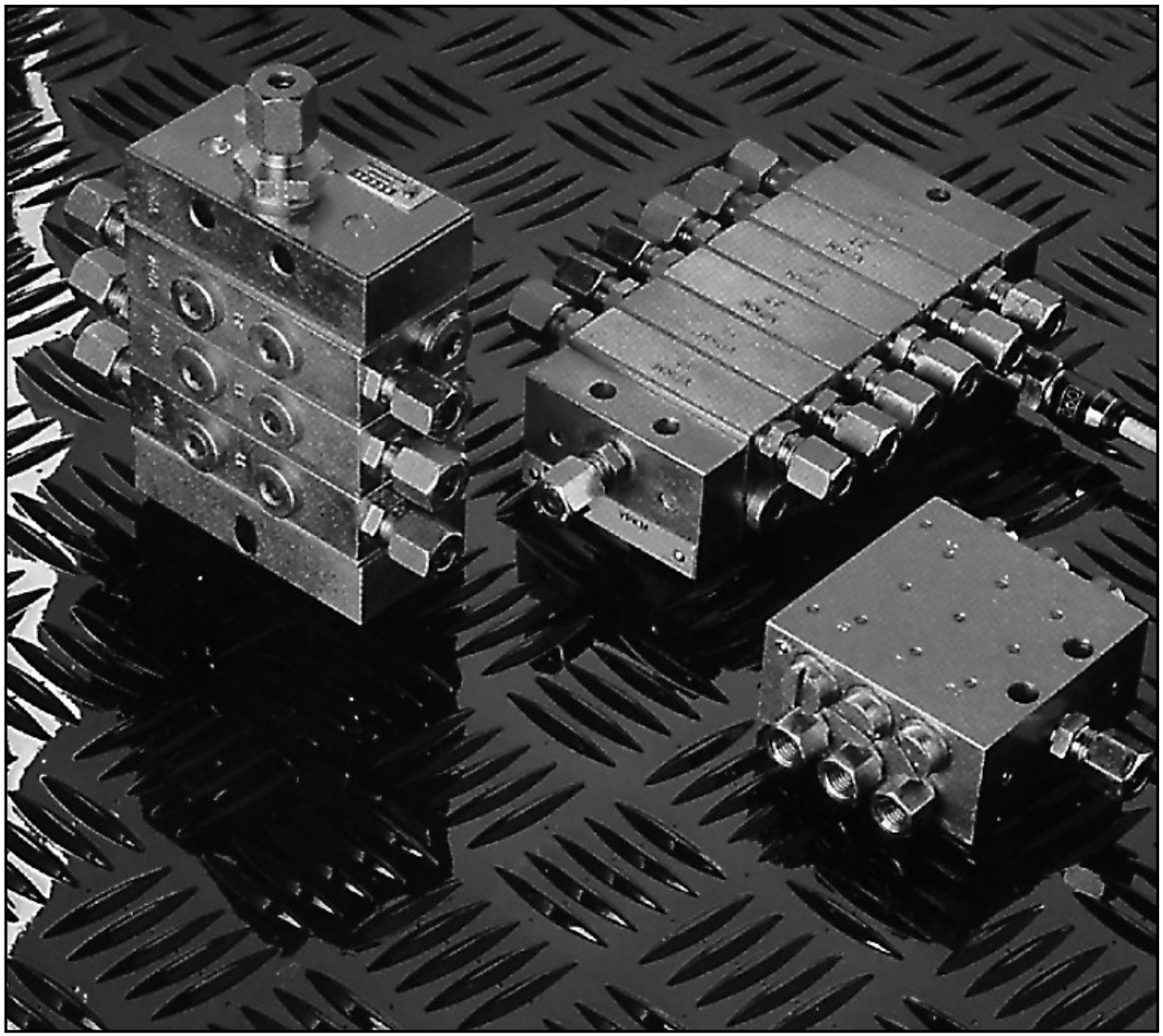


General Operating Instruction for Progressive Systems

VOGEL® Central Lubrication

Imprint

The instruction was prepared in accordance with the current standards and rules for technical documentation, such as VDI 4500 and EN 292.

Responsible in terms of technical matters:

M.Sc. Günter Skarupa
Phone: (++49) 30 / 7 20 02-104
Fax: (++49) 30 / 7 20 02-345
e-mail: skarupa@vogel-berlin.de

Layout, setting, printing:
MDC Marketing Design Chemnitz GmbH

Berlin, this 10th day of October 2000

Certificate of EC Conformity KE 000043

This is to certify that the product named in the following **Piston Pump with Reservoir**
Order designation: **KFGS 1-2, KFGS 5-2**

is in full compliance with the essential safety requirements set forth in the guideline(s) of the Council for Harmonisation of Member States´ Laws, such as

Electromagnetic compatibility
89/336/EEC
as amended by
92/31/EEC, 93/68/EC, 91/263/EEC
and 93/97/EEC

Vehicles 72/245/EEC
as amended by 89/491/EEC, 95/54/EC

Said conformity was ascertained by the use of the following (harmonised) European standards with regard to guideline(s)

Electromagnetic compatibility
EMC 89/336/EEC

EN 50081-1
EN 50081-2

Vehicles 72/245/EEC as amended by 95/54/EC

95/54/EC

This Certificate is given on the manufacturer´s/importer´s responsibility

WILLY VOGEL AKTIENGESELLSCHAFT
Motzener Strasse 35/37, 12277 Berlin
P.O.Box 480149, 12251 Berlin

by the Executive Officers

Manfred Neubert Hans Gaca

Berlin, this 2nd day of September 1999

- The Appendices are an integral part of this Certificate.
- This Certificate is to certify compliance with the aforesaid guidelines, however, does not include any warranty of qualities.
- Safety advice given in the Documentation to the product shall be strictly adhered to.
- Putting into operation of certified products is forbidden until it has been assured that the machine, vehicle and the like in which the product was incorporated complies with the regulations and requirements set forth in the guidelines to be applied.
- Operation of products with non-standard line voltage as well as disregard of installation advice may adversely affect EMC qualities and electrical safety.

Table of Contents

1. Safety

1.1 General advice

The components have been built according to the common rules of the state of the art and in accordance with the occupational safety and accident prevention regulations. However, hazards may occur during their use in practice, resulting in physical injuries of the user or third persons and/or damages of other assets. Therefore, the components should be exclusively used in technically perfect condition, adhering to the operating instruction. Malfunctions that may, in particular, adversely affect safety shall be remedied instantly.

1.2 Use as intended

The apparatus described herein shall be exclusively used for central lubrication of construction machinery. Therefore, they shall be used only for the purpose set forth in this instruction. The user shall be solely responsible for abuse and consequential damages.

1.3 Approved personnel

The components described in this instruction shall be assembled, operated, serviced, and repaired by qualified personnel only. Qualified personnel implies persons who have been trained, authorised and instructed by the user of systems. Thanks to their qualification, experience, and instruction, such persons are conversant with the relevant standards, accident prevention rules, and in-factory conditions. They are authorised to perform the respectively required jobs and prevent any potential hazards.
The definition for experts and the ban on the employment of unqualified personnel are provided for in DIN VDE 0105 or IEC 364.

1.4 Used pictograms

Texts marked with this pictograms provide reference to particular hazards or important actions and jobs.

1.5 Disclaimer of liability

VOGEL AG shall not be liable for damages occurred:

- in consequence of lubricant lacks due to insufficient topping-up of lubricant reservoir
- in consequence of soiled and unfit lubricants
- in consequence of the assembly of non-OEM VOGEL components or VOGEL spare parts
- in consequence of unauthorised conversions of central lubrication system
- in consequence of ecologically harmful disposal of used or soiled lubricants
- on machinery due to the use of VOGEL units beyond the purpose intended.

1.6 Transport and storage

All units and components are shipped in cardboard boxes and shall be kept in a dry room.
Permitted storing temperature: -25°C to +70°C.

1.7 Assembly work

During any and all work performed on construction machinery, strictly adhere to the accident prevention rules as well as to the operating and servicing instructions of machine manufacturer!

1.8 Accident prevention

Such moving parts as lifting arms, boom, member, and bucket shall be secured against lowering movements during assembly.
The accident prevention rules of the respective country shall generally apply.
Safeguards on the machine should not be modified.
Warning signs and/or adhesive labels on the machine should not be covered or removed!
If this is required for reasons of space, fit warning signs and labels to another suitable place.

1.9 Welding and grinding

Prior to welding, principally disconnect the battery of vehicle and switch-off the main disconnector switch of machine to prevent damages of on-board electronics. During any welding and grinding work, cover the hydraulic piston rods and the cabin´s windshield because flying sparks and/or weld spatters may cause considerable damages on them!

1.10 Hazards due to electrical current

The electrical connection of apparatus shall be established only by accordingly trained and skilled electricians, strictly adhering to the local connection conditions and rules (e.g. DIN, VDE)! Serious property and personal damages may be caused by improperly connected equipment!

1.11 Hazards due to overpressure

The units may be pressurised. Therefore, they have to be unpressurised prior to the commencement of any extension, conversion, and repair work. This also applies to all their individual components, such as pumps, accumulators, or valves.

1.12 Environment hazards due to lubricants

The lubricants advised by the manufacturer comply in their composition with the current safety regulations. Notwithstanding this, oils and greases are principally harmful to underground water and their storage, processing, transport, and disposal require special precautionary measures.

2. Lubrication system

2.1 Function

The VOGEL units described herein are designed as additional equipment for the automatic lubrication of construction machinery. The central lubrication system supplies all connected components with their required lubricant quantity in programmable time intervals. The automatic lubrication cycle takes place while the machine is in operation and provides a significant work reduction for the machine operator.

2.2 Additional items of equipment

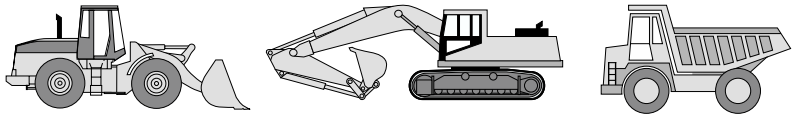
Illuminated pushbutton (yellow indicator lamp) to be mounted on the dashboard

- ensures visual detection of malfunctions with system monitoring feature installed (cycle switch 7)
- ensures manually-triggered intermediate lubrication from the machine's cabin

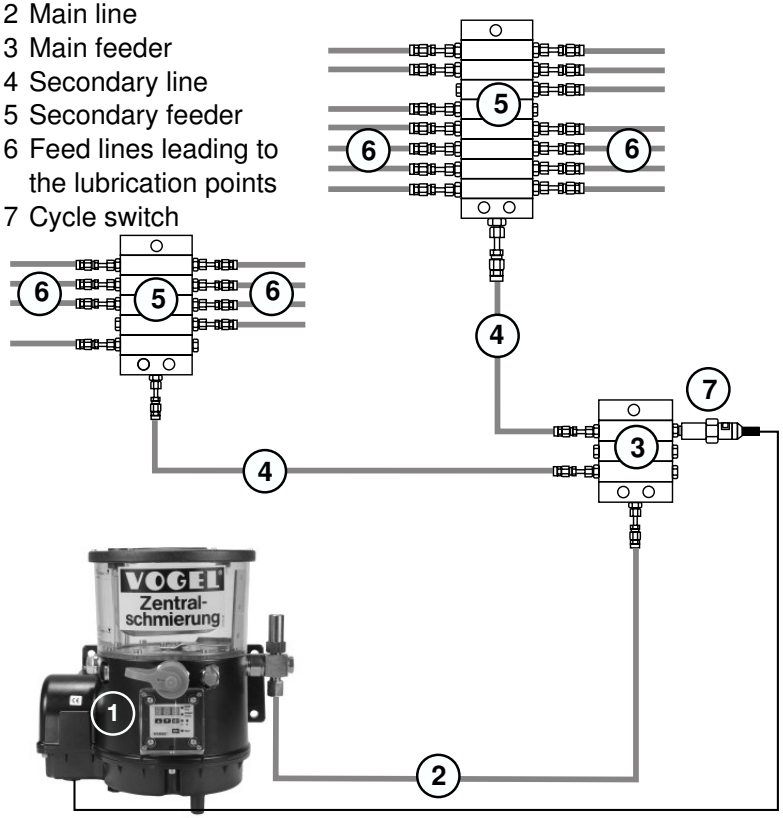
Buzzer to be connected in parallel to yellow indicator lamp

- ensures acoustic detection of malfunction with system monitoring feature installed (cycle switch 7)

Function chart



1 Pump
2 Main line
3 Main feeder
4 Secondary line
5 Secondary feeder
6 Feed lines leading to the lubrication points
7 Cycle switch



Additional items of equipment

Illuminated pushbutton, yellow with monitoring
Order-no. 177-100-065

Illuminated pushbutton, green without monitoring
Order-no. 177-100-062

Buzzer
Order-no. 179-990-605+924

Cycle switch
Order-no. VPM-177-300-091
Order-no. VPKM-177-300-092
Order-no. VPBM-177-300-096

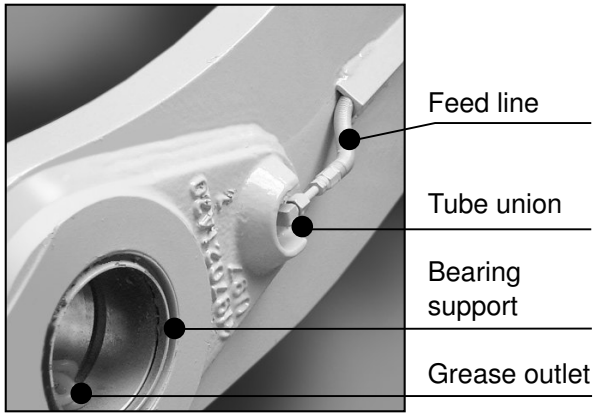
Connector
incl. 5 m cable
Order-no. 179-990-600
straight
Order-no. 179-990-601
elbow

Connector
without cable
Order-no. 179-990-371
straight
Order-no. 179-990-372
elbow

2.3 Application

Extent of lubrication system.
Which machine components are supplied with lubricant by the installed central lubrication system?

- All lubrication points connected to the system
- Can be identified by feed lines with tube unions fitted instead of conventional grease fittings



Feed line on bearing support

Which machine components are not lubricated by the installed central lubrication system?

The lubrication points are marked in the machineís service instruction with the pictogram for manual grease lubrication.

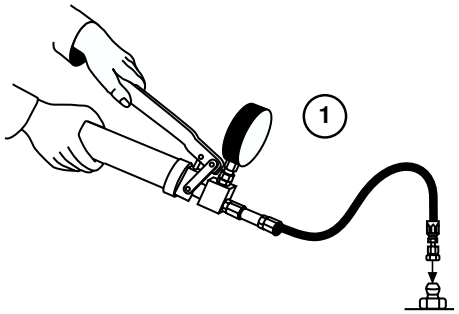
- Wheel loaders: U-joints of cardan drive train
- Excavators: lubrication points below the slewing ring unless expressly ordered as special items of equipment (in many cases, only possible as manual single-fitting system)
- Add on equipment: tippers, grabbers etc. unless expressly ordered as an option
- Low volume consumption points: e.g. door hinges, throttle linkages and the like
- Non-NLGI 2 lubrication points e.g. engines and transmissions of any kind etc. are not addressed by this system.

For correct maintenance and lubrication of these components, please consult the respective chapter of machine´s service instruction or turn to the qualified personnel of machine manufacturer!

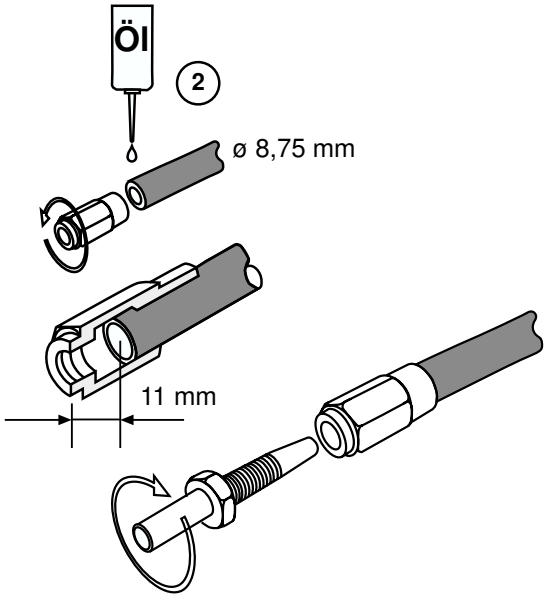
3. Assembly

3.1 General assembly advice

- Compare the contents of assembly kit with the bill of materials.
- Ensure that the voltage of the piston pump matches that of the machine or equipment.
- Prior to installation, check to ensure that all points which will be connected to the CLS freely accept grease from a grease gun or greasing device (see Fig. 1). So, you may reduce system malfunctions and prevent bearing damages.

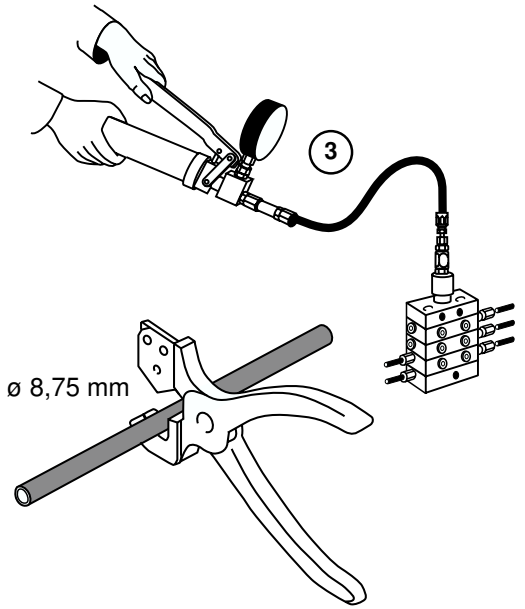


- In case of new machines, fill probably existing hollow spaces in bearing points always with suitable lubricants before assembly. Otherwise, the bearings may be damaged due to starved lubrication. The automatic central lubrication system principally performs small relubrication cycles.
- During assembly, take care of cleanliness and prevent any ingress of contaminants into the central lubrication system or bearing points. Even minor contamination may cause system malfunctions and/or bearing damages.
- Flexible tubing for self-installation, tube connector thread and tubing end shall be greased prior to assembly (see Fig. 2).



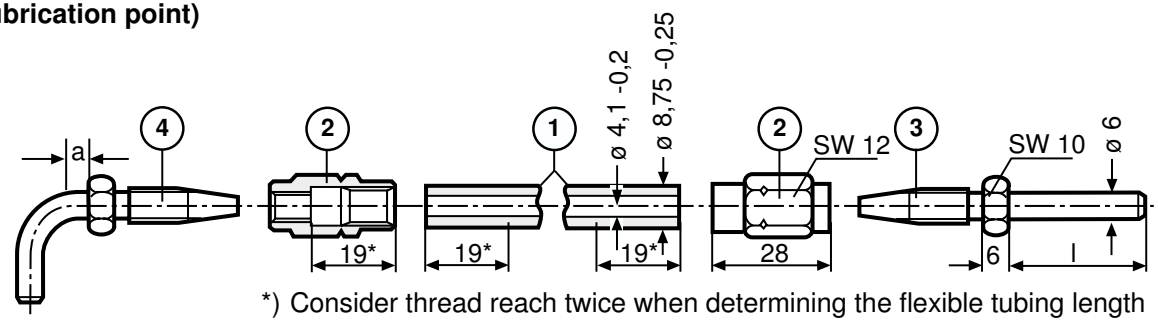
Functional check of progressive feeders
Lever-operated grease gun with pressure gauge (see Fig. 3)

Order-no. 169-000-143



3.2 Fittings for high-pressure hose for self-installation

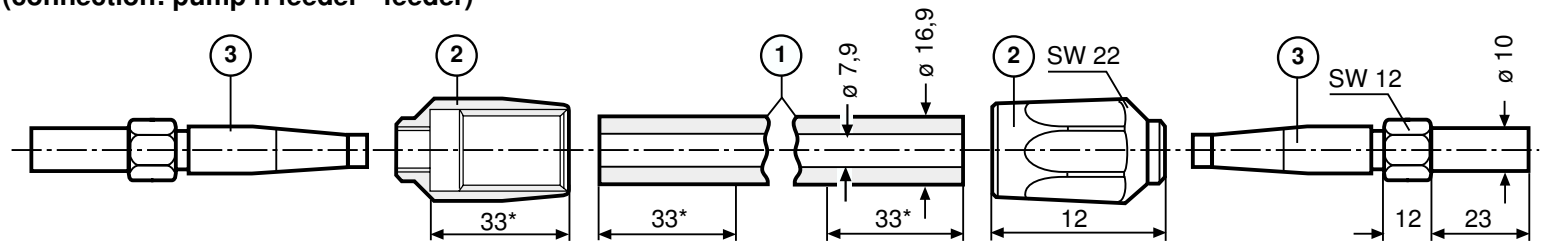
3.3 Main line, dia. 6 (connection: pump - feeder - lubrication point)



*) Consider thread reach twice when determining the flexible tubing length

Description	Remarks	Order-No.		Order-No.	
① High-pressure hose	Max. length supplied 50 m	982-750-091			
	filled with NLGI grade 2 grease	982-750-091 AF2			
② Tapped sleeve	2 pcs. required per hose	853-540-010			
③ Tube connector, straight	2 pcs. required per hose	853-380-002	l = 30	853-370-002	l = 20
④ Tube connector, elbow 90°	2 pcs. required per hose	853-380-003	a = 2	853-390-003	a = 13

3.4 Main line, dia. 10 (connection: pump ñ feeder - feeder)



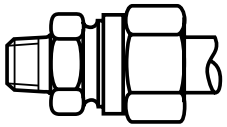
*) Consider thread reach twice when determining the flexible tubing length

Description	Remarks	Order-No.
① High-pressure hose	Max. length supplied 100 m	WVN 711-10
	filled with NLGI grade 2 grease	WVN 711-10 AF2
② Tapped sleeve	2 pcs. required per hose	406-810-002
③ Tube connector, straight	2 pcs. required per hose	406-710-002

SW = wrench size across flats

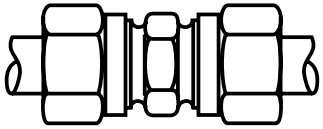
3.5 List of fittings

Straight male connectors



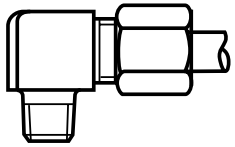
406-443	ø 6	M6	tapered
406-433	ø 6	M8 x1	tapered
406-423	ø 6	M10x1	tapered
410-443	ø 10	M10x1	tapered
406-423W	ø 6	R 1/8"	tapered

Straight connectors



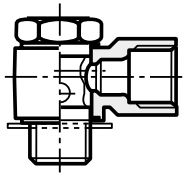
		Series
406-426	ø 6	LL
406-406	ø 6	L
406-410	ø 10	L

Elbow male connectors



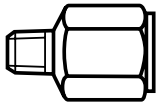
406-445	ø 6	M6	tapered
406-435	ø 6	M8 x1	tapered
406-425	ø 6	M10x1	tapered
406-455W	ø 6	R 1/8"	tapered

Banjo fittings



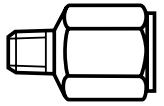
504-102	ø 4	M10x1 / M8x1
504-401	ø 4	M8x1 / M8x1

Adapters with tapered thread



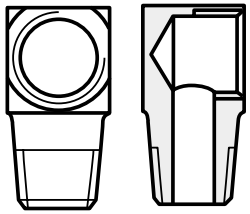
404-673K	M6 x 0.75 tapered / M8 x 1
404-662K	M6 tapered / M8 x 1
404-047K	M7 tapered / M8 x 1
404-003K	M8 x 1 tapered / M8 x 1
404-006K	M10 x 1 tapered / M8 x 1

Adapters with tapered thread



406-004K	M10 x 1 tapered / M10 x 1 short
406-035K	M10 x 1 tapered / M10 x 1 long
404-040K	R 1/8" tapered / M8 x 1
404-054K	R 1/4tapered / M8 x 1
401-019-691	R 1/8 / G 1/8"

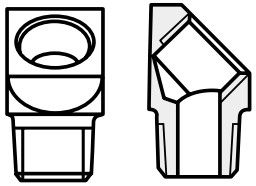
Elbow 90°



406-489K M8 x 1 tapered / M10 x 1

406-090K M10 x 1 tapered / M10 x 1

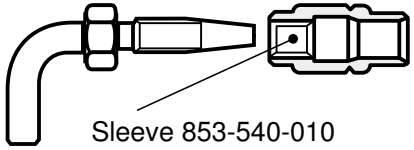
Elbow 45°



406-145K M8 x 1 tapered / M10 x 1

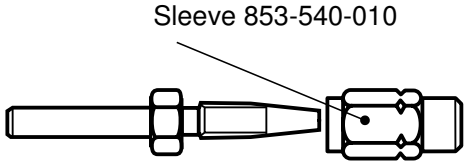
406-045K M10 x 1 tapered / M10 x 1

Fittings for high-pressure hose
982-750-091 for self-installation



853-380-002 ø6 Tube stub 90°

853-390-003 ø6 Tube stub 90°, long



853-370-002 ø6 Tube stub, short

853-380-002 ø6 Tube stub

853-390-002 ø6 Tube stub, long

3.6 Essential advice for service technicians of machine supplier

When removing or installing components (stud bolts, bushes etc.) connected to the central lubrication system: Fill bearings and/or hollow spaces with grease prior to connection of central lubrication lines.

Controller / Memory / Power supply:
The controller is integrated in the bottom part of pump housing and has an EEPROM (non-volatile) memory. If you have to interrupt power supply due to maintenance or repair work, the system is again ready to operate as soon as power supply is energised.

Current modes of operation KFGS:
- Timer operation without monitoring
  Programming: tPA, tCO, COP = OFF
- Timer operation with monitoring
  Programming: tPA, tCO, COP = CS

Programming ranges

Function	Programming range
Pause time	0.1 h to 99.9 h
Pump running time	0.1 min to 99.9 min
Impulses	1 to 999

Display areas

Display	Display area
Fault hours	0.1 h to 99,999.9 h
Operating hours	0.1 h to 99,999.9 h

Further details, see KFG / KFGS 951-130-184 Operating Instruction.

Metering:
Feeder configuration should not be changed because the system was designed per machine bearing requirements during final assembly. By setting the pause time and pump running time, you may control the total grease quantity fed to the system.

General rule:
Longer pump running time = more grease
Shorter pump running time = less grease
Shorter pause time = more grease
Longer pause time = less grease

Example:
Half the pause time = double the grease quantity

Only ignition on-time is accumulated during the pause time and pump running time, equipment down time is not accumulated.

Overlubrication or underlubrication may cause machine damages!

3.7 Initial start-up

Initial start-up is performed by an authorised technician immediately after installation of central lubrication system.

3.8 Start-up after maintenance and repair

After a probable down time of construction machine of several weeks or after repair for which system components had to be dismounted, repeated start-up and functional check shall be performed.
- Filling level check of lubricant reservoir
  Top-up to at least 2/3 of reservoir capacity
- Bleed the pump and the system if the lubricant level in the reservoir falls below the minimum mark as this will introduce air into the system

3.9 Bleed the pump

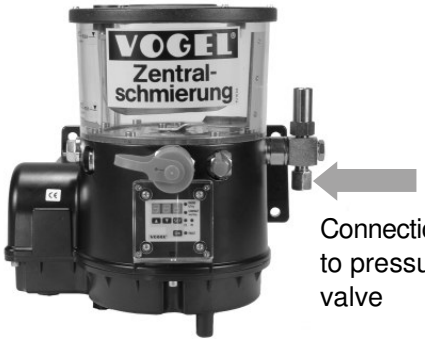
- Unscrew main line from pressure limiting valve on pump element, in case of several pump elements provided, dismount all main lines
- Trigger intermediate lubrication several times until bubble-free oil emerges from all pump elements

3.10 Bleed the system

- Remove contaminants and used grease from all bearing points connected
- Connect a lever-operated grease gun with pressure gauge to the main lines unscrewed from pressure limiting valve and press grease into the feeder and line system until fresh grease emerges from all lubrication points connected to that lubrication circuit.

Watch pressure build-up in the system. According to the size of lubrication system, ambient temperature, and lubricant consistency, the optimal system pressure should be between 60 and 200 bars.

- Next, determine by visual inspection whether all lines and screwed connectors are tight. Leakages can be easily detected by distinctly emerging grease.
- Now, connect a test pressure gauge (0 - 400 bars) to the main lines and reconnect these lines to the pressure limiting valve again.
- Initiate a lubrication cycle by activating the manual trigger facility. Watch pressure build-up. After a few minutes, system pressure should equal the pressure which was achieved with the manual grease gun. If the first lubrication cycle (pump stops) ends before pressure build-up, this may be attributed to the compression behaviour of lubricant. If necessary, repeat the lubrication cycle up to four times. If pressure is built-up during altogether five lubrication cycles as described, the lubrication system is functioning correctly.
- Dismount test pressure gauge, reconnect the main lines directly to the pressure safety valve of pump elements, and restart another lubrication cycle.



Connection of main line to pressure limiting valve

3.11 Functional check of central lubrication system

For following actions, see **KFG / KFGS 951-130-184 Operating Instruction**

- Record set values
- Set new values: Pause time: 0.1 h
  Contact time: ... minutes
  Pump running time (rate of delivery) shall at least ensure one feeder cycle with cycle switch.
- Turn-on ignition
- Activate intermediate lubrication via DK

The yellow pushbutton pilot light on the dashboard should illuminate for 3 seconds. While the ignition is on, leave this setting unchanged for about 1 hour without triggering an additional lubrication cycle by depressing the illuminated pushbutton (optional) or the pushbutton on pump housing.

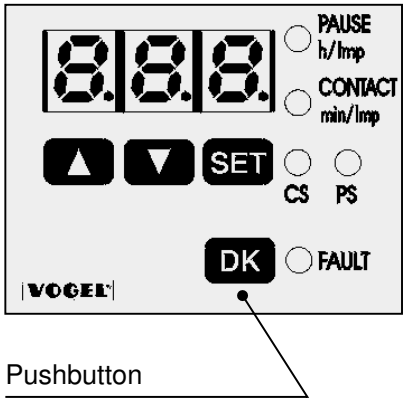
- After one hour has passed, see whether the yellow pushbutton pilot light (optional) is on again. If it does, there is a system malfunction. If the pilot light is not on, turn the ignition off and reset the pause time and contact time to default settings.
- Remove excessive grease related to system testing from all bearing points connected.

Set default values for pause time and contact time.

The central lubrication system is ready to operate! As to problems occurred, see Chapter 6 ìMalfunctionsì.

3.12 Activate intermediate lubrication

The display and control unit is protected from splash water and mechanical damages by a transparent plastic window. For programming, dismount the window by means of screwdriver and remount it after programming.



Pushbutton

LED display	
• Seven-segment display: values and operating status	8.8.8.
• Pause time	PAUSE h/Imp
• Pump operation	CONTACT min/Imp
• Monitoring of system function via external cycle switch CS = cycle switch	CS
• **Not functional for progressive systems**	PS
• Fault alarm	FAULT
Pushbutton keys	▲ ▼
• Turn display on • Display values and parameters • Adjust values and parameters	
• Change-over between programming and display modes • Confirm values	SET
• Activate intermediate lubrication • Clear fault alarm	DK

Depress the pushbutton on pump housing or the illuminated pushbutton on dashboard while the ignition is on. The pump will run for the preset contact time.

Examples:
- After machine cleaning, renew the grease collar on bearings
- Tough conditions of use with substantially increased lubricant demands
- Start-up/Functional check
- Topping-up and bleeding of pump

3.13 Lubricants

To maintain system warranty and functionality, use only Vogel approved greases listed in Chapter 3.15 and approved by us. (Sodium-based grease grades should not be used in on- and off-road sectors due to their water solubility).

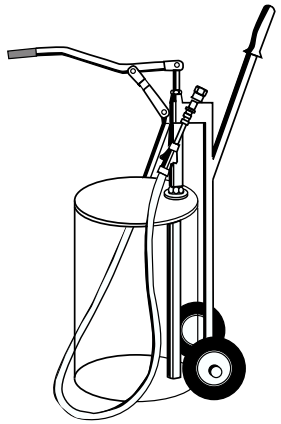
To guarantee system functionality, take care of absolute cleanliness when topping-up lubricant.

Contaminants may cause malfunctions of the central lubrication system and damage at friction points. If approved greases listed in Chapter 3.15 are used, switching between conventional and biodegradable grease will not affect system performance.

Commercially available **greases** advised by the vehicle and/or grease manufacturer that still show adequate suction and/or fluidity at -25°C (max. flow pressure 700 mb) are used as lubricants. They must not tend to bleed which could cause blocking of feeder system during operation.

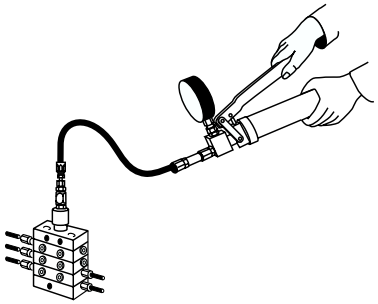
MoS2 greases (up to 5 % molybdenum disulfide content) can be delivered with VOGEL piston pumps and feeders.

For some special applications e.g. chipping hammer lubrication with a maximum of 3 lubrication points, greases (e.g chipping hammer paste) with solid matter portions like graphite or copper can be delivered with the KFG and/or KFGS pump series. Lubricant is directly fed through 3 pump elements to the lubrication point. Progressive feeders should not be used for such purposes. Biodegradable grease may be used in VOGEL progressive feeders under aforesaid conditions.



Topping up pump for grease of NLGI grade 2
(incl. coupling sleeve 995-001-500)

Order-no.: 169-000-042 25 kg barrel
Order-no.: 169-000-154 50 kg barrel



Lever-operated grease gun

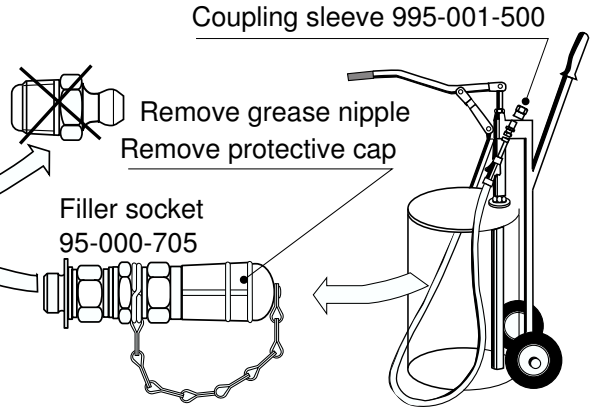
Order-no.: 169-000-143

3.14 Possible filling methods

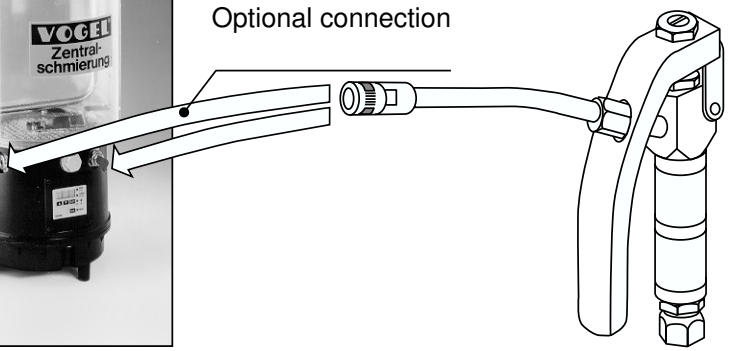
Principally take care of absolute cleanliness!

Filling with putty knife

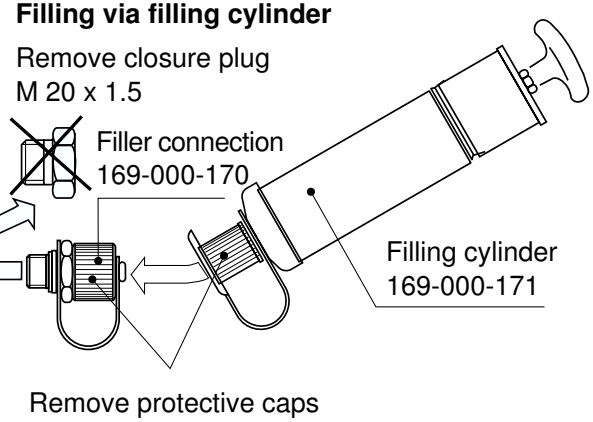
Filling via filler coupling



Filling via conical head nipple with manually or pneumatically operated grease gun



Filling via filling cylinder



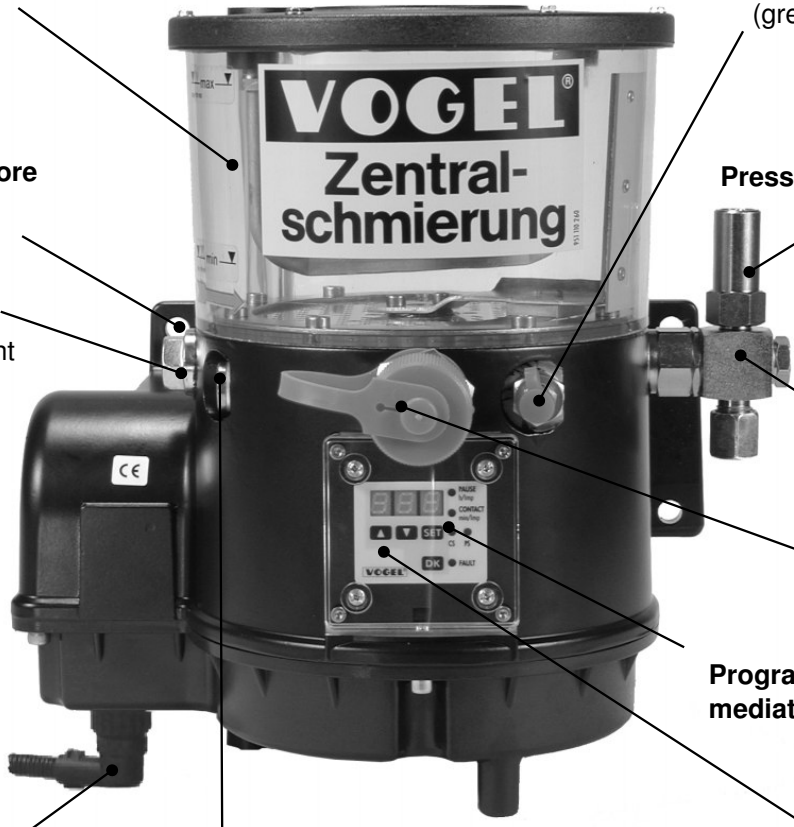
3.15 Table of lubricants

Only use lubricants approved by the machine manufacturer!

Manu-facturer	Type designation	Saponifi-cation	Minimum delivery temperature in °C
AGIP	Autol Top 2000	Spec. Ca	-10
ARAL	Long-life grease H	Li	-25
BECHEM	High-Lub L474-2	Li	-20
BECHEM	Berolub Kryotox II	Li	-55
BP	Energrease LS EP 9346	Li	-25
	Energrease LS EP-2	Li	-20
CASTROL	Spheerol EP L2	Li	-20
ESSO	Exxon Multipurpose Grease	Li	-20
ELF	ELF Multi 2	Li	-20
FINA	Multipurpose Grease EP	Li	-20
FUCHS	Renolit MP	Li	-25
	LZR 2	Li	-25
KROON OIL	Lithep Grease	Li	-10
KRUDE	MPL EP2	Li	-25
MOBIL	Mobilux EP 2	Li	-15
	Mobilgrease MB 2	Li	-20
MOGUL	LV 1 EP	Li	-25
ÖMV	ÖMV Signum M283	Li/Ca	-25
OPTIMOL	Olit EP 2	Li	-25
RHENUS	Rhenus TTF 4938	Ca	-50
RUS-GOST	21150-87LITOL-24	Li	-25
SHELL	Retinax EP L2	Li	-20
SHELL/ASEOL	Aquares LT 860-61	Ca	-40
	Grease acc. to TL VW 745	Ca	-50
TEXACO	Multifak EP2	Li	-15
TOTAL	Multis EP2	Li	-20
Zeller & Gmelin	Litogrease	Li-complex	-25
CAT	**Complex Grease 5P-0960**	Li[1])	-25
CAT BP	**Energrease L 21 M**	Li[1])	-25
CAT	**Grease CAT 130-6951 Z**	Li[1])	-25
CAT Chipping Hammer Paste KX 0813		Al-complex[2])	-25
Biodegradable greases			
ARAL	BAB EP2	Li/Ca	-20
AVIA	Syntogrease	Li	-25
BECHEM	UWS VE 4-2	Li/Ca	-25
DEA	Dolon E EP2	Li/Ca	-20
FINA	Biolical EP S2	Li/Ca	-25
FUCHS	Plantogel 0120S	Li	-25
LUBRITECH	Stabyl Eco EP2	Li/Ca	-20
ÖMV	ÖMV ecodur EP2	Ca	-25
TEXACO	Starfak 2	Ca	-20
Zeller & Gmelin	Divinol E2	Li	-25

1) with MoS2 solid matter portions
2) with solid graphite and copperportions

4. KFGS pump 1-5, 3-5, 5-5



Lubricant reservoir

Filler nipple
(grease gun)

Assembly bore
screws M8

Pressure safety valve

Connection
for another
pump element

Pump element

Filler port

**Programming and inter-
mediate lubrication DK**

Electrical
7-pole connection port

Optional connector
for filler nipple

Control with display

Filler port (**order-no.** 169-000-170) can be fitted as filler socket to a free lubricant outlet.

Connector (extension)
Order-no. 853-950-010

Banjo fitting
Order-no. 405-541-411

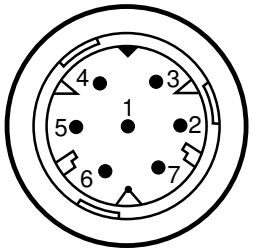
Electrical connection

Electrical connection of the KFGS series is established through a 7-pole plug connector provided on the bottom of unit.

Connection for cable harness

The cable harness is not included in the scope of supplies!

Order-no.	Length of corrugated tube	Wire length
997-000-630	12 m	12.2 m
997-000-650	16 m	16.2 m



7-pole round plug

Colour coding

X1-PIN	Colour code	Wire colour
1	BN	brown
2	RD-BK	red-black
3	BU	blue
4	PK	pink
5	BK	black
6	BK	black
7	VT-GN	violet-green

4.1 Electronic control and monitoring unit IG 502-1 integrated in KFGS pump unit

General

The IG 502-1 control and monitoring unit is an integral part of the KFGS and/or KFAS pump units. The functions have been configured specially for control and monitoring of central lubrication systems installed on commercial vehicles (moving machinery). The control unit can be matched with the operating conditions of vehicle and/or machine by customer programming and adjusted to the following modes of operation:

1. TIMER without monitoring
2. TIMER with monitoring
3. COUNTER without monitoring
4. COUNTER with monitoring

Pause time (tPA) in „TIMER“ mode

The pause time (time between two lubrication cycles) in TIMER mode is defined by a time clock generated in the control and by the value programmed under tPA. It can be adjusted to a value between 0.1 h and 99.9 h.

Adjustment of pause and pump running times and of requested monitoring function

The sequence of operation how to adjust the control to the values and functions depending on the use of vehicles (machines) can be taken from the operating instruction enclosed to the pump unit.

To be noted!

When changing the settings on selector switches A1 and S2, you will essentially affect the lubricant quantity fed to the connected lubrication points!

Underlubrication may cause damages to the machines!

Function (standard „TIMER“ function without monitoring)

Lubrication cycles are cyclically repeated based on the selected pause time (tPA or cPA). The pump running time during a lubrication cycle corresponds to the time set under tCO (contact time) on the operator panel.Both the pause and pump running times are only active when the system has supplied voltage (connect ports 15 and 31 to 12 V DC or 24V DC depending on the unit).
When the supply voltage is interrupted (supply voltage disconnection at connection port 15) the currently active time remaining is saved and continued after resupply of voltage.
With programmed "CS" monitoring function (only for central lubrication systems with cycle switch), the cycle switch fitted to a progressive feeder is interrogated for signal making while the pump is running. At least one signal change is expected from the control sequence (either ON>OFF or OFF>ON) at the ZDS connection of cable harness to start a new pause time after the pump running time has passed and to continue the sequence of functions as usual. If this signal fails to occur during the selected pump running time (tCO), a monitoring program is started (block operation) after elapse of that time. During this program, the pump unit is
additionally turned-on up to two times maximum in specially set intervals and the cycle switch is monitored for signal making. When the signal of cycle switch arrives at the control unit, the monitoring program is instantly ended and operation continues with normal sequence. When the monitoring program is run, a fault message is output at program end and the sequence of functions is stopped.
Intermediate lubrication cycles cannot be activated while the monitoring program is running.

EEPROM memory

The control has a non-volatile EEPROM memory to be independent from permanent voltage supply to save times remaining and fault alarms. When the supply voltage is interrupted (ignition), the current value is saved and is available for continued sequence of functions after resupply of voltage.

Monitoring and fault displays
Function monitoring with cycle switch

Central lubrication systems can be monitored with cycle switch. Set „CS“ (cycle switch) as monitoring feature under „COP“ when programming the unit. Signal making of switch is then monitored during lubrication.

If signal making is not achieved during the lubrication cycle and the successively started monitoring program, a fault message is output after the end of monitoring program („SL2“ connection is activated permanently) and the sequence of functions is interrupted. By depressing of a key on operator panel, the "FCS" error code (Fault Cycle Switch) can be called-up.

Filling level monitoring

Pump units with code „W1“ in the order designation have got a factory-installed integrated filling-level monitoring feature which is always active without any need for programming.

When reaching the maximum filling level, a fault alarm is released („SL2“ connection is activated permanently) and the sequence of functions is interrupted. By depresssing of a key on operator panel, the „FLL“ error code (Fault Low Level) can be called-up.

Clear a fault message

Absence of signal change at ZDS input - this fault message can be cleared with supply voltage applied by depressing of the DK pushbutton.

Filling level fault - this fault message can be cleared with supply voltage applied after topping-up of reservoir by depressing of the DK pushbutton.

Hour meter

The control unit has got a built-in hour meter to accumulate the time during which the control unit was energised. The memory cannot be changed. The stored values can be called-up and viewed on operator panel.

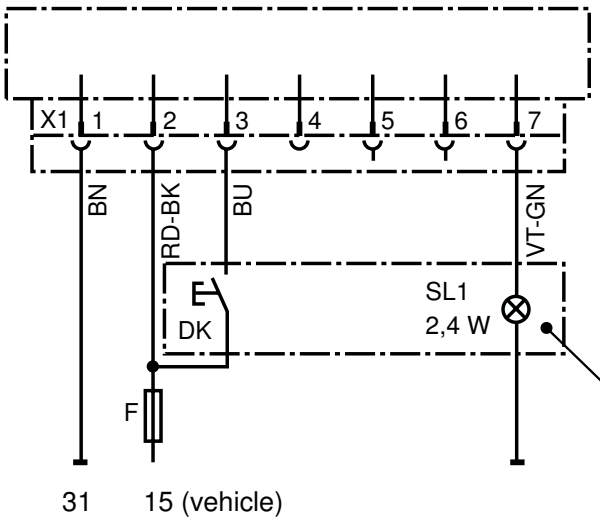
Fault hour memory

The control unit has got a fault hour memory to accumulate the time during which the control unit was operative with fault message obtained and supply voltage applied. The memory cannot be changed. The stored values can be called-up and viewed on operator panel.

Further details, see KFG / KFGS 951-130-184 Operating Instruction.

4.2 Timer operation

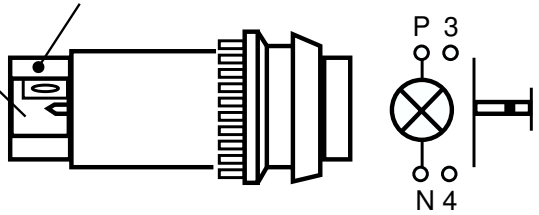
Timer operation without monitoring
Programming: tPA, tCO, COP = OFF



External DK pushbutton and operation indicator light SL 1 can be combined as an illuminated pushbutton.
External DK pushbutton and operation indicator light SL 1 are optional items of equipment.

Illuminated pushbutton (green)
External DK pushbutton (green) and operation indicator light SL 1 can be combined as an illuminated pushbutton.

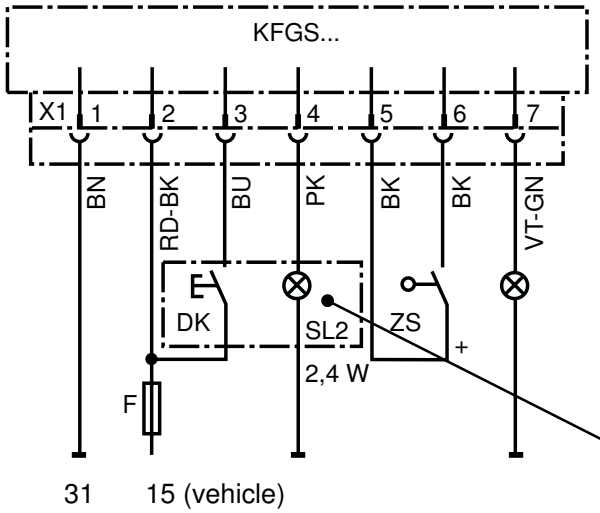
Tab terminal connection 2.8 x 0.8
Fitting diameter ø 20.3



15	positive potential, supply voltage (ignition switch ON)	Vehicle range
31	negative potential, supply voltage (0 V, GND)	
DK	Pushbutton 1. Intermediate lubrication 2. Clear fault message	General
SL1	Indicator light "Pump ON"	
SL2	Indicator light "Malfunction"	
ZS	Cycle switch	Wire colours
X1	Plug connection	table on page 68

4.3 Timer operation

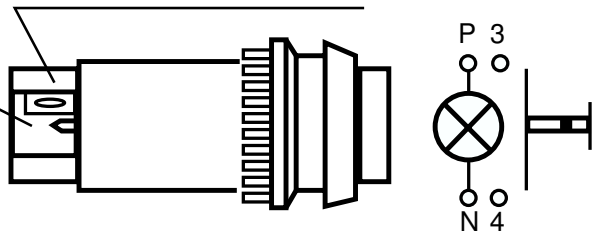
Timer operation with system monitoring
Programming: tPA, tCO, COP = CS



SL 1 operation indicator light (yellow) (pump is running)

External DK pushbutton and fault indicator light SL 2 can be combined as an illuminated pushbutton.

Tab terminal connection 2.8 x 0.8
Fitting diameter ø 20.3



15	positive potential, supply voltage (ignition switch ON)	Vehicle range
31	negative potential, supply voltage (0 V, GND)	
DK	Pushbutton 1. Intermediate lubrication 2. Clear fault message	General
SL1	Indicator light "Pump ON"	
SL2	Indicator light "Malfunction"	
ZS	Cycle switch	Wire colours
X1	Plug connection	table on page 68

4.4 Sequence of functions of KFGS electronic control and monitoring unit

Memory (EEPROM)
Pause time and pump running time

The control has a non-volatile EEPROM memory, therefore, a permanent voltage supply (e.g. battery +30) is not necessary to store times remaining and fault messages. Current system status is stored in the EEPROM memory when the voltage supply (ignition) is cut off. Actual system values are reinstated upon resupply of system supply voltage.

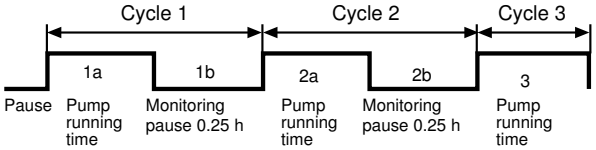
Sequence of functions

Lubrication cycles are cyclically repeated based on selected pause time settings. The pump running time during lubrication cycle corresponds to the time setting with selector switch S1.
Both the pump running time and the monitoring time are only active when the system has supply voltage i.e. when the ignition is in ON position. When the supply voltage is cut off, the respective times remaining are saved and continued after resupply of voltage.
Pump systems with the monitoring function use a cycle switch to monitor internal spool movement within one section of progressive feeder,interrogated via ZDS input. A minimum of one spool movement1) must be registered while the pump is running to start a new pause time without "block operation" upon expiration of the pump running time.

If input of spool movement is not registered by ZDS during pump running time section „1a“ (see diagram), the shortened monitoring pause „1b“ will be initiated after expiration of pump running time. If the expected input is registered during monitoring pause „1b“, the pump will start with adjusted pause time.
If an input of spool movement is not registered at ZDS input during pause „1b“, cycle 2 continues to function. If there is no input of spool movement registered before the end of „cycle 3“, a fault message is output via lamp output SL2 and the further sequence of functions is locked-out. Input of spool movement at ZDS during sections „2a“ and „2b“ of diagram causes instant abortion of pump running time i.e. the pump motor is turned-off. The pump starts with set pause time.

Clear a fault message

(absence of spool movement at ZDS input)
This fault message can be cleared with supply voltage applied i.e. „ignition ON“ by depressing of the DK pushbutton.



1) Input of spool movement means:
cycle switch ON - OFF or
cycle switch OFF - ON

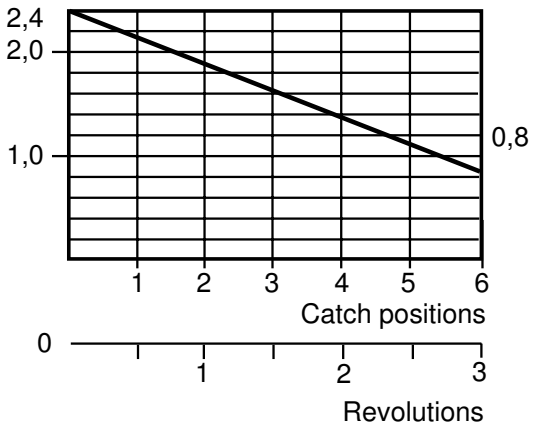
Fault alarm „Memory error“ (component failure). Lamp output SL2 reports a permanent signal in case of „Memory error“ fault alarm and cannot be cleared by depressing of DK pushbutton. The functional sequence of control unit is not interrupted and will be maintained without memory function.

4.5 Pump elements for KFG and KFGS piston pumps

Adjust delivery rates

- Remove closure plug with hexagon socket-head wrench, opening size 6
- The setscrew is turned by means of hexagon socket-head wrench, opening size 8
- Turning in clockwise sense will decrease, turning in counterclockwise sense will increase the delivery rate
- Maximum travel of setscrew = 3 revolutions = 6 catch positions
  1 revolution of setscrew = 1 mm = 2 catch positions
- After adjustment, screw-in and tighten closure plug.

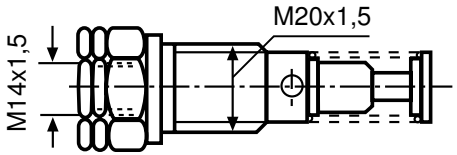
Chart for quantitative graduation
Delivery rate (cm^3/min)



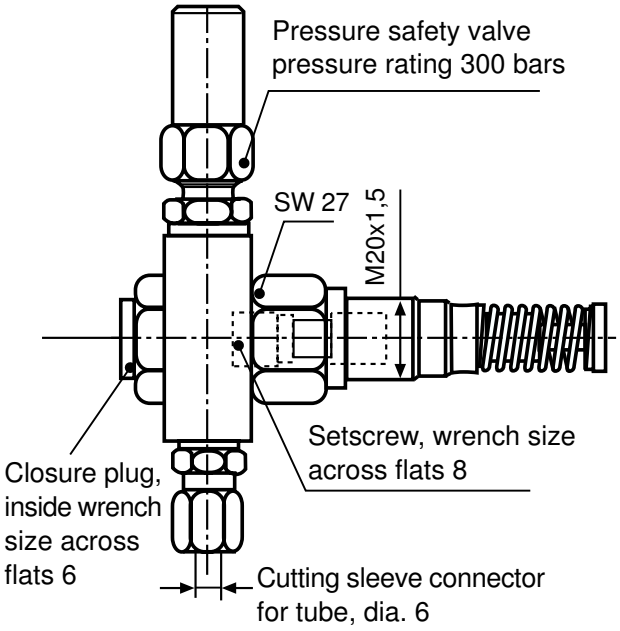
Order-no.	Delivery rate[1] (cm^3/min)	Number of grooves [2]
KFG 1.U1	2.5	1
KFG 1.U2	1.8	2
KFG 1.U3	1.3	3
KFG 1.U4	0.8	4
KFG 1.U40	adjustable between 0.8 and 2.43)	

1) Delivery rates referred to delivery of NLGI class grease at a temperature of 20°C and a system pressure of 50 bars. Temperatures and pressure ratings other than those may cause decrease of delivery rate. Use the indicated values as the basis for configuration of the central lubrication system.
2) The pump elements are marked with grooves on the wrench contact face.
3) Adjusted to maximum delivery rate of 2.4 cm^3 upon shipment.

Pump element with constant delivery rate, without pressure safety valve



Pump element with variable delivery rate, with pressure safety valve

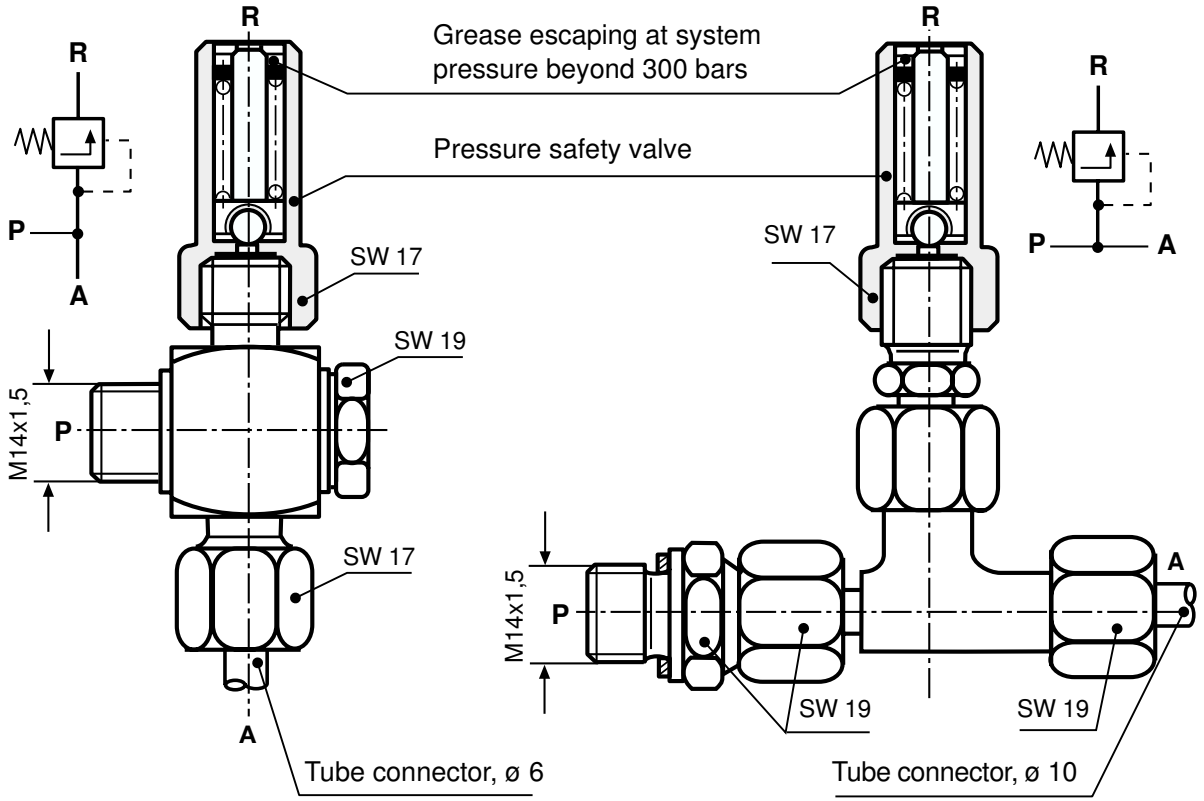


Wrench size across flats 27

4.6 Function of pressure safety valve

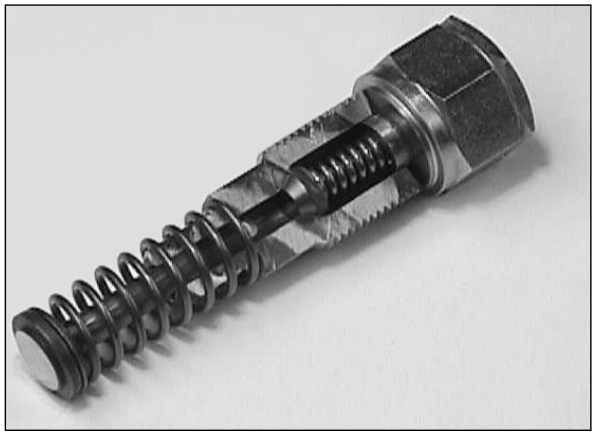
A pressure safety valve fitted to the pump element is to safeguard the entire lubrication system against damages, caused by excessive system pressure. The preset opening pressure of this valve is 300 bars. When system pressure rates exceed 300 bars due to a feeder blockage or a blocked lubrication point, the valve opens allowing lubricant to escape. This is beneficial for visual system monitoring.

Order-no.	Tube	Opening pressure in bars
161-210-012	ø 6	300 ± 20
161-210-016	ø 10	300 ± 20

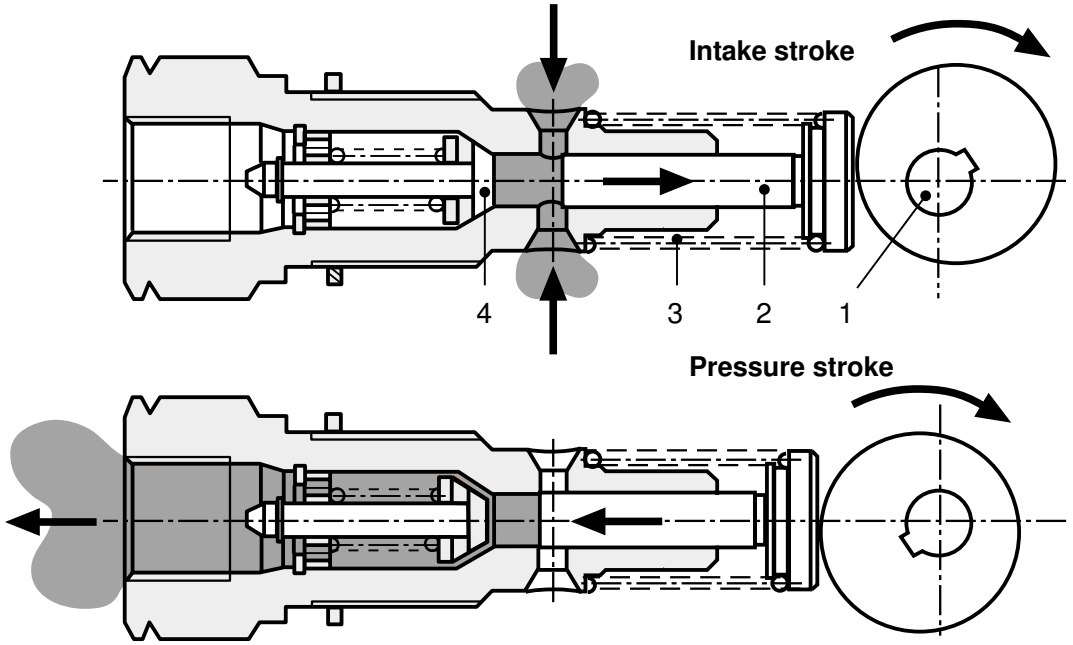


SW = wrench size across flats

4.7 Function of pump element



Sectional view of a pump element with constant delivery rate, without pressure safety valve



Intake stroke

The pump element is driven via cam (1). Upon intake stroke, the recuperating spring (3) pulls back the delivery piston (2) of pump element. The spring-loaded check valve (4) closes the outlet, simultaneously, lubricant is delivered through two ports into the pump element.

Pressure stroke

Upon pressure stroke, the cam (1) moves the delivery piston (3) towards outlet. The intake port is closed by the delivery piston and, then, the check valve (4) opens. The delivery piston (2) delivers the relevant lubricant quantity into the main line of lubrication system.

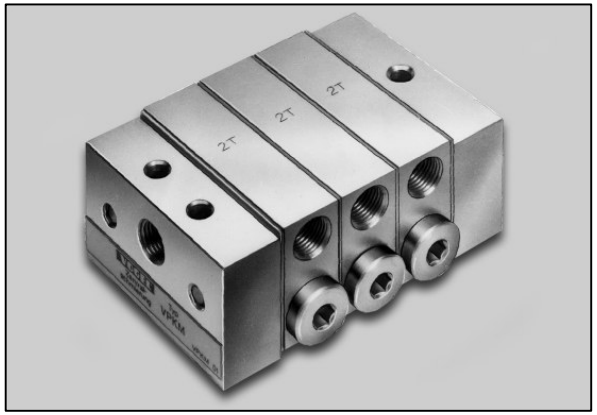
5. Progressive feeders

Outlets of a progressive feeder that are not needed must not be sealed as this will cause feeder blockage.
Crossport outlets not needed with an adjacent outlet as described or connect to pump via a return line.

Without system monitoring

Progressive feeders are assembled of a minimum of three to a maximum of ten individual sections. They are extremely sturdy and meter the lubricant coming from the pump according to the metering rate of individual sections.

Changes in the number of lubrication points are possible, however, changes should be performed only by an authorised VOGEL technician.



With system monitoring via cycle switch

A cycle switch is fitted by the manufacturer to the last piston port of progressive feeder. This is used to monitor the piston movement and the total feeder function.
Installation of an illuminated pushbutton on dashboard for fault indication is advisable for monitoring systems with a cycle switch.

5.1 VPKM progressive feeders
Crossporting (combining several outlets)

Two adjacent outlets are crossported from the end section towards inlet section.

Bear in mind:
1. Start at the end section with one fastening bore.
2. End at the inlet section with two fastening bores.

How to proceed:
Unscrew the associated VPKM.U4 closure plug and seal the outlet hole with a screw plug.
The lubricant quantity of both outlets is then discharged from the next outlet to the direction of inlet section.

The feeder section behind the inlet section should not be closed!

Important!
Insure that the VPKM.U4 closure plug is removed prior to screwing-in the screw plug 466- 431-001. Otherwise, the feeder will be blocked.

By continuing this procedure, two or several outlets of a whole feed side can be combined provided there is no S-section in between them.
The S-section is to terminate the group. A new group can then be formed again behind the S-section.
If later the lubricant quantities of two adjacent outlets have to be singled again because e.g. another lubrication point was added this is a simple procedure. Screw-in the VPKM.U4 closure plug and connect the closed outlet to the additional lubrication point.

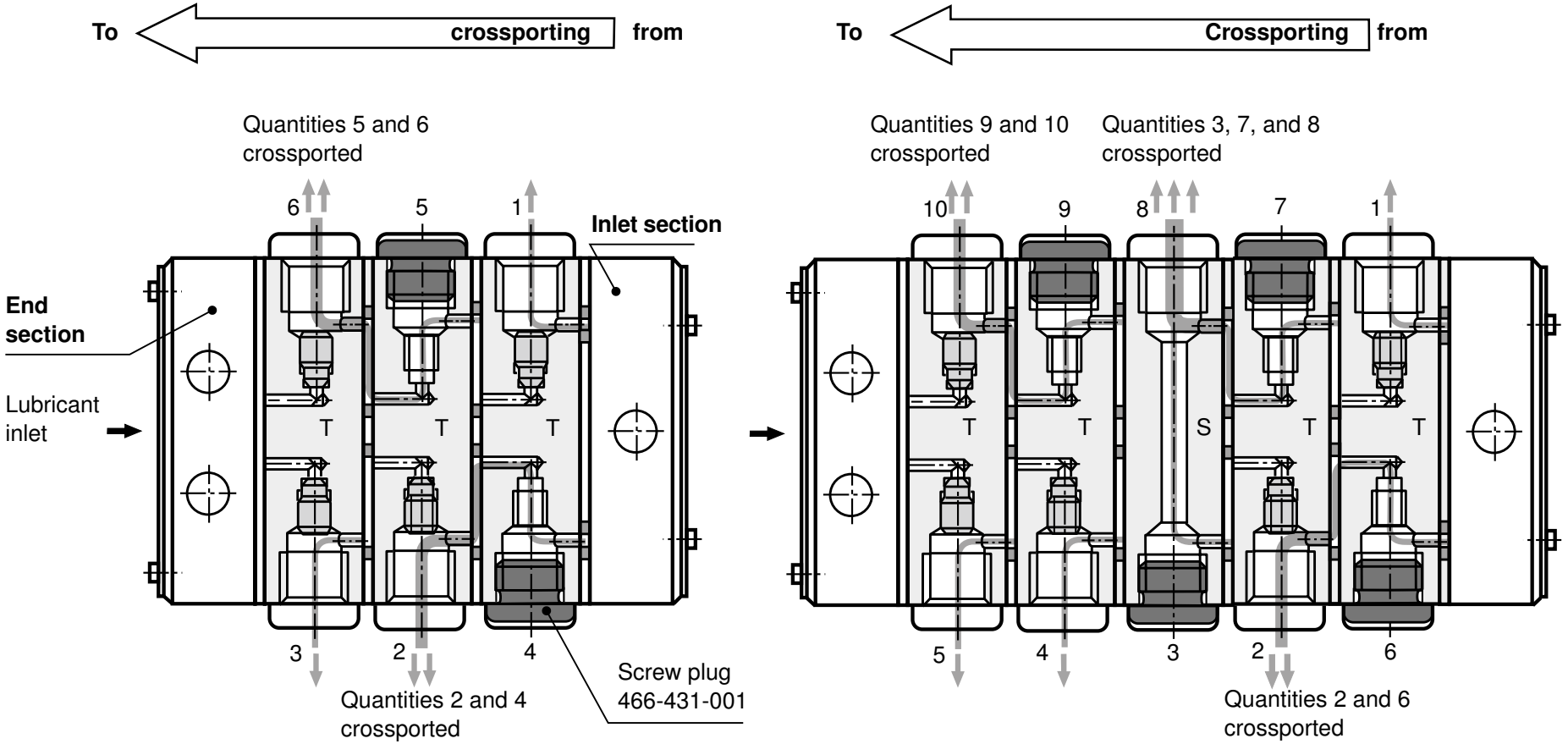
- When individual sections of VPKM progressive feeders shall be replaced by those with other metering rates,
- When a feeder shall be completed by additional sections, or
- When a feeder has to be cleaned or repaired, said feeders have to be dismounted and remounted later on.

When increasing/decreasing the number of sections, the threaded bolt (tie-bolt) that holds the sections in place has to be replaced at any rate.
The VPKM feeder components with various metering rates are listed-up in the following table.

Outlets of a progressive feeder that are not needed must not be sealed as this may cause malfunction of the feeder.
Crossport outlets not needed with an adjacent outlet as described or connect to pump via a return line.
Any change in the number of sections and/or metering quantity of individual sections without adjusting the grease quantity fed to feeder will change all lubricant quantities delivered to existing outlets.

5.2 Construction of VPKM progressive feeder

Crossporting (combining several outlets)



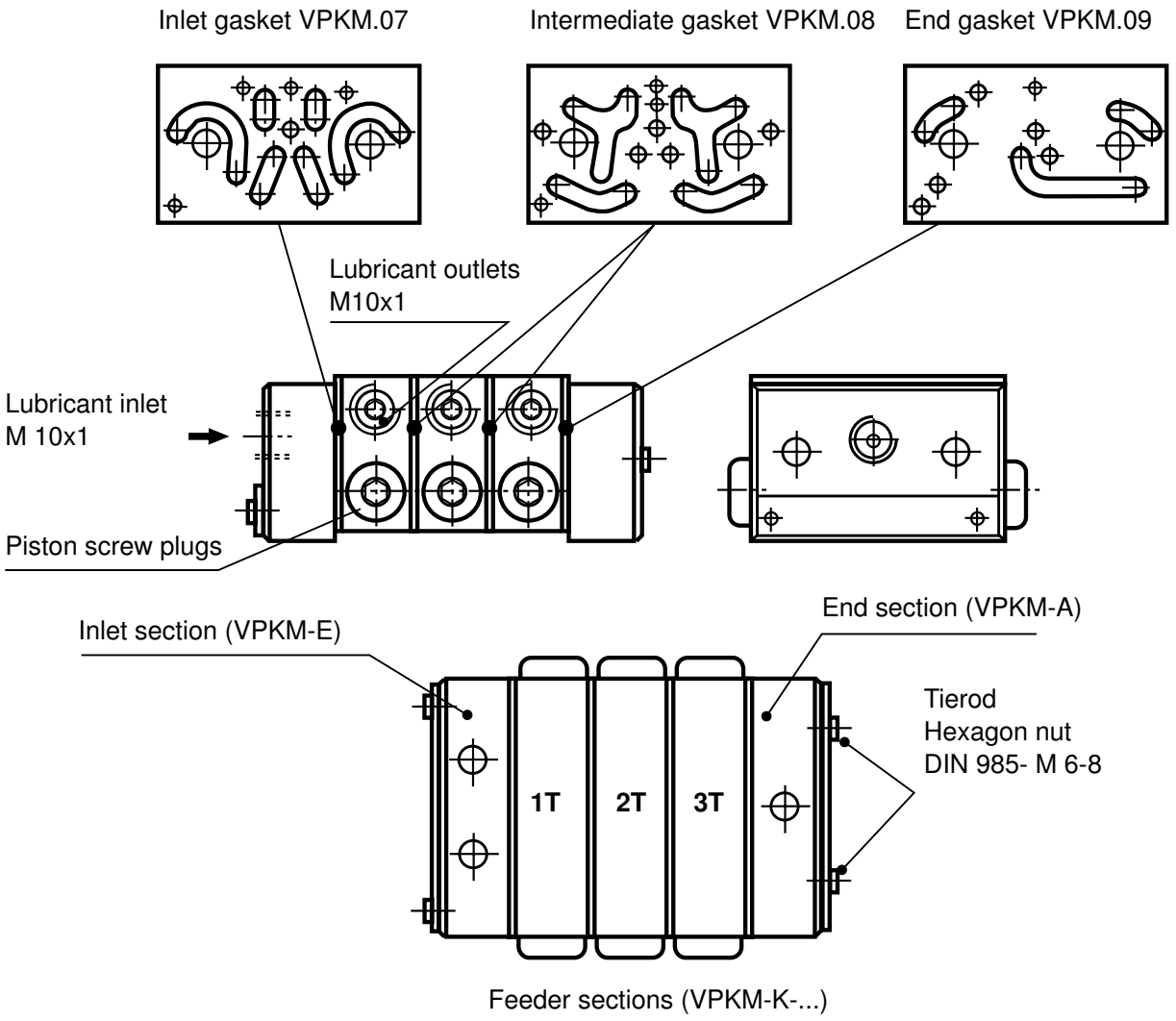
Closure plug VPKM.U4 (hexagon socket, wrench size 3)

Remove closure plug VPKM.U4

5.3 VPKM feeder sections

Sealing gaskets are placed between the feeder sections. They are to link the associated bores in the sections and, at the same time, seal the system.

Specific gaskets have been designed for inlet, feeder, and end sections.



5.4 VPKM proportioning

Output quantities of available feeder sections

Amount per cycle and outlet (cm^3)	Number of outlets	Designation of sections
0.04	2	VPKM-K-05T
0.08	2	VPKM-K-1T
0.14	2	VPKM-K-2T
0.18	2	VPKM-K-3T
0.08	1	VPKM-K-05S
0.16	1	VPKM-K-1S
0.28	1	VPKM-K-2S
0.36	1	VPKM-K-3S

When ordering additional sections, request the desired metering quantity.
Crossporting of outlets is carried out, if necessary, during assembly.

According to the number of sections, various threaded bolts (tierods) are required:

Feeder, complete Order-no.	Number of feeder sections	Number of possible outlets	Tierod Order-no.[2])
VPKM-3	3	6	DMAC 947-11 C83
VPKM-4	4	8	DMAC 947-11 ZY9
VPKM-5	5	10	DMAC 947-11 B20
VPKM-6	6	12	DMAC 947-11 F35
VPKM-7	7	14	DMAC 947-11 C37
VPKM-8	8	16	DMAC 947-11 E08
VPKM-9	9	18	DMAC 947-11 B68
VPKM-10	10	20	DMAC 947-11 ZX5

2) 2 pcs. needed per feeder
The nuts of tierod must be tightened uniformly with 7.5 Nm during assembly.

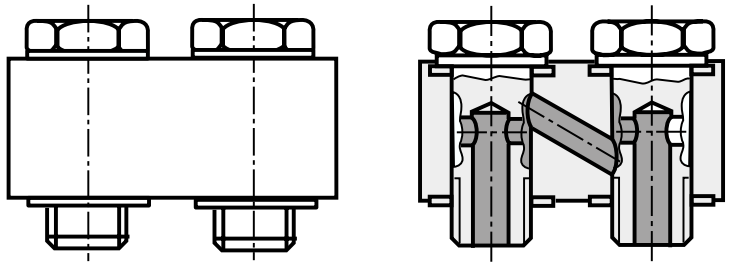
5.5 VPM outlet crossporting

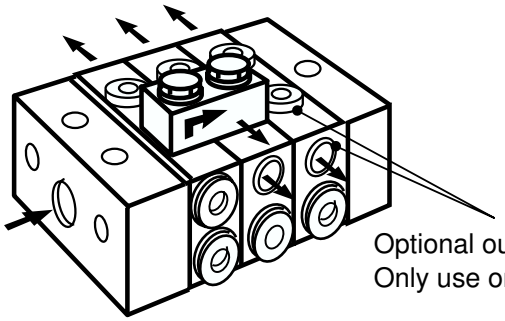
VPM series feeder sections are equipped with two outlets per side, only one of which shall be used. The second outlet must remain closed.
Crossporting of two outlets is possible by using the VP-C crossporting bar to be screwed into the upper optional outlets.
An odd number of outlets can be achieved without use of a crossporting bar by means of S-sections.

Only use one outlet, either the top or side outlet. Crossporting is possible in both directions.

Crossporting bar
Model complete with banjo bolt and washers

Order-no. VP-C

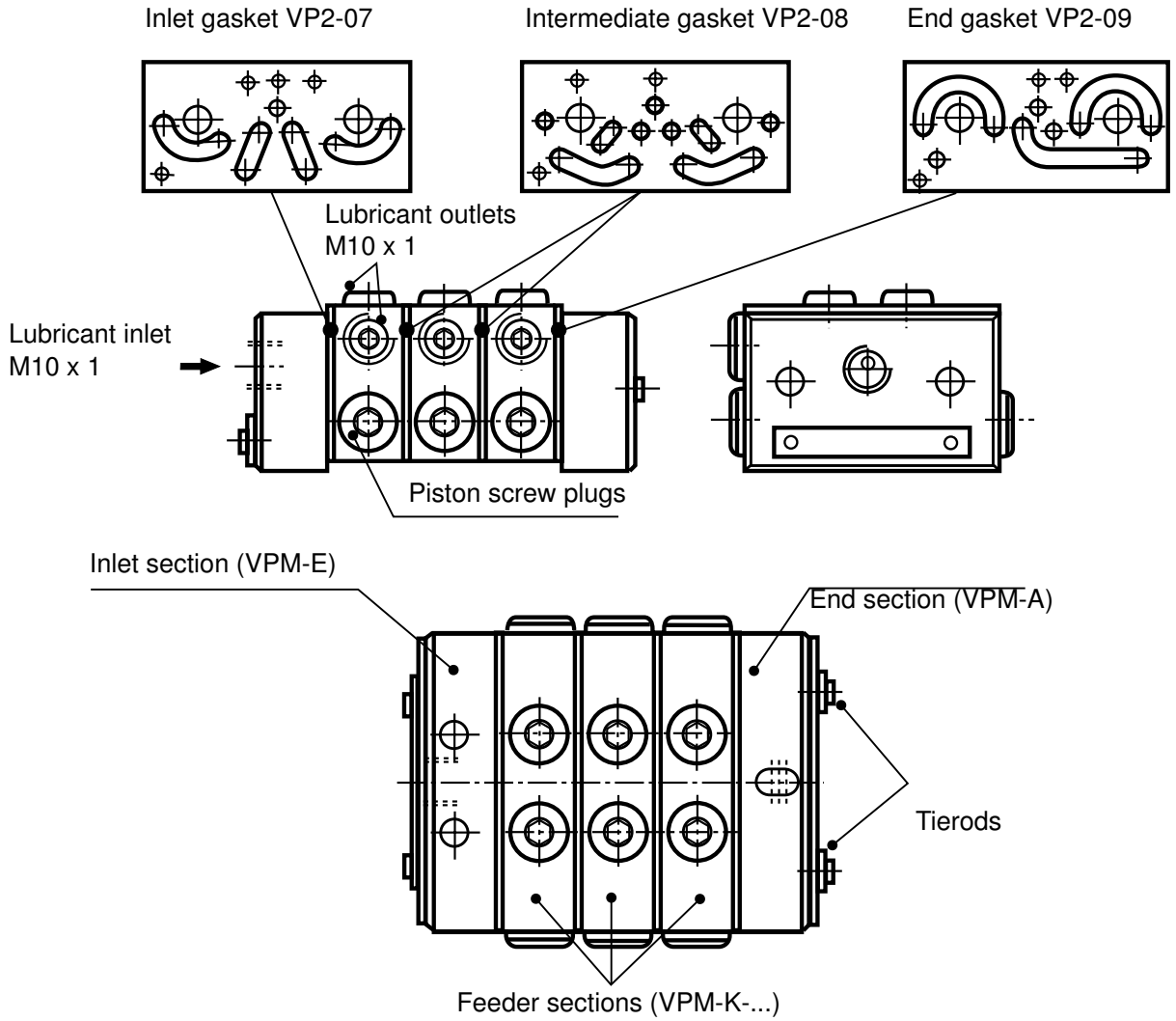




5.6 VPM feeder sections

Sealing gaskets are placed between the feeder sections. They are to link the associated bores in the sections and, at the same time, seal the system.

Special gaskets have been designed for inlet, feeder, and end sections.



5.7 VPM proportioning

Output quantities of available feeder sections

Amount per cycle and outlet (cm≥)	Number of outlets	Designation of sections
0.05	2	VPM-K-1T
0.14	2	VPM-K-2T
0.19	2	VPM-K-3T
0.25	2	VPM-K-4T
0.03	2	VPM-K-5T
0.35	2	VPM-K-6T
0.1	1	VPM-K-1S*
0.28	1	VPM-K-2S*
0.38	1	VPM-K-3S*
0.5	1	VPM-K-4S*
0.6	1	VPM-K-5S*
0.7	1	VPM-K-6S*

* Two outlets of one feeder section are crossported here.

When ordering additional sections, request the desired metering quantity. Crossporting of outlets is carried out, if necessary, during assembly.

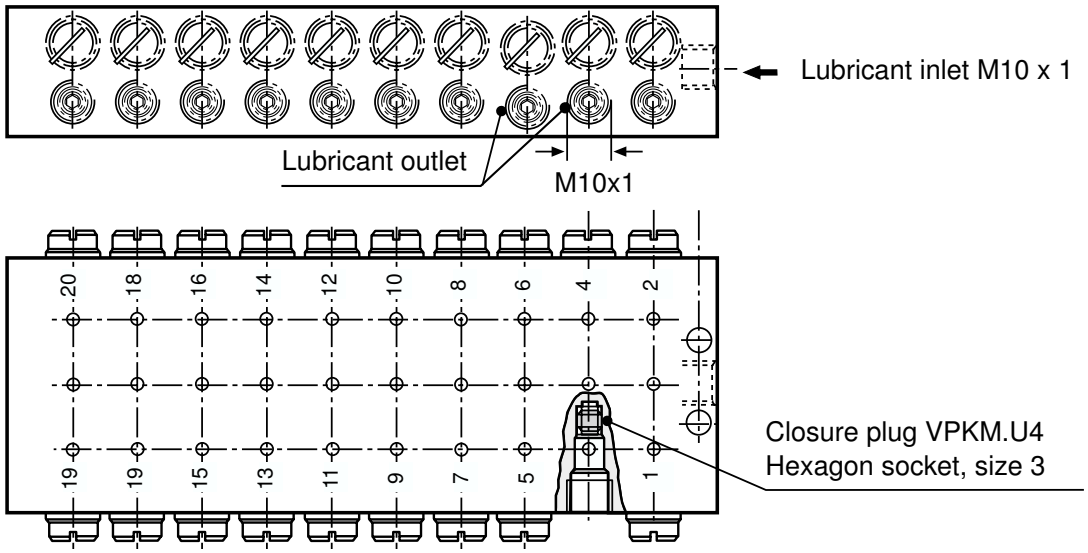
According to the number of sections, various threaded bolts (tierods) are required:

Feeder, complete Order-no.	Number of feeder sections	Number of possible outlets	Tierod Order-no.2)
VPM-3	3	6	VP.93
VPM-4	4	8	VP.94
VPM-5	5	10	VP.95
VPM-6	6	12	VP.96
VPM-7	7	14	VP.97
VPM-8	8	16	VP.98
VPM-9	9	18	VP.99
VPM-10	10	20	VP.100

2) 2 pcs. needed per feeder
The nuts of tierods must be tightened uniformly with 25 Nm during assembly.

5.8 VPBM progressive feeders

VPBM-3
shown with outlet ports 1 through 6



Characteristic features:

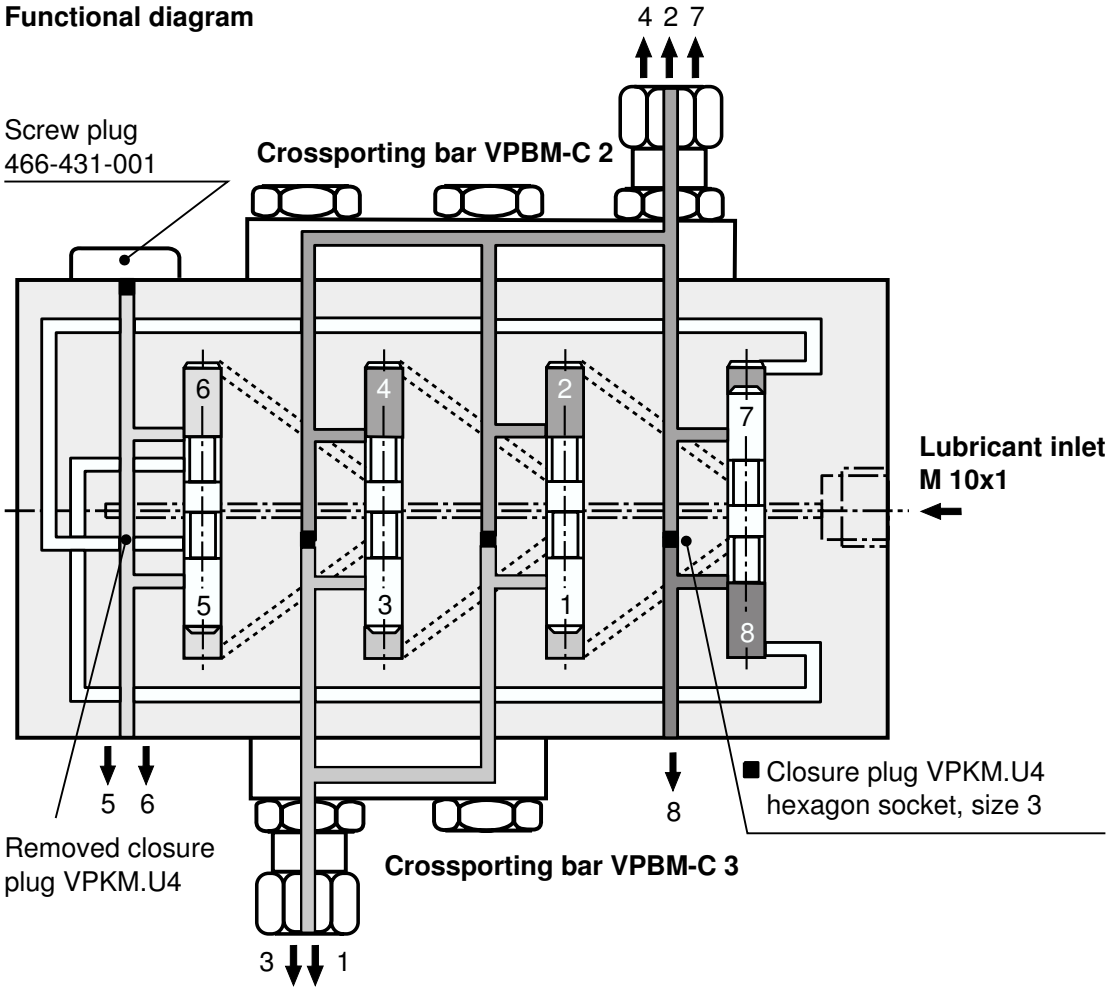
- Block-built design, smallest feeder series
- Uniform metering of 0.13 cm^3 per outlet and piston stroke
- Two outlets opposite each other can be connected by unscrewing of closure plug VPKM.U4 with hexagon socket, size 3. Then, screw-in screw plug 446-431-001
- Two or more adjacent outlets can be crossported by means of external crossporting bars VPBM-C
- Without built-in check valves

Order-no.	Number of outlet pairs (pistons)	Number of maximum outlets
VPBM-31)	3	6
VPBM-4	4	8
VPBM-5	5	10
VPBM-6	6	12
VPBM-7	7	14
VPBM-8	8	16
VPBM-9	9	18
VPBM-10	10	20

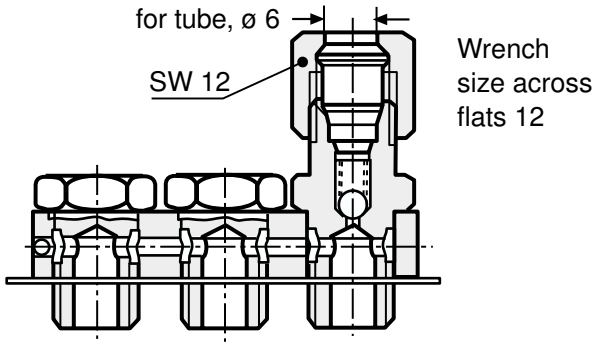
1) **This progressive feeder shall be principally used with VPKM-RV check valve only!**

5.9 Crossporting of outlets VPBM with crossporting bar

Functional diagram



Crossporting bar VPBM-C 3

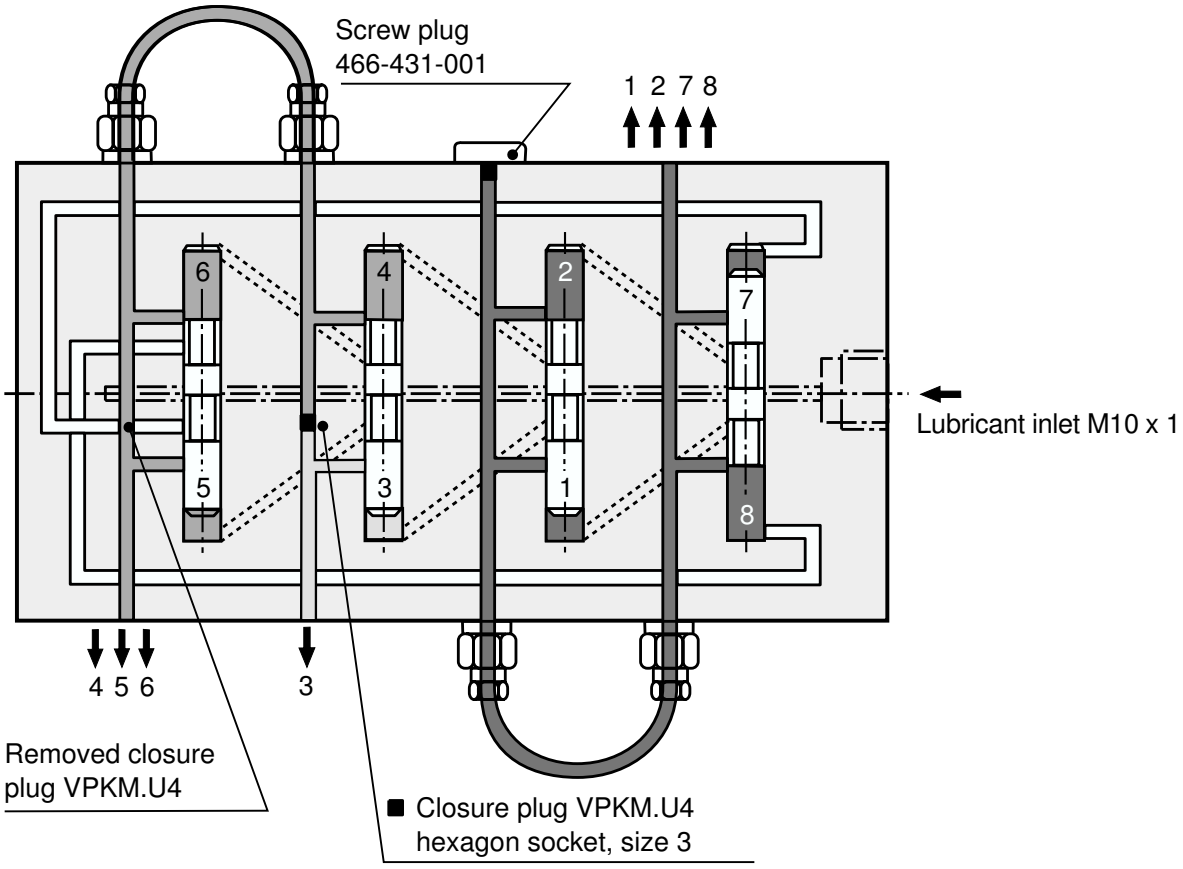


Crossporting bar for crossporting of adjacent outlets

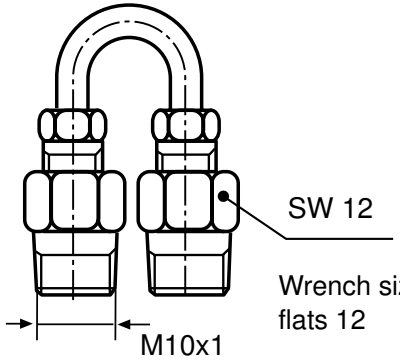
Number of outlets to be crossported	**Order-no.** of complete crossporting bar including banjo bolts and adapter for tube, ø 6, and check valve
2	VPBM-C 2
3	VPBM-C 3
4	VPBM-C 4

5.10 Crossporting of outlets VPBM with tube bend

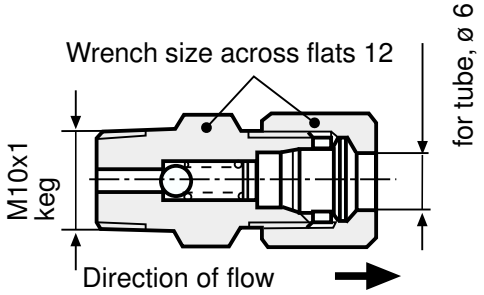
Functional diagram



Tube bend VPBM-C
Tube bend for crossporting of adjacent outlets



Number of outlets to be crossported	**Order-no.** of complete crossporting tube bend
2	VPBM-C



Use VPKM-RV fitting with check valve at feeder outlet port.

6. Malfunctions

6.1 General advice

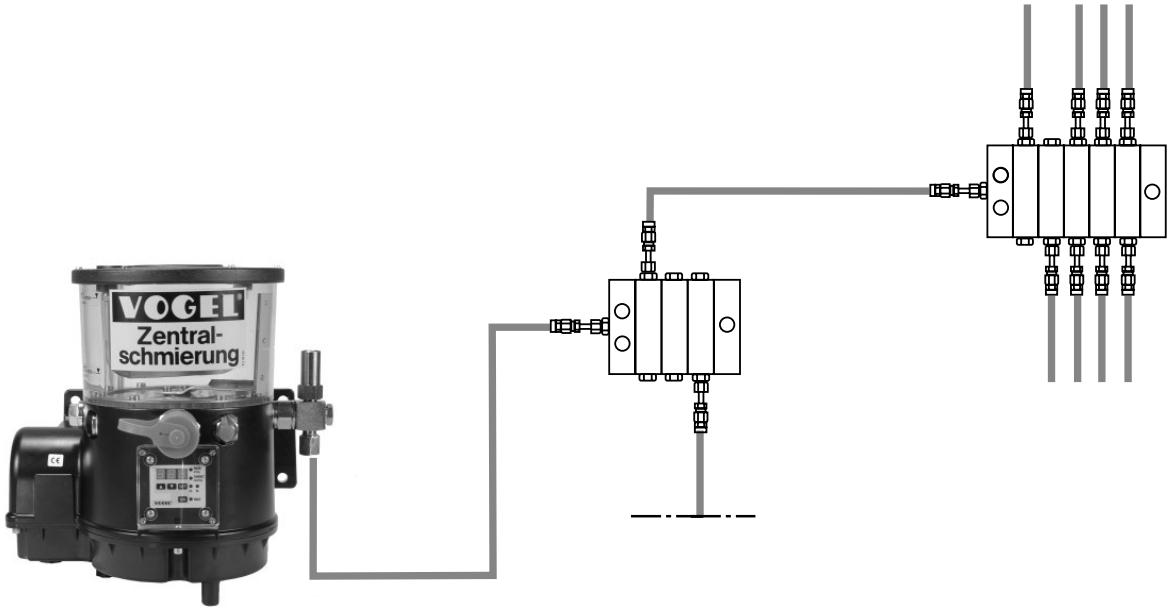
Inspection
When inspecting the lubrication system, begin with the pump and systematically move through the lubrication system from pump to the farthest lubrication point with regard to damages and malfunctions.

Regular visual inspection for fresh grease collars at the lubrication points. Absence of grease collars means a system malfunction.
Maintain cleanliness during removing and reinstalling of components.
When removing system components, mark inlets and outlets and protect from contaminant ingress.

Check system function

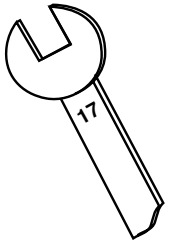
- Visually inspect the entire system for leakages
- Service leaky points and unions
- Go to Section 6.3 if the pump is functioning correctly
- Go to section 6.2 if the pump is not functioning correctly

Repair chart



Inspection - Repair

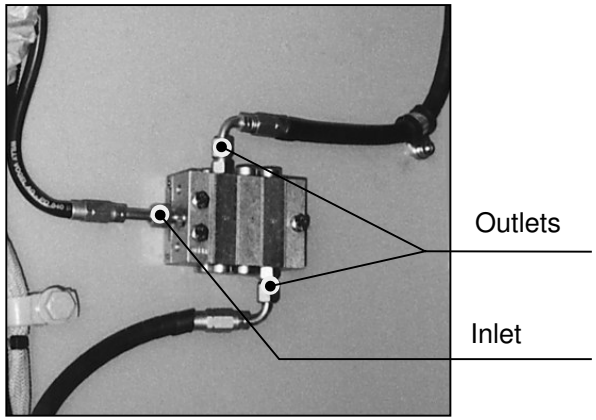
6.2 Pump malfunctions

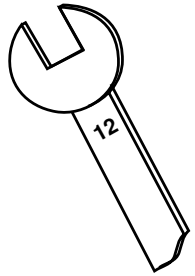
Malfunction / Fault	Remedy
Pump does not function Wiper blade in grease reservoir does not rotate during pump running time. Optional yellow warning light in cabin lights up.  KFGS pump	**Trigger intermediate lubrication** • Loosen the electrical plug by turning in counterclockwise sense • Turn the ignition on • Measure voltage between pin 1 and pin 2, on-board voltage +/-20% • Check fuse • Check cable harness for damages • No response: Check pump function • Check pump function Remove cover from display • Record settings of tPA • Set tPA to 0.1, pause time = 0.1 h = 6 minutes • Turn the ignition on • Wait 6 minutes, pump shall turn-on and turn-off after elapse of contact time set • No response: Replace pump  Wrench size 17 for line diameter 6 Wrench size 19 for line diameter 10
External damages of pump	**Replace pump** • Loosen lubricant main line from outlet of pressure safety valve • Remove 7-pole AMP plug connector by turning incounterclockwise sense • Undo three fastening screws • Install new pump and reconnect all components **Perform start-up and functional check.** **Reset the correct pause time and contact time settings.**

6.3 Lubrication system malfunctions

Malfunction / Fault	Remedy
Lubrication system blocked A blocked lubrication system is identified by grease distinctly escaping from the relief bore of pressure safety valve during pump running time and visibly dry lubrication points	When inspecting the lubrication system, begin with the pump and move systematically through the lubrication system from pump to the farthest lubrication point with regard to damages and malfunctions.(the grease collar around the lubrication points is not renewed)  Relief bore
Defective main line Identified by distinctly emerging grease	**Replace main line** **Only use OEM VOGEL spare parts filled with grease.** **Perform start-up and functional check.**
Main line blocked Identified by distinctly emerging grease from the relief bore of pressure safety valve during pump running time. With optional system monitoring provided, the yellow warning light of illuminated pushbutton is lighting.	• Loosen main line from the inlet of main feeder • Activate intermediate lubrication • **Replace main line if there is no grease flow**

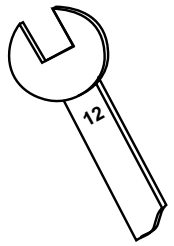
Malfunction / Fault	Remedy
Main feeder defective If grease does not flow through the main feeder after all union nuts have been removed from the outlet connectors, then the feeder is blocked. The optional yellow warning light in the cabin lights-up.	Ensure that grease is flowing • Loosen union nuts at outlet connectors successively • Check valves have been incorporated in the outlet • Activate intermediate lubrication • If grease is distinctly emerging from all outlet connectors, feeder all-right • If grease is not emerging from all outlets - replace feeder **Replace feeder** • Remove all connections, mark lines and protect them from contaminant ingress • Mount the new feeder • Mount feed lines in correct order as marked before **Metering rate and section arrangement of the new feeder must match the configuration of the feeder being replaced.** **Only use OEM VOGEL spare parts!** **Perform start-up and functional check**
Secondary line defective or	**See main line blocked**
Secondary feeder defective or blocked	**See main feeder**





6.3 Lubrication system malfunctions

Malfunction / Fault	Remedy
Lubricant feed line damaged Can only be identified by visual inspection and distinctly emerging grease	Visual inspection • Visual inspection for mechanical damages • Pinches and serious kinks will impede grease flow **Replacement** **Only use OEM VOGEL spare lines.** **Perform start-up and functional check.**
No grease at lubrication points Identified by a dry bearing where one would anticipate a visible collar of grease The optional yellow warning light in the cabin lights-up.	**Check lubricant level** • Check lubricant level in reservoir and top-up as required • Start-up, functional check • Activate an intermediate lubrication cycle
Defective sealed lubrication point Can be identified by a lack of emerging grease and listen for bearing noise)	Bearing support defective • Check bearing support for mechanical damages or contaminants • Investigate functionality of bearing support (move machine and listen for bearing noise) • Attempt to flash the bearing using a high-pressure grease gun • If this is not possible, have bearing support repaired or replaced by trained personnel • Reattach all lines and union removed for troubleshooting procedures **Perform start-up and functional check.**



Service network in Germany

WILLY VOGEL AG
Sinstorfer Kirchweg 74-92
21077 Hamburg
✆ (++49) 40-76 10 28 74 / 75
🖷 (++49) 40-76 10 28 96
Herr Jörg Vasel
Handy: 0171- 770 03 35
E-mail: Vasel@vogel-berlin.de

WILLY VOGEL AG
Möddinghofe 19
42279 Wuppertal
✆ (++49) 202-64 10 81
🖷 (++49) 202-64 97 29
Herr Heinz-Peter Wirth
Handy: 0171- 2754 66 96
E-mail: Wirth@vogel-berlin.de

WILLY VOGEL AG
Gottlieb-Daimler-Straße 7
63128 Dietzenbach
✆ (++49) 60 74-40 96-0
🖷 (++49) 60 74-40 96-33
Herr Klaus-Dieter Colloseus
Handy: 0171- 550 99 83
E-mail: Colloseus@vogel-berlin.de

WILLY VOGEL AG
Nürtinger Straße 46
72622 Nürtingen
✆ (++49) 70 22-5 67 36
🖷 (++49) 70 22-5 53 32
Herr Klaus-Dieter Colloseus
Handy: 0171- 550 99 83
E-mail: Colloseus@vogel-berlin.de

WILLY VOGEL AG
Duisburger Straße 44
90451 Nürnberg
✆ (++49) 911-6 42 70 94
🖷 (++49) 911-6 49 15 70
Herr Bernd Manke
Handy: 0172- 352 62-87
E-mail: Manke@vogel-berlin.de

WILLY VOGEL AG
Otto-Schmerbach-Straße 30
09117 Chemnitz
✆ (++49) 371- 8 81 20 61 / 62
🖷 (++49) 371- 8 81 20 63
Herr Bernd Manke
Handy: 0172- 352 62-87
E-mail: Manke@vogel-berlin.de

WILLY VOGEL AG
Motzener Straße 35 / 37
12277 Berlin
✆ (++49) 30- 7 20 02-184
🖷 (++49) 30- 7 20 02-111
Herr Ronald Behrens
Handy: 0172- 981 71 29
E-mail: Behrens@vogel-berlin.de

Service worldwide

AMERICA

VOGEL LUBRICATION, INC.
P.O. Box 3
1008 Jefferson Avenue
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(++1) 757-380-8585
(++1) 757-380-0709
E-mail: vogel@vogel-lube.com

ASIA

VOGEL JAPAN LTD.
16-20, Hishie 2-chome,
Higashi-Osaka City
Osaka 578-0984
(++81) 729-64 50 55
(++81) 729-65 12 58
E-mail: center@vogel-japan.co.jp

BENELUX COUNTRIES

WILLY VOGEL BELGIUM BVBA
Bergstraat 72
B-1910 Kampenhout-Berg
(++32) 16-65 61 24
(++32) 16-65 14 38
E-mail: info@vogel-belgium.be

VOGEL NEDERLAND B.V.
Buurserstraat 218
Postbus 1242
NL-7500 RG Enschede
(++31) 53-4 76 51 65
(++31) 53-4 77 34 35
E-mail: info@vogel-benelux.nl

**GERMANY,
NORTHWEST EUROPE**

VOGEL fluidtec GmbH
2. Industriestraße 4
68766 Hockenheim
Deutschland
(++49) 62 05-27-0
(++49) 62 05-27-101
E-mail: info@vogel-fluidtec.de

FRANCE

VOGEL MECAFLUID S.A.
Rue Robert Amy
F-49404 Saumur Cedex
(++33) 2-41 40 42 00
(++33) 2-41 40 42 42
E-mail: info@mecafluid.com

ITALY

BERGER VOGEL s.r.l.
Via Mambretti, 9
I-20157 Milano
(++39) 02-3 32 11 51
(++39) 02-33 21 15 20
E-mail: schmier@tin.it

SOUTHEAST EUROPE

WILLY VOGEL HUNGARIA Kft.
Felvég u. 4
H-2051 Biatorbágy
(++36) 23-312-431
(++36) 23-310 441
E-mail: voithbudapest@mail.datanet.hu

SOUTHWEST EUROPE, NORTH AFRICA

WILLY VOGEL IBERICA, S.A.
Avd. de Suiza n°. 3
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Willy Vogel Aktiengesellschaft

Motzener Straße 35 / 37
12277 Berlin
970444, 12704 Berlin
(++49) 7 20 02-227
(++49) 7 20 02-111
info@vogel-berlin.de

Gottlieb-Daimler-Straße 7
63128 Dietzenbach
2058, 63120 Dietzenbach
(++49) 60 74-40 96-0
(++49) 60 74-40 96-33
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