Operation Manual

for

Centrifugal Pumps Typ

SLM NVT

Execution acc. to Directive 94/9/EC
Contents of Operation Manual

1. General________________________________BAE -32900-01/..

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This operation manual describes the following pump construction type:

Single-stage centrifugal pump with magnet drive of submerged-pump construction type SLM NVT.

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 pump unit, e.g. electric motors, monitoring equipment, etc. shall equally be observed.

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KLAUS UNION GmbH & Co. KG

P.O. Box 10 13 49
D-44713 Bochum

Phone : +49 (0) 234 45 95 - 0
Telefax : +49 (0) 234 43 23 87
Internet : www.klaus-union.de
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 **ATTENTION** 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 pump units 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.

![Ex]

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

6. **Safety Instructions for the Operating Company/Operator**

- In case hot (temperature exceeding 50°C) or cold (temperature lower than 0°C) surfaces cause danger, they must be protected against accidental contact.

- Protection against accidental contact for rotating parts (e.g. coupling guard) must not be removed during operation of the machine.

- Electrical hazard may be given. The corresponding instructions are to be observed.

- 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.

For processing dangerous products, the submerged pump must be fully drained to prevent any danger to people or environment. Due to its vertical fitting position, the submerged pump is self-drainable. Local government regulations are to be observed.
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.

As a matter of principle, any works on the pump unit must be carried out during standstill. The pump casing must be depressurized and fully drained. Instructions given in the section "Commissioning and Shutdown" of this operation manual must be observed.

- **Pumps processing health-threatening liquids must be decontaminated.**

- **After disassembly and removal of the submerged pump from its tank, the nozzle on which the pump was installed must be closed by means of a blind flange.**

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 pump unit.**

8. **Unauthorized Modification and Manufacture of Spare Parts**

Modification of or changes to the pump 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 pump 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 pump is only granted for its designated use. The limiting values indicated in the data sheet, particularly those regarding temperature of the pumped liquid and pumping capacity must not be exceeded.

| Ex | In case of pumps for which no datasheet is available, it must be checked prior to their commissioning, whether the allowable surface temperatures are not exceeded (refer to article „Temperature Limits“). |
| Ex | Driving motor and flexible coupling must have an approval for the use in areas subject to explosion hazards. |

10. **Temperature Limits**

| Ex | When being operated to its designated use, the pump's maximum surface temperature must not exceed the temperature category of the explosion protection zone. |

The plant operator must ensure that the maximum allowable temperature of the hazardous area is not exceeded when hot liquids are processed. Refer to the following table for the maximum allowable temperature of the pumped liquid in accordance with the applicable temperature category:

<table>
<thead>
<tr>
<th>Temperature Category</th>
<th>Maximum Temperature of the Pumped Liquid [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1-T4</td>
<td>90</td>
</tr>
</tbody>
</table>

In case of temperature categories T5 or T6, contact KLAUS UNION for further information.

| Ex | The pump is designed for use in ambient temperatures of 40°C max. For ambient temperatures exceeding 40 °C, explosion protection is no longer granted. |
11. **Speed Limits**

It is possible to operate the pump with a frequency converter. Lubrication of the journal bearing and cooling of the magnet drive are sufficient even at a slower speed.

<table>
<thead>
<tr>
<th>Ex</th>
</tr>
</thead>
<tbody>
<tr>
<td>The maximum allowable speed is mentioned on the rating plate and in the data sheet. If the pump is operated at a speed exceeding the maximum speed indicated, explosion protection is no longer granted.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to operating the pump unit with a frequency converter it must be checked, whether the driving motor is appropriate for that purpose.</td>
</tr>
</tbody>
</table>
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, it is possible to disassemble the pump into several sub-assemblies. However, the pump is to be transported in as complete a unit as possible. However, if the pump 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:

- **Top**
- **Fragile**
- **Keep dry**
- **Store away from heat**
- **Use no hooks**
- **Gravity center**
- **Post here**
4. **Transport**

Transport of the pumps must be carried out expertly. During transport, the pump must remain in a horizontal position and it must be ensured that it does not slip out of the transport suspension (ref. to drawing). Shocks and impacts are to be avoided.

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

- **Warning:** The lifting capacity of lifting gear and tackle must be designed to correspond at least with the own weight of the complete pump unit.

The pump unit has to be transported as shown below.

Transport of the submerged pump in condition as delivered.
Assembly of the pump on the tank.

**ATTENTION**

If necessary, use available securing devices for transport.

Never fasten the transport straps to the eye bolts of motor or pump lantern!
5. **Preservation and Intermediate Storage of the Pump**

The submerged pump type SLM NVT 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 submerged pump, special preservative measures are to be taken.

Prior to delivery, shaft ends have been equipped with protection caps for protection against dirt and damage. The connecting flanges of the pump casing are provided with flange covers for protection against dirt. Protection caps and flange covers must not be removed during intermediate storage.

Having been packed into seaworthy cases for their transport, the pumps 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 pumps owing to vibrations, e.g. due to machines operated in close vicinity, the pumps should be stored in rooms free of vibrations.

For intermediate storage, parts of the following low-alloy components must be treated with a preservative:

- bare shaft ends of drive shafts
- surfaces of the pump casing made of cast steel GP240GH (1.0619) that are in contact with the pumped liquid

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 pumps are stored appropriately. If possible, the pumps should be turned by hand once a month during the storage period.

Commercially available preservatives such as RUST-BAN 391 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.

When storing pumps equipped with their driving motors, equally observe the instructions concerning preservation and storage given in the operation manual covering the driving motor.

**ATTENTION** For outdoor storage, the pump unit must be provided with a water-proof cover.
1. **General**

The sealless submerged pump type SLM NVT is a vertically installed centrifugal pump with magnet drive. The pump is appropriate for the processing of aggressive, toxic, explosive, valuable, inflammable, malodorous or noxious liquids in the industry. The capacities of the submerged pump type SLM NVT are standardized to DIN EN 22858.

2. **Pump Identification Marking**

   **SLM NVT 050-032-160-09E03 F**

   - Line of Products __________
   - Submerged Pump __________
   - Nom. Dia. Suction Nozzle __________
   - Nom. Dia. Discharge Nozzle __________
   - Nom. Dia. Impeller __________
   - Size of Magnet Drive __________
   - Material of Magnets __________
   - Length of Magnets __________
   - Additional Constructions __________

**Legend of identification letters for additional constructions:**

- **F** internal filter
- **Z,C** isolation shell of zirconium oxide (Z); isolation shell of plastics (C)
- **E1** external feeding connection:
  - one external connection
  - internal flush bores with closed back
- **E2** external flushing / vent:
  - one external connection
  - internal flush bores open
- **D** double isolation shell
3. **Constructive Design**

The submerged pump type SLM NVT is a single-stage, single-entry, vertical radial flow centrifugal pump with magnet drive. The pump power of the magnet-drive pump is transmitted from the driving motor via the magnet drive to the impeller. 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.

3.1 **Hydraulic Component**

The hydraulic component comprises the impeller and the pump casing. Within the hydraulic component, the mechanical shaft output is transformed into hydraulic power. The pump shaft runs in journal bearings, which are made of ceramics and lubricated by the pumped liquid. The product-side magnet rotor is mounted on the shaft that it drives.

3.2 **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.

3.3 **Driving Component**

The outer magnet rotor is fastened to the drive shaft. The shaft runs in permanently grease-lubricated anti-friction bearings. The bearing lantern, the stand pipe and the suspension flange are screwed to one another. The sealing of the system between the bearing lantern and the stand pipe as well as between the stand pipe and the suspension flange is effected by O-rings. The submerged pump comes with a bare shaft end.
4. Construction Variants

4.1 Internal Filter F

When processing liquids containing solids, the internal filter ensures that no particles of solid matter exceeding a defined size enter the flush flow channels and thus reach the magnet drive and the journal bearings respectively.

4.2 External Feeding and Flushing Connections E1 and E2

The external connections permit the external flushing, feeding or venting of the pump. Connection E1 is used when the constant external feeding of the magnet drive is required. Connection E2 is suitable for short-time flushing or external venting of the magnet drive.

4.3 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 pump should be checked for any damage it might have suffered during transport. The flange covers may only be removed right before installation.

When turning the pump shaft by hand, abradant noises may be heard from within the pump. These noises result from the grease-free assembly of the journal bearings. Having filled the pump with the pumped liquid, these noises will disappear.

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

- Prior to installing the pump with the pertaining driving motor in areas subject to explosion hazards, ensure that the entire equipment has been approved for the prevailing explosion protection zone.

- Instructions given in the operation manuals of the driving motor and the flexible coupling are to be observed.

- The installation of electrical equipment is exclusively to be performed by qualified staff. Any regulations valid at the time are to be observed.

- 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**

Arrange pipework and equipment pertaining to the pump in a way to have enough space available for assembly and maintenance works. For dimensions of the pump refer to the attached installation plan.

3. **Installation**

3.1 **Installation of the Completely Assembled Unit**

The complete unit comprises pump, stand pipe, pressure pipe, suspension flange, motor and flexible coupling. The motor lantern above the flexible coupling serves as a protection against accidental contact.

Carefully bring the unit from its horizontal position (condition as delivered) by means of straps and lifting gear into a vertical position. Place a gasket on the tank flange. Lower the pump slowly and carefully into the tank.

**ATTENTION**

Avoid any impacts between pump and tank

--- Danger of damage to the pump ---

Align the submerged pump with the discharge flange and screw the suspension flange onto the tank.

3.2 **Installation of the Partially Assembled Unit**

In case the pump unit is not supplied as a complete unit but in sub-assemblies such as pump, coupling, motor, the installation is effected as described hereafter:

- Insert the key into the key groove of the motor-side shaft end. Fit the motor-side coupling half on the shaft by means of a standard draw-on device. The same procedure is to be followed for the pump-side coupling half.
- Install the submerged pump in the tank as described under para. 3.1.
- Fix the motor on the motor lantern of the pump.
- The distance between the motor- and pump-side coupling halves is determined by the motor lantern.
4. **Pipework**

Any pipework being connected should be state of the art and designed for the respective operating conditions.

The pipework must not transmit any forces and moments on the pump.

The pipework must be free of any impurities such as weld slag or scale.

When connecting the pipework make sure that as little tension as possible occurs. Refer to instructions such as given in VDMA standard VDMA 24277 „Spannungsarmer Rohrleitungsanschluß“ (Low-tension connection of pipework).

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**ATTENTION**  Do not use the pump as a fixed point for the pipework!

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**Inadmissible pipework forces and moments as well as tensions on the connections can result in escapes and leakages. In such a case, toxic and hot liquids will pose danger to life.**

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4.1 **Pressure Pipework**

Right behind the pump, a control valve must be available to control the rate of flow. A check valve must be provided between pump and shut-off valve when long pressure pipework or static delivery heads exceeding 10 m are given. The check valve protects the pump against liquid reflux and runback at shutdown. The flow velocity in the pressure pipework shall not exceed 5 m/s.

When modifying nominal diameters use conical sections.
5. **Auxiliary Connections**

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

- **Ex** If the pump is fitted with a heating jacket, the temperature of the heating medium must not exceed the maximum allowable surface temperature of the pump.

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

6. **Electrical Connection**

- **Attention** The electrical connection of the driving motor must be performed by a skilled person. The relevant regulations on that subject are to be observed.

- **Ex** To avoid the occurrence of electrostatic charging, pump and tank / foundation must be connected to ground.
1. Preparations for Commissioning

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

1.1 Grease-Lubricated Anti-Friction Bearings

The submerged pumps are supplied with permanently grease-lubricated anti-friction bearings in the bearing supports, stand pipes and bearing housings.

1.2 Checking the Direction of Rotation

The motor's direction of rotation must correspond with the direction-of-rotation arrow on the motor lantern.

Only check the direction of rotation with the pump filled.

To find out the motor's direction of rotation, switch the unit on for a short moment and observe the fan wheel through the fan cowl.

1.3 Filling-Up of the Pump

When a pump is operated which has not been completely filled, an ignition source can develop due to excessive heat input. When being operated in areas subject to explosion hazards, the pump must be completely filled. If the operating company cannot ensure the complete filling of the pump, appropriate monitoring measures must be taken.
The filling of the pump is effected automatically with the pump’s installation in the tank. Prior to start-up, the pump must be submerged in the liquid up to the end of the bearing lantern (refer to drawing), only in this case the complete filling of the pump is granted. Open all valves in the pressure pipework.
2. Monitoring Equipment

When the pump is operated in areas subject to explosion hazards, it may be necessary for the operating company to install monitoring devices to ensure that the pump 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

Slightly open the control valve in the pressure pipe.

To prevent the pump from excessively heating up, never operate it against closed control valve on the discharge side. For start-up, the discharge-side control valve must be sufficiently open for the minimum rate of flow Q_{min}.

Switch on the motor.

If the delivery pressure does not increase despite rising speed, the pump has to be switched off immediately.

When the pressure gauge indicates delivery pressure, slowly open the control valve in the pressure pipe until the duty point is reached. The rate of flow can be increased in accordance with the characteristic curve until a point is reached where the motor would be overloaded.
In case either the operation parameters are modified or they no longer correspond with the ones stipulated in the order (delivery head, rate of flow $Q_{\text{min}}$ and $Q_{\text{max}}$, viscosity, density, liquid temperature), it is to be checked whether:

- the magnet drive is still sufficient,
- the motor is not overloaded,
- the maximum allowable temperature is not exceeded.

### During commissioning or in case of varying operating conditions, do not exceed the maximum speed in temperature changing of 25 °C per minute.

### On initial start-up, operate the pump for at least 3 hours under operating conditions while checking for unusual noises and high temperatures on the accessible pump surface. Measure the surface temperature with commercially available surface temperature meters.

### In rare cases it may happen during acceleration of the pump that the magnet drive desynchronises (“breakaway of magnet drive”). This condition can be detected by monitoring the delivery head, capacity and pump power output. Operation of the pump with a desynchronised magnet drive can cause excessive temperatures.

### 4. Shutdown

Switch off the motor and close the shut-off valves. Drain the pump completely if it is switched off for dismantling purposes.
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 authorization. Dismantling and re-assembly of the centrifugal pump type SLM NVT 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.](image)

![Pumps processing dangerous liquids are to be decontaminated. When draining the pump, any danger to persons and environment must be precluded.](image)

![On principle, the driving motor must have been de-energized prior to effecting any works on pumps. Unintentional energizing of the pump must be precluded.](image)

2. **Lubrication of Bearings**

2.1 **Journal Bearings**

The journal bearings are lubricated by the pumped liquid. When the pump is operated to its designated use, the journal bearings will be provided with a sufficient quantity of lubricant and they will be resistant to wear and maintenance-free. Concerning monitoring of operation to designated use, refer to instructions given in sub-section "Monitoring".

![If the pump has run dry unintentionally, the pump must be allowed to cool down for a longer time. If the pump is filled with cold liquid immediately upon its dry-running, the journal bearings may be destroyed. After longer periods of dry-running, the pump must be dismantled and the journal bearings must be checked for any damage.](image)
2.2 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 submerged pumps are supplied with permanently grease-lubricated anti-friction bearings in the bearing supports, stand pipes and bearing housings. Relubrication of the anti-friction bearings is not necessary.

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.).

3. Inspection and Maintenance

3.1 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 pump.

Failures occurring during operation can cause the occurrence of an ignition source on the pump 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:

<table>
<thead>
<tr>
<th>Malfunction</th>
<th>Possible Consequences</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation with wrong direction of rotation.</td>
<td>Overheating of the isolation shell.</td>
<td>Monitoring of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Delivery head or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Capacity or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pump output</td>
</tr>
<tr>
<td>Dry-running as a result of incorrect commissioning (pump not filled).</td>
<td>Overheating of the isolation shell.</td>
<td>Monitoring of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Delivery head or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Capacity or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pump output</td>
</tr>
<tr>
<td>Malfunction</td>
<td>Possible Consequences</td>
<td>Measures</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pumping of non-specified liquid (liquid temperature too high).</td>
<td>The allowable surface temperature is exceeded. Damage to the anti-friction bearings.</td>
<td>Monitoring of • Liquid temperature</td>
</tr>
<tr>
<td>Pumping of non-specified liquid (liquid density too high).</td>
<td>Breakaway of magnet drive due to exceeding of the allowable transmission capacity.</td>
<td>Monitoring of • Delivery head or • Capacity or • Pump output</td>
</tr>
<tr>
<td>Pumping of non-specified liquid (liquid viscosity too high).</td>
<td>Breakaway of magnet drive due to exceeding of the allowable transmission capacity.</td>
<td>Monitoring of • Delivery head or • Capacity or • Pump output</td>
</tr>
<tr>
<td>Pumping of non-specified liquid (thermal capacity of the liquid too low).</td>
<td>Vaporization of liquid in the pump.</td>
<td>Monitoring of • Delivery head or • Capacity or • Pump output</td>
</tr>
<tr>
<td>Pumping less than the specified minimum flow.</td>
<td>Vaporization of liquid in the pump.</td>
<td>Monitoring of • Capacity or • Pump output</td>
</tr>
<tr>
<td>Breakaway of magnet drive on commissioning or by overload of the magnet drive.</td>
<td>Overheating of the isolation shell.</td>
<td>Monitoring of • Delivery head or • Capacity or • Pump output</td>
</tr>
<tr>
<td>Damage to the anti-friction bearings.</td>
<td>Overheating of anti-friction bearings, heat caused by friction between rotating and stationary components.</td>
<td>Monitoring of • Pump output or • Vibrations</td>
</tr>
</tbody>
</table>

For monitoring of the driving motor and the flexible coupling, observe the instructions given in the respective operation manuals.

3.1.1 Monitoring of the Pump Output

The pump power input indicates whether the pump is operated to its designated use. Moreover, any malfunctions or damage to the pump can be inferred from the pump output. KLAUS UNION recommend the use of appropriate monitoring instruments in areas subject to explosion hazards as well as in non-hazardous locations and offer such devices on request. The instruments will be installed in the control cabinet and thus do not have to be approved for hazardous areas.
3.2 Maintenance

The following descriptions of maintenance works to be executed require that the pump has already been partially dismantled. Check the parts for their re-usability and replace damaged components by new original spare parts.

![Ex]

If the clearance between rotating and stationary components is too narrow, it may happen that these components contact and the resulting frictional heat entails excessive temperatures.

3.2.1 Journal Bearings

Replace the journal bearing or parts of it by new original spare parts when the slide faces show visible signs of wear (e. g. traces of grooves from running). Refer to the following table for dimensions of bearing sleeves and bearing bushes as well as for the axial clearance of the journal bearing.

<table>
<thead>
<tr>
<th>Bearing</th>
<th>Inner Diameter Bearing Bush</th>
<th>Outer Diameter Bearing Sleeve</th>
<th>Thrust Bearing Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ø A</td>
<td>Ø B</td>
<td>C</td>
</tr>
<tr>
<td>09 E</td>
<td>40 +0.025</td>
<td>39.98 –0.01</td>
<td>0.3 ±0.1</td>
</tr>
<tr>
<td>13 E / 16 E</td>
<td>53 +0.03</td>
<td>52.98 –0.01</td>
<td>0.5 ±0.1</td>
</tr>
<tr>
<td>19 E</td>
<td>80 +0.035</td>
<td>79.98 –0.01</td>
<td>0.5 ±0.1</td>
</tr>
</tbody>
</table>
3.2.2 Wear Ring Allowance

Replace wear rings (part no. 512, part no. 512.1) by new original spare parts when the following maximum radial allowances are exceeded:

<table>
<thead>
<tr>
<th>Choke-Gap Diameter [mm]</th>
<th>Maximum Radial Allowance [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>s1</td>
</tr>
<tr>
<td>50 to 75</td>
<td>0.20</td>
</tr>
<tr>
<td>76 to 89</td>
<td>0.25</td>
</tr>
<tr>
<td>90 to 139</td>
<td>0.25</td>
</tr>
<tr>
<td>140 to 209</td>
<td>0.35</td>
</tr>
<tr>
<td>210 to 270</td>
<td>0.50</td>
</tr>
<tr>
<td>&gt; 270</td>
<td>0.50</td>
</tr>
</tbody>
</table>

4. Dismantling

For assembly and dismantling, the following special tools are available:

<table>
<thead>
<tr>
<th>Designation</th>
<th>Id.-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clamping Device for Magnet Carrier Size 90/09E</td>
<td>P00001044</td>
</tr>
<tr>
<td>Clamping Device for Magnet Carrier Size 130/13E</td>
<td>P00001045</td>
</tr>
<tr>
<td>Clamping Device for Magnet Carrier Size 160/16E</td>
<td>P00001046</td>
</tr>
<tr>
<td>Clamping Device for Magnet Carrier Size 190/19E</td>
<td>P00001047</td>
</tr>
<tr>
<td>Assembly Aid Shaft Nut Drive Shaft KM 9</td>
<td>P00548891</td>
</tr>
<tr>
<td>Assembly Aid Shaft Nut Drive Shaft KM 11</td>
<td>P00107749</td>
</tr>
<tr>
<td>Assembly Aid for Journal Bearing Bush Magnet Drive Size 09E</td>
<td>P00969926</td>
</tr>
<tr>
<td>Assembly Aid for Journal Bearing Bush Magnet Drive Size 09E .. Z</td>
<td>P00969925</td>
</tr>
</tbody>
</table>

4.1 Preparations

- Isolate the current feed to the motor.
- Close the valves in the pressure pipe.
- Disconnect the pressure nozzle of the pump from the pipework.
- Disconnect the suspension flange of the pump from the tank.
- Extract the complete unit slowly from the tank draining the unit at the same time.

**ATTENTION**

Avoid any impacts between pump and tank.
-- Danger of damage to the pump --
Suspension loads must not be transported over the heads of persons.

- For assembly, put the pump into a horizontal position.
- Dispose of the remaining residual liquid in the pump.
- Release the motor and remove it together with the coupling half from the motor lantern.
- Remove the pump-side coupling half from the pump's drive shaft.

**ATTENTION**

Use an offset cam for dismantling of the coupling.

4.2 Dismantling of the Pump

**ATTENTION**

For assembly and dismantling of the pump, refer to the pertaining sectional drawing.

It is recommended to use the a. m. assembly tools.

For dismantling, the pump should be positioned as indicated in the following drawing.
• Unscrew the pressure pipe (part no. 730) and remove it from the volute casing (part no. 102) and the suspension flange (part no. 895).

• For pumps with more than two stand pipes: Release the cap screws (part no. 901.13) and remove the pipe clip (part no. 733) from the pressure pipe (part no. 730).

• Release and remove assembly stud nuts (part no. 920.1) and dismantle the volute casing (part no. 102).

• Pull the complete assembly comprising impeller (part no. 230) / casing cover (part no. 161) / isolation shell (part no. 817) off the bearing lantern (part no. 340.1).

• Unscrew the cap screws (part no. 901.1) at the isolation shell flange and dismantle the isolation shell. 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 straining ring and isolation shell.

  Plastic Isolation Shell
  Ceramics Isolation Shell

• For further dismantling, firmly secure the outer magnet carrier. (Use of the KU-clamping aid is recommended.)

• Release the impeller nut (part no. 922) and pull the impeller off the shaft.

• Remove the thrust bearing (part no. 314) on the impeller side together with the holder (part no. 386).

**Magnet Drive Size 09E:**

• Pull the casing cover (part no. 161) together with the bearing bush (part no. 545.1) off the pump shaft.

• Carefully clamp the casing cover and unscrew the bearing bush from the casing cover. (Size of the jaw SW80, KU-assembly tool is recommended.)
• Carefully pull bearing sleeves (part no. 529.1) and distance sleeve (part no. 525) off the shaft.
• Remove the inner magnet carrier from the clamping aid and pull the pump shaft out of the inner magnet carrier.
• Remove the lock washer (part no. 931) and release the shaft nut (part no. 921) (KU-assembly tool is recommended). Pull the complete outer magnet carrier (part no. 861 and 818.1) off the shaft (part no. 211.1 and part no. 213 respectively).
• Pull the bearing lantern (part no. 340.1) off the stand pipe (part no. 714.1). Use the forcing threads in the stand pipe provided for that purpose.

Magnet Drive Size 13E, 16E, 19E:

• Pull the casing cover (part no. 161) together with the bearing bush (part no. 545.1) off the pump shaft.
• Unscrew the cap screws (part no. 901.3) at the casing cover (part no. 161) and remove the wear ring (part no. 512.1). Pull the casing cover off the bearing bush (part no. 545.1) and the bearing bush off the shaft (part no. 211).
• Carefully pull bearing sleeves (part no. 529.1) and distance sleeve (part no. 525) off the shaft.
• Remove the inner magnet carrier from the clamping aid and pull the pump shaft out of the inner magnet carrier.
• Remove the lock washer (part no. 931) and the shaft nut (part no. 921) (use of KU-assembly tool is recommended). Pull the complete outer magnet carrier (part no. 861 and 818.1) off the shaft (part no. 211.1 and part no. 213 respectively).
• Pull the bearing lantern (part no. 340.1) off the stand pipe (part no. 714.1). Use the forcing threads in the stand pipe provided for that purpose.

All Magnet Drive Sizes:

Submerged Pumps with more than two Stand Pipes and two Drive Shafts:

• Unscrew the cap screws (part nos. 901.2 and 901.4) and disconnect the stand pipes (part no. 714.1, part no. 714.2 etc.) together with the ball bearings (part no. 321.1 / part no. 321.2). Use the forcing threads provided for that purpose.
• Remove the ball bearings (part no. 321.1 / part no. 321.2) from the stand pipes (part no. 714.1, part no. 714.2 etc.) and from the shaft (part 211.1 and part no. 213 respectively).
• Dismantle the lower shaft (part no. 211.1) with the fixed bearing.
• Pull the protective sleeve (part no. 524) off the shaft.
• Remove circlips (part no. 932.1), spacers (part no. 504.4) and ball bearings (part no. 321.2) from the shaft.
• Dismantle the ball bearings with standard offset cams.
Submerged Pumps with more than two Stand Pipes and one Drive Shaft:

- Unscrew the cap screws (part nos. 901.2 and 901.4) and disconnect the stand pipes (part no. 714.1, part no. 714.2 etc.) together with the ball bearings (part no. 321.1 / part no. 321.2). Use the forcing threads provided for that purpose.
- Remove the ball bearings (part no. 321.1 / part no. 321.2) from the stand pipes (part no. 714.1, part no. 714.2 etc.) and from the shaft (part no. 211.1 and part no. 213 respectively).

All Submerged Pumps:

- Remove the stand pipe (part no. 714) with the ball bearing (part no. 321.1 / part no. 321.2) from the suspension flange (part no. 895). Use the forcing threads provided for that purpose.
- Unscrew the cap screws (part no. 901.9) and remove the motor lantern (part no. 341). Use the forcing threads provided for that purpose.
- Unscrew the hexagon socket screws (part no. 914.2) and remove bearing cover (part no. 360) and spacer (part no. 504.10).
- Dismantle the shaft (part no. 213) together with the bearing housing (part no. 340.2), ball bearing (part no. 321.1), circlip (part no. 932) and spacer (part no. 504.3).
- Pull the circlip (part no. 932) and the spacer (part no. 504.3) off the shaft.
- Dismantle the ball bearings with standard offset cams from the shaft.
- Remove the bearing housing (part no. 340.2).

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, radial shaft seal rings and O-rings are to be replaced by new ones. Check the clearances and the journal bearing for wear as indicated above.

Fitting surfaces and screwed connections have to be coated with graphite or a similar agent. Where components in contact with the liquid are concerned, make sure that the antiseize agent used is compatible with the pumped liquid.

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

- Heat the ball bearing (part no. 321.1) to abt. 60°C and push it on the drive shaft (part no. 213).
- Push the bearing housing (part no. 340.2) over the ball bearing (part no. 321.1).
- Mount the spacer (part no. 504.3) and the circlip (part no. 932) on the shaft.
- Push the shaft into the suspension flange (part no. 895).
- Screw the bearing cover (part no. 360) and the spacer (part no. 504.10) together with the bearing housing and the suspension flange.
- Insert the O-ring (part no. 412.2) into the O-ring groove at the stand pipe (part no. 714) and screw the stand pipe together with the suspension flange (part no. 895).

Submerged Pumps with more than two Stand Pipes and two Drive Shafts:

- Insert the key (part no. 940.5 and part no. 940.6) into the key groove.
- Mount the spacer (part no. 504.4) and the circlip (part no. 932.1) on the lower shaft (part no. 211.1).
- Heat the ball bearing (part no. 321.2) to abt. 60°C and push it on the lower shaft (part no. 211.1).
- Mount the spacer (part no. 504.4) and the circlip (part no. 932.1) on the shaft.
- Push the protective sleeve (part no. 524) on the shaft.
- Insert the O-ring (part no. 412.1 and part no. 412.3 respectively) into the stand pipes and screw the stand pipes together.
- Push the lower shaft (part no. 211.1) together with the fixed bearing and the protective sleeve into the stand pipe.

- Heat the ball bearing (part no. 321.1) to abt. 60°C and push it on the shaft.
- Insert the key (part no. 940.1) into the key groove.
- Insert the O-ring (part no. 412.1 and part no. 412.3 respectively) into the stand pipe and screw it together with the bearing lantern (part no. 340.1).
- 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-assembly tool is recommended).

5.2 Hydraulic Component

5.2.1 Magnet Drive Size 09E

- Screw bearing bush (part no. 545.1) into the casing cover (part no. 161). (Size of the jaw SW 80, KU-assembly tool is recommended.)
- Push the inner magnet carrier (part no. 818.2) on the pump shaft (part no. 211) and fix it in a clamping aid. [KU-special tool (clamping aid) is recommended.]
• Insert the elastomer washer (part no. 504.2) and the thrust bearing (part no. 314) in the inner magnet carrier.
• Carefully assemble SiC-bearing sleeves (part no. 529.1) and distance sleeve (part no. 525) and push the resulting assembly over the pump shaft.
• Carefully push the assembly comprising casing cover / bearing bush over the bearing sleeves on the pump shaft.
• Put the elastomer washer (part no. 504.2) and thrust bearing (part no. 314) in the holder (part no. 386) and push it on the pump shaft.
• Install the key (part no. 940.4) in the key groove of the pump shaft and push the impeller (part no. 230) on the pump shaft.
• Fasten the impeller by means of the impeller nut (part no. 922). (For tightening moments refer to the corresponding table.)
• Remove the assembled unit from the clamping aid and position the assembly with the impeller facing the ground on a stable support to proceed with the assembly of the isolation shell.

• For Construction with Metal Isolation Shell:
  Insert the gasket (part no. 400.3) into the lining groove of the casing cover. Place the isolation shell (part no. 817) in the centring and fasten it on the casing cover 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 casing cover. Fit the isolation shell (part no. 817, outer and inner isolation shells) in the lining groove of the casing cover. Pull the straining ring (part no. 515) over the isolation shell and screw it with cap screws (part no. 901.1) on the casing cover.

• For Construction with Ceramics Isolation Shell:
  Fit the O-ring (part no. 412) in the lining groove of the casing cover. 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 casing cover.

<table>
<thead>
<tr>
<th>ATTENTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>In case of pump construction with ceramics isolation shell, make sure the</td>
</tr>
<tr>
<td>isolation shell does not jam in the straining ring. You must be able to</td>
</tr>
<tr>
<td>turn the isolation shell freely in the straining ring.</td>
</tr>
</tbody>
</table>

5.2.2 Magnet Drive Size 13E, 16E, 19E

• Screw the bearing bush (part no. 545.1) together with the wear ring (part no. 512.1) with cap screws (part no. 901.3) on the casing cover (part no. 161).
• Push the inner magnet carrier (part no. 818.2) on the pump shaft (part no. 211) and fix it in a clamping aid. [KU-special tool (clamping aid) is recommended.]
• Insert the elastomer washer (part no. 504.2) and the thrust bearing (part no. 314) in the inner magnet carrier.
• Carefully assemble SiC-bearing sleeves (part no. 529.1) and distance sleeve (part no. 525) and push the resulting assembly over the pump shaft.
• Carefully push the assembly comprising casing cover / bearing bush over the bearing sleeves on the pump shaft.
• Put the elastomer washer (part no. 504.2) and thrust bearing (part no. 314) in the holder (part no. 386) and push it on the pump shaft.
• Install the key (part no. 940.4) in the key groove of the pump shaft and push the impeller (part no. 230) on the pump shaft.
• Fasten the impeller by means of the impeller nut (part no. 922). (For tightening moments refer to the corresponding table.)
• Remove the assembled unit from the clamping aid and position the assembly with the impeller facing the ground on a stable support to proceed with the assembly of the isolation shell.

• For Construction with Metal Isolation Shell:
  Insert the gasket (part no. 400.3) into the lining groove of the casing cover. Place the isolation shell (part no. 817) in the centring and fasten it on the casing cover 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 casing cover. Fit the isolation shell (part no. 817, outer and inner isolation shells) in the lining groove of the casing cover. Pull the straining ring (part no. 515) over the isolation shell and screw it with cap screws (part no. 901.1) on the casing cover.

• For Construction with Ceramics Isolation Shell:
  Fit the O-ring (part no. 412) in the lining groove of the casing cover. 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 casing cover.

**ATTENTION**
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.
5.3 Final Assembly

- Fit the gasket (part no. 400.4) in the centring of the bearing lantern (part no. 340.1).
- Position the assembly comprising impeller/casing cover/isolation shell in the centring of the bearing lantern.
- Fit the gasket (part no. 400.1) in the centring of the casing cover.
- Screw the assembly studs (part no. 902) in the threaded bores of the volute casing (part no. 102).
- Fit the volute casing in the centring of the casing cover and use assembly stud nuts (part no. 920.1) to screw it on.
- Screw the pressure pipe (part no. 730) together with the volute casing (part no. 102) and the suspension flange (part no. 895).
- In case the pump is equipped with more than two stand pipes: screw the pipe clip (part no. 733) together with the pressure pipe.
- Insert radial shaft seal ring (part no. 421) in the casing cover (part no. 360).
- Screw the motor lantern (part no. 341) together with the suspension flange (part no. 895).
### 5.4 Tightening Moments for Screws

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

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Position</th>
<th>Screw Material</th>
<th>Thread</th>
<th>Tightening Moment [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>901.1</td>
<td>Isolation Shell Flange</td>
<td>A4 - 70</td>
<td>M 8 / M 10 / M 12 / M 16</td>
<td>20 / 40 / 65 / 90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.7258</td>
<td></td>
<td>25 / 45 / 75 / 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.7709</td>
<td></td>
<td></td>
</tr>
<tr>
<td>901.1</td>
<td>Straining Ring (Isolation Shell made of Zirconium)</td>
<td>A4 - 70</td>
<td>M 8 / M 10 / M 12</td>
<td>15 / 25 / 35</td>
</tr>
<tr>
<td>901.1</td>
<td>Straining Ring (Isolation Shell made of CFRP)</td>
<td>A4 - 70</td>
<td>M 8 / M 10</td>
<td>20 / 25</td>
</tr>
<tr>
<td>901.6/</td>
<td>Pressure Pipe</td>
<td>5.6 galvanized+ chromalized</td>
<td>M 12 / M 16 / M 20</td>
<td>35 / 80 / 110</td>
</tr>
<tr>
<td>901.11</td>
<td></td>
<td>A4-70</td>
<td></td>
<td>55 / 80 / 110</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.7258</td>
<td></td>
<td>65 / 90 / 140</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.7709</td>
<td></td>
<td></td>
</tr>
<tr>
<td>901.19</td>
<td>Impeller Bolt</td>
<td>A4 - 70</td>
<td>M 8 / M 10</td>
<td>20 / 40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.4602</td>
<td></td>
<td></td>
</tr>
<tr>
<td>902/</td>
<td>Volute Casing</td>
<td>5.6 galvanized+ chromalized</td>
<td>M 12 / M 16 / M 20</td>
<td>35 / 80 / 110</td>
</tr>
<tr>
<td>920.1</td>
<td></td>
<td>A4 - 70</td>
<td></td>
<td>55 / 80 / 110</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.7258</td>
<td></td>
<td>65 / 90 / 140</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.7709</td>
<td></td>
<td></td>
</tr>
<tr>
<td>922</td>
<td>Impeller Nut</td>
<td>1.4571 / 2.4602</td>
<td>M 20x1</td>
<td>110 / 110</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M 24x1.5</td>
<td>180 / 180</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M 27x1.5</td>
<td>250 / 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M 35x1.5</td>
<td>350 / 350</td>
</tr>
</tbody>
</table>

Materials of screws are mentioned in the parts list.

### 6. Spare Parts

The attached spare parts list enumerates the recommended spare parts.

Exclusively use original spare parts for repairs and replacements.
1. **Malfunctions and Causes**

When contacting KLAUS UNION for further information please advise our ref.-no. and / or the serial no.

<table>
<thead>
<tr>
<th>Malfunctions</th>
<th>Reference-Number for Cause and Elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of flow is too low</td>
<td>1, 8, 9, 12, 14, 15</td>
</tr>
<tr>
<td>Rate of flow is too high</td>
<td>2, 16</td>
</tr>
<tr>
<td>Delivery head is too low</td>
<td>2, 3, 8, 9, 10, 12, 15</td>
</tr>
<tr>
<td>Delivery head is too high</td>
<td>1, 16, 27, 31</td>
</tr>
<tr>
<td>Pump does not suck or only to a limited extent</td>
<td>3, 5, 8, 15</td>
</tr>
<tr>
<td>Pump does not feed</td>
<td>3, 4, 5, 6, 8, 15</td>
</tr>
<tr>
<td>Pump processes by fits and starts</td>
<td>3, 5, 8</td>
</tr>
<tr>
<td>Pump operates noisily</td>
<td>3, 5, 6, 7, 12, 13</td>
</tr>
<tr>
<td>Power input is too high</td>
<td>2, 6, 7, 10, 11, 13, 16</td>
</tr>
<tr>
<td>Power input is too low</td>
<td>9, 15, 27, 30, 31</td>
</tr>
<tr>
<td>Pump runs backwards</td>
<td>12, 18</td>
</tr>
<tr>
<td>Pump runs unsteadily</td>
<td>7, 13, 17, 19, 20, 21, 22, 23, 24, 25, 26, 27</td>
</tr>
<tr>
<td>Pump casing leaks</td>
<td>26, 28, 29</td>
</tr>
<tr>
<td>Pump runs hot</td>
<td>4, 15, 17</td>
</tr>
<tr>
<td>Pump stalled</td>
<td>6, 7, 13</td>
</tr>
</tbody>
</table>
### Causes and Proceedings for Elimination of Malfunctions

<table>
<thead>
<tr>
<th>Ref.-No.</th>
<th>Cause</th>
<th>Elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Resistance in pressure pipework is too high.</td>
<td>Clean or replace pipework and valves. Check the dimensions of the pipework nominal diameters.</td>
</tr>
<tr>
<td>2</td>
<td>Pressure-side pipework resistance is too low.</td>
<td>Throttle using control valve on pump discharge.</td>
</tr>
<tr>
<td>3</td>
<td>No liquid in the tank or liquid level too low.</td>
<td>Fill up the tank. Check the pump for any damage to the journal bearings.</td>
</tr>
<tr>
<td>4</td>
<td>Shut-off valve in the pressure pipework is closed.</td>
<td>Open the shut-off valve. If necessary, check the check valve.</td>
</tr>
<tr>
<td>5</td>
<td>Pump or suction hose are clogged.</td>
<td>Clean tank, suction hose and pump.</td>
</tr>
<tr>
<td>6</td>
<td>Foreign bodies in the pump.</td>
<td>Dismantle and clean the pump. Replace damaged components using new original spare parts.</td>
</tr>
<tr>
<td>7</td>
<td>Wear of journal bearings.</td>
<td>Check the bearing clearance.</td>
</tr>
<tr>
<td>8</td>
<td>Pressure pipe leaks.</td>
<td>Check the connections of the pressure pipe (tightening moments and gaskets). Check tightening moments of screws and gaskets at the volute casing. Replace damaged gaskets using new original spare parts.</td>
</tr>
<tr>
<td>9</td>
<td>Speed is too low.</td>
<td>Check frequency and voltage of the motor.</td>
</tr>
<tr>
<td>10</td>
<td>Viscosity of the pumped liquid is too high.</td>
<td>Contact KLAUS UNION.</td>
</tr>
<tr>
<td>11</td>
<td>Density of the pumped liquid is too high.</td>
<td>Contact KLAUS UNION.</td>
</tr>
<tr>
<td>12</td>
<td>Wrong direction of rotation.</td>
<td>Check the motor's direction of rotation (observe direction-of-rotation arrow on the pump).</td>
</tr>
<tr>
<td>13</td>
<td>Anti-friction bearings are damaged.</td>
<td>Replace the anti-friction bearings and clean the oil chamber. Check whether the lubricant is appropriate for field of application.</td>
</tr>
<tr>
<td>14</td>
<td>Liquid level in the tank is below minimum liquid level.</td>
<td>Check the liquid level.</td>
</tr>
<tr>
<td>15</td>
<td>Breakaway of magnet drive.</td>
<td>Switch off the motor. As soon as the motor comes to rest, switch it on again. In case of a repeated breakaway of the magnet drive, contact KLAUS UNION.</td>
</tr>
<tr>
<td>16</td>
<td>Speed is too high.</td>
<td>Check the frequency and the voltage of the motor.</td>
</tr>
<tr>
<td>Ref.-No.:</td>
<td>Cause</td>
<td>Elimination</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>17</td>
<td>Flush flow is too low.</td>
<td>Check the flushing system. Clean the components if necessary. Check Q&lt;sub&gt;min&lt;/sub&gt;.</td>
</tr>
<tr>
<td>18</td>
<td>Swing check valve jammed.</td>
<td>Check for correct operation of the swing check valve.</td>
</tr>
<tr>
<td>19</td>
<td>Impeller is clogged or damaged.</td>
<td>Clean the impeller and replace it using a new original spare part if necessary.</td>
</tr>
<tr>
<td>20</td>
<td>Precipitation of crystals from the pumped liquid.</td>
<td>Increase the temperature of the pumped liquid, e. g. by heating the pump. Contact KLAUS UNION.</td>
</tr>
<tr>
<td>21</td>
<td>Specified quantity of lubricant was not observed.</td>
<td>Check the anti-friction bearings and replace them using new original spare parts if necessary. Increase the quantity of the lubricant according to the specification.</td>
</tr>
<tr>
<td>22</td>
<td>Unsuitable lubricant.</td>
<td>Check the anti-friction bearings and replace them using new original spare part if necessary. Check whether the lubricant is suitable for your field of application.</td>
</tr>
<tr>
<td>23</td>
<td>Inexpert assembly of anti-friction bearings.</td>
<td>Check the anti-friction bearings and replace them using new original spare part if necessary. Assemble the anti-friction bearings properly.</td>
</tr>
<tr>
<td>24</td>
<td>Misaligned or loose coupling.</td>
<td>Check the coupling for any misalignment. If necessary, observe the instructions given in the operation manual of the flexible coupling.</td>
</tr>
<tr>
<td>25</td>
<td>Flexible coupling is worn.</td>
<td>Replace the flexible coupling using a new one. If necessary, observe the instructions given in the operation manual of the flexible coupling.</td>
</tr>
<tr>
<td>26</td>
<td>Pump casing is distorted.</td>
<td>Check and correct pipework lengths.</td>
</tr>
<tr>
<td>27</td>
<td>Pump design is incorrect.</td>
<td>Contact KLAUS UNION.</td>
</tr>
<tr>
<td>28</td>
<td>Unsuitable casing gasket.</td>
<td>Replace the casing gasket using a new original spare part.</td>
</tr>
<tr>
<td>29</td>
<td>Casing screws have been tightened insufficiently.</td>
<td>Tighten the casing screws according to the specified tightening moments.</td>
</tr>
<tr>
<td>30</td>
<td>Density of the pumped liquid is too low.</td>
<td>Contact KLAUS UNION.</td>
</tr>
<tr>
<td>31</td>
<td>Viscosity of the pumped liquid is too low.</td>
<td>Contact KLAUS UNION.</td>
</tr>
</tbody>
</table>