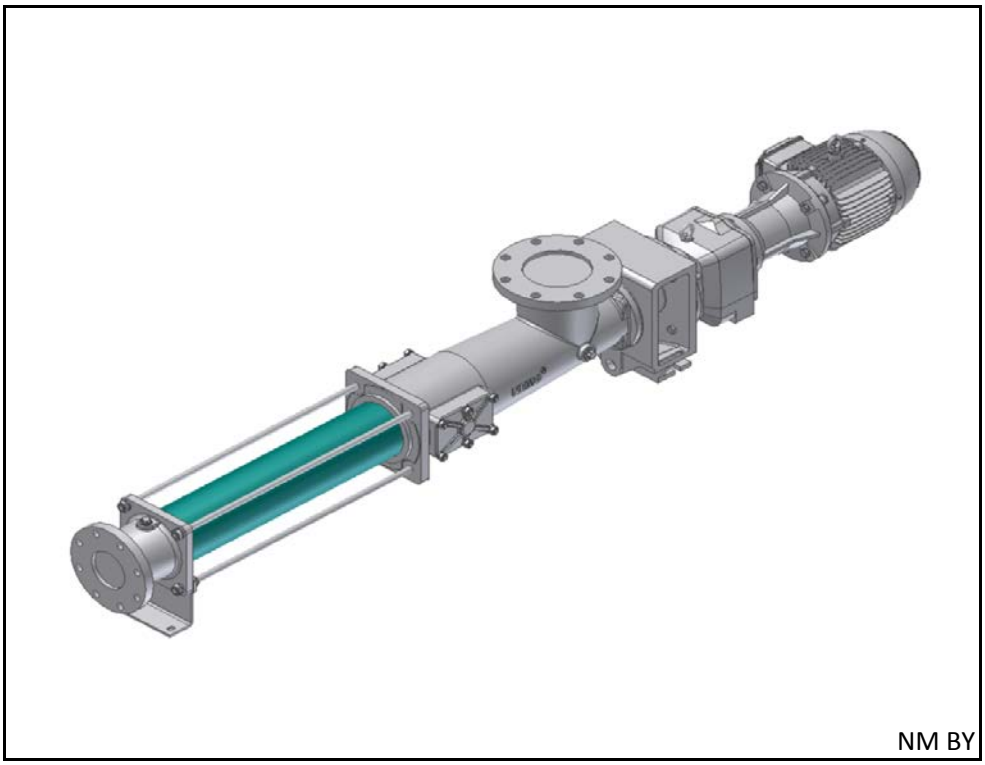
Operating and Maintenance Instructions

NEMO® Pump



Important Note
These operating instructions are designed to familiarize the user with the machine and its designated use.

The Instruction Manual

- Contains important information on how to operate the machine safely, properly and efficiently. Observing these instructions help to avoid danger to reduce repair costs and downtimes and to increase the reliability and life of the machine.

- Must always be available wherever the machine is in use.

- Must be read and applied by any person in charge of carrying out work with and on the machine. Such as:

Operation including setting up, troubleshooting in the course of work, evacuation of production waste, care and disposal of fuels and consumables.

Maintenance (servicing, inspection, and/or repair)

Transport; shall be completed by the end user and authorized personnel with the national requirements in force for the prevention of accidents and the environmental protection.

In addition to the operating instructions and to the mandatoryrules and regulations for accident prevention and environmental protection in the country and place of use of the machine, the generally recognized technical rules for safe and proper working must be observed.

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WARNING!!!!

When **Variable Frequency Drives (VFD's)**
are being used to vary the speed of the
NETZSCH Progressing Cavity Pumps, then they
MUST be CONSTANT TORQUE VFD's.

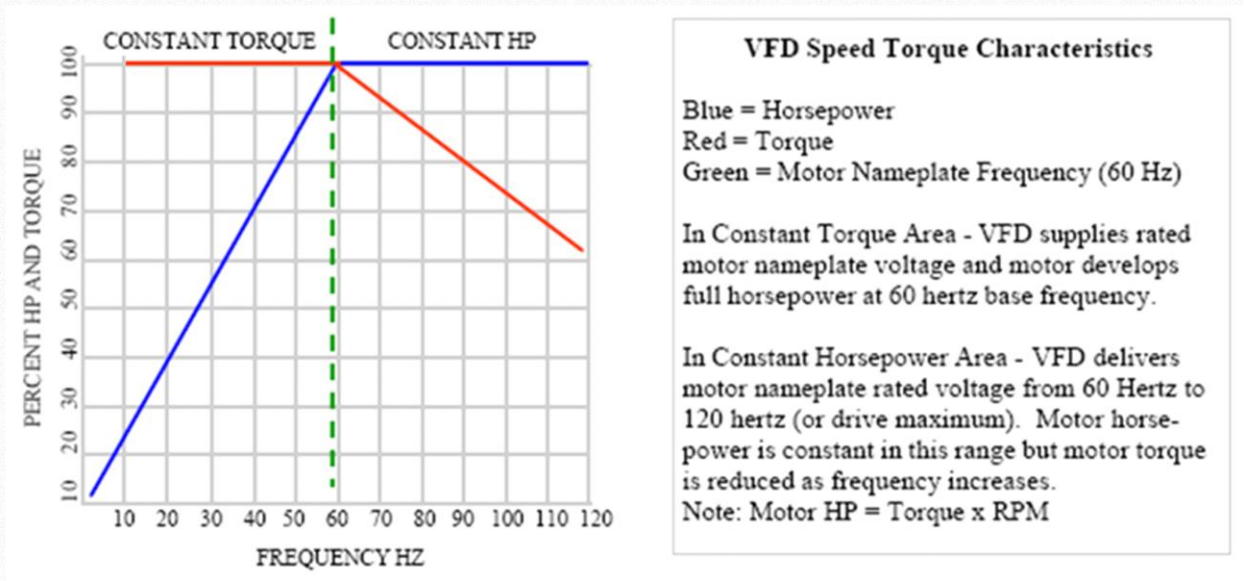
How the pump works

NETZSCH Progressing Cavity Pumps operate at a constant torque requirement for a specific operating pressure. The speed of the pump does NOT affect the torque requirement. **For example:** a pump running at 60psi output pressure at a speed of 200 revolutions per minute requires the same toque input as if it were running at 60psi output pressure at a speed of 600 revolutions per minute. The only exception to this rule is during pump startup; at the moment the pump starts the motor must provide more torque than the pump requires when it is running. This is due to the force of static friction that the motor must overcome in order to begin rotation. Although this is only a momentary force, enough torque has to be available to break the static load.

How the VFD works

Variable Frequency Drives work by taking the supplied power and modulating the supplied power frequency in linear proportion to the supplied voltage. This proportional modulation allows the motors speed to be altered without the motor drawing too many amps and burning out. A VFD can be built to perform this modulation in one of two ways. The VFD can be set to modulate the frequency above the normal supplied 60HZ frequency allowing the output to provide a constant amount of power but the torque will drop off as speed is increased **(THIS IS A CONSTANT HP VFD**) or it can modulate the frequency below the normal supplied 60HZ frequency allowing the output to provide constant Torque but the power will decrease as the speed is reduced **(THIS IS A CONSTANT TORQUE VFD).** This relationship is shown in the detail below. The manufacturers of VFD's typically offer two service factors. Normal Duty; which

has an overload capacity of the VFD's full load ampere rating times 110% - 120% for one minute and Heavy Duty; which has an overload capacity of the VFD's full load ampere rating times 150% for one minute. Typically, constant Hp VFD's are sold with a Normal duty rating since the applications don't call for high starting torque which causes amp draw to spike. Constant torque VFD's are usually sold with heavy duty ratings so that they can supply elevated startup amp draws for high starting torque applications.



Application:

Because while running a progressing cavity pump the torque value required by the pump is fixed; any reduction in supplied torque as a result of operational speed could cause the pump to fail. Also, depending on the running speed required, a constant HP VFD may not be capable of supplying the torque needed for pump startup. This is the reason a **Constant Torque** VFD **MUST** be used to operate a progressing cavity pump.

Brad LaValley / Dan Bachrach
NETZSCH Pumps North America, LLC
Exton, November 2011

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Remark: Because of data transfer the text sheet printouts of our operating instructions do not contain a personal signature.

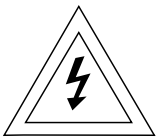
1 Safety Instructions

This manual contains basic instructions which must be observed when installing, operating and servicing the machine / equipment. It is essential therefore for the user / installer or responsible technician to read the manual thoroughly prior to installation and operation.
A copy of the manual must always be at hand where the machine / equipment is being used. In addition to the general safety instructions listed in this main section on safety, it is necessary to observe the special safety rules included in other sections of the manual, eg. for private use.

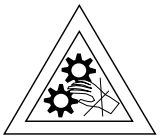
1.1 Safety Signs

The signs below are printed in the manual as general hazard / danger symbols to mark those safety instructions whose non-observance can result in danger to personnel or to the machine / equipment. These signs are:

Hazard sign DIN 4844 - W9
Danger to general public

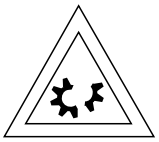


Hazard sign DIN 4844 - W8
Risk of electric shock



Risk of injury from machinery

Danger from suspended loads



Damage to machinery

Risk of injury to your eyes: goggles required.

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Warning plates located directly on the pump/ equipment showing for example the correct direction of rotation or the fluid connections used must always be observed and kept completely legible.

1.2 Personnel Qualifications and Training

Operating, maintenance, inspection and installation staff must possess the correct qualifications for their work. Areas of responsibility, scope of authority and staff supervision must be exactly defined by the user. If personnel do not have the necessary knowledge they must receive due training and instruction. If necessary, the user of the machine / equipment can arrange for such training and instruction to be provided by the manufacturer / supplier. The user must also make sure that the content of the manual is fully understood by the staff concerned.

Responsibilites

All work on and operation of the pump/ equipment should be carried out by trained/ competent and qualified operators, tradesmen and / or engineers as appropriate.

Any person responsible for or in charge of

– **working with lifting gear** and ropes when moving a pump / equipment will have to be duly instructed prior to doing the transportation job;

– **mounting a drive** to a pump / equipment must be qualified / trained as an industrial mechanic / technician;

– **setting up installations into a plant** must be qualified / trained as an industrial mechanic/ technician and must be familiar with the design and functioning of the plant in which the pump / equipment is being installed;

– **doing work on starting up, operation and maintenance** must gain knowledge of the pump / equipment principle prior to performing such works and must study the safety instructions and the manual thoroughly;

– **doing repair works**, and prior to doing such works, must be trained and skilled in the job. He must have due knowledge of the pump/ equipments specific details set up in the repair instructions. Unskilled personnel must be trained and repair works checked.

1.3 Dangers arising from Non-Observance of the Safety Instructions

Non-observance of the safety instructions can result in danger to personnel as well as to the environment and the machine. Non-observance of the safety instructions can result in the loss of claims for compensation.

Non-observance of the safety instructions can have, for example, the following consequences:

▲ Failure of essential functions of the machine / equipment

▲ Failure of mandatory maintenance and servicing methods

Continued Page 1.1

- ▲ Danger to personnel from electricity, machinery and chemicals
- ▲ Danger to the environment from leakage of hazardous substances.

1.4 Safety Conscious Working

In addition to the safety instructions listed in the manual, it is essential to observe the national accident prevention directives currently in force and any of the users own internal regulations concerning work and safety.

1.5 Safety Instructions for the User / Operator

- ▲ If there is a risk of danger from any hot or cold machine component, the user must fit protective guards to prevent such components from being touched (according to Standard EN 563).
- ▲ Protective guards fitted to prevent contact with moving parts (eg. couplings) must be in position when the machine / equipment is in use.
- ▲ Leakages (eg. from a shaft seal) of hazardous materials (eg. explosive, toxic, hot material) must be discharged in such a way that neither personnel nor the environment are placed at risk. Legal directives must be observed.
- ▲ All possible danger from electricity must be eliminated (for details see eg. the regulations of your local power supply company).

1.6 Safety Instructions for Maintenance, Inspection and Installation

The user must ensure that all maintenance, inspection and installation work is carried out by authorized and qualified personnel who understand the operating instructions and are adequately trained.

Work on a pump / equipment must only be carried out with the machine stopped and electrical power supply turned off. The pump/ equipment must not be under any pressure and must have cooled off. All procedures detailed in these operating instructions on the stoppage of the machine must always be adhered to.

Pumps / equipment which convey harmful media must be decontaminated.

Immediately after the maintenance work is finished all safety devices and guards must be re-installed and the safety trips must be tested.

Before putting the machine back into operation the points detailed in section "Start-up" should be observed.

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1.7 Unauthorized Modifications and Manufacture of Spares

Modifications or changes to machines / equipment are only permissible with the manufacturer's agreement. Original spare parts and accessories authorized by the manufacturer ensure safety.
The use of other components revokes any liability for consequences which may result.

1.8 Improper Application

Delivered machinery / equipment is only guaranteed safe for the use specified.

This machine / equipment was designed in accordance with the prescribed conditions of use.
The limits of use are laid down in the conditions of use and should in no way be exceeded.

1.9 Specific Points for the Use of a NEMO® Pump

A NEMO® pump must be used for the **purpose only** for which it was sold.

If you change or wish to change the process medium, you must check with either the supplier or manufacturer that the pump is suitable for the new medium. This is especially important with aggressive, poisonous or otherwise hazardous substances.

Pump criteria include:

1. Compatibility with the medium
2. Suitability for seal design / material, especially the shaft seal
3. Resistance to pressure and temperature of the medium.

Please note that NEMO® pumps are progressing cavity pumps and as such can generate very high pressure.

A blockage or the chance closure of a valve in the discharge line can cause a pressure rise **manifold as high as can be tolerated by the installation**. This can result in the bursting of pipes, which must be avoided especially in the case of dangerous media.

Corresponding safety equipment must therefore be installed, for example an emergency stop button, a pressure relief valve with return pipe or a bursting disc.

During maintenance and repair work on the pump please note the following:

1. Ensure that the pump drive **can not** be turned on without authorization.
2. When opening the pump follow the instructions for handling the medium (eg. protective clothing, no smoking etc).
3. Before putting the pump back into operation ensure that all guards and other safety devices (eg. drive–belt protection, coupling protection) are properly re–installed.

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1 SAFETY PRECAUTIONS

Always bear in mind your safety during operation, maintenance and installation of equipment. Please adhere to the EC-Directive for machinery including the national regulations and follow the US OSHA regulation #1910.219 & 1910.147 titled Mechanical Power transmission apparatus as well as the European Standard EN 292 with the accidents prevention rules laid down by the trade unions and other appropriate technical institutions.

Always bear in mind your safety during operation, maintenance and installation of equipment. Please adhere to the EC-Directive for Machinery including the national regulations and follow the European Standard EN 292 with the accident prevention rules laid down by the trade unions and other appropriate technical institutions.

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1.10 Notes on Inspection and Repair

The legal regulations for safety at work, such as regulations for the workplace, regulations governing dangerous materials, accident prevention, environmental protection eg. regulations on disposal and water balance obligate all commercial business to protect their employees and / or people and the environment from adverse effects caused by contact with dangerous materials.

Important:

Inspection / repair of machinery and its parts only takes place when a safety conformity certificate has been completed by an authorized and qualified specialist. Please use a copy and leave the original in the operation and maintenance manual.

Where special safety precautions are necessary in spite of careful emptying and cleaning of the machinery, the necessary information must be given.

Machinery operating with radio-active media will only be repaired or inspected by one of our specialist engineers under the safety of the owner.

The safety conformity certificate is part of the inspection / repair service. We reserve the right to refuse acceptance of this order / service for other reasons.

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1.11 Instructions concerning explosion protection

The instructions below are to be considered and kept to when using pumps in potentially explosive areas in order to guarantee durable explosion protection of the pumps and avoid any danger of ignition.

In accordance with the regulations 94 / 9 / EC, the pumps are admitted for use in the area II 2G IIB T 4 or II 2G IIB T 3
(pls. see manufacturer's declaration or declaration of conformity).

It is to be taken into account that in case of aggregates the components (e.g. gears, couplings) mounted on the pumps must comply with the regulations 94 /9 / EC as well. The relevant documentation concerning these components is to be considered.
The application area of aggregates is determined by the application area of the mounted component with the lowest approval and thus may deviate from the allowed application area of the pump.

Temperature category	Max. temperature of the conveying product
T 4	100 °C
T 3	165 °C
T 2	265 °C
T 1	415 °C

The maximum conveying product temperatures apply when mechanical seals of Messrs. Burgmann with **carbide – carbide** and **carbide – carbon** as sliding material combinations are used.
In the case of other manufacturers or other sliding material combinations it is necessary to consult the manufacturer.

1. Assembly and repair in potentially explosive areas

When performing assembly and repair work, it is to be seen to it that no dangers of ignition arise especially during heating up the pump parts. This means e.g. heating up by explosion-proof heating devices or exclusively in non-explosive areas. The temperature of the heated part and the ignition temperature of the materials by which the danger of explosion may be caused are to be considered.

2. Dry-running protection

Under no circumstances is the pump to run dry.
The pump is to be equipped with an appropriate dry-running protection device.

Continued Page 1.3R

The device for dry-running protection should be self-regulating.
This means that this device can give alarm signals and/or switch off the pump also in case of failures in its own control system.

Dry-running protection concerning stationary immersion pumps (with mounting plate)

Operation is only permitted with redundant or self-regulating automatic devices to guarantee dry-running protection as well as to control the pump capacity.

Dry-running protection concerning movable immersion pumps (drum pumps)

The filling with liquid during the operation is to be ensured by specific requirements of behavior:

- Drum pumps may only be introduced in and removed from the container in switched-off condition
- Drum pumps, after being introduced in the container to be discharged, may only be started after they have immerged in the fluid.
- Drum pumps are to be switched off before they run dry or are to be switched off at once when specific noises ("slurping" or speed rise) suggest that dry running may or will immediately occur.

3. Overpressure protection

The pump must not be loaded over the maximum allowable pressure.
The pump is to be equipped with an appropriate overpressure protection device. The pump must not convey against a closed slide valve.
The overpressure protection device should be self-regulating.

4. Drives

The drives must be adjusted to the performance of each pump.
In the case of a blocking of the pump, the drives must be turned off automatically by means of a motor protection unit.

5. Alignment of the drive (concerning the pump types SY / SH / SA / SO / SF / SP)

It is absolutely necessary that the drive be aligned within the maximum allowable tolerances. Incorrect alignment causes damage to the seals and the shaft bearings.

6. Potential equalization concerning immersion pumps

The immersion pumps are to be integrated in the potential equalization of the installation. Hand-operated movable immersion pumps are to be grounded before being introduced in the container.

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The connection to ground is to be maintained until the pump has been completely pulled out of the container.
There must not be any potential difference between the pump and a conductive container. This means that container and pump are to be connected at a common grounding point and thus be conductively connected with each other.
(see information brochure "Statische Elektrizität, Zündgefahren und Schutzmaßnahmen" (Static electricity, dangers of ignition and preventive measures); Publisher: "Internationale Sektion für die Verhütung von Arbeitsunfällen und Berufskrankheiten in der chemischen Industrie der IVSS" (International section for the prevention of employment accidents and occupational diseases in the chemical industry of the ISSA (International Social Security Association)) , Heidelberg 1995).
The hand-operated movable immersion pumps are to be provided with an indication referring to the grounding measure (pay attention to grounding).

7. Potential equalization concerning all other pump types (no immersion pumps)

All conductive parts of the pump are to be integrated in the potential equalization of the pumping set unless the conductive connection to the ground potential is guaranteed by the drive or connecting shafts or otherwise.

8. Stator

The stator is to be regularly checked for wear. When the allowable wear limit is reached, the stator is to be replaced. Before exchanging the conveying product, the pump operator has to consult the manufacturer concerning the durability of the stator unless the stator has already been confirmed for the intended application.

Inspection and maintenance interval of the stator:
- **in the case of an operating time of > 16 h/day, at least twice a year**
- **in the case of an operating time of < 16 h/day, at least once a year.**

9. Joints / joint lubrication

The sealing and the lubrication of the joints are to be regularly checked. If necessary, the seals and the lubricants are to be replaced.

Inspection and maintenance interval of the joints:
- **in the case of an operating time of > 16 h/day, at least twice a year**
- **in the case of an operating time of < 16 h/day, at least once a year.**

10. Inspection after initial startup

The aspects relevant for ensuring the explosion protection (such as lubrication and wear check) are to be checked six months after the initial startup of the pump at the latest.

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11. Shaft bearings
(concerning the pump types SY / SH / SA / SO / SF / SP)

Replacement of the bearings after 14,500 operating hours (according to prEN 13463-5: replacement after 90 % of the designated service life).

12. Materials

Although being allowed as material for the pumps, aluminum should be avoided in potentially explosive areas.
The pumps may only be used if, under the particular operating conditions, the materials are resistant to mechanical and/or chemical influences or corrosion such that the explosion protection will be maintained.

13. Noise development
(concerning the pump types SO / BO / SF / BF / SP / BP)

As soon as unusual noises (such as knocking or rubbing) are realized, the pump is to be switched off. The cause of the failure is to be eliminated before the pump is reoperated.
Regular check of the paddle equipment.

14. Direction of flow of immersion pumps

The direction of flow of immersion pumps always has to be from the end connection piece to the pressure nozzle at the top. The reverse direction of flow is not allowed.

15. Mechanical seal of immersion pumps

Before the initial startup and after a prolonged shutdown, the mechanical seal is to be lubricated from outside before the pump is started. In this connection, the compatibility of the lubricant with the sealing material is to be considered.

16. Impurities in immersion pumps

Especially in the case of hand-operated movable immersion pumps it is to be seen to it that no impurities can get into the pump. The pumps are to be deposited only on clean and solid ground or else to be suspended. In case of unusual noises or power losses, the immersion pumps are to be switched off immediately.

17. Gland

If a gland packing is applied it has to be observed that the permitted temperature corresponding to the temperature category is not exceeded. Recommendation: fasten the screws of the stuffing box gland only with low torque (approx. 5 Nm).

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Safety Conformity Certificate

The machinery and its accessories together with this safety conformity certificate relating to repair / inspection services given to the undersigned by ourselves

Machine Type .....
Number .....
Delivery Date ..... Delivery Note No. .....

was carefully emptied and cleaned both inside and out in preparation for shipment ☐ yes ☐ no

Special safety precautions with regard to health or media endangered by water are to be implemented ☐ necessary ☐ unnecessary

The machinery is set up to transport materials dangerous to health or water and came in contact with media containing harmful substances ☐ yes ☐ no

The following safety precautions are necessary with regard to irrigation media, overflow liquid and waste management:

.....
.....

We confirm that the above mentioned details are correct and complete and that despatch will follow in accordance with the legal requirements:

Company ..... Telephone .....
..... Fax .....
..... Telex .....

Address
.....
.....

Name ..... Position .....

....
Date Company Stamp / Signature

2 Description

The NEMO® pump is a progressing cavity pump.
The main components which determine the system discovered by Professor René Moineau are a rotating part, called the rotor and a static part, called the stator.
The rotor is a helical screw with an extremely large pitch, large thread depth and small centre diameter with round cross-section for 1/2-geometry and elliptical cross-section for 2/3-geometry. The stator has a two start or resp. 3 start thread and is double or resp. 1.5 the pitch length of the rotor. This provides space for the medium between the rotor and stator. When the rotor turns round inside the stator the medium moves continuously from the inlet to the outlet.

The universal NEMO® pump system unifies many positive characteristics of other pump types:

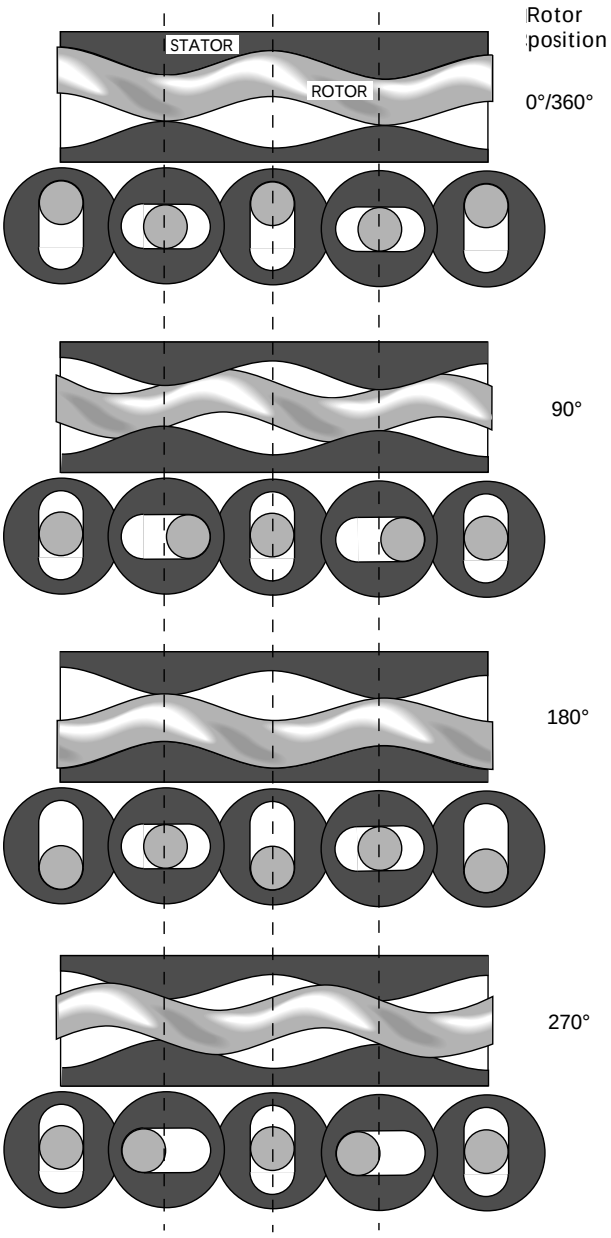
■ Like centrifugal pumps NEMO® pumps have no suction or pressure valves, but do have a stable flow rate in proportion to the number of revolutions.

■ Like piston pumps NEMO® pumps have a suction capability of up to 8.5 m vacuum metric.

■ Like membrane and peristaltic pumps the NEMO® pump can transport every type of inhomogenous, gaseous and abrasive media, as well as those that are not of a liquid consistency or contain solids and/or fibrous material.

■ Like gear pumps and screw pumps the NEMO® pump is capable of coping with high medium viscosities.

■ Like piston, membrane, gear or screw pumps the NEMO® pump can perform dosing operations.



Length and cross-sections through the rotor and stator with 1/2-geometry during a rotation.

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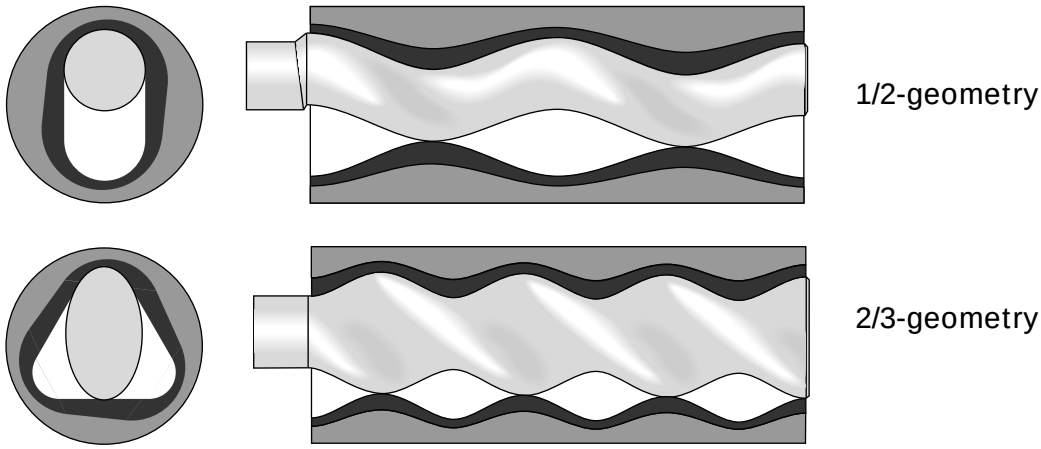


Length and cross-sections through the stator with rotor
with reduced stator wall thickness

2.2 General Data

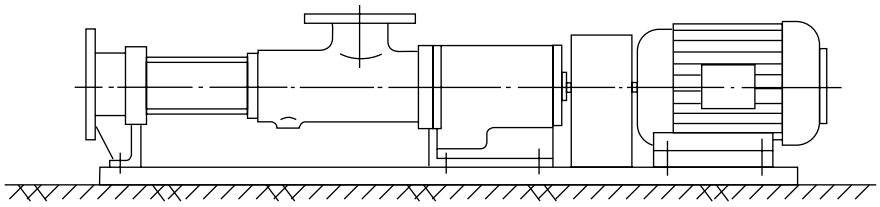
Noise emissions:

The maximum permitted noise emission level at a work place is 70 dB (A).

The noise level was measured in accordance with DIN Standard 45635-24-01-KL2 to assure that the pump does not exceed 70 dB (A).

Noises generated by the drive and pipes are not included in the above emission value.

A prerequisite for the noise emission level of ≤ 70 dB (A) is that the pump is operated in a cavity free regime and is bolted to a concrete base.



3 Packaging, Transportation, Storage

3.1 Packaging and Transportation

NEMO® pumps are shipped in railroad containers or crates unless the customer specifies otherwise.
The packings are labelled and symbols give the handling instructions in accordance with DIN 55402.
On receipt check for any transport damages.
Transport damages should be reported to the transporter immediately.
The pumps should be transported as closely as possible to the location of installation and only there should they be uncrated.

Uncrated horizontal pumps should be lifted by using a shackle which can be attached to the baseplate. The bolt holes of the frame or the lifting lugs attached to the baseplate could be used as shown on the installation drawing.

Vertical pumps should be lifted by using the bolt down holes, lifting lugs or shackles attached to the baseplate. This is shown on the installation drawing. For most applications, the drive is mounted on top of the pump.

Be careful when lifting top heavy pumps. The centre of gravity may be above the points where the lifting gear is attached to. If the case, secure additionally against tipping over!

Vertical pumps should not be deposited unless they are secured vertically. **Hazards of tipping**! Deposit only in horizontal position!

It is essential to avoid that the total pump unit be suspended with eye bolts of the motor or gear box. These eye bolts should be used for lifting the motor and/or the gear box **only.**

The Accident Prevention Rules, Section 18.4 relating to lifting accessories for the lifting of loads (VBG 9a) must be strictly adhered to.

Because of the variety of possible pump designs and applications, only general instructions can be given here. These should be good enough for experienced assemblymen or transportation experts.
When in doubt, please ask for detailed information on the pump unit concerned.

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When moving the pump or unit on **wheels** strictly attend to the following:

- Pad lock the motor drive and secure against unintended starting up.
- Move the pump unit carefully and slowly, especially where the ground is uneven. **Hazards of tipping!**
- Ensure a stable position of the pump or unit at the operating/storage place and secure it by actuating **all** clamping devices on **all** the wheels or rollers against voluntary moving away.
- Where fitted loosely, carefully watch the pipe bends when pumping. **Power of repulsion!**
- Where necessary, secure the pump unit additionally with support blocks.

3.2 Storage

The pumps are preserved for transport unless specified otherwise.
In cases of longer storage the pumps should be handled as follows until installation:

- **Stator:**

If the pump is not to be used immediately, then the elastomer along the contact line between rotor and stator may become permanently distorted (compression-set). This will increase the break away torque. Therefore, the stator should be removed and kept separately in a clean, cool and dry environment.
Standard DIN 7716 summarizes detailed information on the storage of rubber products, some of which is gathered here, and the following notice applies to a storage for a period of up to six months.

General

Most of the rubber products may change their physical properties under unfavourable conditions or if treated improperly, which will result in a shorter lifetime.
Or they may become useless through excessive hardening, aging, regenerating or permanent deformation, also because of blistering, cracking or other damages appearing on the surfaces.
The changes may occur under the influence of oxygen, ozone, heat, light, humidity, solvents or because of storing the products under tension.
If stored and treated properly, the rubber products will keep their properties, even over a long period of time (some years), almost unchanged.
This does, however, not apply to uncured rubber compounds.

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Store room

The environment in which rubber products are being kept must be cool, dry, free of dust and rather airy, and they must not be stored in the open, not even in a weather sheltered space.
Rubber products should be kept in surroundings not having less than minus 10 °C and not more than plus 15 °C.
Store rooms should not be damp, and it must be ensured that there will be no condensation.
Most favourable is an environment offering a relative humidity under 65 %.
Rubber products must be protected against light, particularly direct sunlight or artificial light when having a high UV portion.
They should furthermore be kept away from ventilation, especially draught, by wrapping them up.
As ozone is very aggressive and harmful there should be no store room used which houses equipment likely to produce ozone, e.g. electric motors or other equipment which might bring about sparks or other electrical discharges.
There must be no solvents, oil, grease, lubricants or any chemicals kept in a store room.

- **Rotor**

  Please support with wooden blocks and cover up against harm from mechanical impact.
  For rotors of RCC (material number 1.2436):
  coat the surfaces with protective grease to avoid rusting.

- **Shaft Sealing by packing gland**

  Remove the gland and coat the exposed shaft surface with grease.

- **Pump parts in stainless steel**

  No grease coating necessary.

- **Other, non-coated pump parts**

  Protect with grease.

- **Drives**

  Please observe the drive supplier's instructions.

4 Mounting and Installation

**If the NEMO® pump was stored and the rotor grease protected: Remove the grease before installing the stator.
Clean the rotor thoroughly in order to avoid unsuitability of the grease with the stator material and the pumping medium.**

Screw the pump at all fixing points (bearing housing / drive stool, end stud, support feet) using all fixing bores securely down to the sub-structure (ground plate, machine frame, foundation etc.).

4.1 Direction of Rotation

The direction of rotation of the pump is given on the model plate and in the order confirmation. The direction of delivery of the NEMO® pump is a function of the direction of rotation.

Changes must be agreed upon and confirmed by the supplier.

4.2 Pressure

If not explicitly confirmed otherwise in the order confirmation, the **maximum permissible pressure (e.g. when turning clockwise) inside the pump housing (A)**

– for models with pump housing of cast iron 6 bar

– for models with welded pump housing 10 bar.

The maximum permissible pressures inside the end flange (B) is a function of the design applied for connections

- with flange: maximum nominal pressure (e.g. PN 16)
- with threaded internal socket: maximum 25 bar
- with DIN 11851 "dairy" thread up to DN 100 for one or two stage pumps: max. 12 bar, for multi stage pumps: max. 25 bar
- for other versions: maximum permissible pressure of the socket connection, but not more than 6 bar per pump stage, depending on the stator installed.

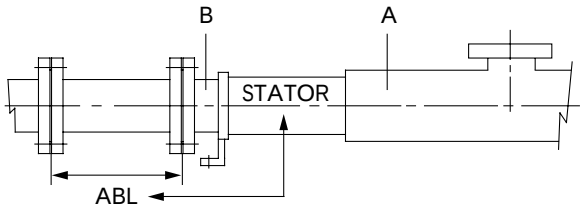
4.3 Piping System

- Arrange suction and pressure pipes so that when the pump is not running, the medium is still present before and after the pump. Sufficient media should remain inside in order to lubricate the pump during restart.

Continued Page 4.0R

4 INSTALLATION INSTRUCTIONS

■ The installation of a removable distance piece between the end flange (B) and the pipe work is recommended in order to make the dismantling of the stator easy. The distance piece (see sketch) needs to have a minimum "ABL" disassembly length the values of which are shown in the table below, depending on the pump size and the number of stages.



Disassembly length ABL in mm:

Pump size	Number of stages			
	1 *)	2	3	4
0 1 5	90	160	230	310
0 2 1	130	230	340	450
0 3 1	170	310	450	590
0 3 8	230	430	630	830
0 4 5	270	500	730	960
0 5 3	320	600	880	1170
0 6 3	370	690	1010	1330
0 7 6	420	800	1170	1540
0 9 0	500	950	1390	1840
1 0 5	630	1180	1740	-
1 2 5	740	1400	-	-

*) for one stage pumps with L or P geometry the ABL values of 2 stage pumps are valid

Continued Page 4.1

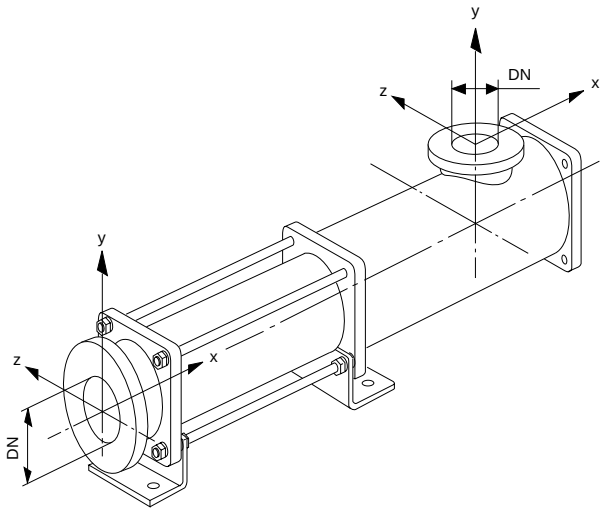
Type key

Example: **N M 0 9 0 B Y 0 2 S 1 2 B**

Internal
Pump size
Type
Model
Number of stages
Geometry
max. permissible pressure difference
anti–clockwise
Joint

The disassembly length "ABL" is also shown in the arrangement drawings in accordance with our Standard QSH V - TB 01 - 002.

- Clean the pipe work and rinse thoroughly before installing the pump.
- Connect the pipe work ensuring that no external stress attacks the pump body. The installation of compensators between the pump and the pipework is recommended:
  - No risk of damage to the pump housing from pipelines "resting" on the pump.
  - No risk of damage to the pump housing through vibrating pipelines.
- The twisting loads (F_x, F_y, F_z) and bending loads (M_x, M_y, M_z) permitted to be put on the suction/discharge flange comply with the requirements of API 676 and exceed the requirements of EN ISO 14847. They are shown in the table below.



Continued Page 4.1R

Pump type NM	Standard nominal diameter DN	F_x, F_y, F_z N	M_x, M_y, M_z Nm	
015 021	(32) G 1¼"	550	(300)	Screwed joints must not be charged with loads which may result in tightening or loosening these joints
31	50	780	420	
38	65	990	530	
45 53	80	1160	620	
63	100	1490	800	
76	125	1820	980	
90 105	150	2190	1180	
125	200	2850	1530	

4.4 Shaft Sealing

- Where applicable, ensure that adequate supply lines for the buffer, flushing or quenching fluid for the shaft seals are connected **before** the pump is put into **operation**.
  For more details see Section 7.4!

4.5 Electrical Connection

All work relating to electricity shall only be made by **authorized and qualified personnel** and it should be in compliance with the requirements of the relevant national regulations!

In particular for control systems should the latest version of the **EC-Directive for Machinery 98/37/EEC, Annex I, Section 1.2 Controls** be carefully observed!

Note for frequency converter operation:
It is absolutely necessary to connect the PTC-resistors of the drive in case of frequency converter operation to protect the drive against overheating.

5 Start-up

The NEMO® pump design requires strict attention to the following:

Never run the NEMO® pump dry!
A few rotations in dry condition
will damage the stator!

- Before starting up for the first time, fill the pump with medium.
  In the case of high viscosity media fill with a liquid.
  Pump priming is vital to ensure lubrication of the rubber stator.
  Fill the piping on the pump suction side.
  In anti–clockwise rotation only: Fill the pump housing.

The NEMO® pump is a progressing cavity pump which can produce pressures that may cause the bursting of vessels or pipes.

The power transmission train (shaft, coupling rod, joints, rotor) of the pump may be overloaded thus resulting in damage or breakage.

Also the pump housing parts with their connections may be overloaded and break. There is a table in Section 4 of these Maintenance and Operating Instructions showing the pressure resistance of the pump housing parts.

Never run the pump against a closed inlet or outlet valve!

- **Open valves and vents before starting the pump!**
- **Check the direction of rotation by briefly switching on the pump motor.**

DETERMINING WHEN TO LOCKOUT

Having performed a hazard analysis on your company's equipment, you can now determine when machines must be locked out – i.e., when employees are exposed to injury from each (or any) of a machine's hazardous energy sources during servicing or maintenance activities. To do this, use your Hazard Analysis Checklist and the "Four Key Questions for Lockout Implementation."

OSHA Requirements

OSHA rules state that equipment must be locked out during equipment servicing and maintenance whenever employees are exposed to injury from unintentional machine movement or startup. According to OSHA's regulations, servicing or maintenance procedures that require lockout include:

"Workplace activities such as construction, installing, setting up, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning, or un-jamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy."

In addition, lockout is required during any machine service or maintenance that requires an employee to:

- Remove or bypass a safety device; or
- Place any part of his or her body into a point of operation or similar danger zone during a machine's operating cycle.

Routine, Repetitive Activities

Routing and repetitive servicing procedures that take place during normal production operations, such as minor tool changes and adjustments, do not require lockout tagout, as long as the work is performed using "alternative measures which provide effective protection." These "alternative measures" include safeguarding methods approved by OSHA and ANSI (American Standards Institute) to protect operators, such as:

- Presence sensing devices
- Interlocking barrier guards

Remember, the factor that determines whether these or any other safeguarding methods eliminate the need for lockout tagout during routine, repetitive activities is whether the employee is protected from injury.

If lockout is not required, you MUST have clearly written procedure that describe the alternative safeguarding measures used and the tasks that may be performed. Refer to OSHA and ANSI standards for approved safeguarding methods.

6 Temporary Shutdown

- After stopping the pump empty and if necessary rinse it if

  – the medium might freeze due to the temperature surrounding the pump. Especially where there is a danger of frost if the pump is installed outside a building
  – the medium tends to solidify or harden
  – the medium tends to glue up the shaft seal.

- Stator:

  When stored for a long period, the elastomer along the contact line between the rotor and stator may become permanently distorted (compression-set).
  This will increase the break away torque. For this reason, the stator should be removed (please observe Section 9!), and stored in a cool, dry place in air tight package to give protection against light and air.

- Rotor:

  Remove **ceramic rotors** (please observe Section 10!) and store away, safe in the original packing.

  Support **other rotors** on wooden blocks and cover to protect them from mechanical damage, after the stator has been removed.

  Rotors made of RCC (material number 1.2436):
  Protect the rotor surfaces against corrosion with protective grease.

  Remove the grease before re–installing the stator and clean the rotor thoroughly in order to avoid unsuitability of the grease with the pumping medium or the stator material.

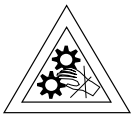
- Stand-by pump:

  A stand-by pump is sometimes used as a back-up for the main pump and, when standing idle for longer periods, should be operated from time to time. The pump may otherwise become seized when being started up. This is due to compression set i.e. distortion of the stator against the surface of the rotor.

7 Maintenance

7.1 Pumps in General

- The pumps should be regularly rinsed or cleaned if deposits of medium are likely to build up (sedimentation).



If the pump needs to be opened to do this, ensure that the pump and motor are switched off and cannot be turned on accidently (eg. by removing the fuse).

Periodical standstill to allow for cleaning during operation depends on the medium and type of operation.

- The pump can be cleaned:

  – through the cleaning ports provided in the pump housing

  – manually by dismantling the pump

  – automatically (CIP cleaning) for special housings with a flushing section (important instructions for CIP procedures are given in Section 5 (START UP).

7.2 Lubrication

The NEMO® pump does not require frequent lubrication.

- Maintenance of the drive should be carried out according to the drive manufacturers instructions.

- Maintenance
  - where no manufacturers instructions are available and
  - when normal conditions of use exist:

  - Strip down the drive unit
  - Remove the bearings
  - Clean all parts
  - Renew the lubricant

  every 5000 operating hours or at least every two years.

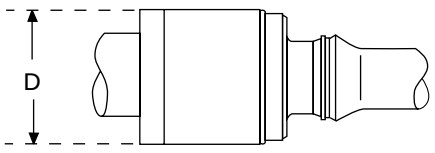
Special lubricants are often specified for mechanically controlled variable speed drives.
It is therefore important to follow the drive manufacturers maintenance instructions.

7.3 Lubricating the Pin Joints with SM-Pin Joint Seals

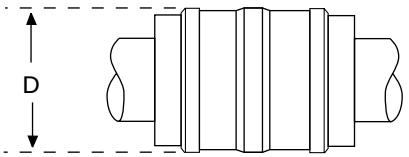
- It is advisable to change the oil and check the seals of the pin joints:
  - when renewing worn joint parts
  - when opening the pump for any reason.

  The quantity of oil added per pin joint is a function of the joint external diameter D:

Joint external diameter D in mm (see sketch)	Basic joint size	Quantity of oil per joint in cm^3
28	NM 015	1,5
30	NM 021	2
40	NM 031	5
54	NM 038	15
65	NM 045	22
76	NM 053	36
83	NM 063	78
102	NM 076	165
125	NM 090	205
148	NM 105	450
162	NM 125	470
Journal cross joint 175	NM125	1650



Pin joint



Journal cross joint

Continued Page 7.2R

7.4 Double Mechanical Seal in "back-to-back" Arrangement with Buffer Fluid System

For correct operation a double mechanical seal requires a buffer fluid. This fluid is designed to lubricate the seals and remove the heat caused by friction. It is also apt to prevent the product handled from entering the sealing gap and it fills the gap between the product and atmosphere side.

As a buffer fluid, any pure and clean fluid may be used. The fluid, however, should not corrode with the wetted parts of the seal, and it should not damage the product handled or harm the environment.

The buffer fluid must:

- be free from solids.
- not tend to form deposits.
- have a fairly high boiling point.
- possess good thermal conductivity.
- not harm the seal elastomers.

Clean soft water meets these requirements quite satisfactorily.

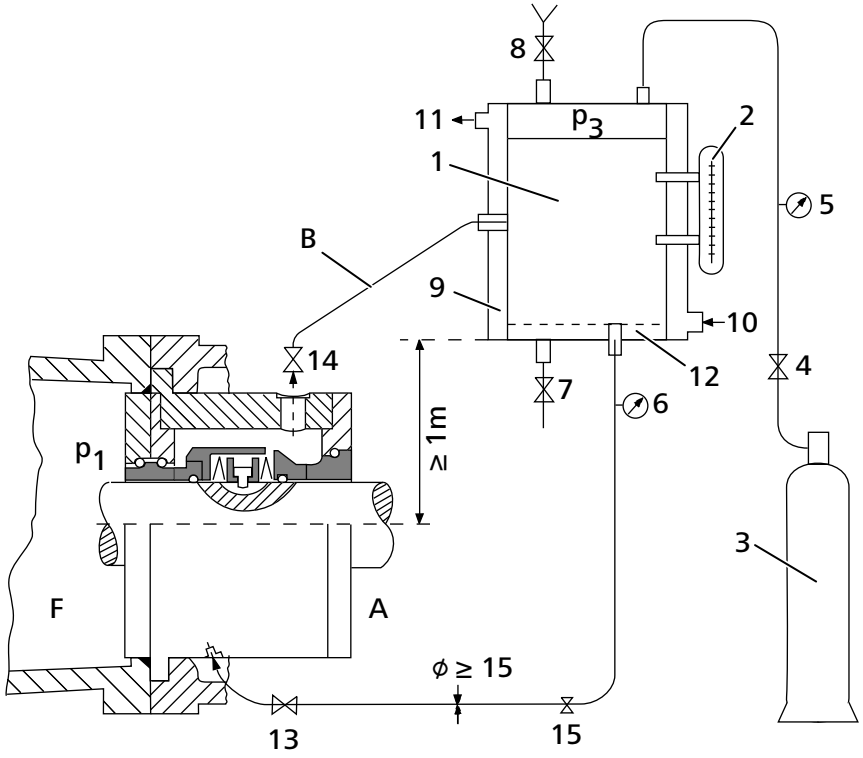
The picture overleaf shows the most common arrangement of a buffer fluid system in thermosyphon design. The circulation in the system results from the differences in density in relation to the buffer fluid temperature.

The buffer fluid pressure p_3 should be about 10 %, i.e. 2 bar at least, above the product pressure p_1.

The outlet temperature should not exceed 60 °C when water is used as a buffer fluid.

As a rule, the outlet temperature should be about 40 °C below the buffer fluid boiling point.

7 MAINTENANCE



1	Vessel, capacity about 5 - 10 liters	11	Coolant outlet
2	Sight glass (MIN/MAX marks)	12	Sump deposit zone, ca. 50 mm
3	Nitrogen bottle (possibly compressed air)	13	Inlet valve
4	Safety valve	14	Outlet valve
5	Manometer	15	Waste outlet
6	Thermometer (if possible with MIN/MAX indicator)	A	Atmosphere
7	Drain valve	B	pipe mounting, no bubbles
8	Refill device for buffer fluid		
9	Cooling jacket or cooling spiral, inside	F	pumped media
10	Coolant inlet		

Before start-up:

- Fill vessel to about two thirds or up to MAX mark on the sight glass.

Wartung:

- In regular intervals check the oil level and colour of the buffer fluid. Control intervals should be determined by the user according to his experience in operation.

Lubricating Oil:

<table>
<tr><th>Industrial application</th><th>Designation DIN 51502</th><th>Permitted Product</th></tr>
<tr><td rowspan="2">Food and Beverage Industry only</td><td>Authorized for use in foodstuffs
CLP HC 460</td><td>"KLÜBER" KLÜBEROIL 4 UH 1 - 460 authorized under USDA H1</td></tr>
<tr><td colspan="2"> 
This synthetic oil meets both the German "Arzneimittelbuch" requirements and the still stricter US American FDA regulations.
Nevertheless, it is not quite harmless if swallowed in more than minor quantities!

At a sudden break in a joint up to 450 ml of lubricating oil together with metal rubbings may enter the pumping medium. It is therefore of essential importance to regularly check the state of the joint seals and renew in time, if necessary.

If the pin joints operate without lubricating oil or seals, there will be no risk of contaminating the medium with oil. This operation, however, results in a higher amount of rubbed off metal parts through wear on the joints. These metal rubbings will inevitably and continuously come into contact with the pumping medium.</td></tr>
<tr><td rowspan="2">General Industry</td><td>CLP 460</td><td>"SHELL" Omala 460</td></tr>
<tr><td>with SM-pin joint seal (8235) of EPDM
CLP PG 320</td><td>prescribed:
KLÜBERSYNTH GH 6-320</td></tr>
</table>

8 Trouble-Shooting and Remedying

8.1 Trouble Chart

The chart overleaf lists possible problems

- the type
- the likely reason / cause
- the remedy.

- A problem may have various causes: Several boxes in the vertical column are marked with a cross.
- A reason/cause may result in various problems:
  Several boxes in the horizontal column are marked with a cross.

8.2 How do you trace the kind of problem to find the possible cause ?

- The column describing a possible problem shows one or several boxes marked with a cross.
- On the corresponding lines you will find the possible reasons/cause and some hints how to handle the problem . Thus the actual cause of the problem can be narrowed down and eventually detected.
- If you find further cross-marked boxes on one of the lines and should there appear corresponding problems as well, then the likely cause of the problem has been detected.

- The table helps in finding the root of the problem and will give you the remedy if it is straight forward. For more complicated problems the manufacturer has to be consulted.

Continued Page 8.0R

The NEMO®-pump is a well established product which was thoroughly tested before leaving the factory. If you use the pump in keeping with your Order Specification and treat it in accordance with our Operating and Maintenance Instructions, it will run satisfactorily for a long period of time.

Possible Problems											
The pump is no longer starting	The pump is no longer sucking	The pumped medium is too little	The pressure is too low	The pumped medium is unstable	The pump is running loudly	The pump is stuck	The drive is overloaded	The stator life time is too short	The rotor life time is too short	The shaft seal is leaking	**Possible Causes** (Remedy overleaf)
X							X				In new pumps or stators : the static friction is too great.
X		X	X				X				The pump electrical equipment is not compatible with the electrical supply.
		X					X	X	X		The pressure is too high.
X						X	X				There are foreign bodies in the pump.
X						X	X	X	X		The temperature of the liquid medium is too high, the stator is too ductile.
X						X	X	X			The stator has swollen, the elastomer is not compatible with the medium.
X						X	X	X			The solids content of the medium is too high and leads to blockages.
X						X	X	X	X	X	The liquid medium sediments or hardens when left to stand.
		X	X	X							There is air in the suction pipe.
	X	X	X	X							The suction pipe is leaking.
	X	X	X	X							The shaft seal is leaking.
		X	X								The rpm is too low.
	X	X	X								With reduced diameter rotors : operating temperature has not been reached.
		X	X	X	X			X	X		The suction is too great or pressure too low (cavitation).
		X	X		X	X	X	X			The pump is running dry.
	X	X	X		X						The stator is worn out, or temperature of liquid is too low.
	X	X	X		X			X	X		The stator material is brittle.
	X	X	X		X			X			The rotor is worn out.
					X						The joints are worn out.
					X						The pump and drive are not axially aligned.
					X						The elastic element of the coupling is worn out.
					X					X	The roller bearings are destroyed.
							X				The rpm is too high.
							X				The viscosity is too high.
							X				The specific weight of the medium is too high.
							X			X	The stuffing box is incorrectly tightened.
										X	The packing is not suited to the liquid medium.
	X									X	Mechanical seal : rotation is incorrect.
										X	Mechanical seal : mechanical seal and mating ring have failed.
										X	Mechanical seal : elastomers damaged, swollen or brittle.

Remedy
Fill the pump up, then pump through manually using a suitable appliance; if necessary use glycerine as lubricant in the stator.
Check order information. Examine electrical installation (possibly 2 phase operation).
Measure the pressure with a manometer and check against order details. Reduce the pressure or change the drive.
Remove foreign bodies and eliminate possible damage.
If the liquid medium temperature cannot be lowered, use a reduced diameter rotor.
Check whether the liquid medium agrees with the order requirements. Possibly change stator material..
Increase the liquid part of the medium.
Clean the pump and rinse through after each run.
Increase the suction liquid level, prevent turbulance and air bubbles at the inlet.
Check seals and tighten pipe connections.
Stuffing box : tighten or renew. Mechanical seal : renew seals, eliminate solid deposits.
In the case of adjustable drives : increase the rpm. If necessary change the drive.
Warm up the pump (stator) to operating temperature first of all.
Decrease suction resistance, lower the temperature of the liquid medium, install the pump at a lower location.
Fill up the pump, provide for dry running protection, move the pipes.
Replace with a new stator or ensure correct liquid temperature.
Fit a new stator. Check the liquid medium agrees with order details; if necessary change the stator material.
Change rotor, establish the cause. Wear and tear, corrosion, cavitation; if necessary change to a different material or coating.
Replace relevant parts, carefully reseal and lubricate.
Re-align the unit.
Use a new connection and re-align the pump.
Replace roller bearings, lubricate, reseal. At higher temperatures observe the lubricant and the bearings.
In the case of adjustable drives : lower the rpm.
Measure the viscosity and compare with order details. If necessary adjust viscosity or change the drive.
Measure specific weight and compare with order details. If necessary adjust specific weight or change the drive.
Service stuffing box according to page 7.4, if necessary renew worn shaft.
Replace fitted packing with another packing type.
Change electrical connection.
Replace relevant rings with new ones.
Replace elastomers. Check whether the liquid medium agrees with order details, if necessary change material.

9 Removal and Fitting of End Stud, Stator and Pump Housing

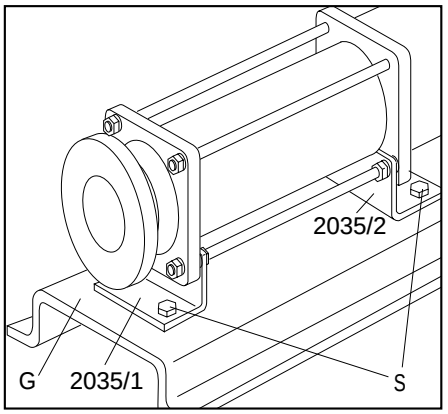
The pump with attached pipework should be empty and must have cooled off!
Disconnect the pipework on the suction side and pressure side of the pump.

Caution for pumps with ceramic rotors!

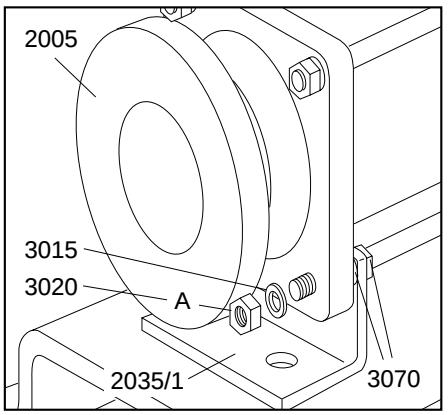
Where a pump is fitted with a **ceramic** rotor (1999) the following operations should be carried out **with great care.**
Do not use any force or sharp tools! Special care must be taken to prevent heavy strokes, vibrations or impact by a hammer.

Dismantling

- Remove the securing screws (S) from support feet (2035) to baseplate (G).



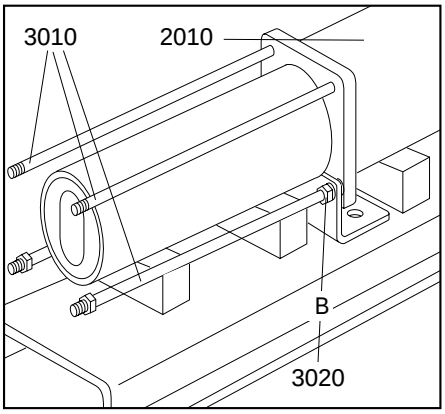
- Unscrew the hex nuts A (3020) and remove with spring washers (3015), then withdraw the end stud (2005) and first support foot (2035/1) with washers (3070).



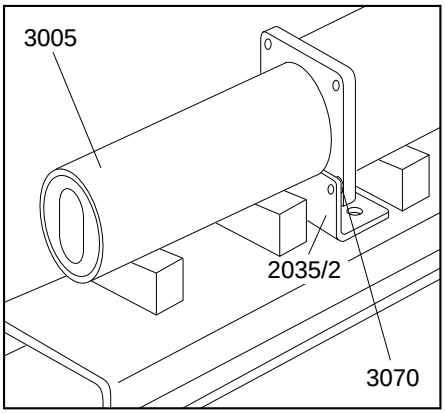
Continued Page 9.0R

9 DISMANTLING AND ASSEMBLY OF THE PUMP HOUSING

- Support pump housing (2010) and stator (3005) with wooden blocks.
- Loosen the hex nuts B (3020), where fitted, and remove the thru bolts (3010).

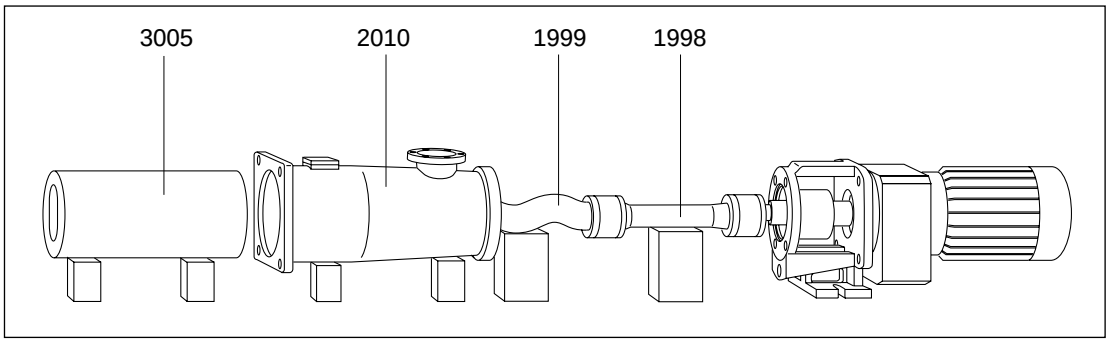


- Where fitted, remove the second support foot (2035/2) and the washers (3070).



Caution for pumps with ceramic rotors!

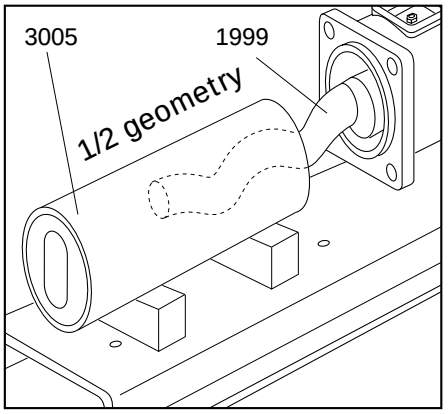
When the stator (3005) is removed from the **ceramic** rotor (1999), the stator must be supported to prevent it from suddenly tilting away downwards. The same applies to the rotor (1999) as soon as it is disengaged from the stator (3005). Removing the stator (3005) from the **ceramic** rotor (1999) is easier by using an extractor. This should be done slowly and with care in a rotating movement. When sliding pump housing (2010) over **ceramic** rotor (1999), both coupling rod (1998) and rotor (1999) should be lifted as the **ceramic** rotor (1999) must not knock onto the pump housing (2010).



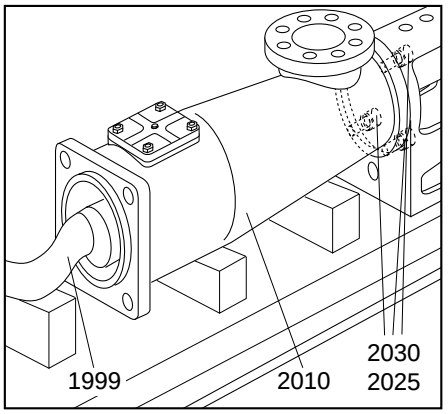
Continued Page 9.1

Caution for pumps with tubular rotors:

Where the walls of tubular rotors are worn in the wear zones, pumping medium may occur inside the rotor and may come out when pulling off the stator.
Ensure that protective measures have been taken when pumping dangerous media!



- Pull the stator (3005) out forward.
  A stator extractor can be supplied as special accessory.



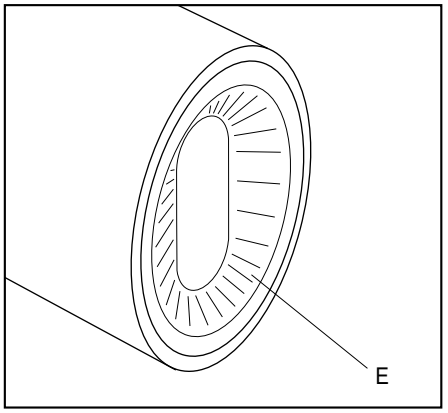
- Remove the hex nuts (2030) with spring washers (2025).
- Pull the pump housing (2010) off forward.

Assembly

- Refitting is a simple reversal of this procedure.

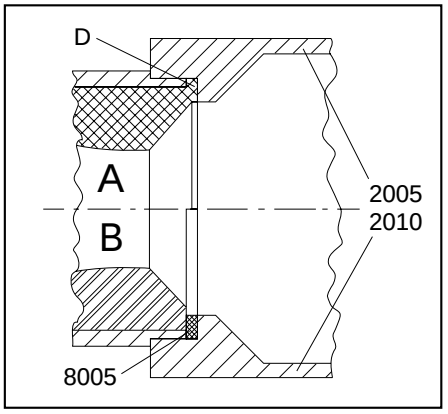
  When refitting the stator (3005) check direction of stator (3005) is correct! The funnel-shaped inflow side (E) of the stator (3005) must show to
  – the pump housing (2010) when rotation is **anti-clockwise**
  – the end stud (2005) when rotation is **clockwise**

  when viewed on pump shaft end.



- **Elastomer stators (A)** have integrated front side sealing profiles (D). They don't need additional gaskets for sealing off the end stud (2005) and the pump housing (2010).

- **Solid stators (B)** have **no** integrated front side sealing profiles. Therefore additional gaskets (8005) should be installed to seal off the end stud (2005) as well as the pump housing (2010).



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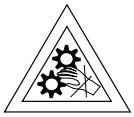
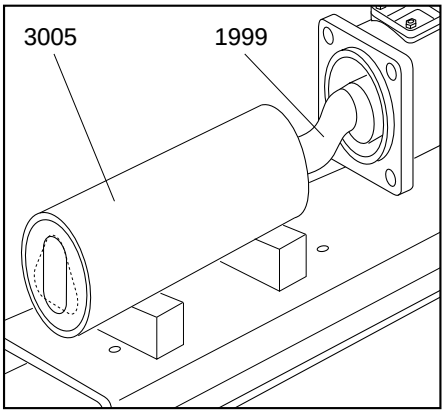
9 DISMANTLING AND ASSEMBLY OF THE PUMP HOUSING

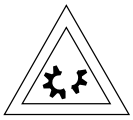


Be careful when engaging the stator (3005) and rotor (1999). Do not trap your fingers!
Do not reach inside the stator!



- Push the stator (3005) with a rotating movement on to rotor (1999).
  Apply an assembly device and some glycerine to ease engaging the stator (3005) and rotor (1999).

- When tightening hex nuts (2030) a gap will remain between drive stool (0085) and pump housing (2010).



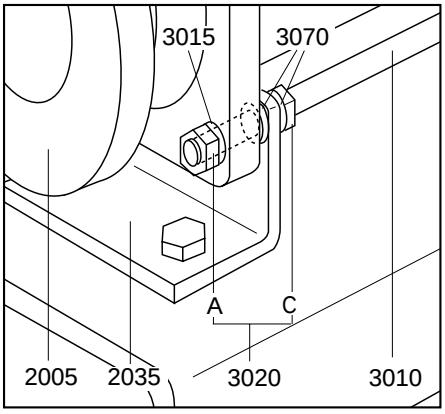
Please do not try to close this gap by overtightening the nuts!
Drive stool (0085) may break!

Torque values for hex nuts (2030):

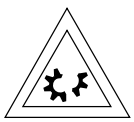
Size	M6	M8	M10	M12	M16	M20	M24	M30
Required torque Nm	8	15	30	45	75	80	100	120

- Fastening the end stud (2005):

Screw the hex nuts C (3020) down into the thru bolts (3010) as far as possible.
Slip on the first washers (3070), the support foot (2035), the second washers (3070), the end stud (2005) and tighten with spring washers (3015) and hex nuts A (3020).
Finally, fasten the support foot (2035) from behind with the two hex nuts C (3020).



Ensure during refitting that the O-ring (8015) or, where a heating jacket (3025) is installed, the O-rings (8030) are in perfect condition and will sit correctly.

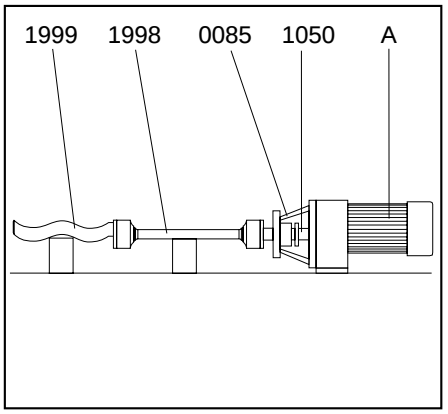


Ensure that the drain plug (2015) is not screwed too tightly into the pump housing (2010), since otherwise its conical thread may break the pump housing (2010).
The torque should be about 40 - 50 Nm.

10 Dismantling and Assembly of the Rotating Parts with Pin Joints with SM-Pin Joint Seal (basic joint size NM015 - NM125)

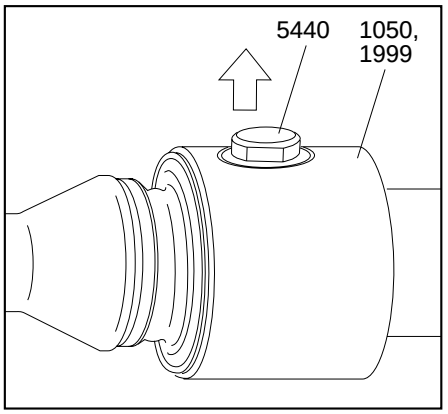
10.1 Removal of Rotor and Coupling Rod

Where a pump is fitted with a **ceramic** rotor (1999) the following operations should be carried out **with great care.** Do not use any force or sharp tools! Special care must be taken to prevent heavy strokes, vibrations or impact by a hammer.
For removal of the rotor (1999) and coupling rod (1998) the pin joints should be dismantled as follows:



- Place the dismantled unit – consisting of drive stool (0085) with drive (A) and connecting shaft (1050), coupling rod (1998) and rotor (1999) – on the work-bench with a wooden block supporting the rotor (1999).

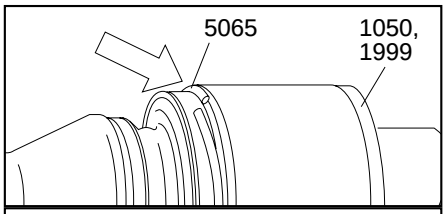
Basic joint size NM125:



- Unscrew the wear sleeves (5440) from the head of rotor (1999) or connecting shaft (1050)

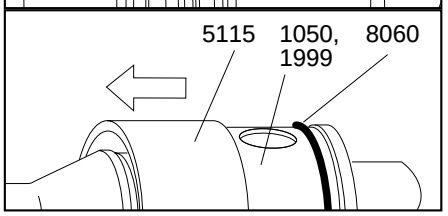
Basic joint size NM021 - NM105:

- Push circlip (5065) out of its groove and slip off over the head of rotor (1999 or connecting shaft (1050).



Pumps fitted with a ceramic rotor (1999):

- **Carefully** turn safety sleeve (5115) with a squeeze belt wrench, and remove.
The following method should **not** be employed for pumps fitted with a **ceramic** rotor.



Pumps fitted with a metallic rotor (1999):

- If necessary hit the edge of sleeve (5115) at an angle with the help of a wooden block and a plastic hammer. Taking care not to damage the O-rings (8060)!

Continued Page 10.0R

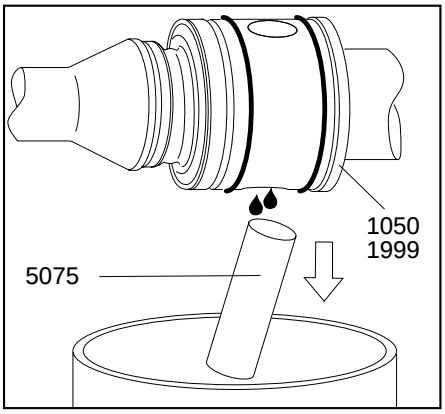
10 DISMANTLING AND ASSEMBLY OF THE ROTATING PARTS

Basic joint size NM021 - NM125:

- Press the pin (5075) out of the head of rotor (1999) or connecting shaft (1050). If necessary use a hammer and a thin cylindrical pin (DIN 6450 C).
  Drain the oil into a receptacle.

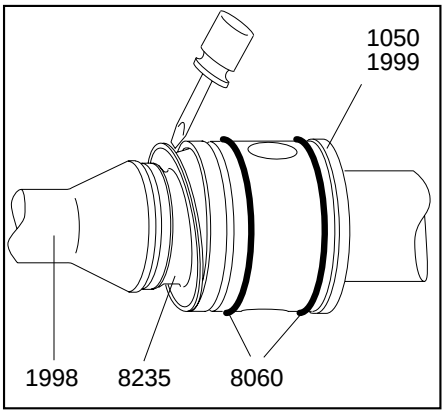
  Caution for pumps with ceramic rotors!

  Where a pin (5075) may not come out easily, the metallic head of rotor (1999) should be supported on wooden blocks. Then the pin (5075) can be driven out with the help of a pin punch (DIN 6450 C). This should be done **with care**, holding the **ceramic** rotor with your hands.
  Please dispose of this oil in the proper manner.

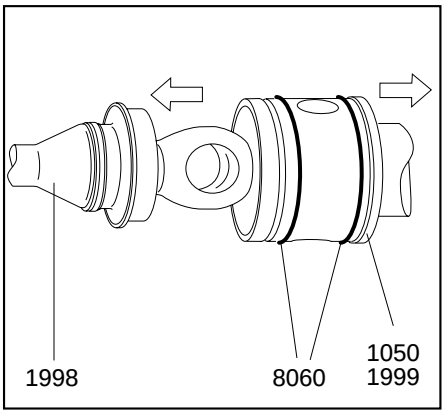


- Using a screwdriver, carefully lever the SM-pin joint seal (8235) out of the head of rotor (1999) or connecting shaft (1050).

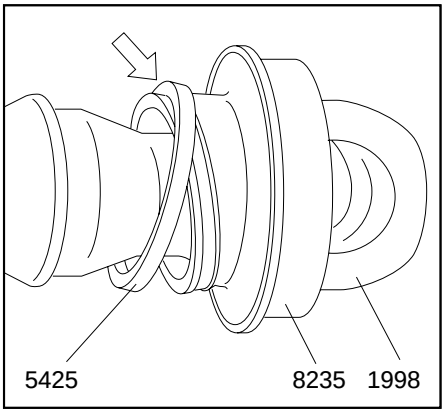
Taking care not to damage the SM-pin joint seal (8235)!



- Pull apart the rotor (1999)/ coupling rod (1998) / connecting shaft (1050) assembly. Remove the O-rings (8060).



- Push the SM-pin joint seal (8235) towards the head of coupling rod (1998). In the narrow coupling rod section press the clamp ring (5425) out of the groove of the seal. Then slip the SM-pin joint seal (8235) and clamp ring (5425) off over the head of the coupling rod (1998).

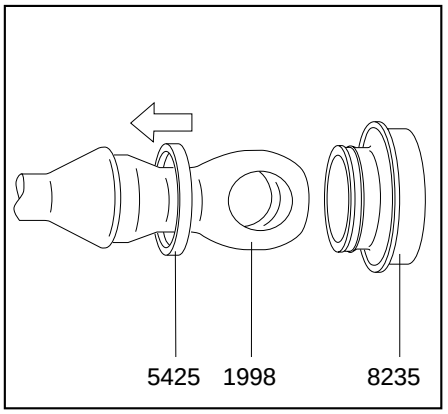


Continued Page 10.1

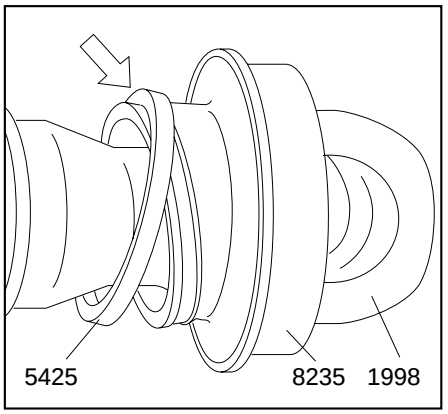
10.2 Fitting the Rotor and Coupling Rod

For fitting the rotor (1999) with coupling rod (1998), the two pin joints should be assembled as follows:

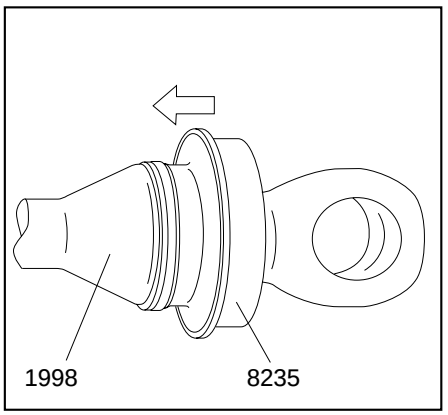
- Slip the clamp ring (5425) over the head of coupling rod (1998).



- Push the SM-pin joint seal (8235) over the head of coupling rod (1998) towards its narrow section, there sqeezing the clamp ring (5425) into the groove of the SM-pin joint seal (8235).



- Push the SM-pin joint seal (8235) with the correctly placed clamp ring (5425) up to the shoulder of coupling rod (1998).

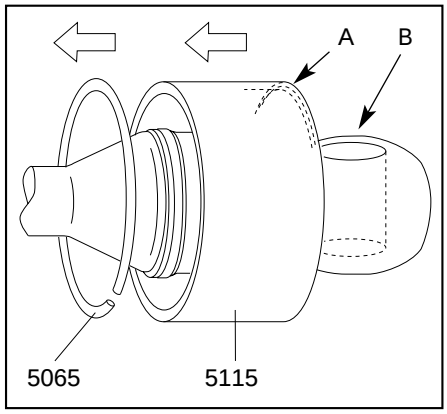


Continued Page 10.1R

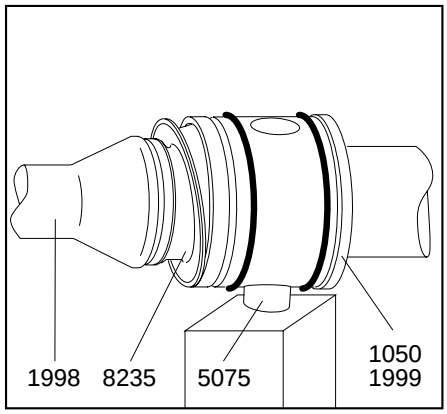
10 DISMANTLING AND ASSEMBLY OF THE ROTATING PARTS

Basic joint size NM021 - NM105:

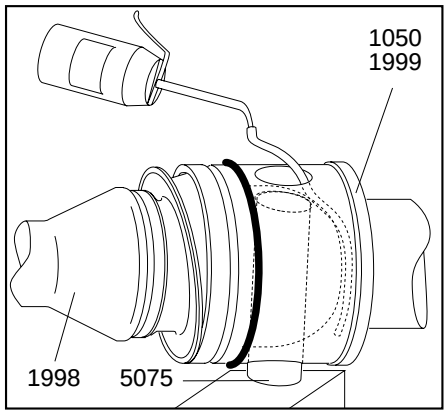
- Slip the circlip (5065) on to the coupling rod (1998). Slide the sleeve (5115) on to coupling rod (1998) so the inside diameter of chamfering (A) is being placed towards the coupling rod (1998) extension. Chamfering (A) will later on ease the installation over the O-rings (8060).
  Orient the head of coupling rod (1998) until it is in vertical position for the bore (B) for the pin (5075).



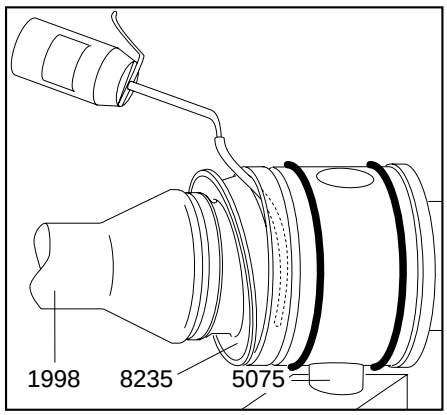
- Slide the coupling rod (1998) with SM-pin joint seal (8235) into the bore of rotor (1999) or connecting shaft (1050) and insert the pin (5075) from below and push up to the upper edge of coupling rod (1998).
  Support the pin (5075) against dropping out.
  Slide the SM-pin joint seal (8235) into the rotor (1999) or connecting shaft (1050) only from below, and in a slightly slanted position.



- For lubrication, use an oil can which should be fitted with a thin plastic hose having an outside diameter of not more than 4 mm.
  Insert this hose into the upper oil port opening in the rotor (1999) or connecting shaft (1050). Then slide the hose end past the coupling rod (1998) all the way down to the bottom section of the rotor head (1999) or connecting shaft (1050).
  Slowly fill with lubricating oil up to the filling port.

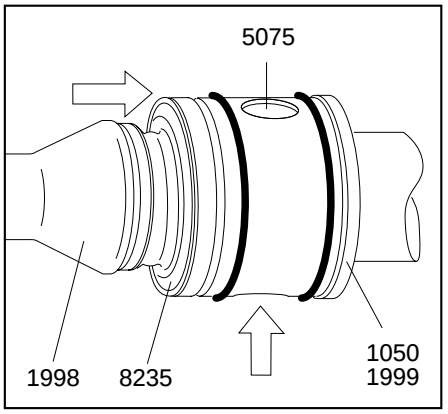


- Pull the hose out.
  Then insert the hose end through the small gap on the topside of SM-pin joint seal (8235) and guide it down to the bottom of the hollow space between coupling rod (1998) and SM-pin joint seal (8235).
  Slowly fill with lubricating oil up to the gap.

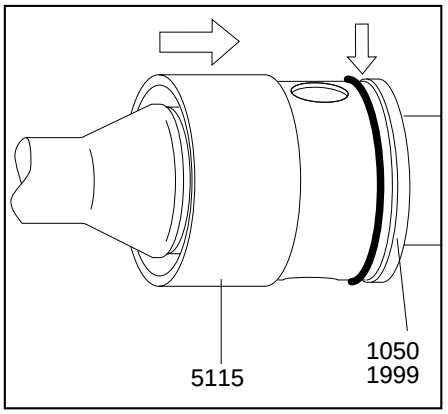


Continued Page 10.2

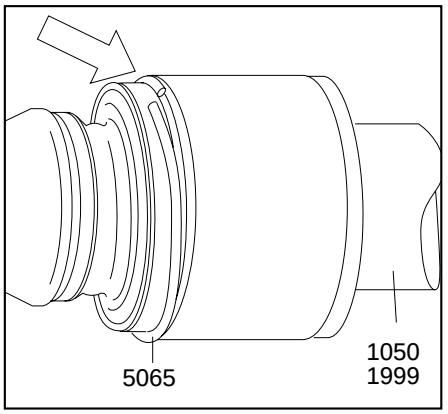
- Pull the hose out.
  Push the pin (5075) entirely into the bore of head of rotor (1999) or connecting shaft (1050) and retain in place.
  Only now, press the SM-pin joint seal (8235) into the bore of head of rotor (1999) or connecting shaft (1050) and push up to the shoulder. In doing so the SM-pin joint seal (8235) should be slightly bulbous around the outer surface. Wipe off overflow oil. Use this oil for lubricating the O-rings (8060).



- Slip the sleeve (5110) or (5115), with its chamfering (A) forward, on to the head of rotor (1999) or connecting shaft (1050) and push up to the shoulder.

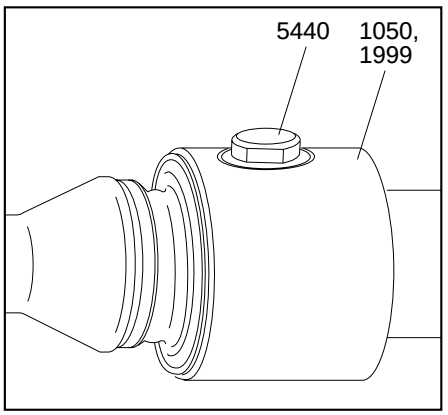


- Place the circlip (5065) into its groove on the rotor head (1999) or connecting shaft (1050) and carefully snap in place all around.

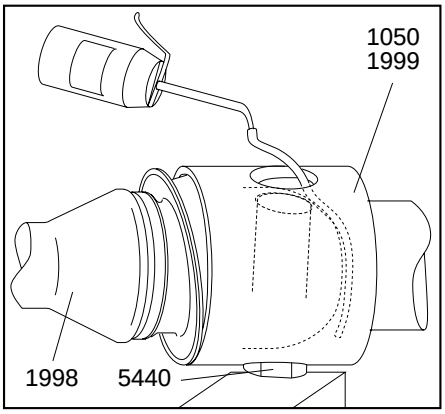


- **Basic joint size NM125:**

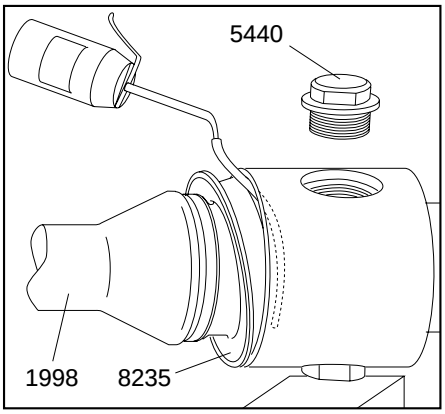
  Slide the coupling rod (1998) into the bore of the head of rotor (1999) and connecting shaft (1050) and insert the pins (5075).
  Insert the SM-pin joint seal (8235) (8235) into the head of rotor (1999) and connecting shaft (1050).
  Only then screw in one wear sleeve (5440) with O-ring (8060) into the head of rotor (1999) and connecting shaft (1050) and turn upside down.



- For lubrication, use an oil can which should be fitted with a thin plastic hose having an outside diameter of not more than 4 mm.
  Insert this hose into the upper oil port opening in the rotor (1999) or connecting shaft (1050). Then slide the hose end past the coupling rod (1998) all the way down to the bottom section of the rotor head (1999) or connecting shaft (1050).
  Slowly fill with lubricating oil up to the filling port.

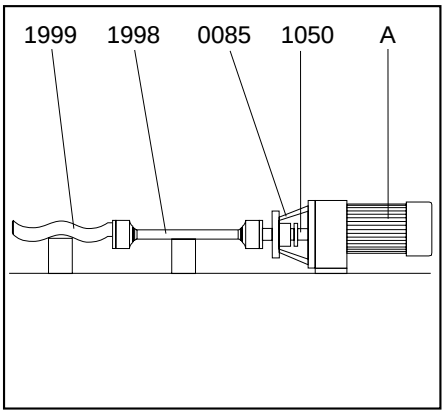


- Pull the hose out.
  Then insert the hose end through the small gap on the topside of SM-pin joint seal (8235) and guide it down to the bottom of the hollow space between coupling rod (1998) and SM-pin joint seal (8235).
  Slowly fill with lubricating oil up to the gap.
- Screw in the second wear sleeve (5440) with O-ring (8060) into the head of rotor (1999) and connecting shaft (1050).



- **Basic joint size NM021 - NM125:**

  Drive connecting shaft (1050), coupling rod (1998) and rotor (1999) are now joined by means of the two pin joints.
  Pump housing (2010), stator (3005) and end stud (2005) may now be fitted.



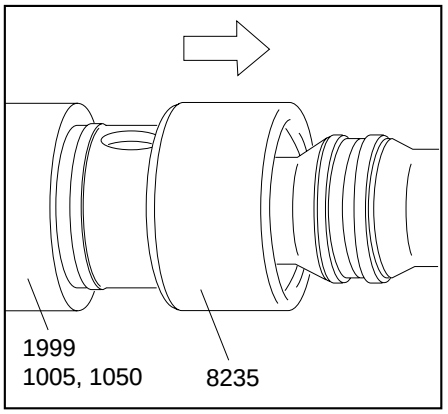
Continued Page 10.3

10.3 Dismantling and Assembly of the Rotating Parts with Pin Joints with SM-Pin Joint Seal (joint basic size NM015)

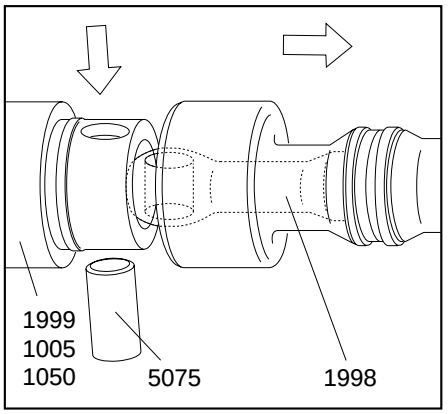
For removal and refitting of the rotor (1999) and coupling rod (1998) the pin joints should be dismantled and re-assembled as follows:

Dismantling:

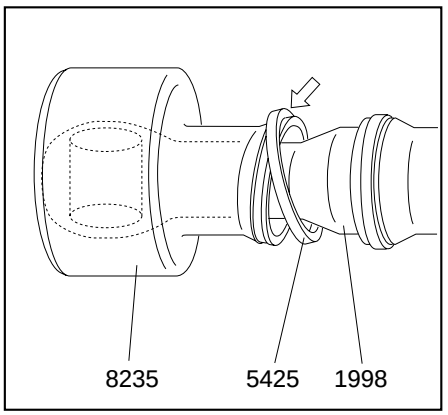
- Push the SM-pin joint seal (8235) away from the rotor (1999), drive shaft (1005) or connecting shaft (1050) so the bore for the pin (5075) comes free.



- Press the pin (5075) out of the rotor (1999), connecting shaft (1050) or drive shaft (1005). Then withdraw the coupling rod (1998) from the bore of rotor (1999), connecting shaft (1050) or drive shaft (1005).



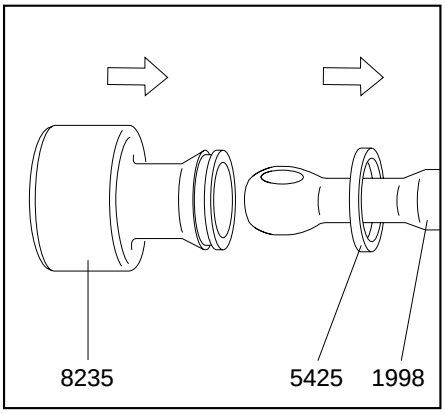
- Push the SM-pin joint seal (8235) towards the head of coupling rod (1998). In the narrow coupling rod section press the clamp ring (5425) out of the groove of the seal. Then slip the SM-pin joint seal (8235) and clamp ring (5425) off over the head of the coupling rod (1998).



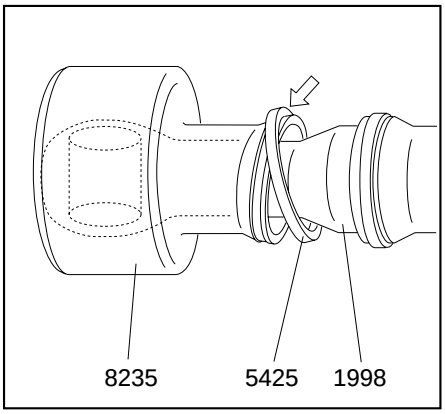
Continued Page 10.0R

Re-Assembly:

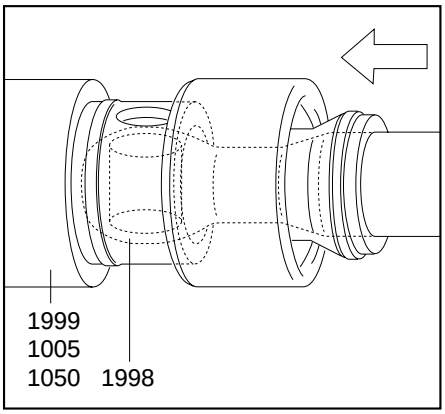
- Slip the clamp ring (5425) and the SM-pin joint seal (8235) on over the head of the coupling rod (1998).



- Push the SM-pin joint seal (8235) towards the narrow section on the head of coupling rod (1998) and place the clamp ring (5425) back into the groove of the SM-pin joint seal (8235).
  Then move the SM-pin joint seal (8235) up to the coupling rod (1998) shoulder.

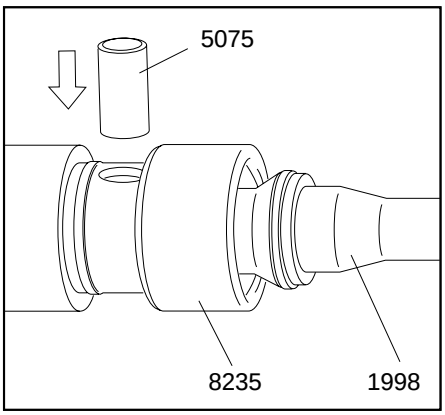


- Place the head of coupling rod (1998) into the bore of the rotor (1999), drive shaft (1005) or connecting shaft (1050).



- Join the rotor (1999), drive shaft (1005) or connecting shaft (1050) and coupling rod (1998) by the pin (5075).
  Then push the SM-pin joint seal (8235) up to the shoulder of the rotor (1999), drive shaft (1005) or connecting shaft (1050).

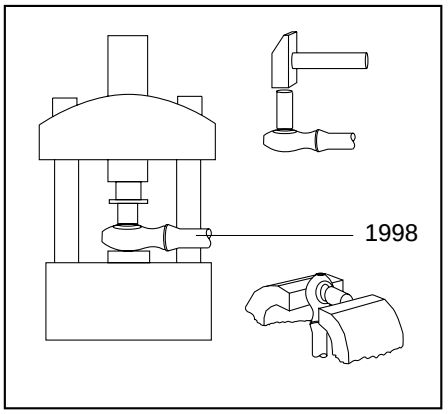
  Re-assemble the second pin joint in the same manner.



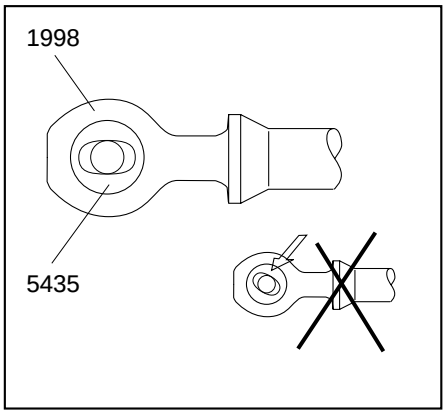
10.3 Replacing the Wear Sleeves of Adapter, Rotor and Coupling Rod

The wear sleeves (5435, 5440) have a very tight fit. A **press should be used** to remove or refit them.

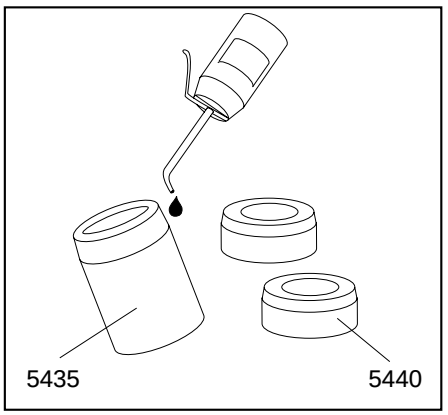
It may be possible though to drive the damaged sleeves out with a suitable mandrel. A rigid vice however is needed at the least for pressing new sleeves (5435, 5440) in again.



Orient the wear sleeves (5435) so that their oval bore agrees with the longitudinal axis of the coupling rod (1998).



- Generously oil the wear sleeves (5435, 5440).
- Every wear sleeve (5435, 5440) has got one smaller outer diameter on one end for better insertion into the bores of the coupling rod.
- Ensure the sleeves are placed in the correct orientation to the coupling rod (1998).



11 Removal and Fitting of the Connecting Shaft with Shaft Seal

Removal:

- Push the circlip (1035) in the direction to the mechanical seal.
- Remove pin (1030).
- Remove the shaft seal housing (7005) and mechanical seal (7010) together with connecting shaft (1050) and set ring (1035) from drive stool (0085) and the drive shaft.
  The thread of cylindrical head screw (1040) can be used as forcing screw.
- If a mechanical seal is installed, see description "Removal and Fitting of Mechanical Seal" after Page 12.0.

Fitting:

- Apply grease into the bore of the connecting shaft (1050) to avoid rust (e.g. TCE-Metallic 600).
- Assemble the shaft seal housing (7005) and mechanical seal (7010) together with connecting shaft (1050) and set ring (1035) with drive stool (0085) and push connecting shaft (1050) on to the drive shaft.
  At this please observe the installation direction of set ring (1035) (please see mark).
- If a mechanical seal is installed, see description "Removal and Fitting of Mechanical Seal" after Page 12.0.
- Connect the connecting shaft (1050) and the drive shaft by pin (1030).
  Push set ring (1035) on pin (1030).

12 Removal and Fitting of the Mechanical Seal

Utmost cleanliness must be observed for all removal and fitting activities.
Please avoid any damage to the sealing surfaces and gaskets.
Die Dichtungseinheit wird auf der Welle zerlegt.

- Remove all visible connecting screws and pull apart the seal housing on the shaft.
  The seal housing can be made up of several parts, depending on the seal construction.
  Compare the attached Sectional Drawing W…
- Carefully remove the housing parts from the shaft together with the seal counter face parts, one after the other.
- Carefully push the seal counter face parts out of the housing parts.

  Special care must be taken when fitting double PTFE-coated gaskets:
  the joint of the outer coating must point away from the seal assembly direction, otherwise the coating may open or be pulled off.

  Refitting is a simple reversal of the above procedure.

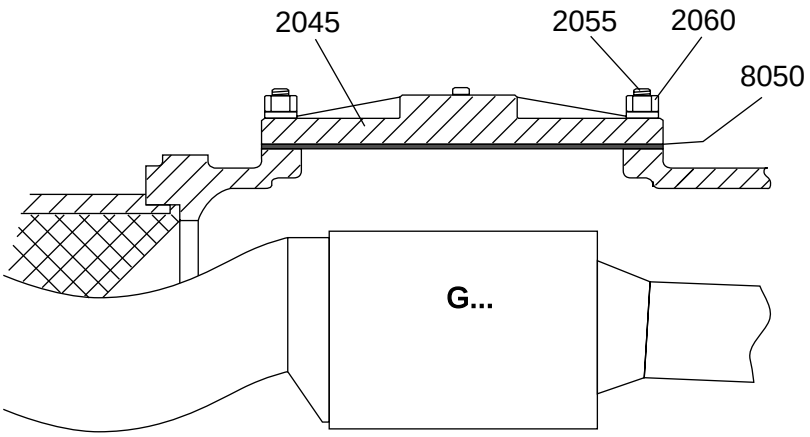
- To reduce frictional forces during seal assembly, apply some glycerine to the shaft and the seal housing in the area of the gaskets.

Ensure that the distribution of pressure is uniform when inserting the pressure sensitive counter rings.
When inserting larger rings, use a suitable mandrel.
Do not allow any foreign bodies to get between the sliding surfaces.

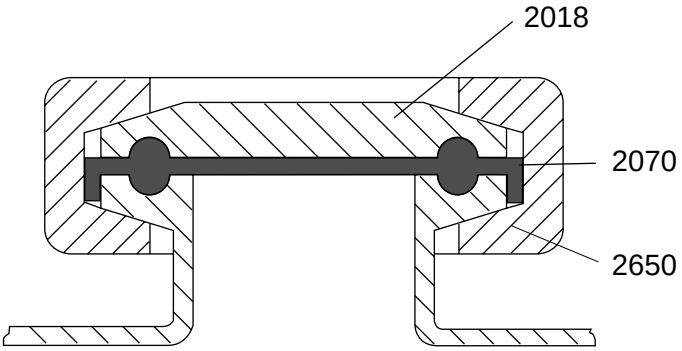
Important: Exactly keep to the seal installation dimensions and ensure that the sealing faces are correctly pressed together (see Manufacturer's catalogue).

Inspection Opening at the Pump Housing

gray cast iron model on from size NM045



design for welded housings – nominal size DN 76,1 – ISO 2852



14 Recommended Spare Parts

In general, we have all spare parts in stock. Our subsidiaries and exclusive representatives also hold a certain stock. For special cases and when short waiting periods are not acceptable, we recommend to keep an amount of spare parts, corresponding to the pump, in stock on site (please see table below).

- **Rotor**
- **Stator**
- **Elastomer parts as O-rings and sleeves**
- **joint parts**
- **shaft seals.**

To avoid mistakes in delivery, please identify the parts by their position number shown in the spare parts list or on the sectional drawing.

For placing a spare parts order, it is absolutely necessary to give the following details:

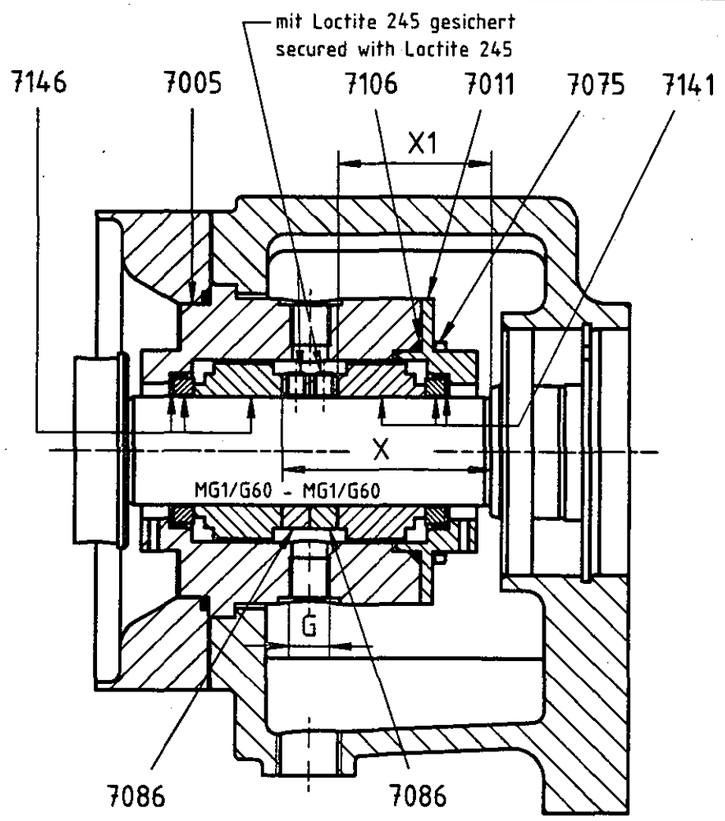
Pieces (see column 2) - Designation (see column 3) - Identification Number (see column 4)

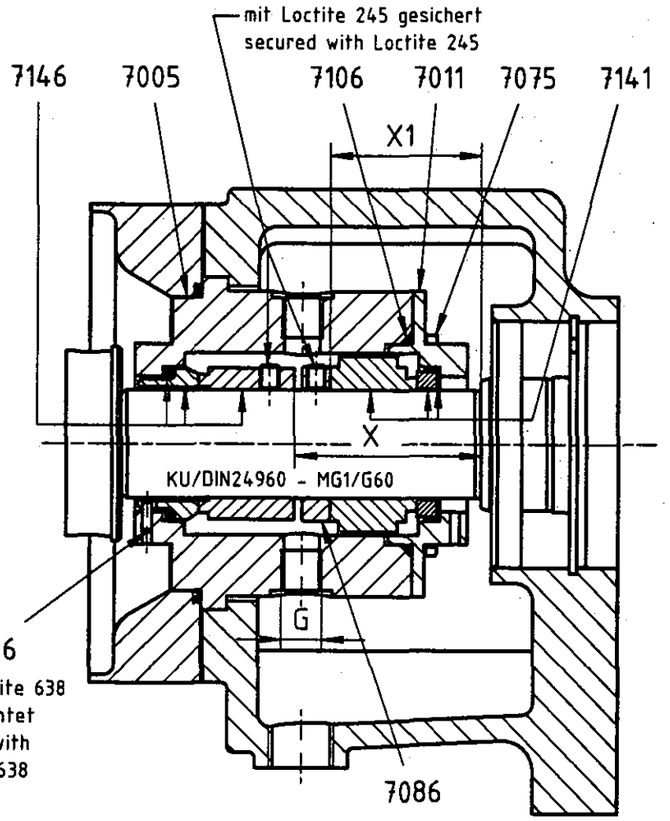
The column details are taken from the spare parts list. See example.

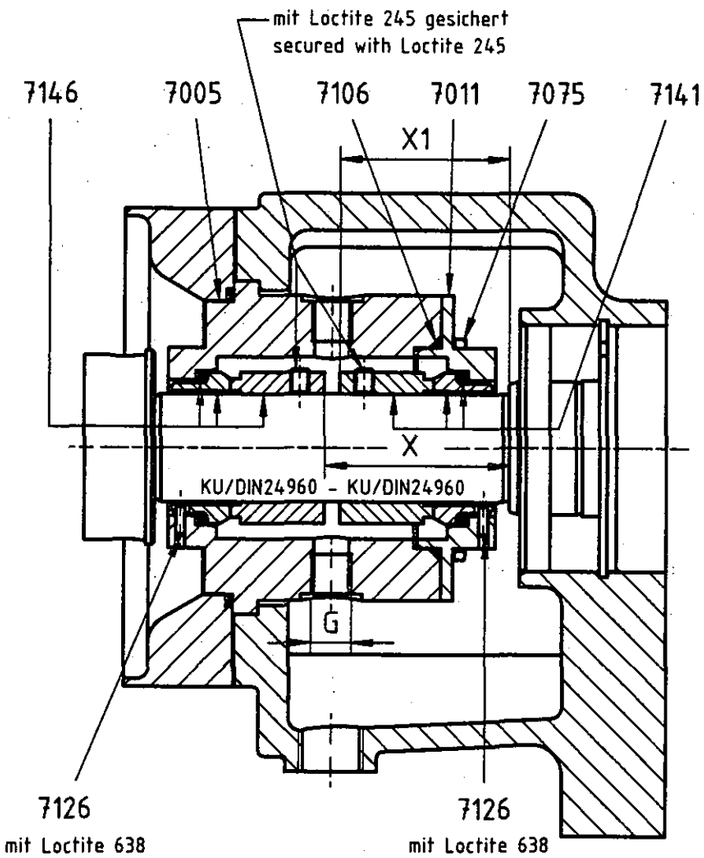
Example:

SPARE PARTS LIST		10.05.94		10:50:18	Page: 1 / 5
1		2		3	4
PART EURO	PART POS.	Quantity	Unit	Designation Size – Norm – Material/Surface	Ident-Number
3410	0005	1,000	pc	bearing housing	850221
2910	0010	1,000	pc	distance sleeve	850220
3520	0015	1,000	pc	bearing cover	850222

15 Sectional Drawings and List of Spare Parts







Type	GLRD Mechanical Seal	Einstellmaß "X" setting "X"	Einstellmaß "X1" setting "X1"	Spülanschluß "G" flushing connection "G"
NM031	MG1/G60 - MG1/G60	72	55	G 1/8
	KU/DIN24960 - MG1/G60	63,5	55	
	KU/DIN24960 - KU/DIN24960	63,5	63,5	
NM038	MG1/G60 - MG1/G60	63	46	
	KU/DIN24960 - MG1/G60	54,5	46	
	KU/DIN24960 - KU/DIN24960	54,5	54,5	
NM045	MG1/G60 - MG1/G60	67,5	49,5	G 1/4
	KU/DIN24960 - MG1/G60	61	49,5	
	KU/DIN24960 - KU/DIN24960	61	56	
NM053	MG1/G60 - MG1/G60	80	62	
	KU/DIN24960 - MG1/G60	74	62	
	KU/DIN24960 - KU/DIN24960	74	68	
NM063	MG1/G60 - MG1/G60	87,5	69,5	
	KU/DIN24960 - MG1/G60	81,5	69,5	
	KU/DIN24960 - KU/DIN24960	81,5	75,5	
NM076	MG1/G60 - MG1/G60	88	70	
	KU/DIN24960 - MG1/G60	86,5	70	
	KU/DIN24960 - KU/DIN24960	86,5	71,5	
NM090	MG1/G60 - MG1/G60	99,5	71,5	
	KU/DIN24960 - MG1/G60	98	71,5	
	KU/DIN24960 - KU/DIN24960	98	73	
NM105	MG1/G60 - MG1/G60	106,2	78,3	
	KU/DIN24960 - MG1/G60	97,5	78,3	
	KU/DIN24960 - KU/DIN24960	97,5	87	

NETZSCH

Zeichnung-Nr.: Drawing No.: W259.000

Dopp. wirk. GLRD
Back to back
Double Mechanical Seal
Back to back

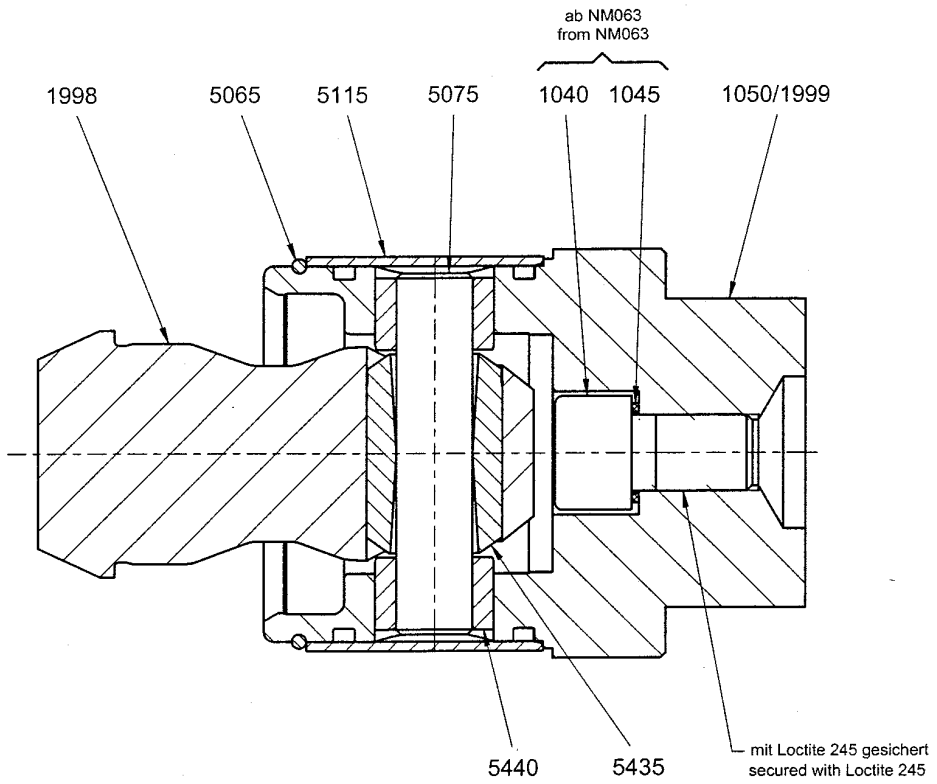
Type: NM031S- (P) - NM105S- (P)

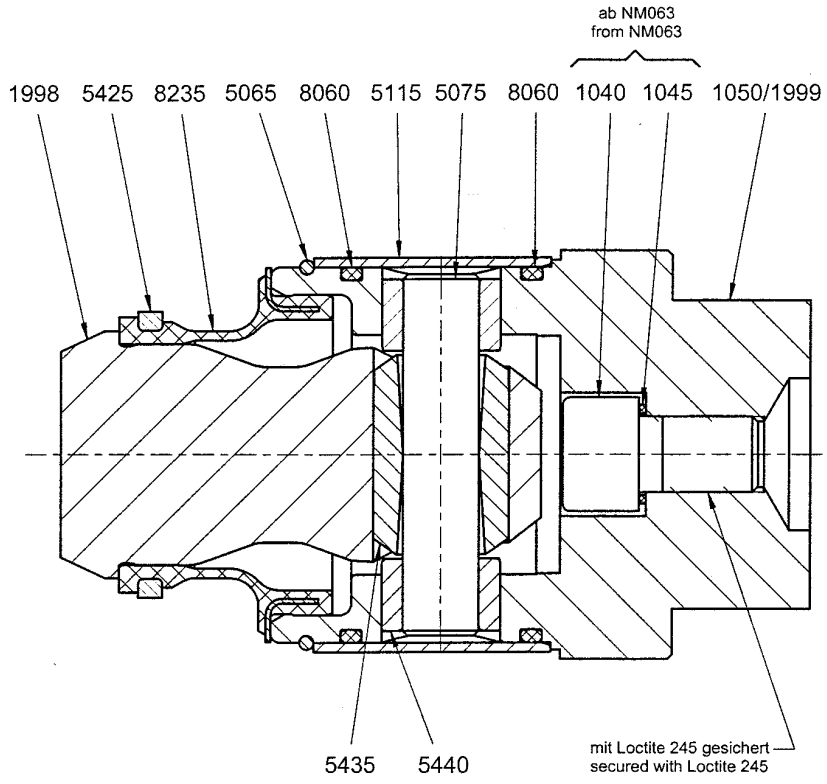
Maßst./Scale: 1 : X	Datum / date	Name / name	Unterschrift/Signature
gezeichnet / drawn	27.05.2011	Preintner	
geprüft / checked	27.05.2011	Thoma	
freigegeben / released	27.05.2011	Denk	

Verteiler: Distributor: 2 / 3 / 50 / 51 / 52 / 58 / 94 / 95 / 98

Revision: 2

Ersatz für Ausgabe vom: Replacement for Version of: 16.02.2010





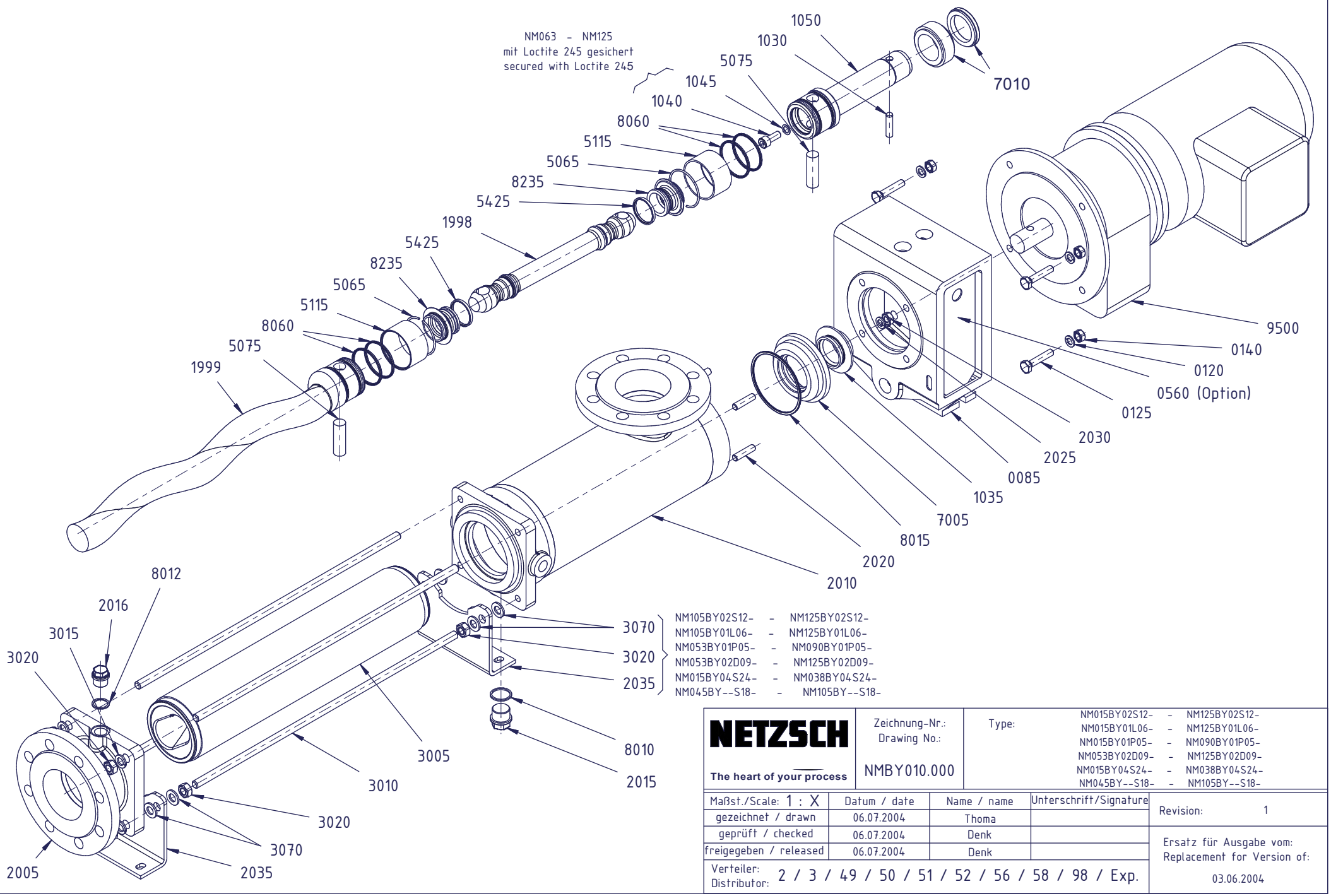
Maßst./Scale: 1 : X	Schnitt-Zeichnung-Nr.: Drawing No.: G147.000	Bolzengelenk mit Verschl.-Buchse ohne/mit SM-Bolzenabdichtung Pin Joint with Wear Sleeves without/with SM-Pin Joint Seal	Type: NM045B- (P) - NM105B- (P)
Abl./Storage: -			

	Datum / date	Name	Unterschrift/Signature
gezeichnet / drawn	23.05.2003	Preintner	Preintner
geprüft / checked	23.05.2003	Denk	Denk
freigegeben / released	23.05.2003	Denk	Denk

Verteiler: Distributor: 2 / 3 / 50 / 51 / 52 / 58

Revision:

Ersatz für Ausgabe vom: Replacement for Version of:



3070	NM105BY02S12- - NM125BY02S12-
	NM105BY01L06- - NM125BY01L06-
3020	NM053BY01P05- - NM090BY01P05-
	NM053BY02D09- - NM125BY02D09-
2035	NM015BY04S24- - NM038BY04S24-
	NM045BY--S18- - NM105BY--S18-

NETZSCH

The heart of your process

Zeichnung-Nr.: Drawing No.: NMBY010.000

Type:

NM015BY02S12-	-	NM125BY02S12-
NM015BY01L06-	-	NM125BY01L06-
NM015BY01P05-	-	NM090BY01P05-
NM053BY02D09-	-	NM125BY02D09-
NM015BY04S24-	-	NM038BY04S24-
NM045BY--S18-	-	NM105BY--S18-

Maßst./Scale: 1 : X	Datum / date	Name / name	Unterschrift/Signature
gezeichnet / drawn	06.07.2004	Thoma	
geprüft / checked	06.07.2004	Denk	
freigegeben / released	06.07.2004	Denk	

Verteiler: Distributor: 2 / 3 / 49 / 50 / 51 / 52 / 56 / 58 / 98 / Exp.

Revision: 1

Ersatz für Ausgabe vom: Replacement for Version of: 03.06.2004

Inquiry/Order Form Spare Parts

►Please copy before use

☐ Inquiry ☐ Order

Netzsch Pumps North America, LLC
119 Pickering Way
Exton, PA 19341-1393

Tel: 1-610-363-8010
npa@netzsch.com
www.netzsch.com

Company Address

Person in Charge

Tel:

Fax:

Delivery address

Billing address

Important: Please fill in		
Machine #	Pump Com #	Type
Quantity	Pos. No.	Description

Required delivery date_____

Address_____

Date_____ Signature/co. stamp_____