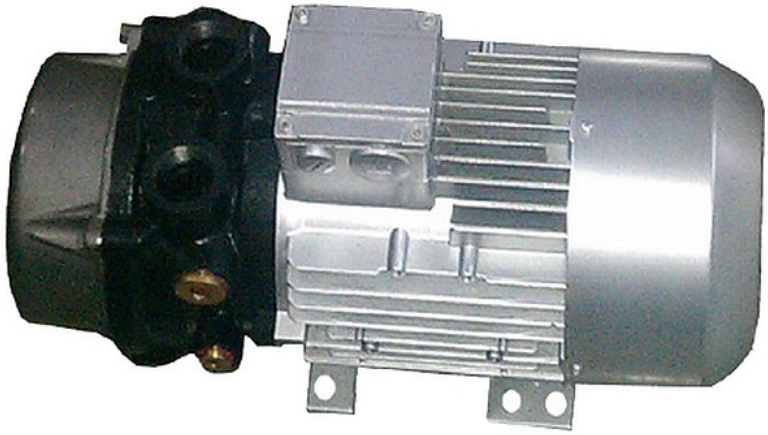
Installation- and Operating Instructions
Liquid Ring Pump



SKV-LRP-Series

high quality – fair prices

SKV-tec GmbH
Forchheimer Str. 4
91338 Igensdorf
Germany
Tel.: +49 (0) 9192 – 99 53 14
Fax: +49 (0) 9192 – 99 52 68
www.skv-tec.de
info@skv-tec.de

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1 Important basic information

These operating instructions contains informations about

- product description,
- safety,
- transport,
- storage,
- set-up and operation,
- maintenance,
- servicing,
- troubleshooting and
- spare parts

of the liquid ring pump.

"exposure" of the liquid ring pump in terms of these operating instructions are the transport, storage, set-up, operation, control over operating condition, maintenance, troubleshooting and servicing of the liquid ring pump.

Prior to exposure of the liquid ring pump the responsible staff for operation and servicing have to completely read and understand the operating instructions. The operating instructions must be strictly adhered to. The operating instructions and all enclosed documents must be kept at the place of installation so it is always available.

If there a dubities please contact the responsible representation of the SKV-tec GmbH!

1.1 Definition

aggregate	**complete liquid ring pump including pump, power unit and its components**
pump	**liquid ring pump without power unit and components**
separator	**device for separating gaseous from liquid media**
vacuum valve	**valve for limiting the created vacuum**

1.2 Safety instructions

The liquid ring pump have been designed and manufactured in accordance with state-of-the-art technology. Nevertheless by exposure of the liquid ring pump there will remain some threats. In these operating instructions we will refer at suitable points to threats.
Safety instructions are marked with keywords like **DANGER**, **WARNING, CAUTION** or **ATTENTION**:

DANGER

Risk of personal injuries!

Disregarding this safety instruction **leads** to accidents resulting in death or severe injuries.

WARNING

Risk of personal injuries!

Disregarding this safety instruction **can lead** to accidents resulting in death or severe injuries.

CAUTION

Risk of personal injuries or property damage!

Disregarding this safety instruction **can lead** to accidents with minor injuries or property damage.

ATTENTION

Risk of hearing loss!

Depending on the size, the unit **can** emit sound of high volume.
Depending on the operating state of the unit **can** emit sounds in a narrow frequency band.
For longer stays in the vicinity of a non-sound-insulated aggregate hearing protection should be worn.

2 Safety

The manufacturer is not liable for damages caused by non-observance of these operating instructions.

2.1 Intended use

- All provisions of this manual , including all safety instructions must be observed
- Inspektion and maintenance intervals must be complied with
- The unit must be operated exclusively for the delivery of approved media. Approved media are:
  - dry or moist gases, which are neither explosive, inflammable, aggressive or toxic
  - Air or air-steam mixtures which contain either no solids, or only small amounts of particulate matter
- The unit may be operated only with approved operating fluids (solid-free water with a pH value of 6-9).
- The following scenarios have to be avoided:
  - Dry run: Ensure that the unit is operated with sufficient (never without) operating fluid, otherwise the seals take damage within a few seconds.
  - Cavitation : Installation of a vacuum safety valve The pump must not be operated with closed suction
  - Overheating: Do not operate the unit with closed connections
  - Motor damage: The following parameters must be considered: the maximum flow rate to pump liquids, the switching frequency of the unit. The motor protection switch must be set at least to the nominal current.
- The unit is intended exclusively for professional use
- The exposure of the unit is only permitted by qualified personnel

Prior to exposure of the liquid ring pump the responsible staff for operation and servicing have to completely read and understand the operating instructions.
If in doubt, please contact the responsible representation of the SKV-tec GmbH!

2.2 Potential misuse

- The operating limits of the unit concerning pressure, temperature of the medium and the operating fluid density, viscosity and velocity are observed and complied with
- The permissible density of the operating fluid must be respected, otherwise the unit will overload. (see chapter 9.1, page 22)

The power consumption of the motor increases with the density of the working fluid.

- Avoid sudden changes in pressure of the transported gas
- Sudden changes in temperature of the transported gas as well as the operating fluid must be avoided
- Unauthorised opening of the unit will void any claims for defects
- If the unit is not approved for the requested use, operation is prohibited in the following scenarios
  - Operation in rooms where explosive gases may be present
  - Extracting, delivering or compressing of explosive, inflammable, aggressive or toxic media

2.3 general safety instructions

The unit is designed and manufactured according to the state-of-the-art of technology and the generally acknowledged rules of safety. Nevertheless by the exposure of the unit it may occur to danger to life of the user or third parties as well as damage to the unit.
Therefore, the following guidelines must be observed:

- The unit may only be operated in a technically flawless condition and in compliance with the regulations, safety precautions and warnings included in this manual.
- Ensure that this manual and related documents are complete and readable. In addition, make sure that the staff has access to these documents at any time.
- Refrain from any operating mode which brings the staff or third parties at risk
- In case of error which impacts on safety, immediately shut down the unit and consult the person responsible for fault diagnosis.

2.4 Residual risks

⚠ WARNING

Risk of injuries from flying parts , which reach into the openings of the engine cooling or the coupling guard!

➔ Don't bring in lose parts!

Danger of burns and scalding by contact with hot surfaces or media!

➔ Do not touch or wear safety gloves!

Risk of injuries caused by escaping operating fluid due to a defective mechanical seal!

➔ Immediate shutdown of the unit and subsequent repair of the pump!

3 Design and function

3.1 Nameplate

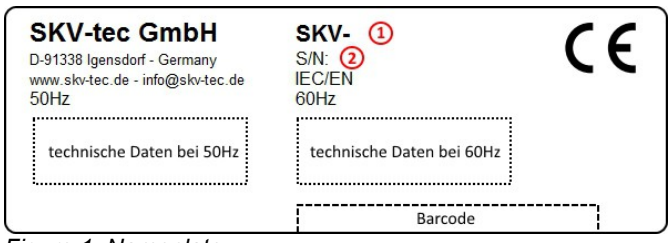

Figure 1: Nameplate

1 Product name
2 Serial number

3.2 Model type (Code)

	LRP	-	50	-	3	-	916
Pump type							
Model size							
Number of phase							
Engine code							

Figure 2: Model-/pump type

3.3 Description of the unit

The aggregates of the LRP series are horizontal, single-stage liquid ring pumps with radial inlet and outlet.

The pumped gases / vapors are thereby controlled internally by appropriate transport channels and special valve systems.

The electric motor is modularly connected to the pump unit. The sealing of the driving shaft is ensured by a maintenance-free mechanical shaft seal.

The LRPs with the size 30 and 50 are internally equipped with a separator which separates the gas-water mixture on the pressure side into its phases. So the separated operating fluid remains in the aggregate and can be reused .

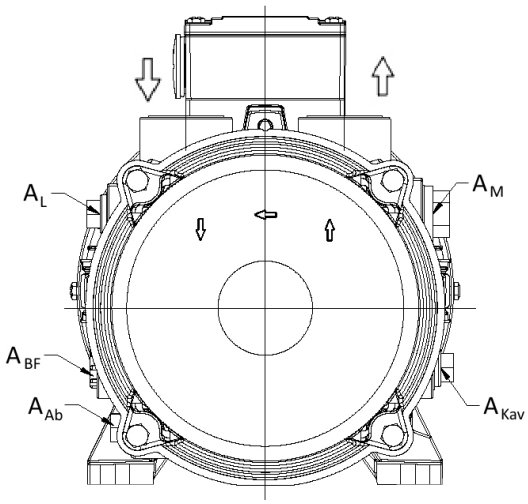

Figure 3: Connections of the unit

Pos.	Description
A_L	Connection for vent valve
A_{BF}	Connection for operating fluid
A_{Ab}	Screw plug for drainage
A_M	Connection for manometer
A_{Kav}	Connection for cavitation protection

Table 1: Legend figure 3

3.4 Design and operating mode of the unit

The pump operates according to the liquid ring principle. In the cylindrical housing - pumping chamber – there is the impeller with the impeller blades. The impeller is positioned eccentrically to the housing.

By the operation of the pump the operating fluid in the pumping chamber will be set in motion and accelerated through the rotating impeller. Due to the centrifugal force a liquid ring which is concentric to the housing and eccentrically to the impeller will be formed.

A crescent-shaped working space between the liquid ring and the impeller hub results due to the eccentric position of the impeller . Thereby the remaining volume between the impeller blades varies with each revolution. Due to the increasing hub in the area of the suction slot the medium to be conveyed is sucked. A half turn later, it is compressed by the decreasing space and discharged on the the pressure side.

The liquid ring – in the form of the operating fluid – thereby ensures that the individual impeller chambers are separated and sealed from one another and that the created heat due to the compression can be dissipated.

Because a part of the operating fluid is discharged with the medium to be delivered, it must be ensured that this will be returned. This can be done by a pressure-side separator.

4 Transport, storage and disposal

4.1 Transport

The weight data of the unit must be observed!

WARNING

Danger from overturning or falling loads!

➔ Before transporting all components must be securely mounted. Loose parts must be secured accordingly or removed!

CAUTION

Overturning or falling loads can lead to bruising, fractures, etc.!
Cuts from sharp edges!

➔ Protective equipment must be worn !

Packaging and inspection:

On delivery, the unit is screwed to a pallet and protected by a foil and a cardboard box. Unpack the unit and check for transport damage. Transport damages immediately report to the responsible representation of the SKV-tec GmbH!

Manual transport by hand:

WARNING

Danger from lifting heavy loads!

➔ The permissable weights for lifting and carrying of components must be observed!

- in men max. 30 kg
- in women max. 10 kg
- in pregnant max. 5 kg

Weights of the unit see chapter 9.3, „Unit data“

Transport with lifting gear:

WARNING

Danger from overturning or falling loads!

➔ The following basic rules must be observed when transporting with lifting equipment:

- the carrying capacity of the lifting gear must be at least the weight of the aggregate
- the unit may only be transported horizontally and must be secured against overturning and falling
- The hanging of the aggregate by the ring lug of the motor is not allowed
- Attach straps as shown in Figure 4
- Do not stand under suspended loads

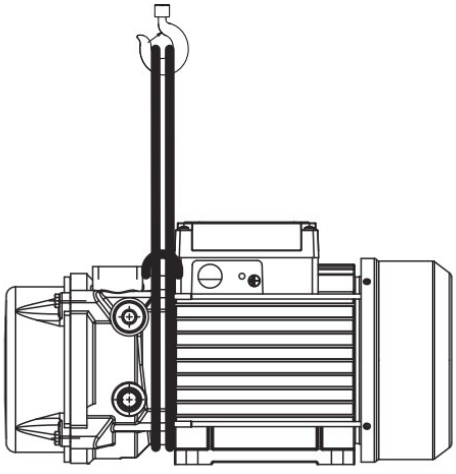

Figure 4: Positioning the strap

4.2 Storage

Units prepared by the factory have an anti-corrosion coating. This protects the aggregate for a maximum of three months when properly stored indoors.
For longer storage periods or for aggregates which were already in operation and should be stored, the unit must be reconserved (see chapter 4.3, page 8).

	**CAUTION** **Risk of material damage due to improper storage!** The unit must be stored in accordance with the guidelines of this manual!

- Seal all openings and connections with appropriate sealing plugs or screw caps
- The storage room must be dry, frost-free, vibration-free, protected and have to ensure a constant humidity
- The motor shaft must be moved once a month. It must be ensured that the position of the motor shaft and the ball bearings changes.
- For storage periods longer than 6 months all components made of elastomers (EPDM) must be replaced for recommissioning. Components such as o-rings and shaft seals must be checked for elasticity and replaced if necessary.

4.3 Preservation

	**CAUTION** **Risk of material damage due to improper storage!** The unit must be handled in accordance with the guidelines of these operating instructions inside and outside with an approved preservative!

- Choose the preservative in accordance with the model type, the storage period and in accordance with the manufacturer's specifications
- All bare metal parts inside and outside the pump and the impeller clearance must be treated with preservatives
- The unit must be switched off!

Inside the system:

- Position a suitable container of the drainage bore
- Remove the screw connection of the drainage bore and drain the operating fluid
- Turn the motor shaft in rotation direction until no more fluid escapes
- Close the drainage bore with the screw
- Remove the pipes on the suction, pressure and operating fluid connection and close the pressure and the operating fluid connection with a screw
- Fill the provided filling quantity of preservative (see chapter 9.2, page 22) into the suction connection and close it afterwards
- For a uniform distribution of the preservative short-time switch on the unit and then off again
- Remove the screw of the drainage and the operating liquid connection and drain the preservative in suitable containers
- Turn the motor shaft in rotation direction until no more fluid escapes
- Finally close the drainage and the operating fluid connection with respective fittings

Outside the system:

- Position a suitable container of the drainage bore
- Close the drainage and the operating fluid connection with respective fittings
- Fill the provided filling quantity of preservative (see chapter 9.2, page 22) into the suction side alternative pressure side connection until the preservative is visible
- Turn the motor shaft in rotation direction until the preservative appears nearly 30 mm below the top edge of the connection
- Remove the screw of the drainage and the operating liquid connection and drain the preservative in suitable containers
- Turn the motor shaft in rotation direction until no more fluid escapes
- Finally close the suction side, pressure side, drainage and the operating fluid connection with respective fittings

Removal of the preservative:

CAUTION

Risk of bearing damage caused by excessive water pressure or splash water!

Protect bearings from water and steam jet!

Risk of seal damage due to unsuitable cleaning agents!

Detergents must not harm the seals!

Choose a suitable detergents for the particular application. Flush out the preservative from the unit and dispose both according to local regulations.

4.4 Disposal

WARNING

Risks of environmental damage caused by liquid being pumped!

- Escaping pumped liquid must be removed and disposed of separately
- Plastic parts must be removed and disposed of separately
- Liquid residues in the aggregate must be neutralized
- Preservatives must be removed

➔ Assign an authorized company with the disposal of the unit

5 Installation and connection

CAUTION

Risk of material damage due to contamination!

➔ Remove transport locks until immediately prior to installation of the unit
➔ Remove the transport covers of the connections until just before installation of the pipes to the unit

Risk of material damage due to overheating of the unit!

➔ Set up the unit according to the specified minimum distances (see chapter 9.3, minimum distance WT) so that heat dissipation and cooling air are unimpeded!
➔ Sucking air from other units must be avoided!

CAUTION

Overturning or falling loads can lead to bruising, fractures, etc.!
Cuts from sharp edges!

➔ While transporting and installing protective equipment must be worn!

Danger of tripping and falling !

➔ The unit must not form a tripping hazard!

Danger from flying parts !

➔ Ensure that loose parts are secured and/or removed!
➔ Provide sufficient safety margin so that no persons may be hurt by a fraction due to a fault in the external fan!

GEFAHR

Electrical danger!

- Installation of the unit must be performed in such a way that it does not harm the electrical device
- Supply lines should be routed safety as cable ducts or in the ground

➔ Any electrical work must be performed by a qualified electrician!

5.1 Preparation

➔ The required environmental conditions (see chapter 9.3, ambient conditions) must be checked

➔ Minimum distances (see chapter 9.3, minimum distance WT) for heat dissipation must be observed

➔ The location of installation must meet the following conditions:

- The unit must be freely accessible from all sides
- sufficient working space for installation of cables as well as for maintenance and repair must be provided
- The unit must be set up vibration-free

Only with adequate vibration freedom faultless operation and a long service life of the equipment is ensured

➔ Before installing the preservative must be removed

5.2 Set-up of the unit

The guidelines from chapter 5.1, „Preparation“ must be observed.

Furthermore, the following must be observed when setting up the unit :

- must be carried out on flat areas
- unless otherwise indicated the aggregate may be set up only horizontally (shaft position)
- on stationary areas or structures must be ensured that the viability of this area is designed for at least the weight of the aggregate
- the unit must be secured on ground with the appropriate feets using suitable fastening elements (4x M12-8.8)

5.3 Connecting pipes/flexible pipes

When designing the pipework the following guidelines should be observed :

- the flow resistance in the tube should be kept as low as possible
- Diameter of the suction / discharge pipe should be at least as large as the corresponding connection diameter on the unit (see chapter 9.3, „Threads of the connections“)
- All pipes should be kept as short as possible
  ➔ for long pipes cross-section must be increased
  ➔ the pipe at the discharge must not be higher than 1m vertically into the air
- sudden changes in cross section must be avoided
- Provide a filter and a ball valve in the suction pipe (avoidance of a backflow of operating fluid while downtime)
- To avoid air pockets the pipes should have a continuous slope to the aggregate

CAUTION

Risk of material damage due to contamination!

➔ The interior of the unit must be free of contamination!

When installing the pipes ensure the following :

- Before installation all pipes and hydrants must be cleaned
- Make sure that no gasket or sealing material (sealing tape) extends into the interior
- The flanges must be free of flange lids, plugs and/or security films

5.4 Electrical connection

The electrical connection must be carried out in accordance with the following guidelines:

- appropriate VDE or national regulations
- the applicable national, local and system-specific regulations
- applicable regulations of the utility company at the location of installation

DANGER

Electrical danger!

Any electrical work must be performed by a qualified electrician!

Before starting work on the unit the following provisions must be performed:

- Disconnect unit from the mains
- Ensure the absence of voltage
- Secure against restart
- Earth and short circuit
- Cover and safeguard neighboring live parts

The data on the **nameplate of the motor** must necessarily match with the conditions at the installation site!

WARNING

Risk due to pressure and vacuum!
Risk caused by escaping media!

Before starting work on the unit:

- Supply of operating fluid closed
- Unit and pipes depressurised

Electrical danger!

Terminal box must be free from:

- foreign bodies
- contaminations
- humidity

The electrical connection must be made in accordance with the circuit diagram in the terminal box cover , thereby following should be noted:

- Protective conductor must be connected
- Terminals must be used
- Ensure that the connections are safe in the long term
- Terminal box cover and cable entries must be close to dust and water

The terminal box must be checked regularly for leaks

To **protect the motor against overload** a motor protection switch **have to be used**. This must be set to the nominal current which can be found on the nameplate of the motor.

CAUTION

Risk of material damage caused by dry running!

➔ Aggregate must be filled with sufficient operating fluid (see chapter 9.3, „operating fluid“)!

Risk of material damage due to incorrect direction of rotation!

It may cause damage to the unit and the escape of operating fluid through the mechanical seal

➔ Check polarity of the electrical connection (if necessary swap two phases)!

6 Operation



⚠ WARNING

Risk due to pressure and vacuum!
Risk caused by escaping media!

Before operating the unit the following conditions must be met:

- At the connections suction, pressure and operating fluid pipes were installed
- all pipes are dense and have a sufficient strength

➔ When working on the unit protective equipment must be worn!

Danger from rotating parts!

Before operating the unit, the pump housing and the fan cover must be installed!

Risk of injury from the operation of the unit!

When operating the unit the following must be avoided:

- To touch the aggregate
- Performing works on aggregate

6.1 Preparations prior to commissioning

➔ Identification of the pump model by the nameplate (see chapter 3.1, page 6)

➔ For treated and / or stored aggregates the preservative (see chapter 4.3, page 8) must be removed

➔ Determination / verification of downtime

- for downtime **over** a year the manufacturer must be contacted for necessary steps
- for downtimes **less** than one year the prescribed steps (see chapter 6.2, commissioning) must be performed

6.2 Commissioning

Filling the operation fluid:

- Open the suction and pressure sides connections
- The aggregate is **maximum** to fill up to the middle of the shaft with operation fluid (see chapter 9.3, operation fluid)
- Check connections and fittings for leaks

CAUTION

Risk of material damage caused by dry running!

Dry running destroys the mechanical seal within seconds

➔ Aggregate must be filled with sufficient operating fluid (see chapter 9.3, operating liquid)!

Start up:

CAUTION

Risk of material damage due to cavitation!

➔ A suction-side shut-off valve must be fully open. Throttling on the suction side is prohibited!

➔ A pressure-side shut-off valve is to open. The unit must not be operated with closed shut-off valve!
The operating limits (see chapter 9.1, page 22) of the unit must be observed.

The following must be checked **before the first start-up**:

- Tightness of the piping and hose connections
- Direction of rotation
- Correct electrical connection of the motor
- Prepared and filled unit

Then continue with the following steps:

- Open the pressure-side fitting (and possibly an existing vent valve)
- Turning on the engine
- Open the suction side and operating fluid connection
- Closing the vent valve (if present) as soon as the motor has reached nominal speed
- repeat checking for leaks of the pipes and the aggregate

Shutdown:

- Closing the operating fluid connection
- Shutting down the motor
- Open the vent valve (if present)
- repeat checking for leaks of the pipes, the unit and the fittings

6.3 Flow rate adjustment of the operating fluid

For the configurations shown in Figure 5 - 8 apply the following steps:

- Turning on the unit
- the pressure of the operating fluid supply must be set to a maximum of 0,2 bar overpressure

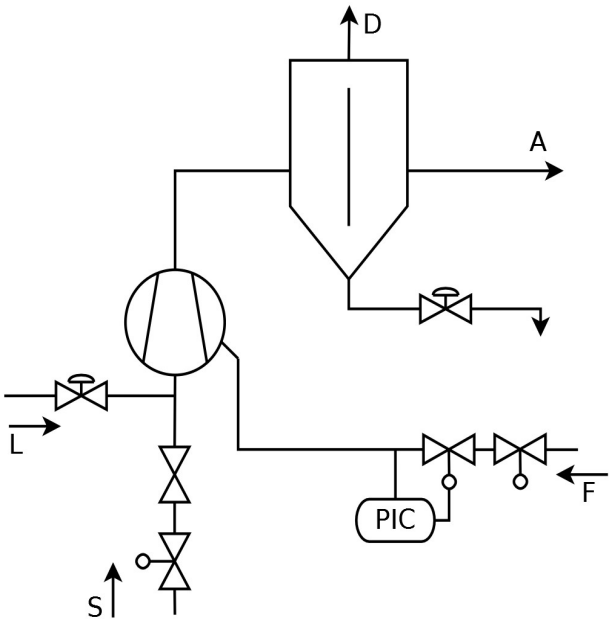

Figure 5: continuous operating fluid supply

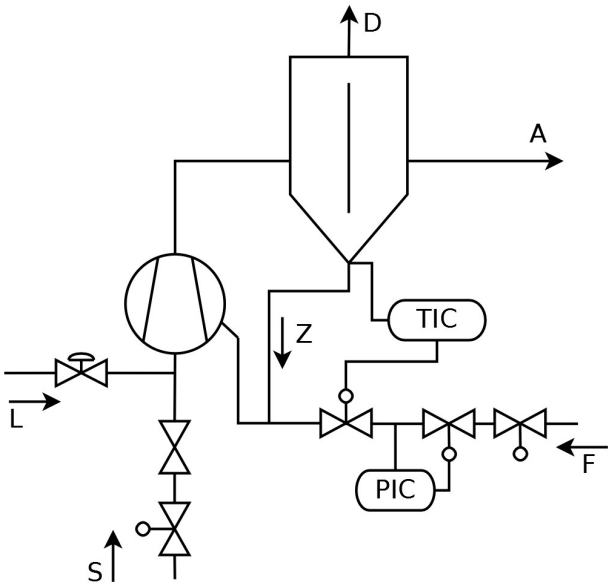

Figure 7: Circulation of the operating fluid with temperature monitoring

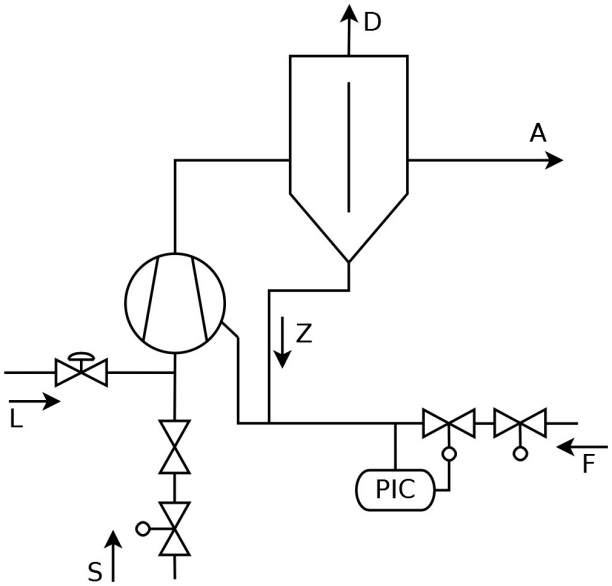

Figure 6: Circulation of the operating fluid

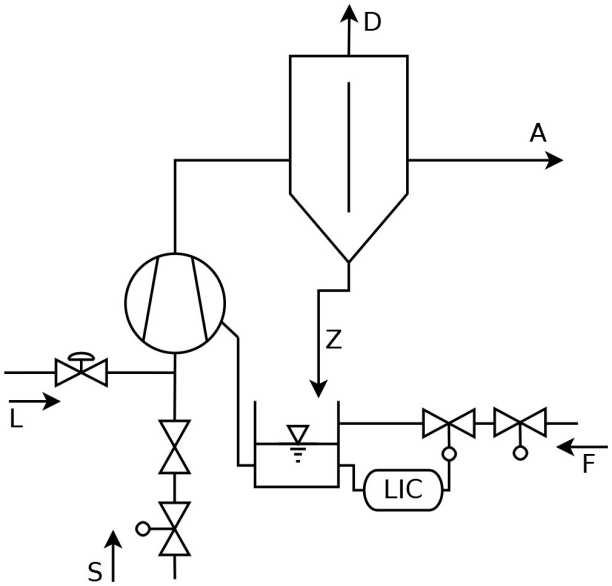

Figure 8: Circulation of the operating fluid through reservoir

For the configuration shown in Figure 9 apply the following steps:

- Turning on the unit
- the pressure of the operating fluid supply should be 0,1 bar less than the compression pressure

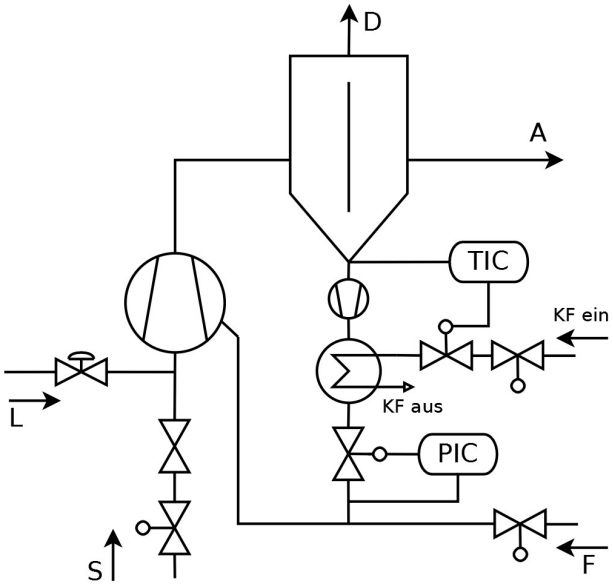

Figure 9: closed circulation of the operating fluid with active cooling

Position	Description
L	Vent connection
S	Suction side inlet
D	Pressure side outlet
A	overflow
F	Fresh operating fluid
Z	Circulation
KF ein	Coolant inlet
KF aus	Coolant outlet
PIC	Pressure control
LIC	Level control
TIC	Temperature control

Table 2: Symbol legend for Figure 5 - 9

6.4 Decommissioning

DANGER

Electrical danger!

The electrical connection must be performed by qualified electricians!

Before starting work on the unit following actions must be performed:

- Disconnect unit from the mains
- Ensure the absence of voltage
- Secure against restarting
- Earth and short circuit
- Cover and safeguard neighboring live parts

WARNING

Risk due to pressure and vacuum!
Risk caused by escaping media!

Before starting work on the unit:

- Supply of operating fluid closed
- Unit and pipes depressurised

➔ When working on the unit protective equipment must be worn!

➔ escaping fluids must be collected and disposed of in accordance with the guidelines!

The following provisions must be performed if the pump / unit is shut down:

- If the unit is shut down but will remain operational:
  ➔ Once a month, the unit briefly (5-10 minutes) must be put into operation
- If the unit is shut down for an extended period:
  ➔ Drain the unit and the water separator (see "Emptying the aggregate")
  ➔ The unit must be protected with a preservative (see chapter 4.3, page 8)
- If the aggregate already drained all connections / fittings must be sealed
- If the unit is dismantled, it should be taken from the mains and secure it against unauthorized activation
- If the unit is stored, the appropriate actions (see chapter 4.2, page 8) must be performed

Emptying the aggregate:

- Turning off the unit
- Position a suitable container to the drainage bore
- Open drain plug and drain operating fluid
- Close drain bore with screw again

6.5 Recommissioning

For longer storage of more than one year, all the steps of commissioning – as described in chapter 6.1, „Preparations prior to commissioning“ and chapter 6.2, „Commissioning“ – must be performed.

If the unit is temporarily turned off and remains ready for operation and filled, it is sufficient if the unit is operated once a week.

7 Service and maintenance

DANGER

Electrical danger!

The electrical connection must be performed by qualified electricians!

Before starting work on the unit following actions must be performed:

- Disconnect unit from the mains
- Ensure the absence of voltage
- Secure against restarting
- Earth and short circuit
- Cover and safeguard neighboring live parts

WARNING

Risk due to pressure and vacuum!
Risk caused by escaping media!

Before starting work on the unit:

- Supply of operating fluid closed
- Unit and pipes depressurised

➔ When working on the unit protective equipment must be worn!

➔ escaping fluids must be collected and disposed of in accordance with the guidelines!

WARNING

Danger from rotating external fan!

The fan cover must not be dismantled!

Danger from rotating impeller of the unit!

Before starting work on the unit, the unit must be taken out of service and the impeller completely stopped!

WARNING

Danger of burns from hot surfaces and / or hot fluids!

In operation, the unit must not be touched! Allow to cool after decommissioning!

CAUTION

Overturning or falling loads can lead to bruising, fractures, etc.!
Cuts from sharp edges!

➔ While transporting and installing protective equipment must be worn!

7.1 Monitoring of the aggregate

The following points must be checked at regular intervals:

- Compliance with the volume flow and the temperature of the operating fluid
- Compliance with the maximum permissible compression pressure and the permitted volume values
- Contamination of the motor and the filter
- conspicuous running noise of the ball bearings
- Current consumption of the motor
- Leak freedom of shaft seal

For trouble-free operation pay attention to:

- tightness of the connections and the aggregate
- no cavitation
- intact and clean filter
- no dry-running
- no unusual running noises or vibrations

7.2 Cleaning of contaminations

The unit is largely maintenance free but through the operating liquid and the pumped gases / vapors dirt (sand, lime) can reach into the unit. To avoid wear as well as fastening of the impeller, the pump has to be cleaned at regular intervals.

Therefore, following actions must be performed regularly:

- Periodically remove dirt which is in the cooling fins, the external fan and the fan cover of the motor.

  ➔ Cleaning using compressed air

- **Fine-grained impurities** which pass through the operating liquid and / or the pumped gases / vapors in the unit must be removed.

  ➔ Therefore install a separator, filter or mesh in the appropriate feed pipe

  ➔ Alternatively, the unit must be cleaned regularly as follows:

  - Decommissioning of the unit
  - Draining the operating liquid (see chapter 6.4, "Draining the unit")
  - Remove the pump housing (see chapter 7.5)
  - Remove and rinse impurities from the housing
  - Screw on the pump housing again (see chapter 7.6, page 19)
  - Recommissioning of the aggregate (see chapter 6.5, page 15)

- In case of **stucked impeller** following steps must be performed:
  - Decommissioning of the unit
  - Screw on the external fan side a suitable M8 screw with sufficient shaft length into the shaft end
  - Free the impeller by rotating with the screw
  - Finally remove screw

- strong - medium **hard water** is used as operating liquid:

  ➔ Softening of the operating fluid

  ➔ Alternatively, the aggregate must be descalcified at intervals of 3 months as follows:

  - Decommissioning of the unit
  - Draining the operating liquid (see chapter 6.4, „Draining the unit“)
  - Disassembling of pipes / hoses
  - Fill suitable decalcifier (10% acetic acid or commercially available decalcifier) via a connection in the aggregate
  - Effective duration of the decalcifier should be at least 30 minutes, meanwhile provide sufficient mixing by rotating the shaft
  - Drain and dispose of the decalcifier (see chapter 6.4, „Draining the unit“)
  - Assembly of the pipes / hoses
  - Recommissioning of the aggregate (see chapter 6.5, page 15)

7.3 Service / Support

For maintenance and repair work, please contact our service.

When returning the unit following must be observed:

- Unit must be emptied (see chapter 6.4, „Draining the unit“)
- Unit must be cleaned inside and outside (see chapter 7.2, page 17)
- Unit must not be disassembled and must be supplied with all the necessary parts
- The identification of the unit on the nameplate must be unrestricted
- a duly completed "Declaration of Harmlessness" must be accompanied by any declining aggregate
- For returning the original packaging should be used

7.4 Spare parts

As spare parts, only the bearings and seals are provided (see Figure 10, page 24). If other parts are necessary for the maintenance contact your responsible representative of the SKV-tec GmbH to determine whether a repair is economically or whether a replacement can be considered.

When ordering spare parts and accessories following information is required:

- complete model code of the unit using the nameplate (see chapter 3.1, page 6)
- Serial number (S/N) of the aggregate (see chapter 3.1, page 6)
- Position and parts designation

Commercially available standard parts can be purchased in free trade.

7.5 Disassembly of the unit

DANGER

Electrical danger!

The electrical connection must be performed by qualified electricians!

Before starting work on the unit following actions must be performed:

- Disconnect unit from the mains
- Ensure the absence of voltage
- Secure against restarting
- Earth and short circuit
- Cover and safeguard neighboring live parts

WARNING

Risk of injuries when the engine is running!

During operation the unit must not be touched! During operation, no work may be performed on the unit!

Risk due to pressure and vacuum!
Risk caused by escaping media!

Before starting work on the unit:

- Supply of operating fluid closed
- Unit and pipes depressurised

Before disassembly work on the unit the following conditions must be met:

- The safety instructions must be observed
- The unit is shut down and disconnected from the mains
- The operating fluid of the unit is drained
- connected pipes / hoses and equipment such as separators, pressure gauge, etc. are disassembled
- The unit has been removed from the system and is on a clean, flat assembly area

(1) Disassembling the casing cover

- Put aggregate on the fan housing
- Loosen and remove the 4 hexagon screws with a wrench SW10
- Removal of the casing cover

(2) Disassembling the impeller

- Pull the impeller using a suitable detaching device from the motor shaft
- Remove shaft key from the motor shaft

(3) Disassembling the water flow plate

- Take the water flow plate from the connection housing
- Remove the o-ring

(4) Disassembling of the valve flap

(5) Disassembling of the mechanical seal

- Remove the retaining ring from the shaft
- Pulling the movable sealing part including the compression spring
- Press out the immovable sealing part of the connection housing

(6) Disassembly of the pump side bearing

- Loosen and remove the 4 hexagon socket screws
- Removing the connection housing
- Remove the retaining ring
- Pulling the bearing out of the connection housing

Disassembling the motor-side bearing

- Set up unit horizontally
- Remove the fan cover
- Loosen and pull off the fan from the motor shaft
- Loosen the screws of the motor cover and remove the motor cover
- Pulling off the rolling bearing of the motor shaft

7.6 Assembling of the unit

CAUTION

Risk of material damage due to improper assembly!

➔ Assemble the unit according to the guidelines for engineering!

➔ Use only original parts!

➔ Carry out the assembly on a clean, level assembly area!

Furthermore, please note the following:

- worn parts must be replaced by original Spare Parts
- use only functional and tested parts
- Seals generally must be replaced
- all parts have to be cleaned
- the necessary tightening torques are to be observed

(1) Assembly of the pump side bearing

- Put aggregate on the fan housing
- Pressing the bearing into the connection housing
- Insert the retaining ring
- Align the connection housing on the motor housing
- Tightening the connection housing with the 4 hexagon socket screws

(2) Assembling of the mechanical seal

- Moisten the sealing surface of the stationary sealing part with lubricant (water, alcohol)
- Pass the stationary sealing part over the shaft to seal seat in the connection housing and press it in with a grouting aid
- Moisten the sealing surface of the movable sealing part with lubricant (lubricant with PTFE)
- Lead the movable sealing part including the compression spring with a spiraling motion through the shaft
- Load washer
- Inserting the retaining ring in the shaft groove

(3) Assembling of the valve flap

- Position the valve flap according to the orientation pins and press it into the connection housing

(4) Assembling the water flow plate

- Position the water flow plate according to the orientation pins and press it into the connection housing
- Insert o-ring into the groove between connection housing and water flow plate

(5) Assembling the impeller

- Insert shaft key in the motor shaft
- Press the impeller with a suitable tool on the motor shaft (cover disc facing up)

(6) Assembling the casing cover

- Align the casing cover on the connection housing (in accordance with the flow arrows)
- Tightening the cover with the 4 hexagon screws (SW10)

Assembling the motor-side bearing

- Set up unit horizontally
- Pressing the rolling bearing on the motor shaft
- Align the motor cover and screw it to the motor housing
- Pressing the fan on the motor shaft
- Reassembly of the fan cover

8 Troubleshooting

DANGER

Electrical danger!

The electrical connection must be performed by qualified electricians!

Before starting work on the unit following actions must be performed:

- Disconnect unit from the mains
- Ensure the absence of voltage
- Secure against restarting
- Earth and short circuit
- Cover and safeguard neighboring live parts

WARNING

Risk of injuries when the engine is running!

During operation the unit must not be touched! During operation, no work may be performed on the unit!

Risk due to pressure and vacuum!
Risk caused by escaping media!

Before starting work on the unit:

- Supply of operating fluid closed
- Unit and pipes depressurised

If the operator of the unit can not resolve the disturbance, the contact person responsible for the maintenance of the unit is to be contacted.

If the problem can not be resolved, contact your responsible representation of the SKV-tec GmbH!

Defect	Cause	Rectification
Engine will not start (no running noise)	At least two phases of the power supply are interrupted	Check the power supply and eliminate interruption
	One phase of the power supply is interrupted	Check the power supply and eliminate interruption
	Motor protection switch has triggered	Check the motor and switch on protection switch again
	Motor blocked	Check the motor
Engine does not start (humming noise)	Rusted impeller and / or connection housing	Use of rust remover to loosen the blockade
	Iced pump	Careful heating and defrosting of the aggregate
	Impeller is stucked	Free the shaft by rotation (see chapter 7.2, page 17)
	Contamination of the pump	Clean the aggregate (see chapter 7.2, page 17)
	Calcification of the pump	Decalcifying of the aggregate (see chapter 7.2, page 17)
	defective impeller	Replace impeller (see chapter 7.5, page 18)
	Defective motor bearings	Replace motor bearings
Motor protection switch triggers	Motor overload	Verification / throttling the operating fluid stream
	Short circuit in the motor winding	Checking the motor winding
	Incorrect setting of the motor protection switch	Check settings, if necessary, replace the motor protection switch
	Excessive back pressure in the pressure side connection	Reduce back pressure
	Excessive share of fluid	Reduce the share of fluid
	Blocked / Plugged suction side	Open / freely accessible suction side
	Motor / pump blocked	See "Engine does not start"

Defect	Cause	Rectification
Excessive power consumption of the engine	Motor overload	Verification / throttling the operating fluid stream
	Excessive back pressure in the pressure side connection	Reduce back pressure
	Excessive share of fluid	Reduce the share of fluid
	Blocked / Plugged suction side	Open / freely accessible suction side
	Contamination of the pump	Clean the aggregate (see chapter 7.2, page 17)
	Calcification of the pump	Decalcifying of the aggregate (see chapter 7.2, page 17)
	Too high viscosity of the operating fluid	Use a recommended operating liquid
No vacuum generation by the pump	No operating fluid in the pump	Check the operation fluid supply
	Leakage on suction side	Check the suction side connections / pipes
	Wrong direction of rotation of the motor	Check direction of rotation
Insufficient vacuum generation by the pump	Leak in the system	Check system for leaking spots
	Excessive operating fluid stream	Reduce operating fluid stream
	Insufficient operating fluid stream	Increase operating fluid stream
	Operating fluid too hot	Cooling of the operating fluid (see chapter 6.3, recommended temperature 15°C)
	Wrong direction of rotation of the motor	Check direction of rotation
	Wear on the control valve	Replacement of the control valve (see chapter 7.5, page 18)
	Wear of the mechanical shaft seal	Replacement of the mechanical shaft seal (see chapter 7.5, page 18)
	Spindle speed too low	Increasing the speed (consulting producer)
	Unit undersized	Exchange / Replace with larger unit
Unusual noises	Cavitation in the pump	Install anti-cavitation valve
	Excessive amount of steam in sucked flow	Reducing the suction side vapor content, if necessary install a condenser
	Blocked / Plugged suction side	Open / freely accessible suction side, if necessary install an anti-cavitation valve
	Excessive operating fluid stream	Reduce operating fluid stream
	Spindle speed too high	Decreasing the speed (consulting producer)
Aggregate leaking	Defective shaft seal	Replace shaft seal (see chapter 7.5, page 18)
	Defective housing seal	Replace housing seal (see chapter 7.5, page 18)
	Wear on housing parts	Replacement of the affected parts
	Loose fittings / connections	Sealing the connections, if necessary, replace the seals
Poor Running of the aggregate	Excessive operating fluid stream	Reduce operating fluid stream
	Overloading of the pipe system	Inspection of the pipe system
	Vibrational resonances in the pipe system	Inspection the pipe system if necessary use of dampers / mountings
	Imbalance in the impeller	Replace impeller (see chapter 7.5, page 18)
	Deposits on the impeller	Clean/Replace impeller (see chapter 7.5, page 18)
	Defective pump / motor bearing	Replacement of the affected bearings

9 Technical Specifications

9.1 Operating limitations

SKV-LRP-30 / -50					
Pressure		**[mbar]**	**Operating fluid (water)**		
minimum inlet pressure		33	temperature		[°C]
permanent compression		1300		range	-10 - +80
permanent Δp	max.	1100	density		[kg/m³]
	min.	200		max.	1200
pumped medium			viscosity		[mm²/s]
temperature		[°C]		max.	4
	dry	200	speed		[min^{-1}]
	saturated	100		max.	3450

9.2 Preservative

As preservatives Rivolta (recommended) or a similar product should be used

The storage must be carried out in closed, dry and dust free rooms.
For a storage time of one to three months, the preservative Rivolta KSP130 is recommended. The preservation process must be repeated every three months.

Filling volume of preservative:

Model	Filling volume (inside the system) [l]	Filling volume (outside the system) [l]
SKV-LRG-30	0,4	~ 0,9
SKV-LRG-50	0,6	~ 1,2

9.3 General technical data

Unit data:

Model	Number of steps	frequency	power	voltage	current
		[Hz]	[kW]	[V]	[A]
SKV-LRP-30-3-906	1	50	0,75	Δ 200 – 275 Y 345 – 480	Y 2,5
		60	1,1		Y 3,1
SKV-LRP-50-3-916		50	1,5		Y 4,3
		60	2,2		Y 4,6

Model	Service factor	Operating fluid quantity	Maximum air flow	Sound pressure level	Weight
		[m³/h]	[m³/h]	[dB (A)]	[kg]
SKV-LRP-30-3-906	1,08	0,2	28	62	17
	1,06		32	67	
SKV-LRP-50-3-916	1,83	0,23	49	65	22
	1,38		53	69	

Threads of the connections:

	Position (see Figure 3)					
Model	A_L	A_{BF}	A_{Ab}	A_M	A_{Kav}	Pressure / suction side
SKV-LRP-30	G ¼	G ¼	G ¼	G ½	G ¼	G 1
SKV-LRP-50						

Operating fluid:

solids-free water with a pH value of 6 - 9

Model	Flow rate (80 mbar/15°C)	Maximum flow rate	Filling volume up to the middle the shaft
	[l/min]	[m³/h]	[l]
SKV-LRP-30-3-906	4	0,25	0,4
SKV-LRP-50-3-916	5	0,3	0,6

Ambient conditions:

temperature:		+5 °C - +40 °C
relative humidity:		
	permanent	≤ 85 %
	Short term	≤ 100 %
max. height over NN:		≤ 1000 m

Minimum distance WT (heat dissipation):

Model	Minimum distance fan housing – adjoining surface [mm]
SKV-LRP-30-3-906	35
SKV-LRP-50-3-916	

10 Appendix

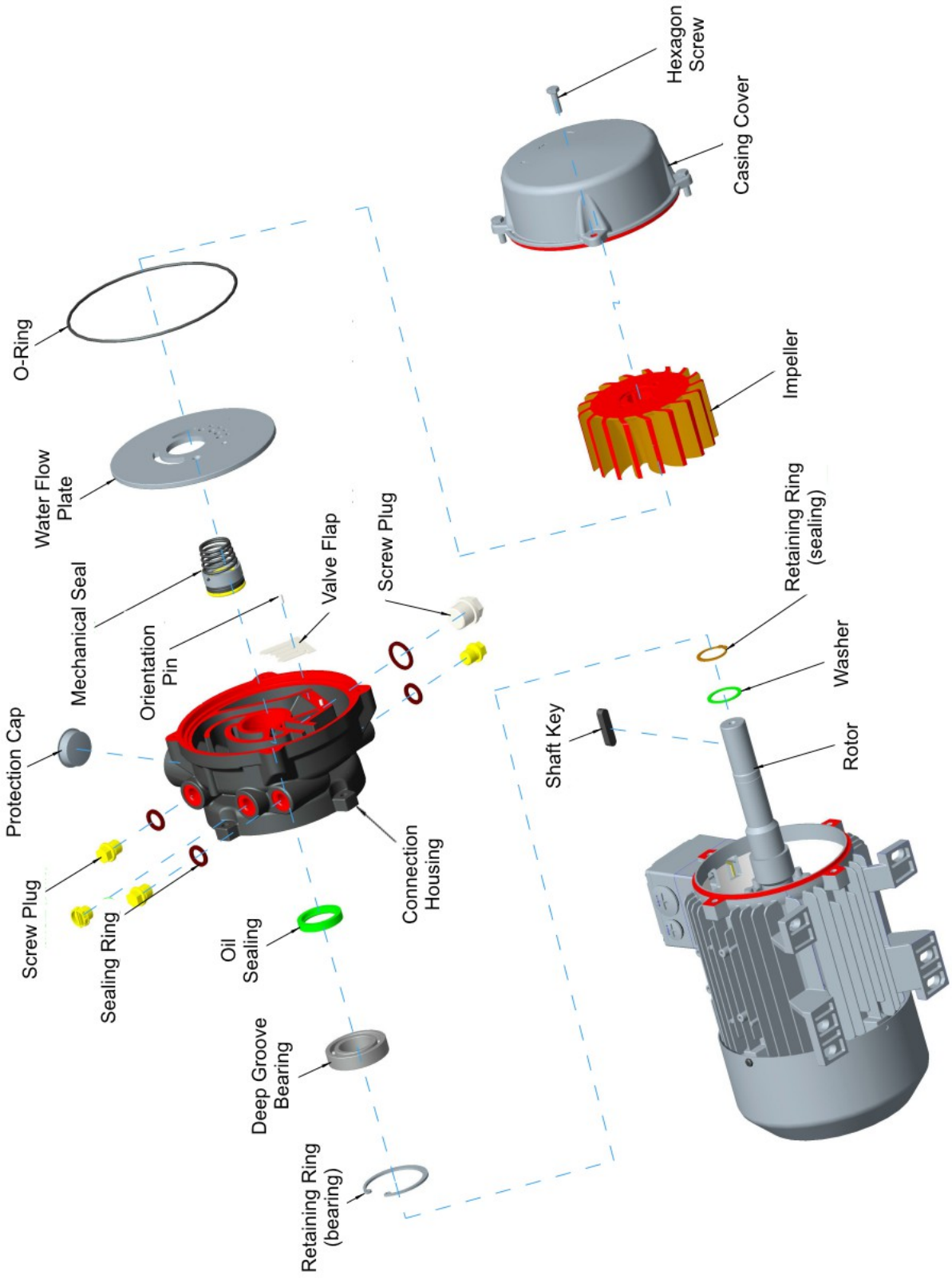

Figure 10: Explosion Drawing of the aggregate

EC - Declaration of Conformity

Object of the declaration:	Liquid ring vacuum / compressor pump of the SKV-LRG-Series
Types:	**SKV-LRG-30**
	SKV-LRG-50

We hereby declare that the pump unit described above - in its delivered state - complies with the following relevant provisions:

- **Machinery Directive 2006/42/EC** of the European Parliament and of the Council of 17.5.2006
- The **safety objectives of the Low Voltage Directive** are complied in accordance with Directive 2006/95/EC
- **Directive 2004/108/EC** of the European Parliament and of the Council of 15.12.2004 - legislation relating to electromagnetic compatibility

Applied harmonized standards:

DIN EN 1012-1	Compressors and vacuum pumps - Safety requirements - Part 1: Compressors
DIN EN 1012-2	Compressors and vacuum pumps - Safety requirements - Part 2: Vacuum Pumps
DIN EN 60034-1	Rotating electrical machines - Part 1: Rating and performance
EN ISO 12100	General principles for design - Risk assessment and risk reduction

This declaration loses its validity if the pump assemblies described above are technically modified without our approval.

Igensdorf, 27.07.2015
(place, date)

Robert Krämer, CEO
(name and function)

(signature Robert Krämer)

SKV-tec GmbH
Forchheimer Str. 4 / D-91338 Igensdorf
Tel.: +49 (0) 9192 – 99 53 14 / Fax: +49 (0) 9192 – 99 52 68

Declaration of Harmlessness

Each send in aggregate this declaration **has to** be accompanied by completely filled!
The following criteria must comply with the declaration:

- It must be completely filled, otherwise the repair / disposal can be refused.
- It must be completed, checked and signed by an authorized service personnel.
- It must be completed in German or English
- It must be attached easily visible on the outside of of the packaging material and if necessary inform the relevant forwarding agency

Type designation: _____

Serial number (S/N): _____

Reason for return: _____

The unit came into contact with hazardous substances: ☐ yes ☐ no
(In repairing / Disposal danger consists for people and the environment)

If the unit came in contact with hazardous substances, the relevant substances in the following are mentioned:

Trade name	**Chemical designation**	**Hazardous Material Class**	**Properties (z.B. corrosive, flammable, toxic)**

The unit has been completely drained, flushed and cleaned both from the inside and from the outside in accordance with these operating instructions ☐ yes

All safety data sheets are enclosed ☐ yes

When handling with the aggregate safety precautions must be taken? ☐ yes ☐ no

If yes, _____

_____

Legally binding statement

We assure that all information provided are complete and correct and I - the undersigned – am authorized and empowered to confirm this. We are aware that in case of incomplete, incorrect information we are liable for damages incurred by the contractor. Due to incomplete, incorrect information we keep the contractor free from damage claims of third parties. Independent of this statement, we are aware that we are directly liable to third parties, which particularly refers to the responsible personnel for the repair of the contractor.

Company: _____ Name: _____

Street: _____ Date, signature: _____

City: _____ Stamp: