.1.

The number of pump elements can also be changed later. The pump has to be shut done

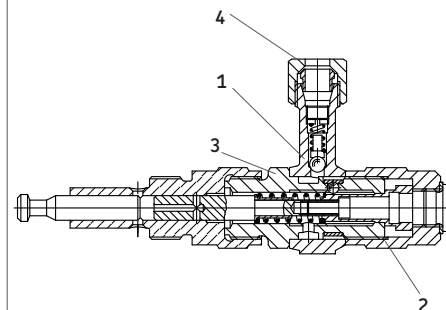
while this is done - see the maintenance chapter in the operating instructions. Internal threads for installing pump elements have to be sealed off with screw plugs M 20 x 1.5 (see accessories, page 61) if not in use.



Warning!

Pump elements must not be connected to the connection for the lubrication line (4).

Fig. 2 Pump units sectional view



Item	Description
1	Ring piece with check valve
2	Cap nut
3	Screw socket
4	Lubrication line connection

**Danger!**

The reservoir cover must be installed before turning on or commissioning the FF and FB multiline pump units. The agitator may cause injury if the reservoir cover is not installed.

**Warning!**

When drilling the assembly holes, you must be careful of any supply lines or other units, as well as of other hazards such as moving parts. Maintain safety clearances and comply with local regulations for assembly and accident prevention.

**Warning!**

Do not tilt or drop the FF or FB multiline pump unit!

The multiline pump units are installed using 3 screws (and washers). If M10 tapped bores are used to fasten the unit, the screws must have a minimum length of 20 mm.

Fastening material to be provided by the customer:

- Hexagon head screws (3x) acc. to DIN933-M10x20-8.8
- Washers (4x) acc. to DIN 125-B10.5-St

- Drill assembly holes (M10) acc. to assembly drawing (Fig. 2) and the conditions on the surface.
- Clean surface to remove drilling chips.
- Place the pump unit on the surface and roughly align it.
- Pass hexagon head screws (3x) acc. to (DIN933-M10x20-8.8) with associated washers (4x) acc. to DIN 125-B10.5-St through the fixing holes on the pump baseplate and apply the screws to the M10 threads on the surface.
- Gently tighten hexagon head screws (3x).
- Align pump unit, tighten hexagon head screws with following torque:

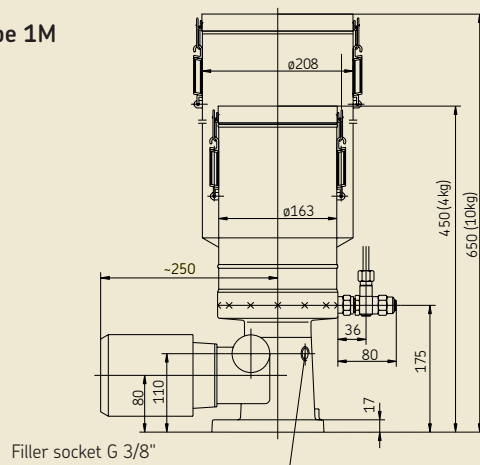
Torque 50 Nm

4.2 Connecting dimensions

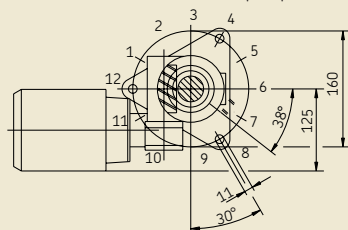
4.2.1 FF assembly drawing

Fig. 3 FF Multiline pump unit 1M and 2M

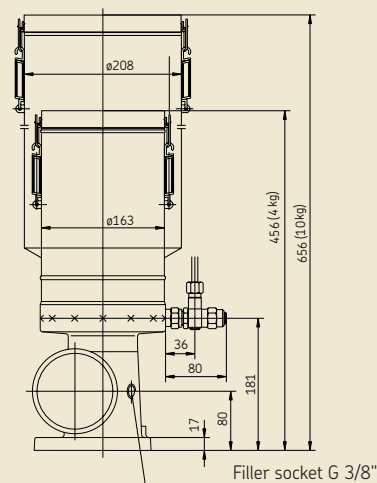
Type 1M



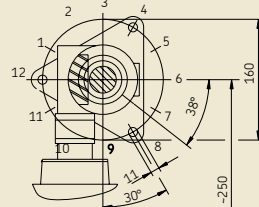
Position of pump elements



Type 2M



Position of pump elements



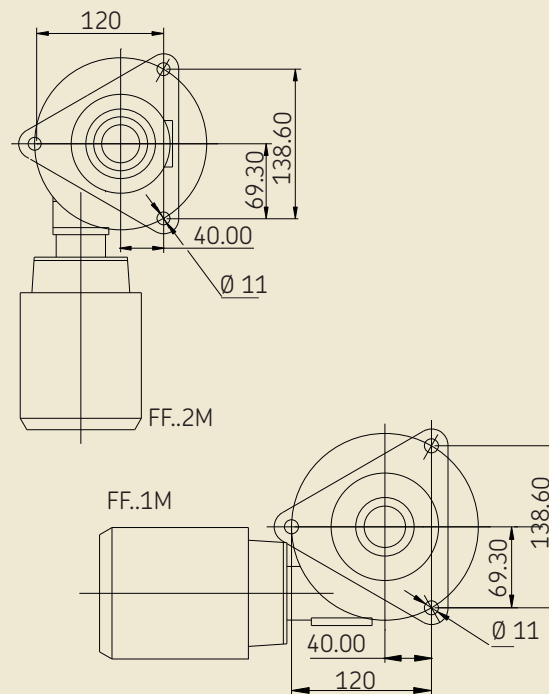
4.2.2 FF Minimum installation clearance

Minimum installation clearance

	FF/4 kg [cm]	FF/10 kg [cm]
U3 ultrasonic sensor	55	75
Fill level control G	68	115
control S	70	90
Fill level switch E	70	110
switch F	75	115
switch H	80	120
Fill level switch A	80	125
Fill level switch W	60	85

4.2.3 FF Assembly holes

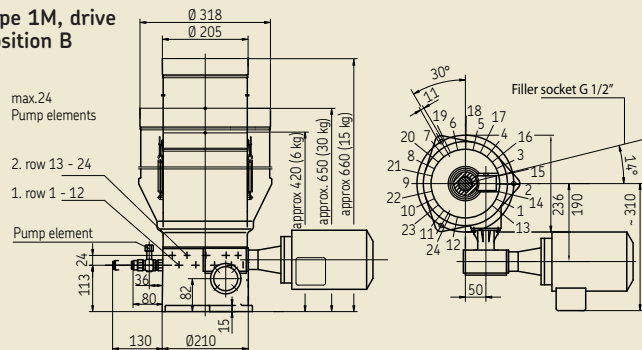
Fig. 4 FF Multiline pump unit, assembly holes 1M and 2M



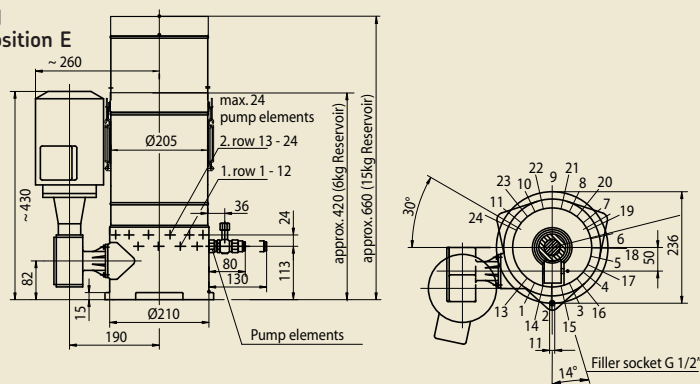
4.2.4 FB Assembly drawing

Fig. 5 FB Multiline pump unit 1M and 2M

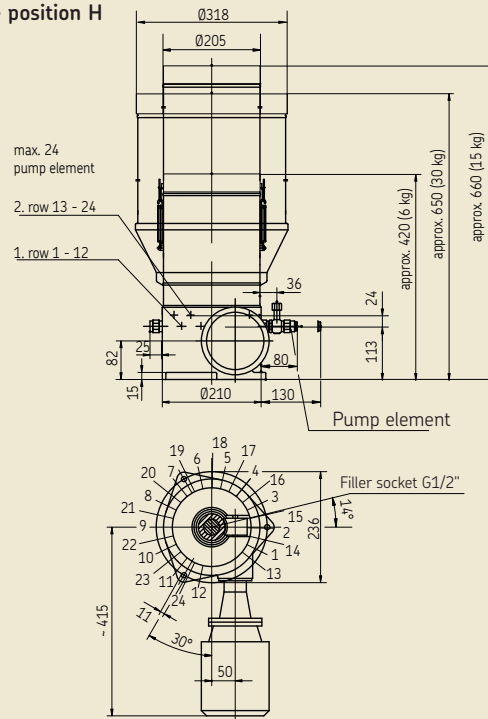
Type 1M, drive position B



Type 1M Drive position E



Type 2M Drive position H



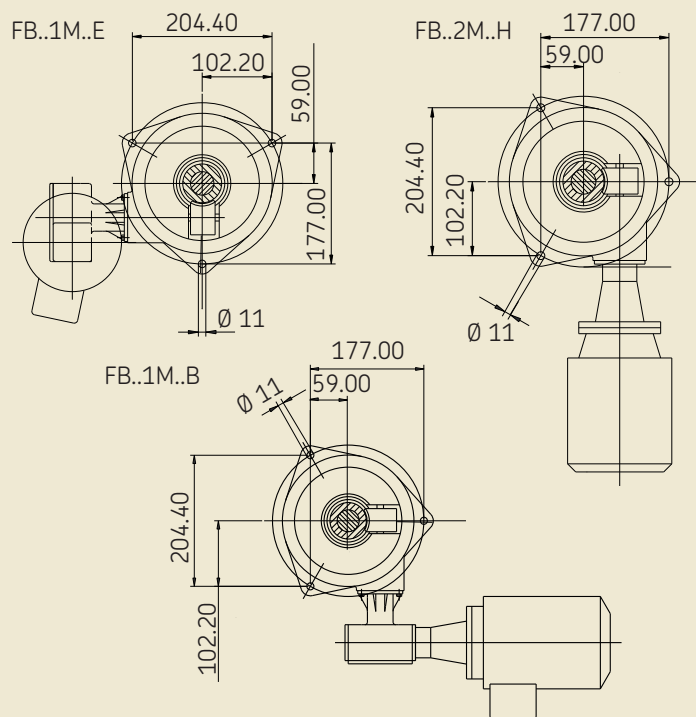
4.2.5 FB Minimum installation clearance

Minimum installation clearance

	FB/6 kg [cm]	FB/15 kg [cm]	FB/30 kg [cm]
U3 ultrasonic sensor	50	80	75
Fill level control G	70	120	110
Fill level control S	70	85	85
Fill level switch E	67	115	100
Fill level switch F	60	115	105
Fill level switch H	75	125	115
Fill level switch A	80	125	120
Fill level switch J	-	-	130
Fill level switch W	65	100	90

4.2.6 FB Assembly holes

Fig. 6 FB Multiline pump unit, assembly holes 1M and 2M



4.3 Electrical motor connection



Electric shock hazard

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



Warning!

Connect lines in accordance with the technical specifications and the local conditions for connections and local regulations (e.g., DIN, VDE).

Consult the motor's rating plate for the electrical characteristics of the motor, such as rated power, rated voltage, and rated current. Observe the guidelines in EN 60034-1 (VDE 0530-1) for operation at the limits of the ranges A (combination of $\pm 5\%$ voltage deviation and $\pm 2\%$ frequency deviation) and B (combination of $\pm 10\%$ voltage deviation and

$\pm 3/-5\%$ frequency deviation). This applies especially with regard to heating and deviations in operating parameters from the ratings on the motor's rating plate. The limits must never be exceeded.



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, else bodily injury and property damage may result.

Be sure to connect the motor so as to guarantee a continuously safe electrical connection (no protruding wire ends); use the assigned cable end fittings (e.g. cable lugs, wire end ferrules). Select connecting cables conforming to DIN VDE 0100 taking into account the rated current and the conditions of the specific system (e.g. ambient temperature, type of routing etc. in accordance with DIN VDE 0298 or IEC / EN 60204-1). Details regarding electrical con-

nection of the motor to the power supply, especially terminal and connector pin assignment, can be taken from the customer's drawing for the reservoir unit.



Warning!

When establishing electrical connection of the pump motor, be mindful of the correct direction of rotation of the motor.

If the direction of rotation of a motor is marked on the product by a rotation arrow, the motor's direction of rotation must match the arrow.

- Connect the pump unit motor according to the specifications on the motor rating plate and the motor characteristics.

4.3.1 FF Motor ratings

Motor ratings, 1M design

Rated speed [rpm]	Frequency [Hz]	Rated power [kW]	Rated voltage [V]	Rated current [A]	Order code
1000	50	0.09	230/400	0.80/0.46	AG
			290/500	0.64/0.37	AL
			400/690	0.46/0.26	AP
1500		0.18	230/400	1.13/0.65	AF
			290/500	0.90/0.52	AK
			400/690	0.65/1.07	AO

Note

This data refers to three-phase motors from VEM. There may be differences with motors from other manufacturers.

Motor ratings, 2M design

Rated speed [rpm]	Frequency [Hz]	Rated power [kW]	Rated voltage [V]	Rated - current [A]	Order code
750	50	0.12	230/400	1.27/0.73	AH
			290/500	0.34/0.58	AM
			400/690	0.73/1.26	AQ
1000		0.25	230/400	1.91/1.10	AG
			290/500	0.51/0.88	AL
			400/690	0.10/0.17	AP

Note

This data refers to three-phase motors from VEM.

There may be differences with motors from other manufacturers.

4.3.2 FB Motor ratings 1M and 2M

Motor ratings, 1M design

Rated speed [rpm]	Fre- quency [Hz]	Rated power [kW]	Rated voltage [V]	Rated current [A]	Order code
1000	50	0.25	230/400	1.91/1.1	AG
			290/500	1.45/0.84	AL
			400/690	1.07/0.62	AP
1500		0.25	230/400	1.36/0.78	AF
			290/500	1.08/0.62	AK
			400/690	0.78/0.45	AO

Note
This data refers to three-phase motors from VEM. There may be differences with motors from other manufacturers.

Motor ratings, 2M design

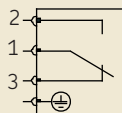
Rated speed [rpm]	Fre- quency [Hz]	Rated power [kW]	Rated voltage [V]	Rated current [A]	Order code
1000	50	0.25	230/400	1.91/1.1	AG
			290/500	1.45/0.84	AL
			400/690	1.07/0.62	AP
1500		0.37	230/400	1.84/0,1.06	AF
			290/500	1.47/0.85	AK
			400/690	1.06/0.62	AO

Note
This data refers to three-phase motors from VEM. There may be differences with motors from other manufacturers.

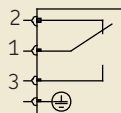
4.3.3 Assembly of the electric fill level switch

Fill level switch E

Design	Reed contact for monitoring minimum level
Form of contact	Change-over
Switching capacity, max.	60 W/VA
Switching voltage, max.	230 V DC/AC
Switched current, max.	1 A
Connection diagram	Plug EN 175301-803 (DIN 43650)
Protection class	IP 65



Switch position
at minimum



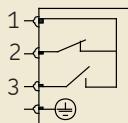
Switch position
above minimum

PIN Description

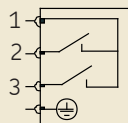
- 1 = + Supply voltage
- 2 = Signal output "above minimum"
- 3 = Signal output "minimum"
- 4 = PE protective earth

Fill level switch F

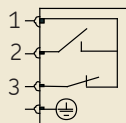
Design:	Reed contact for monitoring minimum and maximum level
Form of contact	
NO-contact/NC contact	
Switching capacity, max.	60 W/VA
Switching voltage, max.	230 V DC/AC
Switched current, max.	1 A
Connection diagram	Plug EN 175301-803 (DIN 43650)
Protection class	IP 65



Switch position
at maximum



Switch position
between minimum
and maximum



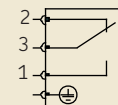
Switch position
at minimum

PIN Description

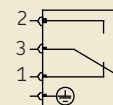
- 1 = + Supply voltage
- 2 = Signal output "Maximum"
- 3 = Signal output "minimum"
- 4 = PE protective earth

Fill level switch W

Design:	Reed contact for monitoring minimum level
Switching capacity	15 W/VA
Switched current	max. 1 A
Switching voltage max.	240 V AC/120 V DC
Form of contact.....	Changeover
Connection diagram	Plug EN 175301-803 (DIN 43650)
Protection class	IP 65



Switch position
above minimum



Switch position
at minimum

PIN Description

- 1 = Signal output "minimum"
- 2 = Signal output "above minimum"
- 3 = + Supply voltage
- 4 = PE protective earth

Fill level switch H

Design: Reed contact with three switching points (maximum, minimum pre-warning, minimum)

Switching capacity . . . 60 W/VA

Switched current, max. . 1 A

Switching voltage, max. 10-30 V DC/AC

1. Maximum fill level . (NO-contact)

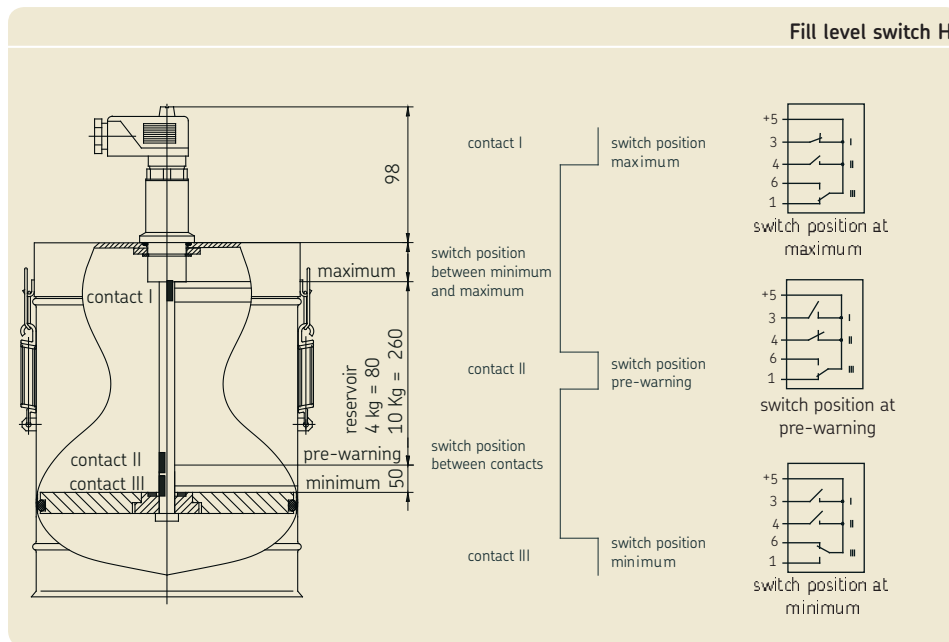
2. Fill level pre-warning (NO-contact)

3. Min. fill level (changeover)

Connection diagram . . Plug

EN 175301-803 (DIN 43650)

Protection class IP 65



Fill level switch A

Design: Microswitch with three switching points (maximum, minimum pre-warning, minimum) and dip stick

Switched current max. . 15 A AC / 10 A DC

Switching voltage max. : 250 V AC/30 V DC

1. Maximum fill level . . Contact 1+2 open
Contact 1+3 open

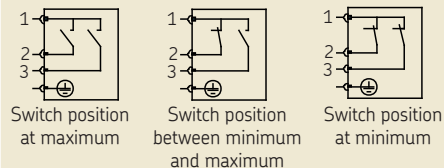
2. Fill level Closed
pre-warning Contact 1+2
Contact 1+3 open

3. Minimum fill level . . Contact 1+2 closed
Contact 1+3 closed

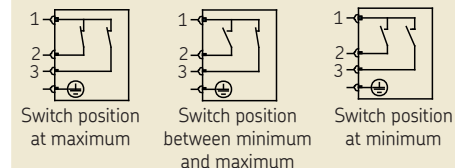
Connection diagram . . Plug

. EN 175301-803
(DIN 43650)

Protection class IP 65


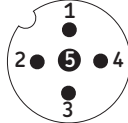
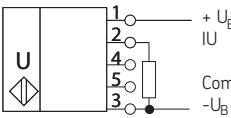
Fill level switch A

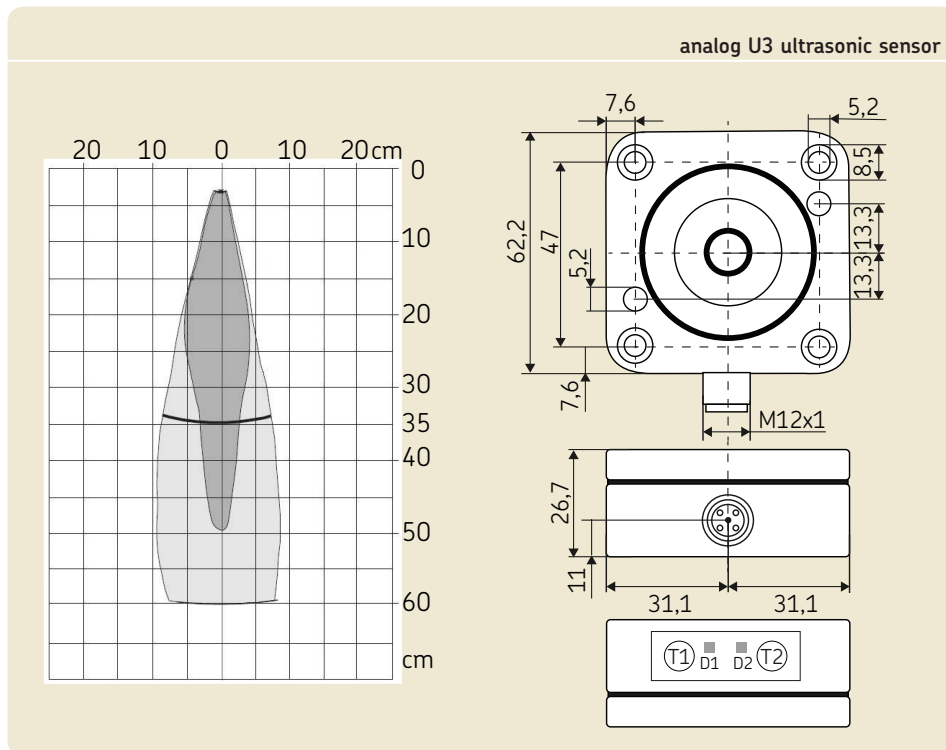
PIN	Description
1	= + Supply voltage
2	= Signal output "above minimum"
3	= Signal output "minimum"
4	= PE protective earth

Fill level switch A..4
with cable break protection

PIN	Description
1	= + Supply voltage
2	= Signal output "above minimum"
3	= Signal output "minimum"
4	= PE protective earth

See Chapter Commissioning, page 40 to 42 and chapter Technical Data, page 57

U3 ultrasonic sensor	
1 Analog output 4-20 mA or 0-10 V	
	
PIN assignment with view of sensor plug	
Pin 1	+U_B
PIN 3	-U_B
Connection	V15 plug connector (M12x1), 5-pin
Sensing range, see graphic U3	
<p>Sensing range in centimeters</p> <p>The dark gray areas indicate the range in which the normal reflector (conduit) is reliably detected. This is the typical operating range of the sensors. The light gray areas represent the range in which a large reflector, such as a grease follower plate, is still detected, provided it is optimally aligned to the sensor. No evaluation is possible outside the light gray area.</p>	



4.6 Lubrication line connection

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



Danger!

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

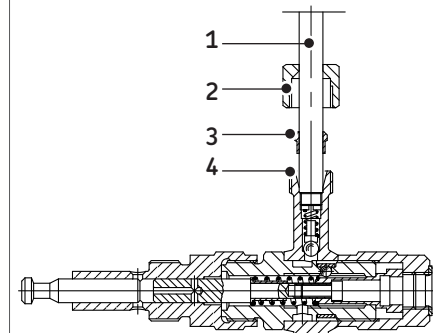
For operating pressures up to 45 bar as can occur especially in single-line piston distributor systems, SKF fittings for solderless pipe unions can be used (double tapered rings or tapered sleeves). For higher operating pressures up to 250 bar as can occur especially in progressive centralized lubrication systems, SKF cutting-sleeve screw unions conforming to DIN 2353 can be used. If using fittings from other man-

ufacturers, pay careful attention to the assembly instructions and technical specifications provided by the manufacturer.

4.6.1 Assembly of the lubrication lines

- Deburr the connecting end of the lubrication line (1)
- Remove the union nut (2) and cutting sleeve (3) from the ring piece (4)
- Insert the lubrication line (1) into the union nut (2) and cutting sleeve (3)
- Insert the lubrication line (1), union nut (2), and cutting sleeve (3) into the ring piece (4)
- Put the union nut (2) on the thread of the ring piece (4), and slightly tighten the union nut (2) by hand
- Tighten the union nut (2) with an open-end wrench

Fig. 7 Lubrication line connection



Item	Description
1	Lubrication line, varying acc. to tube connection
2	Union nut
3	Cutting sleeve
4	Ring piece

4.7 Lubrication line arrangement

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

The main lubricant line must be dimensioned in accordance with the maximum operating pressure occurring in the lubrication unit used and the displacement volume of that lubrication unit. If possible, the main lubricant line should rise upward from the lubrication unit and be ventable at the highest point on the lubrication line system. Lubricant distributors at the end of the main lubricant line must be installed such that the outlets of the lubricant distributors point upwards. If the system configuration requires that the lubricant distributors be arranged below the main lubricant line, they should not be placed at the end of the main lubricant line.

The pipes, tubes, shutoff valves and directional control valves, fittings, etc. that will be used must be designed for the maximum operating pressure of the lubrication unit, the permissible temperatures and the lubricants that will be delivered. In addition, the lubrication line

system needs to be protected from excessive pressure by means of a pressure-limiting valve.

All components of the lubrication line system such as pipes, tubes, shutoff valves, directional control valves, fittings, etc. must be carefully cleaned before assembly. No seals should point inward in the lubrication line system, as this could hinder lubricant flow and introduce contaminants into the lubrication line system.



Warning!

Lubrication lines must always be free of leaks. Lubrication lines should always be arranged so that air pockets cannot form anywhere. Avoid changes in the cross-section of the lubrication line from small to large cross-sections in the direction of flow of the lubricant. When the cross-section does change, the transition should be gentle.

The flow of lubricant in the lubrication lines should not be hindered by the installation of sharp bends, angle valves, or flap valves. Any

unavoidable changes in the cross-section of the lubrication line should be realized as gentle transitions. Sudden changes of direction should be avoided if possible.



Warning!

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

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



Warning!

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

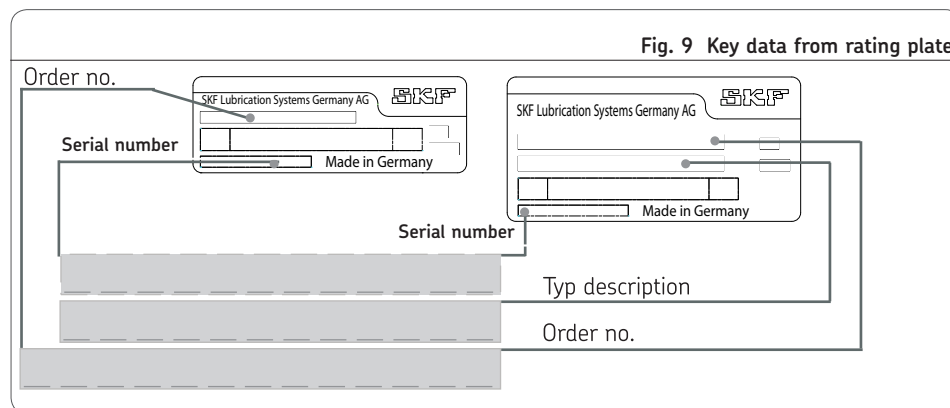
Lubricants are a hazardous substance. The safety instructions on the lubricant's safety data sheet must be followed. The safety data sheet for a lubricant can be requested from the lubricant manufacturer.

4.8 Note on the rating plate

The rating plates on the multiline pump units provide important data such as the type designation, order number, barcode, and serial number.

To avoid loss of this data in case the rating plate becomes illegible, these characteristics should be entered in the following table.

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



FF and FB Multiline pump units

for use in progressive centralized lubrication systems

**Operating instructions associated
with assembly instructions**
according to EC Dir. 2006/42/EC for partly completed machinery

1. Safety instructions

General



Warning!

These operating instructions must be read and properly understood by the assembler and the responsible technical personnel/operator before assembly and commissioning.

The safety instructions listed in Chapter 1, "Safety instructions," of the assembly instructions also apply without restrictions to these operating instructions.



In addition to the operating instructions, general statutory regulations and other binding regulations for accident prevention and for environmental protection (recycling/disposal) must be observed and applied.

Disclaimer of liability

SKF Lubrication Systems Germany GmbH shall not be held liable for damages:

- Caused by contaminated or unsuitable lubricants
- Caused by the installation of non-original SKF components or SKF spare parts
- Caused by inappropriate usage
- Resulting from improper assembly, configuration or filling
- Resulting from improper response to malfunctions
- Caused by independent modification of system components
- Only media approved for these types of pump units may be used. Unsuitable media may result in pump unit failure and potentially severe bodily injury and property damage.

2. Lubricants



Warning!

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

3. Transport, delivery, and storage

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



Warning!

The product must not be tilted or dropped.

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

After receipt of the shipment, the product(s) must be inspected for damage and for completeness according to the shipping documents. The packaging material must be preserved until any discrepancies are resolved.

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

3.1 Lubrication units

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

3.2 Electronic and electrical devices

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

3.3 General notes

- The product(s) can be enveloped in plastic film to provide low-dust storage
- Protect against ground moisture by storing on a shelf or wooden pallet
- Bright-finished metallic surfaces, especially wearing parts and assembly surfaces, must be protected using long-term anti-corrosive agents before storage
- At approx. 6-month intervals: Check for corrosion. If there are signs of corrosion, reapply anti-corrosive agents.
- Drives must be protected from mechanical damage

4. Assembly

4.1 Information on assembly

The assembly procedure for multiline pump units is described in detail in the assembly instructions associated with these operating instructions. Information/instructions about assembling the FF and FB multiline pump units beyond the scope of the assembly instructions are contained later in this chapter.

4.2 Assembly of FF and FB pump units

- Assembly must be performed in accordance with the included assembly instructions and the additional information/instructions contained in this chapter.

4.3 Dismantling and disposal



Warning!

The applicable national environmental regulations and statutes are to be adhered to when dismantling and disposing of the multiline pump unit.

The product can also be returned to SKF Lubrication Systems Germany GmbH for disposal, in which case the customer is responsible for reimbursing the costs incurred.

5. Design and function

5.1 Pump operation

The pump is driven by a worm drive (1) consisting of a worm and related worm gear. The worm gear drives the eccentric drive shaft (2) with the fitted agitator (3). The agitator (3) pushes the lubricant through the strainer (4) into the pump's inlet chamber.

The eccentric drive shaft (2) has a guide ring running on needle bearings (FF (5)) (two guide ring running on ball bearings FB (6,7)) to receive the delivery piston heads of the pump elements (FF (8)) (FB (9)).

The eccentric motion of the guide ring(s) forcibly moves the attached pump element delivery pistons.

Fig. 1 FF Sectional view

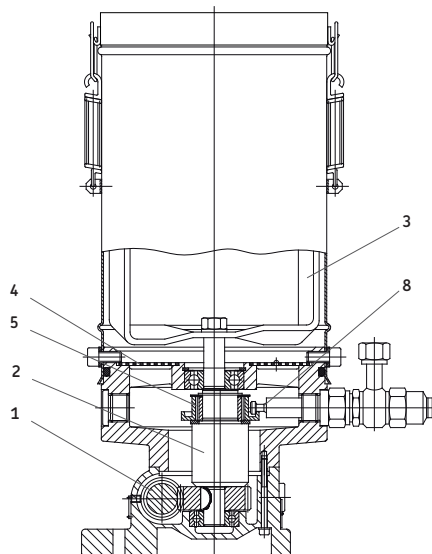
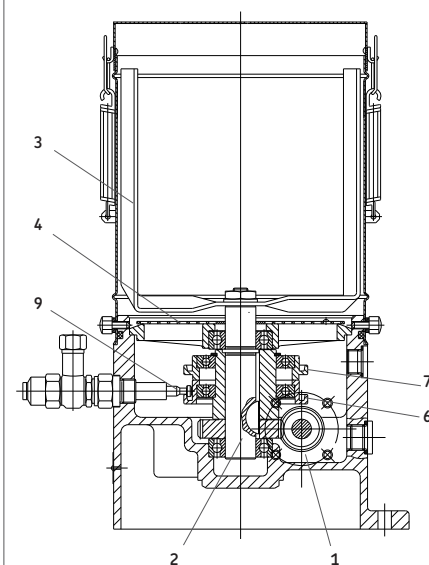


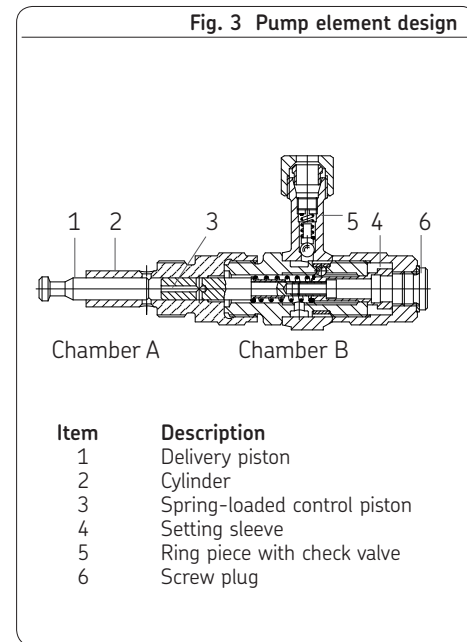
Fig. 2 FB Sectional view



5.2 Pump element operation

The delivery piston is forcibly actuated as described in "Pump operation." In the suction stroke position (as illustrated), the cross hole of the delivery piston (3) is closed. At the start of the pressure stroke, the delivery piston (1) closes the suction hole. The suctioned lubricant in chamber A is pressed against the spring-loaded control piston (3). The cross hole in the control piston (3) is opened. The lubricant reaches chamber B under pressure through the cross and longitudinal hole of the control piston (3), where it flows through the ring duct and the check valve (5) to the outlet. Once the pressure stroke is complete, the suction stroke of the delivery piston (1) begins. Moving the delivery piston (1) also brings the control piston (3) back to its normal position using spring tension. The suction stroke movement of the delivery piston (1) generates negative pressure in chamber A. When the intake hole opens, the lubricant flows into chamber A due to the negative pressure.

The pump element is now prepared for the next lubrication cycle.



5.3 Designs

The grease lubrication pumps in series FF and FB differ in the following:

- Type and speed of drive
- Gear ratio
- Reservoir capacity
(FF = 4-, 10 kg) (FB = 6-, 15-, 30 kg)
- Number of pump elements
(FF max. 12) (FB max. 24)
- Monitoring of grease level and oil level

These result in correspondingly different individual and total displacements and different operating pressures (see Chapter 10-Technical data).

6. Commissioning



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



Warning!

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



Warning!

Different lubricants cannot be mixed, as mixing may result in damage and necessitate costly and complicated cleaning of the product/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.

6.1 Commissioning and recommissioning

Fill the reservoir with oil

- Remove the reservoir lid (1) (with grease follower plate (2) if fitted) and place to one side
- Fill the reservoir (3) with oil (see Chapter 10 for characteristics) up to about 1 cm above the strainer (4)

Check the direction of rotation of the drive shaft



Warning!

The direction of driveshaft rotation is indicated on each pump by an arrow. This marking ensures the correct direction of rotation of the worm drive and agitator for each pump type. The pump should never be put into operation without the reservoir lid fitted properly in place.

- Switch on the grease lubrication pump briefly (for about 1 second) and check the direction of rotation

- Fit the reservoir lid (1) (with grease follower plate (2) if fitted) back on the reservoir (3)

Fill the reservoir with grease (for grease lubrication pumps)



Warning!

The grease lubrication pump may only be filled via the filler socket (5). Filling with grease via the "reservoir lid" (1) is not permitted.

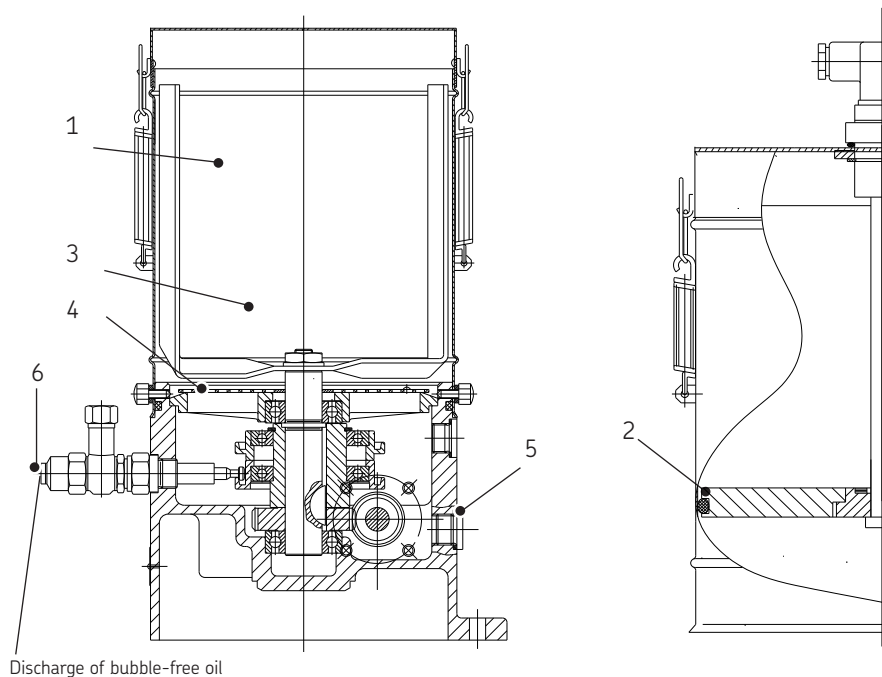
- Fill the reservoir (3) with grease (see Chapter 10 for characteristics) via the filler socket (5)

Vent the pump elements

- Loosen up and remove the screw plugs (6) from all pump elements
- Start the grease lubrication pump (switch it on)

- ☞ Allow pump to run until bubble-free grease (or oil) can be seen discharging from all pump elements.
- Attach and tighten the screw plugs (6) on all pump elements
- Shut down the grease lubrication pump (switch it off)

Fig. 4 Pump design



Reservoir without level indicator

Reservoir with level indicator and grease follower plate

6.2 Varying pump displacement

The pump elements are factory-set to maximum pump output. After commissioning, the output can be adjusted to meet output requirements, as described in the following.

Remove screw plug

- Loosen up and remove the screw plug (1) using a hexagon socket screw key (SW8)

Adjust the displacement

- Place a hexagon socket screw key (WAF6) on the setting sleeve (2)

When adjusting:

Clockwise rotation results in decreased displacement, counterclockwise rotation results in increased displacement.

The pump element's displacement may be reduced to 1/3 of its maximum displacement. This corresponds to



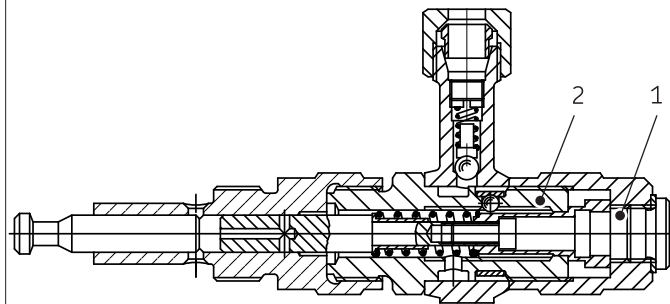
clockwise rotation of the setting sleeve (2) by eight notches. With settings below 1/3 of maximum displacement, fluctuations in displacement volume cannot be ruled out.

- Using the hexagon socket screw key, adjust the setting sleeve (2) for the required displacement (notches 1 to 8 - see displacement chart).
- For displacement variation, the setting sleeve is divided into 8 notch positions (making one full revolution). It is possible to feel the setting sleeve engaging in each notch position.

Attach the screw plug

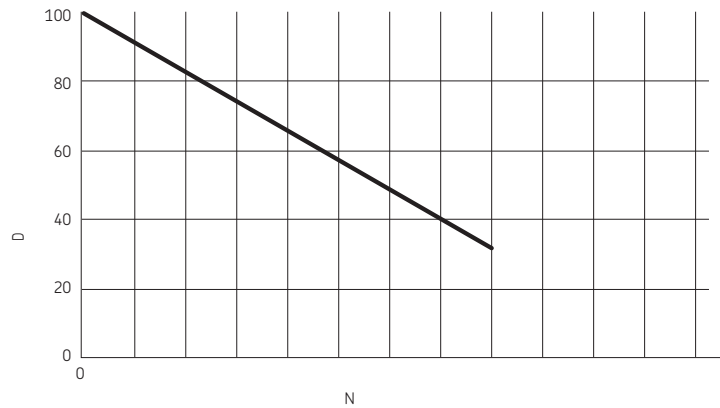
- Put the screw plug (1) in position and tighten it using a hexagon socket screw key (WAF8)





Item	Description
1	Screw plug
2	Setting sleeve

Fig. 5 Pump element displacement variation



6.3 Configuration of U3 ultrasonic sensor



The max./min. switching points are factory-set based on the reservoir size of the pump unit. If the switching points need to be adjusted by the user, the parameters must be set as described below.

6.3.1 Setting with teach-in

☞ See Figure 6 and Fig. 7

The ultrasonic sensor has internal temperature compensation. Due to specific heat of the sensor, the temperature compensation reaches its optimum operating point after approximately 30 minutes of running time.

If there is an object (grease follower plate) within the set window limits of the analog output, LED D1 lights up green; if the object is outside of the window limits, LED D1 lights up red.

If no button is pressed for approx. 5 minutes during the teach-in parameterization, the settings made to that point will be accepted and the sensor will return to normal operation.

The sensor can also be returned to its factory settings.

An LCR-2 LinkControl adapter and the LinkControl adapter software for Windows can optionally be used to make all teach-in settings and other sensor settings.

Fig. 6 Setting window limits

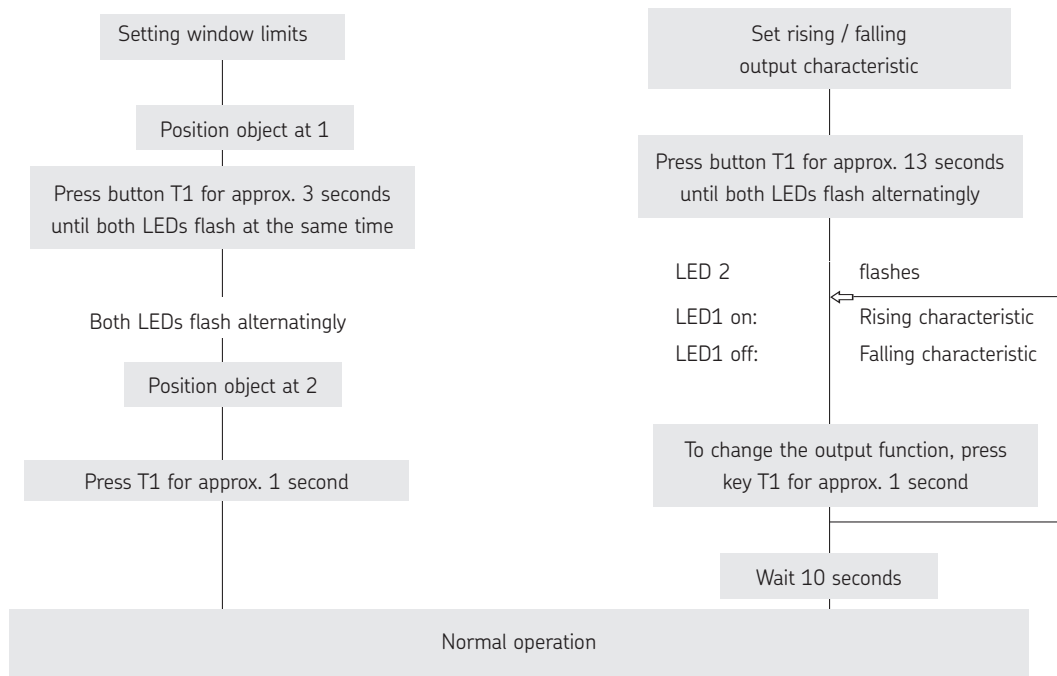
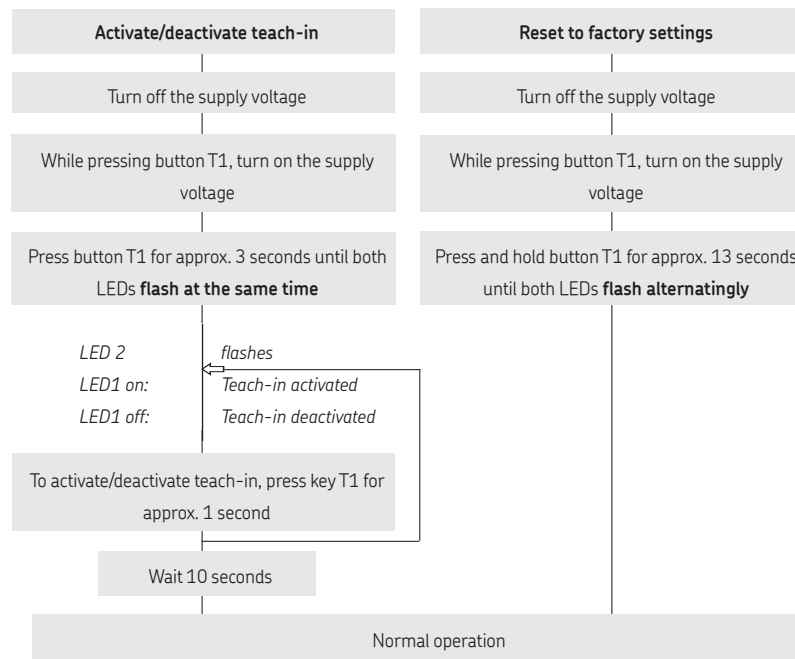
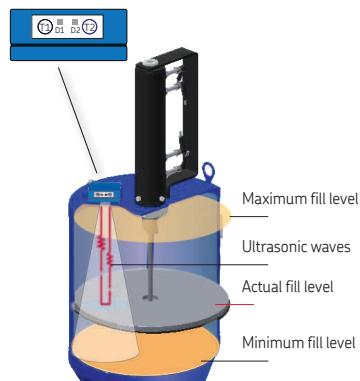


Fig. 7 Activating/deactivating teach-in, resetting to factory settings



7. Shutdown

7.1 Temporary shutdown

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

If the product is to be shut down for an extended period of time, follow the instructions in Chapter 3, "Transport, delivery, and storage," of these operating instructions. To recommission the product, follow the instructions in the Chapters "Assembly" and "Commissioning" in the assembly instructions and operating instructions.

7.2 Permanent shutdown

If the product will be permanently shut down, the local regulations and laws regarding the disposal of contaminated equipment must be observed. Lubricants can contaminate soil and bodies of water.



Warning!

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

The product can also be returned to SKF Lubrication Systems Germany GmbH for disposal, in which case the customer is responsible for reimbursing the costs incurred.

8. Maintenance



Warning!

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

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

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

It must be ensured that no cleaning agent enters the interior of the product during cleaning. It is not necessary to clean the interior of the product if the product is operated normally and intercompatible lubricants are used. The interior of the product must be cleaned if incorrect or contaminated lubricant is accidentally filled into the product. If this occurs, please contact the Service department of SKF Lubrication Systems Germany GmbH for assistance.



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



Only original spare parts from SKF Lubrication Systems Germany GmbH may be used. Arbitrary alterations to products and the use of non-original spare parts and accessories are not permitted and nullify the statutory warranty.

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

8.1 General information

The FF/FB pumps function without maintenance in principle. However, make sure that the level of oil or grease does not fall below the strainer, in order to prevent air being drawn into the pump elements. If a synthetic oil is used as the pumped fluid, consult the lubricant manufacturer beforehand to find out whether it will attack the seals (Perbunan) and whether it can be mixed with the previous lubricant. Switches for the oil level or grease level are only suitable for use with oil or with

grease, and should be replaced if necessary. When removing and installing individual pump elements, proceed as described in the following.

In the case of pumps with a gear train, an oil change (SAE 140) needs to be performed every 7000 hours of operation. Fill the gearbox up to the lower edge of the screw plug.



Only fill with clean grease. The purity of the lubricants used is the decisive factor in the service life of the pump and the lubricated machinery elements.

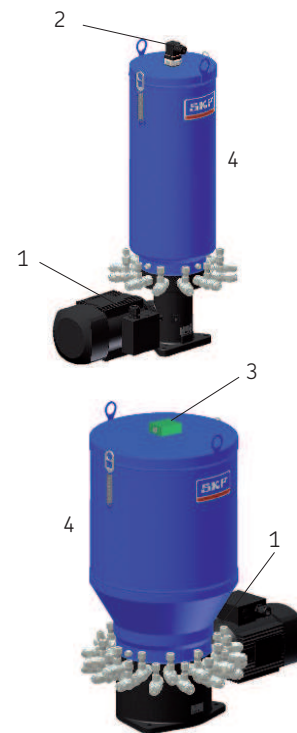
Only fill grease via the filler socket.

8.2 Visual inspection

Visual inspection every 100 operating hours

Item	Component	Check
1	Geared motor	Inspect fan slots on fan impeller for contamination. Inspect for loosened screw unions. Inspect for undesired grease discharge.
1	Geared motor	Inspect for loose cable connections and damage
2	Fill level switch	
3	Ultrasonic sensor	
4	Multiline pump unit	Inspect for contamination and damage

Fig. 8 FF and FB



8.3 Removing a pump element

- Release the union nut (1) on the ring piece (2)
- Remove the lubrication line from the ring piece (2)

Loosen up the cap nut (5) and pull off the ring piece (2)

- Loosen up and remove the threaded socket (3)
- Carefully unscrew and remove the screw socket (4) from the pump housing
- Tilt the front part of the pump element about 30° until the delivery piston (6) is no longer held back by the guide ring (7)
- Remove the front part of the pump element using a circular motion


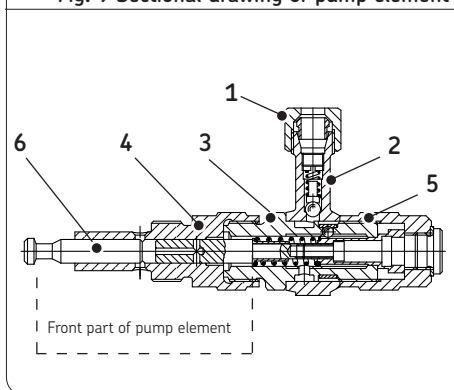
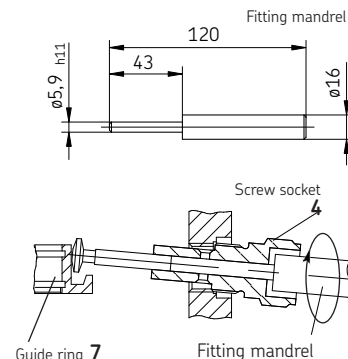
 The circular motion prevents the delivery piston from staying stuck in the grease. If the delivery piston stays stuck in the grease, remove it from the pump housing with tweezers or a magnet.

Fig. 9 Sectional drawing of pump element



8.3.1 Fitting mandrel accessory

Fig.10 Installing pump element - fitting mandrel






Separate accessory - fitting mandrel

Application For installing a pump element

Order no. 44-1827-2010

8.4 Installing a pump element

-see Figure 11

- Pull the delivery piston **(1)** out of the screw socket **(2)**
- Place the delivery piston **(1)** somewhere out of the way, on a clean surface
- Fill the cylinder chamber of the screw socket **(2)** with (clean) grease
- Carefully guide the delivery piston **(1)** into the cylinder chamber of the screw socket **(2)** (about 5 to 10 mm)
- Insert the fitting mandrel into the screw socket **(2)** (see figure)
- Guide the front part of the pump element into the pump element hole and align it, hooking the delivery piston **(1)** into the guide ring at the same time
- Remove the fitting mandrel
- Screw the screw socket **(2)** into the pump housing
 For the tightening torque, see 8.4.1
- Screw the threaded socket **(3)** into the screw socket **(2)**
 For the tightening torque, see 8.4.1
- Fit the ring piece **(4)** and cap nut **(5)** on the threaded socket **(3)** and tighten by hand
- Insert the lubrication line in the ring piece
- Tighten the union nut **(6)** by hand
- Tighten the cap nut **(5)**
 For the tightening torque, see 8.4.1
- Tighten the union nut **(6)**
- Vent the pumps completely - see 6.1 "Recommissioning - Vent the pump elements"

8.4.1 Tightening torques for pump elements

-see Figure 11

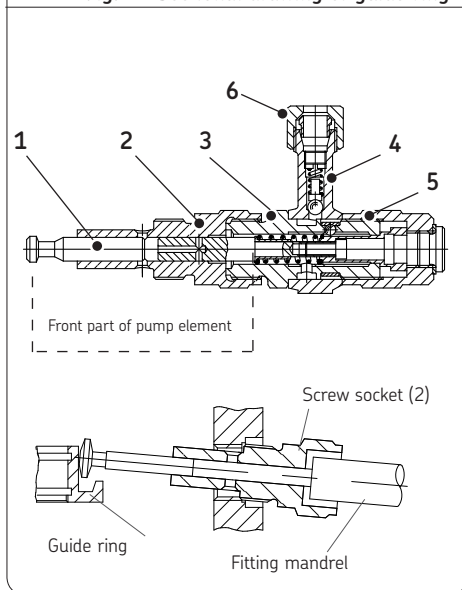
Torques in Nm

Pump elements with Piston diameter from:

Screw socket	(2)	35 Nm	+2 Nm
Threaded socket	(3)	35 Nm	
Cap nut	(5)	60 Nm	

9. Malfunction

Fig. 11 Sectional drawing of guide ring



The following tables provide an overview of possible malfunctions and their causes. Contact the Service department of SKF Lubrication Systems Germany GmbH if you cannot remedy the malfunction.



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



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



Only original spare parts from SKF Lubrication Systems Germany GmbH may be used. Arbitrary alterations to products and the use of non-original spare parts and accessories are not permitted.



Warning!

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



Warning!

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



Warning!

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

9.1 Commissioning malfunctions

Commissioning malfunctions

Malfunction	Cause	Remedy
Displacement volume and/or delivery pressure too low without supply lines connected	Air in the pump element	<ul style="list-style-type: none"> ● Vent and fill according to Chapter 6.1, Commissioning
	Driveshaft rotating in wrong direction Driveshaft speed is too low	<ul style="list-style-type: none"> ● Check electrical connections and voltage ● Check electrical connections ● Remove foreign substances if agitator or pump element is jammed ● Replace motor if necessary
No delivery (with pipe connections and supply lines not yet connected)	Air in the pump element Pump element set too low Pump element not hooked in properly	<ul style="list-style-type: none"> ● Vent the pump element ● Set to 0 notch position ● Remove and install the pump element as instructed in Chapter 8.3
	Drive motor does not run	<ul style="list-style-type: none"> ● Check electrical connections ● Clean venting slots on motor ● Replace geared motor if necessary

9.2 Operational malfunctions

Operational malfunctions, Table 1 of 2

Malfunction	Cause	Remedy
Displacement volume or delivery pressure too low without lines connected	Air in the pump element	<ul style="list-style-type: none"> ● Vent and fill according to Chapter 6.1
	Pump element is clogged	<ul style="list-style-type: none"> ● See "No delivery" malfunction
	Driveshaft speed is too low	<ul style="list-style-type: none"> ● Check electrical connections and motor voltage ● Remove foreign substances if agitator or pump element is jammed ● Permissible operating temperature range of -15 °C to + 40 °C not maintained ● Replace defective motor
No delivery	Pump element is clogged	<ul style="list-style-type: none"> ● Empty and clean lubricant reservoir ● Remove and clean pump element with ring piece ● Vent and fill according to Chapter 6 ● Replace the woodruff key, vent the pump elements as instructed in Chapter 6.1 – Commissioning ● Check supply voltage, replace motor if necessary
	Woodruff key on the drive shaft is defective	
	Motor stopped	

Operational malfunctions, Table 2 of 2

Malfunction	Cause	Remedy
No delivery	Pump element is defective	<ul style="list-style-type: none">● Replace the pump element● Vent and fill according to Chapter 6.1
	Spring pressure, delivery piston breaking loose	<ul style="list-style-type: none">● Install the pump element as instructed in Chapter 8.4
	Guide ring for the pump element piston heads is worn or broken	<ul style="list-style-type: none">● Replace the guide ring, and vent the pump as instructed in Chapter 6.1 – Commissioning

9.3 Malfunctions on fill level control

Fill level control malfunctions

Malfunction	Cause	Remedy
Lubricant over grease follower plate	Seal on the grease follower plate is leaking	<ul style="list-style-type: none"> ● Replace the seal
Lubricant comes out of the lid when filling the reservoir	No signal Signal «max» ignored Seal on the grease follower plate is leaking	<ul style="list-style-type: none"> ● Check the cable connection; replace plug or cable if necessary ● Remove the excess grease. ● Replace the seal
No « min», «max.» or pre-warning signal	Cable connection incorrect or defective Plug is disconnected The reed contact on the switch is defective (H control) Snap-action toggle switch is defective (A control) Grease follower plate is tilted Grease follower plate is jammed	<ul style="list-style-type: none"> ● Correct or repair the cable connection ● Connect the plug ● Change the contact rod ● Replace the switch completely ● Straighten the grease follower plate and secure it to the contact rod ● Check the reservoir for dents and remove them if necessary

9.4. Malfunctions on U3 ultrasonic sensor

Malfunctions on U3 ultrasonic sensor

Malfunction	Cause	Remedy
No output signal	Screw connection of U3 ultrasonic sensor to cable box is loose	● Screw on cable box
	Switching points are no longer programmed into the ultrasonic sensors or are set incorrectly	● Reconfigure (teach) switching points (maximum, (minimum pre-warning), minimum) - see Chapter 6.3
	Ultrasonic sensor is contaminated	● Dismantle and clean ultrasonic sensor
	Ultrasonic sensor is defective	● Replace ultrasonic sensor
Grease reservoir not filled to maximum	Ultrasonic sensor calibrated incorrectly	● Reconfigure (teach) switching points maximum, (minimum pre-warning, minimum)
Pump switches off before reaching minimum	Ultrasonic sensor calibrated incorrectly	● Reconfigure (teach) switching points minimum, (minimum pre-warning, maximum) - see Chapter 6.3

10. Technical data

10.1 FF multiline pump unit, characteristics for designs 1M and 2M

FF characteristics , designs 1M and 2M

Mounting position . Vertical
Temperature range -15 °C to + 40 °C ¹⁾

Reservoir For 4 or 10 kg

Number of
pump elements .1 to 12

Filling Via filler socket G 3/8"

Dry weight FF 04 approx. 15 kg;
FF 10 approx. 20.5 kg

Gearbox

1M

Type Worm drive **1M, dual-stage**

Gear ratios 80:1; 150:1;
300:1; 600:1

2M

Type Worm drive
2M, single-stage

Gear ratio 33:1

Motor

see "Motor ratings" table
and rating plate ²⁾

Pump

Type Multipiston pump with
1 to 12 outlet ports

Displacement of pump elements

Piston-Ø 6 0.027 to 0.08 cm³/stroke
Piston-Ø 8 0.050 to 0.15 cm³/stroke
Piston-Ø 10 0.077 to 0.23 cm³/stroke

Operating pressure for pump elements

Piston-Ø 6 max. 350 bar
Piston -Ø 8 max. 200 bar
Piston -Ø 10 max. 125 bar

Lubricants ³⁾

Mineral oils (base oils) or environmentally
compatible oils from ISO VG 46 to greases of
NLGI Grade 3

- Operating viscosity (oil) ..> 50 to 5000 mm²/s
- Worked penetration (grease)> 220 ¹/10 mm
- Max. flow pressure.....< 750 mbar
- Proportion of solid lubricants...< 5%
- In accordance with DIN 51825 lubricant specification

1) At higher ambient temperatures, note that there is reduction in (motor) performance of approx. 1% per Kelvin.

2) Other specifications available on request.

3) Synthetic and biodegradable oils or greases require approval from SKF.

10.2 FB Multiline pump unit, characteristics for designs 1M and 2M

FB characteristics , designs 1M and 2M

Mounting position Vertical
Ambient and lubricant
temperature range . . . -15 °C to + 40 °C ¹⁾

Reservoir B/H: 6, 15, 30 kg
E: 6, 15 kg

Number of pump elements
Lower row 1 to 12
Upper row 13 to 24

Filling Filler socket G 1/2"

Weight empty, without pump elements
FB 06 approx. 26 kg
FB 15 approx. 28 kg
FB 30 approx. 30 kg

Gearbox

1M
Type Worm drive
. **1 M, dual-stage**
Step-down ratios 105:1; 288:1; 720:1

2M
Type Worm drive
. **2 M, single-stage**
Gear ratio 45:1

Motor

see "Motor ratings" table
and rating plate ²⁾

Pump

Type Multipiston pump with
1 to 24 outlet ports

Displacement of pump elements

Piston-Ø 6 0.027 to 0.08 cm³/stroke
Piston-Ø 8 0.050 to 0.15 cm³/stroke
Piston-Ø 10 0.077 to 0.23 cm³/stroke

Operating pressure for pump elements

Piston-Ø 6 max. 350 bar
Piston -Ø 8 max. 200 bar
Piston -Ø 10 max. 125 bar

Lubricants ³⁾

Mineral oils (base oils) or environmentally
compatible oils from ISO VG 46 to greases of
NLGI Grade 3

- Operating viscosity (oil)> 50 to 5000 mm²/s
- Worked penetration (grease) > 220 ¹/10 mm
- Max. flow pressure < 750 mbar
- Proportion of solid lubricants < 5%
- In accordance with DIN 51825 lubricant
specification

1) At higher ambient temperatures, note that there is
reduction in (motor) performance of approx. 1% per
Kelvin.

2) Other specifications available on request.

3) Synthetic and biodegradable oils or greases require
approval from SKF.

10.3 Analog ultrasound sensor U3

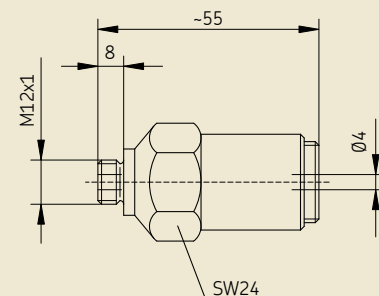
Analog ultrasound sensor U3 Order No. 237-11204-7	
Blind zone	0 to 65 mm
Operating range, max.	500 mm
Sensing range	600 mm
Opening angle of switching loop	-See Fig. 25
Ultrasonic frequency	approx. 400 Hz
Reproducibility	$\pm 0.15\%$
Operating voltage U_B	9 V to 30 V DC, reverse polarity resistant
Residual ripple	$\pm 10\%$
No-load power consumption	≤ 40 mA
Housing	PBT, polyester
Protection class	IP67
Setting option	LCA-2 with LinkControl (optional)
Display elements	LED D2 green (teach-in) LED D1 green/red object in/outside analog window
Operating temperature	-40°C to $+70^\circ\text{C}$
Current output 4-20 mA	$R_L \leq 100 \Omega$ at $9 \text{ V} \leq U_B \leq 15 \text{ V}$ $R_L \leq 500 \Omega$ at $U_B \geq 15 \text{ V}$ Rising/falling characteristic
Voltage output 0-10 V	$R_L \leq 100 \text{ k}\Omega$ at $U_B \geq 15 \text{ V}$ Short-circuit-proof Rising/falling characteristic

11. Accessories

Pressure regulating valves for grease (for insertion into pump elements)

Set pressure [bar]	Weight [kg/each]	Order No.
50	0.13	24-2103-2273
100	0.13	24-2103-2344
125	0.13	24-2103-2345
150	0.13	24-2103-2342
175	0.13	24-2103-2272
200	0.13	24-2103-2346
350	0.13	24-2103-2271

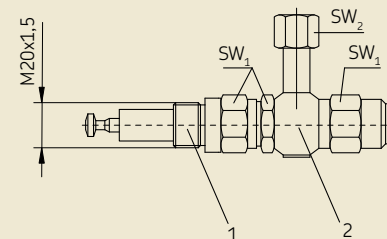
Pressure regulating valve



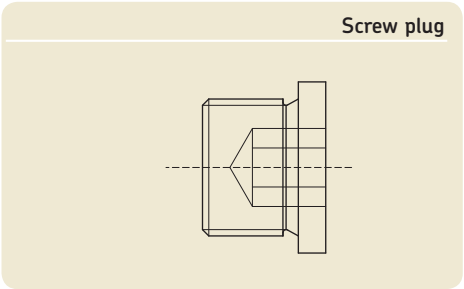
Pump element with ring piece (for installing a pump element)

Description	Piston Ø	WAF ₁	WAF ₂	Weight [kg/each]	Order No.
Pump element (pos.1 in figure)	6 mm	24	-	0,26	24-1557-3680
	8 mm	24	-	0,26	24-1557-3681
	10 mm	24	-	0,28	24-1557-3683
Ring piece (pos.2)	6 mm	-	14	0,10	24-2255-2003
	8 mm	-	17	0,08	24-2255-2004
	10 mm	-	19	0,10	24-2255-2005

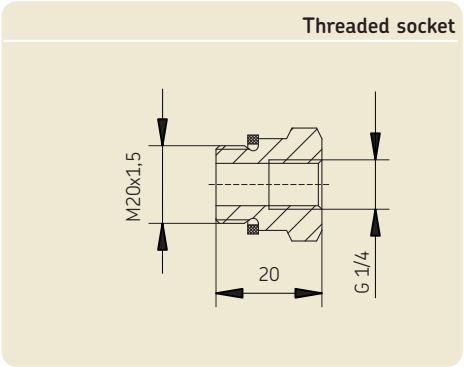
Pump element



Screw plug		
(for closing unused pump outlets)		
Design	Weight kg/each	Order No.
M20x1.5	0.037	95-1520-0908



Threaded socket for grease recirculation	
(in place of a pump element to recirculate grease into pump housing)	
Design	Order no.
Steel, galvanized surface, with copper (Cu) washer	24-1755-2003



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