

P603S

Pump for single line installations



Created on: **20.10.2022**

Document no.: **951-171-073-EN**

Version: **01**



Read these instructions before installation or start-up of the product and keep them readily available for later consultation!

Original EC Declaration of Incorporation in accordance with Directive 2006/42/EC, Appendix II Part 1 B

The manufacturer hereby declares at its sole responsibility that the partly completed machinery conforms to the essential health and safety requirements of the Machinery Directive 2006/42/EC, Annex I, marked in the Annex to the EC Declaration of Incorporation as applicable and fulfilled at the time of placing on the market.

The special technical documents were prepared following Annex VII part B. Upon justifiable request, these special technical documents can be forwarded electronically to the respective national authorities. The authorized company for the compilation of the technical documentation is the manufacturer.

Designation: Electrically operated pump for the supply of lubricants within a centralized lubrication system
Type: P603S
Item number: 645-xxxxx-x; 6450-xxxxxxx
Year of manufacture: See type plate

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

2011/65/EU: RoHS II

2014/30/EU: Electromagnetic Compatibility

EN ISO 12100:2010 EN 60204-1:2018 EN 61000-6-2:2005/AC:2005 EN 61000-6-4:2007/A1:2011

EN 61131-2:2007 EN 809:1998+A1:2009/AC:2010 EN 60034-1:2010/AC:2010 EN 60947-5-1:2004/A1:2009

EN 60947-5-2:2007/A1:2012

EN IEC 63000:2018

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

Walldorf, 01.07.2022

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Original UK Declaration of incorporation according to the Supply of Machinery (Safety) Regulations 2008 No. 1597 Annex II

The manufacturer hereby declares under sole responsibility that the partly completed machinery complies with the essential health and safety requirements of UK legislation Supply of Machinery (Safety) Regulations 2008 No. 1597 Annex I, marked in the Annex to the EC Declaration of Incorporation as applicable and fulfilled at the time of placing on the market.

The special technical documents were prepared following Annex VII part B. Upon justifiable request, these special technical documents can be forwarded electronically to the respective national authorities. The authorized company for the compilation of the technical documentation is SKF (U.K.) Limited, 2 Canada Close, Banbury, Oxfordshire, OX16 2RT, GBR.

Designation: Electrically operated pump for the supply of lubricants within a centralized lubrication system
Type: P603S
Item number: 645-xxxxx-x; 6450-xxxxxxx
Year of manufacture: See type plate

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

• Electromagnetic Compatibility Ordinance 2016 No. 1091

• The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 No. 3032

EN ISO 12100:2010 EN 60204-1:2018 EN 61000-6-2:2005/AC:2005 EN 61000-6-4:2007/A1:2011

EN 61131-2:2007 EN 809:1998+A1:2009/AC:2010 EN 60034-1:2010/AC:2010 EN 60947-5-1:2004/A1:2009

EN 60947-5-2:2007/A1:2012

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Appendix to Declaration of Incorporation in accordance with 2006/42/EC, Annex II, No. 1 B

Description of the essential health and safety requirements according to 2006/42/EC, Annex I, which have been applied and fulfilled. Any essential health and safety requirements not listed here are not relevant to this product.

Table 1**Appendix to Declaration of Incorporation**

No.:	Essential health and safety requirement	Applicable:	Fulfilled:
1.1.1	Definitions	YES	YES
1.1.2	Principles of safety integration	YES	YES
1.1.3	Materials and products	YES	YES
Regarding 1.1.3 Not completely fulfilled: Hazards due to the lubricant used must be assessed by the operator on the basis of the Safety Data Sheet (SDS) and, if necessary, protective measures must be taken.			
1.1.5	Design of machinery to facilitate its handling	YES	YES
1.1.6	Ergonomics	YES	YES
Regarding 1.1.6 Not completely fulfilled: The operator must ensure that the pump is integrated into the higher-level machine in such a way that the pump can be operated and filled ergonomically.			
1.2	Control systems	YES	YES
1.2.1	Safety and reliability of control systems	YES	YES
1.2.3	Starting	YES	YES
1.2.6	Failure of the power supply	YES	YES
1.3	Protection against mechanical hazards	YES	YES
1.3.1	Risk of loss of stability	YES	YES
1.3.2	Risk of break-up during operation	YES	YES
Regarding 1.3.2 Not completely fulfilled: The operator must protect the lubrication system against excessive pressure. For this purpose, a pressure relief valve with max. 350 bar opening pressure must be provided on each pump element.			
1.3.4	Risks due to surfaces, edges or angles	YES	YES
1.3.7	Risks related to moving parts	YES	YES
1.3.9	Risks of uncontrolled movements	YES	YES
1.5	Risks due to other hazards	YES	YES
1.5.1	Electricity supply	YES	YES
1.5.6	Fire	YES	YES
1.5.8	Noise	YES	YES
1.5.11	External radiation	YES	YES
1.5.13	Emissions of hazardous materials and substances	YES	YES
1.5.15	Risk of slipping, tripping, or falling	YES	YES
1.6	Servicing		
1.6.1	Machinery maintenance	YES	YES
1.6.2	Access to operating positions and servicing points	YES	YES
Regarding 1.6.2 Not completely fulfilled: The operator must ensure that the pump is integrated into the higher-level machine in such a way that the pump can be operated without danger.			
1.6.4	Operator interventions	YES	YES
1.7	Information	YES	YES
1.7.1	Information and warnings on the machinery	YES	YES
1.7.1.1	Information and information devices	YES	YES
1.7.2	Warning of residual risks	YES	YES
1.7.3	Marking of machinery	YES	YES
1.7.4	Operating instructions/assembly instructions	YES	YES
1.7.4.1	General principles for the drafting of operating instructions/assembly instructions	YES	YES
1.7.4.2	Contents of the operating instructions/assembly instructions	YES	YES
1.7.4.3	Sales literature	YES	YES

Masthead

Manufacturer

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- South America -
SKF Argentina Pte. Roca 4145,
CP 2001 Rosario, Santa Fe

Warranty

The instructions contain no statements regarding the warranty or liability for defects. That information can be found in our General Terms of Payment and Delivery.

Training

We conduct detailed training in order to enable maximum safety and efficiency. We recommend taking advantage of this training. For further information, contact your authorized SKF dealer or the manufacturer.

Table of contents

Masthead	4	4.6.2 Delivery rate charts for typical NLGI 2 lubricants	32
Table of contents	5	4.7 Usable reservoir volume	33
Safety alerts, visual presentation, and layout	7	4.8 Lubricant requirement when an empty pump is filled for the first time	35
1. Safety instructions	8	4.9 Type identification code for pump P603S	36
1.1 General safety instructions	8	4.9.1 Basic parameters and reservoir version	36
1.2 General electrical safety instructions	8	4.9.2 Pump elements	37
1.3 General behaviour when handling the product	9	4.9.3 Voltage supply and electrical connections	37
1.4 Intended use	9	4.9.4 Other parameters	39
1.5 Persons authorized to use the product	9	5. Delivery, returns, storage	40
1.6 Foreseeable misuse	9	5.1 Delivery	40
1.7 Referenced documents	10	5.2 Return shipment	40
1.8 Prohibition of certain activities	10	5.3 Storage	40
1.9 Painting plastic components and seals	10	5.4 Storage temperature range	40
1.10 Safety markings on the product	10	5.5 Storage conditions for products filled with lubricant	40
1.11 Note on the type plate	11	5.5.1 Storage period up to 6 months	40
1.12 Notes on CE marking	11	5.5.2 Storage period between 6 and 18 months	40
1.13 Note on Low Voltage Directive	11	5.5.3 Storage period more than 18 months	40
1.14 Note on Pressure Equipment Directive	11	6. Assembly	41
1.15 Note on UKCA marking	11	6.1 General safety instructions	41
1.16 Note on UL mark	11	6.2 Mechanical connection	41
1.17 Note on EAC marking	11	6.2.1 Assembly holes	41
1.18 Note on China RoHS mark	11	6.2.2 Minimum mounting dimensions	42
1.19 Emergency shutdown	12	6.3 Installing the pressure relief valve	45
1.20 Assembly, maintenance, fault, repair	12	6.4 Assembly of the reservoir ventilation	45
1.21 First start-up, daily start-up	12	6.5 Electrical connection	46
1.22 Residual risks	13	6.6 Connection of the lubrication line	47
2. Lubricants	14	6.7 Filling with lubricant	47
2.1 General information	14	6.7.1 Filling via the reservoir cover	47
2.2 Material compatibility	14	6.7.2 Filling via filler nipple	48
2.3 Temperature properties	14	6.7.3 Pump filling with 30/40 liter sheet steel reservoir	48
2.4 Aging of lubricants	14	6.7.4 Pump filling with 100 liter sheet steel reservoir	49
2.5 Avoidance of faults and hazards	14	6.7.5 Initial filling of an empty pump with follower plate	49
2.6 Solid lubricants	14	6.7.6 Initial filling with double-lip follower plate	51
3. Overview, functional description	15	7. First start-up	52
3.1 Pumps with plastic reservoir	15	7.1 Inspections before first start-up	52
3.1.1 Without follower plate	15	7.2 Inspections during first start-up	52
3.1.2 With follower plate	15	8. Operation	53
3.1.3 With double-lip follower plate	16	8.1 Operator keys	53
3.2 Pumps with sheet steel reservoir	16	8.2 Multifunction pushbutton	54
3.2.1 Pumps with 30/40 liter sheet steel reservoir	16	8.2.1 Triggering additional lubrications externally	54
3.2.2 Pumps with 100 liter sheet steel reservoir	17	8.2.2 Adjusting the lubricant volume	54
3.3 Electrical connections	18	8.2.3 Function indicator and acknowledging fault signals	54
3.4 Principle of operation of the intermittent empty signal	18	8.3 Display mode	56
3.5 Operational limits of the intermittent empty signal	20	8.3.1 Starting the sequence of the lube routine	56
4. Technical data	21	8.3.2 Messages/fault signals after the test of the display	56
4.1 General technical data	21	8.3.3 Display of the interval time and lubrication time in display mode	57
4.2 Tightening torques	24	8.3.4 Error messages before and during the lubrication time	57
4.2.1 Pumps with plastic reservoir	24	8.3.5 Acknowledging faults	58
4.2.2 Pumps with 30/40 liter sheet steel reservoir	25	8.4 Programming mode	59
4.2.3 Pumps with 100 liter sheet steel reservoir	26	8.4.1 P1, P2 – Time control (TC)	59
4.3 Internal pressure switch	27	8.4.2 P1, P2 – Cycle control (CC)	61
4.4 Internal pressure sensor	28		
4.5 Diagram of single-line lubrication pump P603S	30		
4.6 Nominal delivery rates	31		
4.6.1 Influencing factors on the delivery rate	31		

8.4.3 P4, P5 – signal output of the fault relay.....	63
8.4.4 P6 – start phase, P7 – working pressure	64
8.4.5 P8 – relief pressure.....	65
8.4.6 Ending the programming mode	66
8.5 Operation mode	67
8.5.1 Additional lubrication	67
8.5.2 Parameter and status display	68
8.6 Factory setting.....	71
9. Maintenance and repair.....	72
10. Cleaning.....	73
10.1 Basics.....	73
10.2 Interior cleaning.....	73
10.3 Exterior cleaning.....	73
11. Faults, causes, and remedies	74
12. Repairs.....	76
12.1 Replacing pump element and pressure relief valve.....	76
12.2 Replacing the pressure-relief element.....	77
12.3 Replacing the membrane keyboard.....	77
13. Shutdown, disposal	79
13.1 Temporary shutdown.....	79
13.2 Permanent shutdown, disassembly.....	79
13.3 Disposal.....	79
14. Spare parts	80
14.1 Housing attachment, complete.....	80
14.2 Membrane keyboard.....	80
14.3 Pump elements	80
14.4 Pressure-relief element.....	80
14.5 Pressure relief valves and adapters	81
14.6 Adapter with lubricant nipple.....	81
14.7 Transparent reservoir	82
14.8 Reservoir cover.....	82
14.9 Replacement kit for control circuit board	83
14.10 Replacement kit for relay circuit board.....	83
14.11 Replacement kit for power supply board	83
14.12 Pressure sensor/pressure switch	84
14.13 Accessories.....	84
15. Appendix.....	85
15.1 Terminal diagram.....	85
15.1.1 P603S DC for mobile applications.....	85
15.1.2 P603S DC for industrial applications.....	86
15.1.3 P603S AC for industrial applications	87
15.1.4 P603S AC for industrial applications with machine contact.....	88
15.1.5 P603S AC for industrial applications with relay circuit board (optional).....	89
15.1.6 Terminal diagram for low-level signal on reservoir lid	90
15.2 Jumper configuration P603S	91
15.3 China RoHS Table	93

Safety alerts, visual presentation, and layout

While reading these instructions, you will encounter various symbols, illustrations, and text layouts intended to help you navigate and understand the instructions. Their meaning is explained below.

Safety alerts:

Activities that present specific hazards (to life and limb or possible damage to property) are indicated by safety alerts. Always be sure to follow the instructions given in the safety alerts.

DANGER

These safety alerts indicate an imminent danger. Ignoring them will result in death or serious injury

WARNING

These safety alerts indicate potentially imminent danger. Ignoring them could result in death or serious injury

CAUTION

These safety alerts indicate potentially imminent danger. Ignoring them could result in minor injury

NOTICE

These safety alerts indicate a potentially harmful situation. Ignoring them could result in damage to property or malfunctions

Illustrations:

The illustrations used depict a specific product. For other products, they may have the function of a diagram only. This does not alter the basic workings and operation of the product.

Text layout:

- **First-order bulleted lists:** Items on a bulleted list start with a solid black dot and an indent.
 - **Second-order bulleted lists:** If there is a further listing of subitems, the second-order bulleted list is used.
- 1 **Legend:** A legend explains the numbered contents of an illustration, presented as a numbered list. Items in a legend start with a number (with no dot) and an indent.
 - **Second-order legend:** In some cases, the numbered contents of an image represent more than just one object. A second-order legend is then used.
- 1. **Instruction steps:** These indicate a chronological sequence of instruction steps. The numbers of the steps are in bold and are followed by a period. If a new activity follows, the numbering starts again at “1.”
 - **Second-order instruction steps:** In some cases, it is necessary to divide up a step into a few substeps. A sequence of second-order instruction steps is then used.

1. Safety instructions

1.1 General safety instructions

- Putting the products into operation or operating them without having read the instructions is prohibited. The operator must ensure that the instructions are read and understood by all persons tasked with working on the product or who supervise or instruct such persons. Retain the instructions for further use.
- The product may only be used in awareness of the potential dangers, in proper technical condition, and according to the information in this manual.
- Any faults that could affect safety must be remedied according to responsibility. The supervisor must be notified immediately in case of malfunctions outside one's individual scope of responsibility.
- Unauthorized modifications and changes can have an unpredictable effect on safety and operation. Unauthorized modifications and changes are therefore prohibited. Only original SKF spare parts and SKF accessories may be used.
- Any unclear points regarding proper condition or correct assembly/operation must be clarified. Operation is prohibited until issues have been clarified.
- The components used must be suitable for the intended use and the applicable operating conditions, e.g. max. operating pressure and ambient temperature range, and must not be subjected to torsion, shear, or bending.

1.2 General electrical safety instructions

- Electrical devices must be kept in proper condition. This must be ensured by periodic inspections in accordance with the relevant applicable standards and technical rules. The type, frequency, and scope of the inspections must be determined in accordance with the risk assessment to be carried out by the operator. Work on electrical components may be performed only by qualified electricians. Connect the electrical power only in accordance with the valid terminal diagram and in observance of the relevant regulations and the local electrical supply conditions.
- Work on electrical components may be performed only in a voltage-free state and using tools suitable for electrical work. Do not touch cables or electrical components with wet or moist hands.
- Fuses must not be bridged. Always replace defective fuses with fuses of the same type.
- Ensure proper connection of the protective conductor for products with protection class I. Observe the specified enclosure rating.
- The operator must implement appropriate measures to protect vulnerable electrical devices from the effects of lightning during use. The electrical device is not furnished with a grounding system for the dissipation of the respective electric charge and does not have the voltage strength necessary to withstand the effects of lightning.

1.3 General behaviour when handling the product

- Familiarize yourself with the functions and operation of the product. The specified assembly and operating steps and their sequences must be observed.
- Keep unauthorized persons away.
- Wear personal protective equipment always.
- Precautionary operational measures and instructions for the respective work must be observed.
- In addition to these Instructions, general statutory regulations for accident prevention and environmental protection must be observed.
- Precautionary operational measures and instructions for the respective work must be observed. Uncertainty seriously endangers safety.
- Safety-related protective and safety equipment must not be removed, modified or affected otherwise in its function and is to be checked at regular intervals for completeness and function.
- If protective and safety equipment has to be dismantled, it must be reassembled immediately after finishing the work, and then checked for correct function.
- Remedy occurring faults in the frame of responsibilities. Immediately inform your superior in the case of faults beyond your competence.
- Never use parts of the centralized lubrication system or of the machine as standing or climbing aids.

1.4 Intended use

Supply of lubricants.

The product is intended solely for installation in another machine.

Use is only permitted within the scope of commercial or economic activity by professional users, in compliance with the specifications, technical data, and limits specified in this manual.

1.5 Persons authorized to use the product

Operator

A person who is qualified by training, knowledge and experience to carry out the functions and activities related to normal operation. This includes avoiding possible hazards that may arise during operation.

Specialist in electrics

Person with appropriate professional education, knowledge and experience to detect and avoid the hazards that may arise from electricity.

Specialist in mechanics

Person with appropriate professional education, knowledge and experience to detect and avoid the hazards that may arise during transport, installation, start-up, operation, maintenance, repair and disassembly.

1.6 Foreseeable misuse

Any usage of the product other than as specified in this manual is strictly prohibited. Particularly prohibited are:

- Use of non-specified consumables, contaminated lubricants, or lubricants with air inclusions.
- Use of C3 versions in areas with aggressive, corrosive substances (e.g., high salt load).
- Use of plastic parts in areas with high exposure to ozone, UV light, or ionizing radiation.
- Use to supply, convey, or store hazardous substances and mixtures as defined in the CLP Regulation (EC 1272/2008) or GHS with acute oral, dermal, or inhalation toxicity or substances and mixtures that are marked with hazard pictograms GHS01-GHS06 and GHS08.
- Use to supply, convey, or store Group 1 fluids classified as hazards as defined in the Pressure Equipment Directive (2014/68/EU) Article 13 (1) a).
- Use to supply, convey, or store gases, liquefied gases, dissolved gases, vapors, or fluids whose vapor pressure exceeds normal atmospheric pressure (1013 mbar) by more than 0.5 bar at their maximum permissible operating temperature.
- Use in an explosion protection zone.
- Use without proper securing against excessively high pressures, in the case of pressurized products.
- Use outside of the technical data and limits specified in this manual.

1.7 Referenced documents

In addition to this manual, the following documents must be observed by the respective target group:

- Company instructions and approval rules

If applicable:

- Safety data sheet of the lubricant used
- Project planning documents
- Supplementary information regarding special designs of the pump. This you will find in the special system documentation.
- Instructions for other components for setting up the centralized lubrication system.

1.8 Prohibition of certain activities

- Replacement of or modifications to the pistons of the pump elements
- Repairs or modifications to the drive
- Alterations to the control circuit board beyond adjustment of lubrication times and interval times or replacement in case of defect
- Alterations to the power supply board beyond replacement in case of defect

1.9 Painting plastic components and seals

The painting of any plastic components and seals of the products described is prohibited. Completely mask or remove plastic components before painting the main machine.

1.10 Safety markings on the product

Fig. 1	
	Risk of dangerous electrical voltage (for VAC pumps only)
 	Risk of wrapping, pinching, crushing, or shearing when the reservoir lid is open (only for reservoirs with filling from above)
	Risk of injury from spring tension (only for pumps with a follower plate)
	Direction of rotation of the pump (stirring paddle)
	Read the instructions (before initial filling of a pump with double-lip follower plate delivered without lubricant)

Possible safety markings on the product

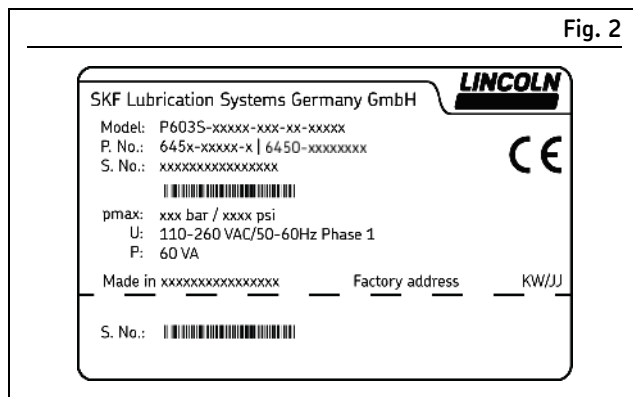
NOTE

Further to the findings of the workplace risk evaluation the operating company has to attach additional markings (e. g. warnings, signs giving orders, prohibition signs or labelling as specified by CLP / GHS), where appropriate.

1.11 Note on the type plate

The type plate provides important data such as the type designation, order number, and sometimes regulatory characteristics. To avoid loss of this data in case the type plate becomes illegible, it should be entered in the manual.

Table 2	
Table for copying out the type plate	
Model:	_____
P-No. :	_____
S-No. :	_____



Type plate

1.12 Notes on CE marking



CE marking is effected following the requirements of the applied directives requiring a CE marking:

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

1.13 Note on Low Voltage Directive

The protection objectives of the Low Voltage Directive 2014/35/EU are met in accordance with Annex I, No. 1.5.1 of the Machinery Directive 2006/42/EC.

1.14 Note on Pressure Equipment Directive

Due to its performance characteristics, the product does not reach the limit values defined in Article 4, Paragraph 1, Subparagraph (a) (ii) and is excluded from the scope of Pressure Equipment Directive 2014/68/EU in accordance with Article 1, Paragraph 2 Subparagraph (f).

1.15 Note on UKCA marking



The UKCA conformity marking confirms the product's conformity with the applicable legal provisions of Great Britain.

1.16 Note on UL mark



The UL Mark certifies that the product has UL certification of compliance with U.S. and Canadian safety regulations.

1.17 Note on EAC marking



The EAC conformity marking confirms the product's conformity with the applicable legal provisions of the Eurasian customs union.

1.18 Note on China RoHS mark



The China RoHS mark confirms that there is no danger to persons or the environment from the regulated substances contained within for the intended period of use (year number shown in the circle).

1.19 Emergency shutdown

This is done by a course of action to be defined by the operator.

1.20 Assembly, maintenance, fault, repair

Prior to the start of this work, all relevant persons must be notified of it. At a minimum, the following safety measures must be taken before any work is done:

- Unauthorized persons must be kept away
- Mark and secure the work area
- Cover adjacent live parts
- Dry any wet, slippery surfaces or cover them appropriately
- Cover hot or cold surfaces appropriately

Where applicable:

- Depressurize
- Isolate, lock and tag out
- Check to ensure live voltage is no longer present
- Ground and short-circuit

The product should be protected as much as possible from humidity, dust, and vibration, and should be installed so that it is easily accessible. Ensure an adequate distance from sources of heat or cold. Any visual monitoring devices present, such as pressure gauges, min./max. markings, or oil level gauges must be clearly visible. Observe the mounting position requirements.

Drill required holes only on non-critical, non-load-bearing parts of the operator's infrastructure. Use existing holes where possible. Avoid chafe points. Immobilize any moving or detached parts during the work. Adhere to the specified torques.

If guards or safety devices need to be removed, they must be reinstalled immediately following conclusion of work and then checked for proper function.

Check new parts for compliance with the intended use before using them.

Avoid mixing up or incorrectly assembling disassembled parts. Label parts. Clean any dirty parts.

1.21 First start-up, daily start-up

Ensure that:

- All safety devices are fully present and functional
- All connections are properly connected
- All parts are correctly installed
- All warning labels on the product are fully present, visible, and undamaged
- Illegible or missing warning labels are immediately replaced

1.22 Residual risks

Table 3

Residual risks									
Residual risk	Possible in lifecycle						Avoidance / Remedy		
Personal injury / property damage due to falling of hoisted parts	A	B	C		G	H	K	Unauthorized persons must be kept away. Nobody is allowed to be present below hoisted parts. Lift parts using suitable lifting gear.	
Personal injury / property damage due to tilting or falling product due to non-compliance with specified torques		B	C		G			Adhere to the specified torques. Mount the product only on components with a sufficient load-carrying capacity. If no torques are specified, use those specified for the screw size for screws of strength class 8.8	
Personal injury, property damage due to spilled, leaked lubricant		B	C	D	F	G	H	K	Be careful when connecting or disconnecting the lubricant lines. Use only hydraulic screw unions and lubrication lines suitable for the specified pressure. Do not mount lubrication lines on moving parts or chafe points. If this cannot be avoided, use anti-kink coils and/or conduits.
Injury by electric shock/ fire hazard, or damage to the pump, from operation with damaged electrical components such as power cables and plugs.		B	C	D	E	F	G	H	Inspect electrical components for damage prior to initial use and then at regular intervals. Do not install cables on moving parts or chafe points. If this cannot be avoided, use anti-kink coils and/or conduits.
Loss of electrical protective function due to incorrect assembly of the electrical components after a repair							G		For VAC models only: An electrical safety check in accordance with EN 60204-1 must be performed after the replacement of electrical components.
Damage to the pump from failure to comply with the permissible cyclic duration factor.			C	D					Operate the pump only within the permissible cyclic duration factor.

Lifecycle phases: A = Transport, B = Assembly, C = First start-up, D = Operation, E = Cleaning, F = Maintenance, G = Malfunction, repair, H = Shutdown, K = Disposal

2. Lubricants

2.1 General information

Lubricants are selected specifically for the relevant application. The manufacturer or operator of the machine should ideally make the selection in consultation with the supplier of the lubricant. If you have no or little experience in selecting lubricants for lubrication systems, please contact us. We would be happy to assist you in selecting suitable lubricants and components to build a lubrication system optimized for your particular application. Consider the following points when selecting/using lubricants. This will spare you potential downtime and damage to the machine or lubrication system.

2.2 Material compatibility

The lubricants must generally be compatible with the following materials:

- Plastics: ABS, CR, FPM, NBR, NR, PA, PET, PMMA, POM, PP, PS, PTFE, PU, PUR
- Metals: steel, gray cast iron, brass, copper, aluminum

2.3 Temperature properties

The lubricant used must be suitable for the specific ambient temperature of the product. The viscosity approved for proper functioning must neither be exceeded at low temperatures nor fall too low at high temperatures. For the approved viscosity, see the "Technical data" chapter.

2.4 Aging of lubricants

Based on past experience with the lubricant used, checks should be conducted at regular intervals defined by the operator, to determine whether the lubricant needs to be replaced due to aging processes (oil separation). In case of doubt regarding the continued suitability of the lubricant, it must be replaced before the system is started up again. If you do not yet have any experience with the lubricant used, we recommend conducting a check after just one week.

2.5 Avoidance of faults and hazards

To avoid faults and hazards, please observe the following:

- When handling lubricants, observe the relevant safety data sheet (SDS) and any hazard labeling on the packaging.
- Due to the large number of additives, some lubricants that meet the pumpability requirements specified in the manual are not suitable for use in centralized lubrication systems.
- Whenever possible, always use SKF lubrication greases. They are ideal for use in lubrication systems.
- Do not mix lubricants. This can have unpredictable effects on the properties and usability of the lubricant.
- Use lubricants containing solid lubricants only after technical consultation with SKF.

- The lubricant's ignition temperature has to be at least 50 kelvin above the maximum surface temperature of the components.

2.6 Solid lubricants

Solid lubricants may only be used after prior consultation with SKF. When solid lubricants are used in lubrication systems, the following rules generally apply:

Graphite:

- Maximum graphite content 8%
- Maximum grain size 25 µm (preferably in lamellar form)

MoS₂:

- Maximum MoS₂ content 5%
- Maximum grain size 15 µm

Copper:

- Lubricants containing copper are known to lead to coatings forming on pistons, bore holes, and mating surfaces. This can result in blockages in the centralized lubrication system.

Calcium carbonate:

- Lubricants containing calcium carbonate are known to lead to very heavy wear on pistons, bore holes, and mating surfaces.

Calcium hydroxide:

- Lubricants containing calcium hydroxide are known to harden considerably over time, which can lead to failure of the centralized lubrication system.

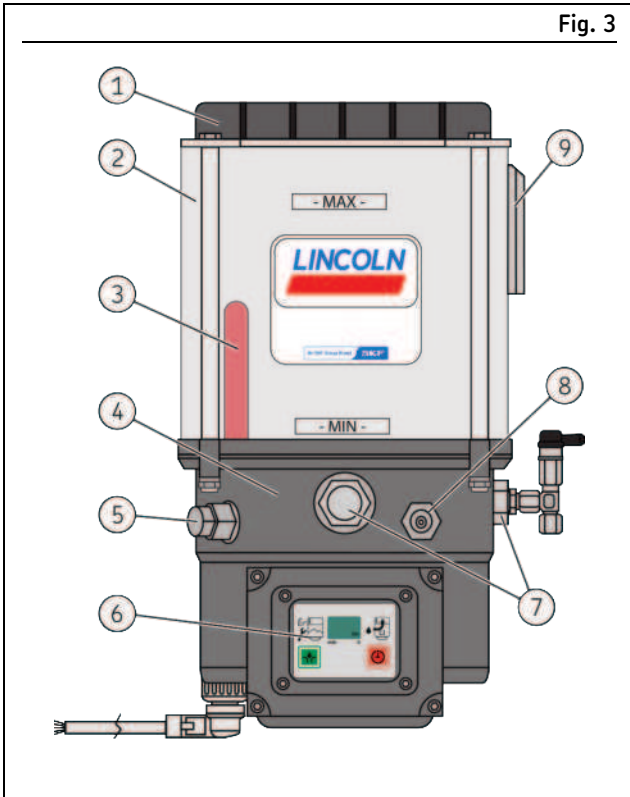
PTFE, zinc, and aluminum:

- For these solid lubricants, it is not yet possible to define any limit values for use in lubrication systems on the basis of existing knowledge and practical experience.

3. Overview, functional description

3.1 Pumps with plastic reservoir

3.1.1 Without follower plate



Single-line lubrication pump P6x3S with stirring paddle

Reservoir cover (Fig. 3/1)

The reservoir lid is used to fill the reservoir with clean and suitable lubricant, and also to protect the lubricant from contamination.

Reservoir (Fig. 3/2)

The reservoir stores the lubricant. Different reservoir designs and reservoir sizes exist in accordance with the pump variant.

Reservoir stirring paddle (Fig. 3/3)

The stirring paddle homogenizes and smooths the lubricant while the pump is running. In addition, the lower vertical part of the stirring paddle presses the lubricant in the direction of the pump elements and improves the suction characteristics of the pump as a result.

Pump housing (Fig. 3/4)

The pump housing contains the motor, the electrical connections, the filler nipple, the pump elements, and (if applicable) the intermittent low-level signal.

Pressure-relief element (Fig. 3/5)

The pressure-relief element discharges the pressure in the main line of the lubrication system. This relieves the pressure in the entire lubrication system. The single-line metering devices (e.g., SL) can transfer the pre-metered lubricant for the next lubrication process.

Membrane keyboard (Fig. 3/6)

The membrane keyboard is used to operate and configure the pump. There are two keys for triggering additional lubrication and acknowledging faults.

The display window shows the operating states and faults of the pump.

Pump elements (Fig. 3/7)

The pump can be equipped with up to 3 pump elements.

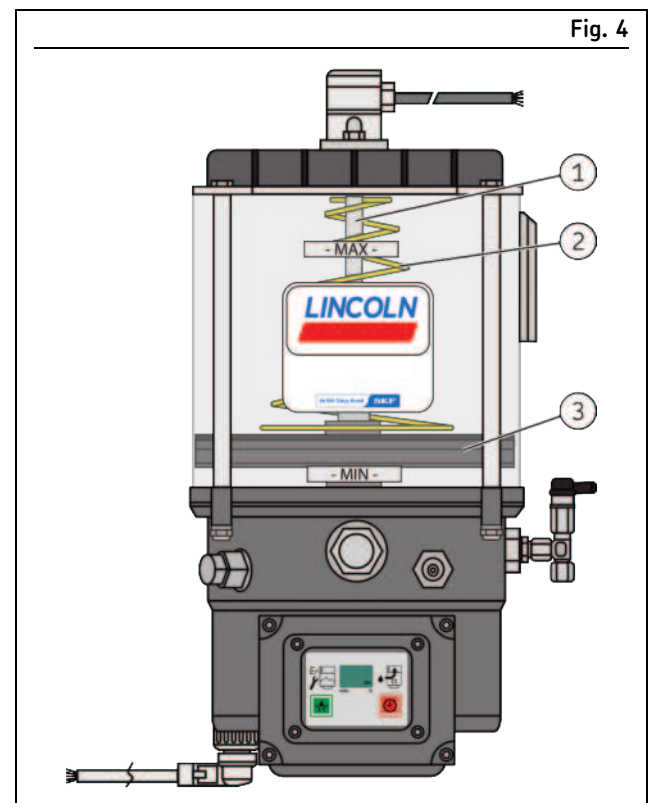
Filler nipple (Fig. 3/8)

Used for filling the pump. Once the filler nipple is removed, corresponding accessories can be used to connect the external grease return from the pressure relief valves to the pump elements through this port.

Reservoir ventilation (Fig. 3/9)

Aerates the reservoir while the pump is working and lubricant is being fed. Bleeds the reservoir while the pump is being filled.

3.1.2 With follower plate



Single-line lubrication pump P6x3S with follower plate

Follower plate (Fig. 4/3)

The follower plate is positioned on top of the lubricant and presses it with spring force (Fig. 4/2) in the direction of the

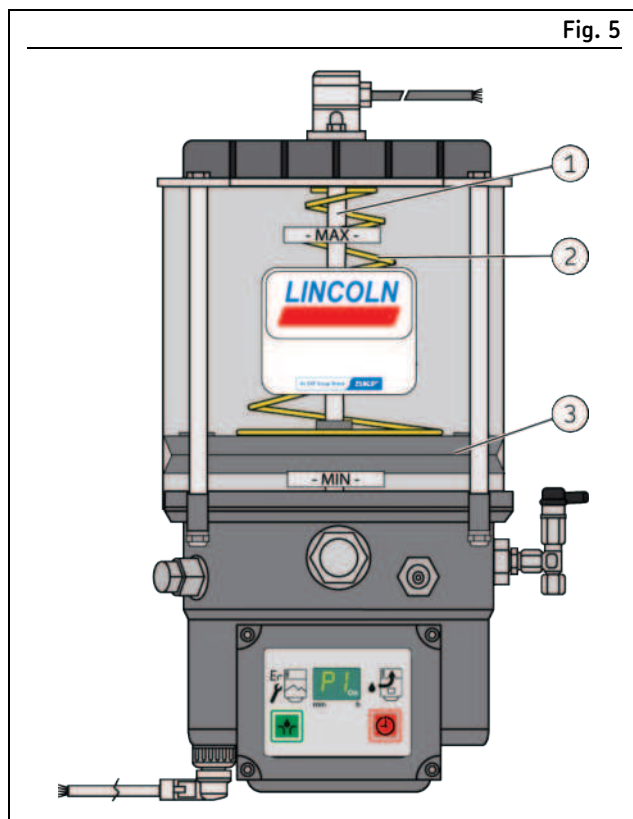
pump elements. Its pressure improves the suction characteristics of the pump.
The follower plate is available for plastic reservoirs up to a reservoir capacity of 20 L.

Full/low-level signal (Fig. 4/1)

The contact rod of the follower plate houses the reed contacts for the low-level signal function.

The follower plate contains a solenoid which activates the reed contact there when a switching point is reached.
The reed contact for the empty signal is located on the bottom switching point.

3.1.3 With double-lip follower plate



Single-line lubrication pump P6x3S with double-lip follower plate

Double-lip follower plate (Fig. 5/3)

The double-lip follower plate provides improved sealing with two seals, for lubricants that tend to separate under pressure. This prevents lubricant components from accumulating above the follower plate.

The double-lip follower plate is available for plastic reservoirs up to a reservoir capacity of 25 L.

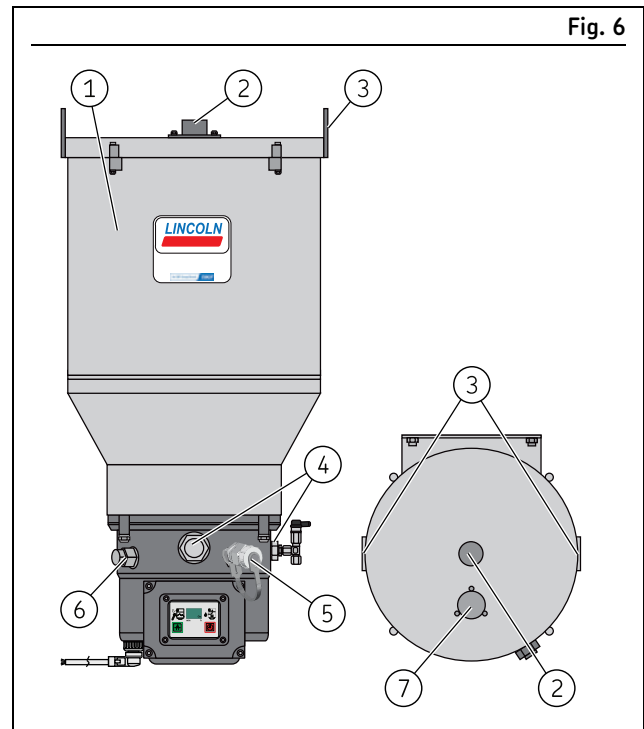
Full/low-level signal (Fig. 5/1)

The contact rod of the follower plate houses the reed contacts for the low-level signal function.

The follower plate contains a solenoid which activates the reed contact there when a switching point is reached.
The reed contact for the empty signal is located on the bottom switching point.

3.2 Pumps with sheet steel reservoir

3.2.1 Pumps with 30/40 liter sheet steel reservoir



Single-line lubrication pump P6x3S with 30/40 liter sheet steel reservoir

Reservoir (Fig. 6/1)

The reservoir stores the lubricant. Different reservoir designs and reservoir sizes exist in accordance with the pump variant.

Reservoir ventilation (Fig. 6/2)

Aerates the reservoir while the pump is working and lubricant is being fed. Bleeds the reservoir while the pump is being filled.

Lifting lugs (Fig. 6/3)

The two lifting lugs are used for lifting the pump.

Pump elements (Fig. 6/4)

The pump can be equipped with up to 3 pump elements.

Fill connection (Fig. 6/5)

Used for filling the pump.

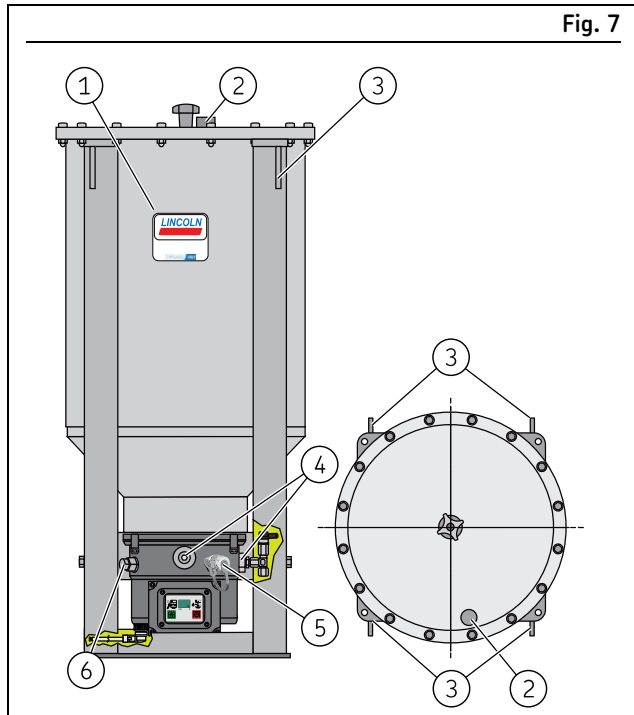
Pressure-relief element (Fig. 6/6)

The pressure-relief element discharges the pressure in the main line of the lubrication system. This relieves the pressure in the entire lubrication system. The single-line metering devices (e.g., SL) can transfer the pre-metered lubricant for the next lubrication process.

Lubricant level gauge (Fig. 6/7)

Used for checking the fill level in the reservoir.

3.2.2 Pumps with 100 liter sheet steel reservoir



Single-line lubrication pump P6x3S with 100 liter sheet steel reservoir

Reservoir (Fig. 7/1)

The reservoir stores the lubricant. Different reservoir designs and reservoir sizes exist in accordance with the pump variant.

Reservoir ventilation (Fig. 7/2)

Aerates the reservoir while the pump is working and lubricant is being fed. Bleeds the reservoir while the pump is being filled.

Lifting lugs (Fig. 7/3)

The four lifting lugs are used for lifting the pump.

Pump elements (Fig. 7/4)

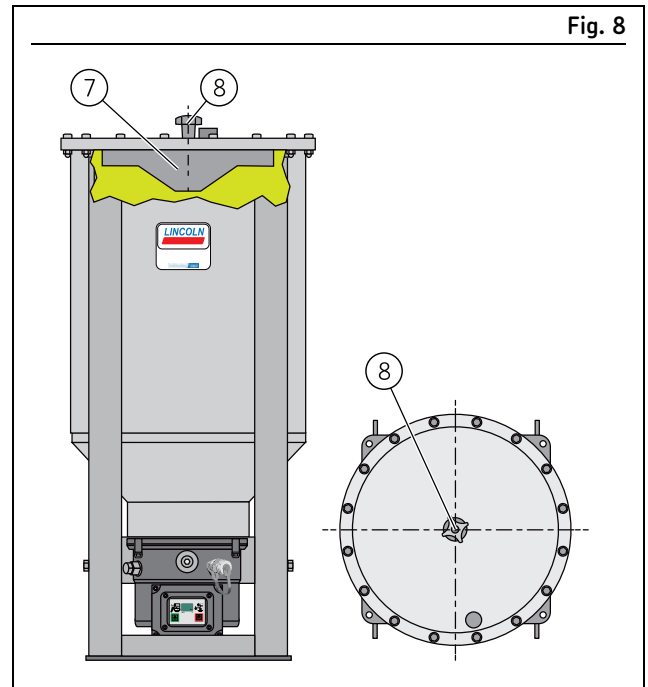
The pump can be equipped with up to 3 pump elements.

Fill connection (Fig. 7/5)

Used for filling the pump.

Pressure-relief element (Fig. 7/6)

The pressure-relief element discharges the pressure in the main line of the lubrication system. This relieves the pressure in the entire lubrication system. The single-line metering devices (e.g., SL) can transfer the pre-metered lubricant for the next lubrication process.

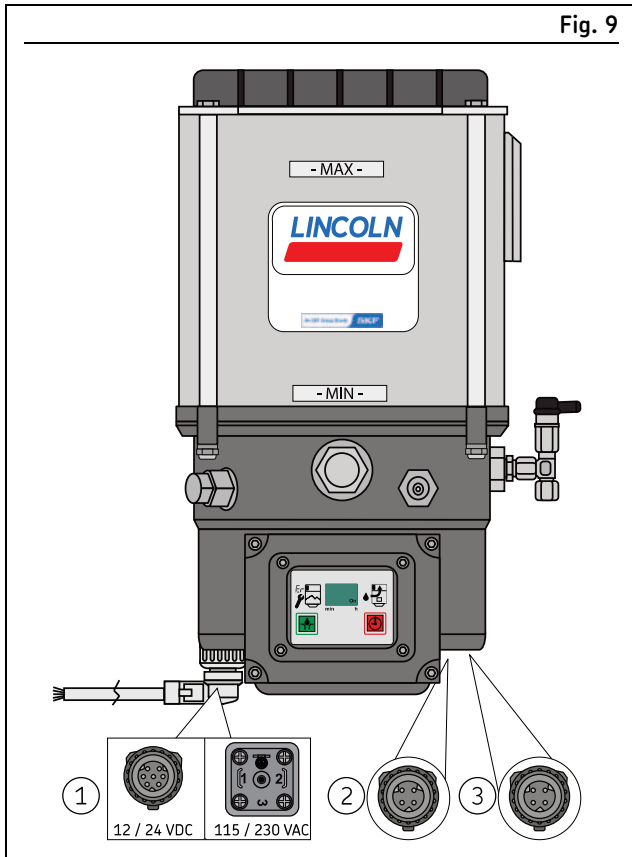


Wiper

Wiper (Fig. 8/7)

The rotary knob (Fig. 8/8) can be used to turn the wiper (Fig. 8/7) on the inside of the transparent plastic cover (PMMA) to remove any grease adhesions which may be present.

3.3 Electrical connections



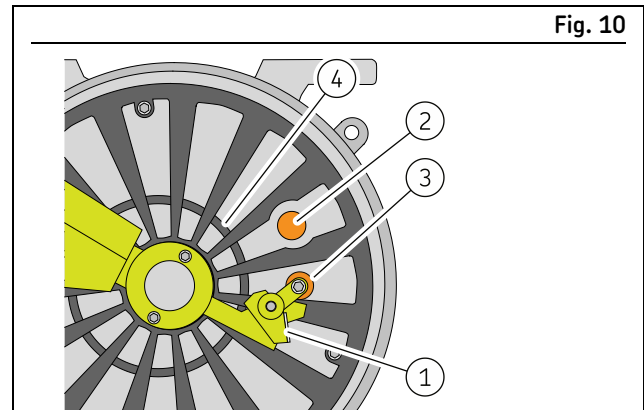
Electrical connections

The electrical connections are located on the underside of the pump:

- Power supply and signal exchange with an external control (Fig. 9/1).
 - Pumps in 12/24 VDC design are supplied with a 7-pin cable with bayonet socket (cable length 10 m).
 - Pumps in 115/230 VAC design have an additional rectangular connector for the power supply.
- Connection of an external pressure sensor with 4/3-pin bayonet socket (Fig. 9/2).
- Connection of relay circuit board signal outputs with 4-pin bayonet socket (Fig. 9/3).

3.4 Principle of operation of the intermittent empty signal

Components of the intermittent low-level signal

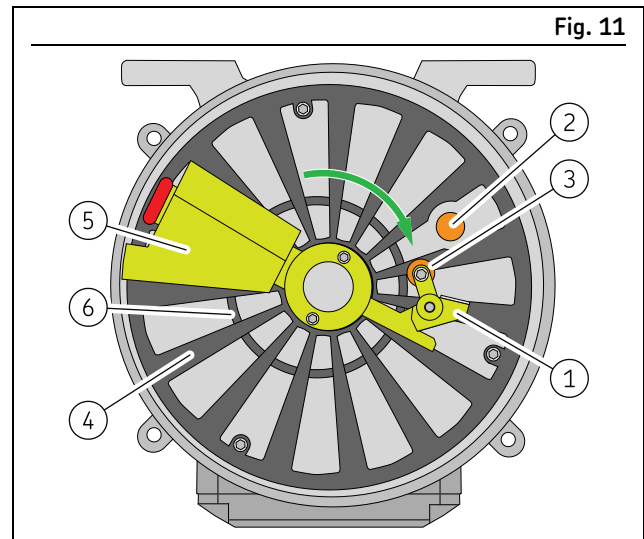


Components

The intermittent low-level signal is contactless in operation and is comprised essentially of the following parts:

- Fixed magnetic switch (Fig. 10/2) in the reservoir bottom
- Mobile baffle plate (Fig. 10/1) connected to the stirring paddle, with a magnet (Fig. 10/3)
- Eccentric guide (Fig. 10/4)

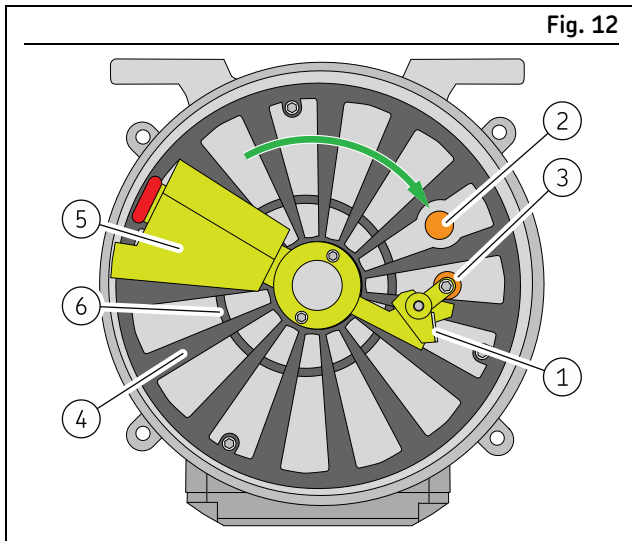
Grease reservoir full



Magnet on inner circular track

1. The stirring paddle (Fig. 11/5) rotates clockwise during the lubrication time. As it does so, the pivoting baffle plate (Fig. 11/1) is deflected out by the eccentric guide (Fig. 11/6) and the magnet (Fig. 11/3).
2. As the eccentric guide (Fig. 11/6) continues its motion, the deflected baffle plate (Fig. 11/1) is deflected back in by the back pressure of the lubricant.
3. This causes the magnet (Fig. 11/3) to move along the inner circular track, with the effect that the reed switch (Fig. 11/2) is **not actuated**.

Grease reservoir empty



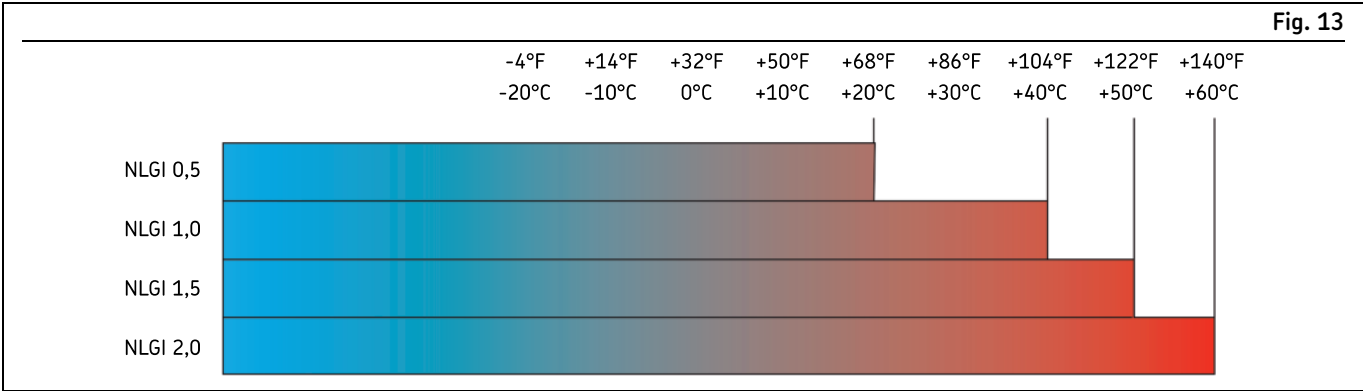
Magnet on outer circular track

1. If there is no lubricant present to act against the deflected baffle plate, the baffle plate remains deflected out (Fig. 12/1).
2. This causes the magnet (Fig. 12/3) to move along the outer circular track, with the effect that the reed switch (Fig. 12/2) is now actuated, triggering a low-level signal pulse.

3.5 Operational limits of the intermittent empty signal

For the correct functioning of the intermittent empty signal, the following lubricant consistencies must be maintained. The correct functioning of the intermittent empty signal is not guaranteed above the specified temperature range. The lower temperature ranges are contingent on the suitability of the respective lubricant for these temperatures. Excessively high consistency of the lubricant could otherwise lead to malfunctions such as interruption of the lubricant feeding or possibly to damage to the pump (e.g., bending of the stirring paddle).

NOTE
The intermittent empty signal is not suitable for lubricating greases with an NLGI class ≤ 0 .



Operational limits of the intermittent empty signal

4. Technical data

4.1 General technical data

NOTE

The specified ratings apply to grease of NLGI Grade 2, measured at 20°C, 100 bar back pressure. Pressures or temperatures that vary from this could cause the delivery rate to vary.
The design of a system should be based on the value specified.

Table 4

Technical data of the pump

Parameter	Values
Operating pressure	max. 300 bar [4351 psi] • Pressure sensor, adjustable: 100 to 320 bar [1451 to 4642 psi] • Pressure switch, non-adjustable: 240 ±5 bar [3481 ±72,5 psi]
Relief pressure	• Single-line metering devices like QSL: ≤ 60 bar [871 psi]¹⁾ • SLC single-line metering devices: maximum 68 bar [990 psi]¹⁾
Ambient temperature ²⁾	-40 °C to 60 °C [-40 °F to 140 °F] ⁴⁾ -40 °C to 70 °C [-40 °F to 158 °F]
Pump elements	Max. 3
Number of outlets	1
Connections	• Main line: R1/4" • Grease fitting: R1/4" Option: other connections (R1/8") on request.
Mounting position ³⁾	Upright, i.e., with the reservoir at top
Sound pressure level	< 70 dB (A)

Pump element Z7

Parameter	Values
Piston diameter	7 mm
Flow rate per pump element	approx. 4 cm ³ /min
Max. permiss. operating pressure	350 bar [5077 psi]
Connection thread	G 1/4" for tube diameter 6 mm

¹⁾ Observe the specific values of other metering devices if applicable.

²⁾ The specified ambient temperature range applies to the pump and the components of the complete lubrication system, not to the lubricant being supplied. Therefore, note that the supply of the lubricant depends on its flow properties in a system. The "permissible operating temperature of the lubricant" may vary from the system temperature and should therefore be checked separately.

³⁾ Rotary installation is possible for pumps with a follower plate, e.g., in wind turbines. Maximum speed and maximum distance to the rotational axis on request.

If the pump does not have a follower plate, and inclination of the pump is expected, the following applies: The maximum filling ("MAX" mark) must be reduced in accordance with the inclination to be expected (e.g., with construction or agricultural machinery). The minimum filling ("MIN" mark) must be increased starting with an expected inclination > 30°, otherwise functional impairments may arise due to a reduced amount of lubricant the suction area of the pump.

⁴⁾ UL-certified pumps can only be operated up to a maximum permissible ambient temperature of +60 °C [140 °F] regardless of the loading. In the case of pumps that are not UL-certified, the maximum duty cycle should be reduced in the case of ambient temperatures ≥ +60 °C [140 °F] and heavy loading (high pressure).

Table 5

Weight of the empty pump

Reservoir version

4 liters [1.05 gal.] Plastic	approx. 9 kg [19.8 lb]
8 liters [2.11 gal.] Plastic	approx. 10 kg [22.0 lb]
10 liters [2.64 gal.] Plastic	approx. 11 kg [24.3 lb]
15 liters [3.96 gal.] Plastic	approx. 13 kg [28.7 lb]
20 liters [5.28 gal.] Plastic	approx. 15 kg [33.1 lb]
25 liters [6.60 gal.] Plastic	approx. 17 kg [37.5 lb]
30 liters [7.95 gal.] Sheet steel	approx. 20 kg [44.1 lb]
40 liters [10.60 gal.] Sheet steel	approx. 43 kg [94.8 lb]
100 liters [26.42 gal.] Sheet steel	approx. 56 kg [123.5 lb]

Table 6

Electrical data of the pump

Parameter	Values		
	12 VDC pump	24 VDC pump	110-240 VAC pump
Enclosure rating ⁵⁾ acc. to ISO 20653	IP6K9K	IP6K9K	IP6K9K
Protection classes			
• Rectangular connector	SELV / PELV / FELV	SELV / PELV / FELV	Protection class I
• Bayonet connector	SELV / PELV	SELV / PELV	
Rated voltage	12 VDC, $\pm 10\%$	24 VDC, $\pm 10\%$	100 – 240 VAC, $\pm 10\%$
Power supply frequency	–	–	47 – 63 Hz, $\pm 5\%$
Current input up to	6 A	3 A	1.6 A
Recommended back-up fuse	6.0 A (slow)	6.0 A (slow)	6.0 A (slow)
Motor operating voltage	12 VDC	24 VDC	24 VDC
Nominal speed	17 rpm	17 rpm	17 rpm
Cyclic duration factor ⁶⁾	S3 25 % duty cycle 120 minutes	S3 25 % duty cycle 120 minutes	S3 25 % duty cycle 120 minutes
Switching output for fault/ready for operation	Transistor 1 A, short-circuit proof	Transistor 1 A, short-circuit proof	Transistor 1 A, short-circuit proof

⁵⁾ The specified enclosure rating of the pump requires the use of IP6K9K-capable connection sockets and corresponding cables. Classification is in accordance with the lowest enclosure rating when connection sockets and cables with low type of protection are used. The achievable types of protection when using the connection sockets and cable which we supply can be found in the “Spare parts” chapter.

⁶⁾ Based on ambient temperature of 60 °C and a mean back pressure at the pump element of 160 bar.

Table 7

Settings**Interval time**

Parameter	TC, time controlled	CC, cycle controlled
Minimum	4 min	1 pulse
Maximum	59 h, 59 min	9999 pulses
Interval	1 min	1 pulse
Factory setting	6 h	10 pulses

Working pressure, internal

Parameter	Values
Minimum	100 bar
Maximum	320 bar
Interval	10 bar
Factory setting	240 bar
Pressure switch 1	NO or NC contact, working pressure permanently 240 bar, ± 5 bar

Working pressure, external

Parameter	Values
Pressure sensor 2	170 bar

Relief pressure, internal

Parameter	Values
Pressure sensor 1 / without optional pressure sensor 2	30 bar, fixed

Relief pressure, external

Parameter	Pressure sensor 2
Minimum	10 bar
maximum	70 bar
Interval	10 bar
Factory setting	50 bar

Other settings

Parameter	Values
Signal output	NO contact, flashing
Start phase	SP (with interval time)
Hold time	2 min
Monitoring time	20 min

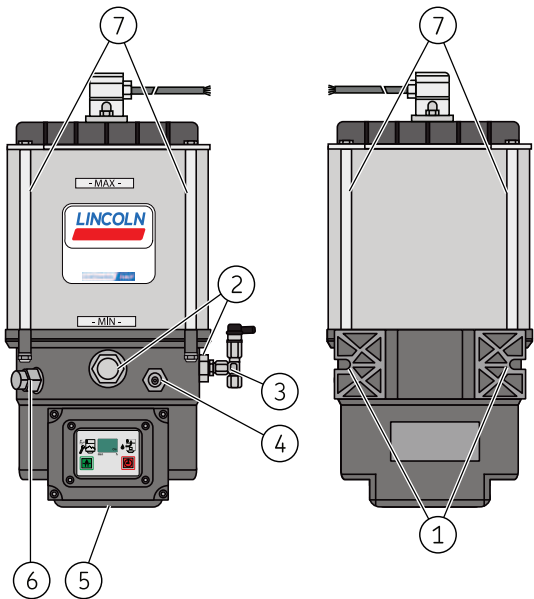
4.2 Tightening torques

4.2.1 Pumps with plastic reservoir

Table 8

Tightening torques for pumps with plastic reservoir

Component	Torque	
	Nm	ft.lb.
1 Fastening the pump	18 ±1.0	13.3 ±0.74
2 Pump element on pump	40 ±2.0	29.5 ±1.5
3 Pressure relief valve in pump element	6 -0.5	4.4 -0.37
4 Plug screw or adapter with cone-type grease nipple	10 +1.0	7.4 +0.74
5 Housing cover (bottom)	0.75 ±0.1	0.55 ±0.07
6 Pressure-relief element	35 ±2.0	25.8 ±1.5
7 Tie rods for reservoir	10 +1.0	7.4 +0.74
Options (not shown in Figure):		
Return flow connection	12 ±1.2	8.9 ±0.89
Screw for rectangular connector	0.5	0.37

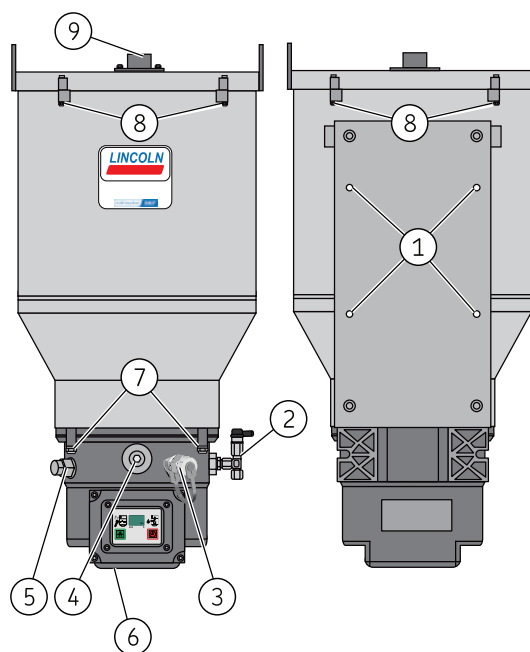


4.2.2 Pumps with 30/40 liter sheet steel reservoir

Table 9

Tightening torques for pumps with 30/40 liter sheet steel reservoir

Component	Torque	
	Nm	ft.lb.
1 Installing the pump	20 ±2.0	14.8 ±1.5
2 Pressure relief valve in pump element	6 -0.5	4.4 -0.37
3 Plug screw / adapter with cone-type grease nipple / fill connection in pump housing	10 +1.0	7.4 +0.74
4 Pump element in pump housing	40 ±2.0	29.5 ±1.5
5 Pressure-relief element	35 ±2.0	25.8 ±1.5
6 Housing cover (bottom)	0.75 ±0.1	0.55 ±0.07
7 4 x screws on reservoir bottom	10 +1.0	7.4 +0.74
8 4 x screws on reservoir cover	5 ±0.5	3.7 ±0.37
9 Reservoir ventilation	0.75 ±0.1	0.55 ±0.07
Options (not shown in Figure):		
Return flow connection	12 ±1.2	8.9 ±0.89
Screw for rectangular connector	0.5	0.37

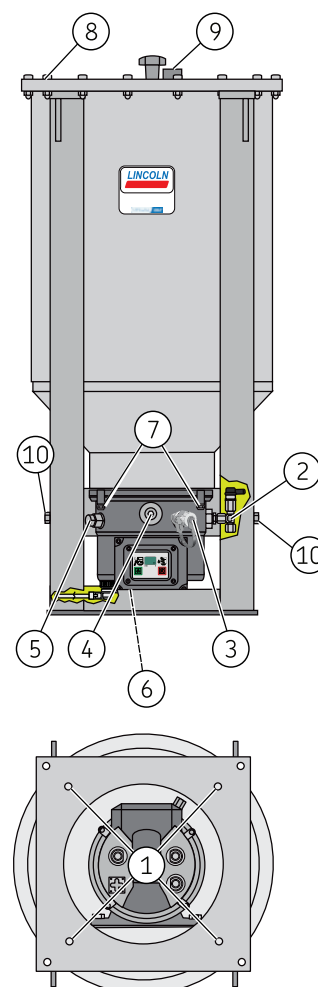


4.2.3 Pumps with 100 liter sheet steel reservoir

Table 10

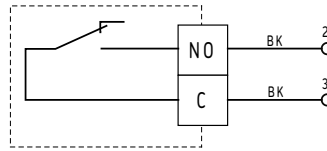
Tightening torques for pumps with 100 liter sheet steel reservoir

Component	Torque	
	Nm	ft.lb.
1 Installing the pump	40 ±5.0	29.50 ±3.7
2 Pressure relief valve in pump element	6 -0.5	4.4 -0.37
3 Plug screw / adapter with cone-type grease nipple / fill connection in pump housing	10 +1.0	7.4 +0.74
4 Pump element in pump housing	40 ±2.0	29.5 ±1.5
5 Pressure-relief element	35 ±2.0	25.8 ±1.5
6 Housing cover (bottom)	0.75 ±0.1	0.55 ±0.07
7 4 x screws on reservoir bottom	10 +1.0	7.4 +0.74
8 16 x screws on reservoir cover	2 ±0.5	1.5 ±0.37
9 Reservoir ventilation	1 ±0.1	0.74 ±0.07
10 Fastening plate on pump housing	40 ±5.0	29.50 ±3.7
Options (not shown in Figure):		
Return flow connection	12 ±1.2	8.9 ±0.89
Screw for rectangular connector	0.5	0.37



4.3 Internal pressure switch

Fig. 14



Item number of NO contact: 234-10723-8

Wiring diagram

Table 11

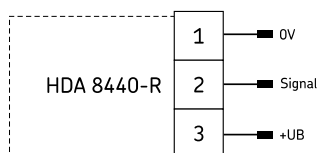
Technical data of the internal pressure switch

Parameter	Values
Switching function	NO contact
Pressure type	Positive gauge pressure
Pressure port	G 1/4"
Measuring principle	Spring-loaded piston
Materials	Measuring element: Steel piston Pressure port: Brass Housing: Brass
Load changes	1 million pressure cycles
Switching outputs	Number: 1 changeover contacts Switching element: gold-plated contacts
switching capacity at ≤ 30 V	≤ 4 mA DC U $\times$ I: max. 0.12 VA
Working pressure ¹⁾	Factory setting: 240 bar ± 5 bar (switching between 160 bar to 210 bar) Maximum: 300 bar Test pressure: 450 bar (briefly)
Hysteresis	25 % to 36 % (of the set value)
Reproducibility ¹⁾	± 5 bar
Temperature range	-40 to 85 °C (briefly 135 °C)
Electrical connection	AMP connector with silver contacts
Enclosure rating	IP 00
Weight	180 g
Max. switching rate	1/s
Tightening torque	30 Nm ± 5 Nm
Mounting position	any

¹⁾ Switch setting at room temperature; switching points and tolerances measured after test run at 20 °C.

4.4 Internal pressure sensor

Fig. 15



Item number: 234-10663-6

Wiring diagram

Table 12

Technical data of the internal pressure sensor

Input characteristics

Parameter	Values
Measuring range	400 bar
Overload range	800 bar
Burst pressure (FS ¹⁾)	400 %
Mechanical connection (DIN 3852)	G 1/4"
Tightening torque	20 Nm
Wetted materials	Stainless steel, FPM

Output characteristics

Parameter	Values
Output signal	0.5 to 4.5 VDC
Characteristic curve deviation (FS ¹⁾) with limit setting acc. to DIN 16086	≤ 0.5 % typ. ≤ 1.0 % max.
Max. temperature compensation, zero point (FS ¹⁾)	≤ 0.025 %
Max. temperature compensation, span (FS ¹⁾)	≤ 0.025 %
Repeatability (FS ¹⁾)	≤ 0.1 %
Rise time	2 ms
Long-term drift (FS ¹⁾)	0.3 %/year

Table 12 (continued)

Technical data of the internal pressure sensor**Ambient conditions**

Parameter	Values
Rated temperature range	-25 to 85 °C
Media temperature range	-40 to 125 °C
Ambient temperature range	-40 to 100 °C
Storage temperature range	-40 to 100 °C
Vibration resistance acc. to EN 60068-2-6	25 g at 5 to 2000 Hz
Shock resistance acc. to EN 60068-2-31	500 g / 1 ms / half-sine
Enclosure rating per EN 60529	IP 67

Other characteristics

Parameter	Values
Power supply	5 VDC, $\pm 5\%$
Residual ripple	$\leq 5\%$
Electrical connection	300 mm ribbon cable with AMP connector Pin1: 0 V / Pin2: Signal / Pin3: +UB
Polarity protection of the power supply	Yes
Overvoltage protection	Yes
Load short-circuit capability	Yes
Service life	> 10 million load changes
Weight	Approx. 55 g

¹⁾ FS = (Full Scale) relative to the full measuring range.

4.5 Diagram of single-line lubrication pump P603S

Fig. 16

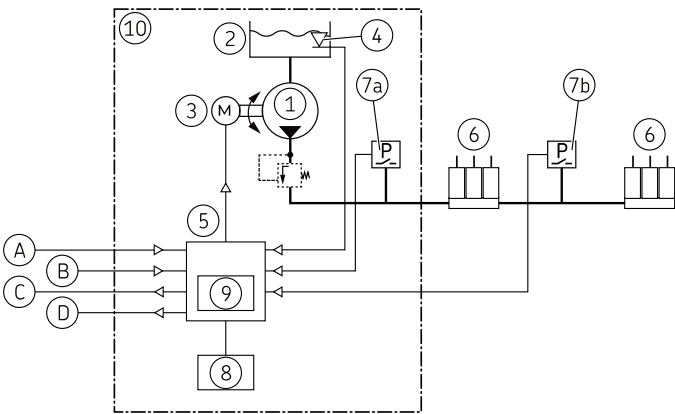


Diagram of single-line lubrication pump 603S

Table 13

Legend to Figure 16

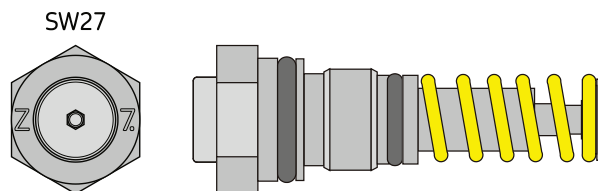
Item	Description
1	Pump
2	Reservoir
3	Motor
4	Low-level signal
5	Control
6	Single-line metering device (QSL)
7a	Internal pressure sensor/pressure switch
7b	External pressure sensor
8	Membrane keyboard
9	Display
10	Single-line lubrication pump 603S
A	Power supply
B	Home
C	Alarm contact / signals
D	Relay control (optional)

4.6 Nominal delivery rates

NOTE

The specified nominal delivery rates per stroke and pump element refer to NLGI grade 2 lubricating greases at an ambient temperature of 20 °C [68 °F] and a back pressure of 100 bar [1450 psi] at the pump element. Differences in operating conditions or a different pump configuration will lead to changes in the motor speed and thus to a change in the delivery rate per unit of time. If the change in the motor speed necessitates an adjustment to the delivery rate per unit of time, then this will be reasonably accomplished by adjusting the lubrication and pause time setting of the pump.

Fig. 17



Pump element Z7

Table 14

Nominal delivery rate per stroke

Pump element	Z7
Nominal delivery rate per stroke	0.25 ccm [0.015 cu. in.]

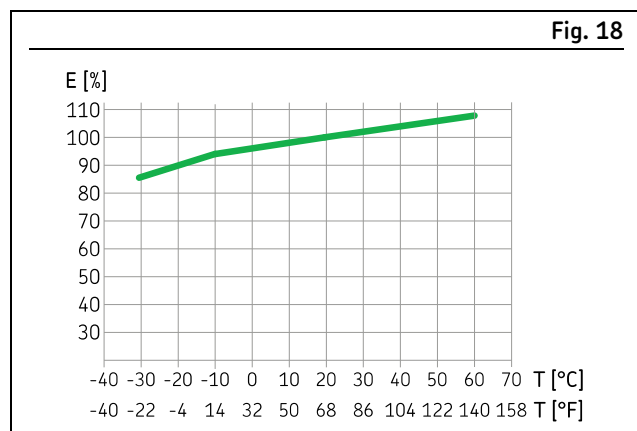
4.6.1 Influencing factors on the delivery rate

Table 15

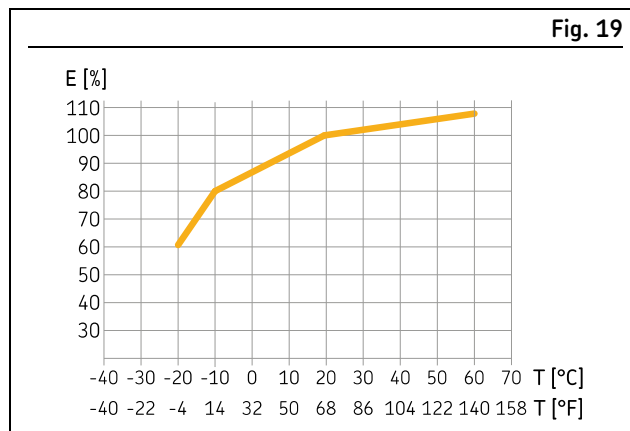
Influencing factors on the delivery rate

Influencing factors	Increasing the delivery rate	Reducing the delivery rate
Ambient temperature	> + 20 °C	< + 20 °C
Consistency class of the lubricating grease	< NLGI 2	N/A
Number of pump elements	N/A	> 1
Back pressure at the pump element	< 100 bar	> 100 bar

4.6.2 Delivery rate charts for typical NLGI 2 lubricants



Delivery rate chart for low-temperature grease



Delivery rate chart for high-temperature grease

NOTE

The values specified in the delivery rate charts represent the average value between different high-temperature and low-temperature greases. The values could therefore vary with the lubrication grease actually used in the pump. This may need to be borne in mind when designing the lubrication system.

Calculation of temperature-dependent delivery rate, using a high-temperature grease as an example

$$OUT = RPM \times V \times E$$

- OUT* Calculated delivery rate per pump element (ccm/min)
- RPM* Nominal speed of the pump (in this example: *RPM* = 17 rpm)
- V* Theoretical delivery rate per pump element (in this example: *V* = 0.246 ccm/stroke)
- E* Efficiency as a percentage (in this example: *E* = 80%) at a temperature of *T* = -10 °C)

$$OUT = 17 \frac{1}{min} \times 0,246 \text{ ccm} \times 80 \% = 3,3 \frac{ccm}{min}$$

4.7 Usable reservoir volume

NOTE

The usable reservoir volume in the reservoir design without follower plate is strongly dependent on the consistency (NLGI Grade) of the lubricant used and the ambient temperature. With high consistency and a low working temperature, more lubricant typically adheres to the inner surfaces of the reservoir and the pump, leaving less lubricant available for feeding.

Table 16

Usable reservoir volume for plastic reservoirs

Reservoir version	Volume in liters and [gal.]					
	4 [1.06]	8 [2.11]	10 [2.64]	15 [3.96]	20 [5.28]	25 [6.60]
Usable reservoir volume for reservoirs without a follower plate						
Lubricants with relatively low consistency ^{1), 3)}	3.65 - 4.15 [0.96 - 1.10]	6.65 - 7.15 [1.76 - 1.88]	8.78 - 9.28 [2.32 - 2.45]	14.35 - 14.90 [3.79 - 3.93]	19.3 - 19.8 [5.10 - 5.23]	-----
Lubricants with relatively high consistency ²⁾	3.35 - 3.85 [0.88 - 1.01]	7.00 - 7.50 [1.84 - 1.98]	9.13 - 9.63 [2.41 - 2.54]	14.75 - 15.25 [3.90 - 4.03]	19.8 - 20.3 [5.23 - 5.36]	-----
Usable reservoir volume for reservoirs with a follower plate						
	3.3 [0.87]	7.0 [1.85]	10 [2.64]	15 [3.96]	20 [5.28]	-----
Usable reservoir volume for reservoirs with double-lip follower plate						
	2.9 [0.77]	6.4 [1.69]	7.7 [2.03]	14.0 [3.70]	18.5 [4.89]	25.3 [6.68]

¹⁾ Consistencies of NLGI 000 lubricants at + 60 °C [140 °F] up to consistencies of NLGI 1.5 lubricants at + 20 °C [68 °F].

²⁾ Consistencies of NLGI 2 lubricants at + 20 °C [68 °F] up to the maximum permissible lubricant consistency.

³⁾ When using lubricants with relatively low consistency in pumps subjected to strong vibrations or tilting motions (e.g., heavy equipment for construction or agriculture), maintain a clearance of about 15 mm [0.59 in.] below the -MAX- mark on the reservoir. This stops lubricant from entering the reservoir bleed screw. In the case of very strong vibrations or large tilting motions, this value must be increased, and can be reduced in the case of lesser vibrations. With the 4 to 20 liter reservoirs, changing the filling level by 10 mm [0.4 in.] equates to a change in volume of approx. 0.34 liter [0.09 gal.].

Table 17

Usable reservoir volume for sheet steel reservoirs

Reservoir version	Volume in liters and [gal.]		
	30 [7.95]	40 [10.6]	100 [26.42]
Usable reservoir volume			
Lubricants with relatively low consistency ¹⁾	30.5 [8.06]	40.8 [10.78]	100.6 [26.58]
Lubricants with relatively high consistency ²⁾	30.9 [8.16]	41.5 [10.96]	101.5 [26.81]

¹⁾ Consistencies of NLGI 000 lubricants at + 60 °C [140 °F] up to consistencies of NLGI 1.5 lubricants at + 20 °C [68 °F].

²⁾ Consistencies of NLGI 2 lubricants at + 20 °C [68 °F] up to the maximum permissible lubricant consistency.

4.8 Lubricant requirement when an empty pump is filled for the first time

The following volumes of lubricant are required in order to fill a new empty pump up to the -MAX- mark on the reservoir.

NOTE

The difference between the lubricant volume required for initial filling and the nominal volume of the reservoir is due to the filling of the space in the pump housing up to the -MIN- mark on the reservoir.

Table 18

Pumps with plastic reservoir

Reservoir version	Volume in liters and [gal.]					
Nominal volume	4 [1.06]	8 [2.11]	10 [2.64]	15 [3.96]	20 [5.28]	25 [6.60]
Reservoir without follower plate	5.8 ±0.25 [1.53 ±0.07]	9.15 ±0.25 [2.41 ±0.07]	11.19 ±0.25 [2.96 ±0.07]	17.5 ±0.25 [4.62 ±0.07]	22.0 ±0.25 [5.81 ±0.07]	-----
Reservoir with follower plate	5.8 ±0.25 [1.53 ±0.07]	9.15 ±0.25 [2.41 ±0.07]	11.19 ±0.25 [2.96±0.07]	17.5 ±0.25 [4.62 ±0.07]	22.0 ±0.25 [5.81 ±0.07]	-----
Reservoir with double-lip follower plate	5.8 ±0.25 [1.53 ±0.07]	9.15 ±0.25 [2.41 ±0.07]	11.19 ±0.25 [2.96±0.07]	17.5 ±0.25 [4.62 ±0.07]	22.0 ±0.25 [5.81 ±0.07]	27.2 ±0.25 [7.19 ±0.07]

Table 19

Pumps with sheet steel reservoir

Reservoir version	Volume in liters and [gal.]		
Nominal volume	30 [7.95]	40 [10.6]	100 [26.42]
	32.3 ±0.25 [8.53 ±0.07]	42.55 ±0.25 [11.24 ±0.07]	103.05 ±0.25 [27.22 ±0.07]

4.9 Type identification code for pump P603S

4.9.1 Basic parameters and reservoir version

		P603	S	X	-	15	X	L	F	-	3Z	7	-	24	-	1A	7	.	16	-	S13	-	SE	-	UL
Type series:																									
P603	Pump P603 for grease ¹⁾ with control																								
How it works:																									
S	Single-line lubrication pump (the outlets of all three pump elements are grouped together in the housing)																								
M	Multi-line pump (not covered by these instructions)																								
Corrosion resistance:																									
Low-level	C3 design																								
X	C5-M design ²⁾																								
Transparent plastic reservoir:																									
4	4 liter reservoir																								
8	8 liter reservoir																								
10	10 liter reservoir																								
15	15 liter reservoir																								
20	20 liter reservoir																								
25	25 liter reservoir																								
Steel reservoir:																									
30	30 liter steel reservoir																								
40	40 liter steel reservoir																								
100	100 liter steel reservoir																								
Lubricant:																									
(Combination of the versions: see Table 20)																									
X	Reservoir for grease																								
Fill level signal:																									
(Combination of the versions: see Table 20)																									
N	Standard design																								
L	Low-level signal																								
BP	Full, low-level (= empty) and pre-empty signals ³⁾																								
Reservoir design:																									
(Combination of the versions: see Table 20)																									
B0	Filling from above																								
F ⁴⁾	Reservoir with follower plate																								
F1 ⁵⁾	Reservoir with follower plate																								
D ⁶⁾	Reservoir with double-lip follower plate																								

¹⁾ The pump comes standard without any lubricant filling

²⁾ Steel parts in stainless steel or electroless nickel plating (DN)

³⁾ An M12x1 connector is used to connect the full, low-level (= empty), and pre-empty signals on the actuating rod at the top of the reservoir

⁴⁾ A rectangular connector is used to connect the low-level signal on the actuating rod at the top of the reservoir

⁵⁾ A bayonet connector is used to connect the low-level signal on the actuating rod at the top of the reservoir

⁶⁾ The double-lip follower plate is only possible with the 4 liter to 25 liter reservoir versions.

Table 20

Reservoir versions

		Possible reservoir capacities										Description
Code		4 l	8 l	10 l	15 l	20 l	25 l	30 l	40 l	100 l		
X	N	B0	✓	✓		✓	✓				Reservoir for grease, filling from above (without follower plate), without low-level signal	
X	L	B0	✓	✓		✓	✓				Reservoir for grease, filling from above (without follower plate), with intermittent low-level signal	
X	L	F	✓	✓	✓	✓	✓				Reservoir for grease, with follower plate and low-level signal	
X	L	F1	✓	✓	✓						Reservoir for grease, with follower plate and low-level signal	
X	L	D	✓	✓	✓		✓	✓			Reservoir for grease, with double-lip follower plate	
X	L								✓	✓	Steel reservoir for grease, without follower plate, with intermittent low-level signal	
X	N								✓	✓	✓	Steel reservoir for grease, without follower plate, without low-level signal
X	BP	F		✓	✓	✓	✓					Reservoir for grease, with follower plate and full, low-level, and pre-empty signals

4.9.2 Pump elements

	P603	S	X	-	15	X	L	F	-	3Z	7	-	24	-	1A	7	.	16	-	S13	-	SE	-	UL
Number of pump elements:																								
3Z																								
3 pump elements brought together on one outlet																								
Pump elements:																								
7																								
Piston diameter 7 mm																								

4.9.3 Voltage supply and electrical connections

	P603	S	X	-	15	X	L	F	-	3Z	7	-	24	-	1A	7	.	16	-	S13	-	SE	-	UL
Power supply:																								
(Combination of the versions: see Table 21)																								
12																								
12 V DC																								
24																								
24 V DC																								
AC																								
110 - 240 V AC ± 10%;																								
50 - 60 Hz ± 5%																								
Number of the electrical connections:																								
(Combination of the versions: see Table 21)																								
1A																								
One connection																								
2A																								
Two connections																								
3A																								
Three connections																								
4A																								
Four connections																								
2B																								
Two connections																								
3B																								
Three connections																								
3C																								
Three connections																								

Electrical connection type:

(power supply voltage, combination of the versions: see Table 21)

- 1 Rectangular connector
- 7 Bayonet connector

Accompanying electrical connection components (outside of the pump):

(Combination of the versions: see Table 21)

- 01 Rectangular connector (connection socket without cable)
- 16 Bayonet socket with 10 m cable (7-pin)

Table 21

Characteristics of the types of electrical connection

Coding (DC types)	Power supply 12 VDC or 24 VDC	Low-level signal and error message	Pressure sensor ⁷⁾	Relay control (optional for low-level signal and error message)
1A7.16	7-pin bayonet connector, left			
2A7.16	7-pin bayonet connector, left		3/ 4-pin bayonet connector, right	
2B7.16	7-pin bayonet connector, left			4-pin bayonet connector, right
Coding (AC types)	Power supply 110 - 240 V AC ± 10%; 50 - 60 Hz ± 5%	Low-level signal and error message	Pressure sensor ⁷⁾	Relay control (optional for low-level signal and error message)
2A1.01	Rectangular connector, left	7-pin bayonet connector, left		
2B1.01	Rectangular connector, left			4-pin bayonet connector, right
3A1.01	Rectangular connector, left	7-pin bayonet connector, left	3/ 4-pin bayonet connector, right	
3B1.01 ⁸⁾	Rectangular connector, left	7-pin bayonet connector, left		4-pin bayonet connector, right

⁷⁾ Incl. 10 m cable (4-core); prerequisite: Jumper position "2S"

⁸⁾ Prerequisite: Pump with S board

4.9.4 Other parameters

		P603	S	X	-	15	X	L	F	-	3Z	7	-	24	-	1A	7	.	16	-	S13	-	SE	-	UL	
Control circuit boards:																										
See Table 22																										
Pressure sensor/switch:																										
SE	Pressure sensor ⁹⁾																									
DS	Pressure switch ¹⁰⁾																									
Number of the electrical connections:																										
Low-level	Standard, without UL certification																									
UL	With UL certification																									

⁹⁾ Can be set from 100 bar to 320 bar, in 10 bar increments, using the membrane keypad

¹⁰⁾ Internal

Table 22

Control circuit boards	
Coding	Description
S01 ... S24	Microprocessor control with various setting versions (jumper position)
B01 ... B24	Microprocessor control with various setting versions (jumper position); terminal 15/30 is jumpered
SR01 ... SR24	Microprocessor control with various setting versions (jumper position) and additional relay control
BR01 ... BR24	Microprocessor control with various setting versions (jumper position); terminal 15/30 is jumpered, and additional relay control

5. Delivery, returns, storage

5.1 Delivery

After receipt of the shipment, it must be inspected for any shipping damage and for completeness according to the shipping documents. Immediately inform the transport carrier of any shipping damage. The packaging material must be preserved until any discrepancies are resolved.

5.2 Return shipment

Before return shipment, all contaminated parts must be cleaned. If this is not possible or practical, e.g. if it would impede fault detection in the case of complaints, the medium used must always be specified. In the case of products contaminated with hazardous substances as defined by GHS or CLP regulations, the safety data sheet (SDS) must be sent with the product and the packaging must be labelled in accordance with GHS/CLP. There are no restrictions for land, air, or sea transport. The choice of packaging should be based on the specific product and the stresses to be expected during transport (e.g., necessary anti-corrosion measures in the case of shipment by sea). In the case of wooden packaging, the applicable import regulations and the IPPC standards must be observed. Required certificates must be included in the shipping documents. The following information, as a minimum, must be marked on the packaging of return shipments.



Marking of return shipments

5.3 Storage

The following conditions apply to storage:

- Dry, low-dust, vibration-free, in closed rooms
- No corrosive, aggressive substances at the storage location (e.g., UV rays, ozone)
- Protected against animals (insects, rodents)
- If possible, keep in the original product packaging
- Protected from nearby sources of heat or cold
- In the case of large temperature fluctuations or high humidity, take appropriate measures (e.g., heating) to prevent the condensation of water
- Before usage, check products for damage that may have occurred during storage. This applies in particular to parts made of plastic (due to embrittlement).

5.4 Storage temperature range

For parts not filled with lubricant, the permitted storage temperature is the same as the permitted ambient temperature range (see "Technical data").

5.5 Storage conditions for products filled with lubricant

For products filled with lubricant, the permitted storage temperature range is:

minimum	+ 5 °C	[+41 °F]
maximum	+ 35 °C	[+95 °F]

If the storage temperature range is not maintained, the following steps for replacing the lubricant may not lead to the desired result under certain circumstances.

5.5.1 Storage period up to 6 months

Filled products can be used without implementing additional measures.

5.5.2 Storage period between 6 and 18 months

Pump:

- Connect the pump to a power source
- Switch on the pump and run it until lubricant comes out of every outlet without air bubbles
- Disconnect the pump from the power source
- Remove and dispose of the lubricant that came out

Lines:

- Remove pre-installed lines
- Ensure that both ends of the line are open
- Fill the lines completely with fresh lubricant

Metering devices:

NOTE

Due to the large number of different metering devices, no universally valid statement can be made regarding the removal of the old lubricant and correct bleeding after filling with new lubricant. The instructions can be found in the technical documentation of the specific metering device used.

5.5.3 Storage period more than 18 months

To prevent faults, the manufacturer should be consulted before start-up. The basic procedure for removal of the old lubrication filling corresponds to that for storage periods between 6 and 18 months.

6. Assembly

6.1 General safety instructions

Observe the safety instructions and the technical data in this manual. Additionally, during assembly pay attention to the following:

- Only qualified and authorized technical personnel may install the products described in this manual.
- Adhere to safety distances and legal prescriptions on assembly and prevention of accidents.
- Possibly existing visual monitoring devices, e.g. pressure gauges, MIN/MAX markings, oil inspection glasses must be clearly visible.
- Protect the product against humidity, dust and vibrations.
- Install the product in an easily accessible position. This facilitates other installations, control and maintenance work.

6.2 Mechanical connection

6.2.1 Assembly holes

NOTICE

Possible damage to the main machine and the pump

The assembly holes should be created only on non-load-bearing parts of the main machine. Do not fasten on two parts which move in opposite directions to one another (e.g., machine base and machine assembly).

- When installing pumps with reservoirs of 10 l [2.64 gal.], 15 l [3.96 gal.], 20 l [5.28 gal.], or 25 l [6.6 gal], the flatness of the upper and lower installation surfaces must not vary by more than 1 mm [0.039 in.] from one another.

The fastening is set up as depicted on the following pages with:

Pumps with 4 or 8 liter plastic reservoir

- 2 hexagon head screws, M8 (8.8)
- 2 hexagon nuts, M8 (8.8)
- 4 washers (8)

NOTE

Tightening torque: 18 Nm $\pm$ 1.0 Nm [13.27 ft.lb. $\pm$ 0.74 ft.lb.]

Pumps with 10, 15, 20 or 25 liter plastic reservoir

- 4 hexagon head screws, M8 (8.8)
- 4 hexagon nuts, M8 (8.8)
- 8 washers (8)

NOTE

Tightening torque: 18 Nm $\pm$ 1.0 Nm [13.27 ft.lb. $\pm$ 0.74 ft.lb.]

Pumps with 30 or 40 liter sheet steel reservoir

- 4 hexagon head screws, M8 (8.8)
- 4 hexagon nuts, M8 (8.8)
- 8 washers (8)

NOTE

Tightening torque: 20 Nm $\pm$ 2.0 Nm [14.8 ft.lb. $\pm$ 1.5 ft.lb.]

Pumps with 100 liter sheet steel reservoir

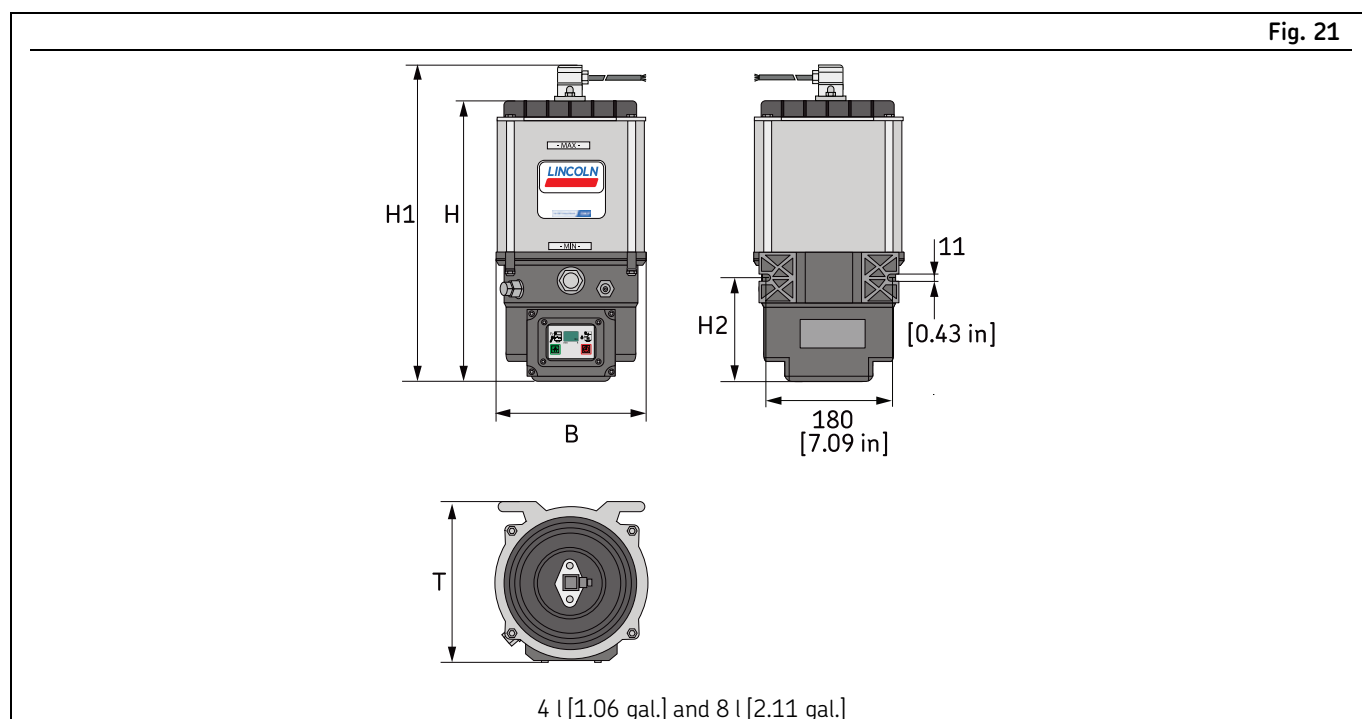
- 4 hexagon head screws, M10 (8.8)
- 4 hexagon nuts, M10 (8.8)
- 8 washers (10)

NOTE

Tightening torque: 40 Nm $\pm$ 5.0 Nm [13.27 ft.lb. $\pm$ 3.7 ft.lb.]

6.2.2 Minimum mounting dimensions

In order to have sufficient space for maintenance work or for the attachment of additional components for the construction of a centralized lubrication system on the pump, a clearance of at least 100 mm [3.94 in.] should be provided for in every direction in addition to the specified dimensions.



Minimum mounting dimensions with plastic reservoir (dimensions in mm [inches])

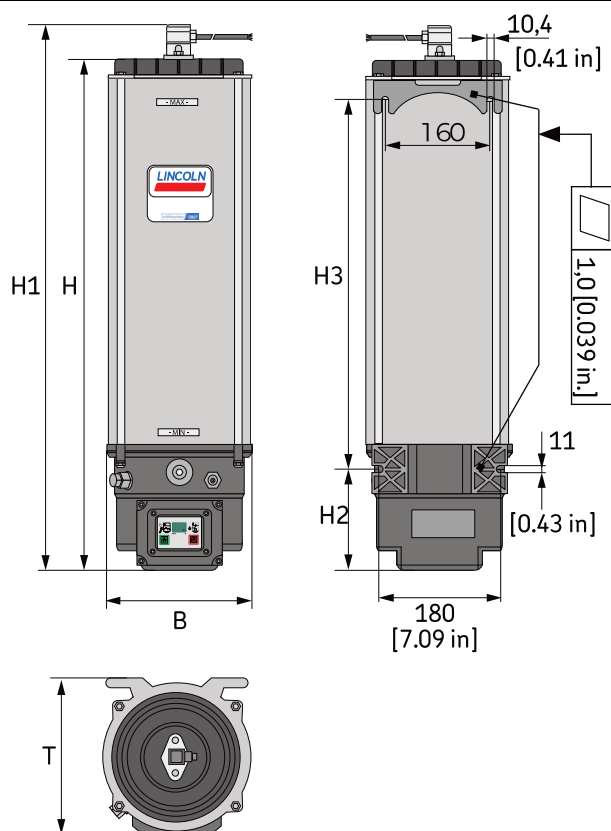
Table 23

Dimensions				
Dimension	4 liters [1.06 gal.]		8 liters [2.11 gal.]	
	VDC	VAC	VDC	VAC
H ¹⁾	415 [16.34]	435 [17.13]	515 [20.28]	535 [21.06]
H1 ²⁾	471 [18.54]	491 [19.33]	571 [22.48]	591 [23.27]
H2	174	----	----	----
H3	----	----	----	----
B	240 [9.45]		240 [9.45]	
T	235 [9.25]		235 [9.25]	

¹⁾ Pumps with stirring paddles

²⁾ Pumps with a follower plate

Fig. 22



10 l [2.64 gal.], 15 l [3.96 gal.], 20 l [5.28 gal.] and 25 l [6.60 gal.]

Minimum mounting dimensions with plastic reservoir (dimensions in mm [inches])

Table 24

Dimensions

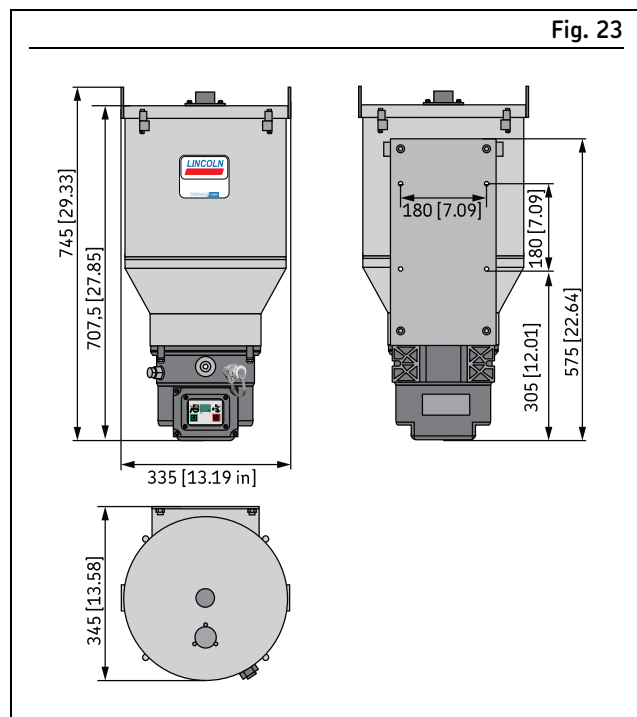
Dimension	10 liters [2.64 gal.]		15 liters [3.96 gal.]		20 liters [5.28 gal.]		25 liters [6.60 gal.]	
	VDC	VAC	VDC	VAC	VDC	VAC	VDC	VAC
H ¹⁾	577 [22.72]	597 [23.50]	758 [29.84]	778 [30.63]	893 [35.16]	913 [35.94]	1152	1172
H ^{1 2)}	633 [24.92]	814 [32.05]	949 [37.36]	653 [25.71]	834 [32.83]	969 [38.15]	1212	1232
H2	154,5 [6.08]	174.5 [6.87]	154,5 [6.08]	174.5 [6.87]	154,5 [6.08]	174.5 [6.87]	154,5 [6.08]	174.5 [6.87]
H3	367.5 [14.47]		550.5 [21.67]		685.5 [26.99]		944.5 [37.19]	
B	240 [9.45]		240 [9.45]		240 [9.45]		240 [9.45]	
T	235 [9.25]		235 [9.25]		235 [9.25]		235 [9.25]	

¹⁾ Pumps with stirring paddles

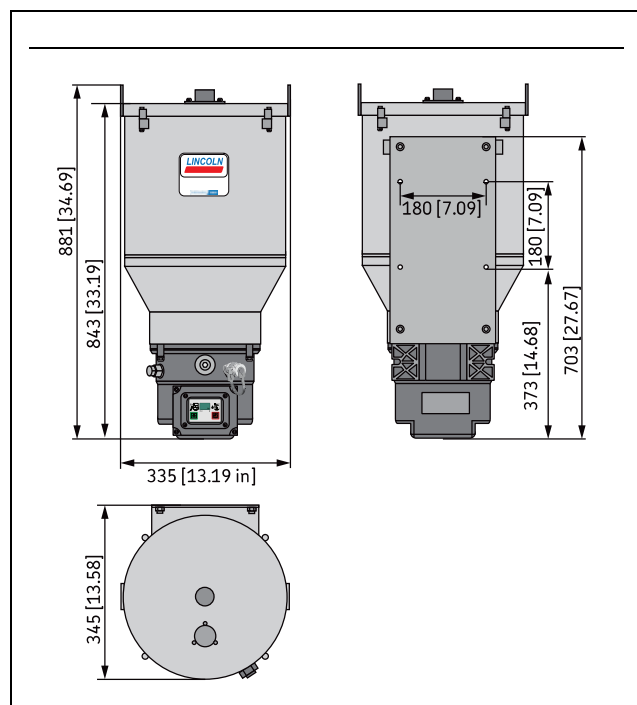
²⁾ Pumps with a follower plate

6.2.2.1 Minimum mounting dimensions 30/40/100 liter sheet steel reservoir

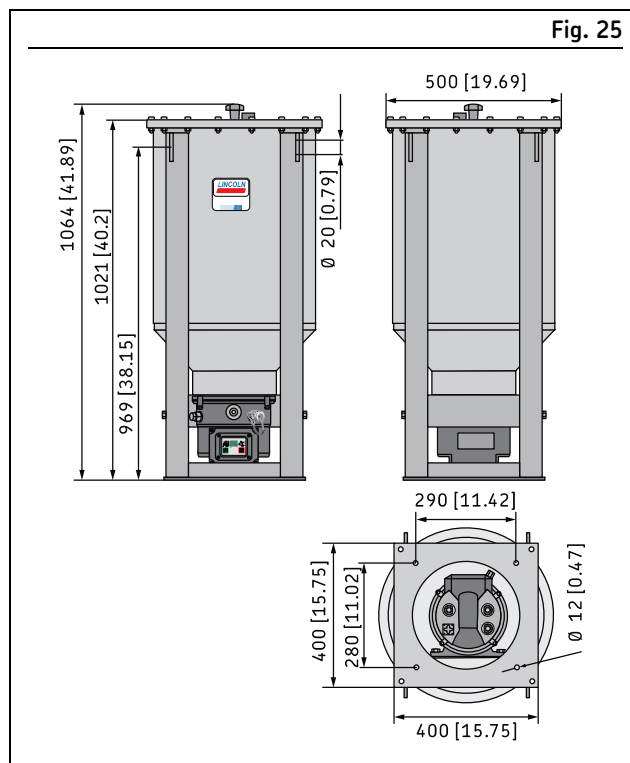
In order to have sufficient space for maintenance work or for the attachment of additional components for the construction of a centralized lubrication system on the pump, a clearance of at least 100 mm [3.94 in.] should be provided for in every direction in addition to the specified dimensions.



Minimum mounting dimensions, 30 liter sheet steel reservoir



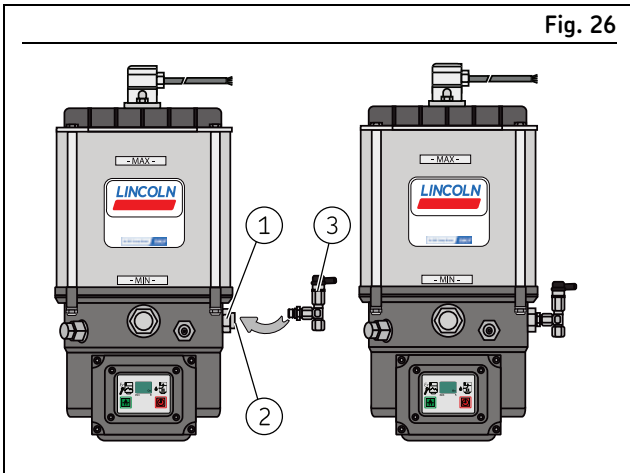
Minimum mounting dimensions, 40 liter sheet steel reservoir



Minimum mounting dimensions, 100 liter sheet steel reservoir

6.3 Installing the pressure relief valve

Each pump element must be secured with a pressure relief valve that is suitable for the projected maximum approved operating pressure of the centralized lubrication system.



Installing the pressure relief valve

Proceed as follows for installation:

1. Remove the plug screw (Fig. 26/2) from the pump element (Fig. 26/1)
2. Screw the pressure relief valve (Fig. 26/3) into the pump element

NOTE

- The torque for tightening the pressure relief valve in the pump element or adapter is:
6 Nm -0.5 Nm [4.43 ft.lb. ±0.07 ft.lb.]

3. Repeat the procedure for each pump element

6.4 Assembly of the reservoir ventilation

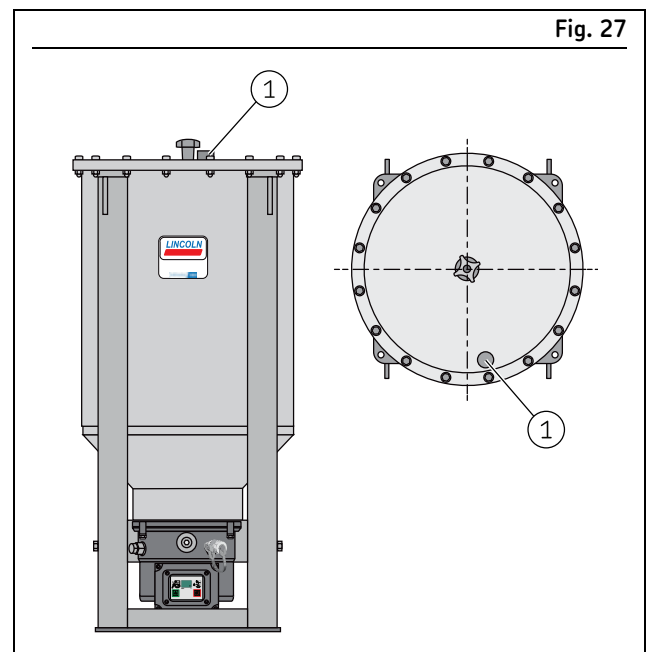
NOTICE

Possible damage to the pump

The pump may not be filled until after the reservoir ventilation has been installed. Otherwise the reservoir cover could become damaged during the filling process.

NOTE

The assembly of the loosely enclosed reservoir ventilation may not take place until the pump has reached its final assembly position and is standing upright.



Installing the reservoir bleed screw on the 100 l sheet steel reservoir

1. Remove any dirt or contamination in the area of the plug screw. Remove the plug screw from the position for the reservoir bleed screw (Fig. 27/1).
2. Secure the thread of the reservoir ventilation against loosening, e.g., with Loctite 403 and screw in the reservoir ventilation (Fig. 27/1).
 - Tightening torque: 1 Nm ±0.1 Nm [0.74 ft.lb. ±0.07 ft.lb.]

6.5 Electrical connection

⚠ WARNING



Electric shock

Work on electrical components may be performed only by qualified electricians.

At a minimum, the following safety measures must be taken before any work on electrical components is done:



- Isolate, lock and tag out
- Check to ensure the absence of voltage
- Ground and short-circuit the product
- Cover any live parts in the surrounding area

Observe the following instructions for a safe connection:

- The electrical connection must be implemented in accordance with the specifications of the standards of the DIN VDE 0100 series or of the standards of the IEC 60364 series, respectively

Connect the electrical lines in such a way that no mechanical forces are transferred to the product

- The pump must be secured with a suitable external fuse (see terminal diagram)

1. Assemble the connectors/cables for the power supply (Fig. 28/1), for connecting the external pressure sensor (Fig. 28/2), and for connecting the external control (Fig. 28/1), according to the applicable terminal diagram.

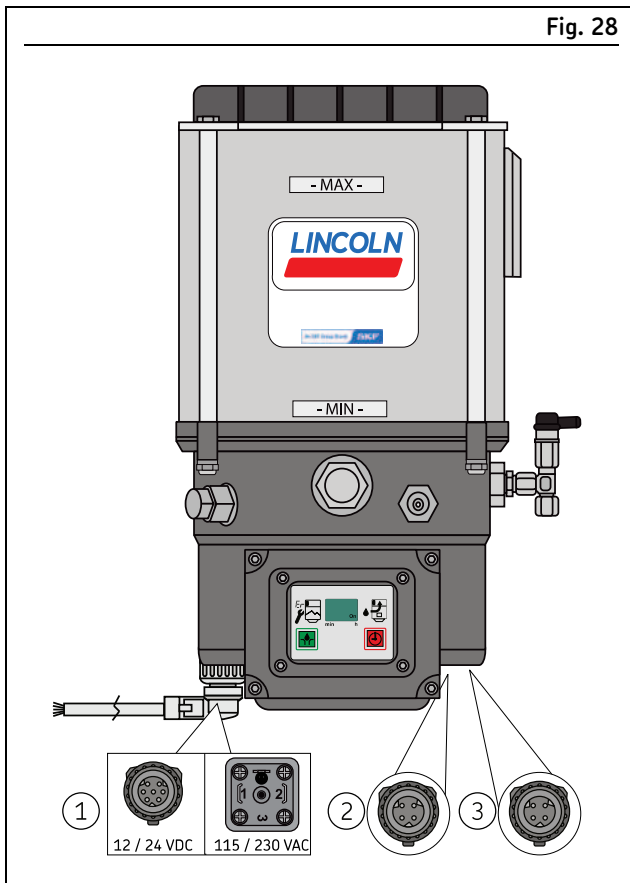
- Rectangular connector, power supply 115/230 VAC
- Bayonet connector, 7-pin, power supply 12/24 VDC and external control (Fig. 28/1)
- Bayonet connector, 4/3-pin, external pressure sensor (Fig. 28/2)
- Bayonet connector, 4-pin, relay circuit board signal outputs (Fig. 28/3)

2. Connect plugs with their respective bushes and secure them against becoming loose using the type of securing method specified for the quick disconnect couplings. Only this way is a safe connection and compliance with the enclosure rating secured.

NOTE

Connect the cables in such a way that no tensile forces can be transferred to the product.

Fig. 28



Electrical connection

The electrical connection is established in accordance with the type of connection of the pump.

6.6 Connection of the lubrication line

CAUTION



Risk of slipping

Exercise caution when handling lubricants. Immediately remove and bind any leaked lubricants.

NOTICE

Damage to the higher-level machine caused by faulty planning of the centralized lubrication system

All parts for the construction of the centralized lubrication system must be designed for the maximum operating pressure that occurs, the permissible ambient temperature range, the required delivery volume, and the lubricant to be supplied.

Observe the following assembly information for safe and trouble-free operation:

- Generally valid regulations and company regulations regarding the laying of pressurized pipe and hose lines must be observed.
- Use only clean, pre-filled components and lubrication piping.
- Secure every lubricant line on the pump against excessive pressure through the use of a suitable pressure relief valve (only in the case of pumps without an internal pressure relief valve).
- The main lubricant line should be arranged ascending and be able to be bled at the highest point. Lubrication lines should always be arranged so that air inclusions cannot form anywhere.
- Install lubricant metering devices at the end of the main lubricant line such that the outlets of the lubricant metering devices point upwards wherever possible.
- If the system configuration requires that the lubricant metering devices be arranged below the main lubricant line, they should not be placed at the end of the main lubricant line.
- The flow of lubricant should not be impeded by the presence of sharp bends, angle valves, flap valves, seals protruding inward, or changes in cross-section (large to small). Unavoidable changes in the cross-section in lubrication lines must have smooth transitions.
- Connect the lubricant lines in such a way that no mechanical forces are transferred to the product (stress-free connection).
- Lubrication piping is to be positioned in such a way that they cannot become kinked, pinched or frayed.

6.7 Filling with lubricant

6.7.1 Filling via the reservoir cover

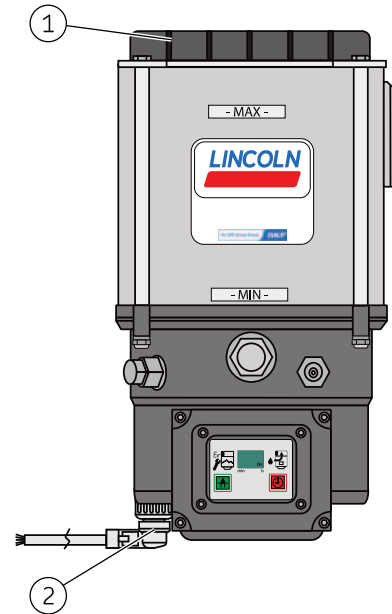
WARNING



Crushing hazard

Crushing hazard on the rotating stirring paddle. Filling through the opening of the reservoir lid is permitted only if the pump has first been disconnected from the power supply (Fig. 29/2).

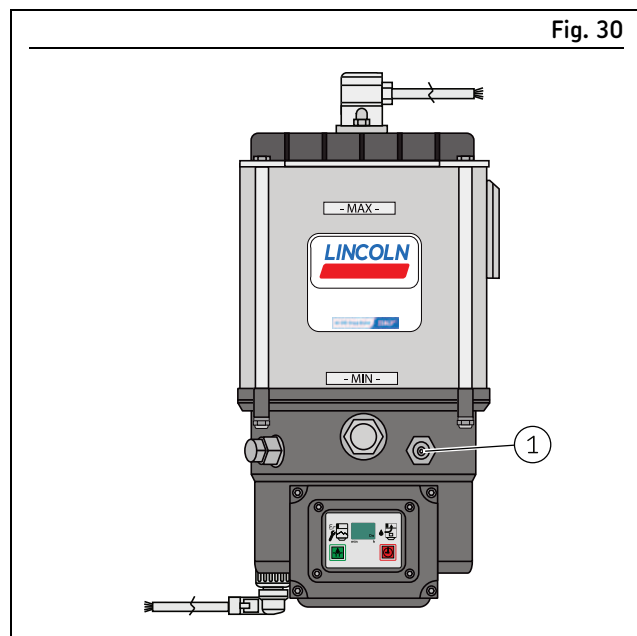
Fig. 29



Filling via the reservoir cover

1. Turn the reservoir lid (Fig. 29/1) counterclockwise and detach it from the reservoir. Set the reservoir cover down at a clean location. The inner side of the reservoir cover must not become contaminated. Remove any contaminations which may be present.
2. Fill the reservoir from the top up to the "MAX" marking. Take care to ensure while doing so that the lubricant is filled in without air inclusions if at all possible.
3. Reinstall the reservoir cover (Fig. 29/1) in clockwise direction.

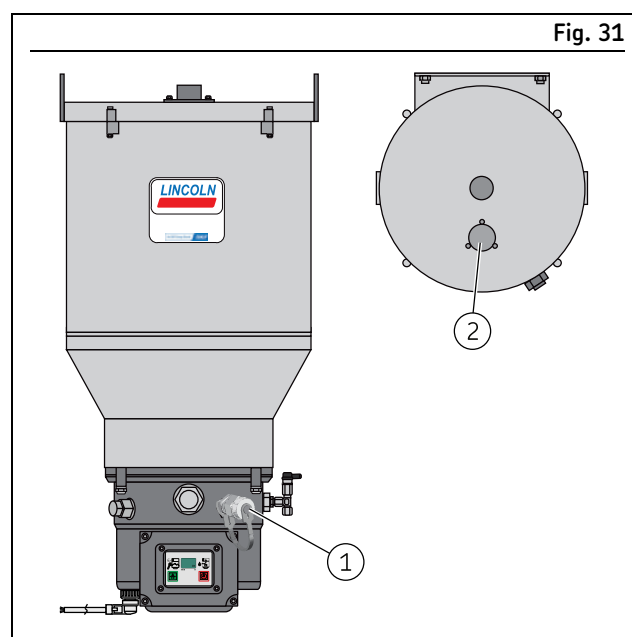
6.7.2 Filling via filler nipple



Filling via the filler nipple

1. Connect the fill connection of the filling pump to the filler nipple (Fig. 30/1).
2. Switch on the filling pump and fill the reservoir up to just below the - MAX - marking.
3. Switch off the filling pump and remove it from the filler nipple (Fig. 30/1) of the pump.

6.7.3 Pump filling with 30/40 liter sheet steel reservoir



Filling via the fill connection

1. Switch on the pump and allow it to run during filling.
2. Unscrew the protective cap on the fill connection (Fig. 31/1) in counterclockwise direction.
3. Connect the fill connection of the filling pump with the fill connection.
4. Switch on the filling pump and fill the reservoir.
5. Check the fill level through the sight glass (Fig. 31/2) and fill up to a maximum of 50 mm [2.0] below the reservoir cover.
6. Switch off the filling pump and remove it from the fill connection of the pump.
7. Screw the protective cap in clockwise direction back onto the fill connection of the pump.
8. Turn off the pump

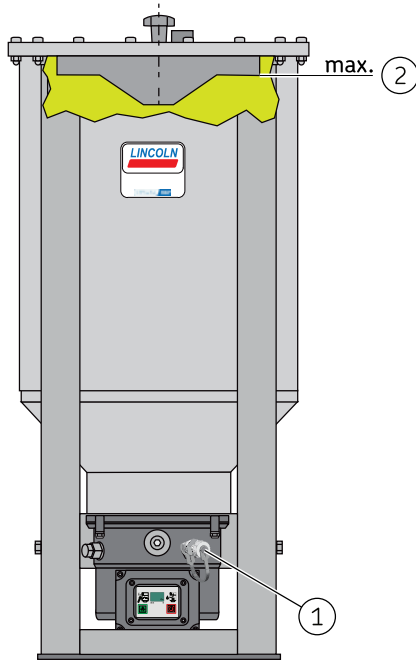
6.7.4 Pump filling with 100 liter sheet steel reservoir

NOTICE

Possible damage to the pump

The pump may not be filled until after the reservoir ventilation has been installed. Otherwise the reservoir cover could become damaged during the filling process.

Fig. 32



Filling via the fill connection

1. Switch on the pump and allow it to run during filling.
2. Unscrew the protective cap on the fill connection (Fig. 32/1) in counterclockwise direction.
3. Connect the fill connection of the filling pump with the fill connection.
4. Switch on the filling pump and fill the reservoir.
5. Check the fill level through the transparent reservoir cover and, at a maximum, fill up to the outer lower edge (approx. 60 mm [2.4] below the reservoir cover) of the scraper (Fig. 32/2).
6. Switch off the filling pump and remove it from the fill connection of the pump.
7. Screw the protective cap in clockwise direction back onto the fill connection of the pump.
8. Turn off the pump

6.7.5 Initial filling of an empty pump with follower plate

NOTE

For pumps without grease filling, the space underneath the follower plate must be filled with lubricant prior to first start-up. All additional fillings take place exclusively via the filler nipple (Fig. 33/5) or the optional fill connection on the pump.

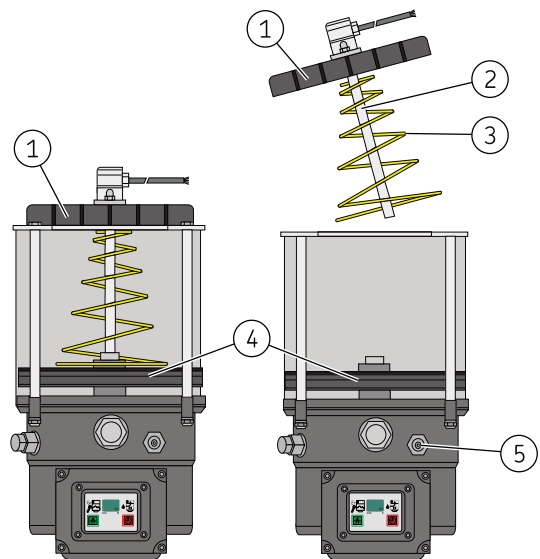
CAUTION

Risk of injury from spring tension



Release the reservoir cover slowly, holding it securely while doing so. Wear goggles.

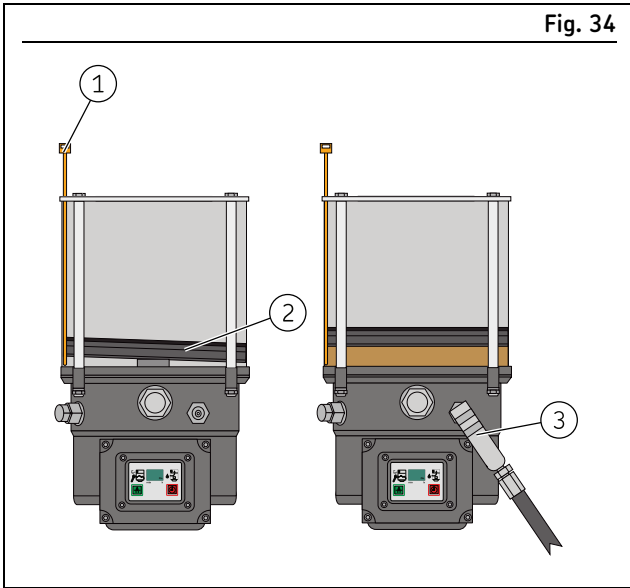
Fig. 33



Initial filling of an empty pump with follower plate

9. Turn the reservoir lid (Fig. 33/1) counterclockwise and detach it from the reservoir.
10. Carefully release the spring (Fig. 33/3) from its fixation on the follower plate (Fig. 33/4).
11. Carefully pull the contact rod (Fig. 33/2) out of the follower plate (Fig. 33/4).
12. Remove the reservoir cover, contact rod and spring together.

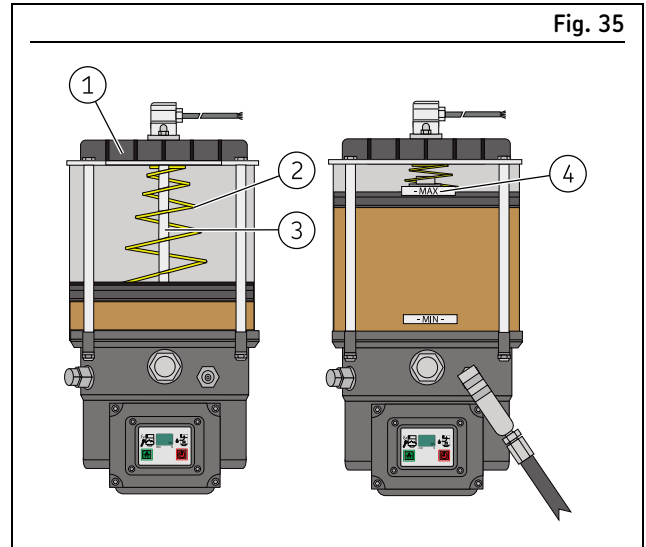
Fig. 34



Inserting a cable tie and filling the pump

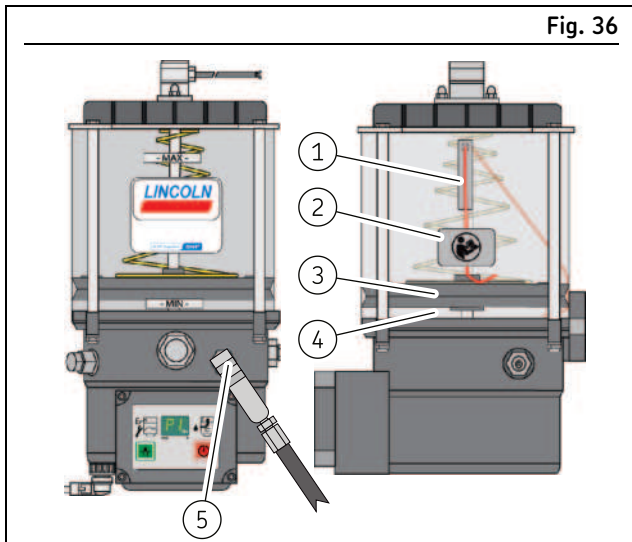
- 13.** Lightly oil the inner side of the reservoir and sealing lip of the follower plate.
- 14.** Tilt the follower plate (Fig. 34/2) in the reservoir slightly so that the side opposite the filler nipple (Fig. 33/5) is positioned at the highest point.
- 15.** Push the cable tie (Fig. 34/1) at this point as shown into the area underneath the follower plate.
- 16.** Move the follower plate (Fig. 34/2) into horizontal position once again. Take care to ensure while doing so that an air gap is created by the cable tie (Fig. 34/1).
- 17.** Set the fill connection (Fig. 34/3) of the filling pump on the filler nipple and fill the space underneath the follower plate with lubricant. Take care to ensure that no air inclusions remain under the follower plate and that no lubricant reaches the upper side of the follower plate.
- 18.** Remove the cable tie (Fig. 34/1).

Fig. 35



- 19.** Reinstall the spring (Fig. 35/2) and the contact rod (Fig. 35/3).
- 20.** Close the reservoir cover (Fig. 35/1) in clockwise direction.
- 21.** Fill the pump via the filler nipple up to the -MAX- marking (Fig. 35/4).

6.7.6 Initial filling with double-lip follower plate



Initial filling with double-lip follower plate

NOTE

For initial filling of a pump delivered without lubricant, the pump is fitted with a bleed thread (Fig. 36/1) and a "Read instructions" sticker (Fig. 36/2). The bleed thread ensures that the air under the follower plate can escape when filling the pump for the first time. This prevents faults due to negative effects on the suction characteristics of the pump resulting from air inclusions under the follower plate. The bleed thread (Fig. 36/1) is **ONLY** required for the initial filling and must then be removed together with the "Read instructions" sticker (Fig. 36/2).

When filling for the first time, proceed as described below:

- 22.** Align the pump so that it is upright.
- 23.** Connect the filling pump to the filler nipple (Fig. 36/5).
- 24.** Switch on the filling pump and carefully fill the space (Fig. 36/4) under the follower plate (Fig. 36/3) completely with lubricant, while observing the follower plate.
- 25.** Switch off the filling pump once all the air under the follower plate has been displaced.
- 26.** Detach the sticker (Fig. 36/2) and slowly and carefully pull the bleed thread (Fig. 36/1) down and out of the pump.
- 27.** Switch on the filling pump and fill the reservoir with lubricant up to just below the - MAX - marking.
- 28.** Properly dispose of the bleed thread and the sticker.

7. First start-up

In order to warrant safety and function, a person assigned by the operator must carry out the following inspections. Immediately eliminate detected deficiencies. Deficiencies may be remedied by an authorized and qualified specialist only.

7.1 Inspections before first start-up

Table 25		
Checklist: Inspections before first start-up		
Inspections to be performed	YES	NO
Electrical connection established correctly.	☐	☐
Mechanical connection established correctly.	☐	☐
The parameters set on the control are appropriate for the pump's intended application.	☐	☐
The performance characteristics for the aforementioned connections match the specifications in the "Technical data".	☐	☐
All components, e.g. lubrication lines, are pre-filled with the correct lubricating grease and correctly installed.	☐	☐
No apparent damage, contamination, or corrosion.	☐	☐
Product is protected by a suitable pressure relief valve.	☐	☐
Any dismantled protective and monitoring equipment is fully reinstalled and functional.	☐	☐
All warning labels on the product are present and in proper condition.	☐	☐
The lubricant used matches the permissible specifications of the pump and the intended use.	☐	☐

7.2 Inspections during first start-up

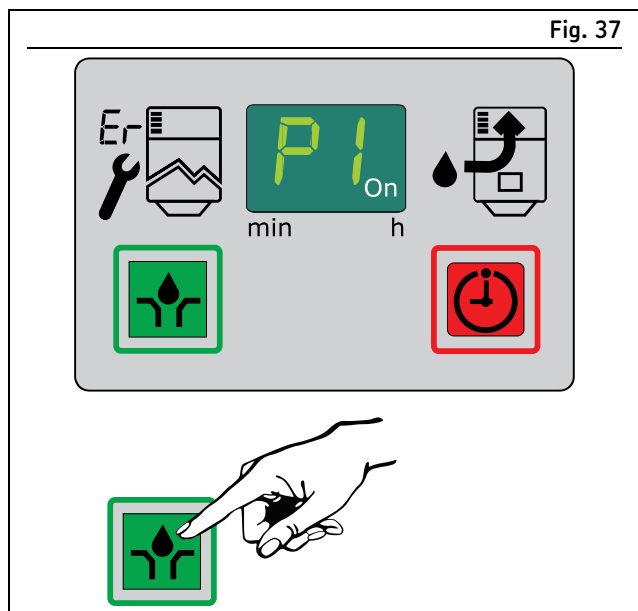
Table 26		
Checklist: Inspections during first start-up		
Inspections to be performed	YES	NO
No unusual noises, vibrations, moisture accumulation, or odors present.	☐	☐
No undesired discharge of lubricant at connections (leakage).	☐	☐
Lubricant is fed without bubbles.	☐	☐
The bearings and friction points requiring lubrication receive the planned lubricant volume.	☐	☐

8. Operation

8.1 Operator keys

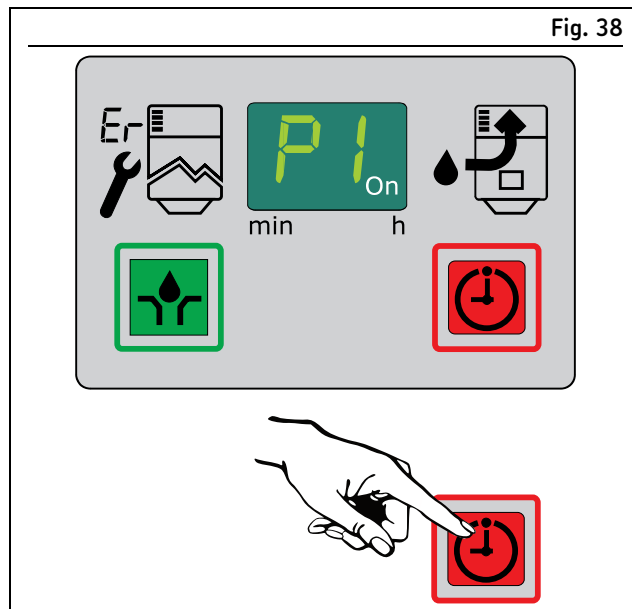
For setting and operation, there are basically three different possibilities on the membrane keyboard:

- Display mode
- Programming mode
- Operation mode



Setting button for changing the parameter values

Fig. 37



Toggle button for moving on to the next program step

Fig. 38

Table 28

Function of the toggle button

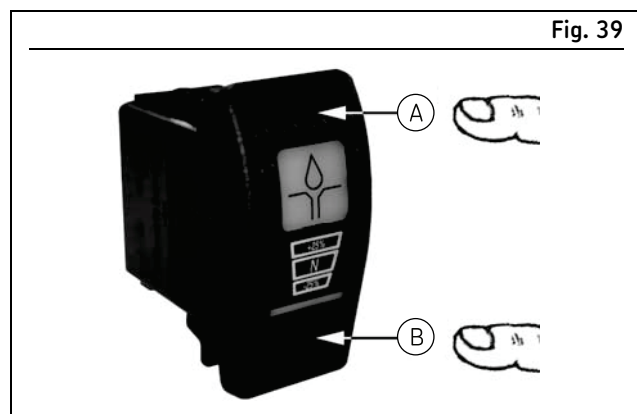
Mode	Function
In operation mode	• Display of the current pump settings
In display mode	• Acknowledge a low-level signal/malfunction
In programming mode	• Switch to the next parameter setting

Table 27

Functions of the setting button

Mode	Function
In operation mode	• Trigger an additional lubrication
In display mode	• No function
Pressed continuously in programming mode	• Rapidly increase the counter
Pressed once in programming mode	• Increase the counter by one increment • Switch between two possible settings • Apply changes to the programming • End the programming mode

8.2 Multifunction pushbutton



Multifunction pushbutton

Table 29

Multifunction pushbutton version	
Voltage	Item number
12 V DC	236-10580-5
24 V DC	236-10280-9

8.2.1 Triggering additional lubrications externally

With mobile applications, it is possible to trigger additional applications externally by pressing the multifunction pushbutton:

- Mobile "M" without ignition: up to two times
- Mobile "M" with ignition: unlimited

With stationary "S" applications, it is possible to trigger additional applications externally multiple times by pressing the multifunction pushbutton.

1. To trigger an additional lubrication, press the multifunction pushbutton (A above) for at least two seconds.

NOTE

- To set to "M" mobile application or "S" stationary application, see the "Jumper configuration" section.
- If the single-line lubrication system is already pressurized, the relief phase can be triggered manually by pressing the button

8.2.2 Adjusting the lubricant volume

NOTE

Activation of this function requires the jumper setting "mobile (M)". See section "Jumper configuration".

A $\pm 25\%$ adjustment of the lubricant volume can be achieved by modifying the interval time:

- Increase the lubricant volume (+25%) by shortening the interval time.
- Reduce the lubricant volume (-25%) by shortening the interval time.

1. While pressing the button (A = +25% or B = -25%), switch on the ignition:
 - A: +25 % the top LED briefly lights up green
 - B: -25 % the bottom LED briefly lights up red
2. Release the button to apply the adjustment of the lubricant volume.
 - The adjustment is retained only until the ignition is switched off. After that, the adjustment is reset.

Table 30

Display of the adjustment of the lubricant volume

Display	Description
	• The increase in lubricant volume is shown on the display window of the membrane keyboard briefly by "25.", then by the decimal point on the right "--.":
	• The reduction in lubricant volume is shown on the display window of the membrane keyboard briefly by "75.", then by the decimal point on the left "-.":

8.2.3 Function indicator and acknowledging fault signals

Pump functions and fault signals are displayed on the multifunction pushbutton as follows:

Table 31**Function indicator**

LED indications	Description
Illuminated green LED, top	Lubrication time and holding time
Illuminated red LED, bottom	Malfunction & low-level signal (factory setting)
<i>OR:</i>	
Flashing red LED, bottom	Low-level signal
Illuminated red LED, bottom	Malfunction
The function of the red LED can be configured in the menu "P5 – programming an external display for malfunctions".	

8.3 Display mode

NOTE

Once power is applied to the pump, the pump is in display mode. The bottom-right segment on the display lights up.

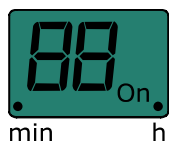
- In display mode, the user receives information about pump functions and malfunctions.
- The display is dark by default. Only the functions (segment display, circulating segment display) and malfunctions (“E1-E4”, “LL”) appear illuminated on the display.

Table 32

Applying the power supply / display test

Display

Description



When the power supply is applied to the pump, the pump is in display mode. When it is applied, a test of the display takes place, in which all segments and decimal points light up for 2 seconds. After that, the centralized lubrication pump is ready for operation.

8.3.1 Starting the sequence of the lube routine

If no error messages or fault signals appear after the test of the display, you can start and stop the sequence of interval and lubrication times via the machine contact or master controller.

8.3.2 Messages/fault signals after the test of the display

NOTE

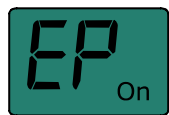
If there is a malfunction of the operator keys, this will be displayed to you immediately after the test of the display.

Table 33

Messages/fault signals after the display test

Display

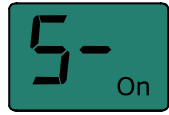
Description



min h

NOTE

The display “EP” (Error PAD) indicates an operator key malfunction.



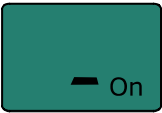
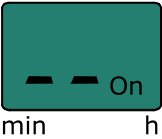
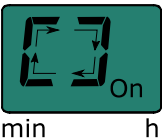
min h

When the pump is switched on, the display will show whether the pump is connected to a pressure switch or a pressure sensor. The example shows an internal pressure switch. The following possibilities are available:

- S-: Internal pressure switch
- t-: Internal pressure sensor
- tt: Internal and external pressure sensor

8.3.3 Display of the interval time and lubrication time in display mode

Table 34

Display of the interval time and lubrication time	
Display	Description
	When the pump is switched ON, the right-hand segment in the display window lights up.
	When a contact 15¹⁾ is energized (e.g., ignition in vehicles or switch-on of a machine), the left-hand segment in the display window lights up. - The interval time begins. If the machine contact/ignition is interrupted during the interval time, the pump resumes operation at the point of interruption when it is switched back on. Mobile applications: In the case of an interruption of the contact 15²⁾ (e.g., master controller), the started work cycle is paused and the single-line system is relieved of pressure. Industrial applications: In the case of an interruption of the contact 15²⁾ (e.g., machine contact), the started work cycle is ended, including pressure build-up and subsequent pressure relief. ¹⁾ See wiring diagrams ²⁾ The power supply (terminal 30) is still applied.
	The lubrication time is displayed as a circulating segment. The monitoring time starts in parallel to the lubrication time.

NOTE

The power supply of the pump must not be interrupted until the pressure in the single-line system has been relieved.

8.3.4 Error messages before and during the lubrication time

If there is no feedback from the pressure sensor/switch at the end of the interval time or when additional lubrication is initiated during the monitoring time, the pump switches off immediately. One of the flashing fault signals “E1” to “E4” appears on the display of the membrane keyboard.

Table 35

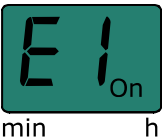
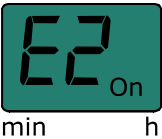
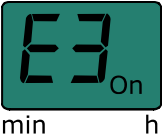
Error message during lubrication time	
Display	Description
	“E1”, monitoring time of pressure sensor/switch 1 (internal): - No pressure build-up - Monitoring time exceeded
	“E2”, monitoring time for pressure sensor 2 (external): - No pressure build-up - Monitoring time exceeded
	“E3”, monitoring time of pressure sensor/switch 1 (internal): - No pressure reduction - Pressure relief time (10 sec.) exceeded

Table 35

Error message during lubrication time

Display	Description
 min h	"E4", monitoring time for pressure sensor 2 (external): - No pressure reduction - Pressure relief time (10 sec.) exceeded
 min h	Lastly, the flashing display "LL" appears for a low-level signal that was not yet remedied. - You can acknowledge the fault first (see next section 8.3.5 Acknowledging faults) - You cannot switch to programming mode In the case of a low-level signal, the currently running lubrication time will be ended. However, the pump will no longer start automatically. The pump can then only be switched back on by means of additional lubrication.

NOTE

If malfunctions and the low-level signal occur simultaneously, the flashing displays **"E1-E4"** and **"LL"** alternate on the display window.

8.3.5 Acknowledging faults

Table 36

Acknowledging an error message in display mode

Action	Description
	To acknowledge an error message/fault signal, press the red toggle button. To acknowledge, you only need to press the button briefly, for less than 2 seconds. - In display mode, pressing the button causes the flashing display to stop flashing and become steady (acknowledgment) - Messages that were acknowledged but not remedied start flashing again when the power supply is switched off and back on again

8.4 Programming mode

NOTE

- You can switch to programming mode only during the interval time. During lubrication time, it is not possible to switch to programming mode.
- To avoid incorrect programming, always perform the program sequence in full, i.e., from “P1” to “P-” (end of programming).

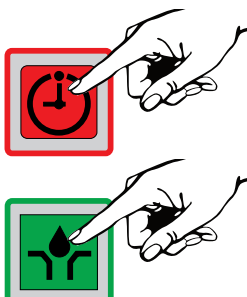
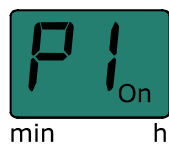
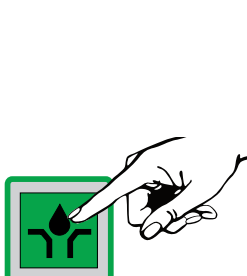
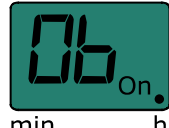
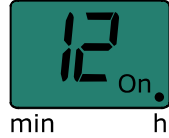
8.4.1 P1, P2 – Time control (TC)

NOTE

Activating time control requires the jumper setting “Time (TC)” (see section Jumper configuration P603S, Page 91).

Table 37

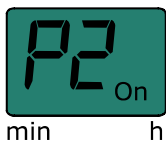
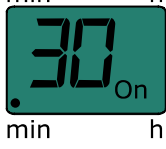
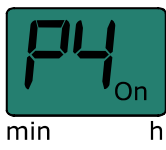
Entering settings in programming mode

Action	Display	Description
		Start programming mode 1. Press the green setting button and the red toggle button at the same time for more than 4 seconds to switch to programming mode - The display shows “P1” - When you release both buttons, the currently set value for “P1” will appear
	 	“P1”, setting of the interval time in hours (h) In this example: Factory-set value of 6 hours Hours are indicated on the display by a decimal point over “h” on the right. 2. Press the green setting button to modify the interval time in hours. The modification of the setting goes in only one direction: “00”, “01”, “02”, “03”, ... “59” hours (in this example: 12 hours) - Pressing the button once increases the value by 1 hour - Pressing and holding the button increases the hours value rapidly

NOTE

At the end of programming (P-: see “Ending the programming mode”, page 66), if you do not press the green setting button within 30 seconds, the modified parameters will not be applied and the previous programming will be retained.

Entering settings in programming mode

Action	Display	Description
		3. Confirm your entry by pressing the red toggle button and move on to the next program step - The display shows "P2" - When you release both buttons, the currently set value for "P2" will appear
	 	"P2", setting of the interval time in minutes (min) In this example: Factory-set value of 0 minutes Minutes are indicated on the display by a decimal point over "min" on the left. 4. Press the green setting button to modify the interval time in minutes. The modification of the setting goes in only one direction: "00", "01", "02", "03", ... "59" minutes (in this example: 30 minutes) - Pressing the button once increases the value by 1 minute - Pressing and holding the button increases the minutes value rapidly
		NOTE The minimum interval time is 4 minutes. If a setting < 4 is entered (with no hours entered), "04" appears on the display automatically. (Requirement: programming sequence was ended.) 5. Confirm your entry by pressing the red toggle button and move on to the next program step "P4": Continue on page 63 "P4, P5 – signal output of the fault relay".

NOTE

At the end of programming (**P-**: see "Ending the programming mode", page 66), if you do not press the green setting button within 30 seconds, the modified parameters will not be applied and the previous programming will be retained.

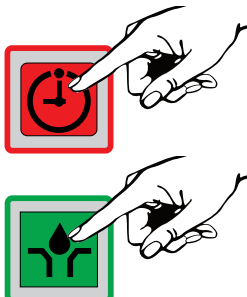
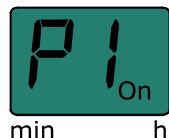
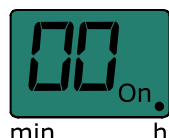
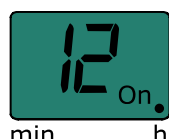
8.4.2 P1, P2 – Cycle control (CC)

NOTE

- Activating cycle control requires the jumper setting “Cycle (CC)” (see section “Jumper configuration”).
- Cycle control is not possible for mobile applications.
- Minimum pulse length: 200 ms.

Table 38

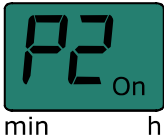
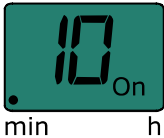
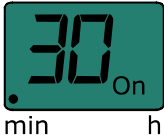
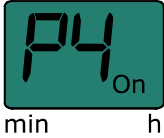
Entering settings in programming mode

Action	Display	Description
		Start programming mode 1. Press the green setting button and the red toggle button at the same time for more than 4 seconds to switch to programming mode • The display shows “P1” • When you release both buttons, the currently set value for “P1” will appear
		“P1”, setting of the interval time in pulses (x100) In this example: Factory-set value of <i>00 pulsesx100</i>
		2. Press the green setting button to modify the interval time in <i>pulsesx100</i> . The modification of the setting goes in only one direction: 00, 01, 02, 03, 99 pulses x 100 (in this example: <i>1200 pulses</i>) • Pressing the button once increases the value by 100 pulses • Pressing and holding the button increases the pulse value rapidly

NOTE

At the end of programming (P-: see “Ending the programming mode”, page 66), if you do not press the green setting button within 30 seconds, the modified parameters will not be applied and the previous programming will be retained.

Entering settings in programming mode

Action	Display	Description
		3. Confirm your entry by pressing the red toggle button and move on to the next program step - The display shows “P2” - When you release both buttons, the currently set value for “P2” will appear
		“P2”, setting of the interval time in pulses (×1) In this example: Factory-set value of 10 pulses <i>Pulses×1</i> are indicated on the display by a decimal point over “min” on the left.
		4. Press the green setting button to modify the interval time in <i>pulses×1</i>. The modification of the setting goes in only one direction: “00”, “01”, “02”, “03”, ... “99” pulses (in this example: 30 pulses) - Pressing the button once increases the value by 1 pulse - Pressing and holding the button increases the pulse value rapidly
		5. Confirm your entry by pressing the red toggle button and move on to the next program step “P4”: Continue on page 63 “P4, P5 – signal output of the fault relay”.

Example of CC cycle control:

Setting of “P1” parameter = 1200 pulses

Setting of “P2” parameter = 30 pulses

Result: The lubrication cycle is carried out after 1230 pulses.

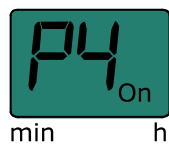
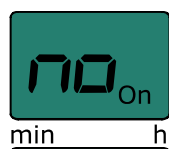
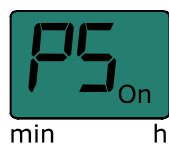
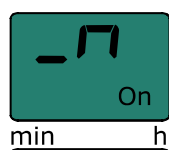
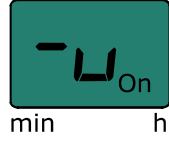
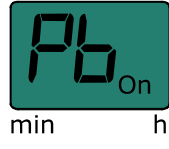
NOTE

At the end of programming (P-: see “Ending the programming mode”, page 66), if you do not press the green setting button within 30 seconds, the modified parameters will not be applied and the previous programming will be retained.

8.4.3 P4, P5 – signal output of the fault relay

Table 39

Entering settings in programming mode

Action	Display	Description
		1. Confirm your entry by pressing the red toggle button and move on to the next program step
		- The display shows “P4” - When you release both buttons, the currently set value for “P4” will appear “P4”, setting of the output signal on the monitoring relay
		In this example: factory-set value for low-level signal with stirring paddle “no” for “NO contact” or for low-level signal with stirring paddle “nc” for “NC contact”.
		2. Press the green setting button to modify the setting of the output signal on the monitoring relay. The setting will switch between:
		– “no”: Normally open contact and – “nc”: Normally closed contact
		3. Confirm your entry by pressing the red toggle button and move on to the next program step
		- The display shows “P5” - When you release both buttons, the currently set value for “P5” will appear “P5”, programming an external display for malfunctions
		In this example: factory-set value “no” for “NO contact”: Low-level signals are then detectable as an intermittent signal and malfunctions as a continuous signal (On), with the malfunctions having priority.
		If the signal on the monitoring output for external fault indication was set in “P4” as an NC contact (“nc”), the display symbol for “external fault indication nc” appears: Low-level signals are then detectable as an intermittent signal and malfunctions as a continuous signal (Off), with the malfunctions having priority.
		Differentiation, external fault signal
		4. Press the green setting button to switch the differentiation of the external fault indication on and off:
		– ON (factory setting): low-level signal = intermittent signal; malfunction = continuous signal – OFF: Low-level signal & malfunction = continuous signal
		5. Confirm your entry by pressing the red toggle button and move on to the next program step “P6”:
		– Continue on page 64 “P6 – start phase, P7 – working pressure”.

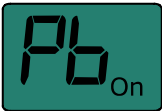
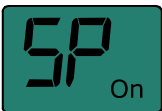
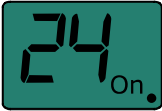
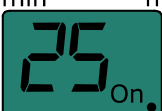
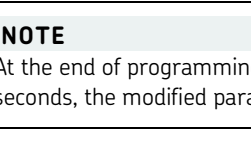
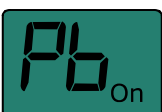
NOTE

At the end of programming (P-: see “Ending the programming mode”, page 66), if you do not press the green setting button within 30 seconds, the modified parameters will not be applied and the previous programming will be retained.

8.4.4 P6 – start phase, P7 – working pressure

Table 40

Entering settings in programming mode

Action	Display	Description
	 min h	1. Confirm your entry by pressing the red toggle button and move on to the next program step - The display shows "P6" - When you release both buttons, the currently set value for "P6" will appear
	 min h	"P6", programming the start phase Preselection for interval time or lubrication time at the start. In this example: start with interval time, "SP" (Start Pause time).
	 min h	2. Press the green setting button to modify the setting for the start phase. The setting will switch between: "SP": Every time the pump is switched on, it starts with the set interval time (Start Pause time). The first lubrication time follows when the interval time has elapsed. "S0": Every time the pump is switched on, it starts with the lubrication time "S0" (Start Operation). The first lubrication time is followed by the set interval time.
	 min h	3. Confirm your entry by pressing the red toggle button and move on to the next program step "P7" appears on the display (only with an internal pressure sensor) - When you release both buttons, the currently set value for "P7" will appear
	 min h	"P7", programming the working pressure in bar×10 (only with an internal pressure sensor) In this example: Factory-set value "24" for "240 bar":
	 min h	4. Press the green setting button to modify the working pressure in 10 bar increments. The modification of the setting goes in only one direction: "10", "11", "12", "13, ... "32" bar×10 (in this example: 250 bar) Setting range: 10 ... 32 (100 ... 320 bar) - Pressing the button once increases the value by 10 bar - Pressing and holding the button increases the pulse value rapidly
	 min h	5. Confirm your entry by pressing the red toggle button and move on to the next program step "P8": Continue on page 65 "P8 – relief pressure".

NOTE

At the end of programming (P-: see "Ending the programming mode", page 66), if you do not press the green setting button within 30 seconds, the modified parameters will not be applied and the previous programming will be retained.

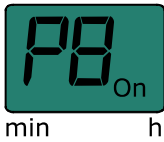
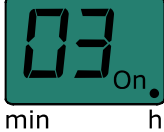
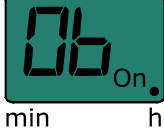
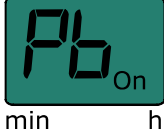
8.4.5 P8 – relief pressure

NOTE

The program step “P8” is displayed automatically if an external pressure sensor was detected.

Table 41

Entering settings in programming mode

Action	Display	Description
		1. Confirm your entry by pressing the red toggle button and move on to the next program step • “P8” appears on the display (only with an external pressure sensor) • When you release both buttons, the currently set value for “P8” will appear
		“P8”, programming the relief pressure in bar×10 (only with an external pressure sensor) In this example: Factory-set value “03” for “30 bar”:
		2. Press the green setting button to modify the working pressure in 10 bar increments. The modification of the setting goes in only one direction: “01”, “02”, “03”, ... “07” bar×10 (in this example: 60 bar) Setting range: 01 ... 07 (10 ... 70 bar)
		• Pressing the button once increases the value by 10 bar • Pressing and holding the button increases the pulse value rapidly
NOTE Base your adjustment of this setting on the relief pressure of the connected injectors, where applicable.		
3. Confirm your entry by pressing the red toggle button and move on to the end of programming, P-: – Continue on page 66 “Ending the programming mode”.		

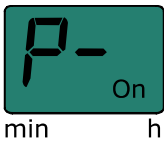
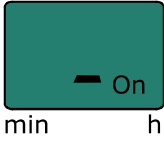
NOTE

At the end of programming (P-: see “Ending the programming mode”, page 66), if you do not press the green setting button within 30 seconds, the modified parameters will not be applied and the previous programming will be retained.

8.4.6 Ending the programming mode

Table 42

Entering settings in programming mode

Action	Display	Description
		1. Confirm your entry by pressing the red toggle button and move on to the end of programming • The display shows “P-”
		2. Press the green setting button to apply the set parameters

NOTE

- If you do not press the green setting button within 30 seconds, the modified parameters will not be applied and the previous programming will be retained.
- After the end of programming, check the setting of the parameters in operation mode (see section Operation mode, Page 67).

8.5 Operation mode

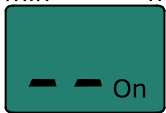
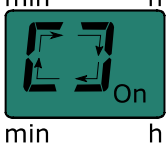
NOTE

The operation mode is available only during the interval time. During lubrication time, it is not possible to switch to operation mode.

8.5.1 Additional lubrication

Table 43

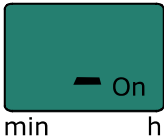
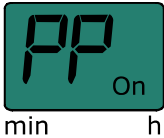
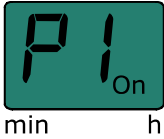
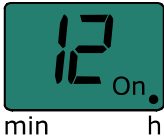
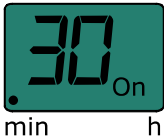
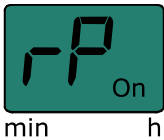
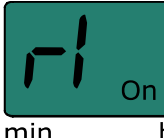
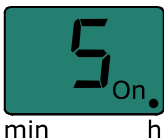
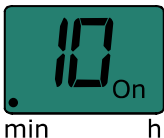
Triggering additional lubrication

Action	Display	Description
Display with ignition switched off:		Requirement: Power supply is applied and the lower right-hand segment lights up.
Display with ignition switched on:		
		
		1. Press the green setting button for more than 2 seconds to trigger an additional lubrication (with ignition switched off: max. 2x; with ignition switched on: unlimited)
		The lubrication time starts. A circulating segment is visible on the display throughout the entire running time. At the same time, the expired interval time is reset.
		NOTE If the single-line lubrication system is already pressurized, the relief phase can be triggered manually by pressing the green setting button.

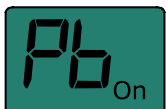
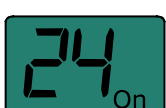
8.5.2 Parameter and status display

Table 44

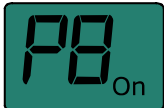
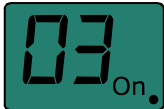
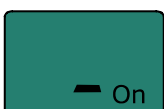
Displaying parameter settings and status

Action	Display	Description
		Requirement: Power supply is applied and the lower right-hand segment lights up.
		1. Press the red toggle button until the display shows “PP” (interval time time-controlled, TC) or “PI” (interval time cycle-controlled, CC)
		• The displays shown below appear once and come to an end after 40 seconds. The display changes every two seconds.
		“PP”, interval time time-controlled, TC: 12 hours “PI”, interval time cycle-controlled, CC: 12 pulses×100 = 1200 pulses
		“PP”, interval time time-controlled, TC: 12 hours 30 minutes “PI”, interval time cycle-controlled, CC: 30 pulses = 1230 pulses
		“rP”, remaining interval time
		“rI” remaining pulses
		“rP”, remaining interval time when time-controlled, TC: 5 hours “rI”, remaining pulses when cycle-controlled, CC: 5×100 pulses = 500 pulses
		“rP”, remaining interval time when time-controlled, TC: 5 hours 10 minutes “rI”, remaining pulses when cycle-controlled, CC: 10 pulses = 510 pulses

Displaying parameter settings and status

Action	Display	Description
	 min h	“P4”, programming of the output signal
	 min h	“P4”, display of the output signal “no” (NO contact) • For empty signal with stirring paddle
	 min h	“P5”, differentiation between low-level signal and malfunction
	 min h	“P5”, differentiation active (malfunction/low-level signal)
	 min h	“P6”, programming of the start phase
	 min h	“P6”, display of the start phase with “SP” (interval time)
	 min h	“P7”, preselection of working pressure (only with internal pressure sensor)
	 min h	“P7”, display of internal working pressure: $24 \times 10 = 240 \text{ bar}$

Displaying parameter settings and status

Action	Display	Description
	 min h	"P8", preselection of the relief pressure (only with external pressure sensor)
	 min h	"P8", display of external working pressure: $3 \times 10 = 30 \text{ bar}$
	 min h	"PE", program edition (e.g., 01.03)
	 min h	"PE", display of program main version: 01
	 min h	"PE", display of program sub-version: 03
	 min h	At the end of the operation mode, after the display has run through the parameters and status once, the lower right-hand segment indicator appears (interval time).

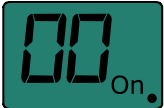
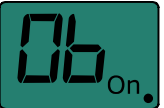
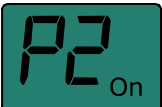
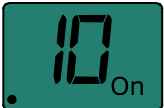
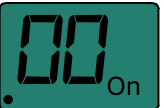
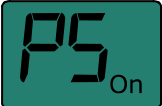
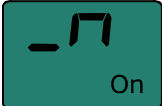
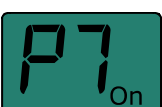
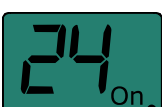
8.6 Factory setting

NOTE

- CC: Cycle Control
 - TC: Time Control
 - 2S: 2 pressure sensors/switches (quantity)
- See section Jumper configuration P603S, Page 91

Table 45

Factory setting of the programming

Program step	Factory setting	Description
 min h	CC:  min h TC:  min h	Interval time CC: Factor 100 / TC: Hours • CC: 0 pulses • TC: 6 hours
 min h	CC:  min h TC:  min h	Interval time CC: Factor 1 / TC: Minutes • CC: 10 pulses • TC: 00 minutes
 min h	CC:  min h TC:  min h	Signal output of the fault relay Signal output during low-level signal or malfunction (ON): • no (NO contact) for reservoirs with stirring paddle • nc (NC contact) for reservoirs with follower plate
 min h	 min h	Differentiation, external fault signal: • no (P4) – Setting of the signals: NO contact – Low-level signal (LL): intermittent signal – Malfunction (E1–E4): Continuous signal
 min h	 min h	Start phase • SP: Start with pause time
 min h	 min h	Only with internal pressure sensor (1S+SE)! (Pressure switch: invariable working pressure) • 24: working pressure ("24" equates to 240 bar)
 min h	 min h	Only with external pressure sensor (2S+SE) (optional) • 03: permissible residual pressure ("03" equates to 30 bar)

9. Maintenance and repair

Careful and regular maintenance is required in order to detect and remedy possible faults in time. The operator must always determine the specific intervals according to the operating conditions, review them regularly, and adjust them where necessary. If necessary, copy the table for regular maintenance activities.

Table 46

Checklist: Maintenance activities

Activity to be performed	YES	NO
Mechanical and electrical system connections established correctly	☐	☐
The performance characteristics for the aforementioned connections match the specifications in the "Technical data"	☐	☐
All components such as lubrication lines and metering devices are correctly installed	☐	☐
Product is protected by a suitable pressure relief valve	☐	☐
No apparent damage, contamination, or corrosion	☐	☐
Any dismantled protective and monitoring equipment is fully reinstalled and functional	☐	☐
All warning labels on the product are present and in proper condition	☐	☐
No unusual noises, vibrations, moisture accumulation, or odors present	☐	☐
No undesired discharge of lubricant (leakages) at connections	☐	☐
Lubricant is fed without bubbles	☐	☐
The bearings and friction points requiring lubrication receive the planned lubricant volume	☐	☐

10. Cleaning

10.1 Basics

Cleaning should be carried out in accordance with the operator's own company rules, and cleaning agents and devices and the personal protective equipment to be used should likewise be selected in accordance with those rules. Only cleaning agents compatible with the materials may be used for cleaning. Completely remove any cleaning agent residue left on the product and rinse with clear water. Unauthorized persons must be kept away. Use signage to indicate wet areas.

10.2 Interior cleaning

The interior normally does not need to be cleaned. The interior of the product must be cleaned if incorrect or contaminated lubricant accidentally enters the product. Please contact our Service department.

10.3 Exterior cleaning

Do not allow any cleaning fluid to enter the interior of the product during cleaning.

WARNING

Risk of fatal electric shock



Cleaning work may only be performed on products that have been de-energized first. When cleaning electrical components, be mindful of the IP enclosure rating.

WARNING

Serious injury from contact with or inhalation of hazardous substances



Wear personal protective equipment. Observe the safety data sheet (SDS) of the hazardous substance. Avoid contaminating other objects or the environment during cleaning.

11. Faults, causes, and remedies

Table 47

Fault table

Fault	Possible cause	Remedy
Pump does not run	- Power supply to pump interrupted. Green segment display for On/h on the display window does not light up. - Main machine is switched off - Pump power cable detached or defective - External fuse defective - The pump is in interval time - The motor of the pump is faulty - Internal cable break - Control circuit board is faulty - Faulty button on the membrane keyboard	- Check whether one of the specified faults exists, and remedy it according to responsibility. - Faults outside one's own scope of responsibility must be reported to the supervisor for initiation of further measures. - Please contact our Customer Service if you cannot determine or resolve the error.
Pump runs, but supplies either no lubricant at all or not enough	- Air inclusions in the lubricant - Unsuitable lubricant used - Suction bore of the pump element clogged. - Pump piston is worn - The check valve on the pump element is faulty or clogged. - Other damage	- Trigger additional lubrication several times. The lubricant must discharge without bubbles. - Renew the lubricant. - Remove the pump element, investigate the suction bore for foreign substances, and remove any found. - Replace the pump element. - Contact our Service department.
	Low-level signal (flashing) Reservoir empty. The current lubrication cycle will be ended. The pump will not start again automatically until the reservoir is filled. However, an additional lubrication is possible.	Fill the reservoir with clean lubricant designed for the intended application. Run the pump by triggering additional lubrications until the lubricant discharges at all lubrication points.
	Error message E1 Pressure build-up error (internal pressure monitoring): pressure P1 was not reached within the monitoring time.	Check the system. You may need to reduce the working pressure.
	Error message E2 Pressure build-up error (internal or external pressure monitoring): pressure P1 or P2 was not reached within the monitoring time.	
	Error message E3 Pressure reduction error (internal pressure monitoring). The pressure did not drop to the required level during the monitoring time.	- Trigger an additional lubrication. The motor rotates in the relief direction (max. 10 sec.). If the pressure is relieved successfully, the error message disappears. - If the pressure is not relieved: reduce the system pressure and repeat step 1 again. If the error message persists: check the pressure relief components or contact our Customer Service.
	Error message E4 Pressure reduction error (external pressure monitoring). The pressure did not drop to the required level during the monitoring time.	

Fault table

Fault	Possible cause	Remedy
	Error message EP • An error on the membrane keyboard or the display has occurred.	Replacing the membrane keyboard

12. Repairs

⚠ WARNING



Risk of injury

At a minimum, the following safety measures must be taken before any repairs:



- Unauthorized persons must be kept away
- Mark and secure the work area
- Depressurize the product
- Isolate the product, and lock and tag it out
- Check to ensure live voltage is no longer present
- Ground and short-circuit the product
- Cover any adjacent live parts

NOTE

Tightening torque = 40 Nm $\pm$ 2.0 Nm [29.5 ft.lb. $\pm$ 1.5 ft.lb.]

3. Afterwards, screw a new pressure relief valve (Fig. 40/2) into the pump element.

NOTE

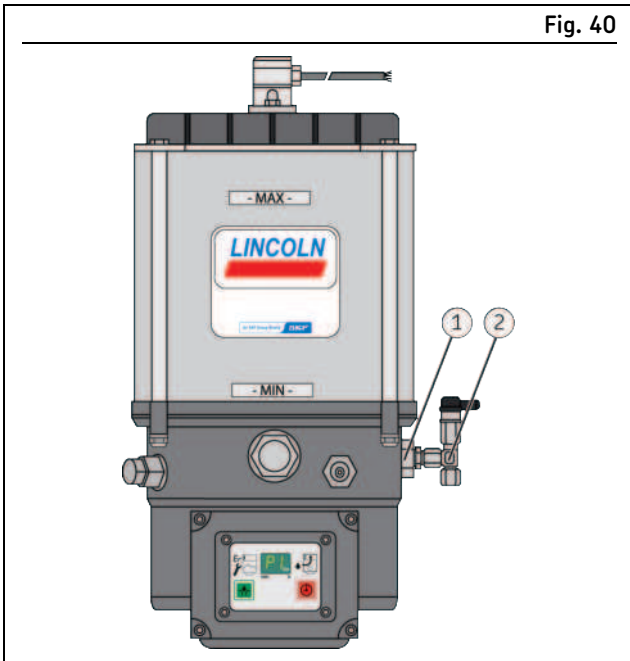
Tightening torque = 6 Nm $\pm$ 0.5 Nm [4.43 ft.lb. $\pm$ 0.07 ft.lb.]

12.1 Replacing pump element and pressure relief valve

NOTE

The characteristics of the new pump element must match the characteristics of the pump element to be replaced.

Fig. 40

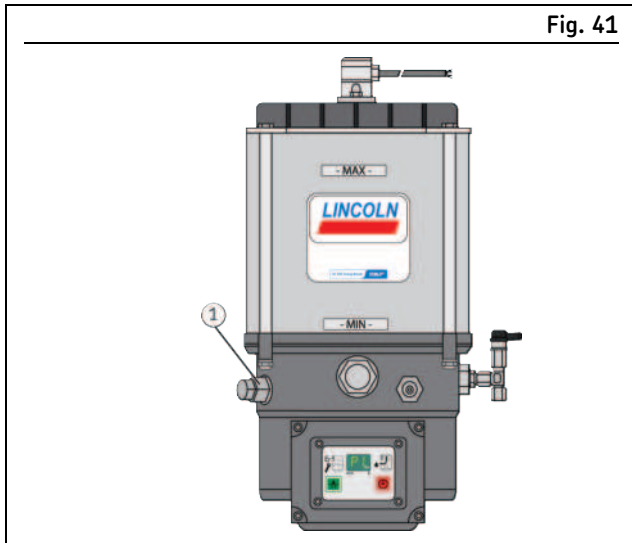


Replace the pump element

Proceed as follows to replace the pump element:

1. Remove the defective pump element (Fig. 40/1) from the pump housing together with the pressure relief valve (Fig. 40/2), by unscrewing on the hexagon of the pump element.
2. Screw the new pump element (Fig. 40/1) together with a new packing ring into the pump housing.

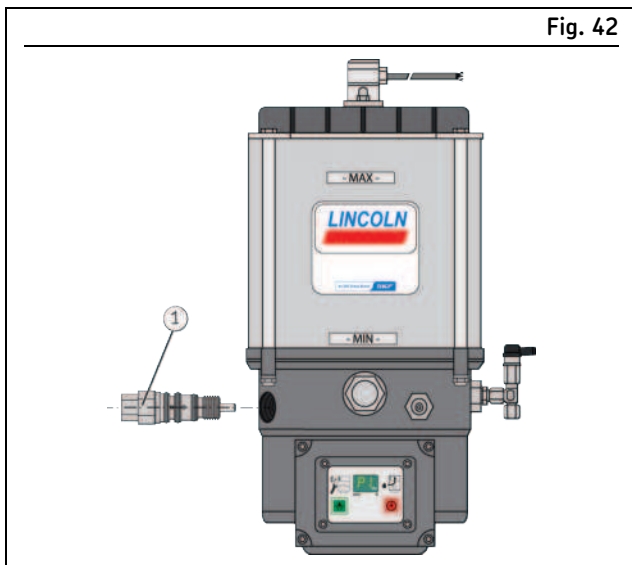
12.2 Replacing the pressure-relief element



Replacing the pressure-relief element

Proceed as follows to replace the pressure-relief element:

1. Remove the pressure-relief element (Fig. 41/1) from the pump housing by unscrewing on the hexagon of the pump element.



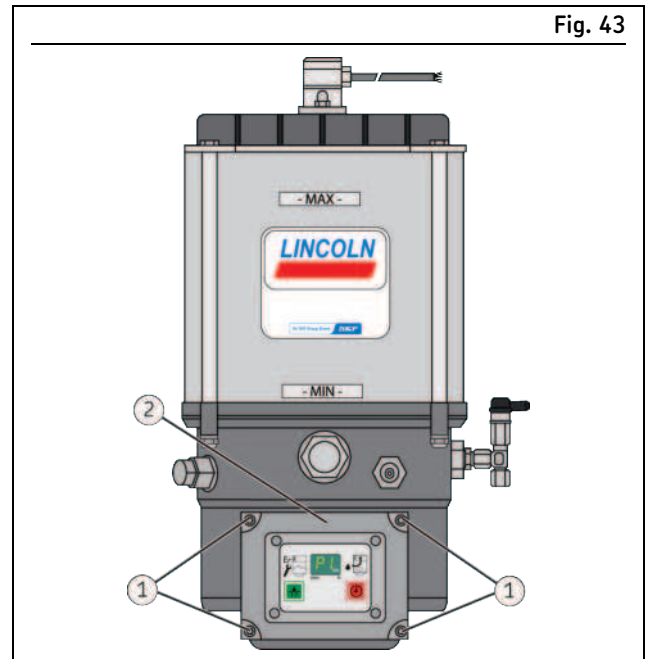
Replacing the pressure-relief element

2. Screw the new pressure-relief element (Fig. 42/1) together with a new packing ring into the pump housing.

NOTE

Tightening torque = 15 Nm $\pm$ 1.5 Nm [11.06 ft.lb. $\pm$ 1.1 ft.lb.]

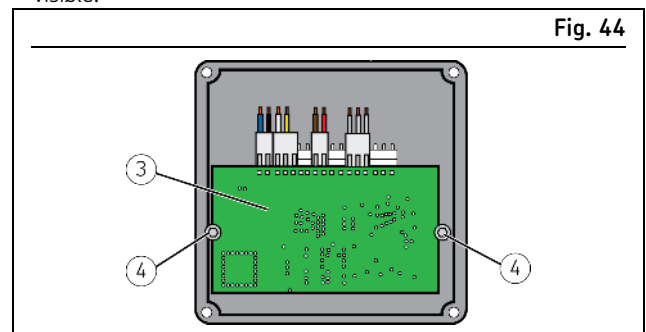
12.3 Replacing the membrane keyboard



Replacing the membrane keyboard

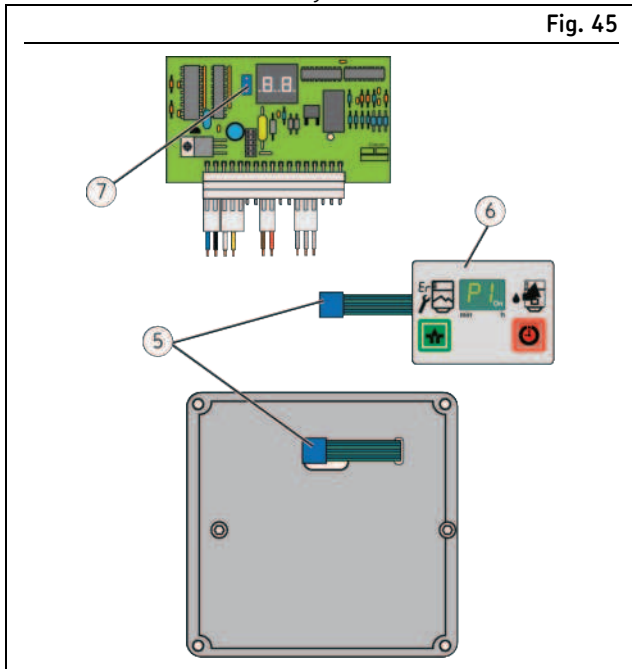
Proceed as follows to replace the membrane keyboard:

1. Check that the new membrane keyboard matches the documentation and the intended use.
2. Take safety measures as specified in the warning at the beginning of this Chapter.
3. Take protective measures against electrostatic discharge.
4. Remove the screws (Fig. 43/1) from the housing attachment (Fig. 43/2).
5. Detach the housing attachment (Fig. 43/2) from the pump housing and keep the parts for later use.
6. Detach the control circuit board (Fig. 44/3) by undoing the two screws (Fig. 44/4).
7. Carefully tilt the control circuit board (Fig. 44/3) up until the connection for the membrane keyboard (Fig. 45/5) becomes visible.



Replacing the membrane keyboard

8. Detach the connector of the membrane keyboard (Fig. 45/5) from the control circuit board.
9. Carefully detach and remove the membrane keyboard (Fig. 45/6) from the housing by pulling it forward.
10. Insert the connector of the new membrane keyboard (Fig. 45/5) through the opening on the front of the housing attachment, and plug it into the corresponding connection point on the control circuit board (Fig. 45/7). Make sure the connector is oriented correctly.



Replacing the membrane keyboard

11. Install in reverse order of removal.

NOTE

Torque for tightening the screws (1) of the housing attachment: 2.5 Nm + 0.1 Nm [1.85 ft.lb. - 0.07 ft.lb.]

13. Shutdown, disposal

13.1 Temporary shutdown

Temporary shutdowns should be done by a course of action to be defined by the operator.

13.2 Permanent shutdown, disassembly

Permanent shutdown and disassembly of the product must be planned properly by the operator and conducted in compliance with all applicable laws and regulations.

13.3 Disposal

The waste producer/operator must dispose of the various types of waste in accordance with the applicable laws and regulations of the country in question.

14. Spare parts

Spare parts may be used exclusively for replacement of identical defective parts. Modifications with spare parts on existing products are not allowed.

14.1 Housing attachment, complete

Designation	Pcs.	Item number	Figure
Housing attachment, complete	1	545-33596-1	

Delivery including profile sealing ring and the appropriate number of screws for installation

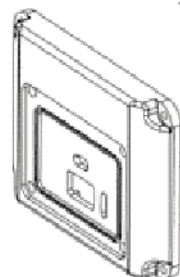


Table 48

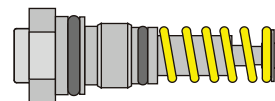
14.2 Membrane keyboard

Designation	Pcs.	Item number	Figure
Membrane keyboard	1	236-14340-7	



14.3 Pump elements

Designation	Pcs.	Item number C3 design	Item number C5-M design	Figure
Pump element Z7 incl. packing ring	1	645-77196-1	645-77625-1	



14.4 Pressure-relief element

Designation	Pcs.	Item number	Figure
Pressure-relief element C3	1	545-33042-1	
Pressure-relief element C5-M	1	545-33858-1	

Supply includes packing rings

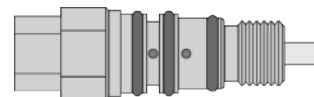
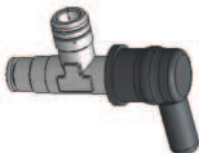
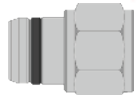


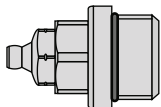
Table 49

14.5 Pressure relief valves and adapters

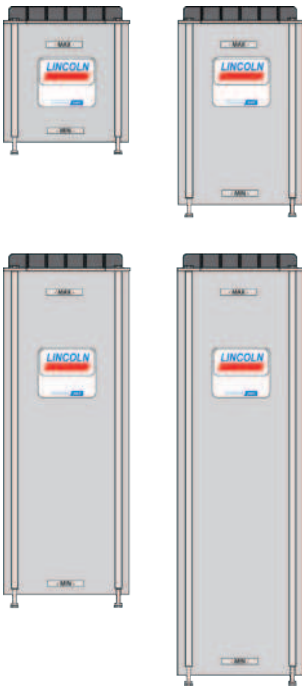
Designation	Pcs.	Item number	Figure
SVTS-350-R1/4-D 8	1	624-28895-1	
SVTS-350-R1/4-D 8 DN	1	624-77917-1	
SVTS-350-R1/4-D10	1	624-77422-1	
SVTS-350-R1/4-D10 DN	1	6240-00000004	
Adapter S2520 1/4-1/4 PTFE packing ring	1	226-14105-5	

Other pressure limiting valves in C3 and C5-M on request.

14.6 Adapter with lubricant nipple

Designation	Pcs.	Item number	Figure
Adapter with lubricant nipple A2 AR 1/4 incl. seal	1	519-33959-1	
Adapter with lubricant nipple ST AR 1/4 incl. seal	1	519-33955-1	

14.7 Transparent reservoir

Designation	Pcs.	Item number	Figure
4XNBO A,B,C	1	545-33761-1	
4XLBO A,B,C	1	545-33758-1	
8XNBO A,B,C	1	545-33762-1	
8XLBO A,B,C	1	545-33759-1	
15XNBO A,B,C	1	545-33763-1	
15XLBO A,B,C	1	545-33754-1	
20XNBO A,B,C	1	545-33764-1	
20XLBO A,B,C	1	545-33760-1	

Delivery includes: A = Lincoln/SKF logo, B = MIN / MAX stickers, C = O-ring

NOTE

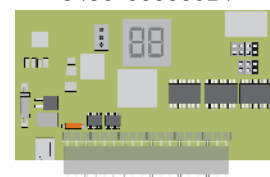
Other transparent reservoirs on request.

14.8 Reservoir cover

Designation	Pcs.	Item number	Figure
Reservoir cover XLBO 4 to 20 l [1.06 to 5.28 gal.]	1	544-33452-1	

14.9 Replacement kit for control circuit board

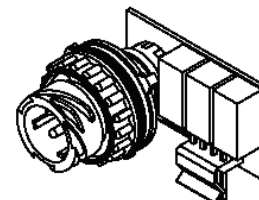
Designation	Pcs.	Item number	Figure
Replacement kit for control circuit board P603S	1	5450-00000023	5450-00000023
Replacement kit for control circuit board, used, P603S (terminal 15/30 jumpered) Delivery including O-ring	1	5450-00000024	5450-00000024



14.10 Replacement kit for relay circuit board

Designation	Pcs.	Item number	Figure
Replacement kit for relay circuit board, P603S	1	5450-00000025	

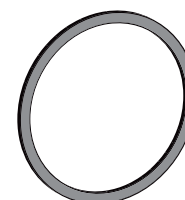
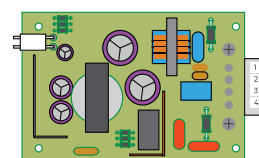
Delivery including O-ring



14.11 Replacement kit for power supply board

Designation	Pcs.	Item number	Figure
Replacement kit for power supply board, P603S	1	545-60459-1	

Delivery including O-ring



14.12 Pressure sensor/pressure switch

Designation	Pcs.	Item number	Figure
Pressure sensor 0.5 to 4.5 VDC, 0 to 400 bar (internal)	1	234-10663-6	—
Pressure switch 240 bar, NO contact G1/4" (internal)	1	234-10723-8	

14.13 Accessories

Designation	Pcs.	Item number	Figure
Power lead 10 m (33 ft.) with bayonet connector (7/7-pin)	1	664-34428-3	
Power cable 10 m (33 ft.), shielded, with bayonet socket (4/3-pin)	1	664-34741-7	
Pushbutton, red/green 12 V (no image)	1	236-10580-5	
Pushbutton, red/green 24 V (no image)	1	236-10280-9	

15. Appendix

15.1 Terminal diagram

15.1.1 P603S DC for mobile applications

Fig. 46

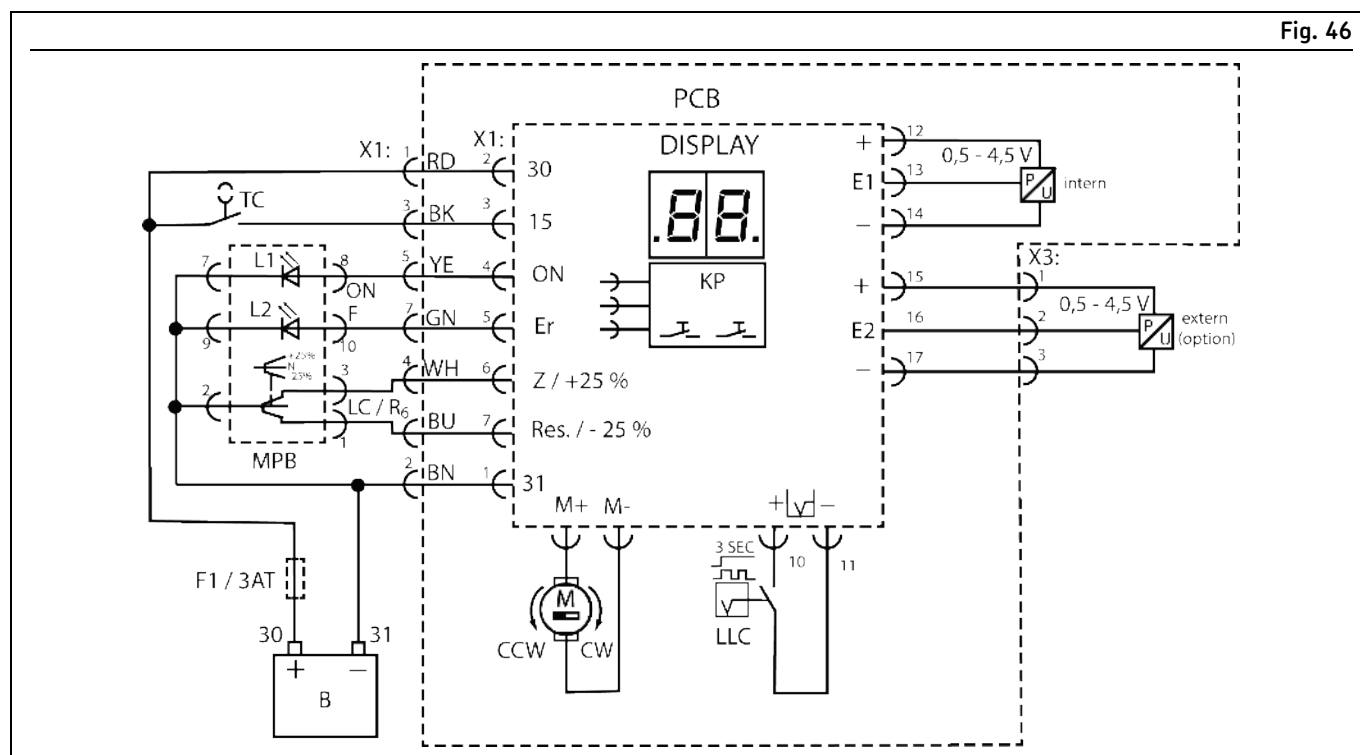


Table 50

Key to terminal diagram			
Symbol	Description	Symbol	Description
X1	Bayonet connector, 7-pin	CW	ClockWise
X3	Bayonet connector, 4-pin	CCW	CounterClockWise
30	Battery +	LLC	Low-Level Control
31	Battery –	Res./R	Reset
B	Battery 24 VDC	E1	Internal pressure sensor/switch
15/TC	Master controller	E2	External pressure sensor (optional)
ON	On	P/U	Internal pressure sensor/switch (optionally: external), SE
L1	green LED	±25%	Temporarily increased/reduced lubrication
Er/F	Error (E1–E4), low-level signal (LL)	rt	red
L2	red LED	sw	Black
Z/LC	Additional lubrication	gb	yellow
PCB	Printed Circuit Board (control circuit board)	gn	green
Display	Display panel	ws	white
KP	Membrane keyboard	bl	blue
MPB	Multifunction PushButton	br	brown
M	Motor		

15.1.2 P603S DC for industrial applications

Fig. 47

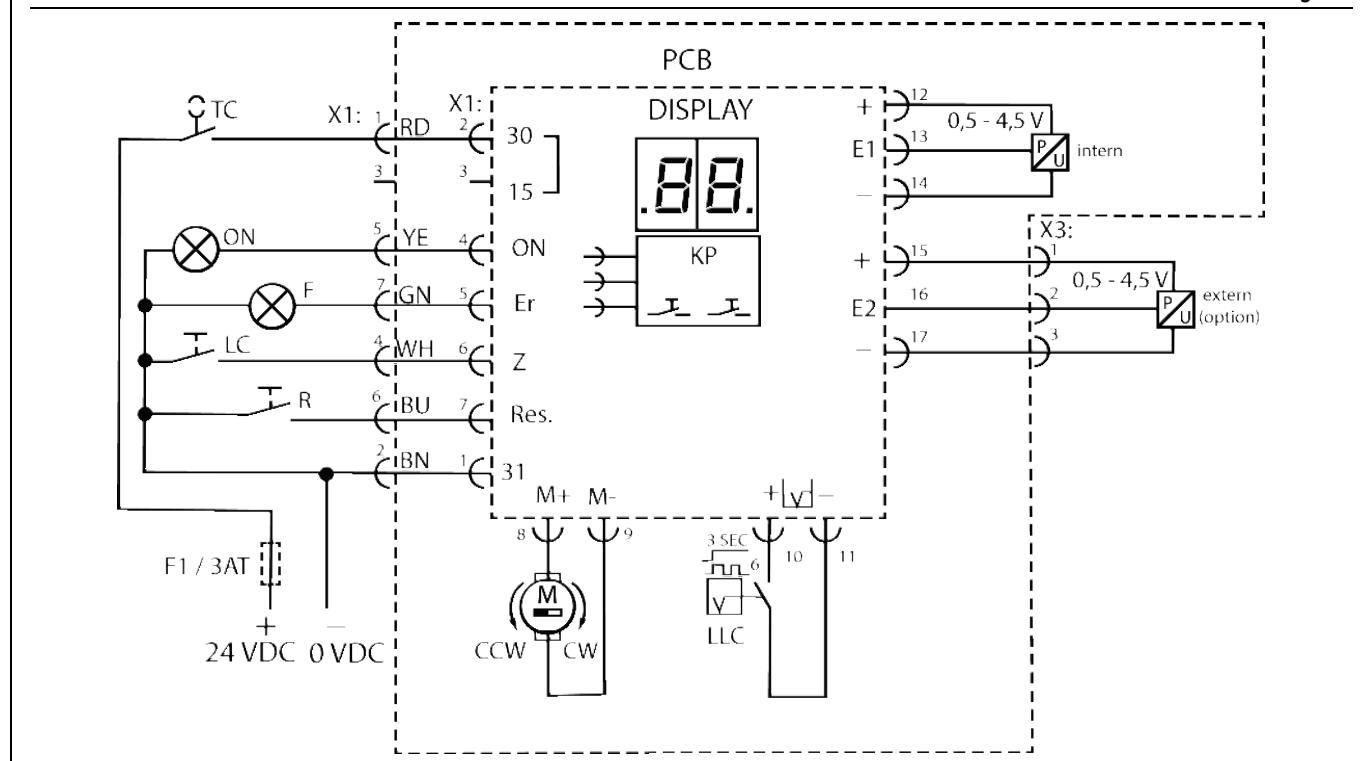


Table 51

Key to terminal diagram

Symbol	Description	Symbol	Description
X1	Bayonet connector, 7-pin	LLC	Low-Level Control
X3	Bayonet connector, 4-pin	Res./R	Reset
15	Jumpered with terminal 30	E1	Internal pressure sensor/switch
30	24 VDC +	E2	External pressure sensor (optional)
31	0 VDC -	P/U	Internal pressure sensor/switch (optionally: external), SE
15/TC	Machine contact (e.g., from machine or time control)	rt	red
ON	On	sw	black
Er/F	Error (E1–E4), low-level signal (LL)	gb	yellow
Z/LC	Additional lubrication	gn	green
PCB	Printed Circuit Board (control circuit board)	ws	white
Display	Display panel	bl	Blue
KP	Membrane keyboard	br	brown
M	Motor		
CW	ClockWise		
CCW	CounterClockWise		

15.1.3 P603S AC for industrial applications

Fig. 48

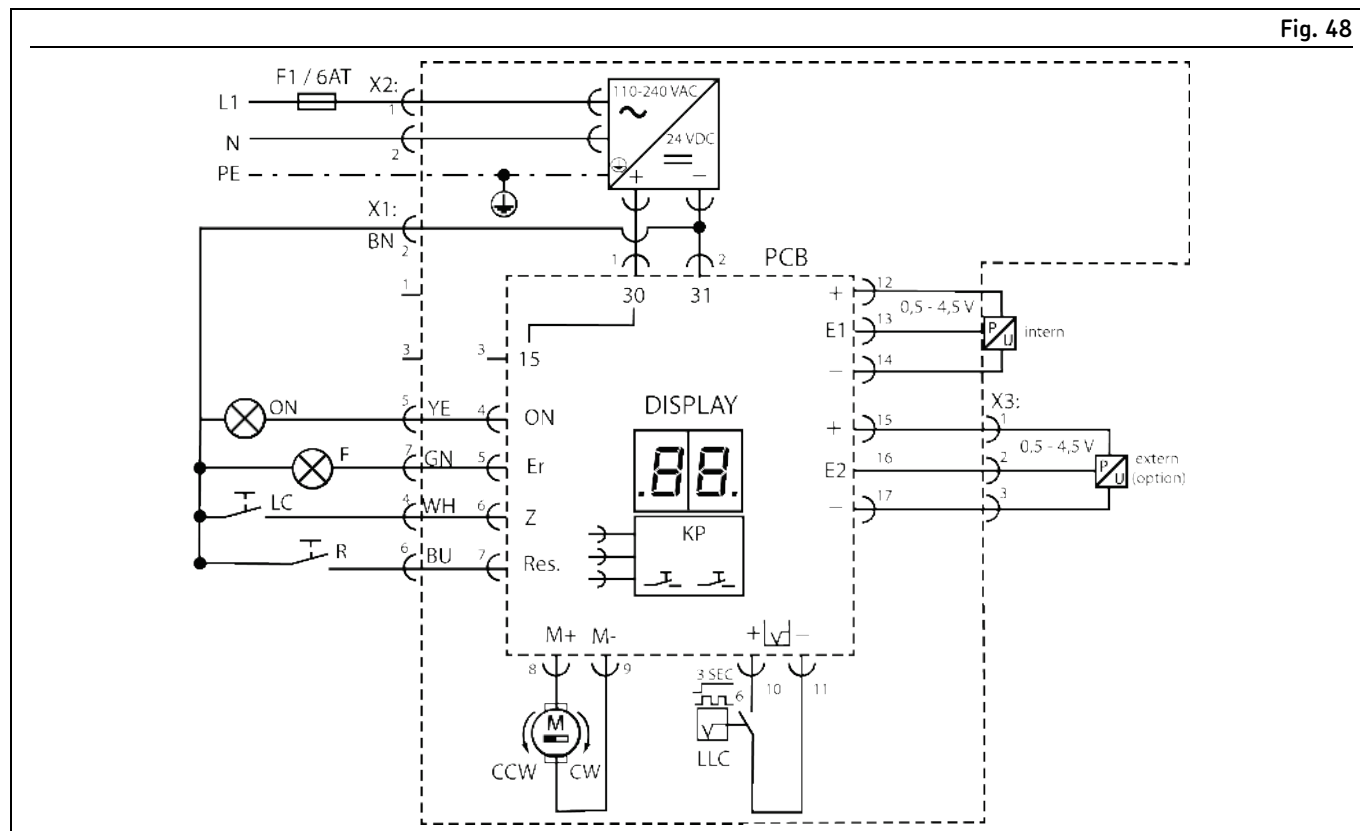


Table 52

Key to terminal diagram

Symbol	Description	Symbol	Description
X1	Bayonet connector, 7-pin	LLC	Low-Level Control
X2	Rectangular connector, 3-pin	Res./R	Reset
X3	Bayonet connector, 4-pin	E1	Internal pressure sensor/switch
L1/N	Power supply 110 to 240 VAC $\pm 10\%$, 50/60 Hz $\pm 5\%$	E2	External pressure sensor (optional)
15	Jumpered with terminal 30	P/U	Internal pressure sensor/switch (optionally: external), SE
30	24 VDC +	rt	red
31	0 VDC -	sw	black
F1	2A fuse (supplied by the owner-operator of the lubrication system)	gb	yellow
ON	On	gn	green
Er/F	Error (E1-E4), low-level signal (LL)	ws	white
Z/LC	Additional lubrication	bl	blue
PCB	Printed Circuit Board (control circuit board)	br	brown
Display	Display panel		
KP	Membrane keyboard		
M	Motor		
CW	ClockWise		
CCW	CounterClockWise		

15.1.4 P603S AC for industrial applications with machine contact

Fig. 49

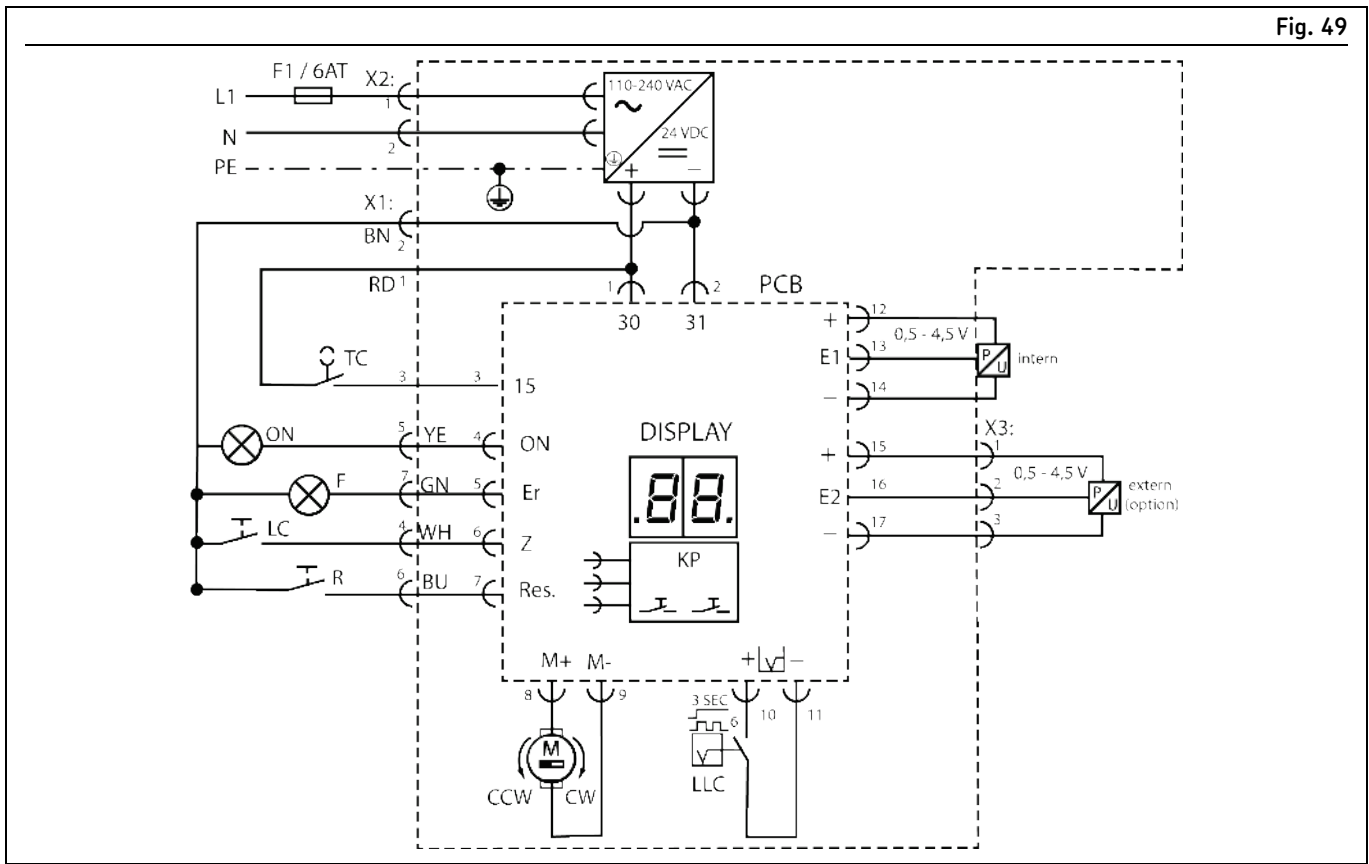


Table 53

Key to terminal diagram

Symbol	Description	Symbol	Description
X1	Bayonet connector, 7-pin	CW	ClockWise
X2	Rectangular connector, 3-pin	CCW	CounterClockWise
X3	Bayonet connector, 4-pin	LLC	Low-Level Control
L1/N	Power supply 110 to 240 VAC $\pm 10\%$, 50/60 Hz $\pm 5\%$	Res./R	Reset
15/TC	Machine contact (e.g., from machine or time control)	E1	Internal pressure sensor/switch
30	24 VDC +	E2	External pressure sensor (optional)
31	0 VDC -	P/U	Internal pressure sensor/switch (optionally: external), SE
F1	2A fuse (supplied by the owner-operator of the lubrication system)	rt	red
ON	On	sw	black
Er/F	Error (E1-E4), low-level signal (LL)	gb	yellow
Z/LC	Additional lubrication	gn	green
PCB	Printed Circuit Board (control circuit board)	ws	white
Display	Display panel	bl	blue
KP	Membrane keyboard	br	brown
M	Motor		

15.1.5 P603S AC for industrial applications with relay circuit board (optional)

Fig. 50

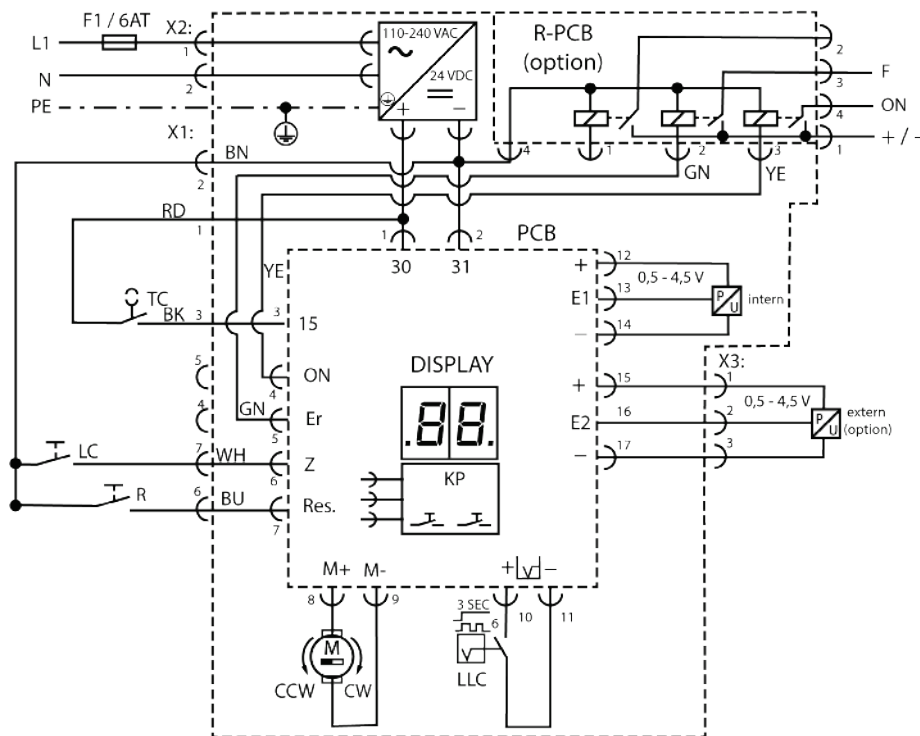


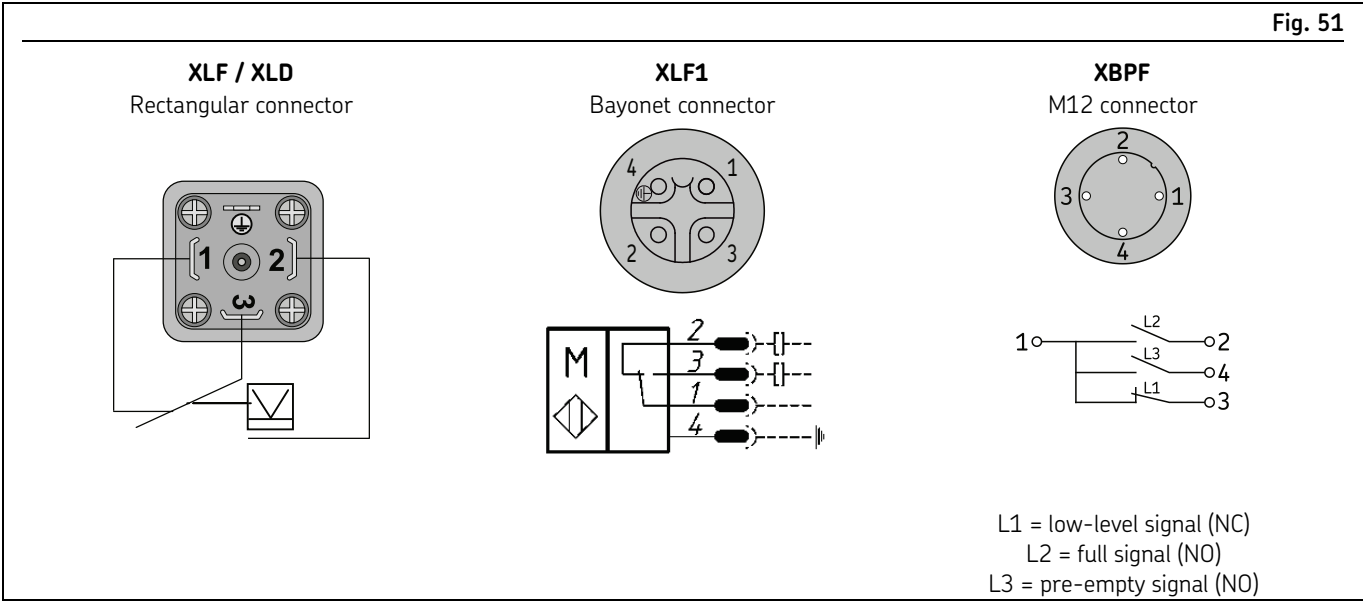
Table 54

Key to terminal diagram

Symbol	Description	Symbol	Description
X1	Bayonet connector, 7-pin	CW	ClockWise
X2	Rectangular connector, 3-pin	CCW	CounterClockWise
X3	Bayonet connector, 4-pin	LLC	Low-Level Control
X4	Bayonet connector, 4-pin (optional)		
L1/N	Power supply 110 to 240 VAC $\pm 10\%$, 50/60 Hz $\pm 5\%$	Res./R	Reset
15/TC	Machine contact (e.g., from machine or time control)	+/-	Customer's infeed potential
30	24 VDC +	E1	Internal pressure sensor/switch
31	0 VDC -	E2	External pressure sensor (optional)
F1	2A fuse (supplied by the owner-operator of the lubrication system)	P/U	Internal pressure sensor/switch (optionally: external), SE
ON	On	rt	red
Er/F	Error (E1-E4), low-level signal (LL)	sw	black
Z/LC	Additional lubrication	gb	yellow
PCB	Printed Circuit Board (control circuit board)	gn	green
R-PCB	Relay Printed Circuit Board (optional)	ws	white
Display	Display panel	bl	blue
KP	Membrane keyboard	br	brown
M	Motor		

15.1.6 Terminal diagram for low-level signal on reservoir lid

NOTE
The low-level signal is connected on the pump housing using a PG9 screwed gland

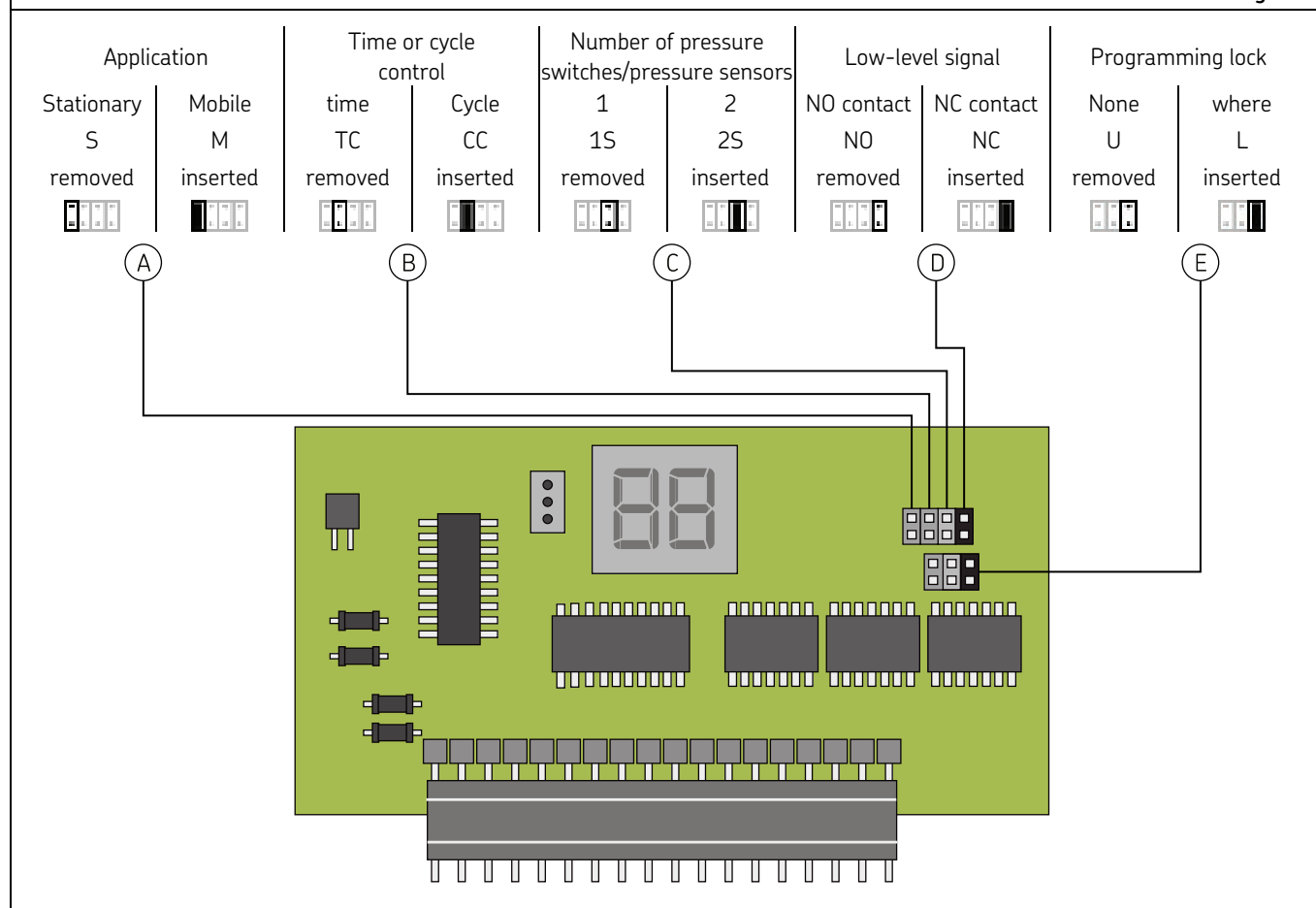


Terminal diagram of the reed switch for the low-level signal on the reservoir lid; shown in unactuated state

Table 55	
Electrical data	
	Reed switch for low-level signal
Switching capacity, max.	60 VA
Max. switching voltage	10 to 30 V AC/DC
Max. switched current	700 mA

15.2 Jumper configuration P603S

Fig. 52



Location of the jumpers on the control circuit board

NOTE

Changes to the jumper configuration are only detected after the pump has been de-energized.

Table 56

Jumper configuration P603S

Setting options

Application

Time or cycle control

Number of pressure
sensors/pressure
switches
(Fig. 52/C)

Low-level signal

Programming lock³⁾

(Fig. 52/A)

(Fig. 52/B)

(Fig. 52/C)

(Fig. 52/D)

(Fig. 52/E)

Stationary

Mobile

Time

Cycle

1

2

NO
contact

NC contact

None

where

S

M

TC

CC

1S

2S*

NO^{a)}NC^{b)}

U

L

Jumper position

 = removed = inserted

Combination no.

S00	B00 ²⁾		X		X		X		X		X
S01	B01		X	X		X		X	X		
S02	B02		X	X			X		X		
S03	B03		X	X		X		X			X
S04	B04		X	X			X		X		X
S05	B05	X			X	X		X	X		
S06	B06	X			X	X		X			X
S07	B07	X			X		X		X	X	
S08	B08	X			X		X		X		X
S09	B09	X			X	X		X		X	
S10	B10	X			X	X		X			X
S11	B11	X			X		X		X		
S12	B12	X			X		X		X		X
S13	B13	X		X		X		X	X		
S14	B14 ¹⁾	X		X		X		X			X
S15	B15	X		X			X		X	X	
S16	B16	X		X			X		X		X
S17	B17	X		X		X		X		X	
S18	B18	X		X		X		X			X
S19	B19	X		X			X		X		
S20	B20	X		X			X		X		X
S21	B21		X	X		X		X			X
S22	B22		X	X		X		X		X	
S23	B23		X	X			X		X		
S24	B24		X	X			X		X		X

Control circuit board B00–B24: terminals 15/30 connected within the PCB

Control circuit board S00–S24: standard (replacement kit)

¹⁾ Example B14: Schematic representation of control circuit board 236-10892-1²⁾ S00/B00 = configuration on delivery (replacement kit)³⁾ Programming lock (L) permits only display mode and operation mode^{a)} XNBO without low-level signal or XLBO with stirring paddle^{b)} With follower plate XLF(1)

* Possible only with pressure sensor

15.3 China RoHS Table

Table 57

部件名称 (Part Name)	有毒害物质或元素 (Hazardous substances)					
	铅	汞	镉	六价铬	多溴联苯	多溴二苯醚
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr(VI))	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
用钢和黄铜加工的零件 (Components made of machining steel and brass)	X	0	0	0	0	0
本表格依据SJ/T11364的规定编制 (This table is prepared in accordance with the provisions of SJ/T 11364.)						
0 :	表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572 规定的限量要求以下。 (Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.)					
X :	表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572标准规定的限量要求。 (Indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.)					

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PUB 951-171-073-EN 20.10.2022