



POMPE MONOVITE – PROGRESSING CAVITY PUMPS

<u>FUNCTIONING AND</u> <u>MAINTENANCE MANUAL</u>

Manual n.03 – Fourth edition

Nova Rotors™ srl Via Carlo Cattaneo, 19/25 36040 Sossano (VI) Tel. +39 0444.888151 – 888099 Fax. +39 0444.888152

e-mail info@novarotors.com - www.novarotors.com



GENERAL

1.1 Introduction

This manual includes the instructions concerning the use and maintenance of progressing cavity pumps made by NOVA ROTORS[™] S.r.l..

The information included in the manual apply to the user, who must read and fully understand it before using the pumps.

This instruction manual must always be available to the user for reference.

In case the manual is lost or damaged, you should require a new one to the pump manufacturer.

Warning – The manufacturer is not held accountable for any improper use of the pump should the manual be read in part or not read at all.

NOVA ROTORS[™] S.r.l. is entitled to alter the specifications included in this manual or the features of every pump. Some pictures in this manual may show parts that might be slightly different from the ones assembled on the pump.

The manual is an integral part of each pump; therefore, it must be kept and equip the pump also in the event that the pump may be made available to a different user.

1.2 Information about CE marking

As well as the CE mark, the details shown on the CE marking plate attached on each pump include the following:

Manufacturer:	NOVA ROTORS™ S.r.l.
Address:	Via Carlo Cattaneo, 19/25
Town/City:	36040 Sossano (VI)
Machine:	Progressing cavity pump
Model:	
Manufactured in	2010

1.3 Compliance of pump with CE

Each progressing cavity pump is provided with a CE-compliance certificate issued by NOVA ROTORS[™] S.r.I.

The pump was made to comply with the basic safety requirements set out in these applicable directives:

Directive on machinery: 2006/42/CE Directive on low tension: 2006/95/CE Directive on electro-magnetic compatibility.



In addition, pumps were designed and made in accordance with these standards:

UNI EN 809: 2009 – Pumps and liquid pumping units – General safety requirements.

UNI EN ISO 12100-1: 2005 – Machine safety. Basic principles, general design principles. Part 1: Basic terminology, methodology.

UNI EN ISO 12100-2: 2005 – Machine safety. Basic principles, general design principles. Part 2: technical principles.

CEI EN 60204-1: 2005 – Machine safety. Electric wiring. General rules.

1.4 Fields of application

Progressing cavity pumps are used to pump fluid as requested in the order concerned. Any pump must not be used for fluid whose chemical and physical properties differ from the ones set out in the order.

The max. pressure required must be lower than the max. pressure a pump can reach, adequately reduced to take into account any leakage from delivery piping.

Unless otherwise stated, the pump must not be used in places where potentiallyexplosive atmospheres may occur.

1.5 Noise

The average noise level A emitted by the pump must not be higher than 80dB(A).

1.6 Safety warning

1.6.1 Overpressure

The progressing cavity pump must be installed within a plant. The delivery pressure of these pumps is only limited by the power of machines.

In case delivery of pump is intercepted, pressure rises until piping breaks or the pump is damaged, which may cause leakage of fluid under pressure.

The plant must therefore be equipped with proper safety devices such as manostats and fracture disks with return piping as shown in § 4.6.



1.6.2 <u>Wiring</u>

The wiring of machines equipped with electric motor must be made by the user in accordance with the instructions set out in standard CEI EN 60204-1:2005.

Take care in:

- the choice of conductor section, which must be able to bear power at start-up with locked rotor;
- connecting the conducting parts of pump to the earthing;
- connecting phases so as to perform the direction of rotation shown on the pump.

Little leakage of pumped fluid is expected for proper pump functioning.

All electric components installed close to the pump must be protected with casings ranked IP 66 or higher.

1.6.3 Mobile parts of pump

The rotor of the progressing cavity pump is connected to the driving unit through a joint.



No removal of casings from mobile parts

The pump must not be started before placing and fixing the casing of driving unit.

1.6.4 Leakage of hazardous fluid

Should the pump be used with hazardous liquid such as poisonous, corrosive fluid, etc., fluid which may leak from seals must be collected and disposed without causing danger to people or the environment.

1.6.5 Handling

Some pumps may reach considerable sizes and weights that they cannot be handled by one single operator manually.



Before handling the pump, read the instructions in sect. 5 of this manual very carefully.



1.6.6 Pump maintenance

Pump maintenance work must be done when the pump is at a standstill.

Before removing the casings of mobile parts, make sure that the motor cannot be started again before restoring safety conditions.

The pump must not be under pressure and must be cooled.

Pumps or units which feed substances affecting people's health must be decontaminated.

Should a pump be disassembled to pump any hazardous fluid, the maintenance operator must wear all DPI prescribed for handling such a substance.

Shortly after finishing maintenance work, all safety and protection devices must be applied and set to work again.

Setting the pump to function again after maintenance work must be carried out following the instructions set out in sect. 7.

1.6.7 Non-compliance with the instructions included in this manual

If the instructions included in this manual are not complied with, this may affect people's health, the environment and the machine.

Such non-compliance may result in:

- inability to perform any key functions of the pump and/or plant;
- damage to the pump and/or plant;
- electric, mechanical and chemical dangers for people;
- danger for the environment due to leakage of hazardous substances.

1.7 Start-up, operation and maintenance

The plant in which the progressing cavity pump will be applied is not an integrating part of the supply; therefore, the user must choose the pump which may best fit his needs, as well as all the accessories needed to ensure the plant safety.

1.8 Safety warning for maintenance, inspection and assembly

The user must make sure that any maintenance, inspection and assembly of progressing cavity pumps should be carried out by expert technicians. Before starting work, the staff must have read this manual very carefully.

1.9 Alteration and discretionary production of spare parts

Any alteration or modification of the pump, within the extent of extraordinary maintenance, are allowed subject to the manufacturer's agreement.

As for ordinary maintenance, original spare parts or any parts deemed to be suitable by NOVA ROTORS[™] S.r.I. must be used.

The use of non-original spare parts leads to the earlier termination of warranty.



2 PUMP FUNCTIONING

A progressing cavity pump is a rotating volumetric pump. The main parts of the system are a rotary part called **ROTOR** (see **A** below) and a fixed part called **STATOR** (see **B**). The rotor is a round thread screw with a very large pitch, a deep thread and a small core diameter. The stator is double-threaded and has a pitch which is double compared to the rotor, so that between the stator and the rotor there are delivery chambers. These move continuously from the inlet side towards the outlet when the rotor is spinning inside the stator.

In progressing cavity pumps the axis of rotation of the rotor A does not coincide with the axis of rotation of the motor. The rotor is driven by a double-joint shaft. This shaft absorbs eccentric motions and shifts axial stresses towards the motor shaft.





The fluid coming from the stator/rotor group is conveyed to the central body, and then ejected through the outlet.

Outlet
Rotor
Stator
Connecting Rod
Hollow shaft
Pump body
Shaft seal
Bearing housing
Close coupled
Male shaft
Shaft joints



3 BRIEF DESCRIPTION OF THE PRODUCT

3.1 Main technological features of progressing cavity pumps

- * Steady capacity, proportional to motor speed.
- * Self-priming, with a min. suction of 4 mt (NPSH), depending on the number of stages and rpm of the pump.



NOVA ROTORS Progressing cavity pumps

- * Pumping of very high viscous liquids.
- * Dosage of liquids.
- * No inlet or delivery valves.
- * Centrifugation-free pumping with low tension stress in the pumped material.
- * High pumping pressure (6 BAR for each stage). Pumps may have **one** up to **four** stages, according to the pressure required:



3.2 Classification

Progressing cavity pumps are divided into two main categories, according to the coupling between pump and motor:

- * Progressing cavity pumps WITH BEARING HOUSING.
- * Progressing cavity pumps CLOSED COUPLED.

3.3 Motors

Motors can be of different kinds; the pump can be fitted to:

- * Electric motors
- * Hydraulic motors
- * Gearmotors
- * Torque converters

3.4 Available configurations

Progressing cavity pumps can be assembled in different configurations, according to the needs:

- * Feedbox and screw feeder
- * Vibrating feedbox
- * Barrel emptier
- * Vertical

Note: customizations include specific inlet and delivery orifices, trailer-mounted base, simple base, electric board, thermal protections etc.

4 COMPONENTS OF THE PRODUCT

4.1 Rotor



The rotor may be made of different materials, such as carbon steel and stainless steel. It may also be coated with hardening surface treatments such as chromium plating, ceramic treatment, gas and ion nitriding, etc.

4.2 Stator

The stator is built with a steel pipe internally coating with elastomeric material, chemically compatible with the properties of the fluid to be pumped. It may be made with different elastomers:

			MAX		
Class	MST °C	MATERIAL	TEMP	Class	Stator
T4	135	VITON	180°C	T4	VITON
T5	100	EPDM	120°C	T5	EPDM
T6	85	NBR	90°C	T6	NBR - SBR
		SBR	90°C		
		CSM	70°C		

MST: Maximum surface temperature allowed for machines of Group II (Cenelec standard EN 50014).

Note: It is possible to manufacture teflon stators for special applications.

4.3 Couplings

4.3.1 Bearing housing coupling

Using the bearing housing coupling the pump is linked to the motor by the male shaft, and it is mounted on a cast iron support through rolling bearings.

This configuration allows optimal resistance to the axial thrust towards the motor in those models working under high pressure. The choice of the motor in this case is not affected by axial thrust. The final coupling between motor and male shaft is made by elastic joints with a protective case.



4.3.2 Closed coupling

Closed coupling mounting does not take into account the use of a male shaft, therefore the hollow shaft of the pump is linked directly to the motor male shaft. In this case, it is necessary to use motors (or motoreducer in the case) capable of standing axial stresses coming from counter-pressure reactions during pumping.



Note: It is possible, for a special series of feedbox pumps, to link the propeller shaft directly to an angular worm screw gearmotor, without any support.



4.4 Connecting rod joints

Depending on the type of pump, the connecting rod can use different types of joints (see par. 9.3):

- * Type SN1: Pin joint with elastomeric sleeve for smaller pumps.
- * Type SN2: Universal joints with elastomeric sleeve and changeable bushing.
- * Type SN3: Homokinetic joint with elastomeric sleeve.
- * Type SN4: Pin joint with dual elastomeric sleeve and changeable bushing.
- * Type SN5: Universal joint with elastomeric sleeve and changeable bushing for high power.
- * Type SN6: Universal joint with elastomeric sleeve and changeable bushing.
- * Type SN7: Open Pin joint for use with foods without sleeve.
- * Type SN8: Pin joint with short bell and flat sleeve.
- * Type SN9: Pin joint with short bell for high power.
- * Type SN10: Pin joint with short bell type "C".

4.5 Sealing systems

The liquid sealing systems may change according to the type of fluid and to the technologic conditions of pumping. The following types are available (see par. 9.4 and Service manual):

- * Type TEN 01: Packing seal.
- * Type TEN 02: Fluxed packing seal.
- * Type TEN 03: Oil seal.
- * Type TEN 04: Single mechanical seal.
- * Type TEN 05: Double fluxed mechanical seal.
- * Type TEN 06: Mechanical seal for food application.
- * Type TEN 07: Oil seal for worm gearmotors.
- * Type TEN 08: Mechanical seal for food application with bearing.
- * Type TEN 09: Mechanical seal with washing quench.
- * Type TEN 10: Single mechanical seal (for pump type 010).

Note: Mechanical seals can be fluxed, or employ quench techniques. On request, it is possible to manufacture mechanical seals complying with API 610 standards.

4.6 Accessories

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All pumps may be equipped with accessories to improve their performance and in order to improve safety of plant.

4.6.1 Dry-run protection

The protection against dry run prevents stator damage whenever the liquid is missing. A thermal sensor is fitted to the stator, and linked to the electric board. If there is no fluid in the stator, the stator rubber overheats and the increase in temperature activates the electric circuit, which stops the motor. This device may be installed subsequently.

4.6.2 Protection against delivery overpressure

The overpressure protection consists of a security valve set to the desired pressure and a bypass pipe which closes delivery or reduces the flow in case the pump may not be stopped.



4.6.3 Return valve in delivery

In case it is necessary to convey part of the product back to the tank in order to mix or make the product more homogeneus, it is possible to fit a valve in the delivery.

4.6.4 Electric board

Upon request, pumps can be controlled by an elecric board, consisting of a main switch, a pilot light, a liter counter, two-position forward/backward selector and a reset emergency switch. The boards are also equipped with a safety lock. All boards are supplied in compliance to the low voltage equipment directive 2006/95/CE.

5 PACKING, TRANSPORT, STORAGE

5.1 Packing and transport

Progressing cavity pumps are shipped in containers (boxes on pallets, cases or cages), unless the customer requires a different system.



The parcels are marked and supplied with handling instructions.

Upon receipt, check for possible damages.

Transport damages are to be reported immediately to the carrier.

Pumps are to be brought packed as near as possible to the installation site and kept packed as long as possible.

Horizontal axis pumps, once unpacked, can be lifted exclusively with the base. Use external holes and eyebolts on the base. (For dimensions, see drawing in the **Service Manual**).

Vertical axis pumps can be lifted using the holes in the support plate or eyebolts or in the bracket. The motor is usually at the top end. (For dimensions, see drawing in the **Service Manual**).

WARNING!: do not lift machines with weight on top (with center of gravity above the lifting point). Make sure they do not capsize.

Vertical axis pumps must never rest in upright position without adequate fixing!

Warning: they may fall! Always arrange them horizontally. Absolutely do not lift the pump using the motor or reduction gear eyebolts. They are meant for transport of motor or reduction gear only.

Due to the diversification of configurations, these are to be considered as general instructions, usually meant for skilled personnel in charge of transport and assembly. If more detailed instructions were needed, instructions related to specific machine can be supplied.

For trailer-mounted pumps follow this:

- * Before moving machine make sure that the motor is not running and that it can not be accidentally started.
- * Move the unit slowly and carefully, especially if over irregular ground.

Overturning hazard!

- * Make sure that the position in the new resting location is steady; lock every stopping devices on wheels/rolls, in order to avoid unwanted motion.
- * Consider the reaction forces and the movements of flexible piping occuring during pump working.
- * Possibly fix the unit with additional wedges.

5.2 Storage

The pumps, unless otherwise agreed, are protected during transport. In case of prolonged storage prior to the assembly:

• <u>Stator</u>: In case of prolonged stop, the rotor may permamently buckle the stator on the contact surface (compression-set). This requires a greater pickup torque.



Therefore, remove the stator, pack it in order to shelter it from light and air, and store it in a cool, dry place.

- <u>Rotor</u>: Rest it on wooden blocks and cover it for protection against mechanical damage.
- <u>Shaft packing</u>: Remove the gland, and grease the shaft.
- <u>Stainless steel parts</u>: No protection needed.
- <u>Other non-painted pump parts</u>: Grease.
- <u>Motors</u>: see manufacturer's instructions.

6 ELECTRIC CONNECTION – PIPELINE CONNECTION

6.1 Installation of motor

6.1.1 Electric connection

The work relating to electric connections shall be carried out by authorized and specialized personnel.

In order to connect electric equipment to the machine please follows at the directive CEI EN 60204-1:2005

The power supply must be equipped with a thermal magnetic overload cutout, or a fuse, and a compulsory earthing system, as mentioned above.

The electric wire shall be double-insulated and fire-retardant and with an adequate crosssection for every phase. The connecting to the Neutral must be coherent with safety system of installation plant (TT-TN etc.).

Before starting the pump, check:

tension, frequency and number of phases conform with the electric motor

- motor connections (star/triangle) conform with the alimentation available.
- wire section conform with the amperage concerned.

6.1.2 Pump-motor coupling

6.1.2.1 Close coupled version

The coupling of a progressing cavity pump with its motor is not difficult, though problems may arise since the mechanical seal (or packing) is installed on the hollow shaft which, if not coupled to the motor/converter, can easily break the seal.

Therefore, during assembly, it is necessary to be careful not to move excessively the axis of the hollow shaft. Oil the male shaft of the motor/converter, place it so that its key is in line with the corrispondant bore.

Engage the propeller shaft until the two flanges (the motor's and the pump's) were connect. Then turn the motor/converter until the bolts holes of the flanges coincide. Let the pump shaft hit the motor shaft and tighten the grub screw (line it up with the cavity set it up on the gearmotor shaft).

6.1.2.2 Bearing housing version (with elastic joint)

Insert the half-joints (or pulleys, if belt drive is employed) at the ends of the shaft **without using a hammer** or other tools which may damage parts inside the support. For assembly, use the threaded hole on the end of the shaft.

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The accurate alignment of motor and the male shaft of the pump is an essential condition for a proper operation.

If the pump is delivered completed, the alignment has already been carried out at the factory.

Nonetheless, it is possible that during the positioning on the floor a misalignment may occur, therefore it is necessary to remove the joint cover and check its alignment by means of a ruler before startup. If the foundation is not properly leveled, the base may buckle. The tolerances usually allowed in joints used by the NOVA ROTORS[™] S.r.I. are:

- Allowed radial variation = 1%
- Allowed angular variation = 1°

6.1.3 Direction of rotation

The direction of pump rotation is shown on the label pump and described on the confirmation order.

The direction of pump rotation sets the direction of the flow through the progressing cavity pump.

Any different setup must be agreed with the supplier and approved by the same. By changing the direction of pump rotation, the product flow reverses.

If the pump turns clockwise, seen from the motor side, it intakes from the orifice at the end and delivers from the middle one; if the pump turns counterclockwise it intakes from the middle orifice and delivers from the one at the end (see below)



Usually, the pump can work in both directions, be it mounted with packing or with a mechanical seal (unless it uses omokinetic joints which allow just one direction). It is advisable, though, to use the pump turning counterclockwise to prevent that the packing rings (or the mechanical seal) or other parts were subject to high pressure that could be difficult to monitor.

The pumps with a mechanical seal, though reversing, shall always turn in the direction indicated on the pump label.

This direction of rotation shall be preset upon the order while the seal assembled shall be preset at the factory.

Contact NOVA ROTORS[™] S.r.l. if you need to change the direction of rotation for pumps that use mechanical seal.



OMI.EN-PCP001 R01



In close coupled versions, it is necessary to check periodically that the shaft grub screw were well tightened and fits properly in the propeller shaft cavity, especially if the pump is employed in both directions. To this purpose, see par. 6.1.2.1 of this Manual.

6.2 Pipe assembly

6.2.1 Important premise

- Intake and outlet pipe diameters must be adequate, according to viscosity and delivery involved.
- Accurately clean the pipes before connecting them to the pump.
- Pipes must be connected to the pump so that no external force may be applied to the pump itself.
- Fit adequate compensators between pump and pipes to protect the pump from vibrations which may damage the pump body.
- Intake and outlet pipes shall be fitted so that, the pump is not working, there is some fluid upstream and downstream, in order to ensure that there is always enough fluid in the pump to provide lubrication at startup.
- Minimize the air intake in the body pump.

Note: In case fluxed packing glands or fluxed mechanical seals or quenches were used, the feeding system connections and system tuning must to be carried out **prior to the first startup**.

6.2.2 Max allowed pressure

Unless otherwise set out in the order confirmation, it is understood that **the maximum pressure inside the pump body (i.e. with pump turning clockwise) is 6 bar per stage**. The maximum allowed pressure at delivery is related its features:

- flange: not exceeding nominal pressure (i.e. PN 16)
- female thread: not exceeding 25 bar
- sanitary male thread according to DIN 11851, up to DN 100: single and double stage pumps: not exceeding 12 bar multiple stage pumps: not exceeding 25 bar

Other configurations: In any case not exceeding 6 bar per stage of the stator being used.

6.2.3 Useful advice

It is advisable to fit to the pipe union a stub pipe of L length. This will allow the replacement of the stator without the need of disassembling the pump. The L value is shown in the table below, according to the size of the pump and the number of stages:

		LENGTH	L
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PUMP 1 STAGE 2 STAGE 3 STAGE 4 STAGE

010	-	80	-	-
015	80	160	-	-
020	110	170	-	360
030	160	300	-	-
040	200	420	-	-
050	260	-	530	-
053	-	-	-	530
055	270	550	-	980
060	440	-	-	1230
062	320	630	-	-
080	440	880	-	-
120	500	-	-	-
200	540	-	-	-
300	540	1050	-	2110
400	660	1260	-	-
500	820	1580	-	-



7 STARTUP



- Never operate the pump without product this is mandatory, otherwise the stator, made of elastomeric material will overheat and may burn. A few seconds are enough to cause damage to the stator.
- The eccentric screw pump is of the volumetric kind, **therefore it shall NEVER be operated with a closed delivery valve**. Since the theoretical pressure is infinite, this would cause excessive stress with partial or total damage to the pump or piping.
- Before startup, check that the direction of rotation were correct.

7.1 Advice for optimal operation

To achieve long life and high performance, it is useful to follow these recommendations:

- The pump is self-priming, but it is advisable to fill its body with the liquid to be pumped before the first startup.
- Control the rate of delivery by modifying the rpm of the motor instead of setting choking valves.
- Install an immediate stop device in case of absence of liquid at intake, by means of a temperature sensor on the stator, to stop the pump after a few seconds of dry operation.

7.2 Pumps for alimentary use

The startup of pumps to be used with food requires the plant to be perfectly clean. Cleaning may be performed in two ways:



- Disassemble the pump and wash every part of it with suitable detergent. Reassemble the parts making sure they stay clean.
- Perform Cleaning in Place (CIP) if the pump is suitable for this kind of cleaning.

7.2.1 When to perform cleaning

- Before startup
- After a prolonged stop
- After replacing parts
- After use if a prolonged stop is foreseen

Several companies supply products for CIP cleaning. Make sure the products used are compatible with the material to be pumped.

7.2.2 CIP cycle

- Pre-washing with clean water, to empty the pump
- Basic washing with caustic soda (1-2% at 60-80°C for 10-20 min.)
- Intermediate washing with clean water for 5-10 min.
- Washing with nitric acid (1-1.5%) at 50-70° C for 5-10 min.
- Final washing with clean water for 5-10 min.

Note: The washing speed of liquid detergents should not exceed 2 m/s at any point.

In this cycle the stator is subject to high chemical and thermal stress. Therefore, in this CIP cycle the pump shall stop and restart, that is, change the relative position of rotor and stator every 2-3 minutes, turning just a few times to make sure that every part of the stator gets cleaned.

7.3 Temporary rest

After stopping the pump, empty it and possibly wash it if:

- The fluid may solidify.
- The mechanical seal may get encrusted.
- The liquid inside the pump may freeze due to the low ambient temperature.

7.3.1 Procedures

7.3.1.1 Stator

In case of prolonged stop, the rotor may permanently deform the stator on the contact surfaces (compression-set). In this case a greater pickup torque is required at restart. It is therefore better to dismount the stator from the pump, pack it to shelter it from air and light and store it in a cool, dry place.

7.3.1.2 Rotor

After the stator has been disassambled, rest the rotor on wooden blocks and cover it to prevent damage.

Before reassembly, degrease and clean the rotor to prevent conflicts with the stator material or with the product to be pumped.

8 MAINTENANCE

IMPORTANT: All maintenance and cleaning operations must be performed with the machine at a standstill and cut out from any energy source.

After a stop and before restarting, the machine must be inspected to determine the cause of the stop command, and act with appropriate measures in order to prevent that from happening again.

The inherent vibrations of a progressing cavity pump are below 2.5 m//sec², therefore they hardly cause risk or trigger possible failures. The vibrations, though, may lead to the loosening of the screws of the pump. It is therefore essential to regularly check the tightening of them.

8.1 Superficial cleaning

It is important to schedule regular cleaning operations, depending on the liquid to be pumped. The pump may be cleaned:

- Through the cleaning windows if present on the pump body.
- Manually, disassembling the pump
- Automatically (CIP) for pumps with suitable connectors.

8.2 Stators and sealing systems

8.2.1 Stators

Approx. every 900 hours of operation, it is necessary to check the wear, especially for the stator and the sealing system (packing or mechanical seal).

The frequency of control operations will be determined according to the wear of both of them, not exceeding anyway 1500 working hours.

8.2.2 Seals

8.2.2.1 Packing seal

Packing seals limit the leakage of product, but do not prevent it entirely. A small leakage is necessary to prevent excessive friction and subsequent possible overheating. At startup, after replacement, tighten the gland bush lightly until it is set and in ideal working conditions (for 10-15 min.), then tighten it more strongly to obtain the smallest possible leakage.

In case the pack were excessively compressed, the following damages may arise:

- Dry working
- Burnt pack
- Scored shaft (with subsequent leakage of fluid).



NOTE: The packing seal is in optimal working condition if constantly damped by the product to be pumped.

8.2.2.2 Single mechanical seal

The type and brand of the mechanical seal used is specified in the order confirmation. In case of significant leakage, check the surfaces of the seal faces and seat. Replace them if necessary.

8.2.2.3 Mechanical seal for vertical pumps

Use particular caution on vertical pumps with motor on top (type SV/VM). At startup, the mechanical seal has not yet been in contact with the fluid and briefly works dry until the air in the pump body has been expelled.

At first startup or after a prolonged stop, lubricate the mechanical seal before starting the pump.

Lubricate with water, glycerine or oil, depending on the product to be pumped: check for compatibility with the elastomers of the mechanical seal.

8.3 Control and replacement of articulated joints

The driveline joint is one of the most stressed parts of the pump, therefore needs regular and adequate controls. On any kind of joint, it is always necessary, though the pump may work normally, to immediately replace damaged sleeves, even if the damage is slight. Sleeves of any kind are to be kept in warm water for some minutes before replacement, in order to soften them and ease the fitting to both ends of the joint and prevent damage on the elastomer they are made of.

8.4 Lubrication

8.4.1 General

The NOVA ROTORS[™] progressing cavity pump is supplied with lubricant for about 3250 working hours. In case of replacement of parts involving lubrication, it is advisable to relubricate. To this purpose, see the table below:

Universal joints: VN 2461 C

Chrome steel joints (Universal joint and Pin joint): Agip SM2 - Esso Beacon Q2 AISI stainless steel joints (Universal joint and Pin joint): Agip SM2 - Esso Beacon Q2 Bearings: Agip MU3

Rubber stators for food: Agip vaseline 1718

Steel Universal Joints	Molycote VN 2461 C
Chromed steel, universal joint and pin joint	Agip SM2 - Esso Beacon Q2
Stainless steel, universal and pin joints	Agip SM2 - Esso Beacon Q2
Bearings	Agip MU3
Food grade stators	Agip vaseline 1718

8.4.2 Bearings

The male shaft bearings are greased at NOVA ROTORS[™]. In case they were removed, their seat shall be filled with grease according to the table above.

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8.4.3 Propeller shaft joints

Pin joints with sleeve are to be periodically lubricated. Moreover, every time parts were replaced with original spare parts, their grease shall be replaced.

IMPORTANT: The pumps that uses sleeves over joints for food are supplied with food-compatible grease.

8.4.4 Motor variator See Service Manual

8.5 Malfunctioning

Below you can find a synthetic table. Malfunctioning References:

Α	The pump does not work	F	The pump stops
	The pump does not		
В	intake	G	Faulty stator
С	Wrong delivery	Н	Faulty rotor
D	Uneven flow		The seal leaks
			Low delivery
E	Noisy pump	J	pressure

	Α	В	С	D	Е	F	G	Н	Ι	J	POSSIBLE CAUSE
1	Х						Х				New stator and rotor are stuck together
2	Х						Х				Faulty electrical contact
3			Х	Х			Х	Х	Х		Excessive delivery pressure
4	Х		Х			Х	Х				Unknown matter in the pump
5	Х	Х					Х	Х	Х		High temperature, the stator squeezed
6	Х	Х					Х				Stator of wrong material. Check the order
7	Х				Х	Х	Х	Х			Product granulometry too high.
8	Х	Х		Х		Х	Х	Х		Х	The product sediments when the pump is
											stopped
9		Х		Х	Х						Air leakage at intake
10		Х	Х	Х	Х						Difficult intake
11		Х	Х	Х	Х						Air intake from seal or packing
12		Х	Х	Х						Х	Too Low speed
13		Х	Х	Х					Х		Wrong direction of rotation
14		Х			Х					Х	Available NPSH below required
15		Х	Х	Х		Х	Х			Х	The pump is working dry
16		Х	Х							Х	The stator is faulty – burned-over
17		Х	Х	Х			Х			Х	Spoilt stator. Check rubber
18		Х	Х	Х				Х		Х	Faulty rotor
19			Х	Х	Х	Х					Faulty connecting rod
20					Х	Х					The pump is not aligned to the elastic joint
21					Х	Х					Broken connecting rod
22					Х	Х					Spoilt bearings
23					Х		Х	Х			Too high speed
24	Х	Х				Х	Х			Х	Excessive viscosity
25		Х	Х	Х	Х		Х		Х	Х	The gland needs to be adjusted
26			Х						Х	Х	Inadequate sealing system



Reference for malfunctioning removal:

1) Fill the pump with suitable product, gliceryn or soap (DO NOT USE any kind of oil if an EPDM rubber stator is used).

2) Check on the order for details concerning electric connections and compare.

3) Measure pressure with a manometer and compare that with the value signed in the order.

4) Remove unknown material and replace damaged parts.

5) If the temperature can not be lowered, install a downsized rotor.

6) Check if the fluid corresponds to the order, change stator rubber.

7) Increase the liquid percentage. Install a grid at intake.

8) Clean the pump and repeat the operation after each single use.

9) Increase the level of liquid at intake to prevent air intake.

10) Check seals and carefully tighten the pipes unions.

11) Tighten or replace the gland. If a mechanical seal is used, carefully clean and replace it if necessary.

12) Increase rpm.

13) Modify electric connections.

14) Increase the pressure at the inlet lowering the pump position and lower the inlet fluid temperature.

15) Fill the pump, install a device preventing dry working.

16) Replace the stator.

17) Replace the stator, check if the fluid corresponds to the order and if necessary change stator rubber.

18) Replace the rotor and try to identify the cause, which may be abrasion, corrosion or cavitation.

19) Replace worn parts.

20) Re-align pump and elastic joint.

- 21) Replace broken part and re-align.
- 22) Replace bearings, lubricate and tight.
- 23) Lower rpm through variator.
- 24) Check viscosity and compare it with the order.
- 25) Check specific weight and compare it with the order.

26) Choose a different mechanical seal or packing.

Note: For any query, please contact NOVA ROTORS[™] or our local agent.

9 DISASSEMBLY AND ASSEMBLY OF COMPONENTS

PREMISE

- 1. Comply with the safety measures set out in Chapter 1 of this Manual.
- 2. The pump and its piping shall be emptied and cooled.



9.1 Disassembly of rotor-stator

- 1. Disconnect the pump from intake and delivery pipes.
- 2. Support the pump body (01) with wooden blocks (02) under the stator (03).
- 3. Remove the screws holding outlet flange (04) and the housing (05) (bearing housing or close coupled housing pumps) to the base (06).
- 4. Remove the oulet flange by taking off the nuts and their washers.
- 5. Loosen the nuts and screw out the tie rods (07).
- 6. Remove the second foot (08) if present.
- 7. Extract the stator from the rotor by slowly turning the stator and pulling in the direction of the black arrow (see below) until they were completely free.



9.1.1 Ceramic rotor

Ceramic rotors require particular care and no force of any kind. In particular, hammer strikes, concussions and collisions are to be avoided.

When the stator is extracted out of a ceramic rotor, the latter must be held to prevent it from toppling downwards and hitting the body edge (09), thus suffering damage.

The rotor shall not collide with the pump body under any circumstances. Struck parts become critical, and could trigger early failures.



9.2 Rotor-stator re-assembly

- 1. Before re-assembly, it is necessary to carefully clean visible and disassembled parts.
- 2. Insert the stator on the rotor, lubricating it with glycerine, vaseline or neutral silicon oil. Assembly is carried out as described in Chap 9.1, with reversed order of operations.



3. The operation is completed by re-inserting the pump body, stator, tie rods and pipe union.

NOTE: Certain types of stators have at their end an integrated sealing profile. In this case no O'Ring washers are needed (see picture Chap. 9.1.1), neither at the union side nor at the pump body side. In any other case, they shall be replaced every time the parts are disassembled.

HAZARD! Do not tighten the pump body threaded cap too strongly (11) (pic. Chap. 9.1.1), since its cone-shaped thread could damage the pump body itself. The tightening torque is about 40-50 Nm. Do not over-tighten screws and tie rods. See table below:

Screw	Dia	M6	M8	M10	M12	M16	M20	M24	M30
Torque	(Nm)	8	15	30	45	75	80	100	12

DANGER! When inserting the rotor into the stator, your fingers may get hurt!

9.3 Rotor / joint disassembly and joint replacement

DANGER! When re-assembling joints with sleeves, sleeves shall be dipped into hot water in order to soften them, thus easing their fitting in their cavities. To re-assemble them, follow the disassembling instructions backwards.

9.3.1 Preliminary measures

- 1. To remove the stator, follow instructions in Chap. 9.1.
- 2. Extract the pump body in the direction of the black arrow (see below). Then the drive joint connected to the rotor will be visible.
- 3. Follow the instructions given in this paragraph for each type of joint.





9.3.2 Joint type SN1

- 1. Move the sleeve backwards (1), following the direction of the arrow.
- 2. Remove the Pin (2). The rotor or hollow shaft drive then will be free.



9.3.3 Joint type SN2

- 1. Remove the clamps (3).
- 2. Remove the sleeve (4) by levering with a screwdriver.
- 3. Remove the 2 retaining rings (5) that holds the pin. Then, after removing the pin and the spider, the rotor will be free and it will be possible to replace it.



9.3.4 Joint type SN3

- 1. Remove the screws (6) that holds the joint to the rotor.
- 2. Extract the propeller shaft (6b) in the direction of the black arrow.





If the pump is equipped with this kind of joint, intake of fluid from the outlet is not possible (only counterclockwise rotation is allowed).

This kind of joint has no spare parts available. In case of malfunctioning it shall be fully replaced.

9.3.5 Joint type SN4

This type of joint shall be almost completely disassembled to be removed from the rotor. Follow these steps:

- 1. Remove the two clamps (08) that holds the sleeve.
- 2. Force the rubber sleeve backwards (09) in the direction of the black arrow.
- 3. Remove the internal flat sleeve (10) by operating on the larger part, then move it in the direction of the black arrow.
- 4. Remove the grub screw (11).
- 5. Move the metallic cover (12) backwards in the direction of the arrow. The bushes and pin (13) will be visible.
- 6. Beat the pin with care, taking care not to damage the bell (14). Then, if necessary, the pin and the bushes can be replaced.
- 7. Pull the sphere in the direction of the black arrow. Since it is integral with the propeller shaft (15), they'll both be free of the joint. Then, the hexagonal-head screws that holds the bell to the rotor (or hollow shaft depending on the joint involved) will be visible.
- 8. Unscrew the screws (7). The bell will be completely free of the rotor (or hollow shaft, as mentioned above).



IMPORTANT: Bushes increase the life of the system but are integral with the pin, hence when the pin is replaced, they shall always be replaced as well.

To re-assemble the internal flat sleeve (10), it is advisable to grease the sphere and use two tools simultaneously (e.g. two large screwdrivers).

9.3.6 Joint type SN5

1. Remove the screws (17) on the rotor side. The joint will be free.

2. Take the joint apart from the rotor by moving it in the direction of the black arrow.

3. The rotor will still be connected to an adapter flange (18) by the screws (19), hence they shall be unscrewed in order to completely free the rotor of the adapter flange (18).

NOVA ROTORS Progressing cavity pumps

NOTE: The screw (20) serves the purpose of topping up the oil in the joint during the maintenance cycles.



This kind of joint has no spare parts available. In case of malfunctioning it shall be fully replaced.

9.3.7 Joint type SN6

- 1. Remove the screws (21) on the rotor side
- 2. Take the joint apart from the rotor by moving it in the direction of the black arrow. Then the rotor will be free.

NOTE: (22) serves the purpose of filling the joint with oil during the maintenance cycles.



This kind of joint has no spare parts available. In case of malfunctioning it shall be fully replaced.



9.3.8 Joint type SN7

- 1. Remove the screw (23), the O'ring (27) and the pin (24).
- 2. Extract the propeller shaft (25) from the rotor (26) (or from the hollow shaft, depending on the joint involved) by moving it in the direction of the black arrow.



This kind of joint has no spare parts available. In case of malfunctioning it shall be fully replaced.

9.3.9 Joint type SN8

- 1. Remove the internal flat sleeve (28) by operating on the larger part, then move it in the direction of the black arrow.
- 2. Remove the grub screw (29).
- 3. Move the metallic cover backwards (30) in the direction of the arrow. The bushing and the pin (31) will then be visible.
- 4. Beat the pin with care, taking care not to damage the bell (32). Then, if necessary, the pin and the bushes can be replaced.
- 5. Pull the sphere in the direction of the black arrow. Since it is integral with the propeller shaft (33), they'll both be free of the joint. Then the hexagonal-head screws holding the bell to the rotor (or hollow shaft depending on the joint involved) will be visible
- 6. Unscrew the screws (34). The bell will be completely free of the rotor (or hollow shaft, as mentioned above).



IMPORTANT: Bushes increase the life of the system but are integral with the pin, hence when the pin is replaced, they shall always be replaced as well. To re-assemble the internal flat sleeve (28), it is advisable to grease the sphere and use

To re-assemble the internal flat sleeve (28), it is advisable to grease the sphere and use two tools simultaneously (e.g. two large screwdrivers).



9.3.10 Joint type SN9

- 1. Remove the two clamps (35) that holds the sleeve.
- 2. Force the rubber sleeve backwards (36) in the direction of the black arrow.
- 3. Remove the grub screw (37).
- 4. Move backwards the metallic cover (38) in the direction of the arrow. The bushing and the pin (39) will then be visible.
- 5. Beat the pin with care, taking care not to damage the bell (40). Then, if necessary, the pin and the bushes can be replaced.
- 6. Pull the sphere in the direction of the black arrow. Since it is integral with the propeller shaft (41), they'll both be free of the joint. Then, the hexagonal-head screws holding the bell to the rotor (or hollow shaft depending on the joint involved) will be visible at the bottom.
- 7. Unscrew the screws (42). The bell will be completely free of the rotor (or hollow shaft, as mentioned above).
- 8. The rotor will still be anchored to the adapter flange (43), to be released through the screws (44). Then, the rotor will be completely free, ready for replacement.



IMPORTANT: Bushes increase the life of the system but are integral with the pin, hence when the pin is replaced they shall always be replaced as well.



9.3.11 Pin joint with short bell (SN10) type "C"



DISASSEMBLING / REASSEMBLING

- 1. The first step is remove the screws (81.8)
- 2. Then pull out the cover (56) and draw back the plate rubber packing (37.1).
- 3. Draw back the front-ring (56)
- 4. The bronze washer (47) and the pin (40) are now visible.
- 5. Extract the pin (40) paying attention to do it without damaging the bell (67).

6. To set the bell completely free from the transmission, draw back the sphere and remove the hexagonal head screw located inside the bell.

Follow the previous operations on the contrary way to reassembling.

9.4 Replacement of seals

9.4.1 Packing seal

This operation is quite easy and fast, since it is possible to replace the packing without the need to remove any other part.

- 1. Loosen the screws (01) and force the gland (02) to move out of from the stuffing box (03) in the direction of the black arrow.
- 2. Remove the old or worn-out packing (04).
- 3. Clean the hollow shaft (05), and replace it if worn-out.
- 4. Insert the new packing, pushing it at first by hand to place it between the shaft and the stuffing box.



DANGER! No sharpened tool shall be used for packing insertion, to prevent damage to the shaft or the packing itself.



9.4.2 Mechanical seal replacement

9.4.2.1 Small sized pumps (Mod. 010 - 015 - 020 - 022)

9.4.2.1.1 DISASSEMBLY

- 1. Remove stator and pump body following the steps outlined in Chap. 9.3.1 (p. 1 and 2)
- 2. Loosen the fixing grub screw (06) and remove the pump motor by extracting it in the direction of the black arrow.
- 3. Move the sleeve (07) in the direction of the black arrow.
- 4. Unscrew the grub screw from the bush (08) in order to be able to move it along the shaft in the direction of the black arrow.
- 5. Extract the long pin (09) and detach the propeller shaft by moving the whole in the direction of the black arrow.
- 6. Extract the hollow shaft (10) from the pump in the opposite direction of the black arrow, holding the seal face (11) to prevent it from damage upon the disjunction of the seal from the hollow shaft.
- 7. Remove the stationary seat (12) using a screwdriver.





9.4.2.1.2. RE-ASSEMBLY

- 1. Check the condition of O'Rings, seal and stationary seat faces.
- 2. Check the condition of the hollow shaft.
- 3. Clean the hollow shaft, the housing (13) (see picture above) and all involved parts.
- 4. Clean and oil the propeller shaft (Rust jams the shafts coupling, thus increasing the danger of damage during disassembly).
- 5. Wet with glycerine the hollow shaft (10) and the bush (08) on the involved area to ease the insertion of the mechanic seal.
- 6. Carefully clean the seal faces before assembly.
- 7. Perform the steps backwards described in Chap. 9.4.2.1.1.

DANGER: During re-assembly, it is necessary to distribute the pressure uniformly on the fixed ring, to prevent malfunctioning or failures.

9.4.2.2 Single mechanical seal (TEN4) for 030, 040, T062-1 pumps type





ASSEMBLING

1. Insert the housing (13) on the closed coupling with the fixed part (12) of the seal already inside the housing.

2. Insert the transmission from the opposite side of the arrow with the rest of the seal (11) and, in case, the separating-ring already assembled.

3. Fix the grub screw (06) paying attention to insert this with careful into his niche.

4. During the assembling of the closed coupling with the body pump, pay attention to the OR-ring conditions between them. Substitute it if damaged (see the pump's section draw). recommendable to

DANGER: to make the mechanical seal assembling easier, it is use only neutral soap.

DISASSEMBLING

1. Remove the stator and the body pump following the previous procedure.

2. Loosen the grub screw (06) grip on the female drive shaft and unthread the transmission from the closed coupling following the arrow direction.

3. Unthread the housing (13) from the closed coupling following the arrow direction.

4. Remove the seal (11) and, in case, the separating-ring (09).

9.4.2.3 Medium and large sized pumps 9.4.2.3.1 Double mechanical seal



9.4.2.3.1.1 Disassembly

- 1. Disconnect the flow pipes at the indicated points (01) (see picture A).
- 2. Remove stator and pump body following the procedure in Chap. 9.3.1 (points 1 and 2).
- 3. Loosen the fixing grub screw in the threaded hole (02) and extract from the support (05) the drive (03) + housing (04) in the direction of the black arrow.
- 4. Extract the drive housing slowly, making sure not to damage the seals inside (see picture B).
- 5. Remove the screws (06) and the gland (07).
- 6. Remove the seals (08) and the separating ring (09).



DANGER! In bearings-mounted pumps as in the picture above, before inserting the male shaft (10) in the hollow shaft, make sure the grub screw slot (11) coincides with the threaded hole (02) in the hollow shaft; then the mechanic seal will be correctly positioned. Otherwise, push the propeller shaft as far as the slot coincides with the threaded hole of the hollow shaft grub screw.

9.4.2.3.1.2 Re-assembly

- 1. Check the condition of the seal faces (as well as the O rings in some types of seal).
- 2. Check the condition of the hollow shaft.
- 3. Clean the hollow shaft, the slot (04) (see picture above) and all involved parts.
- 4. Clean and oil the male shaft (10) (Rust jams the shafts coupling, thus increasing the danger of damage during disassembly).
- 5. Wet with glycerine the hollow shaft on the involved area to ease the insertion of the mechanic seal.
- 6. Carefully clean the seal faces and the separating ring before assembly.
- 7. Perform the steps as described in Chap. 9.4.2.2.backwards.



DANGER: During re-assembly, it is necessary to distribute the pressure uniformly on the fixed ring, to prevent malfunctioning or failures.

9.4.2.3.2 SINGLE MECHANIC SEAL 9.4.2.3.2.1 DISASSEMBLY

- 1. Disconnext flux piping (if fluxed seal).
- 2. Remove the motor (see picture A), after unscrewing the grub screw in the thread (01).
- 3. Remove the stator and the pump body following the procedure outlined in Chap. 9.3.1 (points 1 and 2).
- 4. Extract from the support (02) the drive (03) + housing (04) in the direction of the black arrow.
- 5. Extract the drive housing slowly, making sure not to damage the seals inside (see picture B).
- 6. Remove the separating ring (05), the mobile part of the seal (06) and the fixed part (07).



WARNING! In bearings-mounted pumps as in the picture above, before inserting the hollow shaft (08) in the hollow shaft, make sure the grub screw slot on the motor shaft coincides with the threaded hole (01) in the hollow shaft; then, the mechanic seal will be correctly positioned. Otherwise, push the propeller shaft until the slot coincides with the threaded hole of the hollow shaft grub screw.

9.4.2.3.2.2 Re-assembly

- 1. Check the condition of the seal faces (as well as the O'Rings in some types of seal).
- 2. Check the condition of the hollow shaft.
- 3. Clean the hollow shaft, the gland (04) (see picture above) and all involved parts.
- 4. Clean and oil the motor shaft (Rust jams the shafts coupling, thus increasing the danger of damage during disassembly).



- 5. Wet with glycerine the hollow shaft on the involved area to ease the insertion of the mechanic seal.
- 6. Carefully clean the seal faces and the separating ring before assembly.
- 7. Perform the steps described in Chap. 9.5.2.2.2.1 backwards.

WARNING: During re-assembly it is necessary to distribute the pressure uniformly on the fixed ring, to prevent malfunctioning or failures.

9.4.3 Mechanical seal for food application (TEN6)



9.4.3.1 Disassembling

- 1. Remove the body pump.
- 2. Unthread the pin connecting the transmission shaft with the female drive shaft .
- 3. Take out the packing gland.
- 4. Remove the circlip (71) blocking the bearings.
- 5. Unthread the bearings.
- 6. Remove the second inner circlip (71).

7. Exctract the mechanical seal (23) handling with care; extract the oil seal (35) and the housing (53); the spacer (16), if present.

9.4.3.2 Re-assembly

- 1. Check the seal OR rings and faces (23) integrity.
- 2. Check the female drive shaft conditions.
- 3. Clean the housing (53) and the packing gland (54) before assembling.
- 4. Wet the female drive shaft with glycerin where the mechanical seal glides.

5. Follow the previous operations on the contrary way to reassembling, inserting the spacer (16) if present; then the first part of the seal with the oil seal (53), then the inner circlip (71), the bearings (74), the second circlip (71) and finally closing the group with the packing gland (54).



9.4.4 Oil seal for worm gearmotors (TEN7)



9.4.4.1 Disassembling / re-assembly

- 1. To disassemble with pump in horizontal position, be careful to keep the transmission shaft upright, aligned with rotor.
- 2. Remove the motorization unthreading from the supporting studs.
- 3. Remove circlip (71); softly hit the male shaft using a plastic hammer following the body pump direction till the bearing (74) come out from the male shaft (be careful to keep straight and not superimposed).
- 4. Remove the hexagonal head screws and the oil seals from the housing (53) and replace them.
- 5. To reassemble with pump in horizontal position, be careful to keep the transmission shaft upright. Softly hit the rotor using a plastic hammer by the outlet flange's side, till to set the correct position of the male shaft.
- 6. Follow the previous operations on the contrary way to reassembling.



9.4.5 Mechanical seal for food application (TEN8)



9.4.5.1 Disassembling

1. Remove the body pump.

2. Unthread the pin connecting the transmission shaft with the female drive shaft .

3. Take out the packing gland.

4. Remove the circlip (71) blocking the bearings.

5. Unthread the bearings.

6. Remove the second inner circlip (71).

7. Unthread the housing (53) and extract the mechanical seal (23) handling it with care; extract the oil seal (35).

9.4.5.2 Re-assembly

1. Check the seal OR rings and faces (23) integrity.

2. Check the female drive shaft conditions.

3. Clean the housing (53) and the packing gland (54) before assembling.

4. Wet the female drive shaft with glycerin where the mechanical seal glides.

5. Follow the previous operations on the contrary way to reassembling, inserting the first part of the seal with the oil seal (53), the inner circlip (71), the bearings (74), the second circlip (71) and finally closing the group with the packing gland (54).



9.4.6 Mechanical seal with QUENCH (TEN9)



This kind of seal is part of the single mechanical seals family (see the relative paragraph): the optional is a threaded hole (quench) used for internal washing itself.

9.4.7 Single mechanical seal (TEN10) for pump mod. 010



9.4.7.1 Disassembling

- 1. Remove the screws from the outlet flange.
- 2. Unscrew the two retaining studs.
- 3. Unscrew and unthread the stator
- 4. Remove the grub screw from the female drive shaft.
- 5. Remove the two screws connecting the body of the pump to the closed coupling.

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- 6. Remove the two screws from the seal cover (81).
- 7. Unthread the transmission (WARNING! Unthread from the closed coupling side!).

A part of the mechanical seal remains on the transmission and the other one on the steel support.

8. Remove now the two mechanical seal parts.

9.4.7.2 Re-assembly

Follow the previous operations on the contrary way.

Important note: the mechanical seal part positioned upon the steel support must be mounted at latest and then close the seal cover. This part should be mounted with careful, using neutral liquid soap to let the rubber enter into the seat without bending. Take care about the original position.

The other part of the seal, which must be threaded inside the transmission, must be placed on the backing of the female drive shaft, without needing a pre-load.

10 MECHANICAL SEALS WITH BLOCKING SEAL FOR BARE SHAFT PUMP



This mechanical seal blocking system is basicly used on bare shaft pump or small batcher pumps sized.

It is used to join the motorization without bringing about a damage to the mechanical seal. The blocking ring disassembling sequence to do the connection is the follow:

- 1. Oil the female drive shaft hole and insert the motorization.
- 2. Fix the motorization to the closed coupling using the relative screw bolts.
- 3. Remove the grub screw of the blocking seal ring to be able to take it off of the housing.
- 4. Place the ring in the center between the two grub screw seats.
- 5. Now fix the grub screw to connect the motorization to the female drive shaft.
- 6. It is now possible to pull back the blocking seal ring and make it steady and not encumbering into the female drive shaft.



11 MOTORS

11.1 Useful informations

- 11.1.1 Type of service (sec. IEC 34-1)
 - **1. CONTINUOUS SERVICE**

Operation with constant load of sufficient duration to achieve thermal equilibrium.

- TEMPORARY SERVICE Operation with constant load of duration not sufficient to achieve thermal equilibrium, followed by a standoff long enough to restore the ambient temperature in the motor.
- 3. INTERMITTENT-PERIODIC SERVICE Operation with identical cycles, each one including constant load operationg and a standoff. The motor warming is not significant.
- 11.1.2 Working conditions

In compliance with IEC 34-1, the motors can work under the following working conditions.

- 1. Ambient temp. °C between -16 and +40
- 2. Elevation less than 1000 m.

11.2 Motors connections

Single-speed motors with star-delta connection (6 terminals)

12. DISPOSAL OF PUMP

When the life of pump is finished is necessary proceed to destruction of pump in according to current laws and selecting metallic and plastic parts from electric / electronic, etc.



13 ANNEXED INDEX

13.1 Service manual

- Joint cross section drawing
- Statement of Conformance
- Technical features of the pump
- Dimensions
- Delivery curve
- List of pump components
- Pump section plane
- Spare parts list
- Description of joints and spare parts



- Seal description and spare parts
- Seal cross section drawings
- Motor view and lubrication

13.2 Enclosure for Atex pumps

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Nova Rotors S.r.I Via Carlo Cattaneo, 19/25 – 36040 Sossano (VI) - ITALY Phone +39 0444 888151 Fax 39 0444 888152 www.novarotors.com – info@novarotors.com P.IVA - VAT: 02149270247 – REA: VI-209864 Capital : €1.000.000

