

Operating and Maintenance Instructions

VM No.: 672.0001 GB
 Edition: 09.99
 Ident No.: 550 225

Screw pumps
Series SMFG
 Design Q

**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 order dimension drawing

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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.

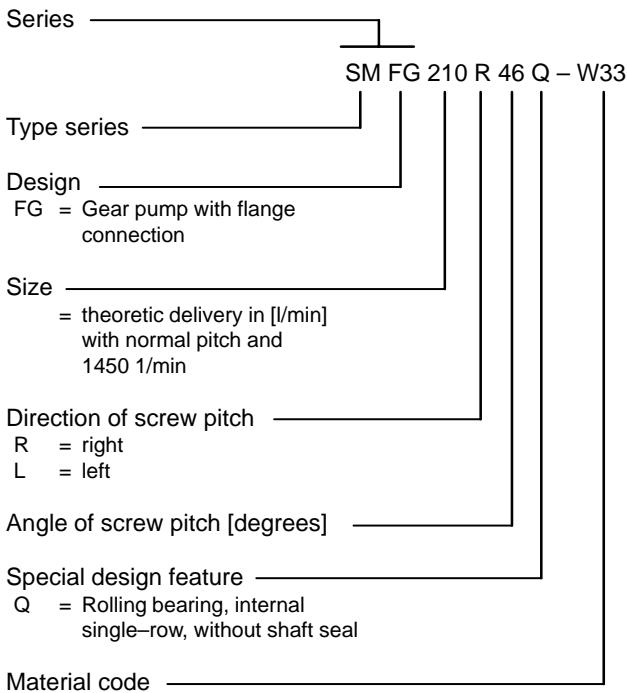
Refer to the operating instructions of the plant manufacturer!

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

1.2.1 Application

The internally supported screw pumps of series SMFG are three-spindle, rotary positive displacement pumps for the attachment to high-speed gears. The pumps are built for normal sense of rotation (rotating clockwise or counterclockwise).

1.2.2 Range of utilization

Liquid pumped

The pumps are suited for handling mineral and synthetic lube and gear oils. The liquids must not contain any abrasive particles nor chemically attack the pump materials. In case of doubt, contact factory.

Kinematic viscosity

During normal operation, the kinematic viscosity of the lube and gear oils should be in a viscosity range between 20 mm²/s and 75 mm²/s. Excessive viscosity as may also occur with too low oil temperatures during starting operation, may result in an increased air separation (aeration) in the suction pipeline and thus in unsteady pump operation connected with a heavy noise development.

Air-separating ability (ASA)

In case of forced feed lubrication in the gear, injection of the lube oil into the meshing will result in the formation of an air-in-oil dispersion, i.e. a high percentage of air bubbles is contained in the return oil. In the event that sufficient air separation is not achieved in the oil tank and oil with an excessive air bubble content sucked in by the pump, this may also result in unsteady pump operation. Therefore, besides the careful design of the oil tank (refer to Section 5.5.10 below), attention should be paid to a good air-separating ability of the lube and gear oils. The air-separating ability (ASA) is the time which, during a test according to DIN 51 831, passes until the residual air content of the air dispersed in the oil has dropped to 0.2 percent by volume. The air-separating ability of the lube and gear oils used should not exceed five minutes at 50°C.

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 Identification of safety instructions in the operating manual

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 indicated as follows:



Warning symbol
as per DIN 4844–W8.

Instructions which are essential to avoid endangering the machine and its operation 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 will lead to the loss of any claims for damages.

Non-compliance may result in 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 machine 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. Please also see 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 in such a way 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, please refer to VDE and local power company regulations.

2.6 Safety instructions for maintenance, inspection and installation

The operating company must ensure that all maintenance, inspection and installation tasks are 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 procedure for shutting down 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 are intrinsic to safe operation. If other parts are used the manufacturer cannot be held liable for the consequences.

2.8 Unacceptable modes of operation

The operational 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 not be exceeded under any circumstances.

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 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.

ATTENTION

During transportation ensure that the aggregate is secured against toppling over.

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 in flange design form, with a double-threaded driving spindle and two double-threaded idler spindles, enclosed in a pump casing insert with narrow running clearance.

The delivery elements are installed in a pump housing which is closed off on the drive side and the end side by pump caps.

4.1.1 Bearing and lubrication

By an internal groove ball bearing to DIN 625 or DIN 628 (four-point bearing), lubricated by the fluid pumped.

4.1.2 Shaft seal

The pumps are provided for direct attachment to a gear casing and have no shaft sealing.

4.1.3 Connections/branch positions/dimensions

Suction and outlet branches arranged truly axially, in opposing offset configuration.

The flange execution is possible to DIN, ANSI or other standards.

The exact data and dimensions are to be found on the order-specific installation drawing.

4.1.4 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.

4.2 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 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 are directly driven by a gear wheel fixed on the driving spindle.

5 Installation/Mounting

5.1 Attachment to the gear

The pumps may be attached to the gear case in any position.

Note: See to it that a breather is provided at the highest point of the pump.

5.2 Mode of fastening

Via the pump mounting flange, the pump is directly screwed with the gear case.

For exact data on shape and dimensions, please refer to the installation plan.

5.3 Fixing to the gear

The screw pump is supplied without driving pinion.

- Prior to the attachment of the pump to the gear, the driving pinion to be provided by the customer is to be mounted on the shaft via the key, and secured.
- Thereafter, a gasket is to be placed on the mounting flange (3).
- Now, the pump can be concentrically fixed to the gear, in doing so, the driving pinion is to be brought into engagement.

ATTENTION During attachment of the pump, see to the directional marker attached for normal sense of rotation. The normal sense of rotation of the driving gear wheel in the gear drive is decisive.

5.4 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, in particular for removal of the pump. It must also be ensured that all pipelines can be attached and removed without hindrance.

5.5 Laying the pipelines

5.5.1 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.

5.5.2 Change of cross-sections and directions

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

5.5.3 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.

5.5.4 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.

5.5.4.1 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 (NPSH_{req.})

The service condition is fulfilled when the plant NPSH value (NPSH_{avail.}) is above the pump NPSH (NPSH_{req.}). The NPSH_{req.} 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.

5.5.5 Stop valves

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

5.5.6 Pressure-relief valve

See Section 4.1 ...

5.5.7 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.

5.5.8 Vent valve

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

5.5.9 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.

5.5.10 Oil tank

The oil tank serves as a storage tank for the provision of the whole oil quantity required for the operation of the lube oil plant. Experience has shown that for stationary gear lube oil plants, the size of the oil tank must be at least five times the quantity of the pump delivery per minute. This corresponds to a circulation of the oil filling of 12 times per hour. It must be assured that during standstill, the oil tank can take the whole oil quantity of the plant.

The oil tank does not only serve as a storage tank, it must in addition accomplish a number of other important tasks. These include above all the separation from the return oil of the air bubbles generated in the plant, and the separation of dirt and condensation water. The heat loss produced in the system must be dissipated over the tank surface.

The separation of the undissolved air from the oil depends on the bubbling-up time of the air bubbles and on the dwelling time of the return oil in the tank. In order to avoid a short circuit flow, the return and suction pipelines must be as far from each other as possible. Through the installation of guide and separating plates, the oil must be carried so as to assure the greatest possible air separation. The installation of screen walls with a mesh size of 0.2 to 0.3 mm proved to be very efficient, they are installed with a 30° inclination so that the air bubbles are deflected towards the surface. The return pipeline must end at least 10 cm below the lowest oil level.


In addition, the following must be observed for the layout and design of the oil tank:

- The oil level and the temperature of the oil must be capable of being controlled.
- Filling and draining of the tank for oil change or oil cleaning and for taking oil samples must be easily possible.
- Sufficiently sized lockable openings must be provided for tank cleaning.
- If a coat of paint is provided, same must be oil-resistant.
- If sufficient cooling over the tank surface cannot be achieved, an appropriately sized oil cooler must be provided.

5.6 Safety and control devices**5.6.1 Manometers**

Suitable pressure gauges are to be installed in the suction and pressure pipelines.

5.6.2 Safety device in the pressure pipeline

 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).

Note: In order to prevent suction of air bubbles, the return flow from a pressure-relief valve installed in the pressure pipeline is to be separated from the suction branch by means of a screening device.

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).

In gear lube oil plants, the pumps can be filled and vented by the auxiliary oil pump through a filling line. Prior to initial operation of the pump, the entire plant must be checked for proper installation and mounting of all pipelines, valves and the necessary auxiliary aggregates and their supervisory and control devices. In detail, proceed as follows:

1. Check the pipeline run by means of the plant piping diagram. Pay special regard to the flow direction of the non-return valves.
2. Check all pipeline connections and screw connections for tightness and retighten, if necessary.
3. Fill oil tank through filler filter with the specified lube and gear oil, check oil level. The liquid level must not be below the minimum limit.
4. Check oil tank for tightness.
5. Open all shut-off valves on the suction and delivery side.

6.1.2 Control of the sense of rotation

A control of the sense of rotation with the pump attached is no more possible. Therefore, the sense of rotation of the driving wheel in the gear drive must be checked prior to attachment of the pump and checked against the directional marker on the pump casing.

ATTENTION The pump must not be operated in counterclockwise sense of rotation.

6.2 Start-up

6.2.1 Starting

1. Prior to starting the gear, the entire pipeline system and the screw pump are to be filled up via an auxiliary oil pump, and vented. For these purposes, the venting screws are to be carefully slackened until the complete air has escaped. Following venting, all screws are to be well tightened again.



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

2. Thereafter, the screw pump is to be taken into operation via the gear.

3. 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.

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.

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 Checking the delivery values

After the gear has reached its operating speed, the inlet pressure and pump outlet pressure must be checked by means of pressure gauges. The temperature and viscosity of the liquid to be pumped must be controlled and checked against the permissible limit values.

Attend to pump noises. If noises similar to cavitation and caused by air inclusions (aeration) do not disappear soon, the possible cause must be found out according to the trouble-shooting plan under the heading "Pump operates noisily".

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 gear. 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.

6.3.2 Measures in case of prolonged interruption

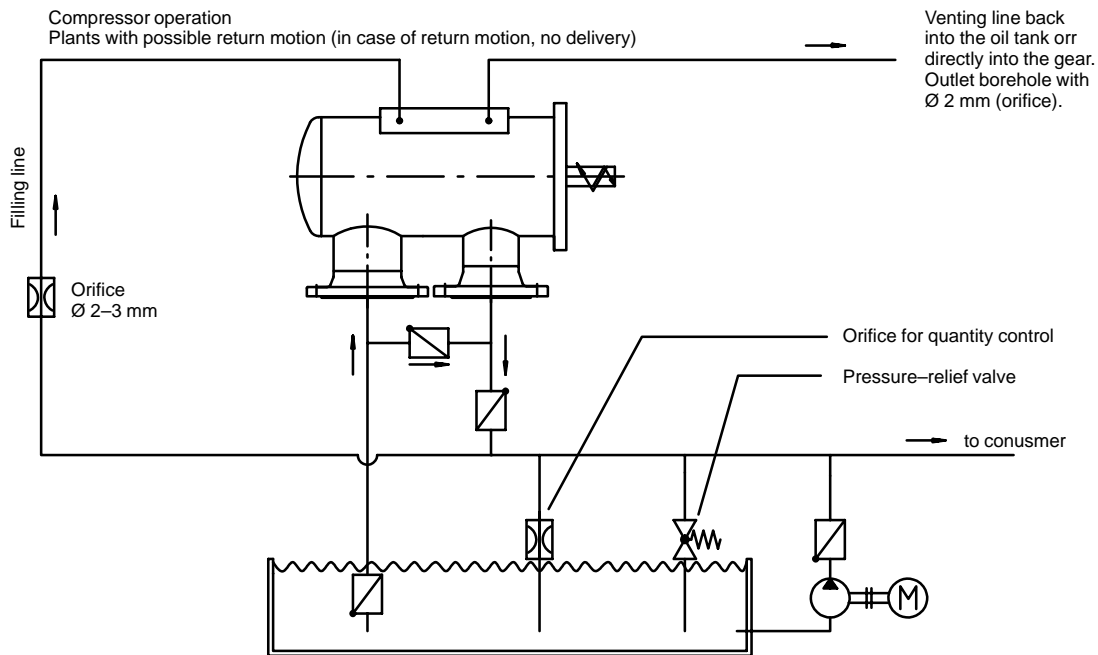
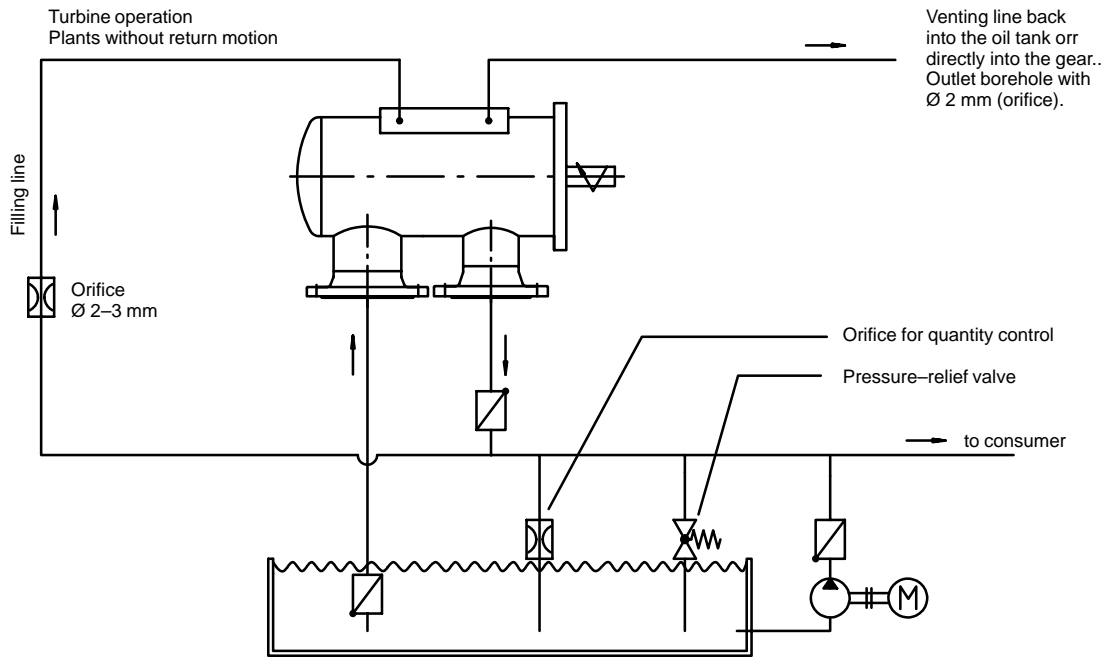
If a prolonged interruption is intended, the pump must be drained thoroughly via the connections on the pump casing. For these purposes, the pump must be dismounted from the gear.



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

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

Ventilation proposal for oil supply plants



The tank size must be at least 5 times the circulation quantity.
See to it that the pump is always vented at its highest point.

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. Pressure and temperature monitors must be observed.
5. The filling level in the tank must be regularly checked.

7.1.2 Maintenance of components

7.1.2.1 Bearing

The installed groove ball bearing is maintenance-free. Under normal operating conditions, it is rated for a service life of approx. 32,000 hours. After this period or in case of revision operations, we recommend to install a new groove ball bearing.

7.1.2.2 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.

7.1.2.3 Filtering

A (double) filter provided in the gear plant is to be checked for pollution via a differential pressure indicator. After initial start-up, rapid pollution of the filters is to be expected. The filter cleaning intervals and filter changes are to be effected according to the manufacturer's instructions.

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:



- Stop the gear. Mechanical danger must be eliminated! The gear must be secured against being switched on.
- Close all stop devices in the suction and pressure 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 must be depressurized and drained.
- Allow the pump to cool to ambient temperature.
- Remove the manometer cables, manometers and retaining brackets.
- Remove supply/suction and pressure pipelines as appropriate.

7.2.1.1 Dismounting the screw pump from the gear

- Secure pump by means of a suitable lifting appliance and sling ropes.
- Loosen screws at the mounting flange and screw out.
- Carefully pull pump out of the flange centering and remove from the gear.
- Remove flange gasket from the mounting flange (3).
- Clean sealing surfaces.

7.2.1.2 Dismounting the cartridge–unit pump

- Bend up lock washer (61) and loosen lock nut (60) and screw off.
- Withdraw driving pinion from the driving spindle (12). Use pull–off device!
- Remove key (41) from the driving spindle (12).
- Remove bush (62) from the driving spindle (12).
- Loosen socket–head cap screws (51) at the pump cover, drive side (3), and screw out.
- Dismount cartridge–unit pump consisting of pump casing insert (2), set of spindles (12) and (13) and pump cover, drive side (3) with installed rolling bearing (34) from the pump casing (1). Use forcing–off screws! If necessary, secure cartridge–unit pump with lifting appliance and sling ropes.
- Remove gasket (21) and clean sealing surfaces.

7.2.1.3 Dismounting the set of spindles

- Following the dismounting of the cartridge–unit pump, loosen socket–head cap screws (54), and dismount pump cover, drive side (3) with the set of spindles from the pump casing insert. Use forcing–off screws!
- Remove gasket (24) and clean sealing surfaces.
- Remove idler spindles (13) with the balance bushes (8) from the driving spindle (12).
- Dismount driving spindle (12) with a pressing tool from the pump cover, drive side (3).

7.2.1.4 Dismounting the rolling bearing

- Following the dismounting of the set of spindles, remove circlip (37) from the pump cover, drive side (3).
- By means of an appropriate tool, dismount rolling bearing (34) from the pump cover, drive side (3).
- Clean bearing seats.

7.2.2 Mounting the screw pump



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 rolling bearing

- If required, carefully clean rolling bearing (34) with Diesel fuel. The bearing surfaces being bright and undamaged, the bearing (34) may be re–used. If this is not the case, the rolling bearing must be replaced.
- Slightly oil bearing seat on the driving spindle (12).
- By means of a suitable pressing tool, press rolling bearing (34) against the shaft shoulder of the driving spindle (12).
Note: The mounting force must be uniformly transmitted onto the side faces of the inner and outer bearing rings.
- Press driving spindle (12) with rolling bearing (34) into the pump cover, drive side (3).
- Mount circlip (37) in the pump cover, drive side (3).

7.2.2.2 Mounting the set of spindles

- Following the mounting of the rolling bearing (34), place new gasket (24) onto the cleaned sealing surface of the pump cover, drive side (3). Mind correct position of the oil bore holes!
- Place idler spindles (13) with the balance bushes (8) against the driving spindle (12).
- Insert set of spindles with pump cover, drive side (3) and installed rolling bearing (34) in the pump casing insert (2). For these purposes, oil set of spindles and bearing points.

Note: The balance bushes (8) on the two idler spindles (13) are secured by the spring dowels (42) in the pump casing insert against torsion. The groove provided in the balance bushes (8) must correspond to the position of the spring dowels (42) in the pump casing insert.

- By means of the socket-head cap screws (54), tighten pump cover, drive side (3) at the pump casing insert (2).

Note: Mount pump cover, drive side (3) so that the bore holes of the cover and the balance bushes (8) are congruent.

- Check set of spindles for workability.

7.2.2.3 Mounting the cartridge-unit pump

- Insert new O-ring (29) in the groove of the pump casing insert (2).
- Place new gasket (21) onto the cleaned sealing surface of the pump casing (1). Mind exact location of the oil bore holes!
- By means of an appropriate lifting appliance, insert cartridge-unit pump in the pump casing (1), and fix by means of the socket-head cap screws (51).
- Install bush (5) over the driving spindle (12) in front of the rolling bearing (34)..
- Insert key (41) in the driving spindle (12).
- Mount driving pinion on the driving spindle (12).

ATTENTION

 During mounting, the driving pinion is to be heated up so that it can be easily pushed on. Beating-up in cold condition is not admissible as this may result in damages to the rolling bearing.
- Secure driving pinion with lock nut (60) and lock washer (61).
Note: Fasten lock nut with the prescribed tightening torque.

7.2.2.4 Attachment of the screw pump to the gear

- Place new gasket on the mounting flange (3) of the pump.
- By means of a suitable lifting appliance, lift pump and concentrically push into the flange centering of the gear.
- Bring driving pinion into engagement, and by means of the fastening screws, fix pump to the gear.

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

- Attach supply/suction and pressure pipelines with new gaskets to the pump.
- If necessary, fill tank with fluid.
- Fill pump with fluid.

Start up pump as per instructions in Section 6.

7.3 Replacement parts/spare parts

The parts marked with footnote ① 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 rating 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

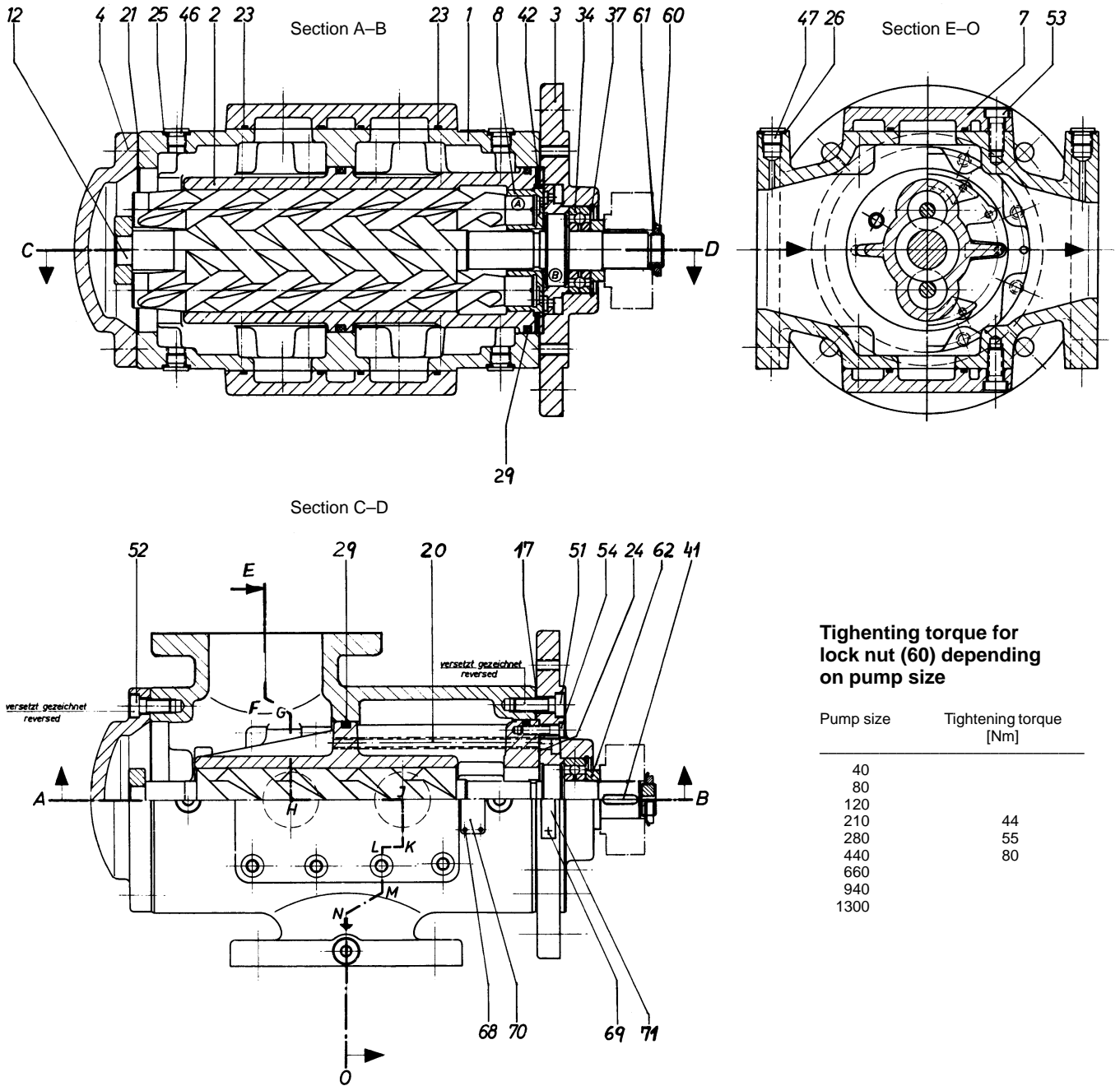
8.2 Causes and remedial action

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	Wrong sense of gear rotation.	The sense of gear rotation must correspond to the directional marker of the pump. The sense of pump rotation can be changed by exchanging the set of spindles.
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	Gear speed too low.	Check gear speed. If necessary, exchange wheel set in the gear.
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	Gear speed too high.	Check gear speed. If necessary, exchange wheel set in the gear.
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.

9 Associated Documentation

SMFG...Q Gear pump with flange connections, without shaft seal



Tightening torque for lock nut (60) depending on pump size

Pump size	Tightening torque [Nm]
40	
80	
120	
210	44
280	55
440	80
660	
940	
1300	

The pictorial presentation may not correspond with the pump supplied. The actual design will be stated in the specific order documents.

Part No.	Benennung	Part No.	Benennung	Part No.	Benennung
1	Pump casing	25 ①	Joint ring	60	Nutmutter
2 ①	Pump casing	26 ①	Joint ring	61	Lock washer
3	Pump cover, drive side	29 ①	O-ring	62	Bush
4	Pump cover, non-drive side	34 ①	Groove ball bearing	68	Rivet
7	Pump casing cover	37	Circlip	69	Rivet
8 ①	Balance bush	41	Key	70	Name plate
12 ①	Set of spindles	46	Screw plug	71	Information plate
17 ①	Gasket	47	Screw plug		
20	Pipe	51	Socket-head cap screw		
21 ①	Gasket	52	Socket-head cap screw		
23 ①	O-ring	53	Socket-head cap screw		
24 ①	Gasket	54	Socket-head cap screw		
				①	Replacement parts/spare parts

Subject to technical changes.

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