Operation Manual

for

SLM Magnet Drive for Assembly with

Glandless Screw Pumps

SLM LV

Execution acc. to Directive 94/9/EC

07/2005

BAE-35900-Coversheet-02.doc

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Contents of Operation Manual

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This operation manual describes the following SLM magnet drives for assembly with Glandless Screw Pumps:

- of bearing-support construction with grease-lubricated anti-friction bearings
    - SLM LVS
- of bearing-support construction with oil-lubricated anti-friction bearings
    - SLM LVO
- of close-coupled construction
    - SLM LVB

Prior to commissioning, this operation manual must be read thoroughly and fully understood by the operational staff (erecting and qualified staff). The manual contains important instructions for the safe operation and designated use of the pump. Observing these instructions helps to achieve a high level of availability and a long working life of the pump while ensuring a safe operation.

Further operation manuals regarding components of the complete pump unit, particularly those concerning the Glandless Screw Pump, shall equally be observed.

Pictorial representations and information given in this operation manual are subject to technical modifications resulting in the improvement of KLAUS UNION products.

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1. General

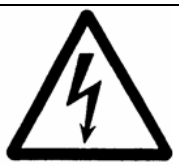
This operation manual contains fundamental instructions to be observed during installation, operation and maintenance. By all means, this operation manual must be read by the installation personnel and the responsible qualified staff prior to installation and commissioning. The manual is always to be held available on site.

In addition to the general safety instructions given in this section, the special safety instructions mentioned in the following sections are to be observed.

KLAUS UNION will not assume any responsibility for damage incurred due to non-observance of this operation manual.

2. Marking of Safety Instructions

The safety instructions given in this operation manual are specially marked:

	**Dangerous situation.** Possible consequences: Damage to health and life of persons.
	**Electrical hazard.** Possible consequences: Severe or even lethal injuries.
	**Important instructions regarding explosion protection.**
	**Danger to health of persons with a pacemaker resulting from strong magnetic field.**

In case of dangers to the machine and its functions the word

A T T E N T I O N

has been inserted.

References made on the machine itself, such as

- direction-of-rotation arrow
- dry-running warning
- marks for fluid connections

must by all means be observed and kept completely legible.

3. Qualification and Training of Staff

The staff responsible for the operation, maintenance, inspection and assembly must have the appropriate qualifications to perform these duties. Scope of responsibility, purview and supervision of staff must be clearly organized by the operating company. If the staff do not possess of the necessary expertise they must be trained to acquire the necessary knowledge. Furthermore, the operating company is to ensure that the contents of the operation manual is fully understood by the staff.

4. Dangers of Non-Compliance with Safety Instructions

The magnet drives described in the present operation manual are usually used in industrial plants for the transport of partly hazardous products. Non-compliance with safety instructions can therefore cause danger to persons as well as to the environment. Non-compliance will result in the loss of any claim for damages.

In detail, non-compliance with the operation manual can result in the following dangers, e.g.:

- Danger to persons by electrical, mechanical and chemical influences
- Danger to the environment by leakage of dangerous substances
- Failure of important functions of the machine or plant

5. Safety-Conscious Work

Safety instructions mentioned in this operation manual, existing national regulations for prevention of accidents as well as any internal working, operating and safety instructions of the operating company have to be observed.

	**When operating the magnet drive in hazardous locations, articles marked with the Ex–sign are to be given special attention and observance.**

6. Safety Instructions for the Operating Company/Operator

	**Magnet drives cause strong magnetic fields. Persons with a pacemaker should not stay close to the magnet drive or come into close bodily contact with parts of it**.

7. Safety Instructions for Maintenance, Inspection and Assembly

The operating company has to ensure that any maintenance, inspection and assembly works are performed by authorized and qualified staff. The staff must have read and fully understood the operation manual.

Instructions given in the section "Commissioning and Shutdown" of this operation manual must be observed.

	**Components processing noxious liquids must be decontaminated.**

Immediately upon termination of the works, any safety and protection devices must be reinstalled and put into operation. During re-commissioning, the instructions given in the section "Commissioning and Shutdown" of this operation manual must be observed.

	**The lifting capacity of lifting gear and tackle must be designed to correspond at least with the own weight of the complete magnet drive.**

8. Unauthorized Modification and Manufacture of Spare Parts

Modification of or changes to the magnet drive may only be carried out upon agreement with the manufacturer. Original spare parts and accessories authorized by the manufacturer contribute to your safety. KLAUS UNION will refuse to accept any responsibility for damage resulting from the use of other parts.

	**If the magnet drive is modified or changed without authority and / or other than original spare parts are used for repair works, the explosion protection will be forfeited.**

9. Designated Use

Operational reliability of the magnet drive is only granted for its designated use.
The magnet drive is provided for assembly with a screw pump. The operation data indicated in the order and in the data sheet shall be observed.

10. Temperature Limits

Temperature Category	Maximum Temperature of the Surface for Instruments Cat. 2 to EN 13463-1
T1	440 °C
T2	290 °C
T3	195 °C
T4	130 °C
T5	95 °C

In case of temperature category T6, contact KLAUS UNION for further information.

1. Scope of Delivery

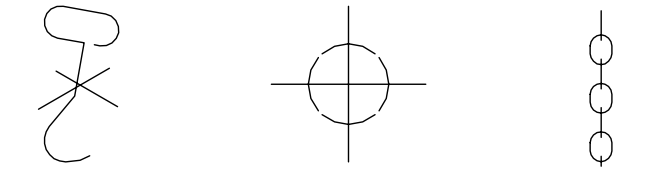
The contents of the individual packing units is listed in the packing list. Upon delivery, it is to be checked whether the consignment as mentioned on the packing list is complete. The supplier is to be given written notice immediately of any damage to the goods incurred during transport and / or missing parts.

2. Degree of Disaggregation

The degree of disaggregation depends on mode and conditions of transport, local conditions and lifting equipment available. On principle, the magnet drive is delivered in several sub-assemblies. However, the magnet drive is to be transported in as complete a unit as possible. However, if the magnet drive is delivered in sub-assemblies, refer to the drawing enclosed with the packing list for the contractual degree of disaggregation.

3. Packing

The transport route is decisive for the kind and material of packaging. If not particularly stipulated in the contract, the packing corresponds with the packaging regulations HPE laid down by the Bundesverband Holzmittel, Paletten, Exportverpackung e.V (Federal Association Wood for Packaging, Pallets, Export Packaging Inc.). The graphical symbols attached to the packing are to be observed:



4. Transport

Transport of the magnet drive must be carried out expertly. During transport, the magnet drive must remain in a horizontal position, shocks and impacts are to be avoided.

	**Suspended loads must not be transported over the heads of persons.**

	**The lifting capacity of lifting gear and tackle must be designed to correspond at least with the own weight of the complete magnet drive.**

A T T E N T I O N	**If necessary, use available securing devices for transport.**

5. Preservation and Intermediate Storage of the Magnet Drive

The magnet drive has been provided with a preservative either according to the customer's specification or as detailed in the operation manual. For a longer-term storage of the magnet drive, special preservative measures are to be taken.

Prior to delivery, shaft ends have been equipped with protection caps for protection against dirt and damage. Protection caps must not be removed during intermediate storage.

Having been packed into seaworthy cases for its transport, the magnet drive can be stored for a period of up to one year in their packing without special measures having to be taken. Nevertheless, to avoid damage to the anti-friction bearings in the magnet drive owing to vibrations, e. g. due to machines operated in close vicinity, the magnet drive should be stored in rooms free of vibrations.

For intermediate storage, low-alloy components, bare shaft ends of drive shafts must be treated with a preservative.

Concerning the anti-friction bearings it is understood that the lubricant in them will not be adversely affected during a one-year storage period provided the magnet drive is stored appropriately. If possible, the magnet drive should be turned by hand once a month during the storage period.

Commercially available preservatives can be used. For application and removal of the preservative, specific instructions given by the respective manufacturer must be observed. Preservation will protect the material for about 1 year. In case of a longer storage period, preservation must be renewed.

The storage area must be dry and free of dust.

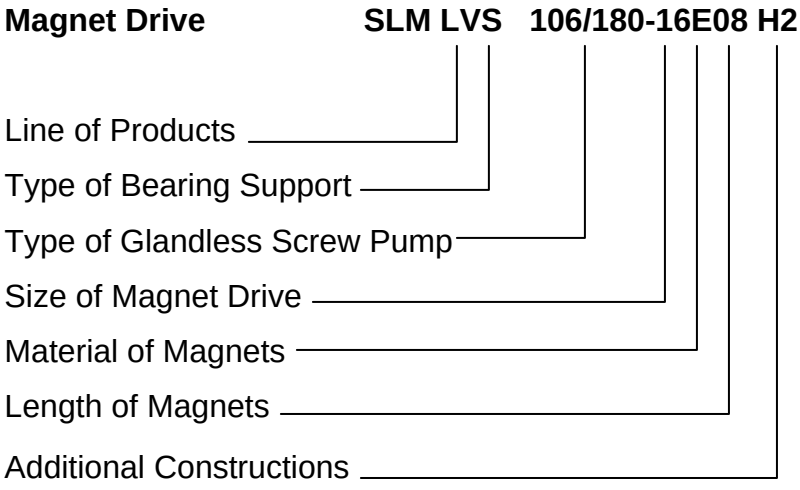
Any plain metal parts must be oil- or grease-lubricated for protection against corrosion.

A T T E N T I O N	**For outdoor storage, the magnet drive must be provided with a water-proof cover.**

1. General Description

The magnet drive is appropriate for assembly with a Glandless Screw Pump.

Marking of the magnet drive



Legend of identification letters for additional constructions:

H2	heated intermediate lantern
S	thermal barrier without secondary sealing
W	thermal barrier with secondary sealing
Z, C	ceramics isolation shell of zirconium oxide (Z); plastic isolation shell of CFRP (C)
D	double isolation shell

Marking of the types of bearing support:

Bearing Support	Type	Comments
SLM LVS	standard	Grease lubrication with larger anti-friction bearing spacing
SLM LVO	standard	Oil lubrication with larger anti-friction bearing spacing

Marking of the types of bearing support:

	Type	Comments
SLM LVB	close-coupled drive	Motor lantern

2. Constructive Design

The magnet drive transmits the torque without slip and hermetically seals the product chamber from the atmosphere. The isolation shell between the two magnet rotors forms the static sealing.

2.1 Hydraulic Component

The hydraulic component will be completed by the manufacturer of the Glandless Screw Pump. If the magnet drive is designed with a heated intermediate lantern (H2), the Glandless Screw Pump with which the magnet drive is assembled must equally be heated.

2.2 Magnet Drive

The magnet drive hermetically seals the hydraulic component from the driving component on the atmosphere. The magnet drive comprises the inner and outer magnet rotors and the isolation shell. The isolation located between the two rotors seals the system. The power transfer is effected without slip.

2.3 Driving Component

2.3.1 Close-Coupled Construction Type SLM LVB

With the close-coupled construction type, the outer magnet rotor is mounted direct on the motor shaft. The motor is bolted via a motor lantern directly onto the intermediate lantern of the magnet drive.

2.3.2 Bearing-Support Construction Type SLM LVS / SLM LVO

With the bearing-support construction type, the outer magnet rotor is fastened to the drive shaft. The shaft runs in anti-friction bearings. The bearing support is screwed on the intermediate lantern, the magnet drive comes with a bare shaft end. Construction type SLM LVS features grease-lubricated anti-friction bearings whereas magnet drive type SLM LVO is supplied with oil-lubricated anti-friction bearings.

3. Construction Variants

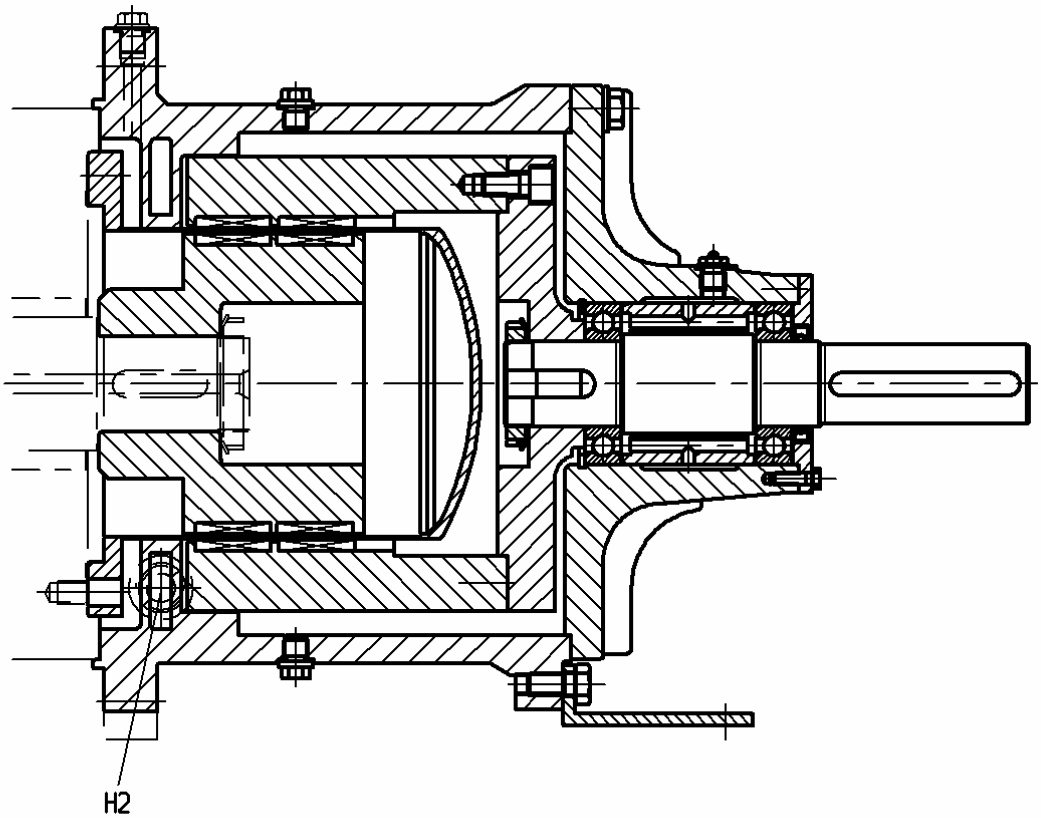
3.1 Heated Magnet Drive H2

The magnet drive is equipped with a heating jacket in the intermediate lantern (H2).
The standard construction features threaded heating connections. Flange connections can be provided on request.

In the standard construction, the heating jackets are designed for a working pressure of 16 bar at 200°C (vapour) or 6 bar at 350°C (heat transfer oil).

The heating jackets may also be used for cooling purposes.

If this variant of the magnet drive is furnished, the pump supplier shall equally design his Glandless Screw Pump with heating.



standard connection threaded
option flange

3.2 Thermal Barrier and Secondary Sealing S or W

Being located between the bearing support (with bearing-support construction) or the driving motor (with close-coupled construction) and the hydraulic component, the thermal barrier helps to dissipate the product heat. Thus, the anti-friction bearing temperature is reduced when warm liquids are processed.

In addition, the thermal barrier can be equipped with a radial shaft seal ring, sealing the area to the outer magnet carrier. By way of a secondary sealing, the gasket prevents the liquid from immediately leaking to the atmosphere in case of a leakage of the isolation shell. A precondition for the use of the secondary sealing is the monitoring of the outer magnet carrier's area in order to detect any leakage in time.

3.3 Double Isolation Shell D

When a high level of safety is required, the pump can be equipped with a double-skin isolation shell. The isolation shell actually consists of two isolation shells with one of them put into the other. Each of the two isolation shells is designed to meet the requirements of the specified operation conditions. If one of them should fail, the system still remains sealed. The space between the two shells can be monitored.

1. General Instructions

Prior to installation, the magnet drive should be checked for any damage it might have suffered during transport.

KLAUS UNION cannot be held responsible for any damage resulting from inexpert installation.

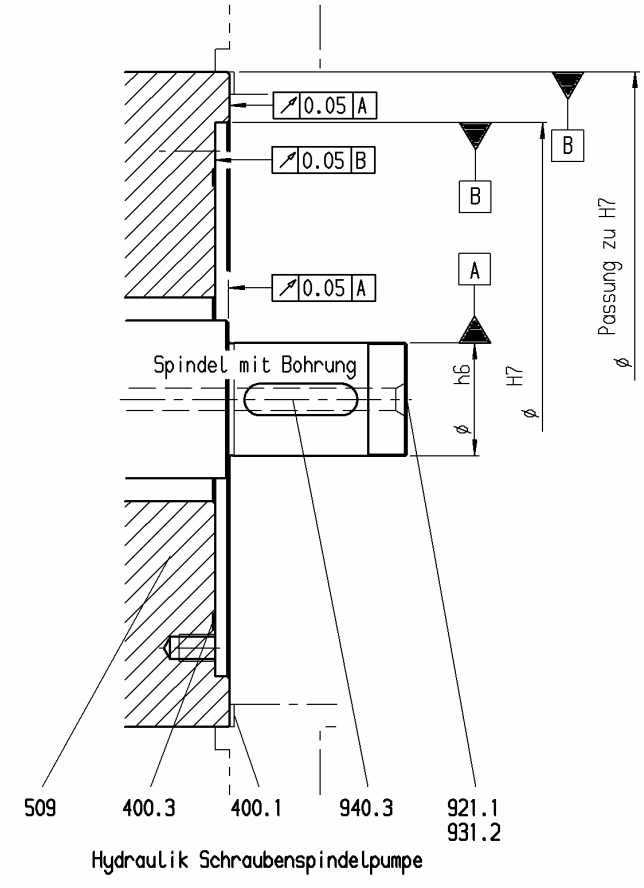
	**Magnet drives cause strong magnetic fields. Persons with a pacemaker should not stay close to the magnet drive or come into close bodily contact with parts of it.**

2. Installation Conditions

Assemble magnet drive or magnet drive with Glandless Screw Pump according to the attached installation plan and / or sectional drawing.

During assembly of the magnet drive with the Glandless Screw Pump the following instructions concerning fit, shape and positional tolerances shall be observed.

Spindel mit Bohrung = spindle with drill-hole; Passung zu H7 = fit for H7



Hydraulic Glandless Screw Pump

3. Auxiliary Connections

Depending on the construction type, the magnet drive can be equipped with connections for heating and for monitoring. Refer to the installation plan attached to the magnet drive for the exact location of those connections.

	**If the magnet drive is fitted with a heating jacket (legend of identification letters: H2), the temperature of the heating medium must not exceed the maximum allowable surface temperature of the magnet drive.**

	**The ignition temperature of the heating liquid must be at least by 50°C higher than the maximum surface temperature of the pump.**

	**The instruments for the monitoring such as temperature sensors, pressure sensors, etc. must have the corresponding approval for use in areas subject to explosion hazards.**

4. Electrical Connection

	**The magnet drive must be earthed.**

1. Preparations for Commissioning

	**The correct functioning of the journal bearings is a precondition to prevent the outer magnet carrier from running into the intermediate lantern and thus to prevent the occurrence of unacceptably high temperatures.**

	**If the pump was not explicitly ordered free from oil and grease, there will be residues of anti-seize paste on wetted components. Prior to commissioning, compatibility of the anti-seize paste with the pumped liquid shall be checked. In case of uncertainty, please contact KLAUS UNION.**

1.1 Bearing Support with Grease-Lubricated Anti-Friction Bearings

Magnet drive SLM LVS of bearing-support construction with grease-lubricated anti-friction bearings is supplied fully greased.

Shortly after commissioning and as a precaution, the bearings should be relubricated with the pump running by means of a relubricating device (lubrication nipple part no. 630.2). (For further details regarding type and quantity of the lubricants to be used and the appropriate relubricating intervals refer to section "Maintenance" of this operation manual.)

	**By all means, observe the prescribed quantity of grease. In case the quantity of grease filled in is either too low or too high, failure of the anti-friction bearings will occur.**

1.2 Bearing Support with Oil-Lubricated Anti-Friction Bearings

	**In case of magnet drive of bearing-support construction equipped with oil-lubricated anti-friction bearings, the bearing support must be filled with lubricating oil prior to initial commissioning.**

	**Always observe the prescribed oil level. The oil level being either too high or too low will result in failure of the anti-friction bearings.**

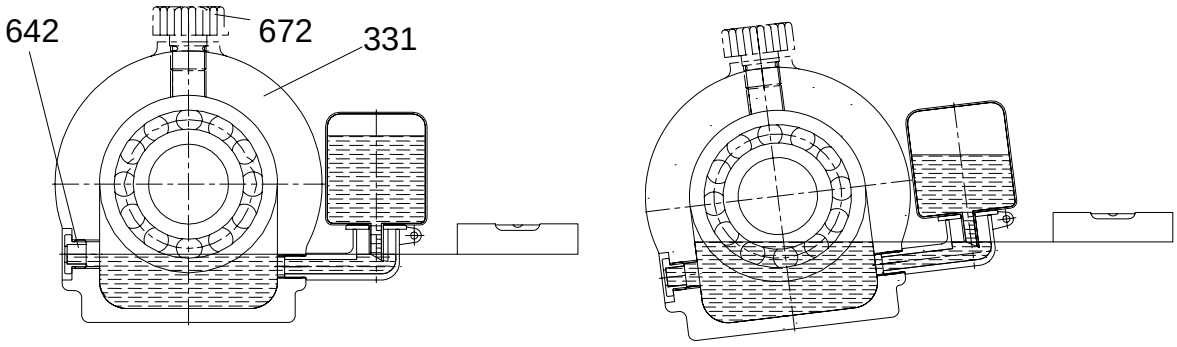
For recommended types of oil refer to section "Maintenance" of this operation manual.

1.2.1 Construction with Gauge

To fill the bearing support with lubricating oil, remove vent plug (part no. 672) and fill the bearing support with oil until half of the gauge (part no. 642) is covered with oil.

1.2.2 Construction with Constant - Level - Oiler

To fill with oil, remove vent plug (part no. 672). Fill oil into the bearing support (part no. 330) until the oil becomes visible in the screwed socket with the oil reservoir folded back. Then fill the oil reservoir through the chamfered drain pipe and fold it back. Now the oil level adjusts to the required level. As long as there is oil in the oil reservoir, the Constant-Level-Oiler will ensure that the oil level is always correct.



Right Wrong

2. Monitoring Equipment

Ex	**When the magnet drive is operated in areas subject to explosion hazards, it may be necessary for the operating company to install monitoring devices to ensure that the magnet drive does not become an ignition source. Essentially, ignition sources are hot surfaces and sparks (when rotating components contact). If required, KLAUS UNION can offer advice and support concerning the choice and purchase of monitoring equipment.**

For installation, commissioning and operation of the monitoring equipment observe the corresponding operation manuals supplied with the instruments.

3. Commissioning

3.1 Designated Operation

The magnet drive is provided for assembly with a glandless screw pump.
The operation data indicated in the order and the data sheet respectively shall be observed.

	**The ignition temperature of the liquid must be at least by 50°C higher than the maximum surface temperature of the pump.**

3.2 Cooling the Magnet Drive

During operation heat will be generated in the magnet drive which must be dissipated by a cooling stream. The cooling stream must be provided by the pump hydraulic. The cooling stream reaches the magnet drive via cooling bores, absorbs the heat and transfers it back to the main pump flow.

The temperature developing on the isolation shell surface depends on the power dissipation, the volume of the cooling stream, the heat capacity of the coolant and the liquid temperature. The approximate temperature increase with regard to the liquid temperature can be calculated by applying the following equation:

$$\Delta T = \frac{(P_v + P_{Reib}) \cdot 3600}{\rho \cdot c_p \cdot Q_T}$$

Enter the values as follows in the equation:

P_v, P_{reib}	Power	[kW]
ρ	Density	[t/m³]
c_p	Thermal capacity	[J/kg/K]
Q_T	Cooling stream	[m³/h]

The power dissipation P_v of the magnet drive depends on the size of the magnet drive, the material of the isolation shell, the wall thickness of the isolation shell and the speed.

The following values are applicable for isolation shell of material 2.4610 with wall thickness s=1 mm:

Magnet Drive	Power Dissipation [kW]		Factor K_{reib}	Factor K_Q
	1450 U/min	980 U/min		
09E02	0,2	0,1	0,8	0,4
09E03	0,25	0,12	1	0,4
09E04	0,3	0,15	1,2	0,35
09E05	0,4	0,2	1,4	0,35
09E06	0,5	0,25	1,6	0,3
09E08	0,6	0,3	2	0,25
13E02	0,3	0,15	2,4	0,8
13E03	0,4	0,2	3	0,8
13E04	0,5	0,25	3,6	0,75
13E05	0,7	0,35	4,2	0,7
13E06	0,8	0,4	4,8	0,65
13E08	1	0,5	6	0,6
16E02	0,3	0,15	4,5	1,3
16E03	0,5	0,25	5,6	1,25
16E04	0,6	0,3	6,7	1,2
16E05	0,8	0,4	7,8	1,1
16E06	0,9	0,45	8,9	1
16E08	1,2	0,6	11,1	0,9
16E10	1,5	0,75	13,2	0,75
19E02	0,4	0,2	7,2	1,9
19E03	0,6	0,3	9	1,8
19E04	0,7	0,35	10,8	1,7
19E05	0,9	0,45	12,6	1,6
19E06	1,1	0,55	14,4	1,5
19E08	1,4	0,7	18	1,35
19E10	1,8	0,9	21,6	1,2

Please contact KLAUS UNION if a different size of magnet drive, a different isolation shell material, a different wall thickness and a different speed are involved.

The power loss through friction P_{reib} depends on the viscosity of the liquid. In case of aqueous liquids the power loss through friction is also included in the power dissipation of the magnet drive, in case of an increased viscosity, the power loss through friction in [W] can be calculated as follows:

$$P_{reib} = K_{reib} \cdot \nu \cdot \rho \cdot \left(\frac{n}{1450} \right)^2$$

The values shall be entered as follows:

P_{reib}	Power loss through friction	[W]
ρ	Density	[t/m³]
ν	kinematic viscosity	[mm²/s]

The factor K_{reib} depends on the size of the magnet drive. Please refer to the table.

The flush flow rate Q_T depends on the delivery head of the pump, the viscosity of the liquid and the geometry of the cooling stream bores. The delivery head provides the driving pressure difference of the cooling stream, the viscosity of the pumped liquid and the geometry influence the flow rate of the cooling stream. The flow rate of the cooling stream can be calculated as follows:

$$Q_T = K_Q \cdot \sqrt{\frac{\rho}{\nu} \cdot \Delta p}$$

The values shall be entered as follows:

Q_T	Cooling stream flow rate	[m³/h]
ρ	Density	[t/m³]
ν	Kinematic viscosity	[mm²/s]
Δp	Pressure difference	[bar]

Example 1:

Magnet drive 13 E02

Speed:	1450 U/min
Pumped liquid:	water at 20°C
Density:	1 t/m³
Viscosity:	abt. 1 mm²/s
Thermal capacity:	4180 J/kg/K
Pressure difference available:	2 bar
Power dissipation of the magnet drive:	0.3 kW
Factor K_{reib}	2.4
Factor K_Q	0.8
Power loss through friction	2.4 W
Volume of cooling stream	1.1 m³/h
Temperature rise	0.23 °C

Example 2:

Magnet drive 16E06	
Speed:	1450 U/min
Pumped liquid:	glycerine at 40°C
Density:	abt. 1.25 t/m³
Viscosity:	abt. 220 mm²/s
Thermal capacity:	2500 J/kg/K
Pressure difference available:	4 bar
Power dissipation of the magnet drive:	0.9 kW
Factor K_{reib}	8.9
Factor K_Q	1.0
Power loss through friction	2.4 kW
Cooling stream flow rate	0.15 m³/h
Temperature rise	25.5 °C
Maximum liquid temperature at T4	104.5 °C

In connection with the calculated temperature rise, the maximum liquid temperature for the temperature category indicated amounts to:

Temperature Category	Maximum Temperature of the surface for instruments cat. 2 to EN 13463-1
T1	440 °C
T2	290 °C
T3	195 °C
T4	130 °C
T5	95 °C

In case of temperature category T6, contact KLAUS UNION for further information.

1. General

Please observe the instructions given in the section "Safety" of this operation manual when carrying out any maintenance works.

During the guarantee period, any maintenance works are either to be performed by KLAUS UNION staff or with KLAUS UNION's authorisation. Dismantling and Re-assembly of the magnet drive SLM have to be carried out by qualified staff.

	**Magnet drives cause strong magnetic fields. Persons with a pacemaker should not stay close to the magnet drive or come into close bodily contact with parts of it.**

2. Lubrication of Anti-Friction Bearings

	**To avoid the anti-friction bearings becoming an ignition source, the anti-friction bearings must be maintained according to the instructions given in the operation manual.**

The anti-friction bearings are designed for a rated working life of 25000 hours at a bearing temperature of 90°C. Replace the anti-friction bearings after 90 % of their service life at the latest. However, the working life of the bearings can reduce due to higher bearing temperatures and unfavourable operating conditions (strong vibrations, aggressive environmental conditions, etc.).

	**The rate of vibration of the complete pump must stay below the limiting values stipulated in the relevant standards (e.g. EN ISO 5199).**

2.1 Grease-Lubrication of Bearing-Support Construction SLM LVS

For lubrication, use a high-quality anti-friction grease on lithium soap basis to DIN 51825 of the following properties:

- Basic oil: Mineral oil
- Basic oil viscosity at 40°C: abt. 90 mm²/s
- Consistency (NLGI grade): 2 to 3

	**When mixing various types of lubricants it may happen that the consistency is changed in a way that sufficient lubrication of the bearings is no longer guaranteed. If it is not clear whether the lubricants can be mixed, the previously used lubricant has to be removed from the bearing completely.**

2.1.1 First Filling SLM LVS

If the pump has not been used for long periods (more than 1 year) the grease has to be replaced. The quantity of grease amounts to 100 ml.

2.1.2 Regreasing During Operation SLM LVS

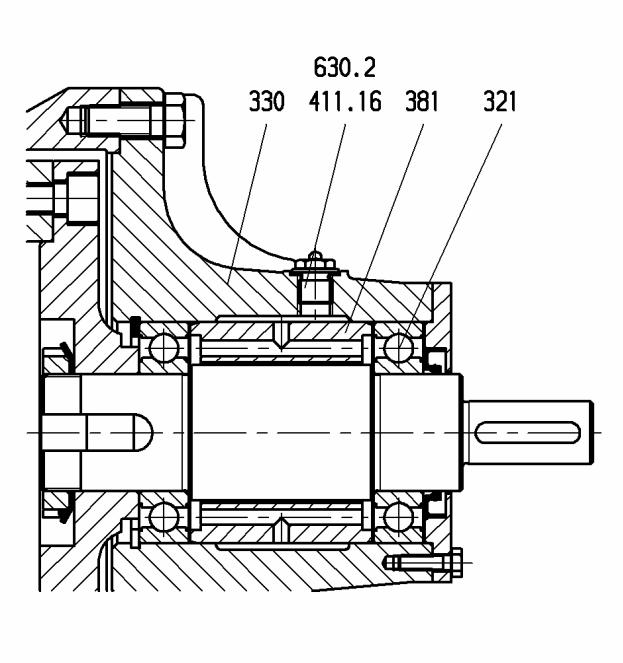
Depending on the temperature of the anti-friction bearings and the magnet drive speed, different relubricating intervals are to be observed:

Temperature of Anti-Friction Bearings	Magnet Drive Speed	Regreasing Intervals
Up to 100°C	max. 1450 / 1750 1/min	5000 h
More than 100°C	max. 1450 / 1750 1/min	1800 h

Regreasing of the bearings can be carried out either during operation or standstill.

	**When regreasing the anti-friction bearings during operation mind the danger due to rotating shafts.**

Lubricate the ball bearings (part no. 321) with 10 g of grease. Regreasing is effected by means of a grease gun via the lubricating nipple (part no. 630.2) located in the bearing support (part no. 330).



2.2 Oil-Lubrication of Bearing-Support Construction SLM LVO

The oil has to be changed at least once a year or after a certain number of operating hours depending on the temperature of the anti-friction bearings.

Anti-Friction-Bearing Temperature	Operating Hours
Up to 80 °C	8000
More than 80°C	5000

Shut the complete unit down for the oil change.

For oil quantities required for the respective magnet drive sizes refer to the u. m. table.

Magnet Drive Size	Oil Quantity
09E	ca. 450 ml
13E	ca. 450 ml
16E	ca. 540 ml
19E	ca. 1300 ml

When using a Constant-Level-Oiler, the additional quantity of oil amounts to 110 ml.

For normal applications (pump temperature < 250°C, ambient temperature between -10°C and 40°C) a lubricating oil on the basis of mineral oil with viscosity grade ISO-VG 68 to DIN 51519 can be used. For special applications at higher temperatures (temperature of the pumped liquid exceeding 250°C), lower temperatures (temperature up to –60°C) or when a wide temperature range needs to be covered, a synthetic lubricating oil with viscosity grade ISO-VG 100 is recommended.

3. Inspection during Operation

	**To prevent the occurrence of ignition sources, which can be caused by failures and result in an explosion, the operating company has to take measures for monitoring the magnet drive.**

Failures occurring during operation can cause the occurrence of an ignition source on the magnet drive that can lead to an explosion when an explosive atmosphere is given. Examples for ignition sources: hot surfaces, sparks and discharge by electrostatic charging. The following table lists possible malfunctions and measures to prevent that these malfunctions result in the occurrence of an ignition source:

Malfunction	Possible Consequences	Measures
Dry-running as a result of incorrect commissioning (pump not filled and vented)	Overheating of the isolation shell	Monitoring of • Delivery head or • Capacity or • Pump output or • Isolation shell temperature
Allowable liquid temperature or allowable cooling temperature are exceeded	Overheating of the isolation shell by vaporization within the liquid of by cavitation within the pump	Monitoring of • Cooling stream temperature or • Isolation shell temperature
Pumping of non-specified liquid (liquid temperature too high)	The allowable surface temperature is exceeded	Monitoring of • Liquid temperature or • Isolation shell temperature
Pumping of non-specified liquid (liquid density too high)	Breakaway of magnet drive due to exceeding of the allowable transmission capacity	Monitoring of • Delivery head or • Capacity or • Pump output or • Isolation shell temperature

Malfunction	Possible Consequences	Measures
Pumping of non-specified liquid (liquid viscosity too high)	Breakaway of magnet drive due to exceeding of the allowable transmission capacity. Overheating of the isolation shell due to flush flow being too low	Monitoring of • Delivery head or • Capacity or • Pump output or • Isolation shell temperature
Pumping of non-specified liquid (thermal capacity of the liquid too low)	Vaporization of liquid in the pump	Monitoring of • Delivery head or • Capacity or • Pump output or • Isolation shell temperature
Breakaway of magnet drive on commissioning or by overload of the magnet drive	Overheating of the isolation shell	Monitoring of • Delivery head or • Capacity or • Pump output or • Isolation shell temperature
Damage to the anti-friction bearings due to non-observance of maintenance instructions	Overheating of anti-friction bearings, heat caused by friction between rotating and stationary component	Monitoring of • Anti-friction-bearing temperature or • Anti-friction-bearing vibration

3.1.1 Monitoring the Isolation Shell Temperature

Many malfunctions have a direct effect on the temperature of the isolation shell. As the surface temperature on the outside of the isolation shell can be a direct ignition source in hazardous areas, it is recommended to use an instrument to monitor the isolation shell temperature particularly when the magnet drive is used in hazardous areas.
KLAUS UNION can offer suitable instruments for that purpose.

3.1.2 Vibration Monitoring

The measuring of vibrations is particularly suitable to monitor the anti-friction bearings. The rate of vibrations has to be measured horizontally and vertically to the shaft axis on the coupling-side end of the bearing support.

4. Dismantling of the Magnet Drive

A T T E N T I O N	**For assembly and dismantling of the magnet drive, refer to the pertaining sectional drawing.**

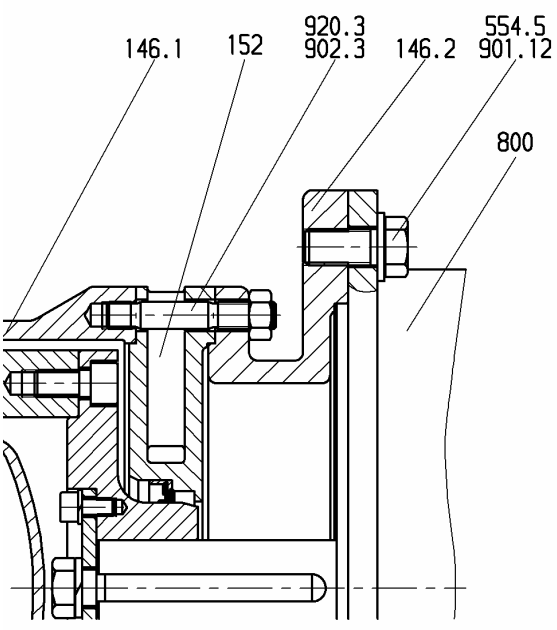
4.1 Magnet Drive of Close-Coupled Construction SLM LVB

- Release assembly stud nuts (part no. 920.1) and pull out the complete magnet drive with a suitable lifting device and position it horizontally on a stable support.
- Unscrew the cap screws (part no. 901.1) at the isolation shell flange and dismantle [from the hydraulic of the Glandless Screw Pump] the isolation shell (part no. 817). Use the forcing threads in the isolation shell flange provided for that purpose.

- **With plastic or ceramics isolation shell:**
  Unscrew the cap screws (part no. 901.1) at the straining ring (part no. 515), dismantle [from the hydraulic of the Glandless Screw Pump] straining ring and isolation shell.
- Remove the lock washer (part no. 931.2) and release the shaft nut (part no. 921.1) [of the hydraulic of the Glandless Screw Pump]. Pull the inner magnet carrier (part no. 818.2) off the spindle [of the hydraulic of the Glandless Screw Pump].

Unit magnet drive / motor:

- Dismantle the motor lantern (part no. 146.2) with the motor from the intermediate lantern (part no. 146.1).
- Remove the lock washer (part no. 554.4) and unscrew screws (part no. 901.11 / 914.11).
- Pull the complete outer magnet carrier (part no. 818.1 / part no. 861) off the motor shaft.



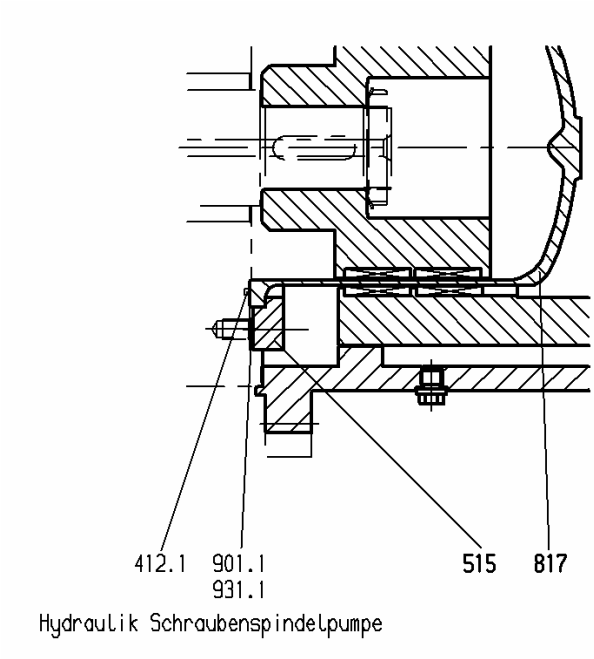
4.2 Magnet Drive of Bearing-Support Construction SLM LVS and SLM SVO

With pumps of construction type with oil-lubricated anti-friction bearings, prior to dismantling the lubricating grease must be drained from the bearing support (part no. 330) via the oil drain plug (part no. 903.8).

- Release assembly stud nuts (part no. 920.1) and pull off the complete magnet drive with a suitable lifting device and position it horizontally on a stable support.
- Unscrew the cap screws (part no. 901.1) at the isolation shell flange and dismantle [from the hydraulic Glandless Screw Pump] the isolation shell (part no. 817). Use the forcing threads in the isolation shell flange provided for that purpose.

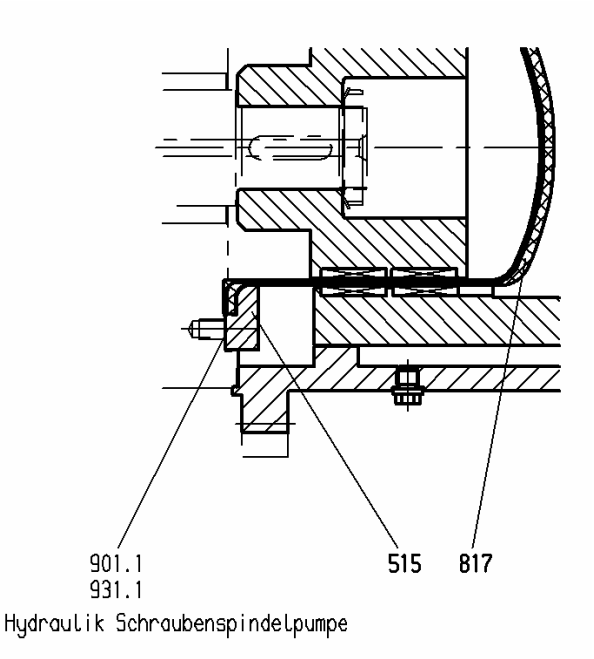
- **With plastic or ceramics isolation shell:**
  Unscrew the cap screws (part no. 901.1) at the straining ring (part no. 515), dismantle [from the hydraulic Glandless Screw Pump] straining ring and isolation shell.

Plastic Isolation Shell



Hydraulic Glandless Screw Pump

Ceramics Isolation Shell



Hydraulic Glandless Screw Pump

- Remove the lock washer (part no. 931.2) and release the shaft nut (part no. 921.1) [of the hydraulic Glandless Screw Pump]. Pull the inner magnet carrier (part no. 818.2) off the spindle [of the hydraulic Glandless Screw Pump].

Unit magnet drive:

- Complete magnet drive is positioned horizontally on a stable support.
- Unscrew cap screws (part no. 901.17) and remove the bearing cover (part no. 360). Use the forcing threads provided for that purpose.

- **For Grease-Lubricated Construction without Thermal Barrier:**
  - Remove the snap ring (part no. 932).

- **For Grease-Lubricated Construction with Thermal Barrier:**
  - Dismantle thermal barrier (part no. 152) with / without shaft seal ring (part no. 421.3) and shaft sleeve (part no. 525.1).
  - Remove the snap ring (part no. 932).

- **For Oil-Lubricated Construction:**
  - Dismantle thermal barrier (part no. 152) with shaft seal ring (part no. 421.3) and shaft sleeve (part no. 525.1).
  - Remove the snap ring (part no. 932).

- **For Oil-Lubricated Construction with Labyrinth Sealing:**
  - Remove the snap ring (part no. 932.2).
  - Dismantle thermal barrier (part no. 152) with bearing cover (part no. 360.2) and shaft sleeve (part no. 525.1).
  - Remove the snap ring (part no. 932).

- Remove the bearing unit [drive shaft (part no. 213), ball bearing (part no. 321)], bearing insert (part no. 381 with grease-lubricated construction) from the bearing support.
- Dismantle the ball bearings with standard offset cams.

5. Re-Assembly

Prior to re-assembly, check the usability of all pump components. During assembly, the anti-friction bearings must be protected from dirt and moisture. Any sealing surfaces are to be cleaned carefully, used static gaskets are to be replaced by new ones.

Fitting surfaces and screwed connections have to be coated with graphite or a similar agent.

	**When replacing the outer magnet carrier tube and/or outer magnet carrier hub by original spare parts, this unit must be assembled prior to balancing. (Balancing quality class G 6.3 to DIN ISO 1940).**

5.1 Magnet Drive

5.1.1 Bearing-Support Construction SLM LVS and SLM LVO

- Heat the ball bearing (part no. 321) to abt. 80°C and push it on the drive shaft (part no. 213).

- **For Grease-Lubricated Construction without Thermal Barrier**:
  - Push the bearing insert (part no. 381) on the shaft.
  - Heat the second ball bearing to abt. 80°C and mount it on the shaft.
  - Insert the snap ring (part no. 932) into the bearing support (part no. 330).
  - Heat the bearing support to abt. 80 °C in the bearing seat area, push the shaft equipped with anti-friction bearings into the bearing seat.
  - Insert the radial shaft seal ring (part no. 421.2) into the bearing cover (part no. 360), mount the bearing cover to the bearing support by means of cap screws (part no. 901.17).

A T T E N T I O N	**During installation of the radial shaft seal ring (part no. 421.2) into the bearing cover (part no. 360) takes care to observe the correct assembly direction.**

- **For Grease-Lubricated Construction with Thermal Barrier**:
  - Push the bearing insert (part no. 381) on the shaft.
  - Heat the second ball bearing to abt. 80°C and mount it on the shaft.
  - Insert the snap ring (part no. 932) into the bearing support (part no. 330).
  - Heat the bearing support to abt. 80 °C in the bearing seat area, push the shaft equipped with the anti-friction bearings into the bearing seat.

A T T E N T I O N	**When installing a new secondary sealing, this must be pushed on the shaft sleeve about 3 minutes prior to its installation in the thermal barrier. Thus, the sealing lip is predeformed prior to final installation.**

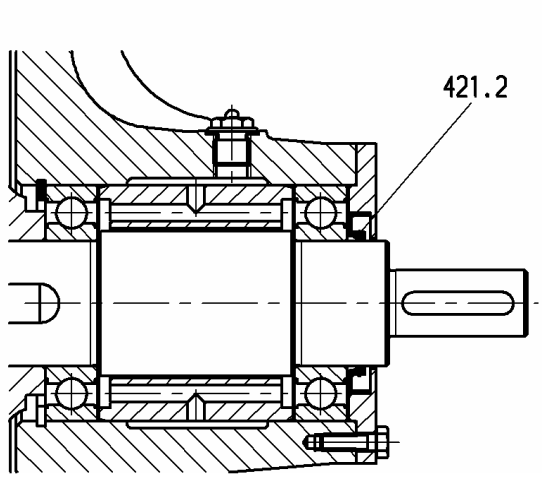
  - Then the shaft sleeve (part no. 525.1) is pushed on the drive shaft.
  - Insert the secondary sealing (part no. 421.3) into the thermal barrier (part no. 152), push the thermal barrier in front of the bearing support

A T T E N T I O N	**When fitting the secondary sealing (part no. 421.3) in the thermal barrier (part no. 152) take care to observe the correct assembly direction. The sealing lip of the secondary sealing must face the outer magnet carrier.**

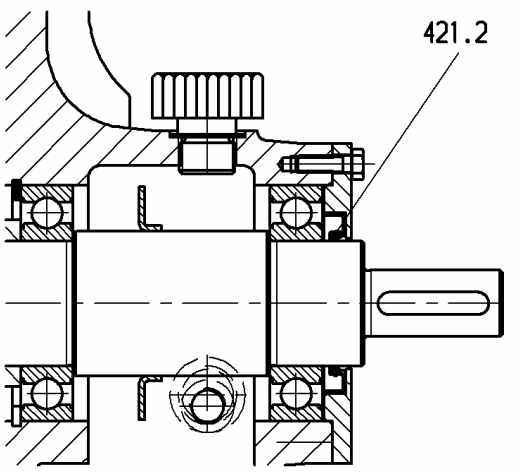
  - Insert radial shaft seal ring (part no. 421.2) into the bearing cover (part no. 360), mount the bearing cover with cap screws (part no. 901.17) to the bearing support.

A T T E N T I O N	**During installation of the radial shaft seal ring (part no. 421.2) into the bearing cover (part no. 360) takes care to observe the correct assembly direction.**

Grease-Lubricated Anti-Friction Bearings



Oil-Lubricated Anti-Friction Bearings



- **For Oil-Lubricated Construction**:
  - Push the splash ring (part no. 508) on the shaft via the knurled surface.
  - Heat the second ball bearing to abt. 80°C and mount it on the shaft.
  - Insert the snap ring (part no. 932) into the bearing support (part no. 330).
  - Heat the bearing support in the bearing seat area to abt. 80 °C, push the shaft equipped with anti-friction bearings into the bearing seat.

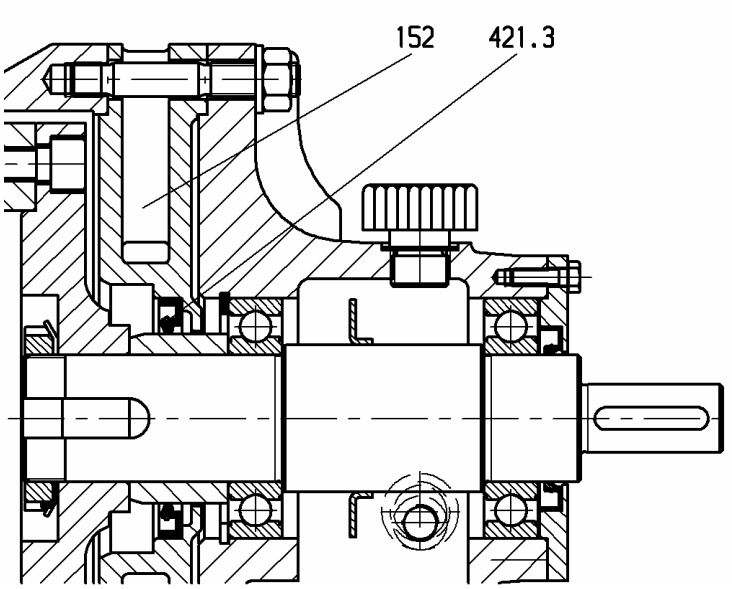
A T T E N T I O N	**When installing a new secondary sealing, this must be pushed on the shaft sleeve about 3 minutes prior to its installation in the thermal barrier. Thus, the sealing lip is predeformed prior to final installation.**

  - Then the shaft sleeve (part no. 525.1) is pushed on the drive shaft.
  - Insert the secondary sealing (part no. 421.3) into the thermal barrier (part no. 152), push the thermal barrier in front of the bearing support

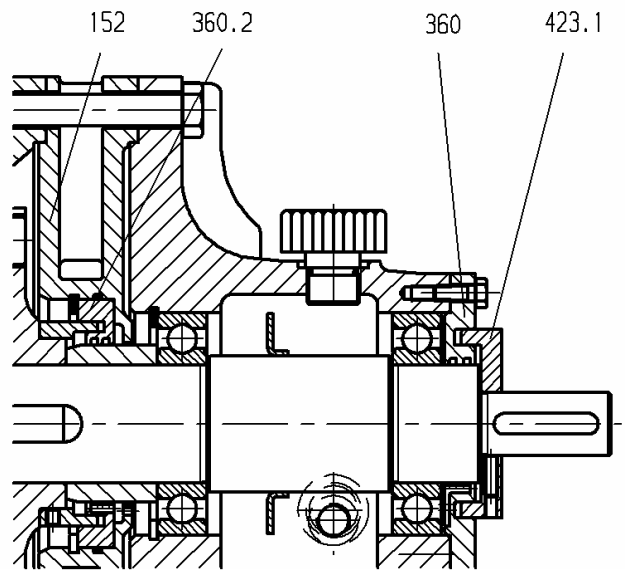
A T T E N T I O N	**When fitting the secondary sealing (part no. 421.3) in the thermal barrier (part no. 152) take care to observe the correct assembly direction. The sealing lip of the secondary sealing must face the outer magnet carrier.**

  - Insert radial shaft seal ring (part no. 421.2) into the bearing cover (part no. 360), mount the bearing cover with cap screws (part no. 901.17) to the bearing support.

A T T E N T I O N	**During installation of the radial shaft seal ring (part no. 421.2) into the bearing cover (part no. 360) takes care to observe the correct assembly direction.**



- **For Oil-Lubricated Construction with Labyrinth Sealing**:
  - Push the splash ring (part no. 508) on the shaft via the knurled surface.
  - Heat the second ball bearing to abt. 80°C and mount it on the shaft.
  - Insert the snap ring (part no. 932) into the bearing support (part no. 330).
  - Heat the bearing support in the bearing seat area to abt. 80 °C, push the shaft equipped with anti-friction bearings into the bearing seat.
  - Push shaft sleeve (part no. 525.1) on the drive shaft.
  - Insert the bearing cover (part no. 360.2) into the thermal barrier (part no. 152) and secure it with snap ring (part no. 932.2).
  - Mount the thermal barrier in front of the bearing support.
  - Mount the bearing cover (part no. 360) with cap screws (part no. 901.17) to the bearing support.
  - Push the splash ring (part no. 423.1) on the drive shaft (part no. 213).



- Secure drive shaft (part no. 213) against turning and insert the key (part no. 940.1) into the key groove.
- Push the outer magnet carrier with the outer magnet carrier hub on the shaft end and fasten and secure the outer magnet carrier with the lock washer (part no. 931) and the shaft nut (part no. 921). (Use of KU-special tool ident-no. P00548891- is recommended)
- Screw the intermediate lantern (part no. 146.1) on the bearing support (part no. 330) by means of screws (part no. 901.18 / part no. 902.3).

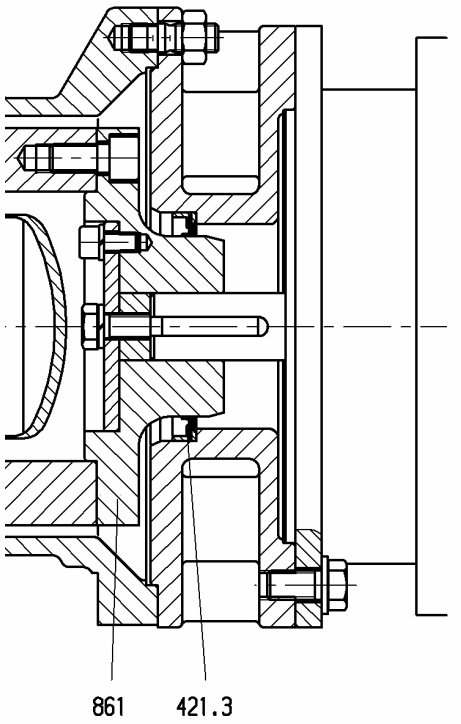
5.1.2 Close-Coupled Construction SLM LVB

Construction with Thermal Barrier and Secondary Sealing:

A T T E N T I O N	**When installing a new secondary sealing, this must be pushed on the outer magnet carrier hub about 3 minutes prior to its installation in the thermal barrier. Thus, the sealing lip is predeformed prior to final installation.**

- Insert the secondary sealing (part no. 421.3) into the thermal barrier (part no. 152).

A T T E N T I O N	**When fitting the secondary sealing (part no. 421.3) in the thermal barrier (part no. 152) take care to observe the correct assembly direction. The sealing lip of the secondary sealing must face the outer magnet carrier.**



- Push the motor lantern (part no. 146.2) with the thermal barrier fitted to it or the motor lantern (part no. 146.2) and the thermal barrier (part no. 152) in front of the motor and fasten the components to the motor by means of cap screws (part no. 901.12).
- Push the complete outer magnet carrier (part no. 818.1 / part no. 861) onto the motor shaft and fasten and secure it by means of cap screws (part no. 901.11 and 914.11) and lock washer (part no. 554.4).
- Screw the intermediate lantern (part no. 146.1) on the bearing support (part no. 330) with thermal barrier by means of screws (part no. 901.18 / part no. 902.3).

Construction without Thermal Barrier and Secondary Sealing

- Push the motor lantern (part no. 146.2) in front of the motor and fasten it to the motor by means cap screws (part no. 901.12).
- Push the complete outer magnet carrier (part no. 818.1 / part no. 861) onto the motor shaft and fasten and secure it by means of cap screws (part no. 901.11 and 914.11) and lock washer (part no. 554.4).
- Screw the intermediate lantern (part no. 146.1) on the bearing support (part no. 330) without thermal barrier by means of screws (part no. 901.18 / part no. 902.3).

5.2 Hydraulic Component

- The hydraulic of the Glandless Screw Pump shall be assembled by the manufacturer.

5.3 Final Assembly

- Push the inner magnet carrier (part no. 818.2) on the spindle [of the hydraulic of the Glandless Screw Pump] and secure it by means of the key (part no. 940.3) / lock washer (part no. 931.2) / shaft nut (part no. 921.1) [of the hydraulic of the Glandless Screw Pump].
- Insert the isolation shell (part no. 817) with the gasket (part no. 400.3) [of the hydraulic of the Glandless Screw Pump] into the lining groove of the adapter (part no. 509) [of the hydraulic of the Glandless Screw Pump].

- **For Construction with Metal Isolation Shell:**

  Insert the gasket (part no. 400.3) into the lining groove of the adapter. Place the isolation shell (part no. 817) in the centring and fasten it on the adapter by means of cap screws (part no. 901.1).

- **For Construction with Plastic Isolation Shell:**

  The inner isolation shell made of PTFE functions like a static gasket at the adapter. Fit the isolation shell (part no. 817, outer and inner isolation shells) in the lining groove of the adapter. Pull the straining ring (part no. 515) over the isolation shell and screw it with cap screws (part no. 901.1) on the adapter.

- **For Construction with Ceramics Isolation Shell:**

  Fit the O-ring (part no. 412.1) in the lining groove of the adapter. Pull the straining ring (part no. 515) over the isolation shell (part no. 817), position it together with the isolation shell in the centring and screw it with cap screws (part no. 901.1) on the adapter.

A T T E N T I O N	**In case of pump construction with ceramics isolation shell, make sure the isolation shell does not jam in the straining ring. You must be able to turn the isolation shell freely in the straining ring.**

- **Bearing-Support Construction:**

  - Secure the complete magnet drive SLM LVS / SLM LVO with the hydraulic of the Glandless Screw Pump [adapter (part no. 509) with fitted gasket (part no. 400.3)] by means of assembly studs (part no. 902), plain washer (part no. 554) and assembly stud nuts (part no. 920.1).
    (For tightening moments refer to the corresponding table)

- **Close-Coupled Construction:**

  - Secure the complete magnet drive SLM LVB with the hydraulic of the Glandless Screw Pump [adapter (part no. 509) with fitted gasket (part no. 400.3)] by means of assembly studs (part no. 902), plain washer (part no. 554) and assembly stud nuts (part no. 920.1).
    (For tightening moments refer to the corresponding table)

5.4 Tightening Moments for Screws

In case materials of screws are not indicated here, please contact KLAUS UNION.

Part No.	Position	Screw-Material	Thread	Tightening Moment [Nm]
901.1	Isolation Shell Flange	A4 - 70	M 8 / M 10/ M 12 / M 16	20 / 40 / 65 / 90
		1.7258		
		1.7709		25 / 45 / 75 / 100
901.1	Straining Ring (Isolation Shell made of **Zirconium**)	A4 - 70	M 8	15
			M 10	25
			M 12	35
901.1	Straining Ring (Isolation Shell made of **CFRP**)	A4 - 70	M 8	20
			M 10	25
902/ 920.1	Intermediate Lantern	5.6 galvanized +chromized	M 12/ M 16 / M 20	35 / 80 / 110
		A4 - 70		55 / 80 / 110
		1.7258		65 / 90 / 140
		1.7709		

Materials of screws are mentioned in the parts list.

6. Spare Parts

The attached spare parts list enumerates the recommended spare parts.

Ex	**Exclusively use original spare parts for repairs and replacements.**