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1 General information / safety

1.1 Important preliminary information
In addition to the safety and caution instructions in this operating instruction also observe all general occupational safety and health regulations!
The LEWA metering pumps and process pumps must only be used in proper technical condition and for the application intended, special attention must be paid to any safety risk observing the operating instruction! Specially problems impairing the safety must be corrected immediately.
Proper use includes observation of the operating instruction and maintaining of all inspection and maintenance requirements.
The metering pumps and process pumps are only intended for the conditions and fluid stated in the technical data sheet. Any deviating use or a use exceeding these conditions is considered to be improper use. The risk rests with the user exclusively.

The operator must assure that all commissioning, service, preventive maintenance and installation work is carried out by authorized and qualified expert personnel only which has gained sufficient information by studying the operating instruction in detail.

In addition to the safety ▲ and caution instructions ▲ in this operating instruction also observe all general occupational safety and health regulations!
Please observe comments with the Ex sign for hazardous areas acc. to guideline 94/9 EC (ATEX).
The operator must assure that at least one copy of the operating instruction always is available near the pump!

- Has the pump drive element been filled with suitable lubricant?
- Have all parts supplied loose been installed (e.g. plungers of plunger pump heads)?
- Is the power supply of the drive resp. the control correct?
- Has the electric hook-up of the metering pump/process pump been carried out properly and meeting local requirements?
- Are all connections hooked-up correctly (no tension and tight)?
- Is the discharge side protected by e.g. a safety valve?
1.2 Application
This operating instruction applies to metering and process pumps manufactured by LEWA. The LEWA commission number and LEWA serial number is stated in the “Technical Data Sheet” and on the pump name plate.

1.3 Performance and applicabilities
• The metering pump/process pump was designed for the conditions listed in the "Technical Data Sheet".
• The metering pump / process pump is approved for use in hazardous areas only when the technical data sheet and the factory name plate displays a degree of explosion protection corresponding to the area.
• LEWA cannot accept any responsibility if these conditions are changed. Under certain conditions this could lead to major problems resulting even in the destruction of the metering pump / process pump. LEWA also cannot accept any responsibility if the fluid conveyed or important operating conditions were not specified or specified incompletely only.

Please consult LEWA if the metering pump / process pump is suited for the changed application conditions.

1.4 Safety
LEWA products meet the regulations for safety at work and prevention of accidents.
• Depending on the place of installation and the operating mode, as well as fluid and heating agent temperature the metering pumps/process pumps can reach a high surface temperature (>80 °C) (danger of burns). Should this be the case protective measures (e.g. protection against physical contact) must be taken.
• When used in hazardous areas the metering pumps / process pumps are designed for temperature classes T1 to T4. For an exact classification therefore take special notice of the temperature of the metering- and heating fluid. The temperatures stated in the technical data sheet must not be exceeded. Please consult LEWA in case of deviations.
• If the fluid conveyed can form an explosive mixture together with the atmosphere, diaphragm pump heads with single diaphragm must not be used in hazardous areas! Exception: diaphragm pumps with a stroke volume < 1 cm³. In case of diaphragm rupture the leaking fluid will be dangerous (e.g. hot/toxic/high pressure).
• Endangering the operating personnel by the fluids used must be prevented by corresponding accident prevention measures of the user. This means all seals, screwed connections and venting screws must be checked for tightness periodically!
• Venting screws must be opened very careful only! The leaking fluid is posing an acute danger (e.g. hot/toxic/high pressure/combustible).
• In hazardous areas, where the fluid conveyed can form an explosive mixture when in contact with the atmosphere, a safe drainage of the leaking fluid must be assured.
• Assure safe draining of the leakage at the plunger seal of plunger pump heads.
• When plunger pump heads are used to convey combustible fluids the leakage at the plunger seal must be minimised (regular maintenance, flushing by a suitable fluid and safe drainage of the leakage).
• Wetted parts must be thoroughly flushed and cleaned before disassembly!
• The hydraulic fluid and the diaphragm intermediate fluid were matched to the fluid conveyed based on the operating data available to us. Fluids causing an exothermal reaction when in contact with mineral oil must be protected by using a suitable diaphragm intermediate fluid. Please consult LEWA in case of doubt.
• Assure that the cover of the holder (24) is always closed!
The oscillating plunger rod is a possible source for accidents by squashing!

Metering pumps / process pumps with an electric drive are machines for use in industrial high tension plants. During operation this equipment has dangerous, live parts and possibly moving resp. rotating parts. Therefore they can cause high health hazards or material damage in case
of non-authorized removal of the required covers, in case of improper use, mis-operation and insufficient maintenance. 

The persons in charge of plant safety therefore must assure that

- only qualified personnel is ordered to work on the machines resp. instruments
- the personnel, among other things, always have the operating instructions and all other documents of the product documentation readily available for all work concerned.
- The persons must be placed under the obligation to strictly adhere to these documents.

Qualified personnel are persons which, due to their education, experience and training as well as their knowledge of the relevant standards, regulations, rules for the prevention of accidents and operating conditions, have been authorized by the persons in charge of plant safety to carry out the corresponding work required and can recognize and prevent possible dangers when performing the work.

1.5 Supply connections

Metering pumps / process pumps with an electric drive and possibly an attached electric stroke actuator need an adequate connection. The power connected is stated in the “Technical Data Sheet”.

For pump heads / pipe lines with heating or cooling jackets or for drives, gears or pump drive elements with cooling the connection and supply of a suitable heating or cooling fluid must be provided.

For plunger pump heads a safe collection and draining of any leakages and the supply and draining of flushing fluid for the plunger seals must be provided.

Pneumatic stroke actuators must be supplied with operating and control air pressure.

When the pump head is equipped with a venting screw a hose connection compatible with the fluid must be installed to a collecting tank or the supply tank.

1.6 Emissions

The exact sound pressure level can be taken from the technical data sheet. Leakages can occur at the plunger seal of plunger pump heads.

Therefore make sure to observe all handling and safety instructions for the fluid conveyed ! (Safety data sheet)

2 Transportation and intermediate storage

2.1 Condition as supplied

If not specified otherwise by the purchaser, LEWA metering pumps / process pumps are preferably tested with water at the performance data stated in the technical data sheet.

Except for small pumps such as e.g. LEWA ecodos the drive elements are delivered without lubricant charge. The airfilter is supplied separately and the bore in the drive element is closed by a plug.

Enclosed holders (refer to fig. 2) of hydraulically actuated diaphragm pump heads are filled with hydraulic fluid. The filling bore is closed by a plug, the airfilter is supplied separately.

Gears usually are supplied filled with lubricant (refer to operating instruction of the drive).

Corrodible components of the plunger pump head (e.g. plungers) are stripped, protected and supplied loose. Installation of plunger acc. to operating instruction B.00, section 4.5. Pump head connections are protected by plastic caps against damage and ingress of dirt.

If metering pumps / process pumps are shipped without motor please read and observe the enclosed operating instruction of the coupling.

2.2 Inspection of the packing at the destination

Please check packing for damages upon receipt. External damages must be reported to the corresponding forwarder immediately and a recording of damages must be requested. The packing must be in a condition which assures protection during the storage period following. The shipment must be opened if packing damage is noticed.

For drives and accessories please observe the instructions of the corresponding manufacturer.
<table>
<thead>
<tr>
<th>Simplex pump vertical design, all pump heads</th>
<th>Simplex pump horizontal design, all pump heads</th>
<th>Multiplex pumps 2 - 6, all pump heads,</th>
<th>Multiplex pumps 2 - 6, all pump heads,</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types EK, EL, EH, EAL, EEL, ELE, GL, GH, EAC, EAK, EEC, EEK, FC, FCE</td>
<td>Types EK, EL, EH, GL, GH, EAL, EEL, LDB, LDC, LDD, LDE,</td>
<td>Typ FC, EAC, EEC, FCE, EAK, EEE, FKE, LDB, LDC, LDD, LDE,</td>
<td></td>
</tr>
</tbody>
</table>

Simplex pump horizontal design, all pump heads, Types EK, EL, EH, EAL, EEL, ELE, GL, GH, EAC, EAK, EEC, EEK, FC, FCE, LDB, LDC, LDD, LDE,

Simplex pump vertical design, all pump heads, Types ES, GS, LDH

Multiplex pumps 2 - 6, all pump heads, Typ FC, EAC, EEC, FCE, EAK, EEE, FKE, LDB, LDC, LDD, LDE,

Refer to general arrangement drawing concerning the attachment of the lifting gear resp. slings

All combinations of metering pumps (e.g. EH1/EK1) up to and including types EH, GH

Simplex pump horizontal design with diaphragm pump heads, Types ES, GS, EG, GG, LDH

Simplex pump vertical design, all pump heads, Types ES, GS

Simplex pump, opposed plunger (boxer) design, vertical with diaphragm pump heads, Types ESB, GSB

Multiplex pumps with diaphragm pump heads, Types G3H, G3S, G3F, G3G

Multiplex pump 2 - 6, in opposed plunger (boxer) design with diaphragm pump heads, Types ESB, GSB, LDHB,

Multiplex pump 2 - 6, in opposed plunger (boxer) design with diaphragm pump heads, Types ESB, GSB, EGB, GGB, LDHB,

The lifting gear must be attached to the corresponding lifting lugs only, install the lifting slings as shown in the pictures/ g.a. drawing.

Slacken the tension of the lifting gear only after the pump was safely installed on the foundation.
2.3 Transportation, lifting devices

The figures and instructions concerning attachment to lifting equipment given on page 5 must be observed. Remove lifting gear only after the pump has been safely mounted to the foundation. The pump could tip over otherwise.

3 Product information

3.1 General description

LEWA metering pumps/process pumps are reciprocating positive displacement pumps. The volume flow is produced by periodically repeating a preset stroke volume given by the plunger area and the stroke length. The volume flow can be changed by altering the stroke length and/or the stroke frequency or both.

3.2 Construction and method of operation

LEWA metering pumps/process pumps are made up of the sub-assemblies driver, pump drive element and pump head and possibly further attachments (see fig. 1).

3.2.1 Driver

The driver (usually an electric motor) supplies the power required to raise the fluid conveyed from suction to discharge pressure. For this make sure to read paragraph 1.4.

3.2.2 Pump drive

The pump drive converts the rotation of the driver into an oscillating (reciprocating) motion of the plunger as described in the operating instruction "Pump Drive Element".

3.2.3 Pump heads (see fig. 2)

The pump heads, being the actual conveying element, can be designed as plunger or diaphragm pump head.

3.3 Dimensions / weights / centres of gravity

Please refer to the attached general arrangement drawing for this information.

4 Erection and assembly

4.1 Permissible ambient conditions

The standard metering pumps/process pumps design is intended for installation in dry rooms with a non-aggressive atmosphere. Other environmental conditions (e.g. installation outdoors, on drilling platforms, in dairies, etc.) are only permissible if they are stated in the “Technical Data Sheet” and if the pump was designed for such a particular purpose (e.g. with an appropriately protected drive or special corrosion protection).

4.2 Space requirements

The space requirement of the pump or package and the position of the foundation holes can be taken from the general arrangement drawing.
4.3 **Foundation**

Reciprocating displacement pumps have pulsating forces and moments which act on the foundation.

For big pumps the foundation must be designed to take up these forces and moments.

The forces to be considered will be given by LEWA on request.

The user is responsible for supplying a proper foundation.

The layout of the foundation should allow ready access to the oil drain plug, oil sightglass and to the bottom cover.

4.4 **Erection** (s. fig. 3)

The pump must be set up so that the centre line of the piston rod is horizontal and the centre line of the valves is vertical.

The following parts should be readily accessible (see fig. 3):

- Handwheel for stroke adjustment and indicating scale (h),
- oil filling and draining plugs (o),
- oil level indication (s),
- valves (v),
- venting valve (e) (if fitted),
- plunger packing (k) for plunger pump heads.

Please also note the assembly distances given in the general arrangement drawing.

4.5 **Installation**

4.5.1 **Electrical** (For this specially observe section 1.4)

The electric motor must be connected acc. to local regulations, with overload protection.

When connecting the motor the direction of rotation marked by an arrow at the drive element housing or the drive flange must be observed.

The complete installation must be equipped with an "emergency stop" switch by the user which is accessible easily and fast from the place of work.

The earthing connection of metering pumps / process pumps in hazardous areas must be connected.

4.5.2 **Hydraulical**

The oscillating operation of LEWA metering pump / process pump must be taken into consideration when designing the pipeline. For this refer to information sheets D0-00 resp. D0-01.

Before mounting the pipelines the protective covers at the suction and discharge connection must be removed. The connections and pipelines must be thoroughly cleaned. The suction and discharge line must be attached to the pump head without tension or stress.

The pipelines must be installed so that the valves (v) are easily accessible and allow simple replacement of the plunger packing (k) of the plunger heads or the diaphragm of diaphragm pump heads (refer to fig. 4). The assembly space required can be taken from the general arrangement drawing.
4.5.3 Safeguarding against overpressure
Reciprocating positive displacement metering pumps/process pumps have a positive displacement characteristic. Therefore the pump and system must be equipped with a safety valve in the discharge line as a protection against possible overpressure (e.g. closed shut-off valve etc). Diaphragm pump heads are equipped with an integral pressure limiting valve which protects the metering pumps/process pumps but not the system.

4.5.4 Dirt traps
Contamination of the fluid conveyed can lead to inaccurate metering results and to increased wear.

If contamination of the fluid conveyed cannot be prevented a dirt trap must be installed. The mesh size of the strainer sieve can be taken from table 1. We recommend to use dirt traps with a sufficient surface area with inserts which can be removed for cleaning. LEWA can offer suitable dirt traps.

Tabel 1

<table>
<thead>
<tr>
<th>Valve DN</th>
<th>max. mesh size (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>micro metering</td>
</tr>
<tr>
<td>≤ 5</td>
<td>0,04</td>
</tr>
<tr>
<td>10</td>
<td>0,15</td>
</tr>
<tr>
<td>15</td>
<td>0,2</td>
</tr>
<tr>
<td>25</td>
<td>0,3</td>
</tr>
<tr>
<td>≥ 32</td>
<td>0,5</td>
</tr>
</tbody>
</table>

4.5.5 Pressure retaining valves
Pressure retaining valves are recommended if the differential pressure between suction and discharge valve is not sufficient. This prevents an uncontrolled flow through the pump head. Pressure retaining valves are not suitable for use as a shut-off device!

4.5.6 Metering of slurries
Trouble-free metering requires even mixing of the fluid conveyed up to the metering pump. Sedimentation must be prevented. The suction and discharge side installation must be properly designed for this. We would be pleased to assist you when planning the installation. Depending on the properties of the slurry suitable slurry valves are installed in the pump.

5 Commissioning / operation / shut down

5.1 Operating equipment
See operating instruction.

5.2 Operating and ancillary means
5.2.1 Lubricant for metering pumps / process pumps drive elements

Note danger of burns by hot lubricant when draining the pump drive element.

See operating instruction of drive elements and separate operating instruction B 1.001.

5.2.2 Others
Hydraulic fluids, heating-, cooling- and flushing fluids, supply lines of stroke actuators see “Technical Data Sheet”, product list and operating instruction “Pump Head/Stroke Actuator”. For hydraulic fluids (selection table) refer to separate operating instruction B 1.002.

5.3 Commissioning, start-up, venting
Before commissioning please check if the metering pump/process pump is installed and hooked-up as required.
Provide guards for coupling, plunger rod, motor fan etc. to prevent possible injury.

- Install single parts (e.g. plungers) supplied loose.
- Fill in lubricant specified (see operating instruction „drive unit, pump head and stroke actuator“).
- Replace oil filling screwed plug and screw-in air filter supplied loose instead on dairy and canner designs.
- Remove screwed plug from the holder of diaphragm pump heads and replace by air filter supplied loose.
- Check if all drain holes are free resp. chocked-up (e.g. leakage bores at the plunger rod guide)
- Set variable stroke metering pumps / process pumps to zero stroke.
- Turn on flushing and/or heating/cooling if provided. Open shut-off valves in suction and discharge line.
- Switch on metering pump/process pump, on low r.p.m. for variable speed drives.
- Slowly increase stroke length and, where applicable, speed.
- Let pump deliver at zero pressure in order to ensure good venting of pipe lines and pump.

- If pump does not prime itself (because of high suction lift, spring loaded discharge valve, high discharge pressure, or small plunger diameter) the suction line and pump head must be vented by one of the following methods:
  - Plunger pump heads with venting screw:
    connect the venting screw to the suction vessel or a collecting vessel using a hose.
    Loosen the venting screw by 1/6 of a turn (ccw).
    The hexagon head of the venting screw serves as reference point for this!
    During each discharge stroke watch the backflow to the collecting vessel until no further air bubbles are carried along.
    Then tighten venting screw slightly.
  - Pump heads without venting screw:
    produce pressure on the suction side forcing a filling of the suction line and the pump head. If you require more information on the subject of start-up/venting please request leaflet D0-0 „Properties and Installation of Metering Pumps“ from LEWA and refer to section 3.5 „Start-up and venting“. For diaphragm pump heads refer to the operating instruction „Diaphragm pump head“. Please ask LEWA for assistance if none of the above procedures is succesful or possible.
  - Slowly increase pressure.

5.4 Adjustment and control

The metered flow can be adjusted by a change in stroke length or by changing the stroke frequency of variable speed drives.

The effective metered flow depends on the discharge pressure.

If you need the exact relation of metered flow to stroke length it is best to calibrate the metering pump / process pump under operating conditions. For this you need to measure the metered flow at different stroke length settings.

Figure 5 shows four methods with determination of volume or weight, namely.

A Volume measurement on suction side with supply burette
B Volume measurement on discharge side with measuring cylinder
C Measurement of weight loss in suction vessel
D Measurement of weight gain in discharge vessel.

Please choose the method which is the most appropriate one for you. In order to achieve adequate accuracy you should measure at least 100 stroke volumes.

You can also calibrate the pump by means of flow meters.
5.5 Shut-down

If the metering pump/process pump is shut-down for a longer period of time you must remove all residual fluid from the pump head by flushing; disassemble and clean if required. Remove metallic plungers from plunger pump heads because of risk of pitting corrosion. Exception: hard metal plungers in high pressure pump heads.

5.6 Dismantling and return transportation

If you are stripping and returning pumps, e.g. for repair (s. par. 2.3 „Transportation, lifting devices“), the following steps must be taken before dispatch:
  • All traces of the fluid must be removed from the pump head and, if required, the pipe line, clean thoroughly, neutralize or decontaminate.
  • In case of return to LEWA the filled-in fluid safety data sheet must be included.
  • Drain lubricant from drive unit.
  • Replace air filter by a screwed plug.
  • If the hydraulic fluid is not drained from pump heads with enclosed holders, replace the air filter by a screwed plug. Also make sure that all connections to outside are sealed off.
  • For pneumatic stroke actuators tighten screws in the lines between oil chamber and position controller (see operating instruction “Pneumatic Stroke Actuator”).

Damage to pump or other goods resulting from leakage of lubricant or residual fluid is the responsibility of the sender.

6 Maintenance and repairs

6.1 Maintenance

Observe section 1.4 "Safety" of this operating instruction before doing any maintenance work!

Weekly: Check lubricant level in pump drive unit.
For this also refer to operating instructions of the subassemblies pump heads, stroke actuators and accessories.
Check all sealing joints for possible leaks.

Please refer to operating instruction “Pump Drive Unit” or “Stroke Actuator” for volume of lubricant.
For lubricant qualities please refer to operating instruction B 1.001 and B 1.002.
Also observe the maintenance instructions of sub-supplied assemblies such as e.g. couplings, external gears.
Depending on the ambient operating conditions (load, temperature, humidity of air, contamination of the surrounding air with pollutants) the lubricants age rather differently. Therefore lubricants should be analysed every 3-6 months, depending on the load, and replaced if they are no longer suitable.

Lubricants which are contaminated by chemicals will cause excessive wear, corrosion and leakages at seals.

For operation in the hazardous area (except category 3 (ATEX)) the maintenance intervals stated in the operating instruction of the corresponding sub-assembly must be maintained precisely.

6.2 Repairs

If you are carrying out repairs yourself, please follow the safety instructions (par. 1.4) in the operating instructions for the sub-assemblies. Otherwise please call in our customer service.
The address of your nearest customer service department is stated at the end of your operating instruction.
# 7 Faults; symptoms, remedial action

The table following contains hints on how to solve faults which can affect the whole pump. Further information can be found in the operating instruction for the pump heads, stroke actuators and accessories.

If you are unable determine the cause of the fault, or if you cannot solve it, please refer to our customer service department.

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible cause</th>
<th>Symptoms</th>
<th>Remedial action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump does not deliver drive motor does not run check</td>
<td>interruption in supply current</td>
<td>no power at motor</td>
<td>find reason for failure and repair</td>
</tr>
<tr>
<td></td>
<td>motor or gear defective</td>
<td>drive motor does not run even when separated from pump</td>
<td>dismantle motor and repair if necessary</td>
</tr>
<tr>
<td></td>
<td>pump is blocked by closed shut-off valve in discharge line</td>
<td>pump can be turned via motor fan wheel at zero stroke, but locks at increased stroke</td>
<td>open valve</td>
</tr>
<tr>
<td></td>
<td>pump drive element has seized due to running dry</td>
<td></td>
<td>repair pump drive unit (see operating instruction &quot;Drive unit&quot;)</td>
</tr>
<tr>
<td>Pump does not deliver, pump does not stroke although motor is running</td>
<td>broken components in pump drive element, built-in worm gear defective</td>
<td>disconnected drive motor runs normal</td>
<td>check pump drive unit (see operating instruction &quot;Drive unit&quot;)</td>
</tr>
<tr>
<td></td>
<td>broken components in gear, coupling defective</td>
<td></td>
<td>check gear and coupling and repair</td>
</tr>
<tr>
<td>increased running noise</td>
<td>cavitation or overmetering taking place.</td>
<td>noise only occurs at increased stroke lengths or speeds</td>
<td>check pipe line (see 4.5.2) and alter accordingly</td>
</tr>
<tr>
<td></td>
<td>gear is defective</td>
<td>flowrate unsufficient, mostly accompanied by unregular operating noise</td>
<td>remove gear and repair</td>
</tr>
<tr>
<td></td>
<td>axial play of worm shaft has increased</td>
<td></td>
<td>reset (see operating instruction &quot;Drive unit&quot;)</td>
</tr>
<tr>
<td></td>
<td>shaft connections or coupling components worn out due to overloading</td>
<td></td>
<td>replace keys and possibly shafts and couplings. Remove cause of overloading</td>
</tr>
<tr>
<td></td>
<td>pump drive components damaged due to overload</td>
<td></td>
<td>dismantle pump drive unit and replace damaged parts. Remove cause of overload</td>
</tr>
<tr>
<td></td>
<td>bearing damage</td>
<td></td>
<td>replace damaged bearings</td>
</tr>
</tbody>
</table>

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