

# Operating and Maintenance Instructions



## NEMO®-Pump

Model Number

Sales Order/Job Number

Machine Number

Date of issue



### Important Note

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

#### The Instruction Manual

- Contains important information on how to operate the machine safely, properly and efficiently. Observing these instructions help to avoid danger, to reduce repair costs and downtimes and to increase the reliability and life of the machine;
- Must always be available wherever the machine is in use.

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

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

**Maintenance** (servicing, inspection, and/or repair)

**Transport;** shall be completed by the end user and authorized personnel with

the national requirements in force for the prevention of accidents and the environmental protection.

In addition to the operating instructions and to the 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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### 1 Safety Precautions

These operating instructions contain essential information which should be observed during installation, operation and maintenance. These operating instructions should be read and understood by the engineer, as well as other responsible operators before assembly and operation. Operating instructions should always be readily available wherever the machine is being used.

The general safety rules detailed under “Safety Precautions”, plus the safety precautions set by the end user, must be followed.

#### 1.1 Symbols Relating to Safety Precautions in the Operating Instructions

Personal injury, damage to machines or contamination of the environment can result if the safety precautions contained in this document are not strictly enforced. Following are signs commonly used to signify areas of danger:



Safety Sign  
Danger to General Public



Safety Sign  
Electrical Hazard



Danger from Possible Injury by Machinery



Danger from Suspended Loads



Damage to Machinery

Warning or indication plates attached to the pump which show the correct direction of rotation (or fluid connections) must always be kept in readable condition.

### **1.2 Qualifications and Training of Personnel**

All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user. If training of personnel is required, it can be provided by the manufacturer/representative. Furthermore, it is the responsibility of the end user to ensure that personnel fully understands the operating instructions.

### **1.3 Non-Observance of Safety Precautions**

Non-observance of the safety rules can result in personal injury, damage to machines or contamination of the environment. Non-observance can void product warranty.

Non-observance can also result in the following:

- ◆ Premature failure of components or machine/equipment malfunction.
- ◆ Danger to personnel from electrical, mechanical or chemical hazards.
- ◆ Danger to the environment from leakage of dangerous materials.

### **1.4 Safe Operation**

The safety precautions outlined in these operating instructions, the existing national regulations on accident prevention and the end user's own operating and safety regulations **must be observed**.

### **1.5 Safety Precautions**

- ◆ Hot or cold machine components must be insulated or shielded.
- ◆ Guards covering moving parts (i.e. shafts, couplings) must not be removed while machines are in operation.
- ◆ Leakage of dangerous materials (i.e. explosives, toxins or hot materials) from the shaft sealing area should be properly contained.
- ◆ In order to prevent electrical hazards, applicable local and/or federal regulations must be adhered to.

### **1.6 Safety Precautions for Maintenance, Inspection and Installation Work**

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

Work on a pump/machine should only be performed when it is disconnected from its power source, pressure has been relieved, and the complete unit has returned to room temperature. It is imperative that these procedures are adhered to before attempting work on the machine.

Pumps or units which transfer dangerous substances must be decontaminated.

Immediately following maintenance work, all safety and protection equipment must be re-installed and safety trips must be tested.

Refer to Section 5.0, "Start-up," before restarting machine/pump.

### **1.7 Unauthorized Use of Spare Parts and/or Modifications to the Pump**

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

### **1.8 Improper Application**

Machinery is only guaranteed safe for the use specified.

This machinery was manufactured in accordance to the specifications and the conditions specified by the end user. The machine should not be operated in any way that exceeds design capacities.

### **1.9 Specific Points for the Use of NEMO® Pumps**

NEMO® Pumps should only be used for the application for which they were sold.

If you wish to change the pumping medium, you should check with either the supplier or manufacturer to ensure that the pump will be suitable for the new medium. This is especially important with aggressive, poisonous or otherwise dangerous media.

Criteria for the selection of a pump includes:

1. Compatibility between the medium to be pumped and the materials of all wetted pump parts.
2. Compatibility between elastomeric components and mechanical seal faces.
3. The pressure and temperature rating of the pump.

NEMO® Pumps are of positive displacement progressing cavity design, and have the potential to generate very high pressure.

## **1 SAFETY PRECAUTIONS**

A blockage or closure of a valve in the discharge line can cause a pressure rise **higher than the installation can withstand**. A substantial pressure increase can result in the bursting of pipes and/or damage to other components of pump or drive systems. Extreme caution must be used, especially when dangerous media is present.

Appropriate safety equipment must be installed (i.e.: an emergency stop button, a pressure relief valve or rupture disc).

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

1. No one other than those involved with maintenance and repair should have access to power supply.
2. When dismantling the pump, follow the instructions for handling the medium (e.g.: protective clothing, no smoking, etc.)
3. Before putting the pump back into operation, ensure that all guards and other safety devices (e.g.: drive belt and coupling protection) are properly re-installed.

**Always keep safety in mind during operation, maintenance and installation of equipment. Please adhere to applicable federal and local rules and regulations.**

### **1.10 Notes on Inspection and Repair**

It is the responsibility and obligation of all commercial businesses to enforce safety in the workplace, regulations governing dangerous materials, accident prevention and environmental protection at all times.

People along with the environment must be protected from adverse effects caused by contact with dangerous materials.

The procedures for proper handling, containment and/or disposal of all hazardous materials, including wastewater, must be strictly enforced.

#### **Important:**

A Material Safety Data Sheet must accompany any machine/part and a Safety Conformity Certificate must be completed prior to inspection or repair. Please make a duplicate copy and leave the original in the Operation and Maintenance manual.

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

Inspection or repair of machinery containing radioactive medium will only be performed by authorized personnel under protection and supervision 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.

### Safety Conformity Certificate

This completed Safety Conformity Certificate and a Material Safety Data Sheet must accompany the machine and its accessories when returned to the manufacturer for repair/inspection services.

Pump Model Number \_\_\_\_\_  
Job Number \_\_\_\_\_  
Date of Manufacture \_\_\_\_\_ Equipment Return Authorization # \_\_\_\_\_  
Machine Number \_\_\_\_\_

Was carefully emptied and cleaned, both inside and out,  
in preparation for shipment.  Yes  
 No

Precautions with regard to health and  
the environment are to be observed.  Yes  
 No

This machine came into contact with media hazardous  
to health and the environment.  Yes  
 No

The following additional precautions are necessary with regard to the handling of media  
and the disposal of waste: \_\_\_\_\_  
\_\_\_\_\_

We confirm the above information is accurate and complete, and shipment will be in  
accordance with legal requirements:

Company \_\_\_\_\_ Telephone No.: \_\_\_\_\_  
\_\_\_\_\_ Fax No.: \_\_\_\_\_

Address  
\_\_\_\_\_  
\_\_\_\_\_

Name \_\_\_\_\_ Date: \_\_\_\_\_

Position: \_\_\_\_\_

\_\_\_\_\_  
Company Stamp/Signature



### 2 Description

The Nemo® Pump is a positive displacement, progressing cavity-type pump.

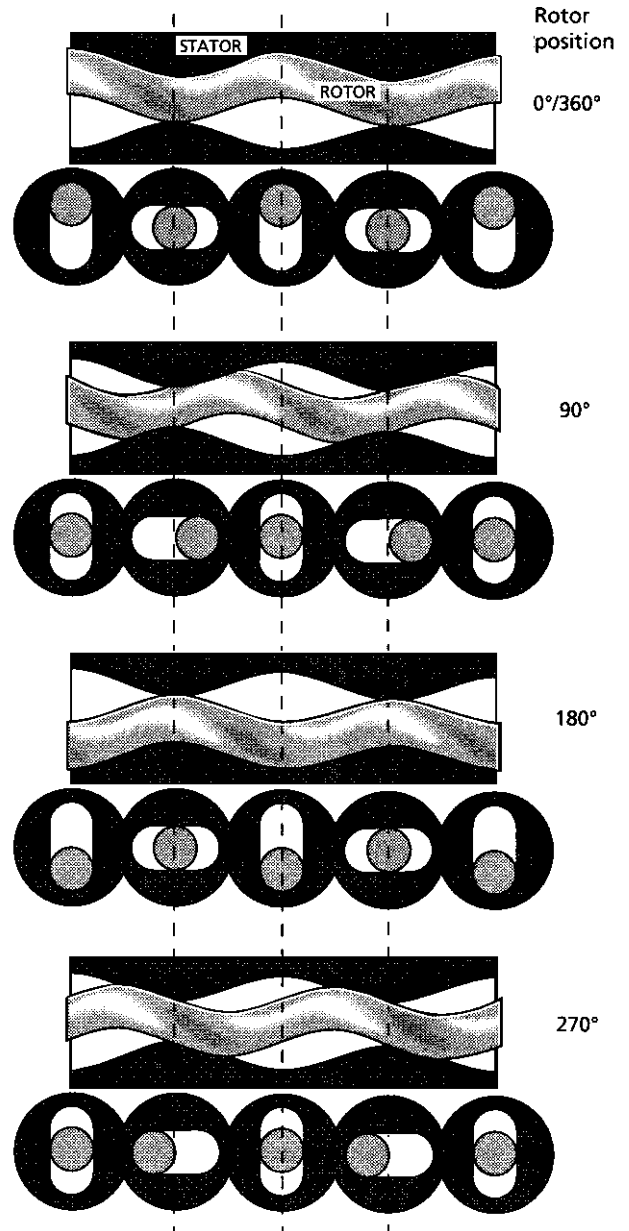
The main components of the pump (which was invented by Professor Rene' Moineau) are: a rotating part, called the rotor; and a stationary part, called the stator.

The rotor has a single helix shape and is normally made of a metallic material. The stator is formed as a double-helix with twice the pitch of the rotor and is normally an elastomer. The interference (compression) fit between the rotor and stator creates a series of sealed chambers called cavities. When the rotor turns inside the stator, the medium moves continuously from the inlet to the outlet of the cavities.

The NEMO® Pump principle utilizes 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 lift up to 28'. Vacuum capacity is 24-25'.
- ◆ Like membrane and peristaltic pumps, NEMO® Pumps can transport all types of media including inhomogeneous, 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, NEMO® Pumps are capable of handling high-viscosity media.

- ◆ Like piston, membrane, gear or screw pumps, NEMO® Pumps can be used for metering applications.



*Length and cross-sections of the rotor and stator during a rotation.*

## **2.2 General Data**

### **Noise Emissions:**

The maximum noise emission level permitted at a workplace is 85 dB (A).

Noise levels are measured in accordance with OSHA CFR 1910.95 to assure that the pump does not exceed 85 dB (A).

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

In order to maintain a noise emission level of  $\leq 85$  dB (A), the pump must be securely mounted and not allowed to cavitate.

### 3 Packaging, Transportation, Storage

#### 3.1 Packaging and Transportation

NEMO® Pumps are shipped on skid-mounted wood-framed cardboard enclosures, unless the customer specifies otherwise.

The packages are labeled with any special handling instructions.

Upon receipt, inspect the pump for any transportation damage.

Claims for damages should be reported to the **freight carrier immediately.**

Uncrated horizontal pumps should be lifted using the bolt holes of the frame or the lifting lugs attached to the baseplate.

Vertical pumps should be lifted by using the bolt-down holes, or lifting lugs attached to the mounting plate.



Use caution when lifting top-heavy pumps. The center of gravity may be above the points where the lifting gear is attached. If this is the case, secure additionally to **prevent tipping over!**

Vertical pumps should be stored horizontally **only**, unless they are secured vertically. **This will prevent hazards of tipping!**



Avoid suspending the complete pump unit by the eye bolts of the motor or gear box. These eye bolts should be used for lifting the motor and/or the gear box only.

**As when operating any type of equipment, exercise caution and adhere to all applicable instructions, rules and regulations.**

Due to the variety of possible pump designs and applications, only general instructions can be given here. These should be adequate for experienced assembly or transportation personnel.

When in doubt, contact the supplier for more detailed information.

When moving the pump or unit on wheels, strictly adhere to the following:

- ◆ Lock out the motor drive to protect against unintended start-up.
- ◆ Move the pump unit carefully and slowly, especially where the ground is uneven.  
**Hazards of tipping!**
- ◆ The pump should be stored in a stable position with wheels or rollers locked or otherwise secured.
- ◆ Be careful not to allow flexible piping to bend or become kinked. Obstruction of flow will cause excessive discharge pressure.
- ◆ Where necessary, secure the pump unit with additional support blocks.

## **3.2 Storage**

Pumps are packaged for transportation and short-term storage. In cases of prolonged storage, the pumps should be protected as follows until installation:

- ◆ **Stator:**  
When stored for a long period, the elastomer along the contact line between the rotor and stator may become temporarily distorted (compression-set). This will increase the required starting torque. For this reason, the stator should be removed and stored in a cool, dry place in an air-tight package and protected from light.
- ◆ **Shaft Sealing by packing gland:**  
Remove the packing gland and protect the exposed shaft surface with protective grease or oil.
- ◆ **Pump parts in stainless steel:** No protection necessary.
- ◆ **Other non-protected pump parts:** Protect with grease or oil.
- ◆ **Drives:** Observe the instructions of the drive supplier.

### *Store Room*

*The environment in which rubber products are being kept must be cool, dry, free of dust and well ventilated, and must not be stored in the open.*

*Rubber products should be kept in surroundings not having less than minus 10° C (14° F) and not more than plus 15° C (59° F).*

*Store rooms should not be damp, and it must be ensured that there will be no condensation.*

*Recommended relative humidity is < 65%.*

*Rubber products must be protected against light, particularly direct sunlight or artificial light having a high UV portion.*

*Rubber products should be kept in a sealed package.*

*As ozone is very aggressive and harmful there should be no store room used which houses equipment likely to produce ozone, i.e. 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 the store room.*

#### ◆ **Rotor**

Support with wooden blocks and protect against damage from mechanical impact. For tool steel rotors (material number 1.2436): coat the surfaces with protective grease to avoid rusting.

#### ◆ **Shaft Sealing by packing gland**

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

#### ◆ **Pump parts in stainless steel**

No grease coating necessary.

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

Protect with grease or oil.

#### ◆ **Drives**

Observe instructions of the drive supplier.

## 4 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 contamination of the stator and the pumping medium.

Verify all hardware has been properly installed and fastened.

### 4.1 Direction of Rotation

The direction of rotation of the pump is given on the name plate.

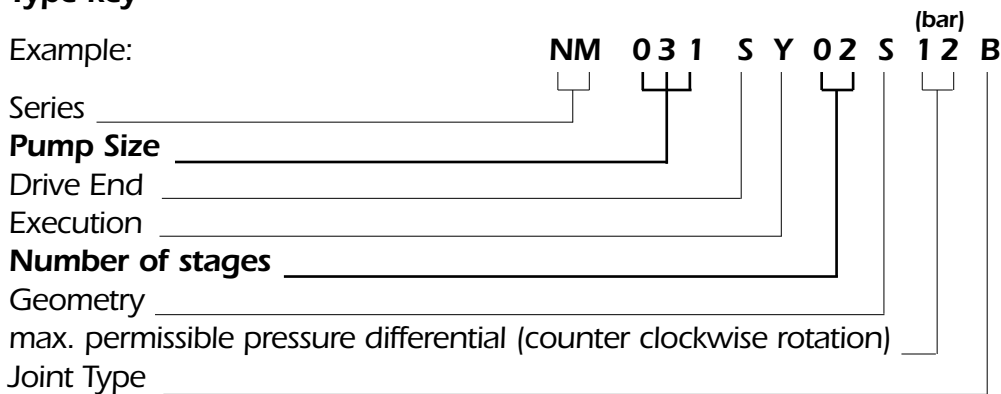
### 4.2 Pressure

Maximum permissible pressure inside the pump housing (A) is 6 bar.

The maximum permissible pressure inside the end flange (B) is 12 bar.

#### Type key

Example:

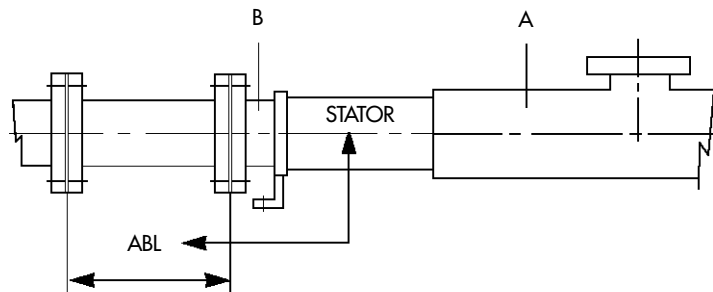


### 4.3 Shaft Sealing

- ◆ 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!

### 4.4 Piping System

- ◆ Arrange suction and discharge pipes so that when the pump is not running, the medium is still present. Sufficient medium should remain inside in order to lubricate the pump during restart.
- ◆ Clean the pipe work and rinse thoroughly before installing the pump.
- ◆ See chart below for recommended disassembly (ABL) dimensions.



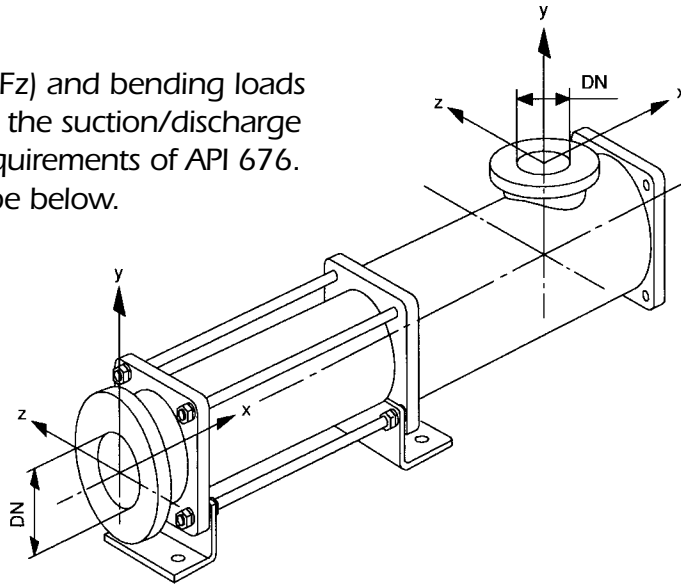
Disassembly length ABL in mm:

Pump size	Number of Stages							
	1*	2	3	4	6	8	10	12
015	160	160	230	310	460	610	770	920
021	230	230	340	450	670	880	1100	1310
031	310	310	450	590	880	1160	1440	1730
038	430	430	630	830	1230	1630	2030	2430
045	500	500	730	960	1430	1890	2350	2820
053	600	600	880	1170	1730	2290	2860	3420
063	690	690	1010	1330	1980	2620	3270	3910
076	800	800	1170	1540	2280	3030	3770	4520
090	950	950	1390	1840	2720	3610	4500	
105	1180	1180	1740	2300	3410	4520		
125	1400	1400	2060	2720	4040			
148	1680	1680	2470	3260				
180	1910	1910						

\*This dimension applies to 1L geometry, 2 through 12 refer to S geometry

**4 INSTALLATION INSTRUCTIONS**

The twisting loads ( $F_x$ ,  $F_y$ ,  $F_z$ ) and bending loads ( $M_x$ ,  $M_y$ ,  $M_z$ ) permitted for the suction/discharge flange comply with the requirements of API 676. They are shown in the table below.



Pump type NM	Standard nominal diameter DN	$F_x, F_y, F_z$ lbs.	$M_x, M_y, M_z$ in/lbs.
003 005 008 011	FNPT	38	NPT joints must not be assembled with loads which may result in over tightening or loosening these joints
015 021	FNPT	95	
31	2"	152	3080
38	2.5"	191	3828
45 53	3"	229	4576
63	4"	305	6116
76	6"	382	7612
90 105	6"	458	9152
125	8"	611	12,188
148	10"	764	15,224
180	10"	764	15,224



### 5 Start-up

NEMO® Progressing Cavity Pumps must be operated with the following precautions:



**Never run the pump dry!**

Even a few rotations in dry condition will damage the stator.



**If the rotor was protected with grease for long-term storage:**

Thoroughly clean the rotor to prevent damage caused by interaction of the grease, stator material and medium.

- ◆ Before initial start-up, regardless of rotation, make sure the pump housing and suction piping are filled with medium. If medium is high in viscosity, it may be necessary to prime the pump with a compatible liquid. Priming of the pump is necessary to lubricate the stator.



**NEMO® Pumps are positive displacement progressing cavity pumps and have the potential to generate very high pressure capable of bursting vessels or pipes.**



**Excessive pressure can overload the drive train (shaft, connecting rod, joints, rotor) or exceed pressure limitations of the housings and their connections, resulting in damage or breakage. Refer to Section 4.4 of this manual for housing pressure limitations.**

**Never run the pump with an inlet or outlet valve closed.**

- ◆ Open valves and vents before starting the pump!
- ◆ Turn pump motor on and off briefly to check direction of rotation.

## 6 Temporary Shutdown



- ◆ Following the temporary shutdown, the pump should be emptied and rinsed when:
  - the pump is installed in a location inside or outside where the medium has the potential to freeze.
  - the medium has a tendency to solidify or harden.
  - the medium tends to build up or become tacky on the shaft sealing area.

- ◆ **Stator:**

When stored for an extended period, the elastomer along the contact line between the rotor and stator may become temporarily distorted (compression-set).

This will increase the required starting torque. For this reason, the stator should be removed and stored in a cool, dry place in an airtight package and protected from light.

- ◆ **Rotor:**

Support with wooden blocks and cover to protect from mechanical damage, after the stator has been removed.

Rotors made with Tool Steel (Material number 1.2436)  
Should be protected against corrosion with protective grease.



**Prior to installation, thoroughly clean rotor to prevent damage caused by interaction of the grease, stator material and medium.**

- ◆ **Stand-by Pump:**

A stand-by pump is sometimes installed to eliminate downtime. Stand-by pumps should be operated occasionally to keep properly conditioned for use.

## **7 Maintenance**

### **7.1 Pumps in General**



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

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



### **7.2 Lubrication**

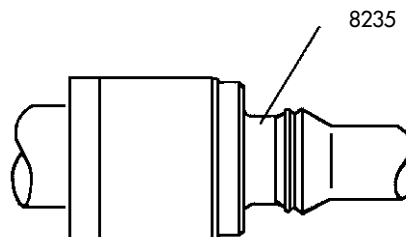
The NEMO® Pump does not require frequent lubrication.

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

**7.3 Lubricating the Pin Joints with SM-Pin Joint Seals**

- ◆ It is advisable to change the oil and check the seals of the pin joints:
  - when replacing worn joint parts
  - when disassembling the pump for any reason

Joint basic size series NM	Quantity of oil per joint	
	cm <sup>3</sup>	fl oz.
NM 003-011	1	0.0338
NM 015	1.5	0.05
NM 021	2	0.067
NM 031	5	0.17
NM 038	15	0.51
NM 045	22	0.75
NM 053	36	1.22
NM 063	78	2.64
NM 076	165	5.60
NM 090	205	6.93
NM 105	450	15.20



### Lubricating Oil:

Industrial Application	Designation DIN 51502	Permitted Product	
General Industry	<table border="1"><tr><td>CLP 460</td></tr></table>	CLP 460	"SHELL" Omala 460 (or equivalent)
	CLP 460		
with SM-pin joint seal (8235) of EPDM <table border="1" style="margin-left: auto; margin-right: auto;"><tr><td>CLP PG</td></tr><tr><td>320</td></tr></table>	CLP PG	320	prescribed: KLUBERSYNTH GH 6-320
CLP PG			
320			

## 7.4 Shaft Sealing through Stuffing Box

### 7.4.1 Preparing for Operation

The function of the pump packing is to **minimize, but not totally eliminate** the leakage of medium. A lubricant or liquid coating is necessary to minimize shaft wear and dissipate the heat caused by friction.

Before Operation, determine whether the gland housing is equipped with flush connections or grease zerk and lantern ring (7050).

If the gland housing has flush connections or lantern ring (7050) installed between the packing rings, proceed with one of the following options:

- 1.) Install a flush under pressure in excess of the internal pump pressure at the gland housing. The flush should be a clean, compatible liquid. This may be necessary for abrasive or dangerous media, or in a suction lift application.
- 2.) Lubricate with a compatible grease.
- 3.) Install a quench of steam, or hot or cold liquid

With options 1.) or 2.), the discharge connection of the gland housing should be sealed off.

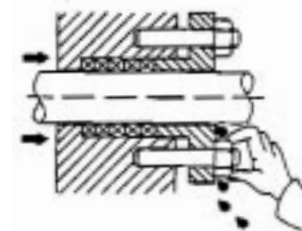
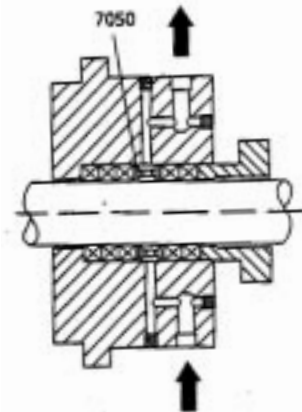
When choosing option 3.), a discharge line should be connected opposite the flush feed.

If, for any reason, none of the options above can be applied, the gland housing connections must be plugged and sealed air-tight. This is necessary to eliminate air passage through the gland housing during pump operation.

#### **Avoid contact with the rotating shaft to prevent injury.**

Proper tightening of the packing gland is necessary to obtain desired sealing of packing.

The packing gland should be hand-tightened for initial start-up. A high rate of leakage (approximately 50-200 drops/min.) should be permitted for the first thirty minutes. After a thirty minute run-in, the packing gland should be properly compressed. Turn gland nuts (approximately 1/16 turn each) until reaching desired leakage.



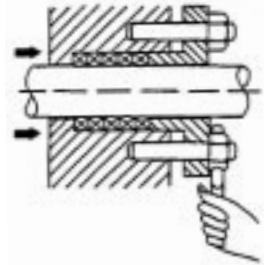
Gland housing temperature should not exceed 70-140° F above medium temperature.

If there is a reduction in leakage and an increase in gland housing temperature, loosen gland nuts and repeat run-in.

The rate of leakage will vary depending on the medium, pressure, temperature, surface tension, shaft run-out, and type of packing.

If leakage occurs around the outer edges of the gland housing, the pump should be stopped and the packing compressed. After compressing the packing, loosen the packing gland and repeat run-in procedure.

**Gland nuts must be tightened evenly!**

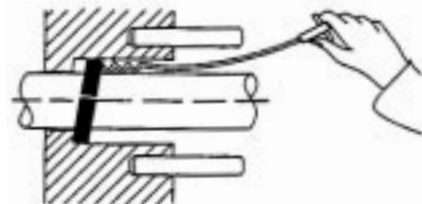


#### 7.4.2 **Packing Replacement**

**Please Observe Safety Precautions 1.5, 1.6 and 1.8!**

##### **Removal of Old Packing**

After releasing the pressure on the unit, draining the pump and removing the packing gland, use the packing extractor to remove all of the old packing rings and debris from the gland housing.



##### **Preparation of the Stuffing Box**

Thoroughly clean the stuffing box area and the shaft surface. Replace corroded or worn shafts. Check the shaft bearings and the shaft concentricity. Examine the gap in the packing gland and the gland housing. To reduce an excessively large gap, insert a washer or disc to prevent the packing material from being extruded beyond the gland housing. An alternative is to use a more rigid material for the first and last packing ring.

### Selection of Grade and Size of Packing

Before installing the packing, check once again to ensure that the packing is suitable for the operating conditions required.

### Cutting the Packing Rings

Packing rings must be cut to the exact dimensions; a packing cutter ensures precision-cut rings. If a cutter is not available, proceed as follows.

The ring length ( $L_m$ ) is determined by the shaft diameter ( $d$ ) and the packing width ( $s$ ) under the following formula:

$$L_m = (d + s) \cdot X \cdot \pi \text{ (in.)}$$

$X$  = tolerance

$X = 1.10$  for shaft diameter  $\leq 2.375$ "

$X = 1.07$  for shaft diameter  $\leq 4.00$ "

$X = 1.04$  for shaft diameter  $> 4.00$ "

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

Example:

Shaft Diameter  $d = 2.375$ "

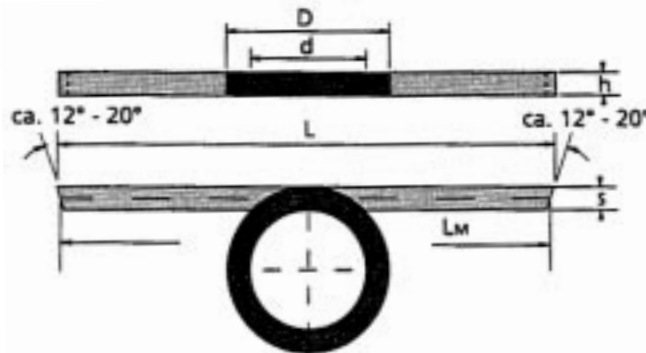
Stuffing Box Diameter  $D = 3.15$ "

Packing Width  $s$ :

$$s = (D - d) / 2 = (3.15 - 2.375) / 2 = .3875 \text{ in.}$$

Cutting Length  $L_m$ :

$$L_m = (d + s) \cdot 1.10 \cdot \pi = (2.375 + .3875) \cdot 1.10 \cdot \pi = 9.5 \text{ in.}$$



### Straight Cuts

It is recommended that the packing be cut 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°.

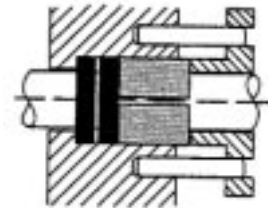
Continued on Page 7.4R



In conjunction with the straight cut, the result is a slight bracing of the rings against the gland housing.

**Installation**

- Carefully twist open the packing rings just far enough to enable them to be easily slipped over the shaft. Excessive bending of the packing rings can cause damage.
- Install each packing ring separately as follows:
  - insert into gland housing, cut end first
  - insert each packing ring uniformly separating the cut ends in 90° increments.



**Never use pointed objects for this Operation**

- Continue inserting packing rings into the gland housing until the last packing ring protrudes approximately 1/2 of the width of the packing ring.
- Compress the packing rings into the gland housing by tightening the gland nuts by hand. Where a lantern ring is fitted, check to ensure that it is correctly aligned with the connection.

**7.4.3 Important Notes**

**Correct:**

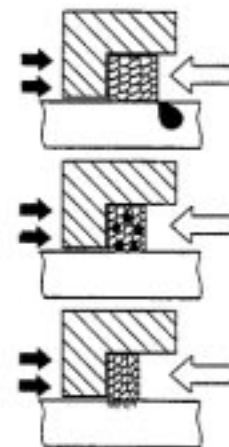
Proper Lubrication through liquid or lubricant.

**Not Correct:**

Lack of lubrication due to excessive tightening of the gland nuts.

**Consequences**

Excessive packing compression can result in shaft damage and accelerated packing wear.



## **8 Trouble-Shooting**

### **8.1 Trouble-Shooting Guide**

The following chart lists possible problems and corresponding solutions:

### **8.2 Determining the Kind of Problem and the Possible Cause**

- The column describing a possible problem shows one or more boxes marked with an "X."
  - On the corresponding lines, you will find the possible reasons/causes and some hints how to handle the problem. Thus, the actual cause of the problem can be narrowed down and eventually detected.
- ◆ The table helps to identify the problem and offers a possible solution. For more complicated problems, consult the manufacturer.

Possible Problem										TROUBLE-SHOOTING GUIDE		
Pump will not start	No suction capability	Discharge output low	Discharge pressure low	Discharge output fluctuates	Pump is noisy	Pump jammed	Drive overloaded	Stator service life too short	Rotor service life too short	Shaft seal leaks	A good service life can be expected if the pump is used in accordance with your specified application and maintained in accordance with this manual. If operating problems arise, use this chart as a guide in locating the problem.	See Next Page for Corrective Action.
										<b>POSSIBLE CAUSE</b>		
X							X				Pump or stator is new, too much static friction.	1
X		X	X				X				Power supply incorrect; drive not properly wired.	2
		X					X	X	X		Discharge pressure too high.	3
X						X	X				Foreign matter or debris in pump.	4
X						X	X	X	X		Temperature of pumped liquid too high; stator swells.	5
X						X	X	X			Stator swells due to chemical attack, unsuitable elastomer.	6
X						X	X	X			Liquid contains too many solids, causing blockages.	7
X						X	X	X	X	X	Liquid settles and hardens at pump shut-down.	8
		X	X	X							Air in suction piping.	9
	X	X	X	X							Suction pipe leaks.	10
	X	X	X	X							Shaft sealing leaks.	11
		X	X								Pump speed too low.	12
	X	X	X								Undersized rotor; operating temperature not reached.	13
		X	X	X	X			X	X		Discharge too high or suction head too low (cavitation).	14
		X	X		X	X	X	X	X		Pump running dry.	15
	X	X	X		X						Stator worn out.	16
	X	X	X		X			X	X		Stator material brittle.	17
	X	X	X		X			X			Rotor worn out.	18
					X						Joints worn.	19
					X						Pump and drive out of alignment.	20
					X						Elastomer in coupling worn out.	21
					X					X	Pump bearings worn.	22
							X				Pump speed too high.	23
							X				Viscosity too high.	24
							X				Specific gravity too high.	25
							X			X	Stuffing box not properly tightened.	26
										X	Incorrect packing.	27
										X	Wrong direction of rotation.	28
	X									X	Stationary or rotating face of mechanical seal worn.	29
										X	O-Rings in mechanical seal worn or damaged.	30



## 8 TROUBLE-SHOOTING

### CORRECTIVE ACTION

1	Fill pump and turn by hand. If necessary, use glycerine to lubricate stator.
2	Check motor nameplate data. Test voltage, phase and frequency.
3	Measure actual discharge pressure and compare to your specification.
4	Remove debris and correct any damage.
5	If liquid temperature cannot be reduced, use an undersized rotor.
6	Check specified application, If necessary, change stator material.
7	Increase liquid-to-solids ratio.
8	Clean pump and rinse out after each use.
9	Increase NPSHA; eliminate leaks (see No. 10).
10	Check seals; tighten piping connections.
11	Packing: tighten stuffing box or replace packing. Mech. seal: replace rings or seals; remove deposits.
12	If drive is variable speed, increase speed at pump.
13	Heat pump (stator) to operating temperature.
14	Reduce suction losses; lower liquid temperature; install pump at lower elevation.
15	Fill pump; provide dry run protection; relocate suction piping.
16	Replace stator.
17	Replace stator, check specified application; change stator material of construction if necessary.
18	Replace rotor; determine cause; change rotor material of construction if necessary.
19	Replace necessary parts; seal and refit carefully.
20	Re-align pump and drive.
21	Replace coupling elastomer; re-align.
22	Replace bearings, lubricate and seal. For high temperature, check bearing tolerances and lubrication.
23	If drive is variable, set at lower speed.
24	Measure viscosity and compare to specified viscosity.
25	Measure specific gravity and compare to specified specific gravity.
26	Service stuffing box; replace worn shafts.
27	Change packing material.
28	Reverse polarity of drive motor.
29	Rework or replace seal faces.
30	Replace o-rings; check specified application. Change o-ring material of construction if necessary.



## **9 Removal and Assembly of End Flange, 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.
- ◆ Remove securing hardware, from support feet to baseplate.
- ◆ Remove the hex nuts (3020) with spring washers (3015).
- ◆ Remove the end flange (2035) from the stator (3005).
- ◆ Remove the stator (3005).
- ◆ Remove the pump housing (2010) from drive stool (0085) or bearing housing (0005).

Reassemble in reverse order.

- ◆ Installing the stator (3005) will be easier when using glycerine as a lubricant.
- ◆ Ensure during refitting that gasket (8110) is in perfect condition and will seat properly.

Torque values for hex nuts (2030):

Size	M6	M8	M10	M12	M16	M20	M24	M30
Required torque in/lbs.	70	132	264	396	660	704	880	1056

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

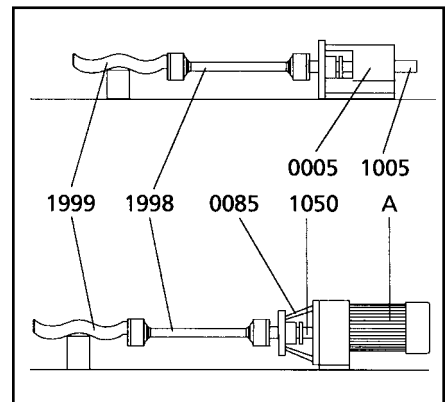
#### 10.1 Removal of Rotor and Coupling Rod

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

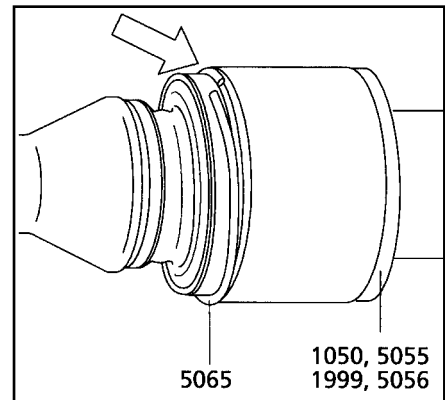
Do not use any force or sharp tools! Special care must be taken to prevent vibrations or impact by a hammer.

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

- ◆ Place the dismantled unit – consisting of bearing housing (0005) with drive shaft (1005) or 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).



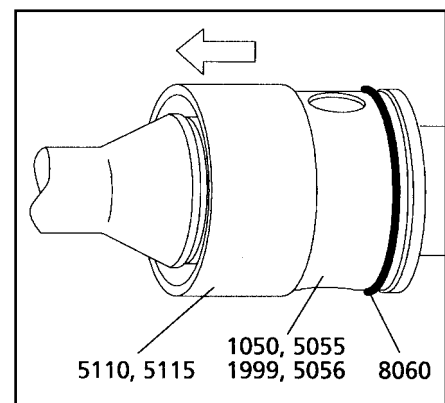
- ◆ Push circlip (5065) out of its groove and slip off over the head of rotor (1999), connecting shaft (1050) or adapter (5055, 5056).



- ◆ **Pumps fitted with a ceramic rotor (1999):**  
**Carefully** turn safety sleeve (5110, 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 (5110, 5115) at an angle with the help of a wooden block and a plastic hammer. Taking care not to damage the O-rings (8060)!



Continued on Page 10.0R

- ◆ Press the pin (5075) out of the head of rotor (1999), connecting shaft (1050) or adapter (5055, 5056). If necessary use a hammer and a thin cylindrical pin (DIN 6450 C).

Drain the oil into a receptacle.

**Use caution for pumps with ceramic rotors!**

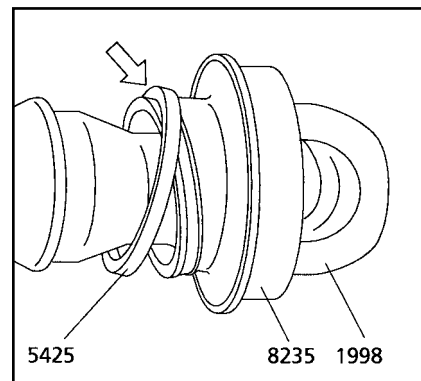
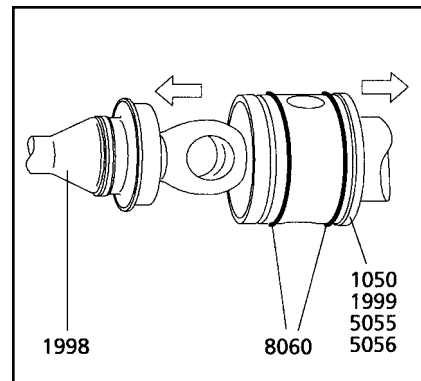
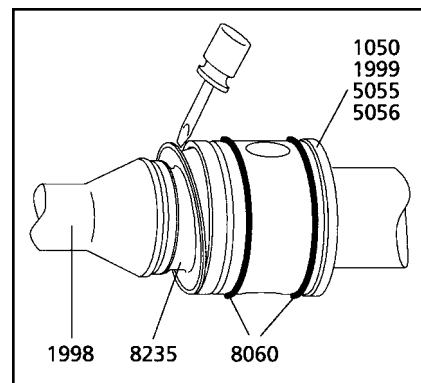
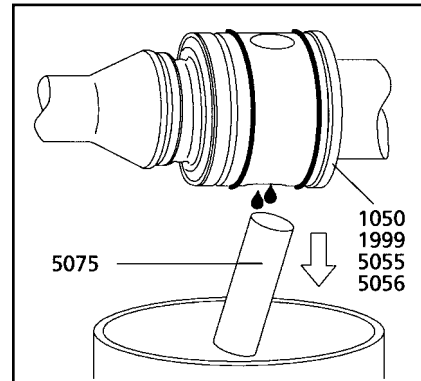
Where a pin (5075) may not come out easily, the metallic head of rotor (1999) should be supported on wooden blocks. Then the pin (5075) can be driven out with the help of a pin punch (DIN 6450 C). This should be done **with care**, holding the ceramic rotor with your hands.

Please dispose of this oil in the proper manner.

- ◆ Using a screwdriver, carefully remove the SM-pin joint seal (8235) from the head of rotor (1999), connecting shaft (1050) or adapter (5055, 5056).

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

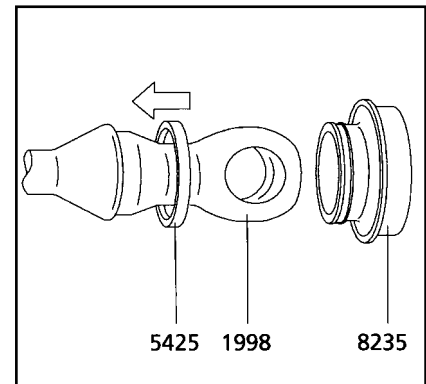
- ◆ Pull apart the rotor (1999)/coupling rod (1998)/drive shaft (1005) or connecting shaft (1050) with adapter (5055, 5056) assembly. Remove the O-rings (8060).
- ◆ Push the SM-pin joint seal (8235) towards the head of coupling rod (1998). In the narrow coupling rod section press the clamp ring (5425) 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).
- ◆ Where an adapter (5055, 5056) is fitted:  
See Page 10.3, Section 10.3:  
Removal and Fitting of Adapters.



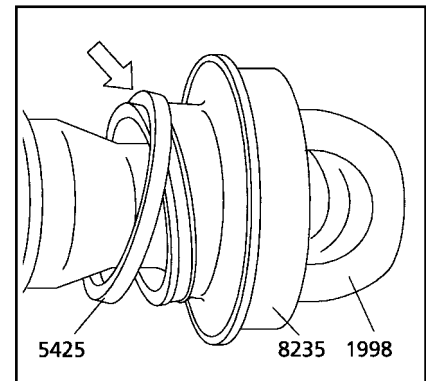
## 10.2 Assembling the Rotor and Coupling Rod

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

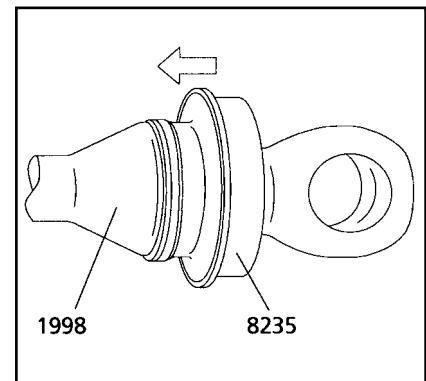
- ◆ If an adapter (5055, 5056) is installed:  
See Page 10.3, Section 10.3 –  
Fitting and Removal of Adapters.
- ◆ Slip the clamp ring (5425) over the head of coupling rod (1998).



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



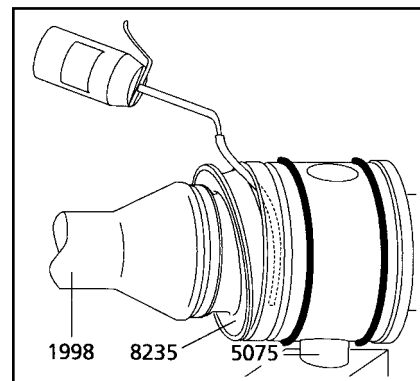
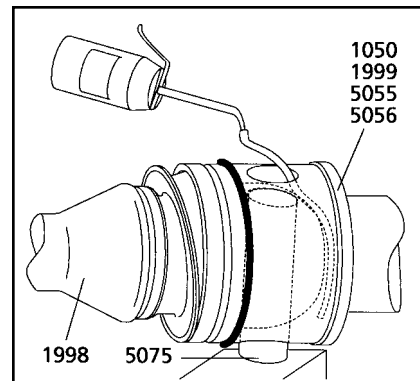
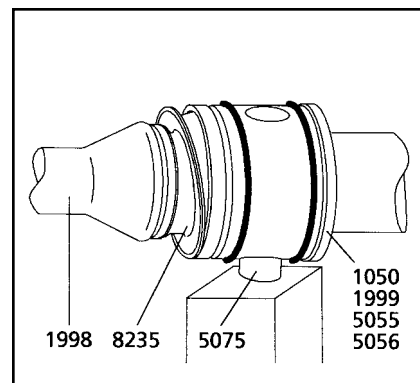
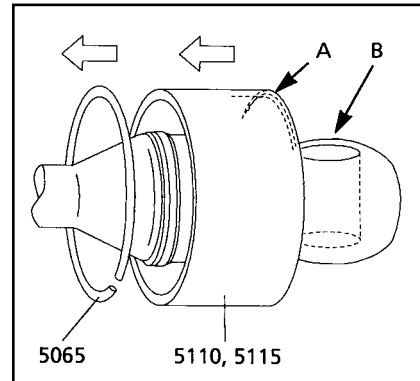
- ◆ Push the SM-pin joint seal (8235) with the correctly placed clamp ring (5425) up to the shoulder of coupling rod (1998).



Continued on Page 10.1R



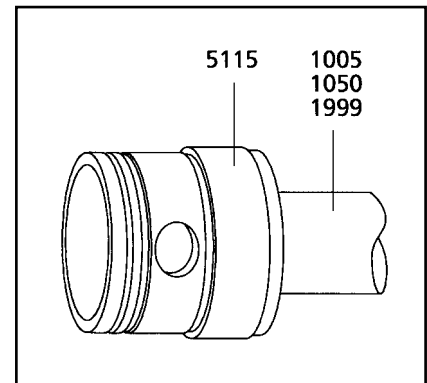
- ◆ Slip the circlip (5065) on to the coupling rod (1998). Slide the sleeve (5110) or (5115) on to coupling rod (1998) so the inside diameter of chamfering (A) is being placed towards the coupling rod (1998) extension. Chamfering (A) will later on ease the installation over the O-rings (8060). Orient 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), connecting shaft (1050) or adapter (5055, 5056) 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), connecting shaft (1050)/ or adapter (5055, 5056) 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), connecting shaft (1050) or adapter (5055, 5056). 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) or adapter (5055, 5056). 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.



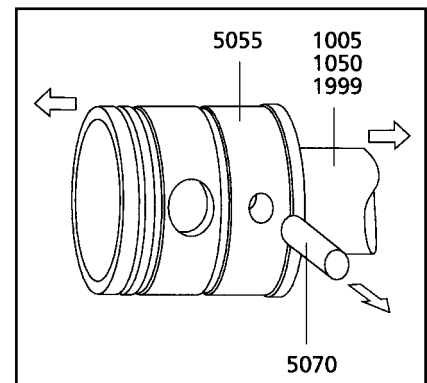
### 10.3 Disassembly and Reassembly of the Adapters

If a pump is fitted with adapters (5055) either on the drive shaft (1005) or connecting shaft (1050) and rotor (1999), these adapters should be removed as follows:

- ◆ Remove the second sleeve (5115) where this has not been taken off earlier when dismantling the joint.

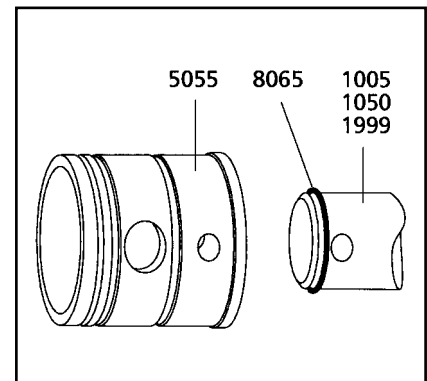


- ◆ Then drive the pin (5070) out of the adapter (5055).



- ◆ Now remove the adapter (5055) from drive shaft (1005) or connecting shaft (1050) and rotor (1999).

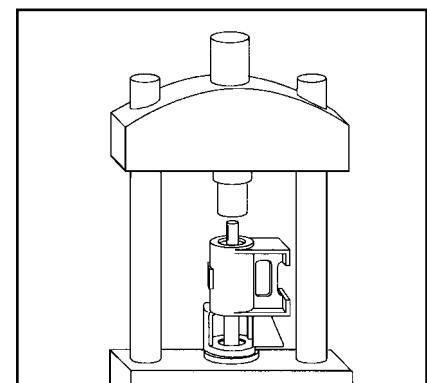
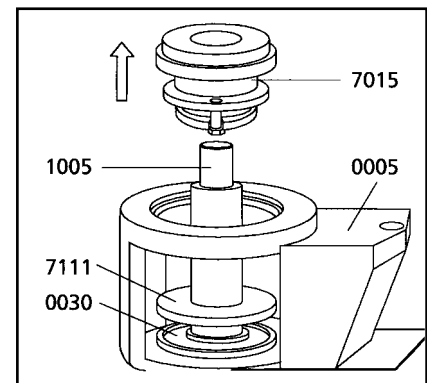
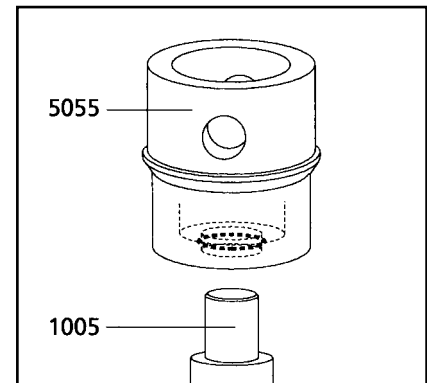
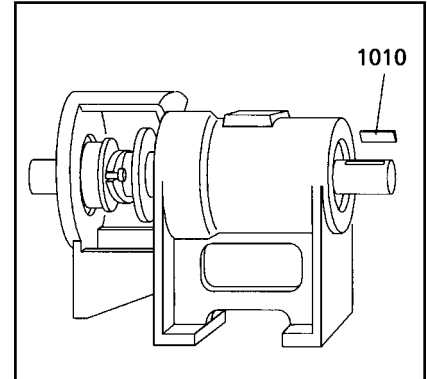
Remove O-ring (8065).



### 11 Disassembly and Assembly of the Bearings

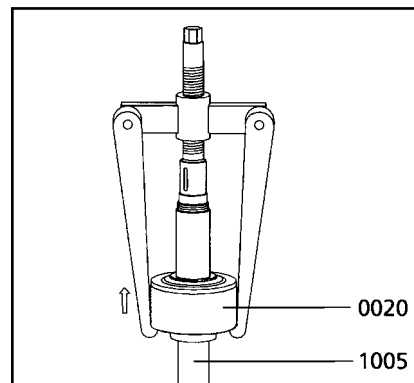
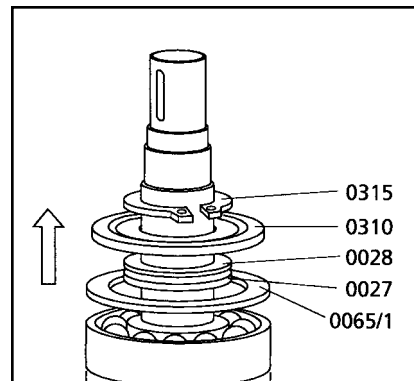
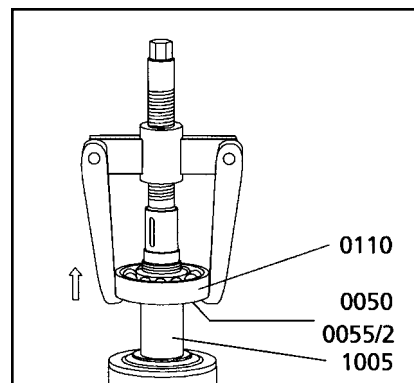
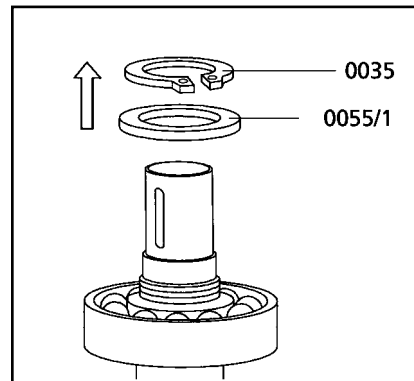
#### 11.1 For drive shaft removal:

- ◆ Remove key (1010).
  
- ◆ If an adapter (5055) exists and had not yet been removed together with the joints:
  - Removal of the adapter according to
    - Page 10.3, Section 10.3 with pin joints.
    - Page 10.5, Section 10.6 with gear joints.
  
- ◆ Remove stuffing box housing (7015) from bearing housing (0005) and slip off from drive shaft (1005).
  
- ◆ For pumps equipped with a different type of shaft sealing, with for instance a mechanical seal, please follow the Instructions under Sections 7 and 12.
  
- ◆ Remove thrower (7111) from drive shaft (1005). Remove lip seal (0030) and substitute a new one every time during refitting.
  
- ◆ Then, remove circlip (0135) as well as second spacer ring (0065/2).
  
- ◆ Press drive shaft (1005) with roller bearings (0020, 0110) out of bearing housing (0005) or apply a standard puller-device.
  
- ◆ Press lip seal (0041) out of bearing housing (0005) and substitute a new one every time during refitting.



**11.2 For removal of bearings from drive shaft:**

- ◆ Remove circlip (0035).
- ◆ Remove first spacer ring (0055/1).
  
- ◆ Pull roller bearing (0110) off from drive shaft (1005).
- ◆ Remove grease retaining ring (0050) and second spacer ring (0055/2).
  
- ◆ Remove circlip (0315), grease retaining rings (0310) and also shim rings (0027) and (0028).
- ◆ Remove first spacer ring (0065/1).
  
- ◆ Pull roller bearing (0020) off from drive shaft (1005).



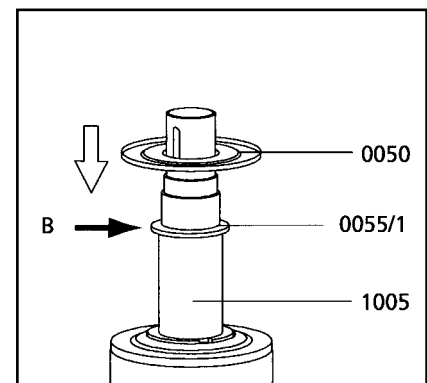
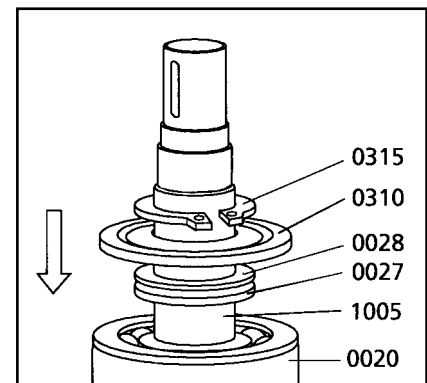
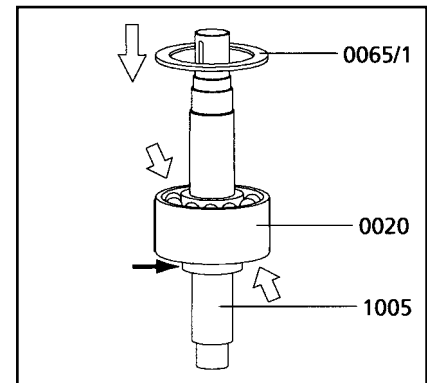
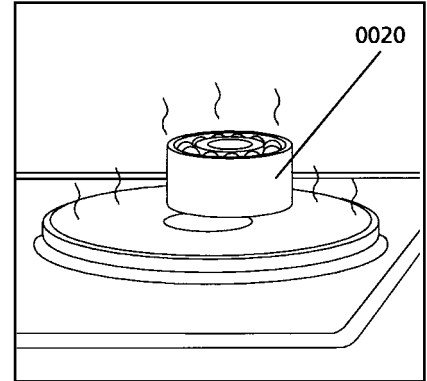
### 11.3 For pre-assembly of drive shaft:

- ◆ Heat up roller bearing (0020) to about 100° C, e.g. on a cooktop.
- ◆ Spread trade recommended “anti-stick paste” on drive shaft (1005) bearing seats to avoid frictional corrosion, also for easier demounting later on.



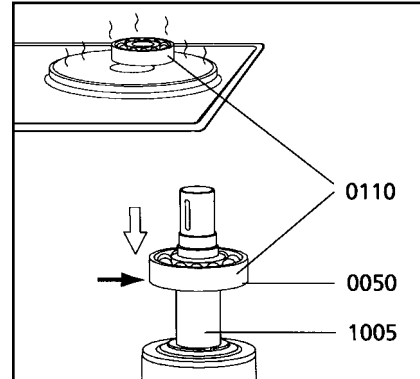
**Please wear heat-proof gloves!**

- ◆ Push roller bearing (0020) up to shoulder (A) on to drive shaft (1005).
- ◆ Apply grease on to both sides of roller bearing (0020). Fill all hollow spaces!
- ◆ From the drive side, slip first spacer ring (0065/1) over drive shaft (1005) and place on roller bearing (0020).
- ◆ Push shim rings (0027) and (0028), also grease retaining ring (0310), until they touch the inner raceway of the roller bearing (0020) on drive shaft (1005). Pay attention to correct orientation of grease retaining ring (0310).
- ◆ Push circlip (0315) until it touches the grease retaining ring (0310) on drive shaft (1005) and snap it into its groove all around.
- ◆ Slip first spacer ring (0055/1) over drive shaft (1005) until it touches the smaller shoulder (B).
- ◆ Slip grease retaining ring (0050) over drive shaft (1005) until it touches the first spacer ring (0055/1). Pay attention to its correct orientation. Please compare sectional drawing NM...!



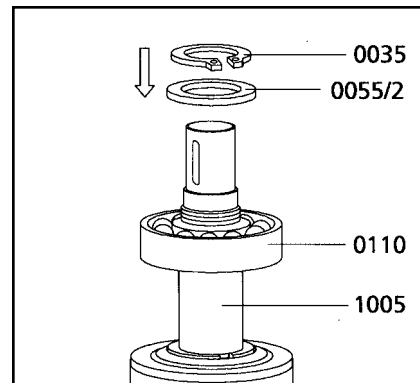
Continued on Page 11.1R

- ◆ Heat roller bearing (0110) up to about 100°C, e.g. on a cooktop.
- ◆ Spread trade recommended “anti-stick paste” on drive shaft (1005) bearing seats to avoid frictional corrosion, also for easier demounting later on.



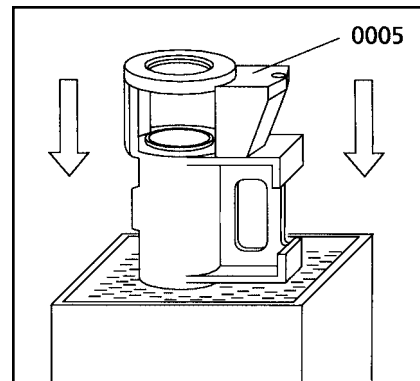
**Please wear heat-proof gloves!**

- ◆ Push roller bearing (0110) over drive shaft (1005) until it touches the grease retaining ring (0050).
- ◆ Apply grease on roller bearing (0110). Fill all hollow spaces!
- ◆ Place second spacer ring (0055/2) until it touches the roller bearing (0110) on drive shaft (1005).
- ◆ Place circlip (0035) on drive shaft (1005) and push until it touches the second spacer ring (0055/2) on drive shaft (1005) and snap into its groove all around.
- ◆ Before fitting pre-assembled drive shaft (1005) into the bearing housing (0005), the shaft must be totally cooled.

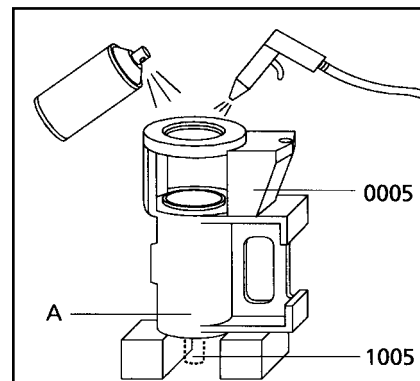


**11.4 For fitting pre-assembled drive shaft into bearing housing:**

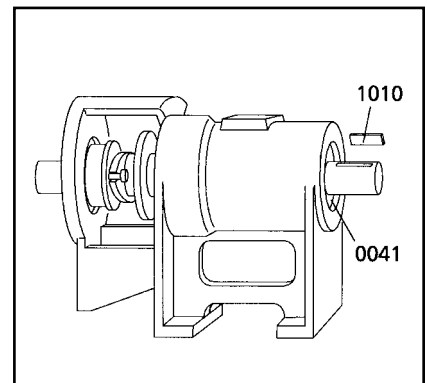
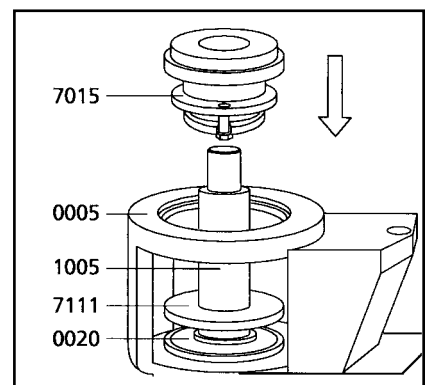
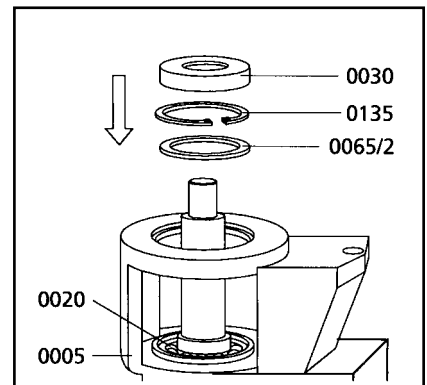
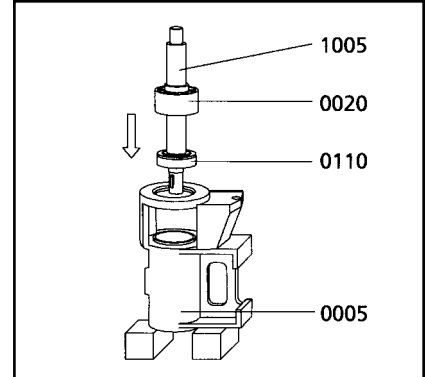
- ◆ Spray anti-corrosion oil (as commercially available) on the inside of bearing housing (0005) and heat for instance in the waterbath to a temperature of 50 - 70°C.  
**Thoroughly prepare all subsequent activities and carry through without delay! The bearing housing (0005) should not cool off too much, otherwise the fitting of the bearings might become difficult! Please wear heat-proof gloves!**



- ◆ With the drive side (A) at the bottom, place vertically and clamp bearing housing (0005) in a vice, or support it on wooden blocks. At the drive side (A) of bearing housing (0005), there should be ample space for the protruding end of drive shaft (0005) by means of compressed air and again treat inside with anti-corrosion oil.

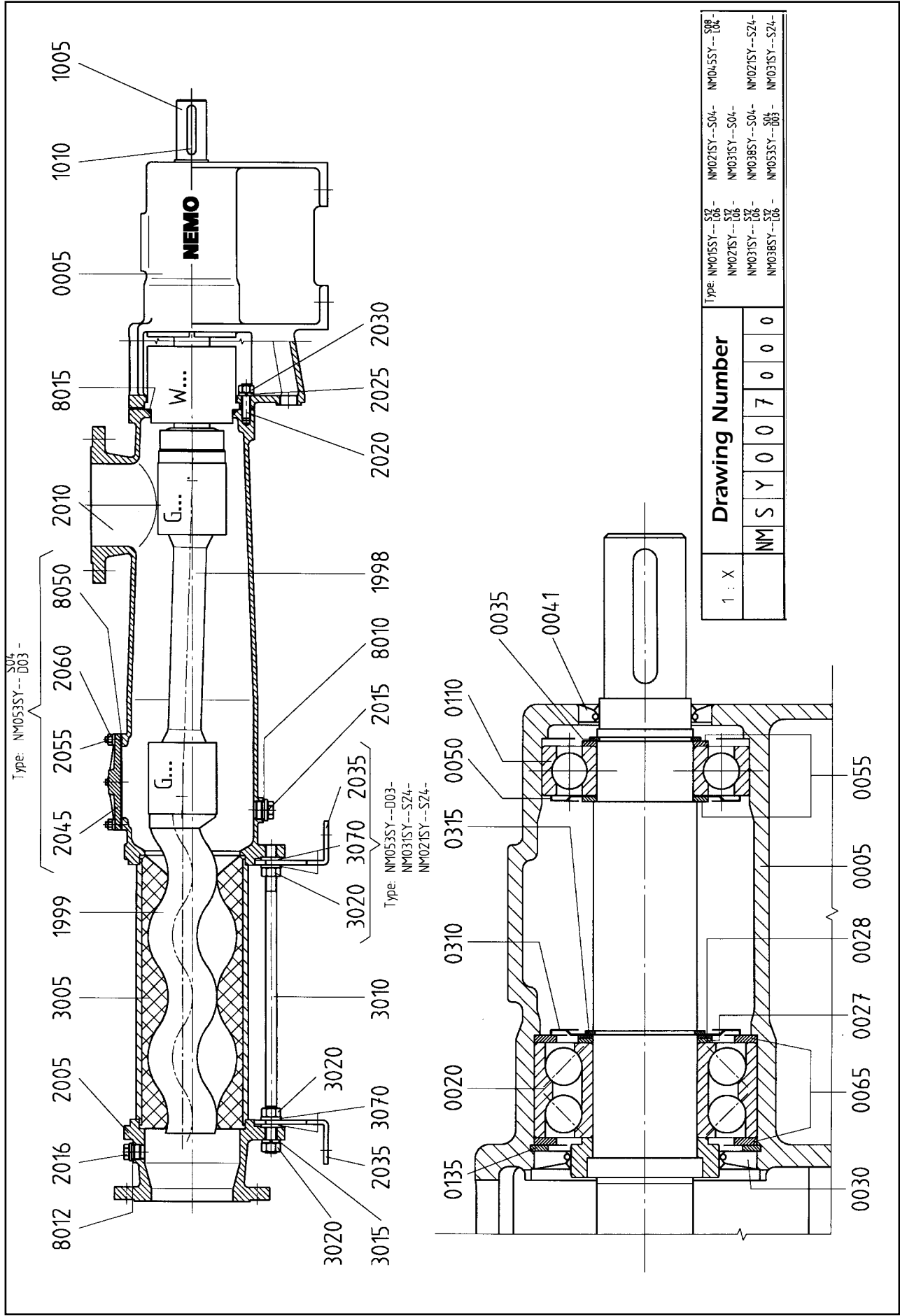


- ◆ Insert pre-assembled drive shaft (1005) with roller bearings (0020, 0110) from above into bearing housing (0005) until it touches the stop of roller bearing (0020) at first spacer ring (0065/1).  
**Do not interrupt this "insertion" procedure!**  
For bigger pumps (size NM 063...and larger) use a crane.
- ◆ Place second spacer ring (0065/2) on roller bearing (0020).
- ◆ Insert circlip (0135) into bearing housing (0005) and snap it into its groove all around.
- ◆ Insert a new lip seal (0030) into bearing housing (0005). Pay attention to correct orientation, The spiral ring must point to the inside of roller bearing (0020). Compare sectional drawing NM....
- ◆ Push thrower (7111) on to drive shaft (1005) in a distance of about 5 to 10 mm to bearing housing (0005).
- ◆ Place pre-assembled stuffing box housing (7015) with inserted front/rear packing (7040, 7045) on to drive shaft (1005) and insert into bearing housing (0005).  
For pumps equipped with a different type of shaft sealing, with for instance a mechanical seal, please follow the Instructions under Sections 7 and 12.
- ◆ Insert lip seal (0041) into bearing housing (0005).
- ◆ Take care of correct orientation. The spiral ring must point to the inside of roller bearing (0110). Compare section drawing NM...!
- ◆ Fit in key (1010).
- ◆ If an adapter (5055) exists:  
Fitting of the adapter according to
  - Page 10.3, Section 10.3 with pin joints.
  - Page 10.5, Section 10.6 with gear joints.





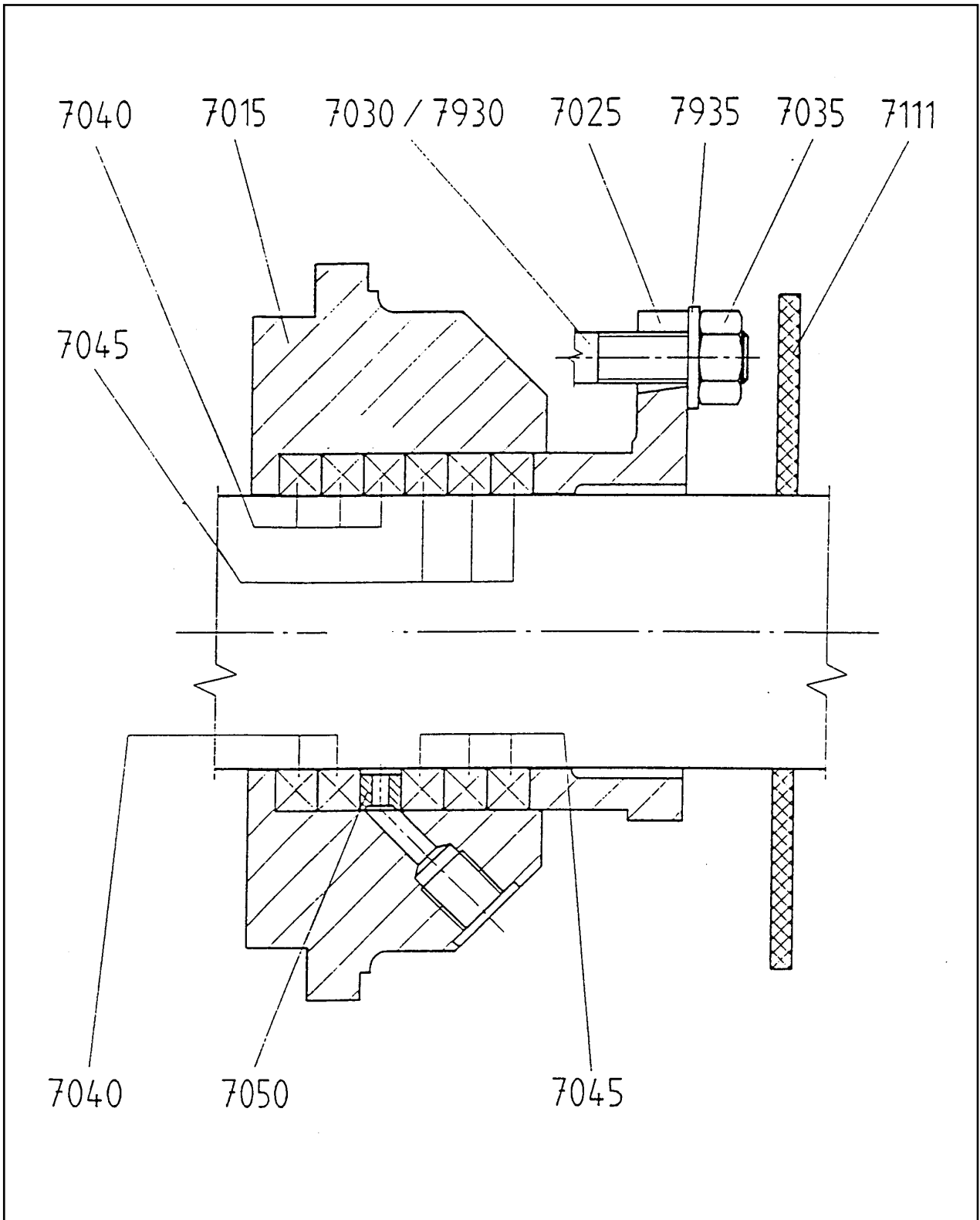




Type: NM053SY--D03-S4

Type: NM053SY--D03-  
NM031SY--S24-  
NM021SY--S24-

1 : X	Drawing Number					Type: NM015SY--S24- NM021SY--S04- NM031SY--S04- NM038SY--S04- NM053SY--D03-	NM045SY--S04- NM021SY--S24- NM031SY--S24- NM038SY--S24- NM053SY--D03-		
	N	M	S	Y	0	0	0	0	0



1 : x	<b>Drawing Number</b>						<b>Packing Gland and Housing</b>	Type:
			W	0	8	4		0

## 14 Recommended Spare Parts (Pump with pin joints with SM-seal)

In general, we have all spare parts subject to wear in stock. Our subsidiaries and exclusive representatives also hold a certain stock. We recommend to keep an amount of spare parts, corresponding to the pump, in stock on site as follows:

Pieces		Position Number	Designation
Large Set	Small Set		
1	1	3005	stator
2	2	8005*	gasket
1	1	8015	O-ring
1	–	1998	coupling rod
2	–	5075	pin
2	–	8235	SM-seal
4	–	8060	O-ring
1	–	8065	O-ring
2	–	5065	circlip
1	–	5110	sleeve
1	–	5115	sleeve
1	–	1999	rotor
2	–	5425	clamp ring

To ensure that you receive the part quickly, please provide the following information with your order. Also, please specify the model number of your pump.

- Either:
1. a. Part number per the parts drawing
  - b. Job number (see pump nameplate)
- or:
2. a. Part number per the parts drawing
  - b. Pump machine number. The machine number is stamped on both the pump nameplate and the bearing housing (0005) or drive stool (0085).
- or:
3. Identification number of part (Note: The I.D. Number is a six digit number which describes the part, pump size, and materials of construction).

\* This gasket is only used with rigid material stators (i.e. metal, PTFE, plastics)

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