Operating Instruction

Diaphragm pump heads type M910
for series LEWA - ecosmart® type LCA

B 2.2911 en

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7 Faults; symptoms , remedial action

1 General information / safety

1.1 Important preliminary information
Refer to operating instruction B 0.100.1.

1.2 Application
This operating instruction applies to diaphragm pump heads types

M 910 with pressure limiting valve and hydraulic snifting valve
for the drive element LEWA-ecosmart®- type LCA

The LEWA works number is stated in the technical data sheet and on the name plate at the drive element housing.

1.3 Performance and applicabilities
Refer to technical data sheet.

1.4 Safety
Refer to operating instruction B 0.100.1.

There is a danger of electrostatic charging in the case of plastic diaphragm pump heads (generation of sparks)!
Avoid rubbing and DO NOT dry clean.

1.5 Supply connections
Refer to operating instruction B 0.100.1.

1.6 Emissions
Refer to operating instruction B 0.100.1.

2 Transportation and intermediate storage
Refer to operating instruction B 0.100.1.

3 Product information

3.1 General description
Refer to operating instruction B 0.100.1.

3.2 Construction and method of operation

3.2.1 Construction
The **diaphragm pump head** is divided into three functional chambers (see figure 1):
- Operating chamber (A): The fluid conveyed flows through the operating chamber (A).
- Pressure chamber (B): The pressure chamber (B) contains the pressurised oil.
- Oil sump (C): The oil sump (C) is under no pressure.

Operating chamber (A) and pressure chamber (B) are separated by a sandwich diaphragm (527).
The operating chamber (A) is hermetically sealed off to atmosphere by static seals at the diaphragm body (526) and the suction and discharge valves (509, 513).
The barrier between pressure chamber (B) and oil sump (C) is provided by the plunger (502), the hydraulic snifting valve (529) and the pressure limiting valve (consisting of items 550, 551, 552, 553).

3.2.2 Method of operation

Starting from the rear dead centre of the plunger movement the individual steps during an operating stroke of the diaphragm pump head proceed as follows:
The plunger (502) starts with its movement in direction of the diaphragm pump head.
At the same time the hydraulic snifting valve (529) closes the connection from the pressure chamber (B) to the oil sump (C) and the lubricating oil is compressed up to the pre-tension pressure of the spring-diaphragm unit (527, 595, 596, 599).
Now the sandwich diaphragm starts to move from its rear dead centre and compresses the fluid to be conveyed in the operating chamber (A).
When the operating pressure is reached, the discharge valve (513) opens and the fluid is displaced into the discharge line.
After the plunger has reached the front dead centre the movement is reversed, the suction stroke starts.
Plunger and sandwich diaphragm move backwards. Thus the pressure in the operating chamber (A) falls below the discharge pressure and the discharge valve (513) closes again.
The fluid pressure is further reduced down to the suction pressure. Now the suction valve (509) opens and the fluid to be conveyed is drawn from the suction line into the operating chamber (A).
During the suction process the sandwich diaphragm (527) and the plunger (502) always move in the direction towards their rear dead centre.
At the end of the suction stroke, the sandwich diaphragm reaches (527) its rear dead end position, the spring load is decoupled and the pressure in the pressure chamber (B) falls slightly below atmospheric level.
Now the hydraulic snifting valve (529) located at the top opens and the leakage discharged into the oil sump (C) during the discharge stroke is replenished during the remaining plunger movement to the rear dead centre.

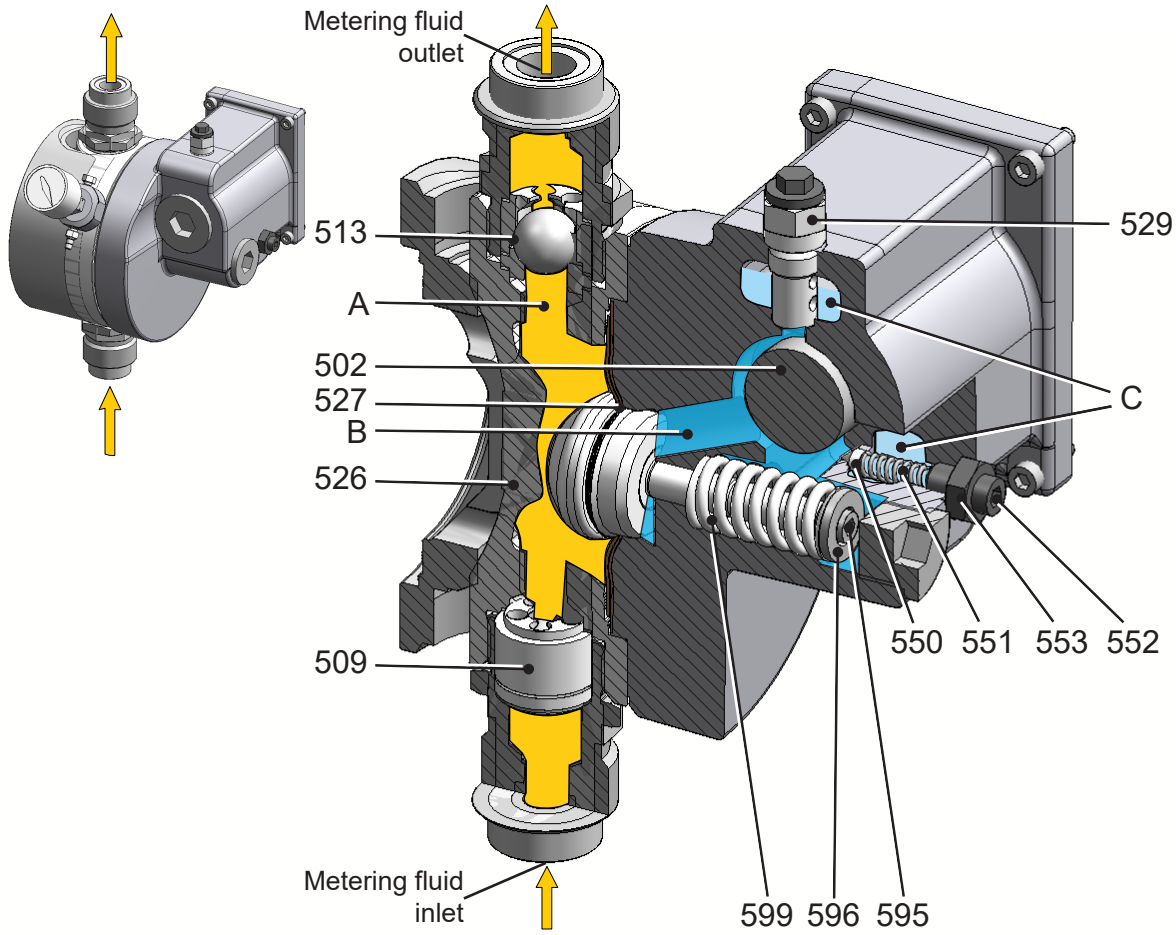


Fig. 1

The main advantages of the M910 operating principle are:

- High suction ability of the LEWA-*ecosmart*®- metering pump because suction flange pressures close to the vapour pressure of the fluid to be conveyed are possible.
- High efficiency and metering accuracy under difficult suction conditions because the mechanical-hydraulic pre-tension of the pressure chamber (B) prevents formation of gas bubbles.
- High diaphragm life times due to the centrally guided, pre-shaped diaphragm with exactly defined and optimised design for the conveying movement.

The LEWA-*ecosmart*®- metering pump is not damaged if the suction line is blocked, e.g. by sedimentation or a closed suction shut-off valve. In this condition vaporisation and cavitation occurs in the operating chamber (A) during each suction stroke. After elimination of the obstruction on the suction side the gas formed in the operating chamber (A) is displaced into the discharge line via the discharge valve (513). After a short time the LEWA-*ecosmart*®- metering pump starts operating properly again.

The diaphragm pump is protected against overstressing of the diaphragm even after a longer shut-down period as the sandwich diaphragm (527) always moves back to the rear dead end position due to the spring load and remains in the rear position even in case of a vacuum in operating chamber (A).

3.2.2.1 Hydraulic snifting valve (529)

The hydraulic snifting valve (529) establishes a stable balance for the exchange of lubricating oil between pressure chamber (B) and the oil sump (C).
In normal operation it replenishes the regular leakage occurring at the plunger.
During start-up of the diaphragm pump head or after activation of the pressure limiting valve due to a problem in the plant it assures that a constant flow is reached fast by removing the gas bubbles from the pressure chamber (B).

3.2.2.2 Pressure limiting valve

The pressure limiting valve (consisting of 550, 551, 552, 553, 554) protects the LEWA-*ecosmart*®-metering pump against overload caused by excessive pressures in the operating chamber (A) and in the pressure chamber (B).

The pressure limiting valve is set to the relief pressure stated in the technical data sheet.
When this pressure is exceeded, e.g. because a shut-off valve in the discharge line is closed, the pressure limiting valve will open and the lubricating oil displaced by the plunger (502) will flow from the pressure chamber (B) into the oil sump (C).
During the subsequent suction stroke the sandwich diaphragm (527) will bottom against the rear support face after a short plunger movement already, and the hydraulic snifting valve (529) will open. Then the plunger (502) will draw in lubricating oil from the oil sump (C) via the hydraulic snifting valve (529).

Activation of the pressure limiting valve will lead to an internal by-pass of the lubricating oil in the diaphragm pump head, the so-called “circulating”.

The high flow velocities which develop during the relief action lead to foaming-up of the lubricating oil in the oil sump (C). Because of this only a fraction of the stroke volume is returned into the pressure chamber (B) via the hydraulic snifting valve during the next suction stroke. Consequently circulating does not occur at each discharge stroke during a longer upset condition period. This reduces the heating-up of the lubricating oil and the load on the pressure limiting valve as well as the drive.
After correction of the upset condition, which has led to circulation, the LEWA-*ecosmart*®- metering pump will start to function properly again after a short time.

In spite of all measures circulating for a longer period of time could damage the pressure limiting valve and other parts.

3.2.2.3 Sandwich diaphragm (527) with diaphragm monitoring

The sandwich diaphragm with diaphragm monitoring allows a fast and safe detection of damage of one diaphragm layer without immediate restrictions on the operation of the LEWA-*ecosmart*®- metering pump or the plant.
During the permissible remaining operating time of the LEWA-*ecosmart*®- metering pump until diaphragm replacement, the plant can undergo a scheduled shut-down and maintenance can be prepared.
If one of the diaphragm layers is damaged or leaking the fluid will penetrate into the space between the diaphragm layers and will cause a pressure increase there.
The diaphragm monitoring will indicate the pressure.
The LEWA-*ecosmart*®- metering pump can be operated for a limited time when the sandwich diaphragm is damaged.

When dangerous fluids are handled the LEWA-*ecosmart*®- metering pump must be shut down immediately after diaphragm failure was detected.

3.2.2.4 Diaphragm monitoring with pressure switch for M9..

When the diaphragm is damaged the pressure switch will be activated.
The switching pressure is set to 1 bar in the factory.

Electric data: Switch NC
Load recommended 24VDC/2A (permissible 220 VAC/1A)
Wiring diagram see figure 2
Exi-protection: if powered intrinsically safe via an isolating switch amplifier

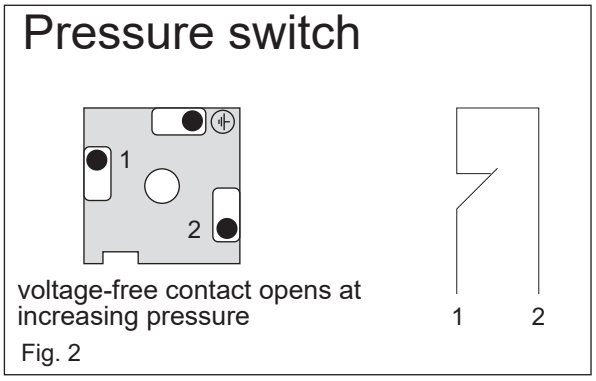


Fig. 2

The operating pressure must be at least 1.5 bar above the ambient pressure.

When the discharge pressure is too low a pressure retaining valve (e.g. 1.6 bar setting pressure) must be installed.

3.2.2.5 Diaphragm monitoring by pressure gauge (pressure ranges: 60 bar, 160 bar)

The rated pressure of the pressure gauge should be at least 20 % (minimum 3 bar) above the operating pressure.

3.3 Dimensions / weights / centres of gravity

Refer to operating instruction B 0.100.1 and enclosed dimensional drawing.

4 Erection and assembly

Refer to operating instruction B 0.100.1.

5 Commissioning / operation / shut down

5.1 Operation

For diaphragm monitoring refer to enclosed, separate operating instruction “Sandwich diaphragm with diaphragm monitoring B 2.2900.4”.

5.2 Operating and ancillary means

5.2.1 Lubricating oil

Drive element and diaphragm pump head have a common oil sump:
refer to enclosed operating instruction “Drive element”, section 5.2.

5.3 Commissioning, start-up, venting

Diaphragm pump heads in a metal version:
In case of operation in areas at risk of explosion with a combustible fluid that can form an explosive atmosphere in the pumping chamber of the metering pump in case of dry running, dry running is not permitted depending on the surface of the plastic diaphragm.

Diaphragm pump heads in a plastic version:
Dry running is not permitted for plastic versions under the above conditions:
When operating with a combustible fluid, the presence of an explosive atmosphere in the pumping chamber of the pump is not permissible for any plunger diameter.

The specifications for the material of the diaphragm pump head / diaphragm pump body (526) can be found in the parts list and on the technical data sheet.
This gives rise to the category or the permissible zone for the interior of the pump (fluid-wetted area); see the table below.

Type of drive unit	Plunger diameter (mm)	Material of diaphragm pump body (526)	Category / permissible zone in the interior of the pump
LCA	6 - 42	Metal version (e.g. SS 316L)	2 / zone 1
LCA	6 - 42	Plastic version (PVC)	- / none

In accordance with the explosion protection requirements, two specifications arise for the marking of the pump: one specification for the outside and an additional specification for the interior (the fluid-wetted working chamber) according to the above table. Examples:
II **2 / 2** G: Category 2 applies to both the interior and the outside of the pump.
II **- / 2** G: No explosive atmosphere is permissible in the interior of the pump (the pumping chamber of the pump must constantly be filled with fluid); category 2 applies to the outside.

To avoid impermissible dry running, ensure a sufficient supply of fluid.
Make sure that the suction line cannot be shut off by the inadvertent closing of a shut-off valve.

Check that the pressure ratios in the suction and discharge lines match the specifications in the technical data sheet.

Venting: see section 6.5.2.

5.4 Adjustment and control
Refer to operating instruction B 0.100.1.

5.5 Shut down
Refer to operating instruction B 0.100.1.

5.6 Dismantling and return transportation
Refer to operating instruction B 0.100.1.

6 Maintenance and repairs

The item numbers in the following sections (in brackets) correspond to the item numbers in the sectional drawings and the corresponding parts lists.

6.1 Maintenance

6.1.1 Inspection intervals

In order to prevent problems check lubricating oil level weekly.

See operating instruction “Drive element” (Drive element and diaphragm pump head have a common oil sump).

6.1.2 Change intervals

Change lubricant after every 4400 hours of operation or, at least, once yearly.

Refer to operating instruction “drive element”, section 6.1.2.

For safety reasons we recommend to replace the sandwich diaphragm (527) once a year also (refer to section 6.3.3 and 6.4.1).

6.2 Repairs

Even after the LEWA-*ecosmart*®- pump has been shut down the operating chamber (A) contains the fluid conveyed. Assure that all safety and handling instructions for the fluid conveyed are observed!

Assure utmost cleanliness during dismantling and reassembly.
This is especially valid for all parts in contact with lubricating oil.

6.2.1 Required documents
Additional documents required: sectional drawing “Metering pump” and corresponding parts list.

6.2.2 Wear parts, spare parts
Check whether the parts marked with “V” as wear parts in parts list are available.
For machines which have been in operation for 5 years we recommend that the parts marked with “E” as spare parts are available also.
For safety reasons, parts designated with “E” or “V” in the parts list should be re-used as an exception and after thorough inspection only.

6.3 Dismantling

6.3.1 Suction and discharge valves (509 and 513)

1. In case of aggressive fluids it is recommended to flush the pipe line.

In case is insufficient flushing the fluid conveyed can leak out during dismantling!

2. Close shut-off valves and remove pipe lines.
3. Unscrew valve bodies (503 and 504).
4. If you remove the suction valve with the pump head still installed make sure that the valve does not drop out downwards after the valve body or the valve retaining flange has been loosened.
   Make sure not to damage any sealing faces when dismantling the valves!

6.3.2 Draining of lubricating oil

Danger of burns when draining hot lubricating oil!
In case of diaphragm rupture the lubricating oil can contain fluid conveyed!

1. Undo screwed plug (40) at the side of the drive element and drain lubricating oil.
2. Unscrew hydraulic snifting valve (529) located on top and remove screwed plug (560) at the diaphragm pump head to drain the residues of the lubricating oil from the diaphragm pump head.

Assure environmentally safe draining and disposal of spent lubricating oil!

6.3.3 Sandwich diaphragm (527)

Used diaphragms must not be reused. For diaphragms which already have been installed previously, the sealing effect in the clamping area is no longer ensured.

1. In case of aggressive fluids it is recommended to flush the pipe line.

Even after thorough flushing, especially after diaphragm rupture, the fluid conveyed can be contained between the sandwich diaphragm, in the pressure chamber (B) as well as in the oil sump (C). Take the appropriate safety measures if required!

2. Close shut-off valves and remove pipelines.
3. Drain lubricating oil according to section 6.3.2.
4. During the work step following the pre-tension of the spring (599) is released. For this special, protective measures are required:

Attention – danger of injury! Special attention is required when heavy corrosion took place in pressure chamber (B) due to insufficient lubricating oil quality or because of ingress of fluid conveyed having corrosive properties.
When slackening screw (595) note that spring (599) is under high pre-tension!

Carefully loosen screw (595) and take out disk / spring plate (596) and spring (599).
Only then loosen screw (536) and unscrew it.

5. Remove diaphragm pump body (526) from diaphragm drive (501) without jamming it.

Residues of lubricating oil can escape from the pressure chamber (B)!

6. Take sandwich diaphragm (527) out of diaphragm drive, to the front (side of diaphragm body).
   Do not damage any sealing faces!

6.3.4 Pressure limiting valve

Increase of the set pressure of a hydraulic pressure limiting valve above the works setting is only permissible after consultation with LEWA!
The LEWA-*ecosmart*®- metering pump can be overloaded and damaged!

If the individual parts of the pressure limit valve (550, 551, 552, 553, 554) are to be removed and the same parts are to be reinstalled, measure and note the distance 'X' (see fig. 10) from the end of the grub screw to the hexagon nut (553) before removal. This dimension is used for orientation when reinstalling.
Pay attention to the note in section 6.2.2: Reuse of the same spare and wearing parts only after thorough inspection.

6.3.5 Hydraulic snifting valve (529)

The lubricating oil can contain the fluid conveyed after diaphragm rupture!

The hydraulic snifting valve (529) can neither be dismantled nor adjusted. It is factory set to the snifting- and discharge volume matching the diaphragm pump head.
Cleaning as well as a visual and acoustic inspection can be carried out if required.
For this unscrew the hydraulic snifting valve (529) from the diaphragm drive (501).
The bores of the hydraulic snifting valve (529) must not be contaminated or clogged.
The integrated closing body must be freely moveable. For this please shake the hydraulic snifting valve (529); movement of the closing body must be heard.
For problems you cannot correct yourself please order a replacement valve from LEWA.

6.3.6 Removal of diaphragm pump head

1. Please observe precautionary measures as per section 6.2. In case of aggressive fluids it is recommended to flush the pipe line.
2. Close shut-off valves in the pipe lines and take pipe lines off the diaphragm pump head.
3. Drain lubricating oil according to section 6.3.2.
4. Heavy diaphragm pump heads must be appropriately supported or attached to a lifting device.
5. Loosen the fixing screws (allen screws (30)) and pull off the diaphragm pump head without tilting (see fig. 3).
   To avoid damage to the plunger (502) during dismantling, the plunger (502) must be supported from below when pulling the diaphragm pump head off!
6. Remove snap ring (555) using an appropriate set of pliers.
   Do not damage the sealing surface of the plunger (502)!

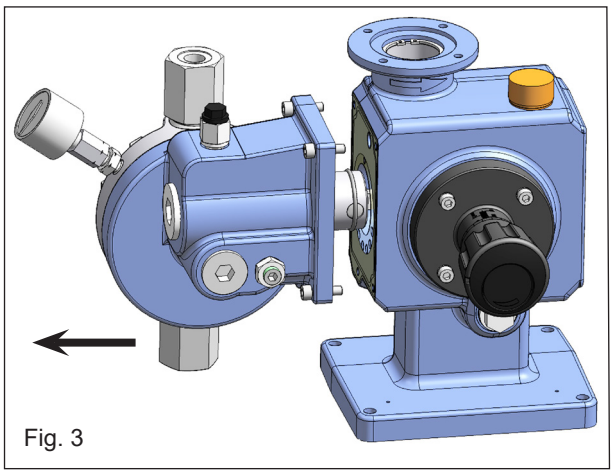


Fig. 3

6.4 Assembly

The assembly is carried out in reverse order to dismantling.

The following points which are important for the function must be observed:

1. All parts must be cleaned thoroughly and checked for proper condition.
   The grooves of the diaphragm sealing areas must be undamaged and absolutely clean from any impurities as well as oil-free (see fig. 4)!
2. Coat all stainless steel threads with suitable lubricating oil for protection against seizing.
   Make sure that this lubricant does not get into the inside of the valves.
3. Observe the torque values specified in the parts list. The corresponding items are marked in the sectional drawing with this symbol:

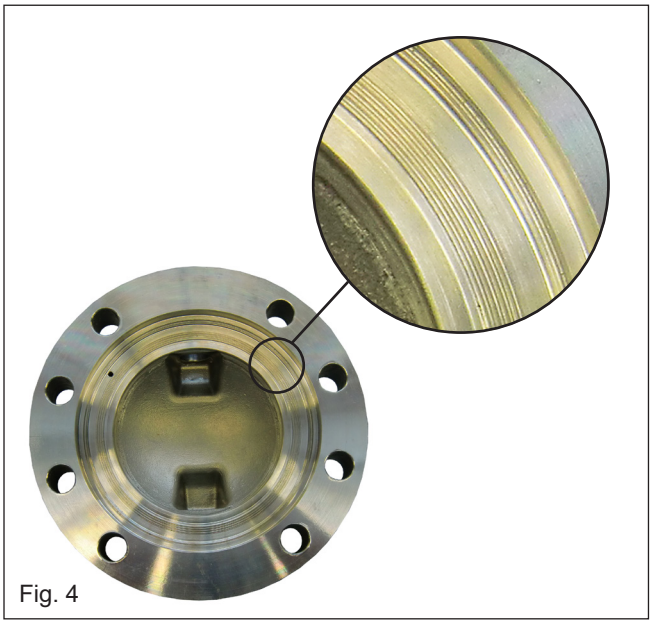


Fig. 4

6.4.1 Sandwich diaphragm (527)

In the case of PVC diaphragm pump heads, the pressure from the diaphragm pump body (526) is not sufficient to prevent the sandwich diaphragm (527) from twisting during assembly.
The sandwich diaphragm (527) is therefore mounted differently, depending on the version:
Metal version (material e.g. SS316L or alloy 20): Assembly in accordance with section 6.4.1.1.
Plastic version (material PVC): Assembly in accordance with section 6.4.1.2.
The specifications for the material of the diaphragm pump head / diaphragm pump body (526) can be found in the parts list and on the technical data sheet.

6.4.1.1 Mounting the sandwich diaphragm (527) in the case of metal diaphragm pump heads

For the work steps following you must observe that the minimum temperature of the parts to be assembled is > +15 °C (otherwise there is the danger that the diaphragm will leak later)!

1. Slightly coat diaphragm drive (501) with lubricating oil around the turned out area of the sandwich diaphragm (527).
2. Place sandwich diaphragm (527) centrally in the diaphragm drive.
   The diaphragm layers must not be distorted!
3. Coat hexagon head screw (595) with lubricating oil.
4. Install the spring (599) with the washer/spring plate (596) and fit the hexagon head screw (595) by hand It may only be screwed in by hand (do not use a power screwdriver)!
5. Place diaphragm body (526) at diaphragm drive housing (501) without jamming it.
   Tighten hexagon head screws (536) evenly by hand.
6. Observe the torque specified in the parts list when tightening hexagon head screw (536).
   Raise the torque across corners in steps!
   Required steps 5 %, 10 %, 20 %, 50 % and 100 %.
7. Apply spring pre-tension manually via hexagon head screw (595).
   Observe the torque specified in the parts list!

6.4.1.2 Mounting the sandwich diaphragm (527) in the case of plastic diaphragm pump heads.

The plastic version of the diaphragm pump body is formed on the outside in such a way that it can be used as an assembly aid (see fig. 5).
The additionally required aids (2 grub screws, matching wing nuts) are included as **assembly aids** in the spare part pack for the sandwich diaphragm.

For the work steps following you must observe that the minimum temperature of the parts to be assembled is >+15 °C (otherwise there is the danger that the diaphragm will leak later)!

1. Slightly coat diaphragm drive (501) with lubricating oil around the turned out area of the sandwich diaphragm (527).
2. Place sandwich diaphragm (527) centrally in the diaphragm drive.
   The diaphragm layers must not be distorted!
3. Screw the two threaded rods (assembly aids) into the diaphragm drive housing (501).

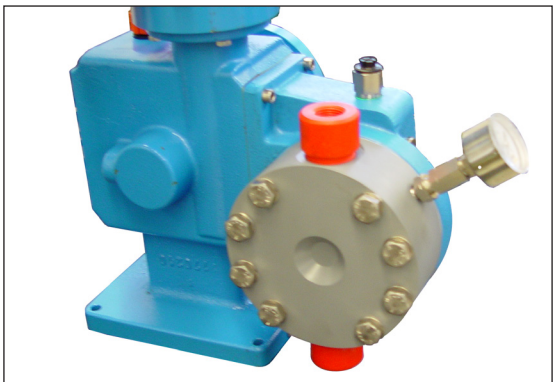


Fig. 5: Diaphragm pump body with assembly aid for sandwich diaphragm.

4. Push the diaphragm pump body (526) onto the threaded rods with the side formed as an assembly aid at the front (see fig. 6).
5. Screw the diaphragm pump body (526) by hand onto the diaphragm drive housing (501) using the wing nuts (assembly aids).
   Tighten the wing nuts evenly when doing this.
   The sandwich diaphragm (527) is thus secured against twisting in the subsequent work steps.
6. Coat hexagon head screw (595) with lubricating oil.
7. Install the spring (599) with the washer/ spring plate (596) and fit the hexagon head screw (595) by hand It may only be screwed in by hand (do not use a power screwdriver)!
8. Apply spring pre-tension manually via hexagon head screw (595).
   Observe the torque specified in the parts list!
   The sandwich diaphragm (527) is now completely mounted and the diaphragm pump body (526) must now be mounted in the operating position:
9. Remove the wing nuts (assembly aids) and the diaphragm pump body and unscrew the threaded rods (assembly aids).
10. Turn the diaphragm pump body (526) around and, without tilting it, place it with the fluid side on the diaphragm drive housing (501) and tighten the screws (536) evenly by hand. The assembly aid side is now on the outside again (see fig. 5).
    Observe the torque specified in the parts list when tightening screws (536).
    Raise the torque across corners in steps!
    Required steps 5 %, 10 %, 20 %, 50 % and 100 %.

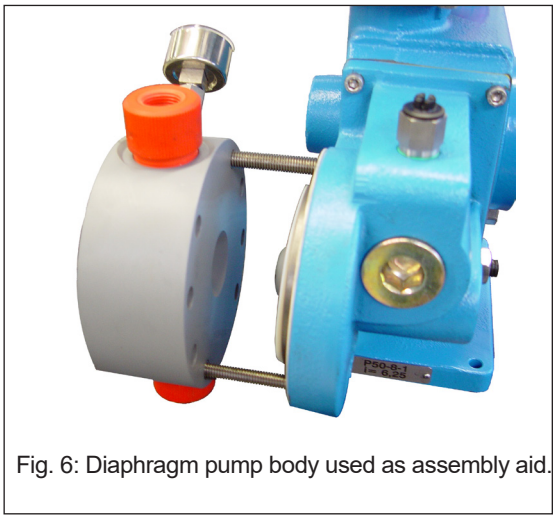


Fig. 6: Diaphragm pump body used as assembly aid.

6.4.2 Suction and discharge valves

Metallic valve seats of ball valves should be re-lapped with a ball of the same diameter using lapping paste:

Up to valve size DN 10:	grain size < 5 µm (e.g. Tetrabor 1200, Elektroschmelzwerk Kempten GmbH),
starting from valves size DN 15:	grain size < 20 µm (e.g. Tetrabor 600, Elektroschmelzwerk Kempten GmbH),

For valves up to 15 mm nominal bore lapping tools are available from LEWA.
For plate valves valve seat and plate should be re-lapped on a plate of grey cast iron if the wear is minor or replaced if required.
Valve seats made of plastic are not reworked.

- Watch directions of flow when fitting the suction and discharge valves (509 + 513).
  The direction of flow is marked on the suction and discharge valves (509 +513) as well as by an arrow cast into the diaphragm body.
- When the pressure limiting valve was dismantled reset according to section 6.5.3.1 if required.
  Utmost cleanliness is mandatory during assembly.

6.4.3 Plunger (502)

1. Install snap ring (555) on plunger (502) next to the circumferential groove (see fig. 7).
2. Mount cylindrical pin (32) into plunger (502) and connecting rod (10) from the side (see figure 8).
3. Then push snap ring (555) into groove of plunger (502) (see figure 9).

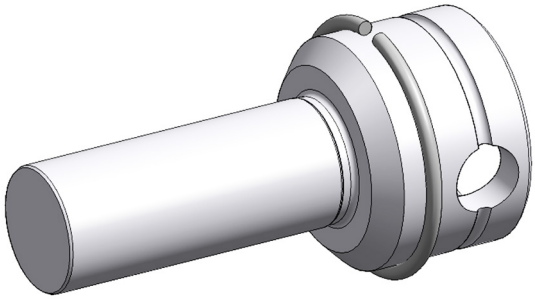


Fig. 7

6.4.4 Presetting the pressure limiting valve

If the individual parts (550, 551, 552, 553, 554) of the pressure valve have been removed, the pressure limit valve must be readjusted to the correct pressure according to the technical data sheet.
When replacing parts of the pressure limit valve, or if you did not note the distance 'X' (see section 6.3.4), begin with work step 1.a.
You may only carry out the assembly starting from work step 1.b if the parts removed from the pressure limit valve are reused and you have noted the dimension 'X' (see section 6.3.4).

1.a Insert the valve cone (550) and thrust spring (551).
Screw the grub screw (552) 1 - 1.5 turns into the diaphragm drive body (501).
Continue with work step no. 2.

1.b Insert the valve cone (550) and thrust spring (551).
Screw in the grub screw (552) using the dimension 'X' for orientation (see section 6.3.4):
The dimension 'X' should be a little larger than the value noted in section 6.3.4.

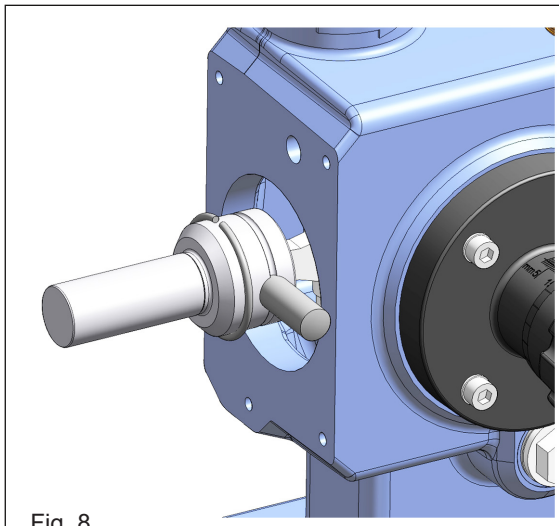


Fig. 8

The dimension ‚X‘ must not be smaller than the value noted, as this can lead to serious damage to the metering pump when commissioning, and thus to a hazard for people, animals and the environment!

2. Fit the seal ring (554). Fix the setting with the hexagonal nut (553).
3. In order to adjust the pressure limit valve precisely, first fill with lubricant and bleed (see sections 6.5.1 and 6.5.2). Then continue as described in section 6.5.3.1.

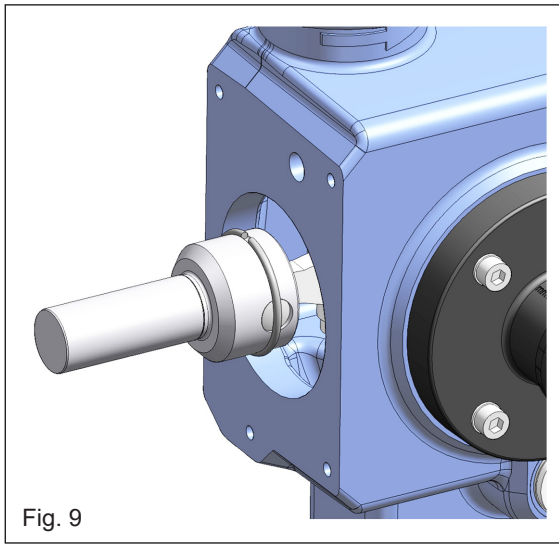


Fig. 9

6.5 Filling, venting, adjusting

6.5.1 Filling of the diaphragm pump head

See operating instruction “Drive element” (Drive element and diaphragm pump head have a common oil sump).

6.5.2 Venting

The LEWA-*ecosmart*®- metering pump is self-venting during shut-down via the hydraulic snifting valve (529).
Under certain circumstances it can occur that the diaphragm pump head does not convey after first filling of the pressure chamber (B) because the gas content in the pressure chamber (B) is still too high. In this case, after a short period of operation the lubricating oil should be replenished (see operating instruction “Drive element”).

It is possible that, for the 6 mm plunger, a further procedure must be carried out during initial start-up after a diaphragm replacement or the change of the lubricating oil:

1. Hydraulic snifting valve (529) has to be installed.
2. **Measure and note distance “X”** (see figure 10) from the end of the grub screw (552) to the hexagon nut (553).
3. Loosen the lock nut of the hexagon nut (553) (do not completely unscrew it, as lubricating oil could escape).
4. Unscrew the grub screw (552) a little until recycle-pumping takes place for a short time at a very low pressure level. **The grub screw (552) must not be completely unscrewed, as otherwise lubricant will escape.**
   This allows any air bubbles remaining from the filling procedure to be flushed out of the pressure chamber (B).
5. After recycle-pumping for a short time (a few seconds), screw in the grubscrew (552) to approximately the originally noted dimension ‘X’ (see work step 2). The dimension ‘X’ should now be a little larger than the noted value. Lock it with the hexagon nut (553).
6. Briefly release the hydraulic sniffting valve (529) (it is not necessary to completely unscrew it) and then tighten it again to the torque specified in the parts list.
7. Adjust the pressure limit valve: see section 6.5.3.1.

6.5.3 Setting and checking of the hydraulic valves

6.5.3.1 Pressure limiting valve (consisting of 550, 551, 552, 553, 554)

1. Relax the thrust spring (551) of the pressure limit valve by releasing the hexagon lock nut (553). Loosen the hexagon nut (553) only slightly; do not completely unscrew it, as otherwise lubricating oil could escape.
2. Set the metering pump to zero stroke.
3. Switch on the metering pump and let it pump against the closed shut-off valve in the discharge line.
4. Adjust the stroke length to approx. 3 mm.

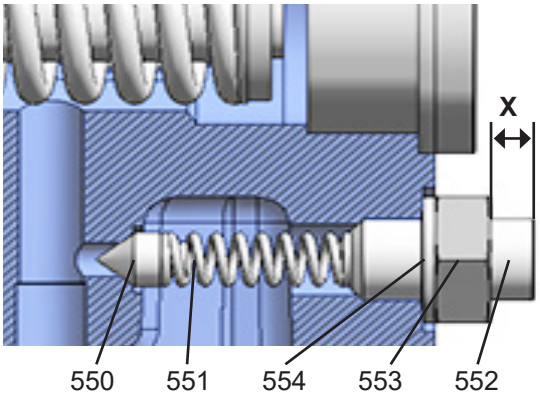


Fig. 10

5. Only if the grub screw (552) was screwed in according to no. 1.a (1 - 1.5 turns) during the presetting (see section 6.4.4): pre-tension the spring slightly by screwing in the grub screw (552).

   If the grub screw / adjusting screw was screwed in according to dimension 'X' (see section 6.4.4, no. 1.b), it may not be screwed in any further.
6. The fluid-side opening pressure can now be read from a pressure gauge installed between the metering pump and the shut-off valve. Slowly increase the spring pre-tension until the maximum permissible or desired opening pressure is reached.

Do not on any account screw in the grub screw more than 3.5 turns in total (including the turns for the pre-adjustment according to section 6.4.4). Otherwise the spring (551) could be destroyed!

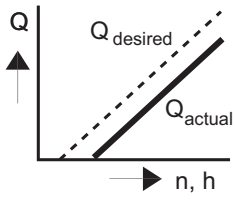
We expressly point out that an incorrectly adjusted pressure limit valve can cause serious damage to the LEWA-*ecosmart*® metering pump, and thus pose a danger to humans, animals and the environment!

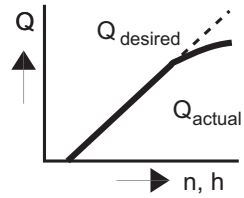
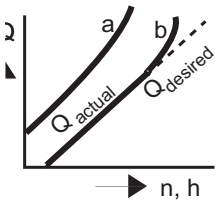
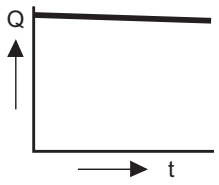
7. If there is no more pressure increase when the spring pre-tension is increased, carefully increase the stroke length until the pressure limit valve responds.
8. After adjusting the pressure limit valve, fix the setting with the hexagon nut (553).

6.5.3.2 Hydraulic snifting valve (529)

The hydraulic snifting valve (529) can neither be dismantled nor adjusted.
It is factory set to the snifting- and discharge volume matching the diaphragm pump head.
In case of damage or malfunction it must be replaced.

7 Faults; symptoms , remedial action

Fault	possible cause →	can be recognised by	remedial action
Metering pump does not deliver	- discharge shut-off valve closed. - back pressure too high (refer to technical data sheet). - discharge valve (513) wrongly fitted or jammed. - discharge dirt trap or line blocked.	- pressure limiting valve operates. Banging or knocking noise can be heard. - foam is building-up in the oil sump (C).	- open shut-off valve. - reduce discharge pressure. - dismantle discharge valve (513), check and re-install correctly. - clean dirt trap or discharge line.
	- metering fluid in the operating chamber solidified (for melts).	- Pressure limiting valve operates. Banging or knocking noise can be heard. Foam is building-up in the oil sump (C).	- improve heating of fluid metered
	- suction shut-off valve closed. - suction pressure too low (metering fluid strongly gassing off, see technical data sheet). - suction valve (509) wrongly fitted or jammed - suction dirt trap or line blocked.	- unusual running noise of metering pump. - unusual flow noises at discharge side due to cavitation, banging suction valve (509). - no working noise of the discharge valve (513).	- open shut-off valve. - check suction conditions (see B 0.100.1). - dismantle suction valve (509), check and re-install correctly - clean dirt trap or pipe line.
	- air in the operating chamber (A). - air in the pressure chamber (B). - oil level in the oil sump (C) too low.	check level of lubricant.	- vent metering pump (refer to section 6.5.2). - check installation - top up lubricant.
pump output over whole range too low 	- suction (509) or discharge valves (513) leaking due to dirt or wear.		- clean or repair valves, check dirt trap.
	- pressure limiting valve or hydraulic snifting valve leaking. - plunger seal or plunger (502) worn out.	leakage rate >> 2 % of the max. volume flow.	- clean valves or replace, clean oil sump (C) and fill in new lubricant. - replace plunger seal or plunger (502); clean metering pump check if suitable lubricant is filled in (see section 5.2.1).

Fault	possible cause →	can be recognised by	remedial action
pump output too low at long stroke lengths or high stroking rates 	- pressure losses in the discharge line are too high.	pressure limiting valve responds.	- re-calculate pipeline and modify accordingly if required.
	- shut-off valve in the suction line not fully opened, dirt trap fouled up.		- open all valves completely, clean dirt trap.
	- pressure losses in the suction line too high or suction pressure too low, fluid conveyed or lubricant forms gas or cavitates.		- re-calculate pipeline and modify accordingly if required.
pump output excessive  flow conveyed fluctuates at or above Q des.	a) static pressure at suction flange higher than at discharge flange.	Fluid metered passing through the diaphragm pump head with metering pump at rest.	- reduce suction pressure, elevate metering pump, provide positive differential pressure. LEWA would be pleased to give advice.
	b) inertia forces in the pipeline cause pressure in the suction line to momentarily exceed the pressure in the discharge line.	Loud, knocking noises, strong vibration in suction or discharge line.	- re-calculate pipeline and modify accordingly if required.
flow conveyed fluctuates but remains smaller than Q des.	- fluid metered contaminated or gas entrained.		- check dirt trap and improve, de-gas fluid conveyed.
	- valves defective.		- refurbish or replace unsuitable or defective valve components.
flow conveyed falls off 	- gas formation in the operating chamber (A). Generally causes difficulties at flows conveyed < 50l/h.	full flow conveyed is restored after brief increase of the stroke length or frequency.	- install special valves. Please enquire from LEWA. Optimize piping installation. LEWA would be pleased to assist you.

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