

Operating and Maintenance Instructions

NEMO®-Pump

Type of machine

NM090SY02S12B

Number of confirmation order

Number of machine

912520

Date of issue

C105.5.2.120130

Important Note

These Operating Instructions are designed to familiarize the User with the machine and its designated use.

The Instruction Manual

- is valid only for this machine (pls. see machine-no. / conf. no.)
- contains important information on how to operate the machine safely, properly and efficiently. Observing these instructions helps 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, repair) and/or **transport**;

- shall be completed by the Enduser and his 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 mandatory rules 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 also be observed.

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

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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

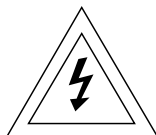
necessary to observe the special safety rules included in other sections of the manual, eg. for private use.

1.1 Safety Signs

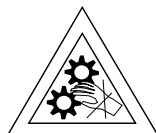
The signs below are printed in the manual as general hazard / danger symbols to mark those safety instructions whose non-observance can result in danger to personnel or to the machine / equipment. These signs are:



Hazard sign DIN 4844 - W9
Danger to general public



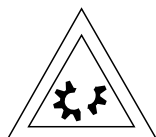
Hazard sign DIN 4844 - W8
Risk of electric shock



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.

Responsibilities

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

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- ▲ 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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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.

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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 immersed 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

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2 Description

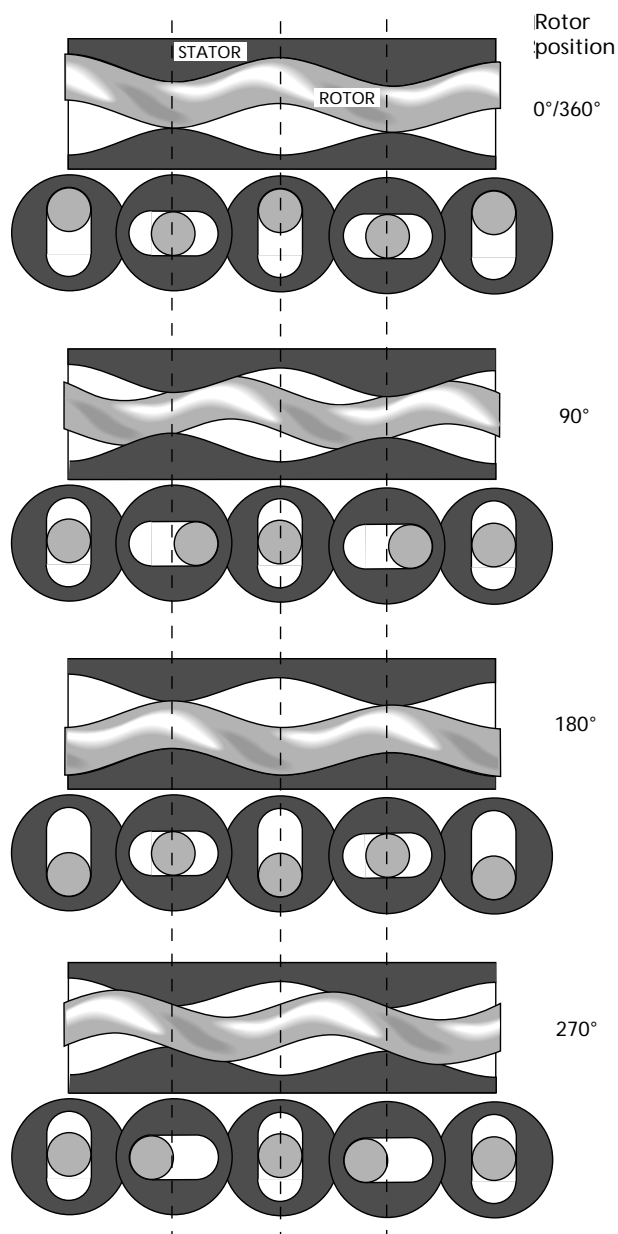
The NEMO[®] pump is a progressing cavity pump.

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:

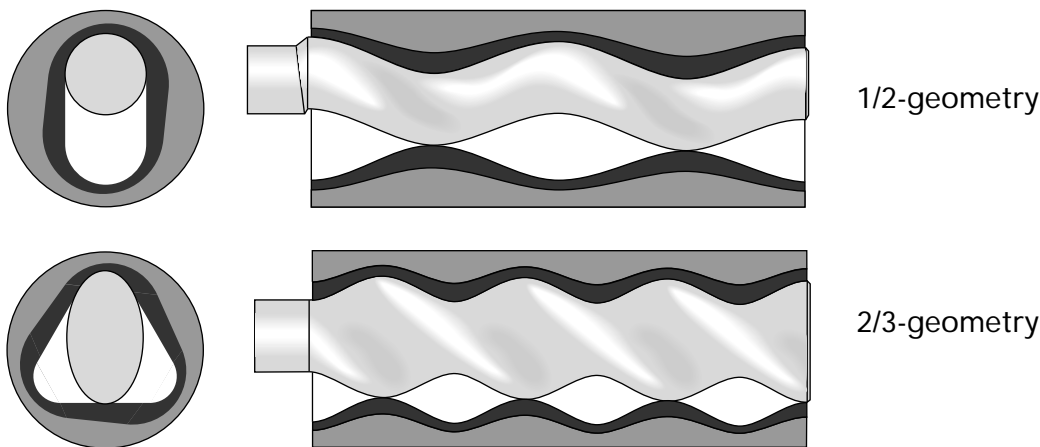
- Like centrifugal pumps NEMO[®] pumps have no suction or pressure valves, but do have a stable flow rate in proportion to the number of revolutions.
- Like piston pumps NEMO[®] pumps have a suction capability of up to 8.5 m vacuum metric.
- Like membrane and peristaltic pumps the NEMO[®] pump can transport 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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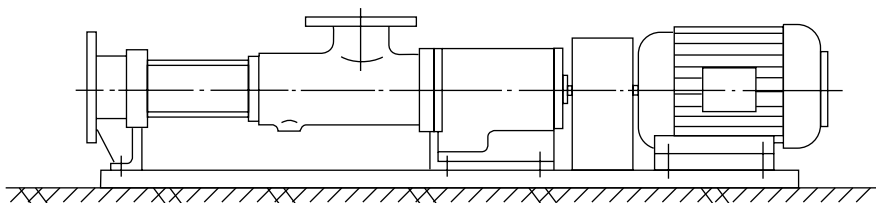


Length and cross-sections through the stator with rotor
with reduced stator wall thickness

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.



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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.

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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

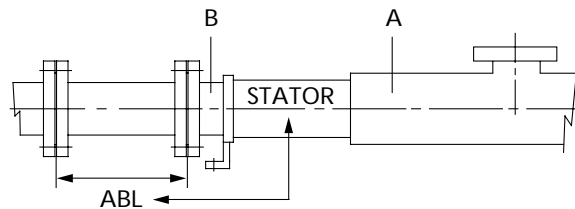
- Arrange suction and pressure pipes so that when the pump is not
running, the medium is still present before and after the pump.
Sufficient media should remain inside in order to lubricate the
pump during restart.

Continued Page 4.0R

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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	-
1 0 5	630	1180	-	-

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

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4 INSTALLATION INSTRUCTIONS

PAGE
4.1

Type key

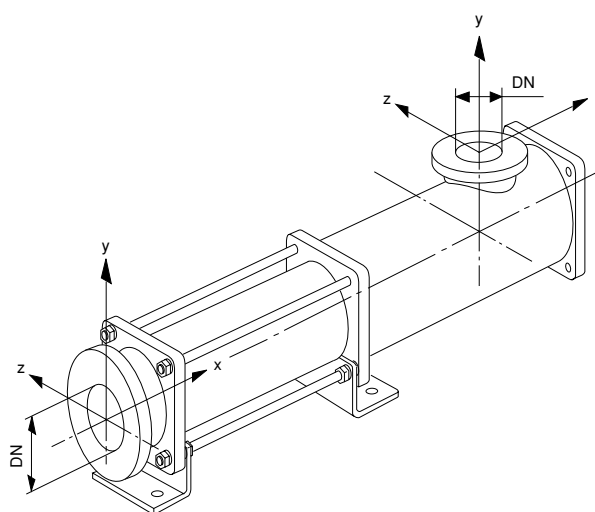
Example:

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

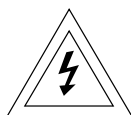
	Date	Name	Signed	Revision:
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Pump type NM	Standard nominal diameter DN	F_x, F_y, F_z N	M_x, M_y, M_z Nm	
015 021	(32) G 1 1/4 "	425	(215)	Screwed joints must not be charged with loads which may result in tightening or loosening these joints
31	50	680	350	
38	65	850	435	
45 53	80	1020	520	
63	100	1360	695	
76	125	1700	865	
90 105	150	2040	1040	

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, Annex I, Section 1.2 Controls** be carefully observed!

Note:

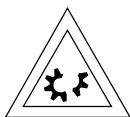
The original edition has the name **Directive 89/392/EWG**.
It has been changed several times since its first issue.

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5 Start-up

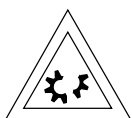
The NEMO[®] pump design requires strict attention to the following:



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!

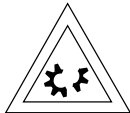
- Open valves and vents before starting the pump!
- Check the direction of rotation by briefly switching on the pump motor.

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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.

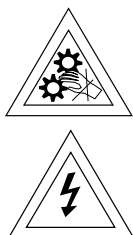
	Date	Name	Signed	Revision: 4
issued	04.11.97	Mangel		Substitute for issue of 09.12.94
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released	06.11.97	Hantschk		text no. 30100 
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7 Maintenance

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 accidentally (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)).

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released	31.10.96	Hantschk		
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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.

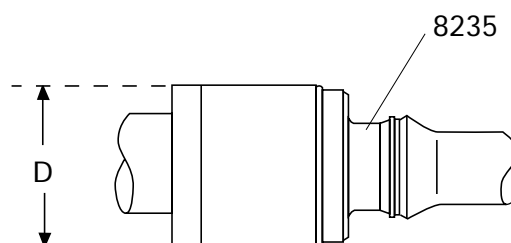
	Date	Name	Signed	Revision: 2
issued	07.12.94	Mangel		Substitute for issue of 18.03.94
approved	08.12.94	Eitler		
released	09.12.94	Hantschk		text no. 30100 
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7.3 Lubricating the Pin Joints with SM-Pin Joint Seals


- 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)	Joint basic 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




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Lubricating Oil:

Industrial application	Designation DIN 51502	Permitted Product
Food and Beverage Industry only	Authorized for use in foodstuffs <div>CLP HC 460</div>	"KLÜBER" KLÜBEROIL 4 UH 1 - 460 authorized under USDA H1
<div>  <p>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!</p> <p>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.</p> <p>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.</p> </div>		
General Industry	<div>CLP 460</div>	"SHELL" Omala 460
	with SM-pin joint seal (8235) of EPDM <div>CLP PG 320</div>	prescribed: KLÜBERSYNTH GH 6-320

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	released	24.06.03	Denk	
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7.4 Shaft Sealing through Stuffing Box

7.4.1 Putting Into Operation

Before operation, it should be found out by visual check or on the order confirmation whether the stuffing box housing is fitted with buffer fluid connections and equipped with a buffer ring (7050).

With a buffer ring (7050) fitted between the packing rings and suitable connection bores provided in the stuffing box housing, it will be possible to proceed as follows:

- Adding a clear liquid as buffer medium under slight excess pressure. This applies for dirty or dangerous media or for the exclusion of air at suction operation of the pump.
- Adding a lubricant.
- Adding a cooling or warming fluid or steam.

For a) and b) it is usually enough to just add the buffer medium. However, the second connection in the stuffing box housing should then be closed off.

For c) it is necessary to feed in and carry away the medium via the two connection bores.

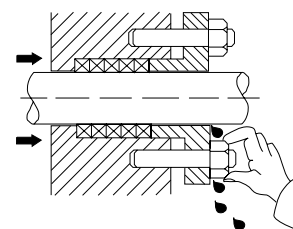
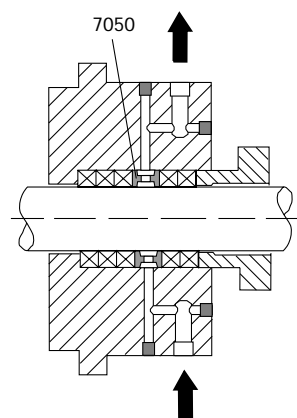
If for a compelling reason a stuffing box with buffer ring has to be operated without a medium as described in a) to c), it is essential to ensure that all the connection bores in the stuffing box are tightened with plugs (please note the material resistance!). This is especially important when the pump has to prime as otherwise air will be drawn in through the bores.

Stuffing box packings have the function of **minimizing, but not totally eliminating** the escape of medium. A lubricant or liquid coating is required to reduce the shaft wear to a minimum and dissipate the heat caused by friction.




**Avoid touching the rotating shaft.
Risk of injury where the pin is visible!**

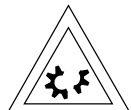
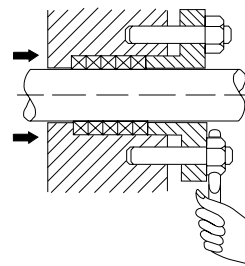
The stuffing box gland should therefore be tightened only gently by hand prior to putting into operation. A high initial rate of leakage should be permitted, particularly with PTFE or PTFE-impregnated packings; 50 – 200 drops/min depending on the medium and sliding velocity.



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During the 30 minute running-in time the minimum leakage rate should be set by tightening the gland nuts in steps approx. 1/6th of a turn each. The stuffing box temperature should not rise above normal, about 20 – 60 °C above the temperature of the medium is permissible.



If there is a sudden jump in temperature and a notable reduction in leakage, the gland must be slackened immediately and running-in repeated.

The attainable leakage amounts depend, among other things, on the medium, pressure, temperature, leakage gap, sliding velocity, shaft movement and the packing material used.

In the event of increased peripheral leakage i.e. around the stuffing box outer edges, the pump should be stopped and the packing rings briefly compressed. Then the gland should be slackened and running-in repeated.

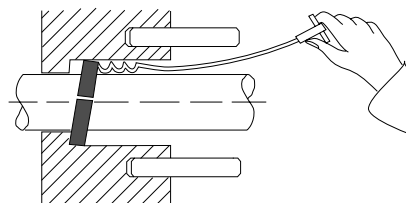
7.4.2 Replacement



Please observe Safety Precautions 1.5, 1.6 und 1.8 !

Removal of old packing

After releasing the pressure on the unit and removing the gland, use the packing extractor to remove all the old packing rings and debris right down to the bottom of the stuffing box.



Preparation of the stuffing box area

Thoroughly clean the stuffing box area and the shaft surface. Replace corroded or worn shafts or sleeves. Check the shaft bearing and the shaft concentricity. Examine the gap in the gland and stuffing box base. To reduce an excessively large gap, insert a washer or disc in order to prevent the packing material from being extruded into the gap. An alternative is to use extrusion-resistant packing material for the first and last packing ring.

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Selection of grade and size of packing

Before installing the packing, check once again whether you have chosen a packing suitable for the operating conditions required.

Cutting the packing rings

Exactly cut rings are required: a packing cutter ensures exactly cut rings.

If no cutter is available, proceed as follows:

The ring cutting length L_M is determined by the shaft diameter d and the packing width s under the following formula:

$$L_M = (d+s) \cdot X \cdot \pi \text{ (mm)}$$

X = allowance factor:

$X = 1.10$ for shaft dia ≤ 60 mm

$X = 1.07$ for shaft dia ≤ 100 mm

$X = 1.04$ for shaft dia > 100 mm

These are mean values which may vary with specific packing grades and types of application.

Example:

Shaft diameter $d = 60$ mm

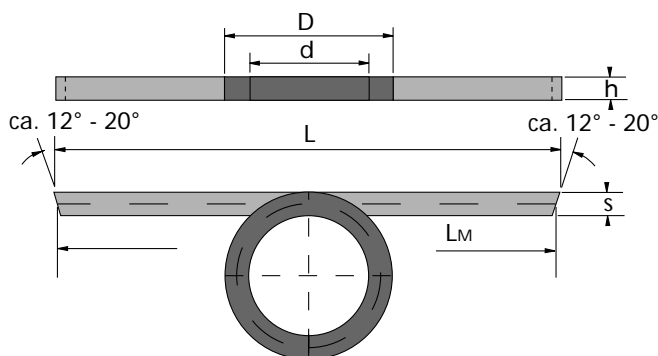
Stuffing box diameter $D = 80$ mm

Packing width s :

$$s = (D - d) / 2 = (80 - 60) / 2 = 10 \text{ mm}$$

Cutting length L_M :

$$L_M = (d + s) \cdot 1.10 \cdot \pi = (60 + 10) \cdot 1.10 \cdot \pi = 242 \text{ mm}$$




Straight cuts

For rotating shafts we generally recommend cutting the packing straight and at right angles to the shaft. In order to achieve parallel contact of the cut ends without a gap when closing the packing ring, the cutting angle on both ends should be about 12–20°.

By applying the above formula or using the packing cutter, the cut ring will be slightly overlong.

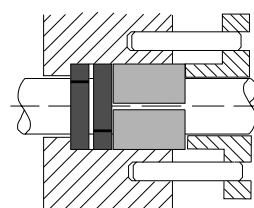
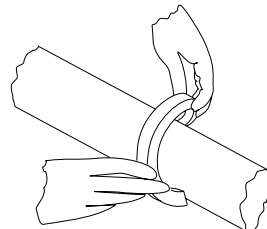
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In conjunction with the straight cut this results in a slight bracing of the rings against the stuffing box outer diameter, thus preventing co-rotation of the packing rings on the product side as well as leakage to the outside.

Installation

- Carefully twist open the die-pressed rings in axial and radial direction just far enough to enable them to be easily slipped over the shaft. Excessive bending of the rings can cause structural damage through kinking.
- Install each ring separately as follows:
 - insert into stuffing box with cut ends first
 - place around shaft with each next cut ends turned by 90°
 - push into stuffing box compartment by means of assembly shells or gland.



Never use pointed objects for this operation!
Risk of damaging the shaft and deforming the packing material!

- Only continue inserting rings into the stuffing box until the gland projects for guidance into the stuffing box compartment by at least approx. 1/2 of the packing width "s".
- Now press the rings home with the gland and tighten the nuts by hand. Where a buffer ring is fitted, check that it is correctly positioned to the connection even after the gland has been tightened.

7.4.3 Important Notes

Correct:

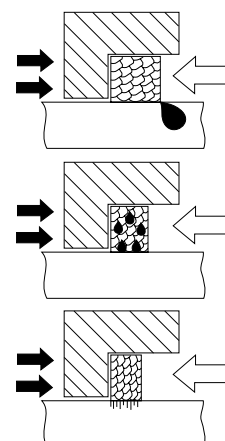
Lubrication through liquid or lubricant.

Not correct:

Lack of lubrication by liquid due to excessive tightening of the gland nuts; impregnation squeezing.

Consequences

due to excessive gland compression:
Dry running, burning of packing; heavy wear on the seals and therefore high leakage.



Source reference:

This material (abridged and adapted) is taken with kind approval from the catalogue of Burgmann / Wolfpratshausen. It is also valid for other gland packing manufacturers.

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	approved	23.05.95	Eitler	
GB text no. 30100	released	24.05.95	Hantschk	
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7.5 Shaft Sealing through Single Mechanical Seal

There are various constructions of mechanical seals. Especially advantageous is the use of standard mechanical seals according to DIN 24960. These seals have regardless of their brand the same fitting dimensions which makes them interchangeable. Mechanical seals with a coil spring can only be used for pumps which are run in one direction of rotation.

- The seal specification of a NEMO[®] pump is recorded on the order confirmation sheet.
- Pumps fitted with direction dependent seals should **never** be run in the opposite direction of the rotation arrow.
- If excessive leakages occur the spring tension and the seal surfaces should be checked, and the seal be replaced, if necessary.

Single mechanical seals usually work without any additional equipment. Their application range can be increased by operating them with a rinsing or cooling system.

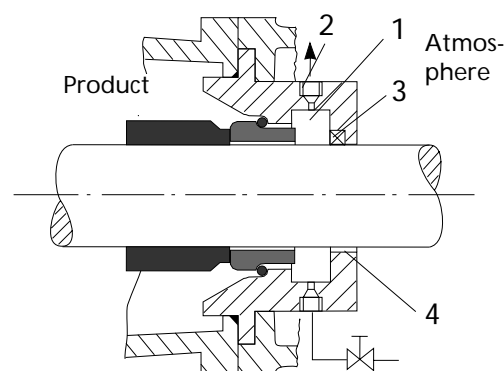
a) **Quench**, in accordance with ISO 5199, Appendix E, Plan Nos. 08, 09, 10 or 13 or API 610, Appendix D, Plan No. 62.

Quench is the designation commonly used in sealing engineering for an arrangement that applies a non pressurized external fluid to the atmospheric side of a mechanical seal. The quench is used when


- a single mechanical seal will not work or only to a limited extent without auxiliary measures or
- a double mechanical seal with pressurized buffer fluid is not necessary.

Recommended for the following applications:

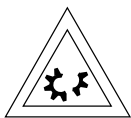
- Low temperature (danger of freezing)
- Operation in a vacuum (dry running)
- Media which must be isolated from the atmosphere (eg. due to build up of solid deposits or because of less severe damage to the environment, like smell).



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Leakages will be transported away by the quenching liquid.
In vacuum operation dry running of the seals is avoided.



No pressure higher than that of the pumped medium **in front** of the mechanical seal is allowed to build up in the quenching area (1) **behind** the mechanical seal. Otherwise the counter ring will be pushed out of the housing. **Free discharge** from (2) is necessary!

Closing off the quenching area from the atmosphere can be done in three ways:

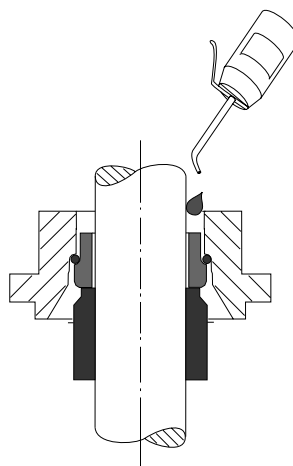
1. In the case that high emission levels can be tolerated:
Through a throttle bush (4). Cooling liquid not permanently used, only released from time to time.
2. In the case that medium emission levels can be tolerated:
By a radial shaft seal ring (3). Permanent radial shaft seal lubrication through quenching liquid is necessary.

b) Top lubrication

Attention: For vertically installed pumps with overhead drive as type NT:

On initial start-up the mechanical seal has not come in contact with the medium. It runs therefore dry for a short period of time until the air is displaced from the pump housing.

- On first start-up and if stood idle for longer periods lubricate the mechanical seal before switching on the pump.
- Apply water, glycerine or oil depending on their compatibility with the pumping medium and the elastomer of the mechanical seal.
- Fill the quench cup of the mechanical seal housing.



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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

	Date	Name	Signed	Revision: 2
issued	20.09.95	Mangel		Substitute for issue of 18.03.94
approved	21.09.95	Eitler		
released	22.09.95	Hantschk		text no. 30100 
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Possible Problems									
The pump is no longer starting	X	X							
The pump is no longer sucking									X
The pumped medium is too little		X	X						
The pressure is too low		X							
The pumped medium is unstable									
The pump is running loudly									
The pump is stuck			X	X	X	X	X	X	
The drive is overloaded	X	X	X	X	X	X	X	X	X
The stator life time is too short			X	X			X	X	
The rotor life time is too short									
The shaft seal is leaking	X	X	X					X	

Possible Causes (Remedy overleaf)

Mechanical seal : elastomers damaged, swollen or brittle.

Revision:		Date	Name	Signed
Substitute for issue of	issued	20.09.95	Mangel	
	approved	21.09.95	Eitler	
 text no. 30100	released	22.09.95	Hantschk	
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8 TROUBLE-SHOOTING AND REMEDYING

PAGE
8.1

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 turbulence 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.

	Date	Name	Signed	Revision: 3
issued	18.10.95	Mangel		Substitute for issue of 22.09.95
approved	19.10.95	Hantschk		
released	20.10.95	Hantschk		text no. 30100 
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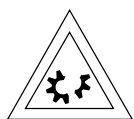


9 Removal and Fitting of End Stud, Stator and Pump Housing



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.

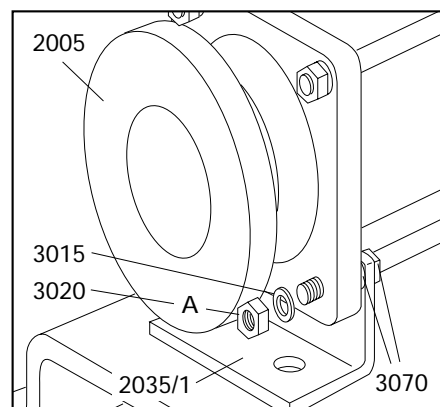
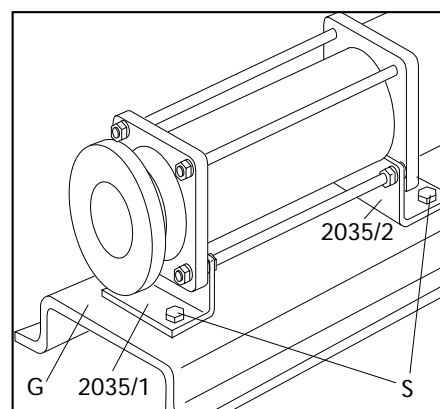
Caution for pumps with ceramic rotors!



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).

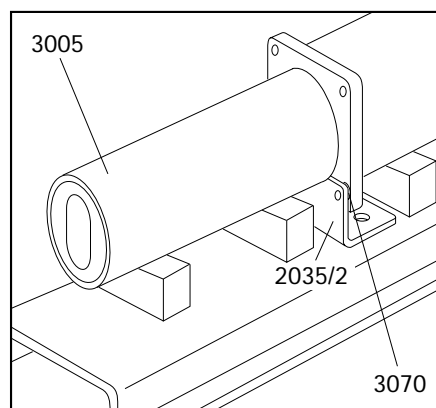
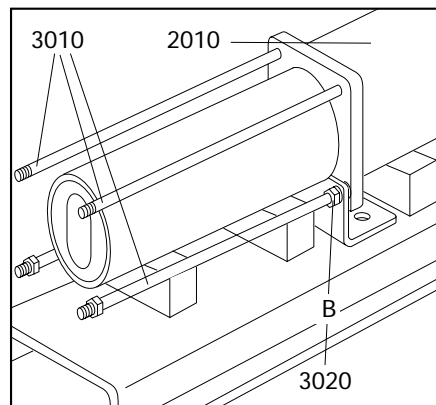


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	Date	Name	Signed	Revision:
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released	25.06.03	Denk		text no. 30100
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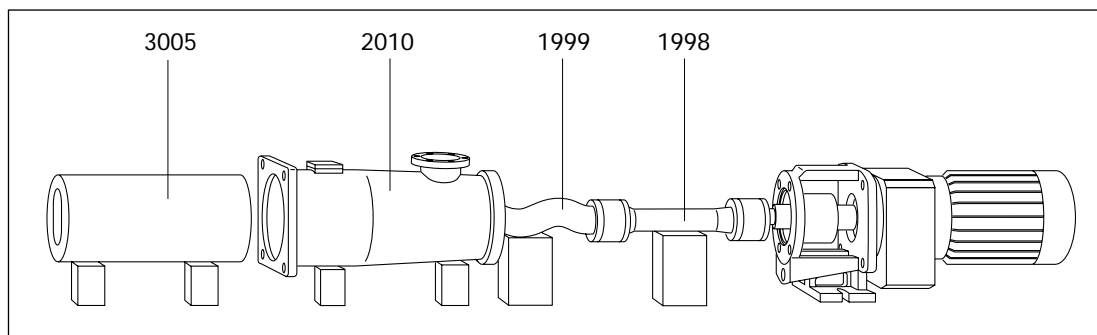
9 DISMANTLING AND ASSEMBLY OF THE PUMP HOUSING

- 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

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	approved	25.06.03	Denk	
 text no. 30100	released	25.06.03	Denk	
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9 DISMANTLING AND ASSEMBLY OF THE PUMP HOUSING

PAGE
9.1

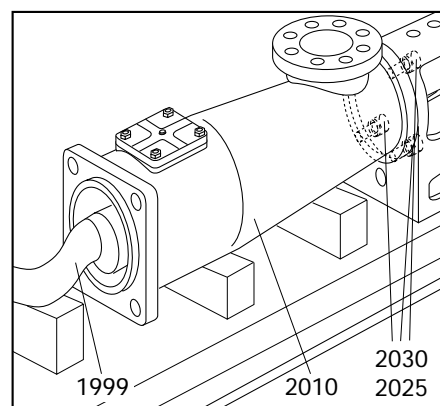
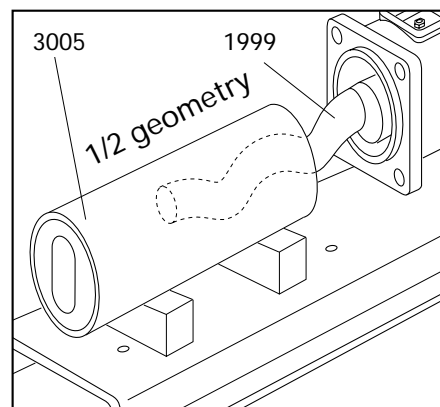


Caution for pumps with tubular rotors:

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.

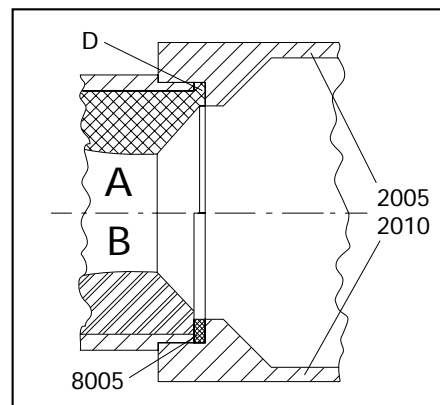
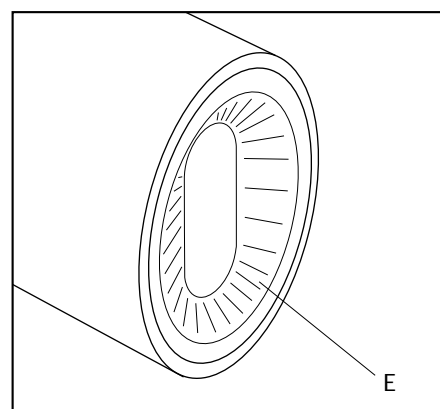
Ensure that protective measures have been taken when pumping dangerous media!

- 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).



Continued Page 9.1R

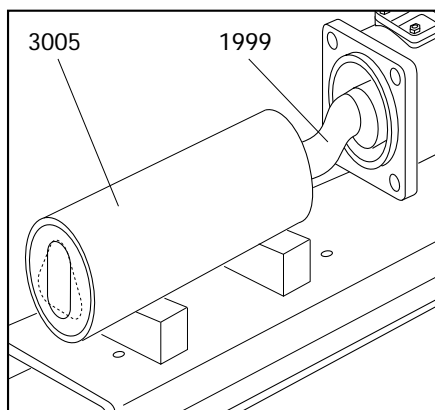
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9 DISMANTLING AND ASSEMBLY OF THE PUMP HOUSING

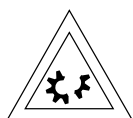


Be careful when engaging the stator (3005) and rotor (1999). Do not trap your fingers!
Do not reach inside the stator!

- 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):

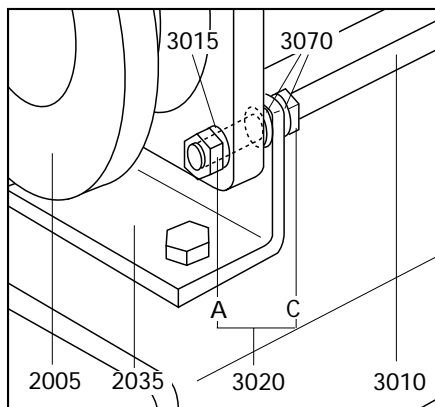
Size	M6	M8	M10	M12	M16	M20	M24	M30
Required torque Nm	8	15	30	45	75	80	100	120

- Fastening the end stud (2005):

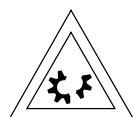
Screw the hex nuts C (3020) down into the thru bolts (3010) as far as possible.

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.

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10 Dismantling and Assembly of the Rotating Parts with Pin Joints with SM-Pin Joint Seal

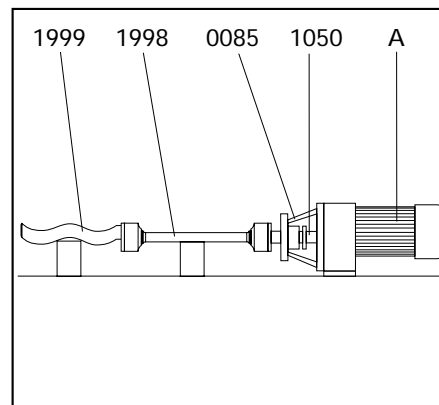
10.1 Removal of Rotor and Coupling Rod

Where a pump is fitted with a **ceramic** rotor (1999) the following operations should be carried out **with great care**.

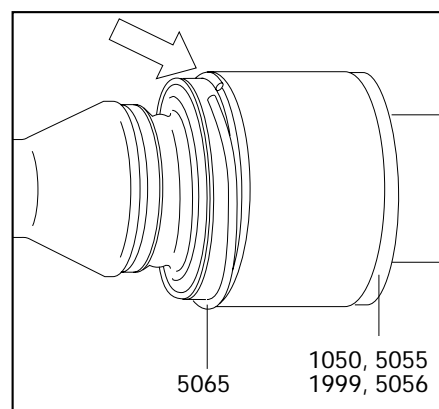
Do not use any force or sharp tools! Special care must be taken to prevent heavy strokes, vibrations or impact by a hammer.

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

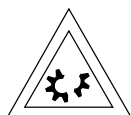
- Place the dismantled unit – consisting of drive stool (0085) with drive (A) and connecting shaft (1050), coupling rod (1998) and rotor (1999) – on the workbench with a wooden block supporting the rotor (1999).



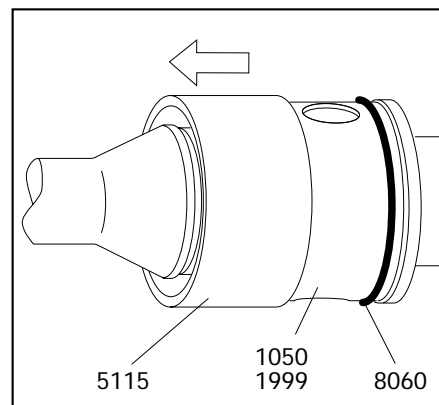
- Push circlip (5065) out of its groove and slip off over the head of rotor (1999 or connecting shaft (1050).



- **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)!



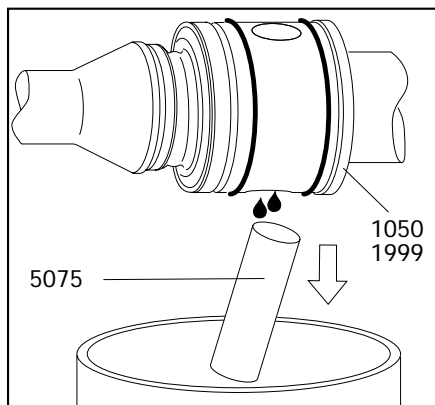
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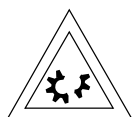
- Press the pin (5075) out of the head of rotor (1999) or connecting shaft (1050). If necessary use a hammer and a thin cylindrical pin (DIN 6450 C). Drain the oil into a receptacle.

Caution for pumps with ceramic rotors!

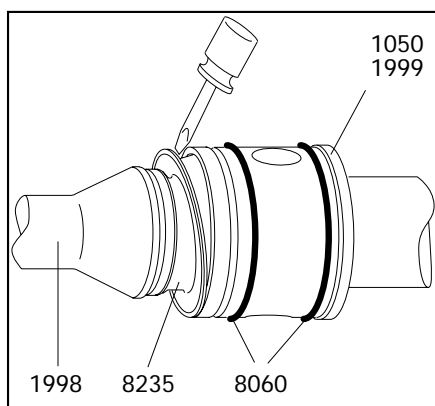
Where a pin (5075) may not come out easily, the metallic head of rotor (1999) should be supported on wooden blocks. Then the pin (5075) can be driven out with the help of a pin punch (DIN 6450 C). This should be done **with care**, holding the ceramic rotor with your hands. Please dispose of this oil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



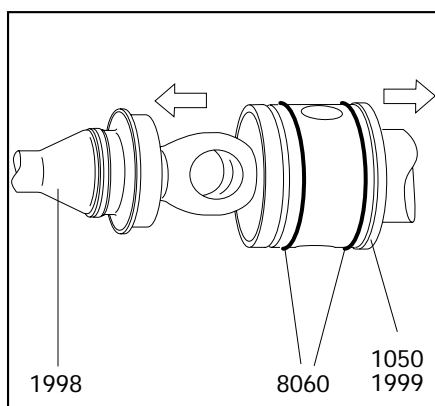
- Using a screwdriver, carefully lever the SM-pin joint seal (8235) out of the head of rotor (1999) or connecting shaft (1050).



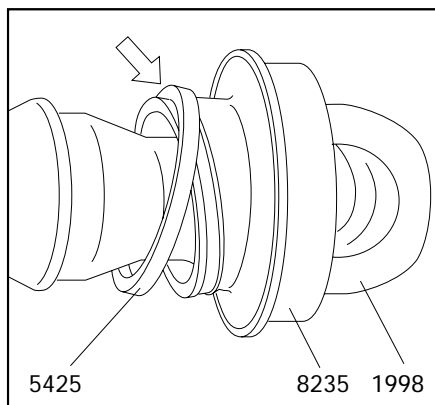
Taking care not to damage the SM-pin joint seal (8235)!



- 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

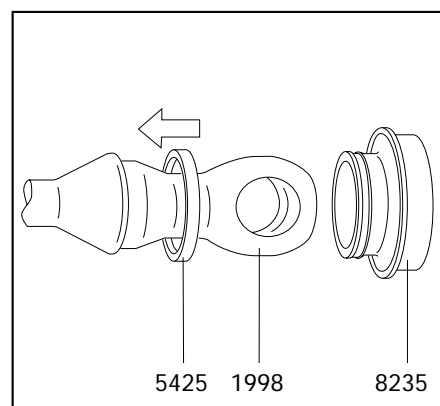
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	released	25.06.03	Denk	
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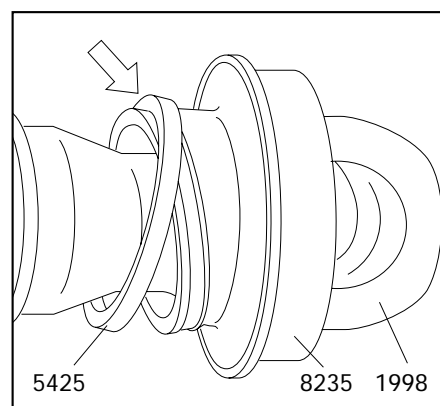
10.2 Fitting the Rotor and Coupling Rod

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

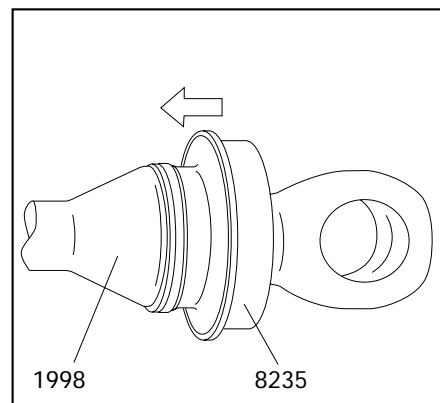
- Slip the clamp ring (5425) over the head of coupling rod (1998).



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



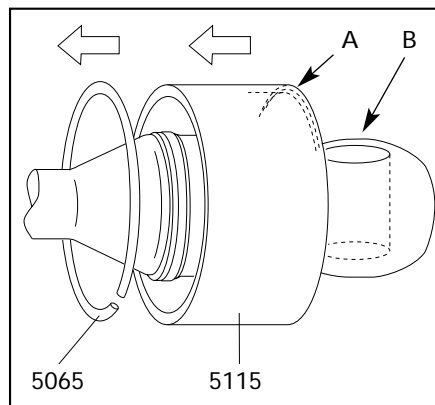
- Push the SM-pin joint seal (8235) with the correctly placed clamp ring (5425) up to the shoulder of coupling rod (1998).



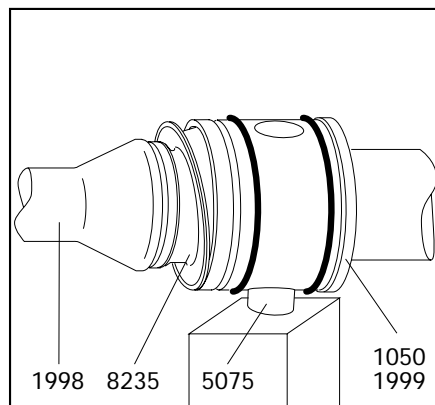
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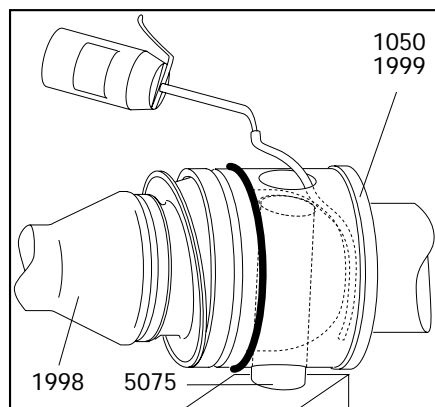
- Slip the circlip (5065) on to the coupling rod (1998). Slide the sleeve (5115) on to coupling rod (1998) so the inside diameter of chamfering (A) is being placed towards the coupling rod (1998) extension. Chamfering (A) will later on ease the installation over the O-rings (8060). Orient the head of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



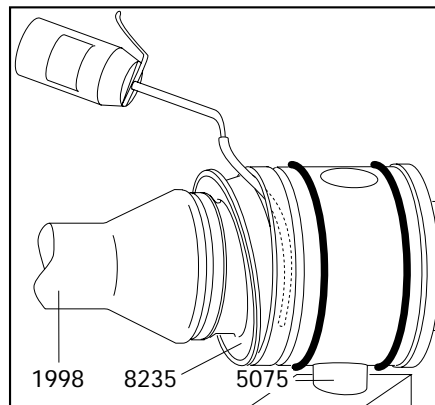
- Slide the coupling rod (1998) with SM-pin joint seal (8235) into the bore of rotor (1999) or connecting shaft (1050) and insert the pin (5075) from below and push up to the upper edge of coupling rod (1998). Support the pin (5075) against dropping out. Slide the SM-pin joint seal (8235) into the rotor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



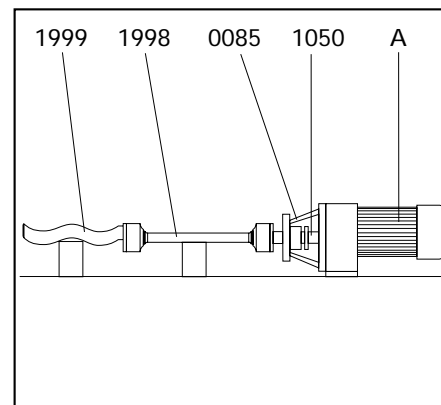
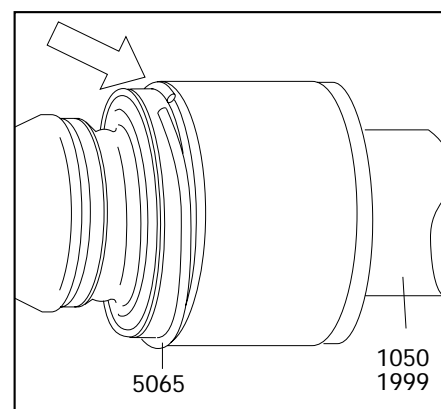
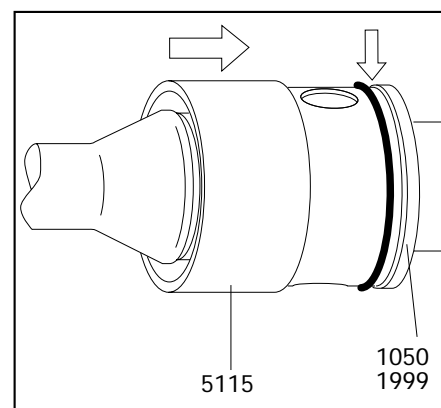
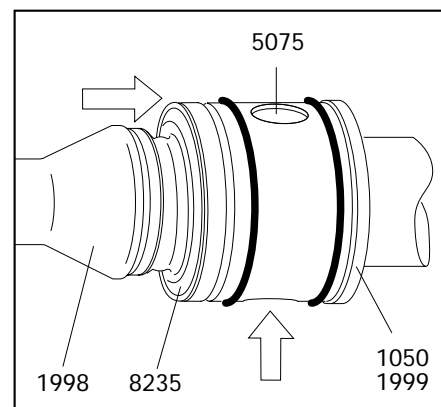
- Pull the hose out. Then insert the hose end through the small gap on the topside of SM-pin joint seal (8235) and guide it down to the bottom of the hollow space between coupling rod (1998) and SM-pin joint seal (8235). Slowly fill with lubricating oil up to the gap.



Continued Page 10.2

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- 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.
- 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.



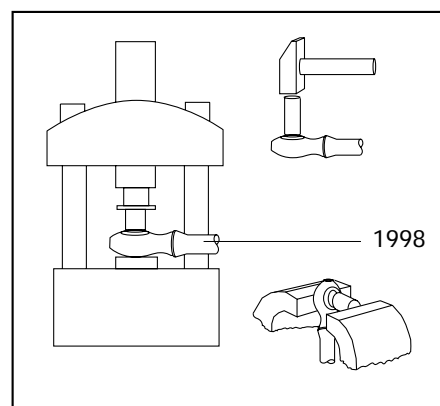
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10.3 Replacing the Wear Sleeves of Adapter, Rotor and Coupling Rod

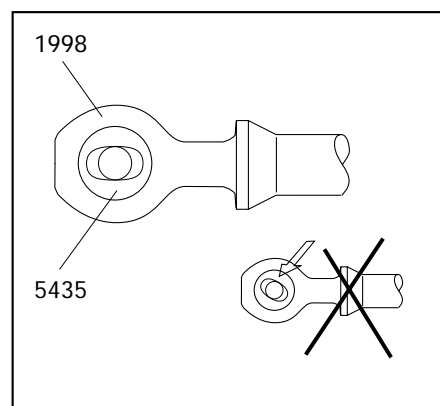


The wear sleeves (5435, 5440) have a very tight fit. **A press should be used** to remove or refit them.

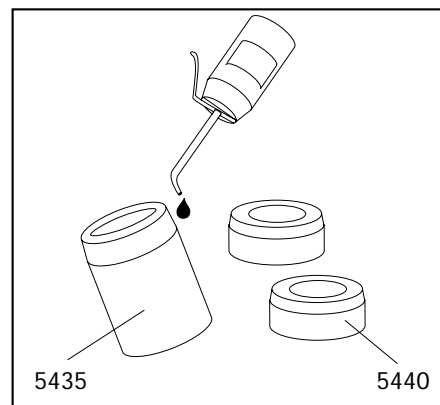
It may be possible though to drive the damaged sleeves out with a suitable mandrel. A rigid vice however is needed at the least for pressing new sleeves (5435, 5440) in again.




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).



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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).

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12 DISMANTLING AND ASSEMBLY OF THE SHAFT SEALING

PAGE
12.0

12.1 Removal and Fitting of the Single Mechanical Seal

- **Carefully** slide out mechanical seal housing (7005) together with the parts of the mechanical seal contained in it from connecting shaft (1050).
- **Carefully** push mechanical seal (7010) stationary seat out of mechanical seal housing (7005).

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.
- 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!



Ensure that the distribution of pressure is uniform when inserting the pressure sensitive counter rings. When inserting larger rings, use a suitable mandrel.

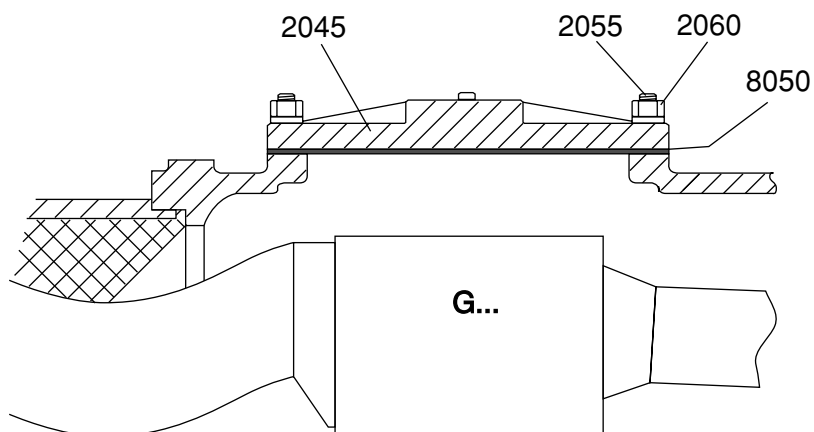
Do not allow any foreign bodies to get between the sliding surfaces.

- Exactly keep to the seal installation dimensions and ensure that the sealing faces are correctly pressed together (see table on sectional drawing W 209.000 or W 210.000).
- Insert mechanical seal (7010) stationary seat into mechanical seal housing (7005).
- Insert mechanical seal housing (7005) together with the stationary seat into the drive stool **without the installed connecting shaft (1050)**.
- If necessary take the installation dimension from the table and add the thickness S of the set ring (7086) when existing.
- Mark this installation dimension on the connecting shaft (1050).
- Fix the rotating unit of the mechanical seal (7010) on the connecting shaft (1050) depending on the installation dimension so that the rotating unit of the mechanical seal (7010) or the set ring (7086) is at the mark.
- Insert connecting shaft (1050) with the rotating unit of the mechanical seal (7010) into drive stool (0085) and install lip seal (7091, if existing). Push the set ring (1035) on to connecting shaft (1050) and observe at this the installation direction (see mark). Push connecting shaft (1050) on to the drive shaft and connect with pin (1030). Push the set ring (1035) on pin (1030).

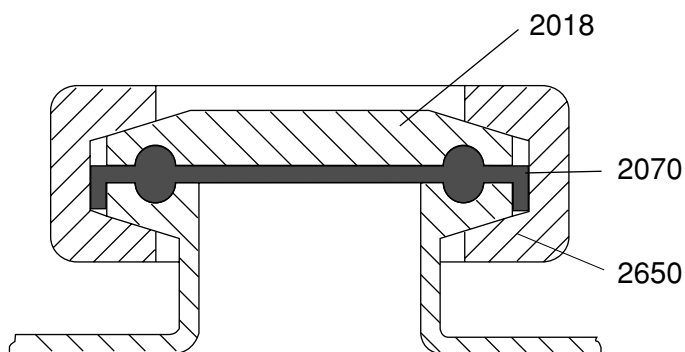
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Inspection Opening at the Pump Housing

gray cast iron model on from size NM045

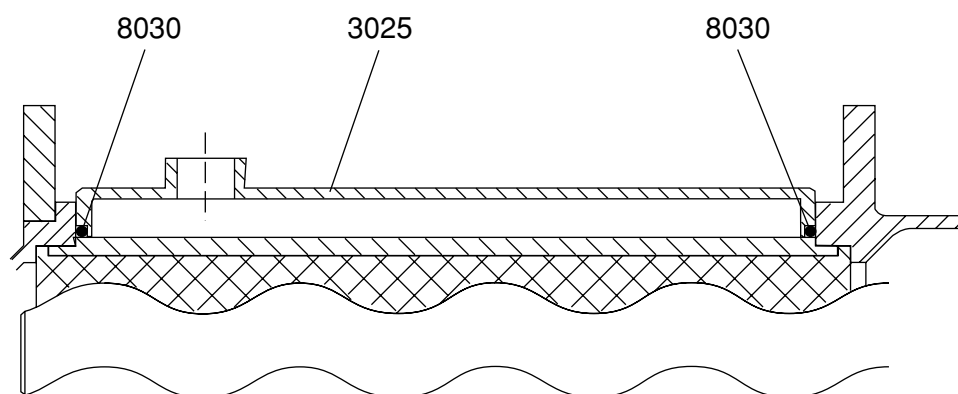


design for welded housings – nominal size DN 76,1 – ISO 2852

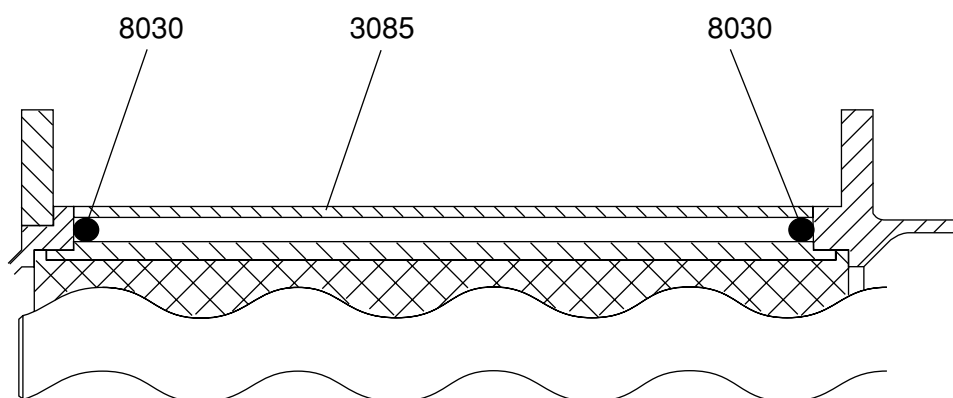


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Stator heating jacket



Stator protecting tube



Additional accessories, if fitted, pls. see after section 15.

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ติดต่อสอบถามเกี่ยวกับการติดตั้งได้ที่
คุณสาริต 089-487 2977 หรือ
คุณชีพ 081-375 2054

Stator Protector STP-2A A Device to protect the Stator from Dry Running

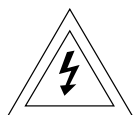
Contents	Page
1 Functioning principle	13.6
2 Technical data	13.6
3 Safety precautions	13.6R
4 Installation of temperature sensor and controller	13.6R
5 Set point parameters	13.9
6 Setting the cut-off temperature	13.9
7 Selecting the cut-off temperature	13.9
8 Stator Protector switching functions	13.9R
9 Stator Protector terminals	13.9R
10 Stator Protector with safeguard barrier	13.10

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released	30.03.04	Denk		
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Stator Protector STP-2A



Warning

The temperature controller and the installations connected to it contain live parts. On no account should the customer open the controller. Access is only permitted to authorized personnel.

The **Stator Protector** which is a device to protect the stator from dry running mainly consists of three parts: Temperature controller (processor) with LED display, temperature sensor, sensor conduit and if required offers a safeguard barrier for ex-hazardous application.

1 The Device functions as follows:

In the stator of the pump there is a temperature sensor installed which continuously measures the stator temperature (measuring range -35 to +180 °C). If the actual stator temperature rises above the intended cut-off temperature (about 5 °C above the pumping temperature) as set on the controller because of eventual dry running friction heat in the stator, there will be an optical or acoustic signal indication on the controller display, or the pump is switching off immediately.

2 Technical Data of the temperature controller

- ☐ Microprocessor-based
- ☐ Measuring input for PT 100 temperature sensor
- ☐ LED display, three digits, 13mm high, red indication
- ☐ Switching position indication for internal K1 relay
- ☐ Supply voltage 12 to 24 V AC/DC, separate mini trafo available for 115 V or 230 V
- ☐ Current consumption maximum 100 mA
- ☐ Storage temperature -20 to +70 °C
- ☐ Permissible operating temperature of the temperature controller 0 to +55 °C
- ☐ Relative humidity maximum 75%, no dew
- ☐ Protection: front side IP 65, back IP 20
- ☐ Safeguard barrier as a **special accessory** for the sensor to be operated in ex-hazardous application. For the wiring diagram please see Page 13.9R.
- ☐ Output: 1 relay 250V AC, 2,2 A, 1 changeover contact
- ☐ Installation dimensions: Front panel 84 x 42 mm, panel cut out 67,2 x 31,2 mm, 90 mm deep including terminals
- ☐ Connection: 12 pole clamp type terminal block for 2.5 sq mm cable
- ☐ Insulation group in accordance with VDE 0110
- ☐ All parts relevant to safety meet the VDE and UL requirements

Continued Page 13.6R

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3 Safety Precautions

For the installation of the Stator Protector as well as for the separate mini transformer the latest regulations which apply for electrical installations must be adhered to.

If a temperature sensor is operated within the ex-area there must be a safeguard barrier installed between the temperature controller and the temperature sensor. Please see Page 13.9R for the switching diagram.

The switching of inductive loads (contactors) may result in undue interferences or, in extreme situations, in interferences in the temperature controller. Here, we recommend the wiring in of spark blow-out coils.

4 Installation of Temperature Sensor and Controller

4.1 Installation in small stators, dia. $d = 27$ mm, according to Table 1

The stator (3005) is delivered with a built-in temperature sensor (4180).

Installation of spacer piece (0150), nut (4465), snap elbow (4610) with intermediate piece (4620), reduction (4630) and flange box (4640) is as follows (pls. see fig. 1):

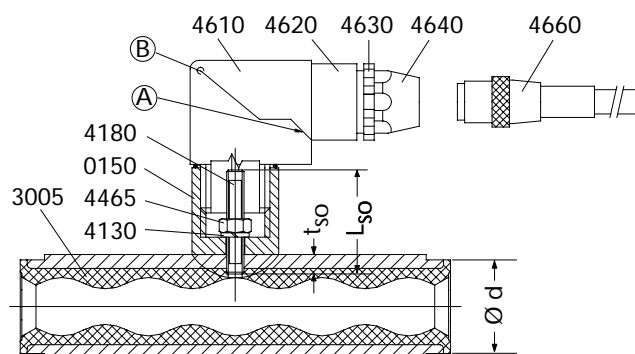


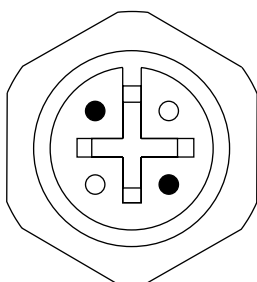
Fig. 1: Installation temperature sensor in $d = 27$ mm diameter stators acc. to table 1

- Slip spacer piece (0150) onto sensor (4180). Tighten down hex nut (4465) with spring washer (4130) to stator (3005).
- Where a snap elbow (4610) is folded down, please unfold by simultaneously undoing both hooks at (A) with the help of two screw drivers. Snap top elbow part open so far that it just touches on bottom part. In this position, top elbow part may be twisted against bottom part for the hinge to be disengaged at (B).

Continued Page 13.7

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- Elbow bottom part (4610) may now be screwed into spacer piece (0150).
- Draw all free sensor (4180) connecting wires through snap elbow (4610) top part / intermediate piece (4620)/ reduction (4630) assembly and solder to flange box (4640) contacts.



viewed from front on plug
socket of flange box



solder to these contacts
from behind!

Remark: Soldering only necessary on exchange of stator.
First pump delivery with equipment is mass soldered
and connected ready for operation.


- Screw reduction (4630) as well as intermediate piece (4620) onto flange box (4640).
- Screw snap elbow (4610) top part onto intermediate piece (4620).
- Slip snap elbow (4610) top part with intermediate piece (4620), reduction (4630) and flange box (4640) and elbow (4610) bottom part together, and snap the elbow shut with hooks (A) closed on both sides.
- The temperature controller can be installed in a switchboard.
For installation dimensions pl. see Technical Data in section 2.
- Fit connector plug (4660) to flange box (4640).

4.2 Installation in small stators, dia. $d \leq 71$ mm and $d > 27$ mm, according to Table 1

The stators are delivered with a temperature conduit (4570) already built-in.

Stator (3005) installation into NEMO pump must be carried out that sensor conduit (4570) comes on stator **suction side**.

Continued Page 13.7R

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Installation of nut (4465) with reducing fitting (4540), snap elbow (4610), flanged socket (4640) and temperature sensor (4180) is as follows (pls. see fig. 2):

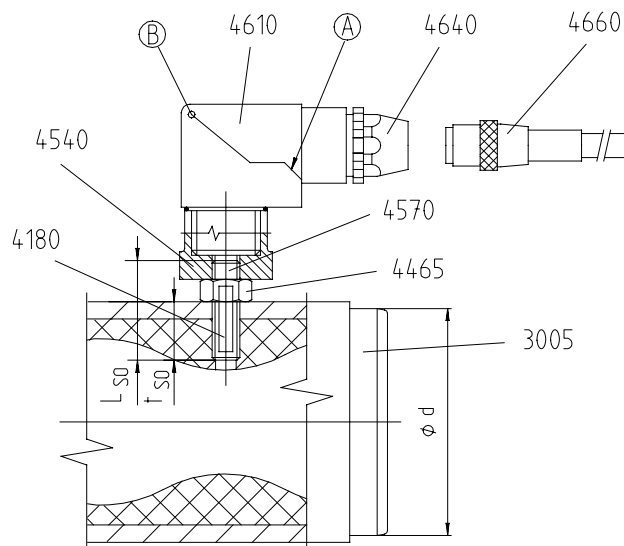


Fig. 2: Installation temperature sensor in $d \leq 71$ mm and $d < 27$ mm diameter stators acc. to table 1

- Screw the nut (4465) with reducing fitting (4540) on to the sensor conduit (4570) and tighten down against the stator (3005).
- For sensor conduit insertion, the snap elbow (4610) should be straightened by simultaneously undoing the hooks at (A) with the help of two screw-drivers and the top elbow part snapped open so far only as to touch on the bottom part. In this position, the top part may be twisted against the bottom part for the hinge to be disengaged at (B).
- The elbow bottom part (4610) can now be screwed into the reducing fitting (4540).
- By applying some heat conducting paste insert the temperature sensor (4180), flanged socket (4640) and elbow top part (4610) into the sensor conduit (4570).
- Fit elbow top part (4640) and socket (4640) together with elbow bottom part (4610) and snap shut, also the hooks on both sides at (A).
- The temperature controller can be installed in a switchboard. For installation dimensions pl. see Technical Data in section 2.
- Fit connector plug (4660) to flange box (4640).

Continued Page 13.8

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4.3 Installation in large stators, dia. $d \geq 86$ mm, according to Table 1

The stators are delivered with a temperature conduit (4570) already built-in.

Stator (3005) installation into NEMO pump must be carried out that sensor conduit (4570) comes on stator **suction side**.

Installation of snap elbow (4610), flanged socket (4640) and temperature sensor (4180) is as follows (pls. see fig. 3):

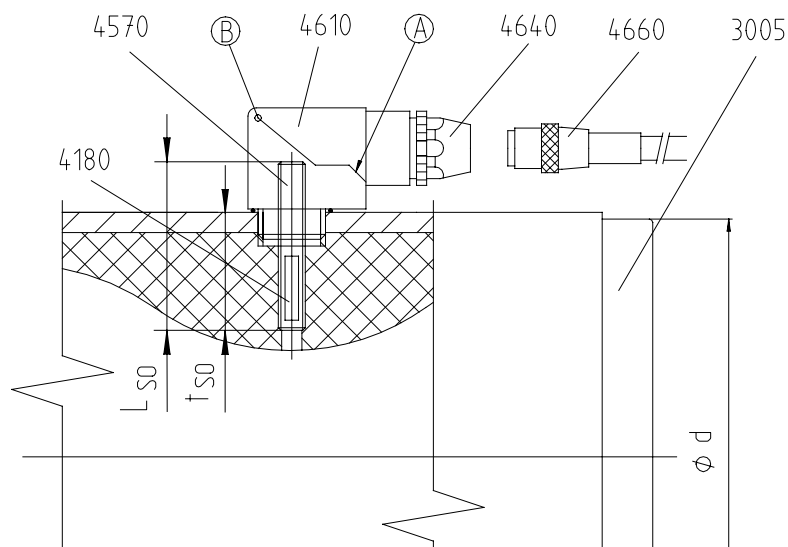



Fig. 3: Installation temperature sensor in $d \geq 86$ mm diameter stators acc. to table 1

- For sensor conduit insertion, the snap elbow (4610) should be straightened by simultaneously undoing the hooks at (A) with the help of two screw-drivers and the top elbow part snapped open so far only as to touch on the bottom part. In this position, the top part may be twisted against the bottom part for the hinge to be disengaged at (B).
- The elbow bottom part (4610) can now be screwed into the stator thread (3005).
- By applying some heat conducting paste insert the temperature sensor (4180), flanged socket (4640) and elbow top part (4610) into the sensor conduit (4570).
Fit elbow top part (4640) and socket (4640) together with elbow bottom part (4610) and snap shut, also the hooks on both sides at (A).
- The temperature controller can be integrated into a switch board.
For installation dimensions pl. see Technical Data in section 2.
- Connect the plug (4660) with the flanged socket (4640).

Continued Page 13.8R

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13 DISMANTLING AND ASSEMBLY OF SPECIAL UNITS

Table 1: Sensor conduit length ($L_{SO} = 150$ mm at delivery)

Stator		Sensor		
pump size	dia. d	Lso	tso $\pm 0,5$	aso *)
N-series, rotor/stator 1/2-geometry ⑨				
N 15	39	30	11	1,5
N 20	49	30	13	2
N 30	71	30	18	3
N 40	94	37	24	3,5
N 50	118	42	30	5
N 60	138	47	35	5
N 69	138	47	35	5
N 80	174	56	43	5
N 89	174	56	43	5
N 100	218	67	55	5
N 120	260	82	68	5
N 150	315	96	79	5
N 200	408	130	117,5	5
NM-series, rotor/stator 1/2-geometry ⑨				
NM 003	27	30	9,5	1
NM 005			9	
NM 008			8	
NM 011			5,5	
NM 015	37	30	11	1,5
NM 021	47	30	13	2
NM 031	66	30	17	3
NM 038	86	37	23	3,5
NM 045	101	37	25	5
NM 053	118	42	30	5
NM 063	141	50	36	5
NM 076	166	56	43	5
NM 090	195	67	50	5
NM 105	225	70	58	5
NM 125	265	82	70	5
NM 148	315	96	84	5
NM-series, rotor/stator 2/3-geometry ⑩				
NM 053	118	37	23	5
NM 063	141	42	28	5
NM 076	166	47	32	5
NM 090	195	50	38	5
NM 105	225	56	44	5
NM 125	265	67	53	5
NM 148	315	76	64	5

Continued Page 13.9

*) a_{SO} is the distance from the **rotor** surface

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5 Set Point Parameters

There are options to adjust the controller by setting various parameters. This is done on three levels.

The first level allows access to the set point (desired value) **only**, here, for example, the set points of the cutoff temperatures. Two independent set points can be fed in. The selection of the set point is done by the switching input E1.

On the second and third level all the remaining control parameters can be set or adjusted. These parameters, however, have been preset in the factory and the entry to this level is intentionally made difficult in order to avoid accidental or non-authorized adjustment of these values.

Important:

Any changes by the customer of the values preset in the factory are not permitted as this may result in dangerous functional errors.

6 Setting the first and second cutoff temperature S1 and S2

(e.g. temperature of pumped medium and cleaning liquid)
(S1: switching input E1 open, S2: switching input E1 closed)

In normal condition of the controller, the cutoff temperature value is easily to adjust. Whith no key pressed, the display shows the measured stator temperature.

- Press SET key:
The cutoff temperature is displayed.
- Hold down SET key and also press UP or DOWN key:
Cutoff temperature goes up or down.
- Unlock UP or DOWN key:
The adjusted cutoff temperature is stored
- Now unlock SET key:
The cutoff temperature is retained in memory even in case of a power failure.

7 Selecting the cutoff temperature

- Adjust the cutoff temperature to 150 °C at the temperature controller.
- Start the pump.
- When steady pumping is being attained, read out the temperature of the stator on the temperature controller display.
- If this presently attained pumping temperature is realistic, also considering the product and ambient temperatures, then the cutoff temperature may be set about 5 °C higher. Description see Section 6.

Continued Page 13.9R

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8 Switching Functions

With the temperature sensor connected and the operating voltage applied to the controller, the internal relay K1 is energized.

If the cut-off temperature is being exceeded or a short circuit is occurring in the temperature sensor, the internal relay K1 drops out. Then the display flashes and a buzzer sounds. The optical and acoustical signals are deleted by pressing the DOWN key.

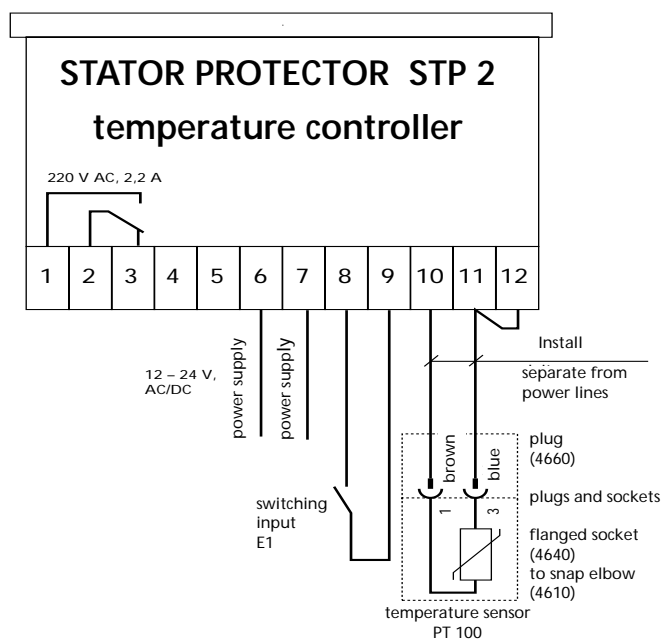
The set point switching from S1 to S2 is effected by closing the switching input E1. For terminals see illustration below.

Status information:

Display	Failure cause	Remedy
F1L	sensor failure, short circuit	check sensor
F1H	sensor failure, sensor interruption compensating circuit not connected	check sensor connect compensating circuit
- - -	key lock active	parameter P19 or A19
flashing display	temperature alarm	
buzzer	temperature alarm	buzzer can only be acknowledged by DOWN key
EP	data loss in the parameter store (control contact 1 and 2 currentless)	failure removal by switching mains on/off ; if not possible, repair of the controller necessary

Sensor failure informations are still stored and indicated even when the failure cause has already been removed. By pressing the DOWN key the failure information is deleted.

9 Terminals



Continued Page 13.10

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(GB) text no. R 13105-5/6	released	30.03.04	Denk	
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14 RECOMMENDED STOCK OF WEAR PARTS

PAGE
14.0

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


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15 SECTIONAL DRAWINGS AND LIST OF SPARE PARTS

PAGE
15.0

15 Sectional Drawings and List of Spare Parts

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Spare part list

NETZSCH

Pump type :

NM090SY02S12B

Order confirmation
number :

C105.5.2.120130

912520, 912521

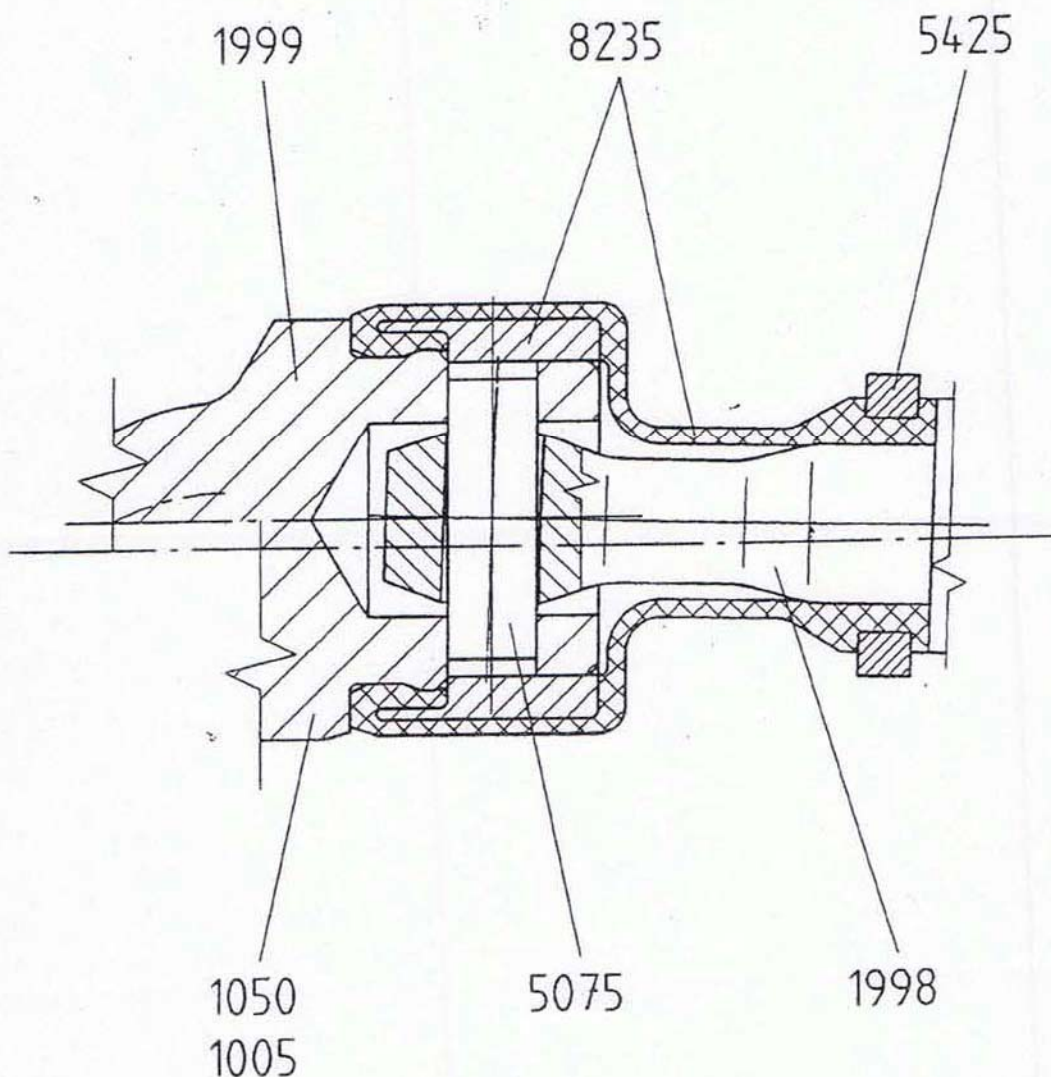
Customer :

Netzsch Thailand Ltd.

Customers P/O number :

ONTB(P)007/2012 Dt.30-01-2012




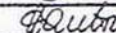
Position No.	Quantity	Unit	part description
0005	1	PCS	Transmission Assembly
1020	1	PCS	numberplate
1020	1	PCS	name plate
1030	1	PCS	pin
1035	1	PCS	thrower
1040	1	PCS	cylinder head screw
1045	1	PCS	gasket
1050	1	PCS	connecting shaft
1998	1	PCS	coupling rod
1999	1	PCS	rotor
2005	1	PCS	end socket
2010	1	PCS	pump housing
2015	2	PCS	drain plug
2020	4	PCS	bolt
2025	4	PCS	spring washer
2030	4	PCS	hexagon. Nut
2035	2	PCS	support
3005	1	PCS	stator
3010	4	PCS	thru bolt
3015	4	PCS	spring washer
3020	8	PCS	hexagon. Nut
3070	8	PCS	washer
5065	2	PCS	circlip
5070	2	PCS	pin
5116	2	PCS	sleeve
5425	2	PCS	clamp ring
7005	1	PCS	Mechanical seal housing
7025	1	PCS	Mechanical seal
8010	1	PCS	gasket
8012	1	PCS	gasket
8015	1	PCS	O-ring
8060	4	PCS	O-ring
8235	2	PCS	SM-pin joint seal

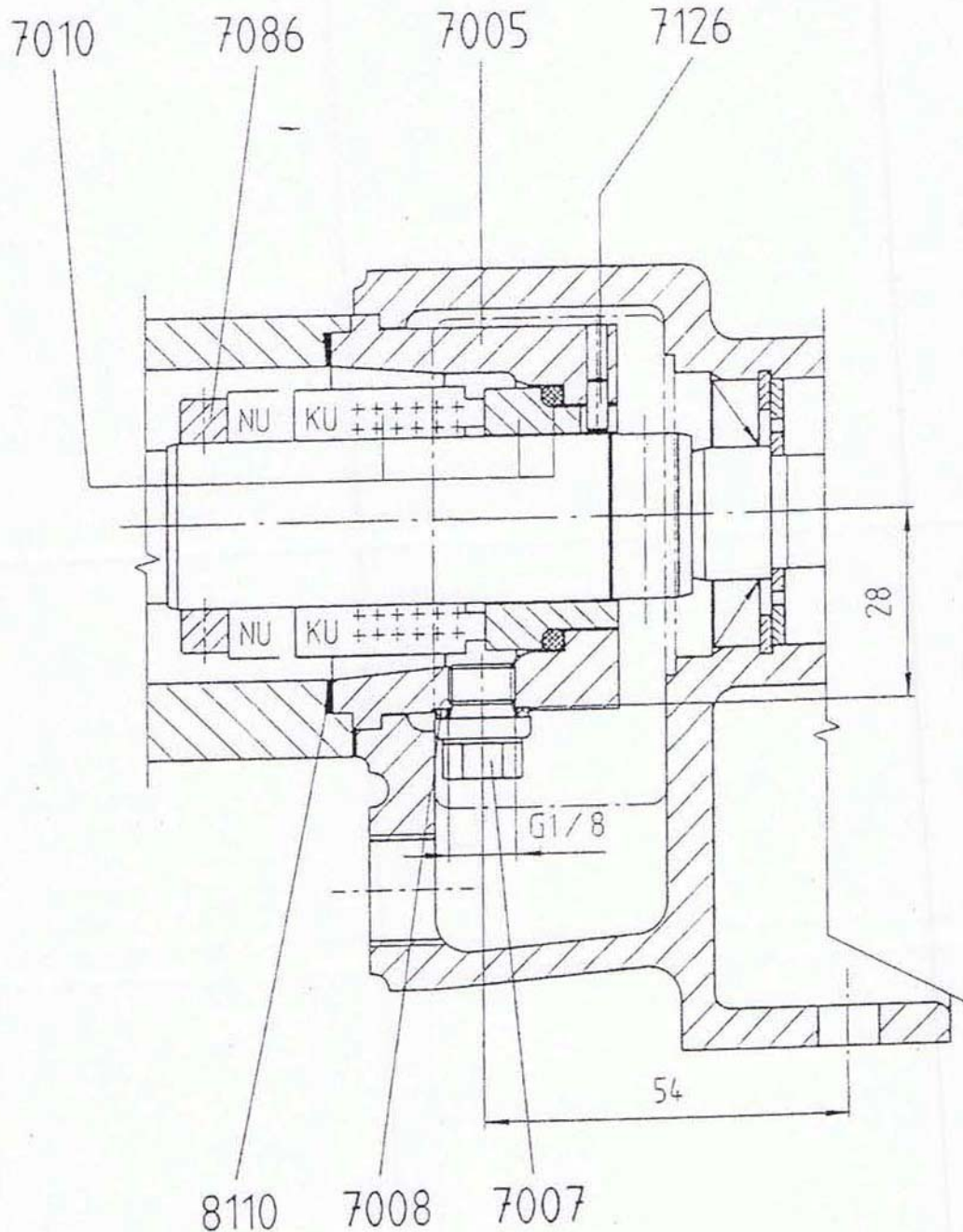


Gf	14021
Gb	10009
Ga	07307

TEXT

Type:	NM015
	NM011
	NM008
	NM005
	NM003

Maßstab: 1 : x	Schnitt-Zeichnung-Nr.							Bolzengelenk		Type: NM015 NM011 NM008 NM005 NM003
Ablage:			G	0	6	2	0	0	0	mit SM-Bolzenabdichtung
		Datum		Name		Unterschrift		Revision: 2		
erstellt		07.12.95		Thoma				Ersatz für Ausgabe 1 		
geprüft		07.12.95		Denk				vom: 14.09.94		
freigegeben		07.12.95		Hantschk						
Verteiler:		②	③	⑤1	⑨7	NM 6.4.1.1 52 53 98 58 50 95				



Maßstab: 1 : 1	Schnitt-Zeichnung-Nr.		Einf. wirk. GLRD		Type
Ablage:	W 0 9 6 0 0 0		NU 025 DIN 24960 ohne mit Spülanschluß		NM011S NM008S NM005S NM003S
	Datum	Name	Unterschrift	Revision: 3	
erstellt	26.01.00	Pfeiffer	<i>Pfeiffer</i>	Ersatz für Ausgabe 2	
geprüft	26.01.00	Denk	<i>Denk</i>	vom 26.02.98	
freigegeben	26.01.00	Hantschk	<i>Hantschk</i>		
Verteiler:	② ③ ⑤① ⑤② ⑤③ ⑤⑧ ⑨⑧ 50 95 97				