

Operating and Maintenance Instructions

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Screw pumps
Series SM...ER..
Design U

Retain
for future
use!

Order no.:

Pump ident. no.:

Machine no.:

Pump type:

Operating data of pump as per order data sheet
 Dimensions as per technical specification VM 618/...

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These Operating and Maintenance Instructions contain information from the pump manufacturer. They may need to be supplemented by instructions of the operator company for its personnel. These instructions do not take account of specific information relating to operation and maintenance of the process plant into which the pump is integrated. Such information can only be given by the persons responsible for construction and planning of the plant (plant manufacturer).

Such specific instructions relating to operation and maintenance of the process plant into which the pump is integrated have priority over the instructions of the pump manufacturer.

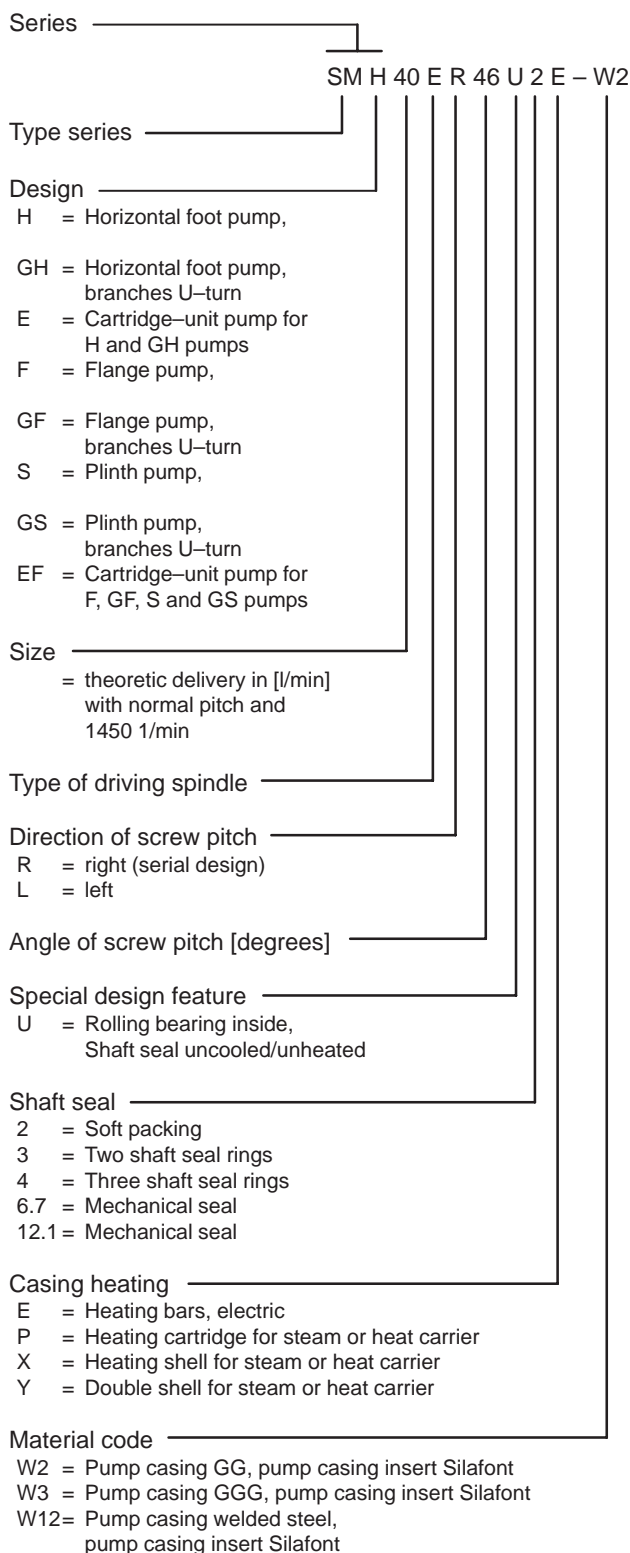
Refer to the operating instructions of the plant manufacturer!

1 General

1.1 Abbreviation

The abbreviation of the screw pump is set up according to the following schema, and is engraved on the type plate.

Example:



1.2 Application and range of utilization

The inside–bearing screw pumps of type series SM...ER.. are three–screw, rotary positive displacement pumps for lubricating liquids. The liquids must not contain any abrasive particles nor chemically attack the pump materials.

Due to a modular system, the pumps may be designed as cartridge–unit pumps, horizontal foot–mounted pumps, flange–mounted pumps as well as vertical plinth–mounted pumps.

1.3 Performance data

The exact performance data applicable to the pump can be taken from the order data sheet and/or acceptance test report, and are engraved on the name plate.

The pressure data indicated there apply only to approximated static pressure load. In the case of dynamic alternating pressure load, consult the manufacturer.

1.4 Warranty

Our warranty for shortcomings in the supply is laid down in our delivery conditions. No liability will be undertaken for damages caused by non–compliance with the operating instructions and service conditions. If at any later date the operating conditions change (e.g. different fluid conveyed, speed, viscosity, temperature or supply conditions), it must be checked by us from case to case and confirmed, if necessary, that the pump is suited for those purposes. Where no special agreements were made, pumps supplied by us may, during the warranty period, only be opened or varied by us or our authorized contract service workshops; otherwise our liability for any defects will cease.

1.5 Testing

Prior to leaving our factory, all pumps are subjected to a thorough test run and performance test on the test stand. Only properly operating pumps, achieving the performance assured by us, leave the factory. Thus, compliance with the following operating instructions ensures fault–free operation and full delivery.

1.6 Availability

As a matter of principle, we recommend stocking replacement pumps and withdrawable units (hydraulic action system) where the supplied pumps are a decisive factor in maintaining a production or delivery process. In this way downtimes can be avoided, or reduced to a minimum.

2 Safety

These operating instructions contain basic safety instructions for installation, operation and maintenance. It is therefore essential that they are read by fitters and all specialist staff and customer personnel prior to installation and start-up. They must always be kept at hand at the place of installation.

The special safety instructions contained in the other chapters must be observed in addition to the general safety instructions in this chapter.

2.1 Marking of instructions in the operating instructions

The safety instructions contained in these operating instructions which represent a danger to personnel if not complied with are specially marked by the general danger symbol:



Warning symbol
as per DIN 4844–W9

Warning of danger from electric voltage is given as follows:



Warning symbol
as per DIN 4844–W8.

Instructions which are essential to avoid endangering the machine and its functioning are marked by the word

ATTENTION

Instructions affixed directly to the machine such as

- Directional markers
- Signs for fluid connections

must always be observed and maintained in fully legible condition at all times.

2.2 Personnel qualification and training

The operating, maintenance, inspection and mounting personnel must be appropriately qualified for the duties assigned to them. The scope of their responsibilities, competency and supervisory duties must be closely controlled by the customer. If the personnel do not have the required knowledge, they must be trained and instructed. If required, this may be provided by the manufacturer/supplier on behalf of the customer. The customer must additionally ensure that personnel fully understand the content of the operating instructions.

2.3 Dangers in the event of non-compliance with safety instructions

Failure to comply with the safety instructions may result in danger to persons, and place the environment and the machine at risk. Non-compliance with the safety instructions may lead to the loss of any claims for damages.

Non-compliance may relate to the following dangers:

- Failure of important functions of the plant
- Failure of specified methods for maintenance and servicing
- Danger to persons resulting from electrical, mechanical and chemical effects
- Danger to the environment resulting from leakage of hazardous substances

2.4 Responsible working practices

The safety instructions contained in these operating instructions, current national accident prevention regulations, as well as internal working, operating and safety rules of the customer, must be observed.

2.5 Safety instructions for the user/operator

- Hot or cold parts representing a danger must be protected against accidental contact on site.
- Protection against accidental contact for moving parts (such as the coupling) must not be removed while the machine is in operation.
- When operating pump aggregates in a dust-laden environment (e.g. milling, chipboard manufacture, bakeries), the surfaces of the pumps and motors must be cleaned at regular intervals, depending on local conditions, in order to maintain the cooling effect and eliminate the possibility of spontaneous combustion. Refer also to explosion protection regulations (ZH 1/10).
- Leakage (e.g. from the shaft seal) of hazardous substances being handled, such as explosive, toxic or hot materials, must be discharged such that no danger to persons or the environment is created. Legal regulations must be observed.
- Dangers from electrical energy must be eliminated. For details in this regard, refer to VDE and local power company regulations.

2.6 Safety instructions for maintenance, inspection and mounting work

The operator company shall ensure that all maintenance, inspection and mounting work is performed by authorized and qualified specialist personnel who have thoroughly studied the operating instructions.

Work on the machine is only to be carried out when the machine is at a standstill. The means of shutdown of the machine described in the operating instructions must always be followed.

Pumps or aggregates handling fluids which are detrimental to health must be decontaminated. All safety and protective devices must immediately be refitted and made operational on completion of the work.

The instructions under Section 6.1, "Preparation for start-up", must be observed before restarting.

2.7 Unauthorized conversion and production of replacement parts

Conversion or modification of the machines is only permissible after consultation with the manufacturer. Original replacement parts and accessories approved by the manufacturer serve safety purposes. If other parts are used the manufacturer cannot be held liable for the consequences.

2.8 Impermissible modes of operation

The operating safety of the machine supplied is only ensured when it is used in accordance with *Section 1* of the operating instructions. The limit values given on the data sheet must under no circumstances be exceeded.

3 Transportation and Intermediate Storage

3.1 Packaging

Attention must be paid to the markings on the packaging.

The suction and pressure sides and all auxiliary connections must always be closed during transportation and storage. The closing plugs must be removed when the pump aggregate is installed.

3.2 Transportation

The pump or pump aggregate is to be safely transported to the place of installation, if required by means of lifting gear.



The generally applicable safety regulations for lifting loads must be observed. The crane device and cables must be adequately dimensioned. The cables must not be attached to the attachment eyes of the motor.

Complete aggregates, with a base plate-mounted horizontal foot pump and mounted, coupled motor, must be transported to the place of installation as shown in the illustration.

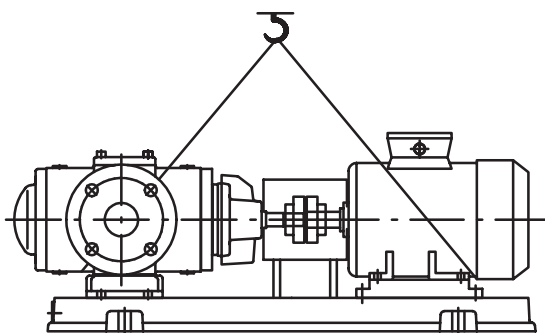


Fig. 1: Transportation of a horizontally mounted pump aggregate

In the case of vertically and horizontally mounted flanged pump aggregates, it is advisable to attach the cables to the wall/foot lantern or intermediate fitting lantern (not shown).

ATTENTION During transportation ensure that the aggregate is secured against toppling over. The attachment eyes of the motor can be used to secure it.

Transport damage

ATTENTION Check the pump for damage on receipt. Any damage detected must be notified immediately.

3.3 Preservation and storage of the screw pumps

3.3.1 Preservation

In the case of storage or prolonged standstill, the pumps must be protected against corrosion. In those cases, an outside and inside preservation is to be provided. The durability of the protection against corrosion, which is limited in time, depends on the composition of the preservative to be applied and the storage conditions.

ATTENTION Under normal circumstances the pumps have no special preservative.

At an additional charge we can, however, supply pumps and replacement parts ex factory with a preservative adequate to the planned storage period.

We will be pleased to specify suitable preservatives for you on request.

3.3.1.1 Outside preservation

The outside preservative should be applied by painting or spraying with a spray gun.

Points of preservation:

All bright and unvarnished parts (e.g. shaft ends, couplings, flange facings, valve and manometer connections).

3.3.1.2 Inside preservation

The preservative is to be applied by filling the pump. For these purposes, the suction side of the pump must first be closed with a dummy flange. During filling, the pressure flange must be on a higher level than the suction flange. During the filling process, the shaft must be slowly cranked against the direction of rotation. Filling must be continued until the preservative reaches the sealing strip of the delivery flange, bubble-free. Then the outlet side is to be closed with a dummy flange.

Note: Not required for pumps made of stainless materials.

Points of preservation:

All bright parts inside the pump (e.g. pump casing inside, screw spindles, ball bearings, pressure-relief valves).

3.3.1.3 Monitoring of preservation

In the event of prolonged storage, the preservation of the pump must be checked by the customer at regular intervals.

Every six months the pump level must be checked; if necessary, preservative must be topped up to the sealing strip on the pressure flange.

At the same time, the packing must be checked for destruction, and repaired if necessary.

Note: Liability for damages caused by improper preservation cannot be assumed by us.

3.3.1.4 Depreservation



Prior to setting the pump in motion, the preservative applied must be removed.

Environmentally compatible disposal must be ensured.

The preservative applied for inside preservation can normally be removed by flushing the pump with the fluid to be conveyed.

Alternative, suitable solvents may be applied for removing the inside and outside preservation. Appropriate solvents are for example: petroleum, benzene, Diesel fuel, spirit, alkalis (industrial cleaners) or any other wax solvents. Steam jet cleaning devices with appropriate admixtures can also be used (allow wax solvent to act beforehand).

ATTENTION Prior to start-up after prolonged storage, all elastomers (O-rings, shaft seals) must be checked for their elasticity of shape. Embrittled elastomers must be exchanged. Elastomers of ethylene-propylene rubber (EPDM) must always be replaced. The pump must be filled with fluid to prevent seizing of the components. A pressure-relief valve attached or fitted in the pipeline must be checked for passage.

Note: If on the plant side, the pipelines, (oil) tanks or other parts are wetted with paraffin-containing preservative, the entire plant must be depreserved as paraffin is detrimental to the air separating capability of oil. This may result in unsteady operation of the pump and loud noise.

3.3.2 Storage

During storage of the pump, the suction and outlet branches and all other supply and discharge branches must always be closed with dummy flanges or dummy plugs.

Storage should be in a dry, dust-free room. During storage, the pump should be cranked at least once a month. During this process, parts such as the shaft and bearings should change their position.

4 Description

4.1 Structural design

Three-screw pumps with a double-threaded driving spindle and two double-threaded idler spindles, enclosed in a housing insert with narrow running clearance.

The delivery elements are installed in a pump housing which is closed off by pump caps.

In the plinth pumps, the end-side pump cover is designed as a round foot. Cartridge-unit pumps do not have a pump casing. Depending on the installation situation, they can be installed in pump columns, submersed bodies, (hydraulic) tanks and cylinder casings etc.

4.1.1 Bearing and lubrication

By an internal groove ball bearing to DIN 625, lubricated by the fluid pumped.

4.1.2 Shaft seal

- **Stuffing box (Design U2)**
Soft packing; packing rings of teflon-impregnated mineral fibre yarn.
- **Shaft seal rings (Design U3 and U4)**
Two or three shaft seal rings of Perbunan or Viton.
- **Mechanical seal (Design U...)**
Uncooled, maintenance-free mechanical seal of the unbalanced type.

Material of the mechanical seal ①:

| | |
|-----------------------|--------------------------------|
| Rotating seal ring: | Hard carbon, metal-impregnated |
| Stationary seal ring: | Alloyed grey cast iron |
| Auxiliary gaskets: | Viton |
| Spring: | CrNiMo-steel |
| Metal parts | CrNiMo-steel |

① Special mechanical seals and/or other material designs may be installed.

4.1.3 Connections/Branch positions/Dimensions

SMH, SMF, SMS: with symmetrically arranged opposite suction and delivery branches, offset.

SMGH, SMGF: suction and delivery branches arranged one behind the other (U-turn).
②

SMGS: suction and delivery branches arranged one above the other (U-turn).
②

Flanges on all designs

Suction side: PN 16 to EN 1092-2
Delivery side: PN 100 to DIN 2546

② These designs are only available with steel-welded casing.

4.1.4 Heating

Where heavy heating oils or other fluids which tend to solidification when cooling are to be pumped, the following equipment is available for pump heating.

| Short cut | Heating | | | |
|-----------|--------------|----------------------------|-------------------|------------------|
| | electrical | with steam or heat carrier | | |
| | Heating rods | Heating shell | Heating cartridge | Heating jacket ① |
| – | – | – | – | – |
| E | x | – | – | – |
| X | – | x | – | – |
| P | – | – | x | – |
| Y | – | – | – | x |

① Only pumps of steel-welded construction are fitted with a heating jacket.

For further details on pump heating and the necessary heating capacity, refer to our specific brochure VM 4.70/Z.–Nr. 6000002024.

4.1.5 Pressure relief valve



For safety reasons, screw pumps must generally be equipped with a pressure relief valve.

Most pumps are already equipped with a pressure relief valve when they leave the factory. The standard trigger pressure of this valve is approximately 10% above the operating pressure.



Pumps that are supplied without a pressure relief valve must be provided with a suitable safety valve by the customer. The safety valve must be fitted in the discharge pipeline between the pump and the first shut-off device.

4.1.6 Additional devices/Auxiliary systems

Any additional devices required (heating, cooling, quench, pressure relief system) are dependent on the order and the plant operating conditions. Please refer to the order-specific documents for precise details of the construction and the operating conditions.

4.2 Mode of operation

Through the suction connection, the fluid is conveyed into the suction chamber of the pump. From there the fluid flows into the spindle chambers, which are constantly formed by the rotary motion at the spindle end on the suction side. By the translatory rotary motion, the chambers filled with the fluid move from the suction side to the outlet side. During this process the closed chamber volume does not change. At the spindle end on the outlet side the chamber opens towards the delivery chamber. The fluid is steadily pushed out into the delivery chamber from where it is transported, through the pressure connection, into the pressure pipeline.

The axial thrust acting on the faces of the profile flanks on the outlet side is hydraulically balanced by an appropriate dimensioning of the compensating piston of the driving spindles and the compensating journals of the idler spindles. Thus the bearing is relieved of the hydraulic axial thrust.

The idler spindles are hydraulically driven by means of appropriate dimensioning of the spindles. Only the torque resulting from the fluid friction is transmitted via the profile flanks. They are therefore practically stress-free, and not subject to any wear.

As a result of the constant chamber volume the medium inside the pump is transported, almost entirely free of turbulence and squeezing, from the suction side to the outlet side.

The compartment for the shaft seal is connected to the pump suction chamber. An installed stuffing box regulating valve provides for an excess pressure in the stuffing box housing during suction operation. This excess pressure is approx. 0.5 bar above the pressure in the suction chamber. Thus, during suction operation, air aspiration by the shaft seal is avoided and dry running prevented. In case of flooded operation or design with shaft seal rings the regulating valve is not required.

The structural design and mode of operation of the screw pump ensure a very low noise level and an almost pulsation-free delivery.

4.3 Construction of the pump aggregate

4.3.1 Drive

The pumps can be directly coupled with electric motors or any other prime movers.

In most cases, surface-cooled three-phase squirrel cage induction motors are used as driving motors, type IM B3 or IM V1, class of protection IP 54 to IEC standard, class B insulation, outputs and main dimensions to DIN 42 673 or 42 677.

The exact motor data are to be found on the order data sheet.

4.3.2 Shaft coupling and contact protection

Power transmission is effected via a flexible coupling to DIN 740. Additional radial forces must not act on the driving spindle.

Protection against accidental protection to EN 809 is provided where the product package comprises a pump, base plate and shaft coupling, or where a wall/foot lantern or intermediate fitting lantern is supplied as part of the product package.



According to accident prevention regulations, the pump must only be operated with a protection against accidental contact as per EN 809.

If no contact protection is provided, it must be attached by the operator.

4.3.3 Base plate

Horizontal foot pumps are mounted with the drive motor on a common base plate. Base plates can be provided in cast or steel design.

4.3.4 Wall/foot lantern

Horizontally or vertically mounted flange pumps are connected to the drive motor by way of a wall/foot lantern.

4.3.5 Fitting lantern

Fitting in fluid tanks is enabled by using fitting lanterns.

4.3.6 Motor lantern/intermediate lantern

Vertically mounted plinth pumps are connected to the drive motor by way of a motor lantern or intermediate lantern. In the plinth pumps the end-side cover is executed as a round foot for vertical plinth mounting.

5 Installation/Mounting

5.1 Installation

The pumps can be horizontally or vertically mounted.



For safety reasons the "downward-facing motor" arrangement is not permitted.

5.2 Mode of fastening

The mode of fastening is dependent on the design type and size of the pump and the coupled motor, as well as local installation conditions.

Horizontal foot pumps are normally mounted with the drive motor on a common **base plate**.

Flange pumps can be fastened by means of a **wall/foot lantern**, either horizontally or vertically, at the place of installation.

Vertical plinth pumps have a small installation area due to their design, and can also be fastened on a **concrete foundation** or **foundation frame**.

In the case of flange and insertion pumps which are installed in immersion bodies, tanks, cylinder housings etc., the **fixing flange** of the pump, together with the **flange contact surface**, provides a fastening option in the various executions.

Precise details on form and dimensions are given in the installation drawing.

5.3 Foundation

5.3.1 General

The foundation may be a floor/concrete base or a load-bearing steel foundation frame.

Note: The foundation must be designed so it can take the weight of the pump aggregate across its entire area.

5.3.2 Characteristics of a steel foundation frame

A steel foundation frame must be designed so that the base plate makes contact across its entire area, and can be bolted or welded down.

ATTENTION If the base plate is only supported at four points the pump aggregate will hang down in the middle. This will affect the alignment of the coupling and may also lead to severe noise being generated.

5.3.3 Characteristics of a floor/concrete foundation

The foundation must be horizontal, flat and clean, and be capable of bearing the full load upon it.

Note: Concrete foundations must be executed with standard concrete of strength class B 25 as a minimum.

5.3.4 Alignment of the pump aggregate

The pump aggregate must be aligned to its pre-set height and system dimensions. This is done using suitable steel shims, arranged directly adjacent to each fixing bolt.

The total height of the steel shims is determined by the pre-set system dimensions of the plant. The steel shims and the base plate must sit flush.

If the fixing holes are more than 750 mm apart, we recommend fitting additional steel shims in the middle of the base plate.

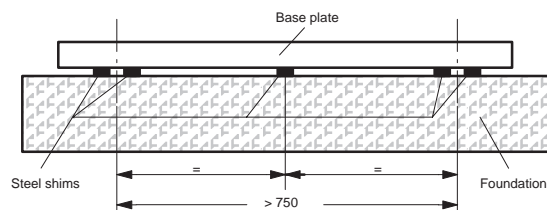


Fig. 2: Alignment with steel shims

Horizontal alignment of the aggregate is produced by way of flat-machined surfaces on the pump using a machine spirit level. Measurements are taken in longitudinal and transverse directions of the pump aggregate.

Permissible deviation: max. 1 mm per 1 m length.

5.3.5 Fixing the pump aggregate

When the aggregate has been aligned on the foundation the fixing bolts should be tightened evenly, alternating side to side.

Recommendation: As far as possible, the base plate should be cast-on over its entire length with a non-shrinking mortar casting compound.

Note: When casting-on and packing with the mortar casting compound, it must be ensured that the base plate makes contact with the foundation over its entire area, and that there are no cavities.

5.4 Checking the coupling alignment

5.4.1 Checking the coupling alignment in case of horizontal setup on base plate (if used)

A complete delivered pump aggregate has been carefully assembled at the factory. After proper installation, and prior to start-up of the pump aggregate, the alignment of the coupling must be checked.

The check can be made with a straight-edge and a feeler gauge, or with other suitable equipment (such as a laser alignment device).

The measurements are taken in two planes, each offset by 90°, on the circumference of the coupling.

If a height, lateral or angle offset is detected between the two coupling halves, the drive motor should be re-aligned such that the coupling halves are flush with each other (level out with flat packing shims as necessary).

The gap between the two coupling halves must be the same all round the circumference of the coupling. The specified gap is shown in the installation diagram.

The spacing between the straight-edge laid over both coupling halves and the respective shaft must be the same all round the circumference.

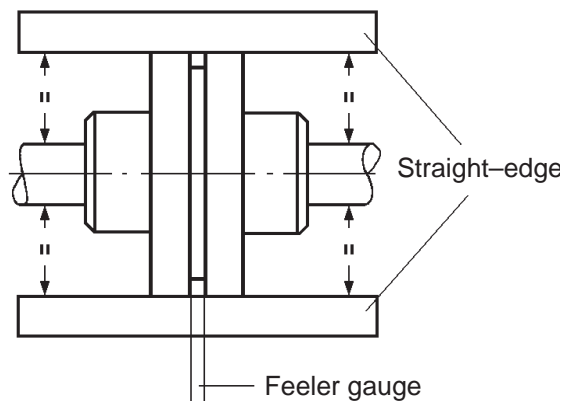


Fig. 3: Alignment of the coupling with straight-edge and feeler gauge

For couplings with a distance piece (removable couplings) the alignment of the coupling can be checked with dial gauges.

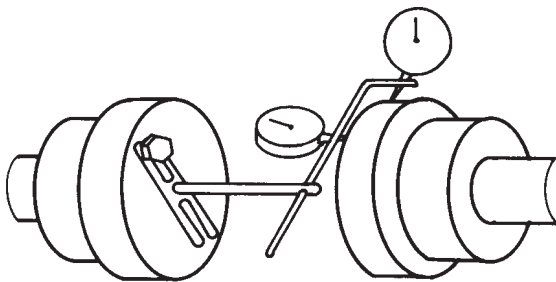


Fig. 4: Alignment of the coupling with dial gauges

Note: The permissible axial and radial deviation, measured on the front face of the coupling and the coupling circumference respectively, may be max. 0.1 mm, but as far as possible should be kept below 0.05 mm.

When the fixing bolts have been aligned and tightened the pump/drive motor unit must be able to be spun by hand without pressure points.

ATTENTION Out-of-flush errors on the coupling may lead to heavier wear of the coupling, the anti-friction bearing and the shaft seal, and even cause the shaft end to be torn off.

5.4.2 Coupling alignment in case of flanged aggregates (if used)

In the case of pumps with flanged drive motor, the pump and motor are precisely centered in the lantern. Alignment or re-alignment of the coupling is not required.

Note: Improper handling, e.g. during transportation, may impair the alignment between the pump and the motor. In this case the pump and the motor must be returned to the factory for checking.

5.4.3 Coupling alignment of special designed couplings (if used)

Refer to the operating instructions of the coupling manufacturer.

5.5 Assembly of pump and motor

If the aggregate is only assembled at the place of use, the coupling is assembled as follows:

1. Coat the pump and motor shaft ends with a fine film of molybdenum disulfide (e.g. Molykote) and insert keys.
2. Push on the coupling halves on the pump and motor side with the aid of a pusher device until the shaft end is flush to the coupling hub.
If no puller is available, heating the coupling halves to approx. 100°C (without rubber buffer) facilitates pushing.

ATTENTION Impacts to the components of the pump or motor must be avoided.

3. Tighten the grub screw on both coupling hubs.
4. When assembling the pump and motor, make sure the specified gap between the coupling halves is maintained (see our installation drawings).
5. In the case of horizontally mounted pump aggregates fixed on a base plate or directly on the foundation, the coupling must be aligned as described in Section 5.4.
In the case of pump aggregates with flanged motor, the coupling does not need to be re-aligned.

6. Mount the contact protection.
According to accident prevention regulations, the pump must only be operated with a protection against accidental contact.



5.6 Space required for maintenance and repair

ATTENTION The pump must be accessible from all sides in order to be able to carry out necessary visual inspections.

Adequate space must be provided for maintenance and repair work. It must also be ensured that all pipelines can be attached and removed without hindrance.

5.7 Laying the pipelines

5.7.1 Nominal widths

If possible, the nominal widths of the suction and pressure pipelines should be rated so that the rate of flow does not exceed a maximum of 1 m/s in the suction pipeline and 3 m/s in the pressure pipeline. If possible, suction pipelines laid "uphill" are to be avoided.

5.7.2 Change of cross-sections and directions

Sudden changes of cross-sections and directions, as well as hairpin bends, are to be avoided.

5.7.3 Supports and flange connections

The pipelines must be connected to the pump, stress-free. They must be supported close to the pump and must allow easy screwing-on to avoid twisting. When the connections are loosened the pipeline must neither be slanted nor springing, nor must it be under pressure.

Any thermal stresses occurring on the pipelines must be kept away from the pump by suitable means, e.g. installing compensators.

5.7.4 Cleaning pipelines prior to attachment

Prior to assembly, all pipeline parts and valves must be thoroughly cleaned; especially in the case of welded pipelines, burrs and welding beads must be removed. Flange gaskets must not protrude inwards. Blanking flanges, plugs, protective film and/or protective paint on flanges and seals must be removed completely. Water residues, still in the pipeline network from pressing-out or steeping for example, must be removed.

Delivery of water destroys the pump. The pump relies on the fluid being conveyed for its lubrication.

5.7.4.1 Inlet/suction conditions (NPSH)

To ensure fault-free continuous operation, the inlet and suction conditions of the plant must be appropriately adjusted to the pump demand (NPSHreq.)

The service condition is fulfilled when the plant NPSH value (NPSHavail.) is above the pump NPSH (NPSHreq.). The NPSHreq. is given in the characteristic sheets of the respective pumps

ATTENTION When pumping air-laden or volatile liquids, particular attention must be paid to the NPSH requirements of the plant.

5.7.5 Stop valves

Stop valves are to be installed in the suction and pressure pipelines close to the pump.

5.7.6 Pressure-relief valve

See Section 4.1 ...

5.7.7 Check valve

It is recommended to install a check valve between the pressure connection of the pump and the stop valve in order to prevent the pump from running dry when it is at a standstill and the pressure stop valve is open.

5.7.8 Vent valve

A vent valve must be provided at the highest point in the pressure pipeline.

5.7.9 Filtering

To protect the pump against coarse dirt contamination, we recommend as a matter of principle installing a filter in the suction pipeline, mesh width 0.6 mm.

Note: The service life of the pump is decisively influenced by the degree of dirt contamination of the fluid being conveyed, that is, by the number, size and hardness of the abrasive components.

5.7.10 Auxiliary pipelines (if present)

All auxiliary pipelines must be connected in accordance with the installation drawing, stress-free and sealed.

5.8 Safety and control devices**5.8.1 Manometers**

Suitable pressure gauges are to be installed in the inlet and pressure pipelines, and in the pressurized auxiliary pipelines.

5.8.2 Safety device in the pressure pipeline

ATTENTION For pumps delivered without a pressure-relief valve, an overload protection must be provided in the control, or a pressure-relief valve (return valve) in the pressure pipeline (see separate Operating Instructions).

5.9 Electrical connections

The power supply cables of the coupled drive motor must be connected by a trained electrician, according to the motor manufacturer's circuit diagram. The applicable VDE regulations and local power company rules must be observed.

Danger from electrical energy must be eliminated.

6 Start-up/Shutdown

6.1 Preparation for start-up

6.1.1 Filling the pump with fluid

ATTENTION Prior to initial operation, the screw pump must be filled with fluid and bled. This at the same time provides the spindles with the sealing required for suction.

The pump must not run dry.

ATTENTION Before filling, the operator must ensure careful and thorough rinsing of the pump if the fluid to be conveyed is not chemically compatible with the test medium (see performance test report).

The fluid is filled through a bore hole in the pump casing or via the pressure pipeline. The pump must be filled with fluid until the fluid emerges free from air.

In the case of immersion pump aggregates the filling level must ensure adequate covering of the inlet rim before and during operation.



During bleeding of the pump and the plant, hazardous or environmentally harmful fluid and gas emerging must be safely collected and discharged.

6.1.2 Control of drive motor direction of rotation

The direction of rotation of the motor must match the direction of rotation arrow on the pump. The motor can be briefly switched on with the suction and pressure valves open to check the direction of rotation. If the direction of rotation is wrong there is no pump suction. This damages the pump. The direction of rotation of the three-phase motor can be reversed by swapping any two phases.

ATTENTION If the direction of rotation is to be checked before the pump is filled with fluid, the drive motor must be disconnected from the pump. The pump must not run dry.

6.1.3 Switching on any auxiliary devices

Before switching on the pump, any additional devices (e.g. heating, cooling, quench system, pressure relief system) must be set in operation and must have reached the necessary flow/temperature and pressure values.

Note: Ensure that flow/temperature and pressure values are in accordance with the order data sheet or manufacturer's operating instructions!

6.2 Start-up

6.2.1 Starting

1. Prior to starting, the stop valves in the suction and pressure pipelines must be completely opened.
2. Where the pump is fitted with a pressure-relief valve, it is set on our test panel to respond 10% above the operating pressure. The opening pressure can be altered within narrow limits by means of

an adjusting screw. The installation of a pressure-relief valve is always required when an impermissible pressure rise is possible, due to a stop device or throttle point in the pressure pipeline for example. If the pressure-relief valve has a hand-wheel regulation, the pump can be started at zero pressure. For this, the pressure-relief valve must be completely opened using the hand-wheel. The starting torque of the motor is thereby reduced.

ATTENTION When starting and stopping the pump under pressure, make sure that the speed- and viscosity-dependent pressure load is not exceeded.

If this is not ensured, the pump must be started and stopped at zero pressure. This also applies to pumps with speed-controlled drive motors.

3. During starting, a vent valve installed on the outlet side of the plant must be opened until the air has escaped from the suction side of the pump. As soon as fluid emerges the vent valve can be closed. The pump is self-priming and is automatically vented without counter-pressure.
4. The fluid level in the tank must be checked. It must be ensured that, when the plant is running, the fluid level in the tank does not fall below the minimum limit. Top up fluid as necessary.

6.2.2 Drive

Switch on the motor.

Pay attention to product-specific characteristics. Refer to the operating instructions of the drive motor manufacturer.

6.2.3 Checking the delivery values

When the motor has reached its operating speed, the inlet pressure and outlet pressure of the pump must be checked using manometers.

For pumps fitted with a hand-regulated pressure-relief valve, the hand-wheel must be closed slowly beforehand, until the pump outlet pressure is reached.

The motor must not be overloaded. The current consumption can be checked with an ammeter. In this connection, the temperature and viscosity of the fluid must also be checked. The readings must be checked against the layout or acceptance test report.

ATTENTION If there should be an inadmissible increase in pressure, mounted pressure-relief valves may shift the media from the discharge to the intake side (recirculation).

Recirculation leads to heating up of the medium. An inadmissible pressure and temperature increase can be indicated by a pressure gauge and a thermometer. Determine the cause immediately and eliminate it in order to avoid damage to the pump as the result of excessive heating up and the related drop in viscosity.

6.3 Shutdown

6.3.1 Stopping and interrupting operation

1. Switch off the motor. Make sure the pump runs down smoothly and evenly.
2. If a check valve is installed in the pressure pipeline, the stop valve can remain open. If no check valve is fitted, the stop valve must be closed.
3. Stop any additional devices that are present (e.g. heating, cooling, quench system, etc.).

6.3.2 Measures in case of prolonged interruption

If a prolonged interruption is intended, the pump must be drained thoroughly via the connections on the pump casing. We recommend removing cartridge-unit pumps and immersion pumps from the tank or the plant.



Safe draining and environmentally compatible disposal of the fluid must be ensured.

Preservative should then be applied to the pump (see Section 3.3).

7 Maintenance/Repair

7.1 Maintenance

- The instructions in Section 2, *Safety*, must be observed in maintenance and repair work.
- Regular monitoring and maintenance of the pump and drive motor increases their service life.

The following instructions are generally applicable.

7.1.1 General monitoring

1. The pump must not run dry.
2. The drive motor must not be overloaded.
3. The suction and pressure pipelines must be checked for leaks. Air must be prevented from entering the delivery system.
4. Built-in stuffing boxes must drip slightly in operation. Mechanical seals must have no inadmissible leakage.
5. Pressure and temperature monitors must be observed.
6. Any additional devices on the pump/shaft seal must be operated and monitored in accordance with regulations.

7.1.2 Maintenance of components

7.1.2.1 Bearing

The bearing of the driving spindle is maintenance-free. The groove ball bearing is designed for a service life of approx. 24,000 hours under normal operating conditions.

The actual service life may be reduced due to intermittent operation, high temperature, low viscosity, poorly lubricating fluids and the like. We therefore recommend checking the running noises and temperature in the bearing area at regular intervals.

If scraping or rattling noises are heard compared to the normal humming, or if excessive temperature rises are detected, this indicates impending bearing damage, and the ball bearing should be replaced as soon as possible.

7.1.2.2 Shaft seal

The shaft is either sealed by the stuffing box, shaft seal rings or mechanical seal.

- **Stuffing box (Design U2)**
Increased leakages, if any, at the stuffing box during the first operating hours normally disappear automatically during the running-in time. If necessary, slightly tighten hexagon nuts (39) at the gland (9).

See to it that the stuffing box must be slightly dripping. Thus, the frictional heat generated at the sealing surface is dissipated.

If leakage losses increase excessively and if even repeated slight tightening of the hexagon nuts (39) does not result in any leakage reduction, the packing rings have lost their elasticity of shape and must be replaced.

- **Shaft seal rings (Design U3 and U4)**

Two or three shaft seal rings may be installed. The shaft seal rings must be checked for a potential leakage. Leaky shaft seal rings must be replaced.

Note: If new shaft seal rings are installed, the sealing lips must be coated with rolling bearing grease and the space between the shaft seal rings filled with rolling bearing grease.

- **Mechanical seal (Design U...)**

An uncooled, maintenance-free mechanical seal will be installed which, in its mode of operation, corresponds to the requested operating conditions. Minimal dripping of non-volatile media resulting from the functioning of the components is to be expected. In the event of heavy leakage due to wear, the mechanical seal should be replaced.

ATTENTION Since the mechanical seal must not be allowed to run dry, the pump must only be started up when charged and bled.

7.1.2.3 Pressure-relief valve

Pressure-relief valves must be checked from time to time, in particular after prolonged downtimes, for passage and functioning. Leaking pressure-relief valves may cause damage to the pump. Damaged parts should be replaced or repaired as necessary.

Note: Operating instructions for pressure-relief valves should be ordered separately.

7.1.2.4 Coupling

The alignment of the coupling and the condition of the flexible elements in the coupling should be checked after initial start-up and at regular intervals.

Note: Worn flexible elements must be replaced.

7.1.2.5 Drive

Refer to the operating instructions of the motor manufacturer.

7.2 Repair (Dismounting and Mounting Instructions)

General

Trained Service fitters are available on request to carry out mounting and repair work.



Where repairs are carried out by the operator's own personnel or by specialist fitters, it must be ensured that the pump is fully drained and cleaned.

This particularly applies to pumps which are sent for repair to our factory or one of our service workshops. We must refuse acceptance of repair work on pumps filled with fluid, for the protection of our staff and for environmental reasons. Otherwise we must invoice the customer/operator for the costs of environmentally compatible disposal.

Where repairs are to be carried out on pumps which have been operated with hazardous substances ^① and/or environmentally harmful media, the customer/operator must inform its own personnel on site, or our personnel where repairs are returned to our factory or a service workshop, without being specifically requested to do so.

In such cases a verification of delivery material, for example in the form of a DIN safety data sheet, must be submitted to us together with the request for a Service fitter.

Alternatively, you can request a certificate of safety (form no. 448/191) from our Service department, filling it out truthfully, correctly and in full. Send the completed form to the center commissioned with carrying out the repair, or hand it to our Service fitter.

① Hazardous substances are:

- Toxic substances
- Health-endangering substances
- Corrosive substances
- Irritants
- Explosive substances
- Fire-inducing substances
- Highly flammable, easily flammable and normally flammable substances
- Carcinogenic substances
- Substances impairing fertility
- Genetically distorting substances
- Substances in other ways hazardous to humans



For all work on site, the operator's own personnel and/or our fitters must be advised of the possible dangers involved in the repair work.

The most important dismounting and mounting operations are described in these instructions. The mounting steps described in the individual sections must be consistently observed.

7.2.1 Dismounting the screw pump

Before dismounting, the following work must be carried out:



- The power supply cable must be disconnected from the motor by an authorized electrician. Electrical danger must be eliminated! The motor must be secured against being switched on.

- Close all stop devices in the inlet and delivery pipeline, and in the auxiliary pipelines.

- Drain the fluid in flowable condition from the pump. **Note:** Use a collecting tank.



- Hazardous substances and/or environmentally harmful media must be drained off and collected such that no danger to life and limb is created. Environmentally compatible disposal must be ensured.

- The pump and any auxiliary systems must be depressurized and drained.

- Allow the pump and motor to cool to ambient temperature.

- Remove the manometer cables, manometers and retaining brackets.

- Remove the contact protection.

- Remove the motor from the base plate or pump bracket where appropriate. **Note:** Use suitable lifting gear.

- Remove immersion pump aggregates from the tank.

- Remove supply/suction and pressure pipelines as appropriate.

- Dismount auxiliary pipelines, if any.

- Loosen the fastening and remove the pump from the base plate or pump bracket.

Note: Use suitable lifting gear.

7.2.1.1 Dismounting the shaft seal, Design U2 Stuffing box

- Loosen grub screw at the coupling hub and withdraw coupling half from the shaft end (12). Use pull-off device!

- Remove key (41) from the driving spindle (12).

- Loosen hexagon nuts (39) at the gland (9), and dismount gland (9) over the driving spindle (12).

- Dismount packing rings (32) and junk ring (81) from the shaft sealing housing (5). Carefully clean stuffing box chamber.

7.2.1.2 Dismounting the shaft seal, Designs U3 and U4 Shaft seal rings

- Loosen grub screw at the coupling hub and withdraw coupling half from the shaft end (12). Use pull-off device!
- Remove key (41) from the driving spindle (12).
- Loosen socket-head cap screws (54), and dismount shaft sealing housing (5) with installed shaft seal rings (107) over the driving spindle (12). Use forcing-off screws!
- Loosen hexagon screws (110) at the seal cover (9), and dismount seal cover (9) over the driving spindle (12).
- Press shaft seal rings (107) with spacer bush (109) and supporting rings (108) out of the shaft sealing housing (5).
Note: The arrangement and number of shaft seal rings must be recorded.

7.2.1.3 Dismounting the shaft seal, Design U12.1 Mechanical seal

- Loosen grub screw at the coupling hub, and withdraw coupling half from the shaft end (12). Use pull-off device!
- Remove key (41) from the driving spindle (12).
- Loosen socket-head cap screws (54), and dismount shaft sealing housing (5) with stationary seal ring (83) over the driving spindle (12). Use forcing-off screws!
Note: Particularly see to it that the shaft sealing housing with stationary seal ring is pulled out concentrically and not canted to avoid damages to the stationary seal ring.
- Remove gasket (22) and clean sealing surfaces.
- By means of an auxiliary tool, dismount stationary seal ring (83) and O-ring from the shaft sealing housing (5).
For these purposes, in case of pump sizes 940 to 3600, loosen socket-head cap screws (79) and remove seal cover (9).
- Dismount rotating part of the mechanical seal (83) over the driving spindle (12).
- Dismount spacer ring (80) and supporting washer (81).
Note: In case of pump sizes 210, 940, 1700 and 2200, the spacer ring (80) is not required.
In case of pump sizes 2900 and 3600, the spacer ring (80) and supporting ring (81) are not required.

7.2.1.4 Dismounting the shaft seal, Design U6.7 Mechanical seal

- Loosen grub screw at the coupling hub, and withdraw coupling half from the shaft end (12). Use pull-off device!
- Remove key (41) from the driving spindle (12).

- Loosen socket-head cap screws (54), and dismount shaft sealing housing (5) with stationary seal ring (83) over the driving spindle (12). Use forcing-off screws!
Note: Particularly see to it that the shaft sealing housing with stationary seal ring is pulled out concentrically and not canted to avoid damages to the stationary seal ring.
- Remove gasket (22) and clean sealing surfaces.
- By means of an auxiliary tool, dismount stationary seal ring (83) and O-ring from the shaft sealing housing (5).
For these purposes, in case of pump sizes 940 to 3600, loosen socket-head cap screws (79) and remove seal cover (9).
- Dismount rotating part of the mechanical seal (83) over the driving spindle (12).
- Dismount supporting washer (81).

7.2.1.5 Dismounting the groove ball bearing

- Following the dismounting of the shaft seal, remove circlip (35) and supporting washer (36) from the driving spindle (12).
- Dismount groove ball bearing (34). For these purposes, apply appropriate tool behind the bearing, and concentrically force off groove ball bearing (34) from the driving spindle (12).
- Clean bearing seat.

7.2.1.6 Dismounting the set of spindles

Dismounting the set of spindles is effected following the dismounting of the shaft seal and the groove ball bearing (please refer to Sections 7.2.1.1 to 7.2.1.5 above).

- Following the dismounting of the shaft seal and the groove ball bearing (34), loosen socket-head cap screws (51), and dismount the cartridge-unit pump from the pump casing (1) towards the driving side. Use forcing-off screws!
Note: Not required in case of cartridge-unit pumps of series SME and SMEF without pump casing.
- Remove gasket (21) and clean sealing surfaces.
- Loosen socket-head cap screws (55), and dismount pump cover, drive side (3) over the driving spindle (12).
- Remove gasket (24), and clean sealing surfaces.
- Pull set of spindles consisting of driving spindle (12) and two idler spindles (13) with the balance bushes (8) out of the pump casing insert (2).
- Remove idler spindles (13) with the balance bushes (8) from the driving spindle (12).

7.2.2 Mounting the screw pump

ATTENTION

Before remounting check all parts for wear and, as necessary, replace with **original replacement parts**.

Clean all parts before mounting. Always fit new gaskets.

7.2.2.1 Mounting the set of spindles

- Insert new O–ring (29) in the groove of the pump casing insert (2).
- Push pump casing insert (2) with (balance) pipe (20) above into the pump casing (1).
Note: Not required in case of cartridge–unit pumps of series SME and SMEF without pump casing.
- Insert set of spindles consisting of driving spindle (12) and two idler spindles (13) with the balance bushes (8) in the pump casing insert (2). In doing so, oil set of spindles and bearing points.
Note: In the pump casing insert, the balance bushes (8) on the two idler spindles (13) are protected against torsion by means of the spring dowels (42). The groove in the balance bushes (8) must correspond to the location of the spring dowels (42) in the pump casing insert.
- Place new gasket (24) onto the cleaned sealing surface of the pump casing insert (2).
Note: Mind the bore holes in the balance bushes (8). Gasket must be congruent with the bore holes.
- Place new gasket (21) onto the cleaned sealing surface of the pump casing.
- By means of the two socket–head cap screws (55), fix pump cover, drive side (3) over the driving spindle (12) to the pump casing insert (2).
Note: Mount pump cover, drive side (3) so that the bore holes of the cover and balance bushes (8) are congruent.
- By means of the socket–head cap screws (51), fix pump cover, drive side (3) to the pump casing (1).
Note: Not required in case of cartridge–unit pumps of series SME and SMEF without pump casing.

7.2.2.2 Mounting the groove ball bearing

- Slightly oil bearing seat on the driving spindle (12).
- By light blows onto the inner bearing ring, mount the groove ball bearing (34) by means of an appropriate pipe length on the bearing seat of the driving spindle (12) against the shaft shoulder.
- Mount supporting washer (36) over the driving spindle (12) in front of the groove ball bearing (34).
- Mount circlip (35) in the key provided in front of the groove ball bearing (34) and/or in front of the supporting washer (36).

7.2.2.3 Mounting the shaft seal, Design U12.1

Mechanical seal

Mechanical seals are high–quality precision parts. Careful handling and extreme cleanliness during mounting are a condition of proper functioning. To facilitate mounting, an appropriate lubricant must be used (e.g. oil, no grease).

- Mount supporting washers (81) with spacer ring (80) in front of the circlip (35).
In case of pump sizes 210, 940, 1700 and 2200, the spacer ring (80) is not required.
In case of pump sizes 2900 and 3600, the spacer ring (80) and the supporting washer (81) are not required.
Note: The specified number of supporting washers (81) with or without spacer ring (80) must be mounted in order to achieve the assembly dimension “X”.
The assembly dimension “X” depends on the pump size.

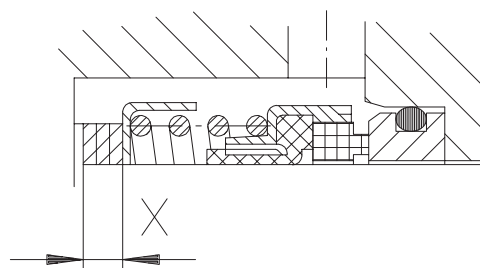


Fig. 5: Mechanical seal U12.1 with assembly dimension X

The table below shows the number of supporting washers (81) and spacer rings (80) to be installed and their dimensions as well as the resulting dimension “X” depending upon the pump size.

| Pump Size | Supporting washer (81) Quantity Dimension [mm] | Spacer ring (80) Quantity Dimension [mm] | Dimension »X« [mm] |
|-----------|--|--|-----------------------|
| 40 | 2 pieces Ø 25/35x2 | 1 piece Ø 25/40x5,2 | 9,2 |
| 80 | 2 pieces Ø 25/35x2 | 1 piece Ø 25/40x5,2 | 9,2 |
| 120 | 1 piece Ø 30/42x2,5 | 1 piece Ø 30/46x3,5 | 6,0 |
| 210 | 4 pieces Ø 35/45x2,5 | – | 10,0 |
| 280 | 1 piece Ø 40/50x2,5 | 1 piece Ø 40/60x5,5 | 8,0 |
| 440 | 1 piece Ø 45/55x3 | 1 piece Ø 45/65x7 | 10,0 |
| 660 | 1 piece Ø 50/62x3 | 1 piece Ø 50/60x4,5 | 7,5 |
| 940 | 1 piece Ø 55/72x17,5 | – | 17,5 |
| 1300 | 1 piece Ø 60/75x3 | 1 piece Ø 60/78x9,5 | 12,5 |
| 1700 | 1 piece Ø 65/85x21 | – | 21,0 |
| 2200 | 3 pieces Ø 70/90x3,5 | – | 10,5 |

- Concentrically press stationary seal ring (83) with new O-ring into the cleaned shaft sealing housing (5).
With pump sizes 940 to 3600, previously fix seal cover (9) to the shaft sealing housing (5) by means of the socket-head cap screws (79).
- Push spring and valve spring plate of the rotating part of the mechanical seal onto the driving spindle (12).
- Coat location hole of the rotating part of the mechanical seal with a lubricant (oil, no grease). Push rotating seal ring, casing, retaining ring and profile washer onto the driving spindle (12) until a contact with the spring is achieved without pre-tensioning the spring.
- Place new gasket (22) on the cleaned sealing surface of the pump cover, drive side (3).
- By means of the socket-head cap screws (54), fix shaft sealing housing (5) with installed stationary seal ring to the pump cover, drive side (3).
Note: Mind exact positioning of the sliding surfaces! The sliding surfaces must not be damaged. Slightly oil sliding surfaces with clean oil.
- Loosen socket-head cap screws (54) to some degree, and slightly untension shaft sealing housing (5) with the stationary seal ring once again from the assembly position to check the axial flexibility of spring and mechanical seal.
Note: As the profile washer of the mechanical seal is relatively soon sucked on the driving spindle, finish mounting of the mechanical seal should be effected within a short period of time after mounting commencement.
- Firmly screw shaft sealing housing (5) via the socket-head cap screws (54) to the pump cover, drive side (3).
- Mount key (41) in the driving spindle (12).
- Heat pump-side coupling half without rubber buffers to approx. 100°C, and mount on the driving spindle (12).

7.2.2.4 Mounting the shaft seal, Design U6.7

Mechanical seal

Mechanical seals are high-quality precision parts. Careful handling and extreme cleanliness during mounting are a condition of proper functioning. To facilitate mounting, an appropriate lubricant must be used (e.g. oil, no grease).

- Mount supporting washer (81) in front of the circlip (35).
- Concentrically press stationary seal ring (83) with new O-ring into the cleaned shaft sealing housing (5).
By means of the socket-head cap screws (79), previously fix seal cover (9) to the shaft sealing housing (5) of pump sizes 940 to 3600.

- Mount rotating part of the mechanical seal consisting of rotating seal ring, intermediate ring, spring, slotted ring and O-ring over the driving spindle (12).
Note: The slotted ring must be pushed against the supporting washer (81) or the circlip (35).
- Place new gasket (22) onto the cleaned sealing surface of the pump cover, drive side (3).
- By means of the socket-head cap screws (54), fix shaft sealing housing (5) with installed stationary seal ring to the pump cover, drive side (3).
Note: Mind exact positioning of the sliding surfaces! The sliding surfaces must not be damaged. Slightly oil sliding surfaces with clean oil.
- Mount key (41) in the driving spindle (12).
- Heat pump-side coupling half without rubber buffers to approx. 100°C, and mount on the driving spindle (12).

7.2.2.5 Mounting the shaft seal, Design U2 Stuffing box

- Install junk ring (81) in the cleaned stuffing box chamber of the shaft sealing housing (5).
- Bend up four new packing rings (32) in axial direction and install in the stuffing box chamber of the shaft sealing housing (5) over the driving spindle (12). In doing so, carefully rebend packing rings in annular shape. The kerfs of the individual packing rings are to be staggered.

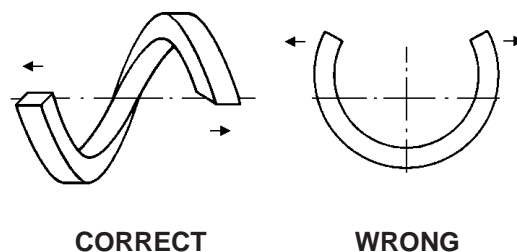


Fig. 6: Bending-up of the packing rings

- Push gland (9) over the driving spindle (12) into the shaft sealing housing (5), and turn hexagon nuts (39) onto the stud bolts (38).
- Uniformly tighten hexagon nuts (39) at the gland (9) until when turning the driving spindle (12) by hand, a frictional resistance is felt.
- Loosen hexagon nuts (39) again, and thereafter, slightly tighten.
- Mount key (41) in the driving spindle (12).
- Heat pump-side coupling half without rubber buffers to approx. 100°C, and mount on the driving spindle (12).

7.2.2.6 Mounting the shaft seal, Designs U3 and U4




Shaft seal rings

The arrangement of the shaft seal rings depends on the suction and/or supply conditions of the pump. Position and number of the shaft seal rings, supporting rings and spacer bushes to be installed must be identical with the previous dismantling.

Shaft seal, Design U3:

2 shaft seal rings (107)
2 supporting rings (108)
1 spacer bush (109)


The two shaft seal rings may be arranged as represented hereinafter.

| | | |
|-----------------|---|---------------------------------|
| Arrangement I |  | against supply head |
| Arrangement II |  | against suction head |
| Arrangement III |  | against supply and suction head |

Shaft seal, Design U4:

3 shaft seal rings (107)
3 supporting rings (108)

The three shaft seal rings are arranged as represented hereinafter.

| | | |
|-------------|---|---------------------------------|
| Arrangement |  | against supply and suction head |
|-------------|---|---------------------------------|

Mounting of the shaft seal rings is to be effected as described below.

- Coat sealing lips of the new shaft seal rings with rolling bearing grease.
- According to the arrangement, consistently press new shaft seal rings (107) individually into the cleaned stuffing box chamber of the shaft sealing housing (5).
Note: The sealing lip of a shaft seal ring must always face the side to be sealed.
Pressing-in into the stuffing box chamber is effected by means of a mechanical pressing device and suitable pressing stamp.
During (flush) pressing, the face of the shaft sealing housing must form a vertical plane to the bore axle. Absolutely see to it that the pressing force is applied as close as possible to the outside diameter of the shaft seal ring.
- To support the sealing lip, mount the appropriate supporting ring (108) so that same rests on the side not to be sealed at the sealing lip profile.
- In case of shaft seal design U3, mount spacer bush (109) between the two shaft seal rings (107) and supporting rings (108).

- Fill stuffing box chamber with rolling bearing grease.
Note: In case of shaft seal design U4, the spacer ring (109) and the additional grease filling in the stuffing box chamber are not required. Here, a shaft seal ring (107) is provided.
- Fix seal cover (9) to the shaft sealing housing (5) by means of the hexagon screws (110).
- Mount key (41) in the driving spindle (12).
- Heat pump-side coupling half without rubber buffers to approx. 100 °C, and mount on the driving spindle (12).

When the screw pump has been mounted the following work must be carried out:

- Align coupling if necessary (see Section 5.4).
- Attach supply/suction and pressure pipelines.
- Attach auxiliary pipelines of the additional devices, if any.
- Attach manometer lines, manometers and brackets to pump.
- Install immersion pump aggregate in the tank.
- Attach contact protection.
- The power supply cable must be connected to the motor by an authorized electrician. Electrical danger must be eliminated! Pay attention to direction of rotation.
- Fill pump with fluid.



Start up pump as per instructions in Section 6.

7.3 Replacement parts/spare parts

The parts marked in the parts list can be provided as replacement/spare parts.
The drive spindle (12) and idler spindles (13) are available only as a complete spindle set.

However, for operational safety reasons, we recommend you always stock a complete cartridge-unit or standby pump.

The advantage is that in the event of a fault or damage the standby unit can replace the non-functioning unit quickly and without great effort.

When ordering spare and replacement parts, besides the **part number, denomination** and **quantity**, the following should also be quoted:

Pump abbreviation,
Pump number,
Year of construction.

This information is engraved on the name plate of the pump.

8 Operating Faults, Causes and Remedial Action

8.1 Faults with reference number for cause and remedial action

The table below is intended as a guide to identifying faults and their possible causes. Faults relating to the pressure-relief valve are listed separately.

If faults occur which are not listed here, or which cannot be traced back to the listed causes, we recommend consulting the factory, or one of our branch offices or sales offices.



The pump must be depressurized and drained when faults are being rectified.

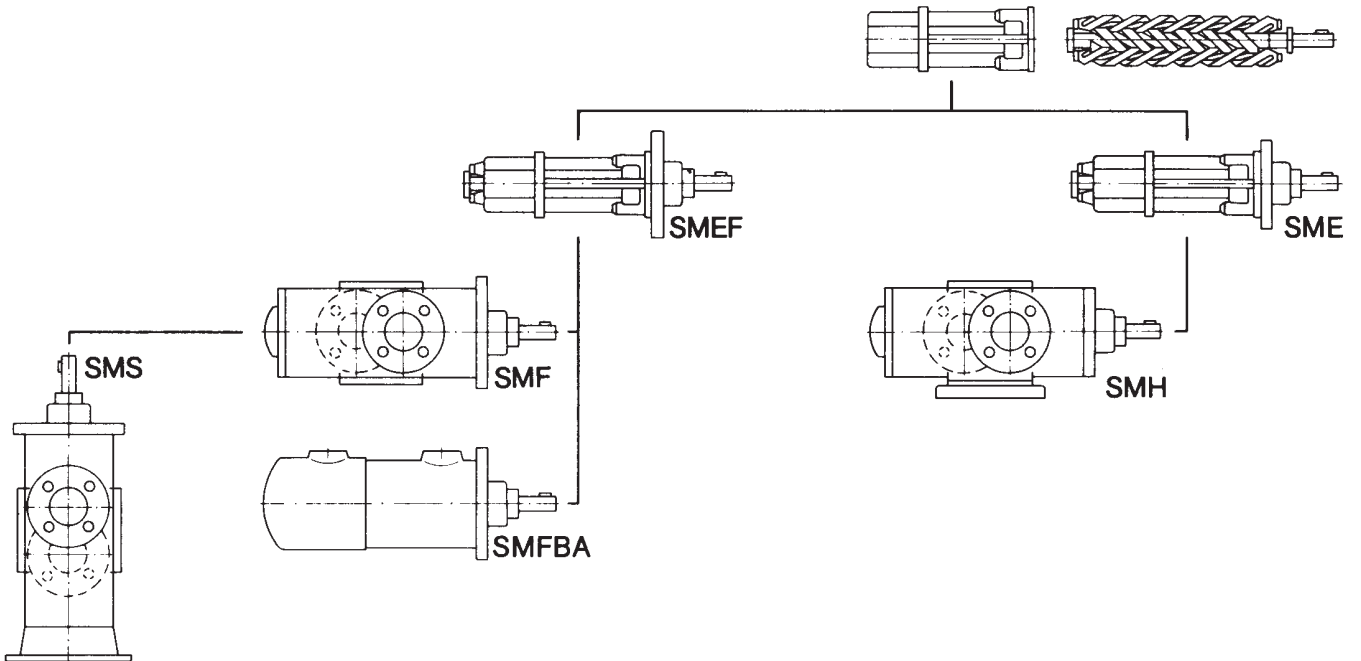
| Screw pump faults | Reference numbers for cause and remedial action |
|--------------------------------------|---|
| No pump suction and no delivery | 1, 2, 3, 4, 5, 11 |
| Delivery too low | 2, 6, 7, 8, 9, 10, 11 |
| Pump operates noisily | 4, 5, 6, 7, 8, 10, 11, 12, 13 |
| Irregular delivery | 6, 7, 10 |
| Pump gets too warm | 6, 7, 11, 14, 16 |
| Pump is seized | 14, 15, 16 |
| Motor overload | 6, 13, 14, 15, 16 |
| Pressure-relief valve faults | Reference numbers for cause and remedial action |
| Delivery pressure drops | 17 |
| Pressure-relief valve does not open | 18 |
| Pressure-relief valve does not close | 19 |
| Pressure-relief valve knocks | 20 |

8.2 Causes and remedial action

| Ref. no.: | Cause | Remedial action |
|-----------|--|--|
| 1 | Pump not filled with fluid before initial operation. | Fill pump with fluid. |
| 2 | Stop valves/sliders not open or only partially open. | Fully open stop valves/sliders during operation. |
| 3 | Motor direction of rotation wrong. | The direction of rotation of the motor must match the direction of rotation arrow on the pump. The direction of rotation can be reversed by swapping any two phases. |
| 4 | Suction pipeline or shaft seal leaky. | Retighten flange screw connections. Check shaft seal. |
| 5 | Air in suction and pressure system. | Open vent valve on pump pressure side until air has escaped. Close valve again. |
| 6 | Wrong fluid viscosity. | Check that viscosity matches entries in acceptance test report. In case of zero-pressure delivery of low-viscosity fluids, apply 1 to 2 bar to pump. |
| 7 | Pressure-relief valve leaking. | Check pressure-relief valve for passage. If necessary, regrind valve seat and/or exchange valve cone. |
| 8 | Geodetic suction head too high. | Check underpressure on suction side using connected pressure/vacuum gauge. Increase fluid level in tank, lower pump. |
| 9 | Motor speed too low. | Check speed and current consumption of motor. Check voltage and frequency against motor rating plate. |
| 10 | Air separating time in operating tank too short. | Provide better air separation in operating tank. Return lines must emerge below oil level of tank. |
| 11 | Fluid level in tank too low. | Fill tank to necessary fluid level. |

| | | |
|----|---|--|
| 12 | Flow rate in suction and pressure pipelines too high. | Flow rate in suction pipeline must not exceed max. 1 m/s, and in pressure pipeline max. 3 m/s. |
| 13 | Motor speed too high. | Check speed and current consumption. Check voltage and frequency against motor rating plate. |
| 14 | Delivery pressure too high. | Set specified delivery pressure via pressure-relief valve. Pump outlet pressure must not be exceeded. |
| 15 | Foreign bodies in pump. | Dismantle pump, remove foreign bodies and smooth damaged points with oilstone. Check suction filter and strainer. |
| 16 | Damaged ball bearing. | Replace ball bearing. |
| 17 | Pressure spring fatigued. Valve seat leaking. | Install new pressure spring. Install new valve cone. |
| 18 | Pressure spring heavily pre-tensioned. Valve cone stuck in valve housing. a) Due to foreign body or b) Operating temperature of plant substantially higher than quoted on order. | Release pressure spring using adjusting screw, and reset to required pressure. Dismantle pressure-relief valve. Clean internal parts. Consult factory. |
| 19 | Pressure spring not pre-tensioned, or insufficiently pre-tensioned. Valve seat leaking. | Turn adjusting screw to right until required operating pressure is reached. Rework or replace valve cone and valve housing. |
| 20 | Pressure-relief valve knocking. | Check overpressure with pressure valve closed. Reset valve. Opening pressure 10 % above operating pressure. |

Modular principle

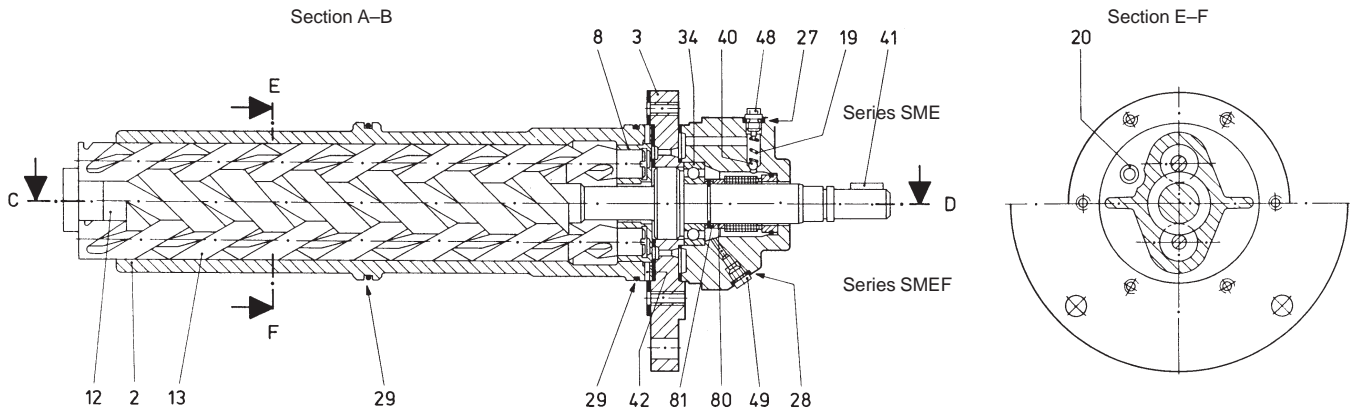


The pumps of series **SMF**, **SMFBA** and **SMS** are not represented as same differ only in the type of installation or the casing design.

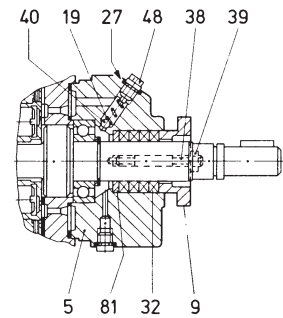
Sectional drawing

SME..., SMEF... – cartridge unit,
 internal ball bearing, with mechanical seal, design U...
 internal ball bearing, with stuffing box, design U2
 internal ball bearing, with shaft seal rings, design U3

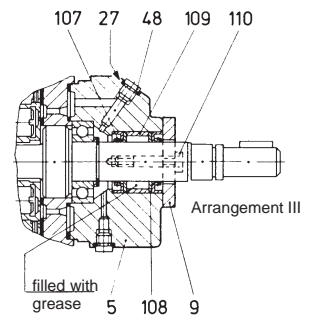
Design U... with mechanical seal



Design U2

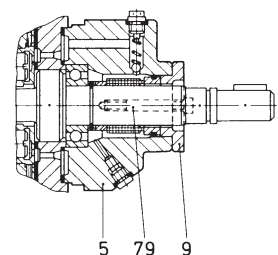


Design U3



Arrangement of shaft seal rings
 Arrangement I ↙ ↘ against supply head
 Arrangement II ↘ ↙ against suction head
 Arrangement III ↙ ↘ against supply head and suction head

Design U... with mechanical seal with pump size 940 to 3600



| Part No. | Denomination |
|----------|----------------------------------|
| 2 ① | Pump casing insert |
| 3 | Pump cover, drive side |
| 5 | Shaft sealing housing |
| 8 ① | Balance bush |
| 9 | Seal cover |
| | Gland (only with design U2) |
| 12 ① | Driving spindle |
| 13 ① | Idler spindle |
| 19 | Valve spring |
| 20 | Balance pipe |
| 21 ① | Gasket |
| 22 ① | Gasket |
| 24 ① | Gasket |
| 27 ① | Joint washer |
| 28 ① | Joint washer |
| 29 ① | O-ring |
| 32 ① | Gland packing ring |
| 34 ① | Groove ball bearing |
| 35 | Circlip |
| 36 | Supporting washer |
| 38 | Stud bolt |
| 39 | Hexagon nut |
| 40 | Ball valve |
| 41 | Key |
| 42 | Spring dowel |
| 48 | Stop screw |
| 49 | Screw plug (only with design U3) |
| | Screw plug |
| 51 | Socket-head cap screw |

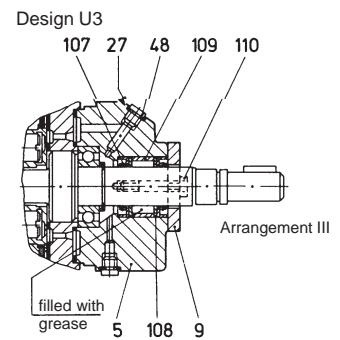
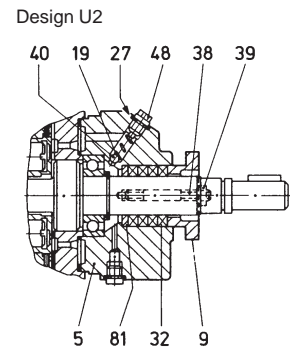
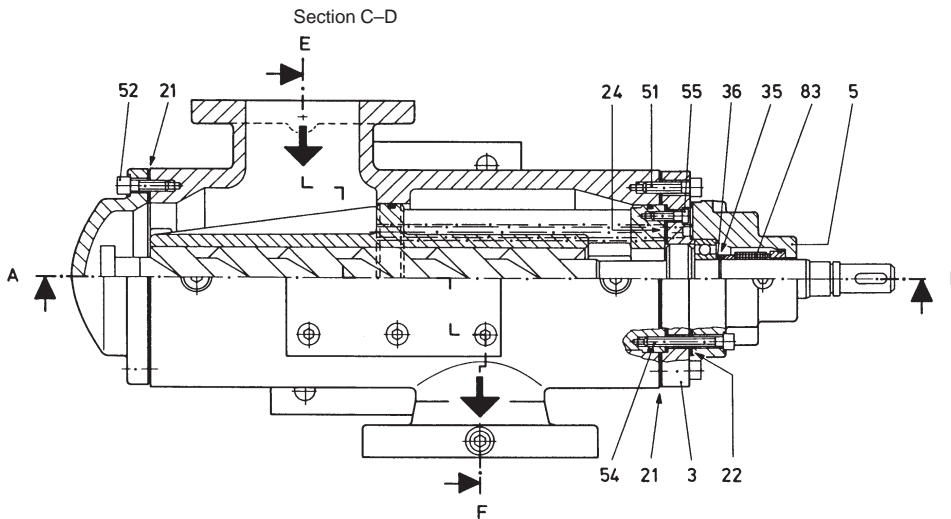
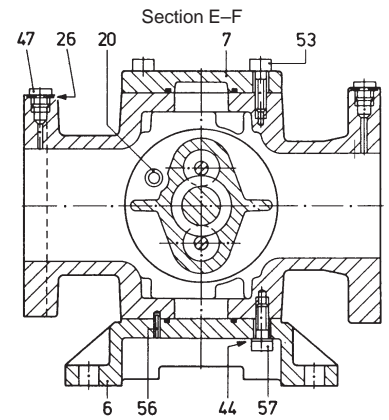
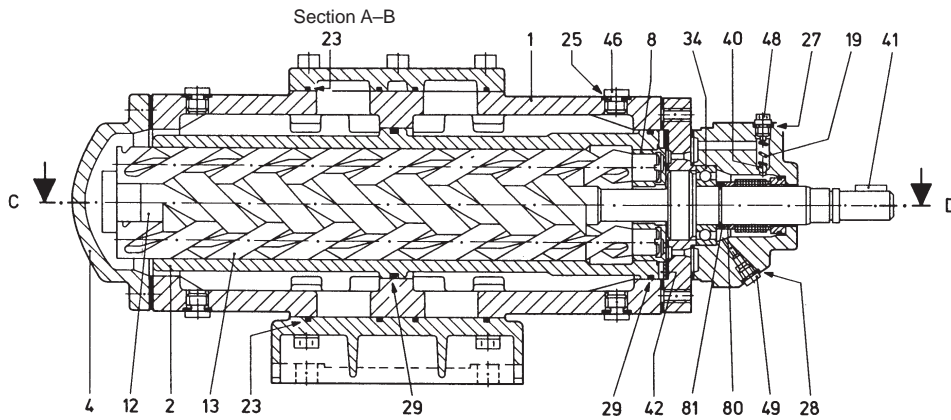
| Part No. | Denomination |
|----------|------------------------------------|
| 54 | Socket-head cap screw |
| 55 | Socket-head cap screw |
| 79 | Socket-head cap screw |
| 80 | Spacer ring |
| 81 | Supporting washer |
| | Support ring (only with design U3) |
| 83 ① | Mechanical seal |
| 107 ① | Shaft seal ring |
| 108 | Supporting ring |
| 109 | Spacer bush |
| 110 | Hexagon screw |

① Ersatzteile/Reserveteile

Sectional drawing

SMH... – horizontal foot pump, internal ball bearing, with mechanical seal, design U...
 internal ball bearing, with stuffing box, design U2
 internal ball bearing, with shaft seal rings, design U3

Design U... with mechanical seal

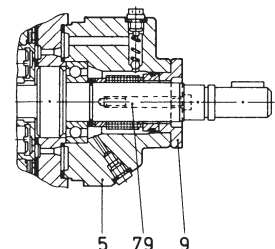


| Part No. | Denomination |
|----------|--|
| 1 | Pump casing |
| 2 ① | Pump casing insert |
| 3 | Pump cover, drive side |
| 4 | Pump cover, non-drive side |
| 5 | Shaft sealing housing |
| 6 | Pump foot |
| 7 | Pump casing cover |
| 8 ① | Balance bush |
| 9 | Seal cover |
| | Gland (only with design U2) |
| 12 ① | Driving spindle |
| 13 ① | Idler spindle |
| 19 | Valve spring |
| 20 | Balance pipe |
| 21 ① | Gasket |
| 22 ① | Gasket |
| 23 ① | O-ring |
| 24 ① | Gasket |
| 25 ① | Joint washer (only with pump size 440 to 1300) |
| 26 ① | Joint washer |
| 27 ① | Joint washer |
| 28 ① | Joint washer |
| 29 ① | O-ring |
| 32 ① | Gland packing ring |
| 34 ① | Groove ball bearing |
| 35 | Circlip |
| 36 | Supporting washer |
| 38 | Stud bolt |
| 39 | Hexagon nut |

| Part No. | Denomination |
|----------|------------------------------------|
| 40 | Ball valve |
| 41 | Key |
| 42 | Spring dowel |
| 44 | Lock washer |
| 46 | Screw plug |
| 47 | Screw plug |
| 48 | Stop screw |
| | Screw plug (only with design U3) |
| 49 | Screw plug |
| 51 | Socket-head cap screw |
| 52 | Socket-head cap screw |
| 53 | Socket-head cap screw |
| 54 | Socket-head cap screw |
| 55 | Socket-head cap screw |
| 56 | Spring dowel |
| 57 | Hexagon screw |
| 79 | Socket-head cap screw |
| 80 | Spacer ring |
| 81 | Supporting washer |
| | Support ring (only with design U2) |
| 83 ① | Mechanical seal |
| 107 ① | Shaft seal ring |
| 108 | Supporting ring |
| 109 | Spacer bush |
| 110 | Hexagon screw |
| ① | Ersatzteile/Reserveteile |

Arrangement of shaft seal rings
 Arrangement I ↙ ↘ against supply head
 Arrangement II ↘ ↙ against suction head
 Arrangement III ↙ ↘ against supply head and suction head

Design U... with mechanical seal with pump size 940 to 3600



Heating – not valid for fabricated Design

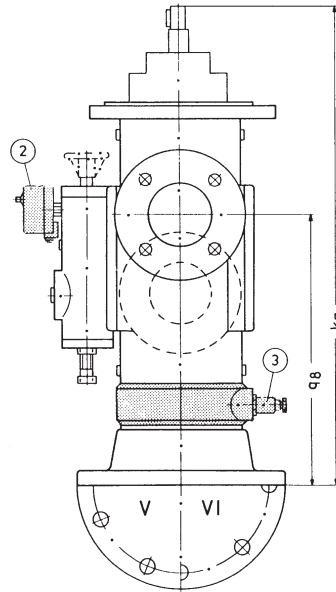
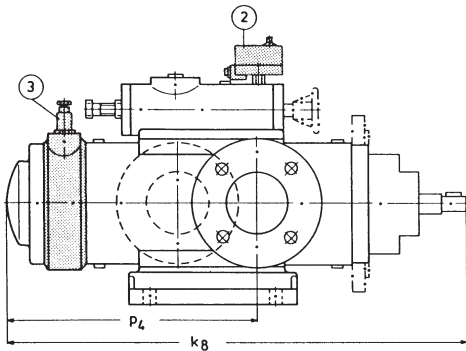
Series SMH, SMF, SMS,

Design ...E = with heating elements for electrical heating
 Design ...P = with heating cartridge for steam or heat conveyors
 Design ...X = with heating cover for steam or heat conveyors

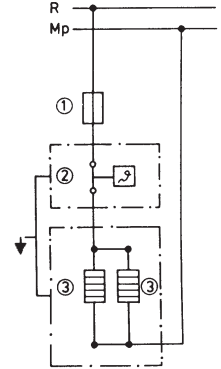
Design ...E (with 2 heating elements, electric)
 SMH/SMF 40 bis 1300

SMS 40 bis 1300

Wiring diagram



Screw arrangement at pump foot
 II = SMS 40
 IV = SMS 80 to 210
 V = SMS 280 to 940
 VI = SMS 1300

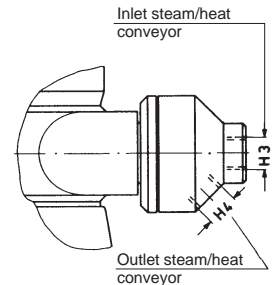
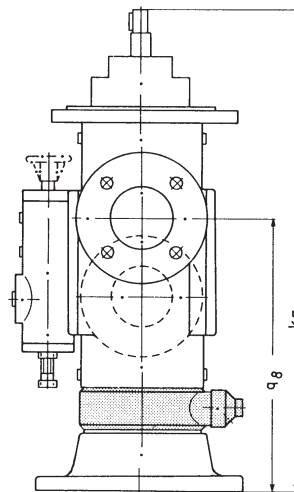
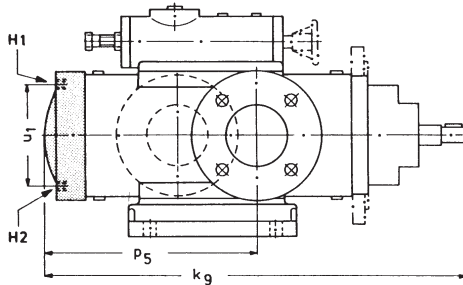


- ① Fuse
- ② Thermostat (control range 0 up to 150 °C)
- ③ Heating elements 220 V, 50 Hz

Design ...X (with heating cover)
 SMH/SMF 40 to 1300

Design ...P (with 2 heating cartridges, steam/heat conveyor)
 SMS 40 to 1300

Connection – cartridge



Dimensions in mm
 Alteration of dimensions reserved

| Pump size | Pump dimensions ④ | | | | | | | Heating steam/heat conveyor | | Total heating capacity (2 elements) W | Heating (electrical) | | | | Heating up time of pump in minutes at Δt = | | | |
|-----------|-------------------|-------|------|-------|-----|-------|-----|-----------------------------|-------|--|-------------------------------|----|----------------|-----------|--|-------|-------|--------|
| | k7 | k8 | k9 | p4 | p5 | q8 | u1 | H1/H2 | H3/H4 | | Heating elements 220 V, 50 Hz | | | | 25 °C | 50 °C | 75 °C | 100 °C |
| | | | | | | | | | | | Length | Ø | Con-connection | Key width | | | | |
| 40 | 546,5 | 524,5 | 484 | 274,5 | 234 | 296,5 | 100 | G 1/4 | G 3/8 | 240 | 130 | 20 | G 3/4 | 32 | 60 | 120 | 240 | 320 |
| 80 | 631,5 | 603,5 | 567 | 315,5 | 278 | 342,5 | 120 | G 1/4 | G 3/8 | 260 | 150 | 20 | G 3/4 | 32 | | | | |
| 120 | 718,5 | 699,5 | 631 | 339,5 | 271 | 358,5 | 145 | G 1/4 | G 3/8 | 300 | 170 | 20 | G 3/4 | 32 | | | | |
| 210 | 795,5 | 792,5 | 748 | 404,5 | 360 | 407,0 | 170 | G 1/4 | G 1/2 | 420 | 190 | 25 | G 1 | 41 | | | | |
| 280 | 978,5 | 868,0 | 800 | 466,0 | 398 | 576,5 | 175 | G 3/8 | G 1/2 | 460 | 210 | 25 | G 1 | 41 | | | | |
| 440 | 1028 | 954,0 | 921 | 497,0 | 464 | 571,0 | 200 | G 3/8 | G 1/2 | 460 | 210 | 25 | G 1 | 41 | | | | |
| 660 | 1141 | 1101 | 1050 | 551,0 | 500 | 591,0 | 225 | G 3/8 | G 1/2 | 680 | 240 | 32 | G 1 1/4 | 60 | | | | |
| 940 | 1279 | 1240 | 1176 | 709,0 | 645 | 748,0 | 244 | G 3/8 | G 1/2 | 880 | 250 | 40 | G 1 1/2 | 60 | | | | |
| 1300 | 1380 | 1326 | 1260 | 771,0 | 705 | 825,0 | 265 | G 1/2 | G 1/2 | 1000 | 280 | 40 | G 1 1/2 | 60 | | | | |

④ Further dimensions see dimensions leaflet VM 618/... 2000 for SMH, VM 618... 2001 for SMF, VM 618... 2002 for SMS.

Subject to technical changes.

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