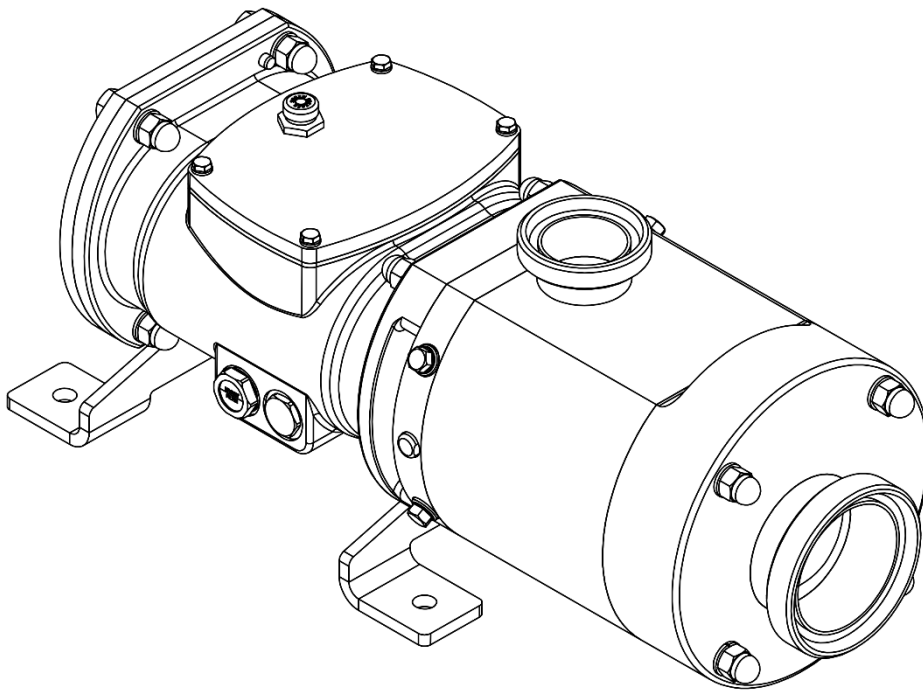


INSTALLATION, SERVICE AND MAINTENANCE INSTRUCTIONS

TWIN SCREW PUMP

DCH+



Original Instructions
01.532.30.02EN
(0) 2024/02

INOXPA S.A.U.

Telers, 60
17820 - Banyoles (España)

hereby declare under our sole responsibility that the

Machine: **TWIN SCREW PUMP**

Model: **DCH+**

Type: **DCH+ 1C1, DCH+ 1C2, DCH+ 1C3, DCH+ 1C4
DCH+ 2C1, DCH+ 2C2, DCH+ 2C3, DCH+ 2C4
DCH+ 3C1, DCH+ 3C2, DCH+ 3C3, DCH+ 3C4
DCH+ 4C1, DCH+ 4C2, DCH+ 4C3, DCH+ 4C4**

Serial number: **IXXXXXXXXXX to IXXXXXXXXXX
XXXXXXXXXXIINXXX to XXXXXXXXXXXXIINXXX**

fulfills all the relevant provisions of the following directive:

**Machinery Directive 2006/42/EC
Electromagnetic Compatibility Directive 2014/30/UE
Low Voltage Equipment Directive 2014/35/UE
Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2011/65/UE
Directive on waste electrical and electronic equipment 2012/19/UE
Regulation (EC) n° 1935/2004**

and with the following harmonized standards and/or regulations:

**UNI EN ISO 12100:2010
UNI EN ISO 809:2009
UNI EN ISO 13857:2020**

The technical file has been prepared by the signer of this document.



David Reyero Brunet
Technical Office Manager
6th February 2024



Document: 01.532.30.01EN

Revision: (0) 2024/02

INOXPA S.A.U.

Telers, 60
17820 - Banyoles (Spain)

hereby declare under our sole responsibility that the

Machine:	TWIN SCREW PUMP
Model:	DCH+
Type:	DCH+ 1C1, DCH+ 1C2, DCH+ 1C3, DCH+ 1C4 DCH+ 2C1, DCH+ 2C2, DCH+ 2C3, DCH+ 2C4 DCH+ 3C1, DCH+ 3C2, DCH+ 3C3, DCH+ 3C4 DCH+ 4C1, DCH+ 4C2, DCH+ 4C3, DCH+ 4C4
Serial number:	IXXXXXXXXXX to IXXXXXXXXXXX XXXXXXXXXXIINXXX to XXXXXXXXXXXXIINXXX

fulfils all the relevant provisions of these regulations:

**Supply of Machinery (Safety) Regulations UK SI 2008 No. 1597
Electromagnetic Compatibility Regulations UK SI 2016 No.1091
Electrical Equipment (Safety) Regulations 2016 UK SI 2016 No.1101
Restriction of the Use of Certain Hazardous Substances in Electrical
and Electronic Equipment Regulations UK SI 2012 No. 3032
Directive on waste electrical and electronic equipment 2012/19/UE
(RAEE)**

and with the following designated standards:

**BS EN ISO 12100:2010
BS EN ISO 809:2009
BS EN ISO 13857:2020**

The technical file has been prepared by the signer of this document.



David Reyero Brunet
Technical Office Manager
6th February 2024



Document: 01.532.30.03EN

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2 FOREWORD

2.1 Manufacturer's details

INOXPA S.A.U.

Telers, 60 – 17820 – Banyoles – Spain

2.2 Purpose of the Operating Instructions

These Operating Instructions are an integral part of the machine and are directed to all those persons that operate on the machine or that interact with its users, for the purpose of providing all the information necessary to:

correctly perform all the operations involved in the set up, running, maintenance and scrapping stages;

ensure protection of the health and safety of all persons involved in working with the machine;

ensure the efficient operation of the machine.

2.3 Use of the Operating Instructions

The Operating Instructions must be read carefully in their entirety prior to carrying out any operation on the machine; if in doubt about the correct interpretation of any of the instructions, contact the Manufacturer.

The Operating Instructions must be stored with care for the entire life of the machine and they must accompany the machine in all its transfers, of any kind, and made available to the users.

The Operating Instructions must be stored in the immediate vicinity of the machine, in a place that is easy to access and known to all users; it must be treated with care during consultation, pages must not be removed and its contents must not be altered in any way; it must be stored in a place that is protected from the weather, heat, humidity, corrosive agents, and preferably enclosed in a protective cover.



CAUTION!

The Manufacturer shall not be liable for consequences resulting from improper use of the machine caused by the failure of the user to read these Operating Instructions and shall not be liable for *any civil or criminal liability* arising from the user's failure to comply with these instructions.

2.4 Intellectual property rights

The rights on the entire contents of these Operating Instructions and of the documents supplied with the machine, including information, drawings and diagrams, are reserved. No information contained in these Instructions may be reproduced or communicated to third parties without the written consent of the Manufacturer, who retains all proprietary rights.

Only the Customer to whom the Operating Instructions are supplied as an integral part of the machine, for the sole purpose of ensuring that all the operations related to the various stages in the life cycle of the machine are carried out correctly, is authorised to use this information.

2.5 Warranty and voiding of warranty

The Manufacturer warrants that the machine and all the equipment supplied with it are free from flaws, defects in material or workmanship and comply strictly with the declared technical specifications and quality standards.

The warranty covers the replacement of defective materials for a period **12 months** from the date of shipment unless otherwise specified in writing in the order confirmation. The rotors, the pump casing and the components of the seal system, which are subject to wear and tear, are excluded from the warranty except for workmanship defects.

The warranty will only be valid if the machine has been used in the strictest observance of the provisions and instructions contained in these Operating Instructions and if operational limits agreed in the Order Confirmation have been complied with.

The warranty will not be valid if the machine is installed incorrectly, or for any changes, replacements, repairs or alterations made by the Customer or third parties.

For machines supplied without a drive system the warranty is not valid for damage caused by a drive that has been incorrectly mounted by the Customer or third party. It is advisable to contact the Manufacturer for information about mounting the drive system.

All tools and consumables supplied by the Manufacturer together with the machine are not covered by warranty.

The Manufacturer is not liable for damage or removal of parts that might occur during transit.

To ensure that material and workmanship defects and flaws are dealt with under warranty they must be reported in writing to the Manufacturer at the above address.

If judged by the Manufacturer to be defective the part will be replaced or repaired free of charge.

However, the Customer will be required to pay for costs of transport and/or shipment of parts and/or for travel expenses incurred by the Manufacturer's personnel if required to travel to the Customer's factory. The replaced parts will remain the property of the Manufacturer.

Parts repaired or replaced under warranty will be covered by a new warranty for a period of **12 months** from the date of the replacement or repair, however this does not apply to any parts that are not replaced or repaired.

3 GENERAL INFORMATION

3.1 Conventions and symbols used in these Operating Instructions

3.1.1 Textual conventions

Bold type is used to highlight important information. References to the figures are indicated in bold type, using the abbreviation "**Fig.**" and a number that identifies the figure (e.g. **Fig.1**). Sometimes a letter or a number is added to identify a particular component of a figure (e.g. **A - Fig.1** or **1 – Fig.1**).



NOTE!

The illustrations in these Operating Instructions are simply by way of example; the pumps illustrated in the figures with different dimensions, optional accessories or different types of construction may differ in some details, however the general contents of the Operating Instructions apply to all the pumps.

3.1.2 Terminology and symbols

The terminology used in the Operating Instructions is based on the definitions and glossary included in the Machinery Directive : 2006/42/EC. The following symbols are used throughout these Operating Instructions to ensure correct and safe use of the machine:



CAUTION!

This symbol alerts the user to hazardous situations or situations that could cause damage to the machine.



CAUTION! SUSPENDED LOAD!

The symbol alerts the user to dangerous situations related to the presence of suspended loads during machine handling and positioning procedures.



CAUTION! ROTATING PARTS HAZARD!

The symbol alerts the user to dangerous situations due to rotating parts in motion.



PROHIBITED!

The symbol draws the user's attention to actions that are prohibited.



NOTE!

The symbol draws the user's attention to information that is particularly important.



PERSONAL PROTECTIVE EQUIPMENT

Indicates that **protective gloves** must be worn when carrying out the operations to which it is associated.



PERSONAL PROTECTIVE EQUIPMENT

Indicates that **protective footwear** must be worn when carrying out the operations to which it is associated.



PERSONAL PROTECTIVE EQUIPMENT

Indicates that a **safety helmet** must be worn when carrying out the operations to which it is associated.

3.2 Target audience for these Operating Instructions and duties



SUPERVISOR

Customer's employee who oversees all operations related to the machine to ensure they are carried out correctly, in compliance with the instructions contained in these Operating Instructions and with general safety regulations.



OPERATOR

Customer's employee who is responsible for operating the machine under normal conditions.



QUALIFIED TECHNICIAN

Customer's employee who has the technical-professional qualifications to carry out specialist operations in the various stages of the machine's life cycle. The specialization required for particular operations that requiring the assistance of the qualified technician will be indicated each time.

MANUFACTURER'S TECHNICIAN

Manufacturer's employee or personnel authorised by the Manufacturer, or by the Reseller/Distributor, who has the technical-professional qualifications to carry out specialist operations that require a thorough knowledge of the machine and its operation.

4 SAFETY

4.1 Failure to comply with the safety regulations

NOTE!



Failure to comply with the safety regulations described in these Operating Instructions and common sense safety rules could result in hazards to persons, the environment and the machine.

Specifically, this could lead to:

- failure of the machine and/or system to carry out key functions
- damage to the machine and/or system
- electrical, mechanical and/or chemical danger to persons
- environmental hazards caused by leakage of dangerous substances.

Failure to observe or comply with the safety regulations will invalidate warranties and lead to loss of compensation for damages.

4.2 Startup, operation and maintenance

The plant of destination for the progressing cavity pump is not an integral part of the supply, consequently the customer is required to verify the suitability of the machine for the specific requirements, to provide the process data necessary to ensure that the right pump is selected and to ensure that any accessories required to guarantee the safety of the plant are included in the order. If the user maintains that certain accessories he considers useful or essential have not been included in the Order Confirmation, it is the customer's responsibility to inform the Manufacturer and to request that the parts in question be installed on the machine.

4.3 Intended conditions of use

The machine is designed pumping a product, referred to as "fluid", of the type specified in the Order Confirmation.



NOTE!

The machine must always observe the operating limits for which it was constructed and those declared in the Order Confirmation.

The main limits to observe relate to: temperature, pressure, capacity, viscosity and speed.

Only **1 Operator** is required to run the machine. The work station is in the vicinity of the drive unit.



NOTE!

If the machine is required to work with a different rotating direction to the one indicated in the order, contact the Manufacturer to verify the possibility of changing the direction and to define the operating limits.

4.4 General rules – Training of personnel and guidelines for safe use of the machine

It is the Customer's responsibility to provide their personnel with the necessary general training in the following areas:

- safety and health hazards related to the activities carried out in the company's plant
- measures and devices adopted for the prevention of accidents and for the protection of worker safety and health
- specific hazards to which the workers are exposed in relation to their duties, the safety regulations and the corporate health and safety provisions
- general safety rules laid down in the European Directive 89/391/EEC and in the regulations in force in the country of installation
- first aid procedures, use of fire-fighting equipment and emergency evacuation procedures.

It is the Customer's responsibility:

- to provide workers with the necessary training on the contents of these Operating Instructions
- to identify which of their workers should be given this training
- to verify that the worker has achieved the required knowledge and understanding to perform his assigned duties
- to verify that the application of these Operating Instructions becomes routine practice in all machine operating stages.

Personnel training must be updated as new hazards arise connected to changes in the configuration of the machine or its use.

4.5 Spare parts and design modifications

4.5.1 How to request Technical Assistance

The Manufacturer's sales office is at the Customer's disposal:

- for explanations and information
- to provide expert technical personnel on site at the Customer's premises for geographically limited areas
- to send spare parts.

For technical assistance requests, the Customer is required to contact the Manufacturer directly using the details provided in **2.1 Manufacturer's details**. To enable the Manufacturer to identify the machine see **6.1 Product identification**.

4.5.2 How to request Spare Parts

Only genuine spare parts supplied by the Manufacturer or those authorised in writing by the Manufacturer may be used.

The Manufacturer accepts no liability for any damage to objects and/or personal injury or any other damages arising from the Customer's use of non-genuine spare parts or parts not authorised by the Manufacturer.

Follow the instructions provided by the Manufacturer to disassemble the parts to be replaced and to assemble the replacement parts. For the spare parts list see **12 SPARE PARTS**.

4.5.3 Design modifications



PROHIBITED!

It is strictly prohibited to make structural changes to the machine without the written authorization of the Manufacturer.

4.6 Noise emission

The machine is designed and constructed to reduce the sound emission level at the source.

The A-weighted sound power level emitted by the machine does not exceed **85dB(A)**.

This value is guaranteed if the pump is installed correctly, in stable conditions and with the appropriate fixings and it is measured at a distance of 1 metre from the pump. It does not include any other external noise sources or reverberation of the pipes connected to the pump while it is operating.

The Manufacturer does not guarantee this value if the pump is used in working conditions that do not comply with those specified in the work order and stated in the Order Confirmation.

4.7 Leakage of dangerous fluids and other emissions



CAUTION!

If the pump is used to pump dangerous fluids (toxic, corrosive, etc...), the fluids leaking from the seal must be collected and disposed of without endangering persons or the environment.

4.8 General rules – Work area and protective clothing

The work area and the surrounding area must be kept free of objects that could cause trips or falls. The work area must be well-illuminated, clean, free of grease, oils, water or any other liquid that could make the floor around the machine slippery and therefore represent a slip or falls hazard. Access to the work area must be prohibited to persons who are not authorised to work on the machine during any of its various working stages; prohibition signs to this effect must be displayed in the vicinity of the pump. Adequate fire-fighting equipment must be provided in the work area and it must be indicated by suitable signs.

Suitable protective equipment must be worn to protect the parts of the body:

- safety gloves to protect hands against various hazards: mechanical, electrical, chemical and hot temperature
- appropriate clothing and safety footwear to protect the foot against drop hazards.

4.9 General rules for machine maintenance

Before beginning any maintenance work it is mandatory to put the machine in "MAINTENANCE MODE" as described in **10 MAINTENANCE**, unless otherwise indicated in these Operating Instructions.



CAUTION!

Do not disassemble the machine until the fluid has been emptied from the tubes. Even if the tubes are empty, some fluid may remain in the machine. The fluid could be a hazard to persons and to the environment, and it could be extremely hot. In servicing operations that require the machine to be running at least 2 people must be present so that in the event of a dangerous situation one person can disconnect the power supply or sound the alarm.



CAUTION! ROTATING PARTS HAZARD!

The machine contains rotating parts in motion. Do not insert limbs while the machine is in operation.



CAUTION! RISK OF ELECTRIC SHOCK!

For machines fitted with an electric motor, the drive is powered.



PROHIBITED!

Do not carry out any operation on the safety systems while the machine is in operation. While the machine is in operation the safety systems must be installed and mounted properly on the pump.

4.10 General rules - Prohibitions

PROHIBITED!

The following prohibitions apply to all workers.

Do not use the pump for operations other than those intended.

Do not use the pump in ambient conditions other than those intended.

Do not use accessories, tools, lubricants, consumables other than those intended.

Do not make any changes to the machine without the Manufacturer's approval.

Do not use the machine in a configuration different from that authorised by the Manufacturer.

Do not remove, tamper with, deactivate or bypass the safety devices unless required in specific foreseen situations.

Do not run the machine dry.

Do not remove or deface danger or prohibition labels affixed to the machine.

Do not climb onto the machine.



Do not use the machine or the protections as work tables.

Do not store inflammable material such as petrol, solvents, gas cylinders, etc, in the vicinity of the machine.

Do not perform any repairs, adjustment, cleaning, lubrication or maintenance action on moving parts.

Do not wear clothing with loose sleeves, ties, scarves, rings, watches, bracelets, chains or any other object or item of clothing that could catch on the moving parts.

4.11 Fire emergency procedures

Use carbon dioxide extinguishers to put out electrical equipment fires. Do not use dry powder extinguishers or water jets, as they could cause a short circuit or electrocute the firefighter during the firefighting procedure. If the fire is not extinguished immediately, be alert to the possible dispersion of air, water, oil and heating fluids. If the machine is fitted with pressurised tanks and tubes, exposure to flames for an extended period of time could lead to an explosion: consequently make sure you are not showered by the fluids contained in the tanks or tubes.



CAUTION!

Carbon dioxide and dry powder extinguishers must be stored in the vicinity of the machine. To prevent the onset of fire, the machine must be kept free of oils, solvents, cloths, etc...

Dry powder extinguishers cause serious damage to the machine, so only use one in the event of actual necessity and not on the electrical parts or parts that may accidentally have been left under voltage.

When using carbon dioxide extinguishers, the firefighters (minimum of 2) must wear suitable protective gloves and use self-contained breathing apparatus.

4.12 Description of the residual risks

Pursuant to European Community Directive 2006/42/EC the danger zones and the residual risk zones for the Operator, that could not be eliminated so as not to compromise the functionality of the pump, are listed below:

- **Danger zone 1:** electric motor while the machine is operational being an electric shock hazard due to the presence of voltage.
- **Danger zone 2:** machine while operating being a burn hazard due to possible contact with hot surfaces.
- **Danger zone 3:** for the construction types with hopper DCH+-H, DCH+F-H when the pump is running the hopper is a trapping, impact hazard for upper limbs.
- **Danger zone 4:** for special applications when the fixed steel shield of the shafts has been removed, transmission shafts rotating during operation of the machine with risk of trapping, impact of the upper limbs on the transmission shafts.

4.13 Affixed information and warning signs

The machine is supplied with warning signs and decals. These signs do not replace the information and the warnings contained in these Operating Instructions nor must they be considered the only ones to be observed.



PROHIBITED!

Do not remove, damage or deface the signs affixed to the machine.

5 DESCRIPTION OF THE MACHINE

5.1 Main technical characteristics of the machine

The main characteristics of the machine are:

- uniform flow rate proportional to the number of revolutions of the machine;
- minimum suction capacity of 4 water column metres; (NPSH) depending on the size, rotor pitch and the number of revolutions of the machine;
- pumping flow rate of uneven products, containing gases, abrasives, solid or fibrous substances in the liquid matrix;
- pumping capacity of liquids with low and high viscosity;
- liquid dosing flow rate;
- pulseless pumping with minimal tension stress of the fluid;
- high pumping pressures;
- 4 rotor steps for each pump size depending on the required pressure;
- operating capacity with a wide range of revolutions.

5.2 Machine operating principle

The twin screw pump is a self-priming rotary volumetric machine, the hydraulic part of which consists of 2 rotors (**1 and 2 - Fig.1**).

Metal rotors perform purely rotational movement without ever coming into contact. They rotate inside a body: the pump casing (**3 - Fig.1**). The fluid is thus pushed from the intake port to the delivery port.

The theoretical flow rate (Qt) is directly proportional to the pitch and inversely proportional to the useful area. "Useful area" refers to the area indicated in red in Figure 2 (**Red - Fig.2**).

$$Qt = \frac{P \cdot n \cdot 60}{Ae \cdot 1000^3}$$

Qt = theoretical flow rate [m^3/h]

P = rotor pitch [mm]

Ae = useful area [mm]

n = RPM [rpm]

The power absorbed is calculated with the following ratio:

$$P = \frac{Q \cdot H}{36 \cdot \eta}$$

P = power consumption [kW]

Q = flow rate [m^3/h]

H = differential pressure [bar]

η = total efficiency (corresponds to the product of volumetric efficiency and mechanical efficiency)

The rotating torque deriving from the motor is transferred to the rotors via the shaft drive (**8 - Fig.1**). Through the use of a gear system comprising gear drive (**5 - Fig.1**), gear driven (**6 - Fig.1**) and locking element (**7 - Fig.1**), it transfers the motion to the shaft drive (**9 - Fig.1**). The 2 rotors, right (**1 - Fig.1**) and left (**2 - Fig.1**), are keyed on the rotating shafts in order to avoid reciprocal helical contact.

5.3 Machine structure

For the description of the machine, refer to **Fig.1**.

The machine is coupled to the drive via a joint connected to the shaft drive (**8**).

Within the gear casing (**10**) the shaft drive (**8**) transfers the rotational motion to the shaft driven (**9**). This transmission takes place through the use of 2 gears, gear drive (**5**) and gear driven (**6**), and the keyless locking device (**7**).

Inside the gear casing there is also a system of ball bearings for each shaft (**11**), designed to withstand all the axial and radial pressures from the hydraulic part of the pump.

The machine can be configured with single or double flushed mechanical seals (**4**). For both sealing configurations listed, the knife edge variant can be mounted.



NOTE!

All variants must be defined and verified with the Manufacturer both during the offer phase and during the Order Confirmation phase. The operating limits of the machine are agreed upon during the Order Confirmation phase.

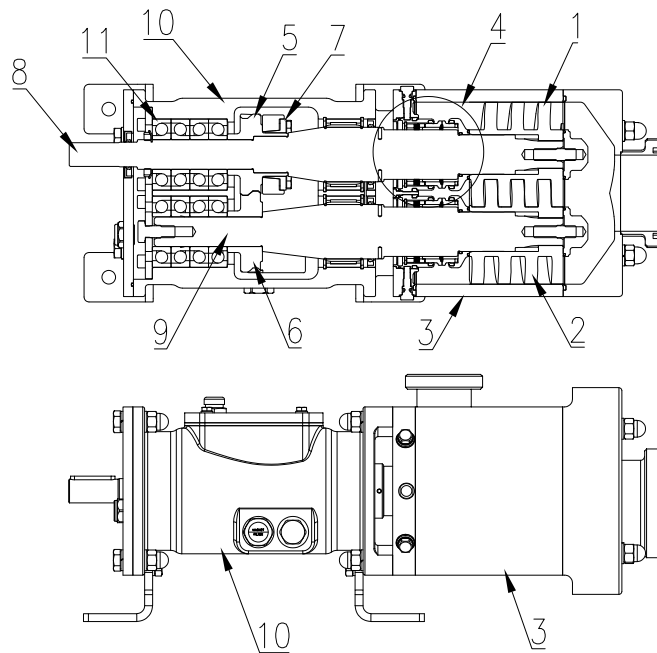


Fig.1 - General description

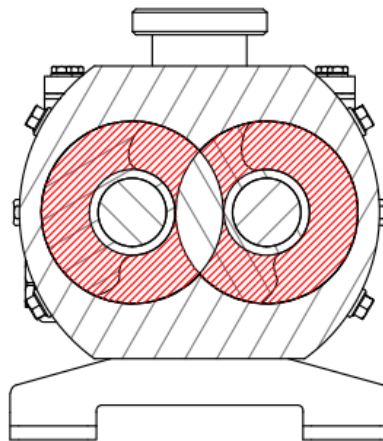


Fig.2 - Useful area

5.4 **Safety, overpressure and check valves**

For installation of the machine, the Customer should prepare the following devices:

- safety valve on the delivery of the machine to avoid operating pressures exceeding the specifications of the machine itself;
- check valve on the delivery of the machine to avoid the return of the flow through the system.



NOTE!

If both the safety valve and the check valve are present, it is advisable to install the safety valve closer to the machine than the check valve.

5.5 **Dry operation protection**



ATTENTION!

Dry operation, even for only a few moments, can damage, possibly irreparably, the machine.

Dry operation of the pump is only possible after flushing the double seals. In the presence of single seals, therefore, dry operation irreparably damages the seal faces.

Flow switches or other systems evaluated according to requirements can be used for direct control of the presence of the product.

6 ORDER IDENTIFICATION

6.1 Product identification

To enable the Manufacturer to identify the pump you must quote the following details that are marked on the data plate:

- *model and version (marked on the data plate in the "PUMP TYPE" field)*
- *serial number (marked on the data plate in the "SERIAL NUMBER" field)*

6.2 Supplied documentation and technical specifications

The documents listed in **Tab.1** are provided together with these Operating Instructions.



NOTE!

Specific documentation relating to special pumps or pumps with features made to customer specifications must be requested prior to signing the order.

All documents relating to a job order are certified by the Manufacturer solely for the pump specified in that job order.

Document	Description
Datasheet / Order Confirmation	Technical specification of the pump and the drive (if installed), operating conditions, operational limits, product configuration
Dimensional Drawing	Size configuration, operational dimensions, connection sizes
Performance Test (on request)	Performance and functional testing of the pump
Third Party Documents	Technical documents, instructions for use and maintenance for third party components installed on the pump
Declaration of Conformity	Compliance with Pump Directive 2006/42/EC

Tab.1 – Supplied Documentation

6.3 Data plate

Each pump has a nameplate with the basic data required to identify the model:

 	
<p>INOXPA S.A.U. C. TELERS, 60 - 17820 BANYOLES GIRONA (SPAIN) - www.inoxpa.com</p>	
Type	
Serial	Year

6.4 Model identification

The pump is identified with the following code number, corresponding to the "SIZE PUMP" section on the data plate:

- *pump type (DCH+)*
- *construction type*
- *rotor pitch (corresponding to Model column in **Tab.2**)*

The technical characteristics for the different sizes and models are given in **Tab.2**.

Pump model	Pitch	Qmax 0 bar [m³/h]	Rpm range	P max [bar]
DCH+ 1	C1	11	100 - 3600	25
	C2	15		20
	C3	21		15
	C4	27		10
DCH+ 2	C1	27	100 - 3600	25
	C2	32		20
	C3	44		15
	C4	65		10
DCH+ 3	C1	42	100 - 3000	25
	C2	53		20
	C3	71		15
	C4	101		10
DCH+ 4	C1	85	100 - 2500	25
	C2	107		20
	C3	142		15
	C4	214		10

Tab.2 - Performance of each model



NOTE!

The data in **Tab.2** are merely intended as a guide and only serve to give a rough indication of the range of use for each size. For the actual operating data always refer to the supplied Datasheet and Performance Curves. Depending on the construction type some models are not available or are limited to different pressure and capacity values.

The pump can be:

- *DCH+:* the pump is coupled to the drive with a flexible coupling

The construction type can be:

- *Standard:* pump with pump casing and front cover with couplings for connection to the system tubes

Each model can have a different rotor pitch (**Tab.2**), which depends from the differential pressure

7 TRANSPORTATION AND STORAGE

7.1 Transportation, handling and positioning

7.1.1 Instructions for transportation

Twin screw pumps are packed in special containers (boxes on pallets, crates) unless the user/purchaser specifies a different type of packaging in the order.

The Manufacturer is not liable for damages or lost parts that could occur following transportation of the machine.

7.1.2 Precautions to be taken upon receipt of the pump

On receipt of the pump the Customer must:

- check against the delivery note that all the machine parts have been delivered;
- check that the information on the data plate corresponds to the specifications set out in the order;
- check for damages incurred during transit;
- inform the carrier and the Manufacturer immediately if you discover any damage incurred during transit;
- check that you have received all the documents listed in **6.2 Supplied documentation and technical specifications**, if any are missing contact the Manufacturer for a copy.

7.1.3 Ambient conditions required for storage

The pump must be stored in a safe, cool and dry location, sheltered from the weather.

7.1.4 Instructions for handling and positioning the pump



QUALIFIED TECHNICIAN – Person in charge of handling the machine

All the handling/positioning operations are the responsibility of the Customer.

These operations are the responsibility of the **Person in charge of handling the machine**, who has been adequately trained on the use of lifting and handling equipment.

The following instructions must be observed when handling and positioning the machine:

prohibit access to unauthorised persons;

move away from the loads before carrying out lifting and lowering operations;

prohibit vehicles that are not used for lifting/handling the pump from circulating in the installation area to prevent accidental collision with protruding parts.



CAUTION!

The equipment used, including the ropes, must be approved for lifting and handling the specific weight of the pump (use the dimensional drawing as reference).

NOTE!

Use suitable lifting and handling equipment and always observe appropriate safety measures.



The pump must be transported manually or with suitable transportation or lifting equipment, depending on: the construction type and size, its mass and distribution (barycentre) and the lug points provided on the pump.

Avoid collisions with and/or application of pressure on the protruding parts, particularly the protection guards.

Some medium and small sized models are trolley-mounted for easy handling.

The individual packages are marked with the name of the part and handling instructions are affixed to each one.

Refer to the dimensional drawing for the weight and dimensions of the machine.



PROHIBITED!

It is prohibited to lift the machine with its barycentre shifted with respect to the lift point.

It is prohibited to lift the whole machine using the eyebolts on the motor or gearbox. These are intended solely for the purpose of lifting the motor or the gearbox.



CAUTION! RISK OF TIP-OVER!

Abrupt or reckless manoeuvres can cause the pump to tip over with serious consequences.

Operators must ensure that the pump will not tip over while being transported and positioned, and that it is handled safely and in a stable position.

The pump must always and only be placed in a horizontal position.

Vertical axis machines (V) must never be left in an upright position without adequate fixing.



PERSONAL PROTECTIVE EQUIPMENT

It is mandatory to wear a **safety helmet** when handling and positioning the machine.



PERSONAL PROTECTIVE EQUIPMENT

It is mandatory to wear **protective gloves** when handling and positioning the machine.



PERSONAL PROTECTIVE EQUIPMENT

It is mandatory to wear **protective footwear** when handling and positioning the machine.

As the pump configurations are all very different, the following instructions are of a general nature, but they do provide sufficient guidelines on how to correctly handle the pump. If in doubt contact the Manufacturer for more detailed instructions.

Once the packaging has been removed, it must only be lifted by means of the base (**1 - Error! No s'ha trobat l'origen de la referència.**). The external fixing holes or the eyebolts on the base (**2 - Error! No s'ha trobat l'origen de la referència.**) can be used to lift it.



NOTE!

If the pump is not supplied with a base or eyebolts, use ropes. The ropes must be placed around the pump in such a way to ensure a balanced lift (**3 - Error! No s'ha trobat l'origen de la referència.**).

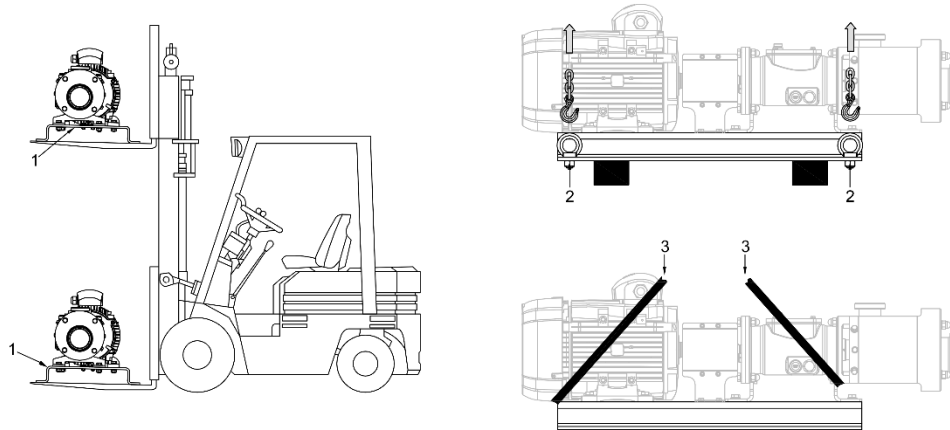


Fig.3 – Handling and positioning

7.1.5 Instructions for subsequent handlings and positionings

Subsequent handlings and positionings differ depending on whether the machine is trolley-mounted or not.

For machines that are not trolley-mounted there are no particular instructions, simply refer to **7.1.4 - Instructions for handling and positioning the pump.**

For subsequent handlings and positionings, if the pump is trolley-mounted, proceed as follows:

- put the machine in "MAINTENANCE MODE" as described in **10 MAINTENANCE**;
- verify that the machine is not connected to any plant;
- release the wheel brakes;
- shift the trolley-mounted pump manually, slowly and carefully, and position it in its new position;.
- apply the brakes to the wheels;
- return the machine to normal operating mode as described in **10 MAINTENANCE**.

7.2 Unpacking and disposal of packaging materials

Packaging requirements are discussed and agreed with the Customer at the ordering stage. They can include:

- boxes;
- pallets;
- crates.

Once the pump has been unpacked, check that all machine parts are intact. Contact the Manufacturer if there is evidence of damage and/or defects. Unpacking and disposal of the packaging are the responsibility of the Customer, who is required to comply with the applicable regulations in the country of installation.

8 INSTALLATION AND ASSEMBLY

8.1 Positioning the machine



QUALIFIED TECHNICIAN – Plant engineer

The Customer must adhere to the applicable regulations in the country of installation and employ a **Plant engineer** to perform this operation.



CAUTION!

The Customer is responsible for assessing the space available in their facility for the installation of the pump. Unless otherwise specified at the ordering stage, the machine must not be used in environments that are subject to the formation of a potentially explosive atmosphere.

The Customer must provide an installation area that is adequate for the dimensions of the pump, while also allowing for the movement of the handling equipment. There must not be any obstacles along the route required for the placement of the machine. The foundations of the installation site must be capable of absorbing the weight of the machine.



CAUTION!

Pump casing and rotors maintenance operations require the amount of space illustrated below (L – Fig.4) for disassembly and replacement. For the overall dimensions of the pump casing refer to **Tab.1**

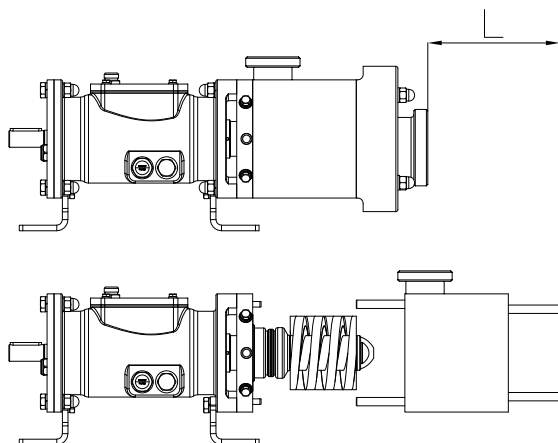


Fig.4 – Space required for maintenance of the pump casing and the rotors

Pump model	L [mm]
1C	145
2C	190
3C	203
4C	274

Tab.3 – Overall dimensions pump casing



CAUTION!

The entire base, whether provided by the Customer or supplied by the Manufacturer, must lie flat against the foundations. The pump must not be installed on a base that is larger than the foundations. For the dimensions of the base refer to the supplied dimensional drawing.

The pump should be placed and positioned in such a way that the access and escape routes are practical and easy to use in an emergency. Lighting must comply with applicable regulations in the country of installation; in any case, it must be uniform and provide good visibility in all points of the pump.

In addition, take into account:

- the space required for maintenance of the pump and for any additional devices
- the space required for handling the pump
- the space required for adjusting/reading the number of revolutions and for the regulation of the bypass valve (if fitted)
- the position and functional orientation with respect to the other machines
- the sizing and the connection to the power supply

8.2 Mounting the pump



QUALIFIED TECNICIAN – Maintenance Mechanic

A **Maintenance Mechanic** is responsible for carrying out the operations involved in mounting the pump.



PERSONAL PROTECTIVE EQUIPMENT

It is mandatory to wear **protective gloves** when carrying out operations involved in mounting the pump.

No special equipment is required to mount the pump. Simply fasten the pump by means of the bolts on the base, the size and position of which is provided in the supplied dimensional drawing. It is essential that all the holes in the base be used to fasten the pump to the foundations. If the machine is mounted on a trolley do not lock the wheels while it is operating; unlocked wheels will ensure greater stability while the machine is operating.

8.3 Installation



QUALIFIED TECNICIAN - Installer

Installation of the machine is the Customer's responsibility, unless otherwise specified at the ordering stage, and must comply with applicable regulations in the country of installation. Prior to making the electrical connection and the first startup the technician must verify that the rotation direction of the pump complies with the direction indicated on the data plate.



CAUTION!

If the machine is not installed immediately refer to **7.1.3**.

8.3.1 Connection to tubing



QUALIFIED TECNICIAN – Maintenance Mechanic

It is the Customer's responsibility to connect the pump to the tubes in compliance with the applicable regulations in the country of installation and to employ a **Maintenance Mechanic** to perform this operation.



CAUTION!

The dimensions and the position of the tubes must comply with those indicated in the dimensional drawing while taking into account the space needed to disassemble the pump.



PERSONAL PROTECTIVE EQUIPMENT

It is mandatory to wear **protective gloves** when connecting the machine to the tubes.

Prior to connecting the pump to the tubing carry out the operations listed below in the following order:

- ensure that the diameters of the inlet and outlet tubes are suitable for the viscosity and required flow rate
- thoroughly clean the tubes and remove any sediment and any other solids
- in case of single seal conformation, position the pump in such a way that when it is stopped, a sufficient quantity of fluid is guaranteed inside the suction body to provide lubrication for the pump at startup
- evaluate the reaction forces and reaction moments generated on the delivery and suction connections when the machine starts up.

To connect the pump to the tubes carry out the operations listed below in the following order:

- install compensators between the pump and the tubes
- fill the pump with fluid
- connect the pump to the tubes using the dimensional drawing as reference
- minimize the air input to the pump's suction casing



CAUTION!

The compensators are intended to protect the machine from vibrations that could damage the pump body.

8.1 Auxiliary systems of double mechanical seals

8.1.1 Preface

This part of manual covers the installation and operation of a reservoir containing an external buffer or barrier liquid to feed double mechanical seals. These systems are designed to support rotating sealed equipment operating with double mechanical seals as an effective method of controlling emissions and monitoring seal performance.

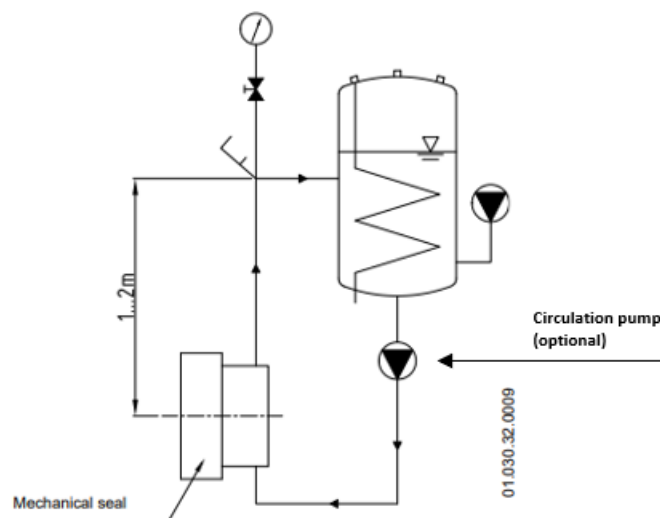


Fig.5 – Tank scheme and connections for double mechanical seal

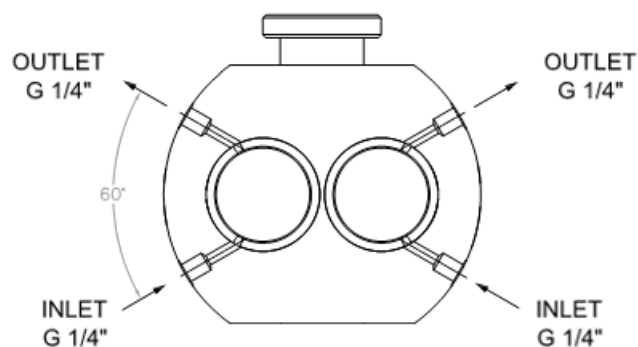


Fig.6 – Connection diagram for flushing system

8.1.2 Installation

The installation of the barrier/buffer system should provide an easy operation, monitoring and maintenance. Mount the reservoir in a vertical position within a 1m radius of the vertical centreline of the seal chamber. The tank should be positioned above the mechanical seal (approximately 1 ... 2 m) to allow a natural circulation of the barrier/buffer medium. If a circulation pump for the auxiliary liquid is installed, the distance may be shorter.

The piping of the barrier/buffer system loop should be made of stainless steel.

The arrangement of the piping should be as short and streamlined as possible. To avoid air pockets the pipes should be installed steadily rising. The outlet pipe of the mechanical seal has to be connected with the lateral connection of the barrier/buffer system tank.

The reservoir should be flushed before commissioning.



NOTE!

The capping/plugging of unused seal connections before operation is the responsibility of the end user.

Connect the seal supply line from the lower seal connection on the reservoir to the bottom connection of the sealing chamber. Connect the seal return line from the top seal chamber to the upper seal connection on the reservoir.

To maximize thermal siphoning and the flow output, it is imperative to minimize all friction loss in the piping loop between the gland plate and the reservoir. A minimum of 1/2" pipe should be used. All bends must be large radius with a maximum of 6 recommended.

To ensure piping is self-venting and to further enhance circulation, the piping or tubing from the gland plate to reservoir should follow a minimum slope upward of 1/4 inch per foot (6 mm ogni 300 mm). A drain valve could be installed at the lowest point in the piping loop.



ATTENTION!

Do not place any valves in the piping loop that could restrict the flow. If ball valves or gate valves are used for isolation of the seal chamber and reservoir, it is important to ensure that these valves are locked open during filling and operation.

If ball valves or on / off valves are used to isolate the sealing chamber and reservoir, it is important to make sure that these valves are locked (open) when filling and operating the pump.

If supplied weld pad level gauge will require re-torque as the gaskets lose resiliency under initial bolt pressure at factory assembly. Using a torque wrench, tighten nuts in 5 ft-lb (7 Nm) increments following a centre to outside alternating sequence until the full torque value has been achieved.



NOTE!

Thermal shock and mechanical stress must be minimized during start up. Take all necessary precautions.

Do not pressurize reservoir until the reservoir has been filled with barrier liquid.

Remove the fill plug on the top of the reservoir and fill it with the selected buffer/barrier liquid, any valves in the piping from the reservoir to the gland should be locked open. Fill the reservoir to proper level, visible in sight glass, normally the mid-point of the level sight glass. Close the fill connection. Check for leaks in the piping or reservoir system.

8.1.3 Buffer fluid

The liquid used as buffer/barrier, must be compatible with the pumped product and also with the installed materials (mechanical seal solid parts and elastomers).

Low viscosity fluids are normally the most suitable fluids. If no circulation pump is used, the viscosity should be lower than 5 cSt.

The selection of the buffer/barrier fluid should be always a responsibility of the customer.

Generally, a good buffer/barrier liquid must have a good lubrication capacity and a high heat capacity, because the heat capacity is proportional to the heat removal.

The maximum operating temperature should be at least 40 °C (104 °F) lower than the boiling point of the barrier/buffer medium.

It must be free of solids, not classified as a hazardous substance and to have no tendency to foam or build up deposits. It should have a high ageing resistance, that means that its properties should not change after some time.

8.1.4 Maintenance

The auxiliary liquid level should be checked and logged on a regular basis.

Any change in the liquid level can indicate a leakage of the mechanical seals (An increase on an unpressurised system, and a decrease on a pressurised system). Any major changes in liquid level should be addressed immediately with the proper corrective action.

On regular basis, the reservoir and tubing/piping should be given a visual inspection for leaks or other potential maintenance problems.

Buffer/barrier liquid should be drained and changed after any seal change or failure and during planned maintenance. This will ensure the quality of the liquid and enhance the sealing environment.

8.2 Alignment and connection (for machine coupled with flexible coupling)

MANUFACTURER'S TECHNICIAN

For machine coupled with flexible coupling the pump is aligned and verified by the Manufacturer before shipment.



QUALIFIED TECHNICIAN - Installer

If the Customer is installing their own drive then alignment must be organised and carried out by the Customer. It is recommended to employ a Qualified Technician to ensure correct installation of the drive.



PERSONAL PROTECTIVE EQUIPMENT

It is mandatory to wear **protective gloves** when connecting a pump coupled with flexible coupling.

It is possible that during transit, handling and storage events could occur that lead to the misalignment of the flexible joint that connects the male shaft to the drive. Consequently, it is essential to check the alignment before starting the pump.

Tab. below indicates the maximum misalignment values tolerated in the coupling of 2 half-couplings, with the following characteristics:

- S is the distance required between the 2 half-couplings and the corresponding tolerance;

- β is the maximum permissible angle between the two 2 half-couplings;
- a is the maximum misalignment value on the longitudinal axis of the 2 half-couplings.

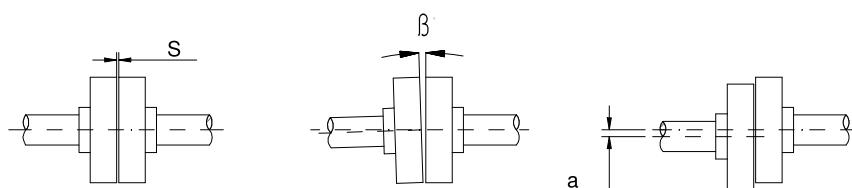


Fig 7 – Connection of a pump coupled with flexible coupling

Pump model	S [mm]	β	a [mm]
1C	1,2	1° 30'	0,20
2C	1,4	1° 30'	0,22
3C	1,8	1° 30'	0,28
4C	2,1	1° 30'	0,36

Tab.4 - Maximum misalignment values of pumps coupled with flexible coupling



NOTE!

For the dimensions of the independent shaft of the pump refer to the supplied dimensional drawing. For the drive refer to the Manufacturer's specifications.

9 PUMP OPERATING INSTRUCTIONS

9.1 Filling the pump

If single mechanical seals are mounted, the machine must be filled with fluid before starting. This procedure is required to provide the necessary lubrication to the faces of the seals in the period of time prior to the priming of the process fluid.

If, on the other hand, the machine is equipped with double-flushed seals, the dry operation of the pump for short periods does not involve damage.



CAUTION!

If single or double mechanical seals are mounted without an auxiliary system, running the pump on dry, even for just a few seconds, can ruin or even irreparably damage them.

Running the pump on dry increases the friction between the sliding faces of the mechanical seals, and generates unacceptable high temperatures. This increase of temperature can damage very fast the mechanical seals.

9.2 Electrical connection for pumps equipped with electric motor



QUALIFIED TECHNICIAN – Maintenance Electrician

The Customer is responsible for the electrical connection, which must comply with the applicable regulations in the country of installation, and it must be carried out by a **Maintenance Electrician**.



CAUTION!

The electrical system must comply with the provisions of CEI EN 60204-1:2005, the Manufacturer's specifications and any other applicable regulations in force in the country of installation of the pump.

The electrical panel of the drive system is live, risk of electric shock.



PERSONAL PROTECTIVE EQUIPMENT

It is mandatory to wear **protective gloves** when connecting the pump to the electrical system.

To connect the pump to the electrical system carry out the operations below in the following order:

- verify that the supply voltage corresponds to the voltage required by the pump, as indicated on the data plate of the electric motor
- carefully read the instruction manual provided by the supplier of the electric motor
- determine the cross-section of the conductors;
- verify the ingress protection rating IP of the electric motor;
- connect the conductive parts of the pump to the earth circuit in the place of installation
- check the star/delta connection of the wires to the motor terminals (see **Fig.8**)
- check the phase connections to ensure that the rotation is in the direction indicated on the pump



NOTE!

If an inverter is used an incorrect configuration of the parameters could cause problems.

On motors with 7.5 kW or larger inverters it is recommended to set an acceleration ramp of at least 4 s, whereas for motors with smaller inverters, at least 2 s. This will reduce the stress at start-up. Moreover, the starting rpm significantly affects the startup torque required to start the pump. It is therefore recommended to reduce the pump's starting rpm if any problems arise. See the supplier's manual for information on how to set the parameters for the inverter.

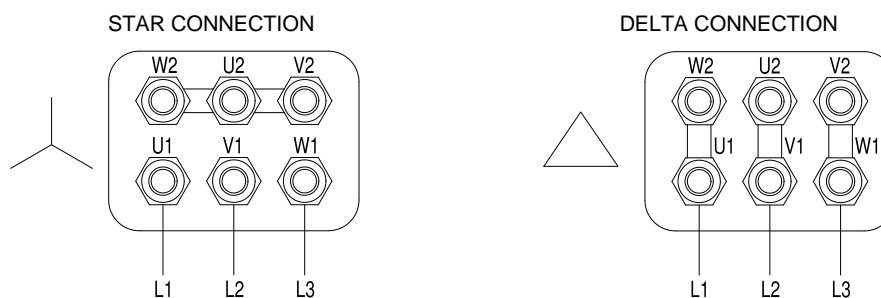


Fig.8 – Electrical connection

9.3 Other connections

For pumps equipped with a hydraulic motor see the manual provided by the supplier of the hydraulic motor.

9.4 Preparation for putting into service

9.4.1 Lubrication

MANUFACTURER'S TECHNICIAN

The pump is pre-lubricated at the Manufacturer's factory.

9.4.2 Adjustments



QUALIFIED TECHNICIAN – Maintenance Mechanic

The adjustments are the responsibility of a **Maintenance Mechanic**.



PERSONAL PROTECTIVE EQUIPMENT

It is mandatory to wear **protective gloves** when carrying out adjustments on the pump.

Before beginning the first startup operations check the following regulations:

- if present, check the seal flushing system
- if present, check the inverter
- if present, check the safety valve on the pump's delivery casing
- if present, check the check valve on the pump's delivery casing



NOTE!

To adjust the **seal flushing system**, for the **safety valve** on the delivery casing and for the **nonreturn valve** on the delivery casing refer to the documentation relating to the third-party components.

To adjust the **inverter** refer to the Datasheet and the user manual provided by the supplier.

9.4.3 Testing

MANUFACTURER'S TECHNICIAN

The pump is tested at the Manufacturer's factory.

If the pump is supplied without a drive system it is not tested, unless otherwise agreed at the time of ordering.

9.4.4 Pre-use checks

Before starting the pump carry out the operations below in the following order:

- check that the pump is complete and that all the protections and fixed guards are correctly fitted;
- check that the pump is filled with fluid if in the configuration with single mechanical seals.

9.4.5 Startup

For instructions on starting the pump refer to the drive system manual.

9.5 First startup



NOTE!

The following paragraphs refer to a drive system consisting of an electric motor but the description is also applicable to a pump fitted with any other type of motor.

In general, refer to the user manual provided by the supplier.

9.5.1 Precautionary checks



QUALIFIED TECHNICIAN – Maintenance Mechanic

The precautionary check prior to the first startup is the responsibility of the **Maintenance Mechanic** and involves checking that the pump rotation direction is correct.

The rotation direction determines the fluid flow direction (**Fig.9**).



CAUTION!

If the rotation direction is incorrect then the operational limits, set out in the Datasheet, are not applicable.

To verify the correct operational limits refer to the Datasheet and to **data plate**.

To check the pump rotation direction carry out the operations below in the following order:

- start the pump as instructed in the motor manual;
- check the fluid flow direction **Fig.9**;
- stop the pump as instructed in the motor manual.

If the pump rotation direction, that is, the fluid flow direction, is not correct then it is necessary to invert the phases of the connection to the electrical system as set out in the drive system manual.

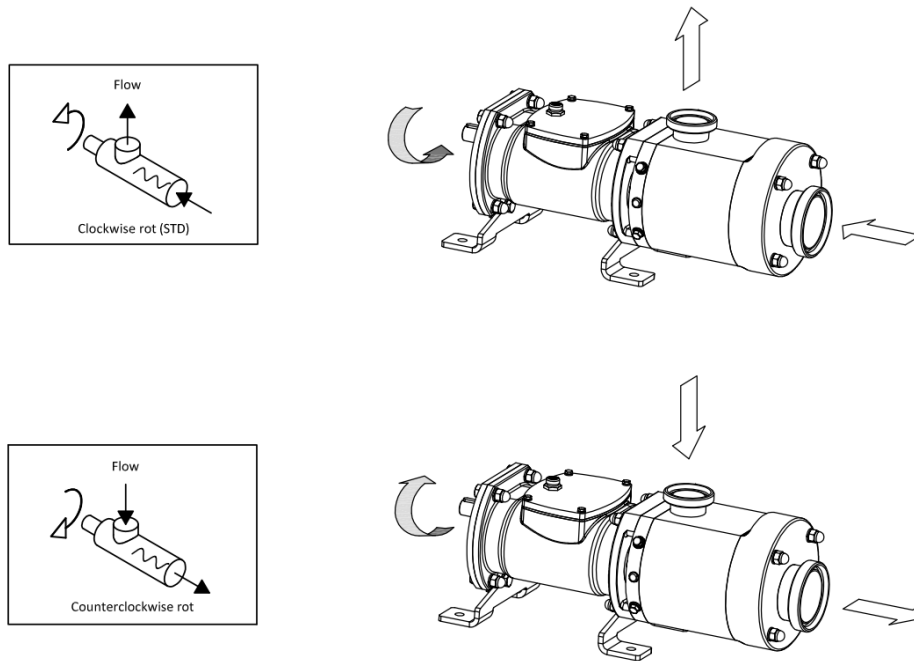


Fig.9 – Pump rotation direction

9.5.2 First startup operations



QUALIFIED TECHNICIAN - Maintenance Mechanic

A **Maintenance Mechanic** is responsible for the first startup operations.



CAUTION!

If all of the following operations cannot be completed refer to the Troubleshooting section or contact the Manufacturer.

For the first pump startup carry out the operations below in the following order:

- start the pump as instructed in the motor manual
- check that the pump reaches the operating speed
- check that the flow rate is within the operational limits
- check that the pressure in the delivery connection does not exceed the values set out in the Datasheet
- check that the pressure in the suction connection does not exceed the values set out in the Datasheet
- stop the pump as instructed in the motor manual



CAUTION!

Excessive tube lengths, sediment in the tubes or closed valves produce pressure increases that, if greater than those agreed on at the time of ordering, can irreparably damage the pump. For this reason it is important to monitor the pressure in the delivery connection and adopt suitable preventive systems to prevent overpressure.

Excessive pressure in the suction connection can break the seal, the hollow shaft and the joints or irreparably damage the entire pump. For this reason the suction connection pressure data agreed on at the time of ordering must be guaranteed.

9.6 Periods of inactivity



QUALIFIED TECHNICIAN - Maintenance Mechanic

A **Maintenance Mechanic** is responsible for carrying out the operations required when the pump is expected to be inoperative for some time.

9.6.1 General guidelines

If the pump is inoperative for a long period of time the operations below must be carried out in the following order:

- disconnect the pump from the power supply systems
- clean the pump as instructed in chapter **10 MAINTENANCE**
- cover the rotors with suitable protections against knocks and blunt objects
- rotate the drive shaft once a month
- for the motor and the other accessories refer to the supplier's manual



NOTE!

When the pump is shut down due to long process stops or plant downtime, is it essential to thoroughly clean it by removing solids, sediment, corrosive fluids or fluids that tend to crystallise and in general all residual fluids, to prevent the formation of ice inside the pump.

The stainless steel pump parts do not require protection.

9.6.2 Storage for periods of inactivity

In periods of inactivity the pump must be stored in a safe, cool, dry place protected from the weather.



CAUTION!

Incorrect storage preparation and warehousing can result in pump damage.

9.6.3 Restarting after periods of inactivity

When restarting after a long period of inactivity, carry out the operations below in the following order:

- for the motor, refer to the dedicated user manual
- check that the pump is complete and that all the protections and fixed guards are correctly fitted
- carry out the maintenance operations of the parts indicated in **10 MAINTENANCE**
- fill the pump with fluid
- connect the pump to the electrical power supply system
- start then pump as instructed in the motor manual

9.7 Pump operation



OPERATOR

The **Operator** is responsible for operating the pump, unless otherwise specified.



CAUTION! DANGER! PARTS IN MOTION!

The pump contains parts in motion. Do not insert limbs or objects other than those being processed while the pump is running.



PERSONAL PROTECTIVE EQUIPMENT

It is mandatory to wear **protective gloves** when operating the pump.

9.7.1 Pump work cycle

For information on the pump work cycle refer to the motor manual.

During the work cycle carry out these operations in the following order:

- check that the flow rate is within the operational limits
- check that the pressure in the delivery connection does not exceed the values set out in the Datasheet
- check that the pressure in the suction connection does not exceed the values set out in the Datasheet

9.8 Stop functions

**CAUTION! RISK OF ELECTRIC SHOCK!**

Even when the pump stops some electrical parts remain live.
If the pump stops due to a fault the Supervisor must be informed.

For instructions on stopping the pump refer to the drive manual.

9.9 Reset functions

For instructions on stopping the pump refer to the drive manual.

9.10 Scrapping and disposal instructions

**QUALIFIED TECHNICIAN – Officer in charge of Reclamation, Recycling and Disposal**

The scrapping and disposal operations are entrusted to **Companies specialising in Reclamation, Recycling and Disposal**, and whose personnel possess the required technical-professional qualifications and PPE.

When scrapping the pump the authorised personnel are required to separate the materials by type and deliver the separated waste to the appropriate collection points in compliance with the regulations in force in the country of installation.

10 MAINTENANCE

Safety of both machine and workers also depends on following proper maintenance practices and observing the maintenance schedule.



CAUTION!

Partial or complete failure to observe the indications provided in these Operating Instructions and in the manuals supplied with the pump relating to maintenance operations will render the contractual warranty null and void and relieve the Manufacturer of all liability for any bodily injury and/or property damage caused by the machine.

The Manufacturer will not be held liable for any damage caused by operations that are not compatible with those set out in these Operating Instructions. If it is not possible to carry out any of the operations described herein see **11 TROUBLESHOOTING** or contact the Manufacturer.



QUALIFIED TECHNICIAN - Maintenance Mechanic

A **Maintenance Mechanic** is responsible for carrying out maintenance operations on the machine.



PERSONAL PROTECTIVE EQUIPMENT

It is mandatory to wear **protective gloves** when carrying out maintenance operations.



PERSONAL PROTECTIVE EQUIPMENT

It is mandatory to wear **protective footwear** when carrying out maintenance operations.

10.1 Put the pump in "Maintenance Mode"

To put the pump in "MAINTENANCE MODE" carry out the operations below in the following order:

- stop the pump and disconnect it from the power supply as described in the drive manual, and make sure that it cannot be switched back on by third parties
- discharge the pressure and make sure that there is no residual pressure remaining in the system
- close the on-off valves and/or gate valves
- disconnect the delivery and suction tubes



CAUTION!

It is mandatory to put the pump in " MAINTENANCE MODE " prior to starting any maintenance operation excepting in cases where these Operating Instructions specify the exact opposite.

Once the maintenance operations are completed return the pump to normal use mode by carrying out the operations below in the following order:

- check that all the protections and guards removed for servicing have been correctly replaced and positioned and are functional
- reconnect the delivery and suction tubes
- if the on-off valves and/or gate valves were closed before the operation, reopen them
- connect the machine to the electrical power supply as described in the drive manual
- if the pump was completely emptied of all fluid and its configuration is not with double flushed seals, fill with sufficient fluid to avoid a dry startup

10.2 Maintenance Operations

The maintenance operations include:

- cleaning operations
- lubrication operations
- disassembly operations
- assembly operations

The disassembly and assembly operations, described below, are required when it is necessary to access the internal parts of the pump for: adjustments, operations related to periods of inactivity, cleaning or servicing operations.



CAUTION!

Maintenance requirements and the type of operations to perform will determine the most appropriate sequence for each Customer to follow.

The maintenance operations involve :

- disassembly and assembly of the gear casing
- disassembly and assembly of the joints
- disassembly and assembly of the mechanical seals and the back flange
- disassembly and assembly of the hydraulic part, including rotors, pump casing and front cover



NOTE!

If necessary, remove the joint protection cover.

10.3 Cleaning operations

It is important to set time intervals between one cleaning operation and the next depending on the type of pumped liquid, its density and consistence, the pressure, the frequency of use and the ambient conditions. For these reasons if in doubt contact the Manufacturer. The pump can be cleaned in the following ways:

- manually by disassembling the pump
- automatically through a cleaning cycle

It is recommended to carry out the cleaning operations every time the pump is used and before leaving it idle for long periods. The product to use for this operation must not be aggressive as this could cause deterioration of the pump seals, it must be compatible with the process fluid and with the application, that is, whether it is used in the food industry or the industrial sector.

10.4 Wear and tear of pump parts

10.4.1 Gear casing

Tab.5 indicates the volume of oil that each **single** gear casing can contain.

Pump model	Oil vol. [L]	Food NSF/H1 certified
1C	0,30	LUBCON TURMOSYNTHOIL PG 100
2C	0,55	
3C	0,70	
4C	1,5	

Tab.5 - Lubrication of joints and transmission shaft

Avoid using different lubricants inside the same gear casing. The quantities specified will ensure perfect operation and maximum durability of the gears. We recommend using no less than the quantity indicated.

Regular inspection and lubrication of the gear casing will prolong the life the gears and improve their efficiency.

Maintenance on the gear casing must be carried out **every 3000 hours** of operation.



CAUTION!

The use of high quality synthetic oil is essential to ensure optimal durability of the gears. The lubricants tested by the Manufacturer guarantee performance and compatibility with the elastomers used for the joint protection sleeves. Lubricants other than those indicated in the table below are not guaranteed as they will not have not been tested and could cause premature wear or breakage of the gears.

10.4.2 Seal

Wear and tear on the seal is related to many factors, the main ones being:

- abrasiveness and viscosity of the pumped fluid
- pump speed
- pressure
- temperature of the fluid.

To ensure satisfactory performance it is essential to select, at the Ordering stage, the type of seal that is most suitable for the operating conditions of the pump and the process fluid.

In systems using mechanical seals, the seal itself (rotating part and stationary part) is the only element that wears, consequently the shaft does not contribute to wear and tear on the system. The mechanical seals can be single or double flushed.

CAUTION!

When checking the presence of seal leaks do not remove the protections or safety devices.



For the double flushed seals to prevent serious damage to the sealing system it is essential for the Customer, unless specifically ordered through the Manufacturer, to provide the machine with a suitable flushing system. If you do not have sufficient information about how to install the flushing system contact the Manufacturer.

Using the above sealing systems without suitable flushing, therefore causing them to run dry even for a few seconds, can irreparably damage the contact faces of the mechanical seals.

10.5 **Notes on service and maintenance**

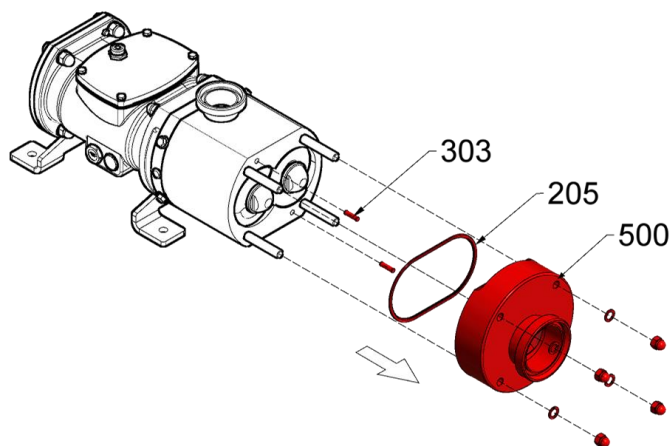
Period	Assembly	Jobs
Weekly	Gear casing	Check oil level. If necessary top up/change the oil
	Flushing system (if present)	Check the fluid level. In case of lowering of the fluid level check the presence of leakages or damages to the seals
Monthly	Nut screw	Check tightening nut screws
3000 hours	Gear casing	Change gear oil
Yearly	O-ring and liporing	Replace all O-ring and liporing
According to the specifications of the drive manual	Driver	Perform driver maintenance

**QUALIFIED TECHNICIAN - Maintenance Mechanic**

A **Maintenance Mechanic** is responsible for carrying out maintenance operations on the machine.

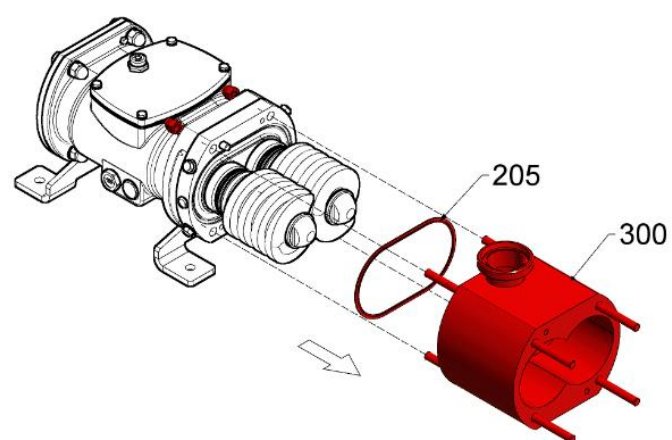
10.6 Disassembly of rotors and pump casing

To disassemble the rotors and the pump casing, perform the following operations in order:



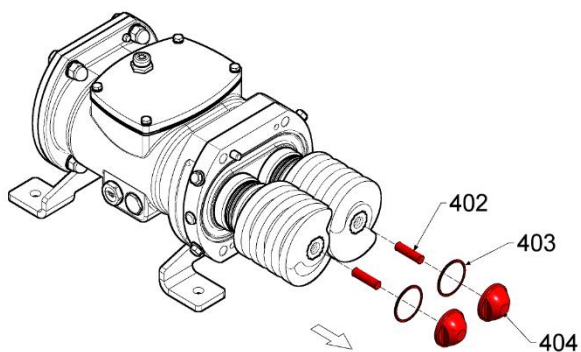
1. Disassemble the front cover (500), lip O-ring (205) and 2 pins (303).

10.6 / 1



2. Disassemble the pump casing (300) and remove the lip O-ring (205).

10.6 / 2

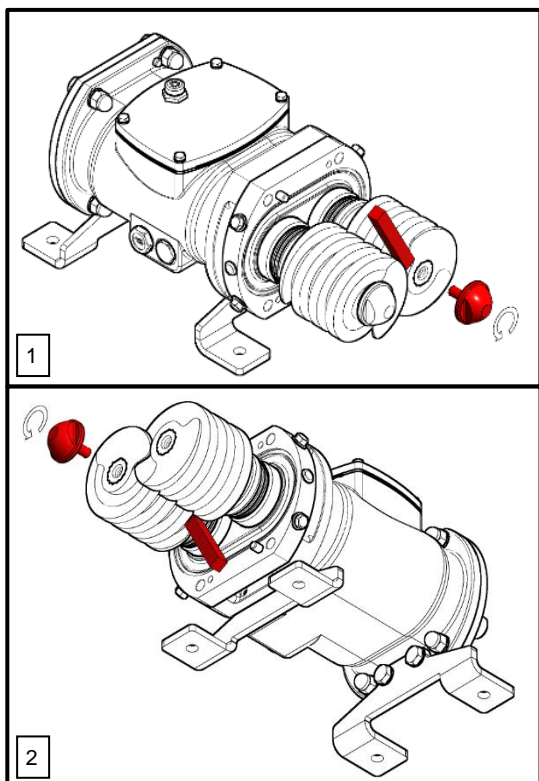


3. Disassemble nut screws (404), lip O-rings (403) and studs (402). Follow these steps:


NOTE!

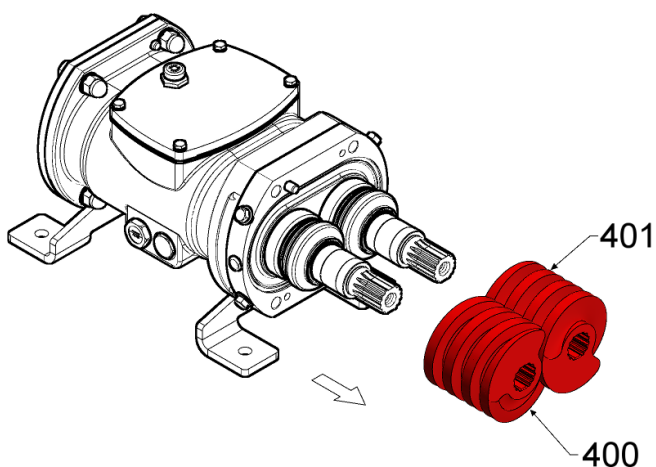
During the operation, be sure to block rotation of the rotors using a dedicated parallelepiped.

- 3.1 Using a dedicated parallelepiped block the rotation of the right rotor (401) at the tip. Then loosen the nut screw (404) (Figure 1).
- 3.2 With a dedicated parallelepiped block the rotation of the left rotor (400) at the start of the rotor. Then loosen the nut screw (404) (Figure 2).



10.6 / 3

4. Remove the rotors (400, 401) from the shafts.

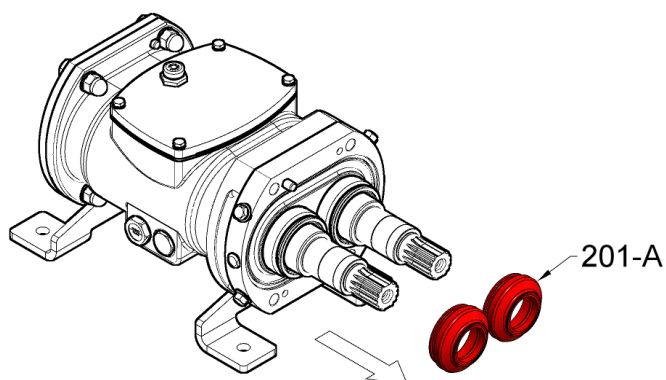


10.6 / 4

10.7 Disassembly of single mechanical seals BFH

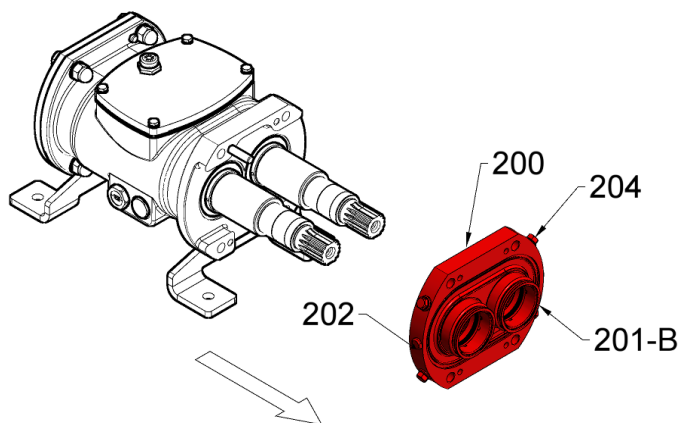
To disassemble the single mechanical seals, perform the following operations in order:

1. Remove the rotary part of the seals **(201-A)** from the shafts.



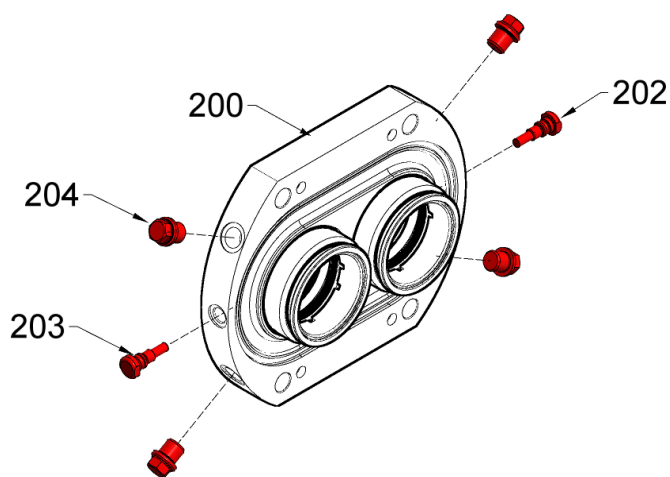
10.7 / 1

2. Remove the back flange **(200)**, on which are mounted the pin seal blocks **(202)** and the single seal stationary elements **(201-B)**.

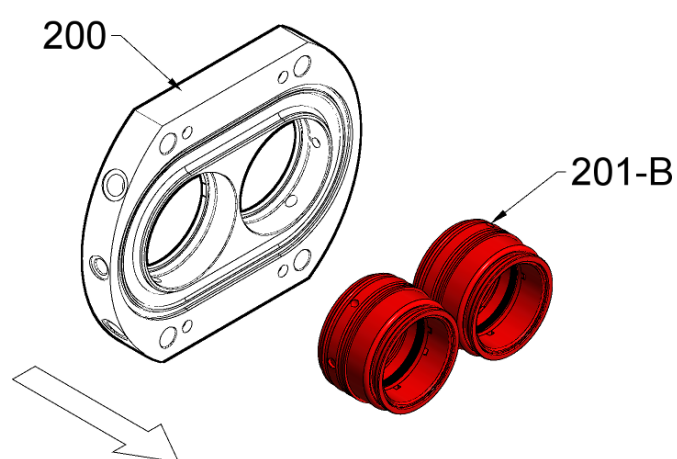


10.7 / 2

3. Unscrew the pin seal blocks **(202)**, with relative O-rings **(203)** and threaded caps **(204)** from the back flange.



10.7 / 3

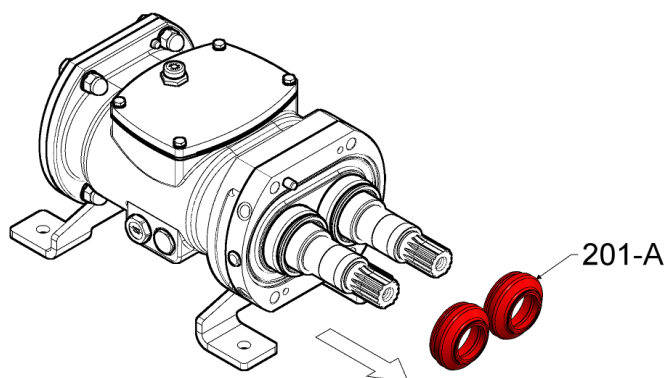


4. Remove the isingle seal stationary elements **(201-B)** from the back flange.

10.7 / 4

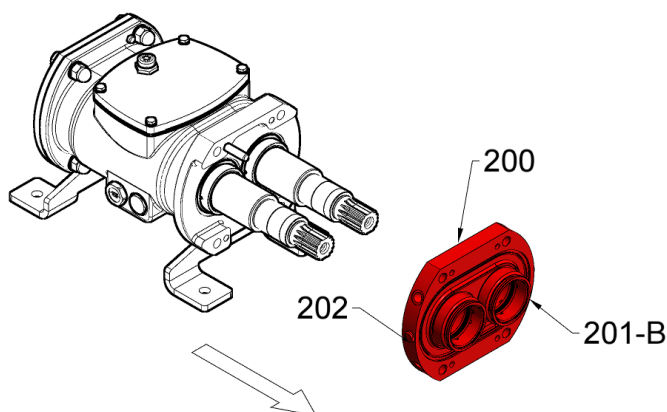
10.8 Disassembly of double mechanical seals BCH

To disassemble the double mechanical seals, perform the following operations in order:



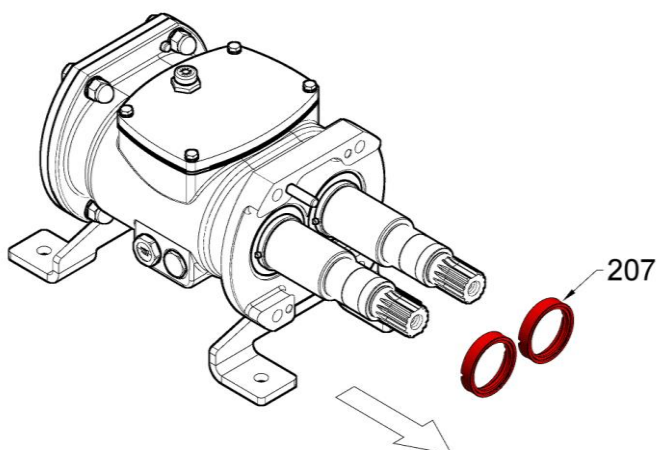
1. Remove the rotary part of the primary seals (**201-A**) from the shafts.

10.8 / 1



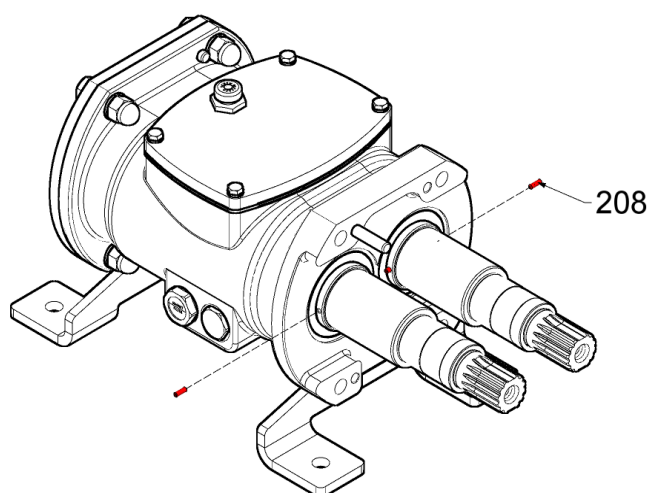
2. Remove the back flange (**200**), on which are mounted the pin seal blocks (**202**) and secondary seal stationary elements (**201-B**).

10.8 / 2



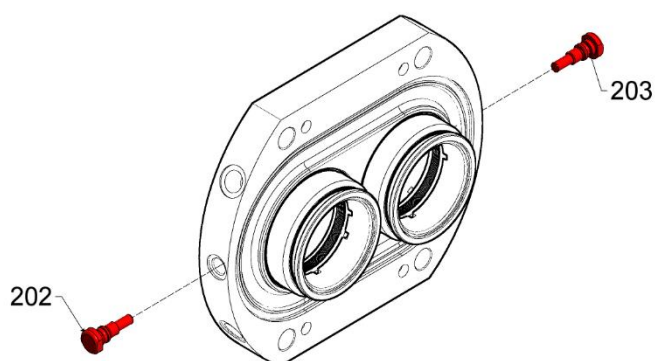
3. Remove the rotary part of the secondary seals (**207**) from the shafts.

10.8 / 3



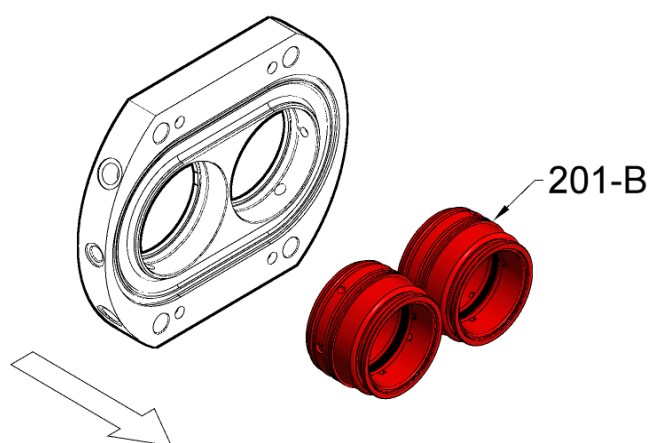
4. Remove the recessed hexagon head screws **(208)** from the shafts. 2 screws are fitted for each shaft.

10.8 / 4



5. Unscrew the pin seal blocks **(202)**, with relative O-rings **(203)** from the back flange.

10.8 / 5



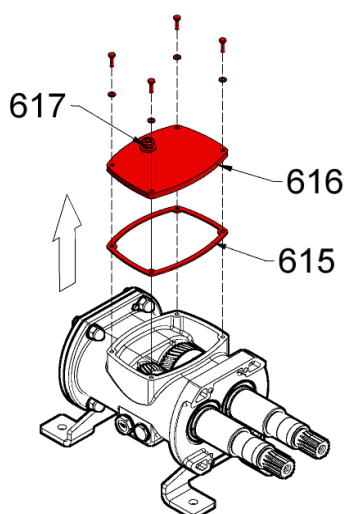
6. Remove the double seal stationary elements **(201-B)** from the back flange.

10.8 / 6

10.9 Gear casing disassembly

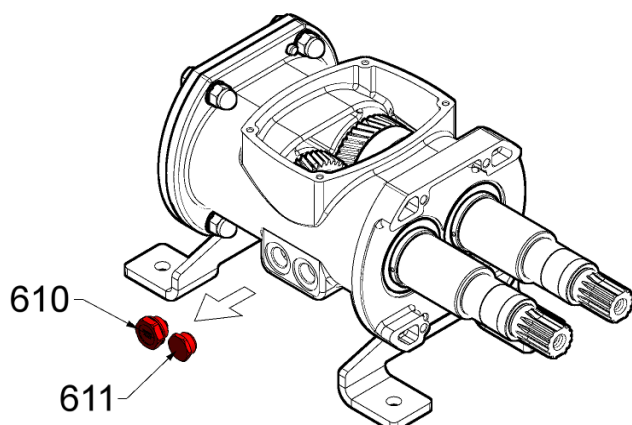
To disassemble the gear casing, perform the following operations in the order:

1. Dismantle the inspection port (616) and gasket inspection port (615).



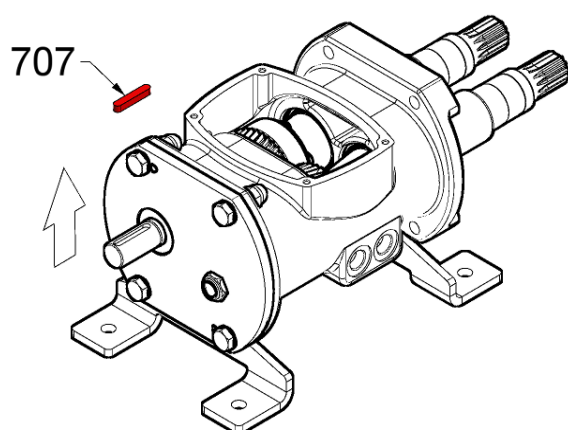
10.9 / 1

2. Remove the magnetic threaded cap (610) and threaded cap (611).
3. Drain the lubricant inside the body through the appropriate side holes.

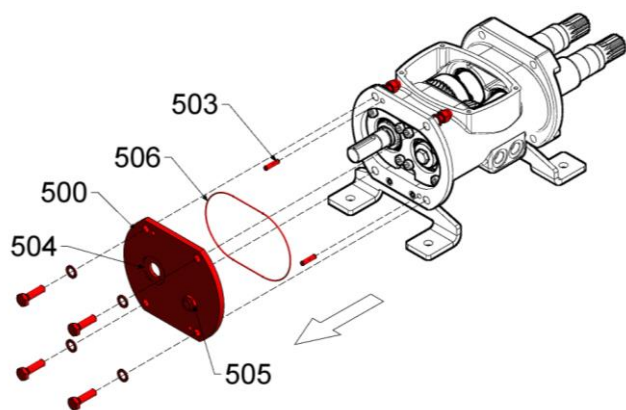


10.9 / 2

4. Remove the key (707) from the appropriate shaft drive seat.

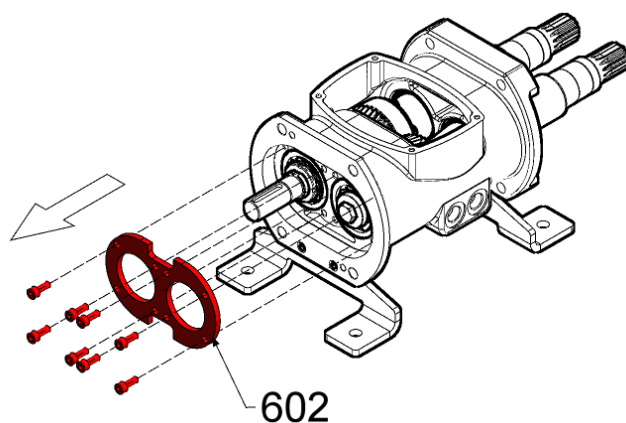


10.9 / 3



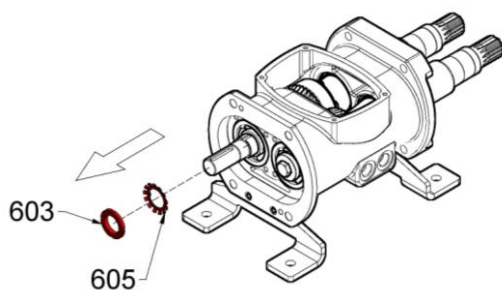
5. Disassemble the cover gearbox (**500**), on which the lip seal (**504**) and oil sight glass (**505**) are inserted.
6. Remove the O-ring (**506**) and pins (**503**).

10.9 / 4

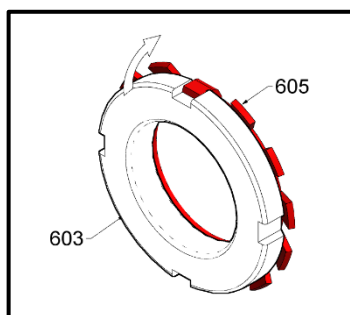


7. Remove the plate bearing retainer (**602**).

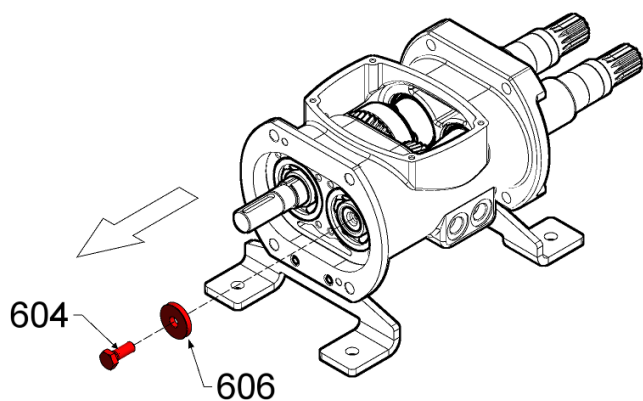
10.9 / 5



8. Open the safety washer tooth (**605**) to release the ring nut (**603**).
9. Loosen the locking ring nut (**603**) from the shaft head and remove the safety washer (**605**).

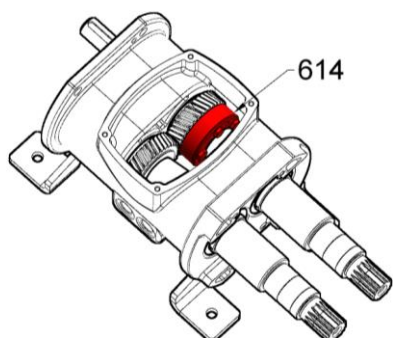


10.9 / 6



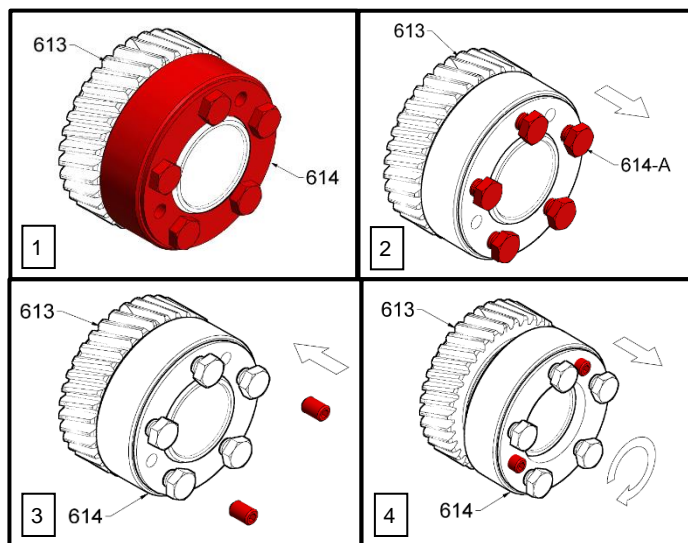
10. Loosen the hex head screw (604) from the shaft head and then remove the ring bearing retainer (606).

10.9 / 7



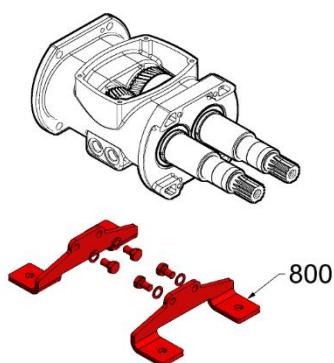
11. Loosen the keyless locking device (614). Follow the instructions:

- 11.1 Loosen the screws (614-A) of the locking device (Figure 2).
- 11.2 Insert headless recessed hexagon screws inside the threaded holes of the locking device (Figure 3)
- 11.3 Tighten the headless screws until the locking device is free to rotate independently of the gear drive (613) (Figure 4).

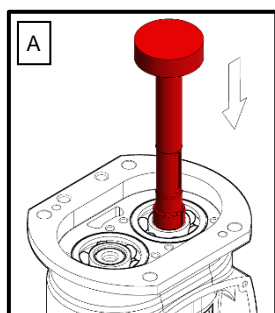


10.9 / 8

12. Disassemble the foot mounting (800).



10.9 / 9



13. Using a buffer, push the shaft drive head (700) to remove the back flange side face of the gear casing (600). During the procedure, the corresponding lip seal (705) will also be removed.

13.1 Push on the head of the shaft drive (700) until the screws of the locking device will stop in contact with the gear casing (Figure 1).

13.2 Move the support washer (620) (Figure 2), widen the seeger ring (621) with a gripper and pull it out in the direction of the ball bearings (Figure 3 e 4).

13.3 Push on the head of the shaft drive (700) until it is removed from the gear casing.



NOTE!

To perform the operation, the gear casing must be brought under press.



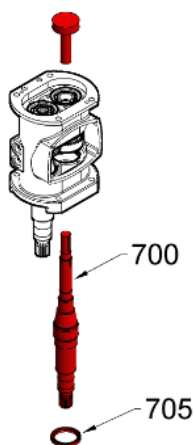
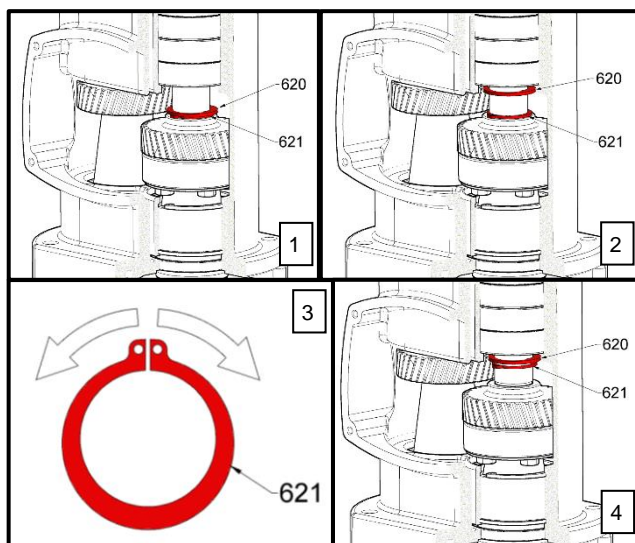
NOTE!

The positioning of the buffer at the beginning of the procedure is shown in the figure in the box.

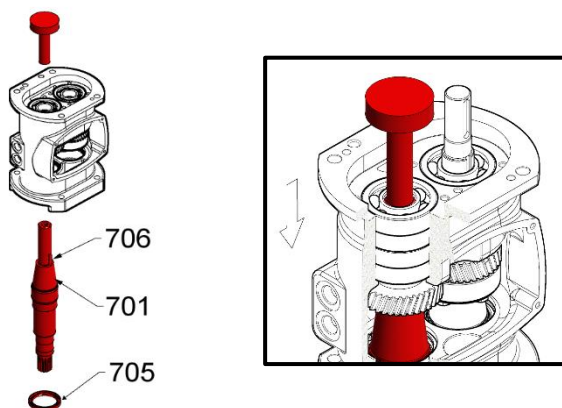


NOTE!

During the second phase during which the shaft drive is removed (described in 13.3) pay attention that the seeger ring does not fit into the shaft thread.



10.9 / 10



14. Using a buffer, push the shaft driven head (701) to remove the back flange side face of the gear casing (600). During the procedure, the key (706) and the corresponding lip seal (705) will also be removed.

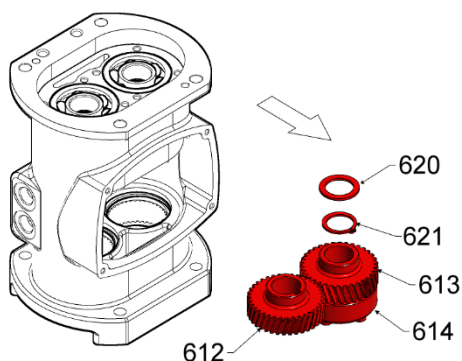

NOTE!

To perform the operation, the gear casing must be brought under press.


NOTE!

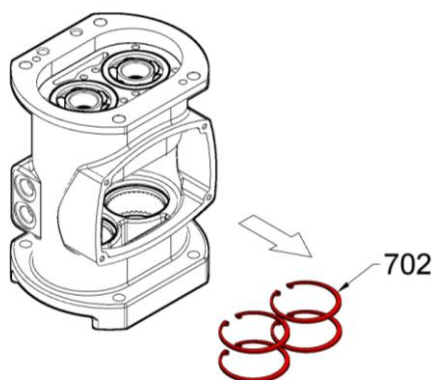
The positioning of the buffer at the beginning of the procedure is shown in the figure in the box.

10.9 / 11



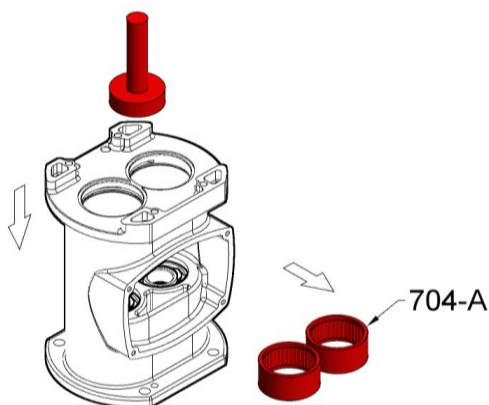
15. Remove the gear driven (612), the gear drive (613), the locking device (614), the seeger ring (621) and the support washer (620) from the gear casing.

10.9 / 12



16. Use the appropriate gripper to remove the seeger rings (702) from the gear casing seats.

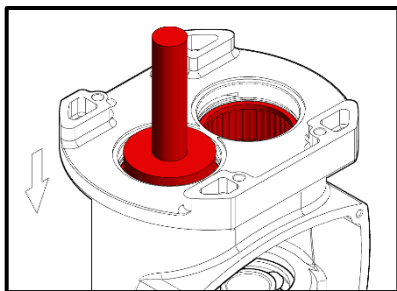
10.9 / 13



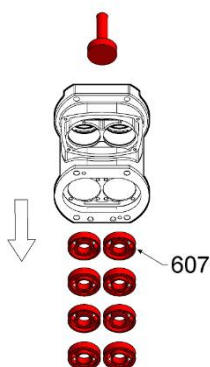
17. Using a buffer, push the outer rings of the needle bearings (704-A) inside the gear casing, and then remove them from the inspection port.


NOTE!

The positioning of the buffer at the beginning of the procedure is shown in the figure in the box.



10.9 / 14



18. Using a buffer, disassemble the ball bearings **(607)**, pushing them out of the gear casing from the gearbox cover side face.


NOTE!

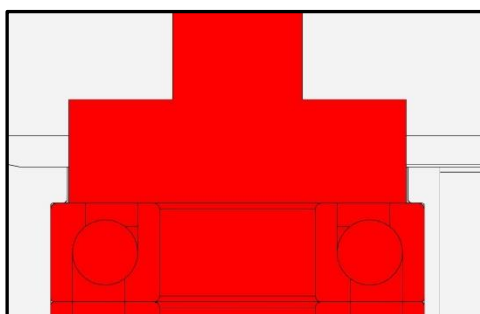
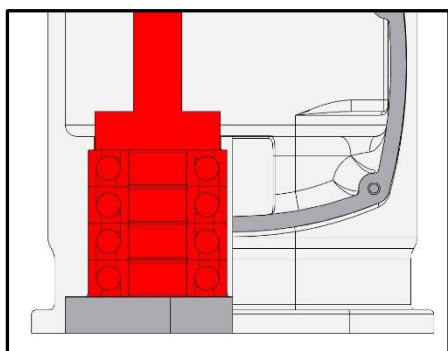
It is important that the buffer is pushed simultaneously on the inner crown and on the outer crown of the first back flange side ball bearing (see last figure).


NOTE!

To perform the operation, the gear casing must be brought under press.

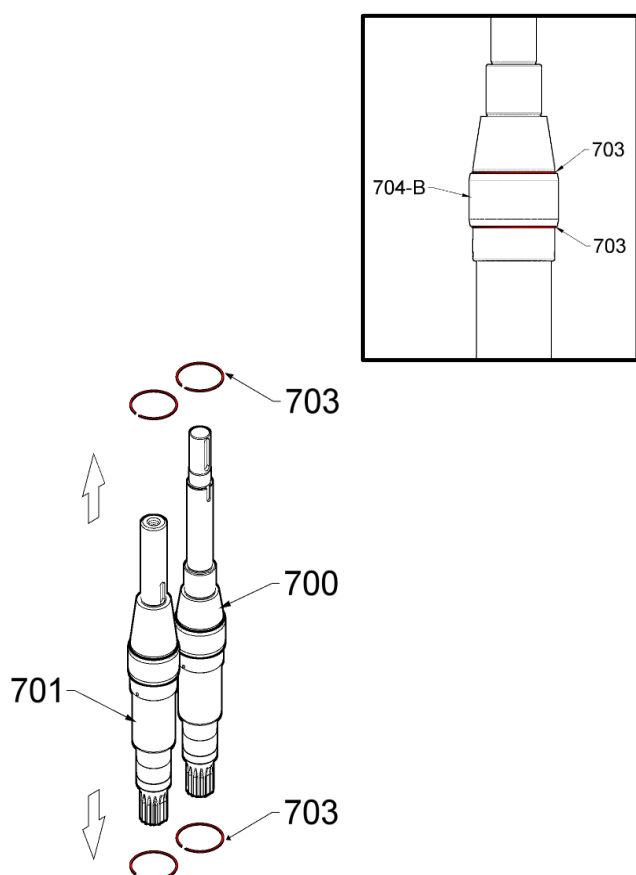

NOTE!

The positioning of the pad at the beginning of the procedure is shown in the first figure in the box.



10.9 / 15

19. Remove the stop rings (**703**), which lock the inner rings of the roller bearings (**704-B**) from the shafts (**700**, **701**). To do this, simply widen the rings and then remove them from the nearest end of the shaft.

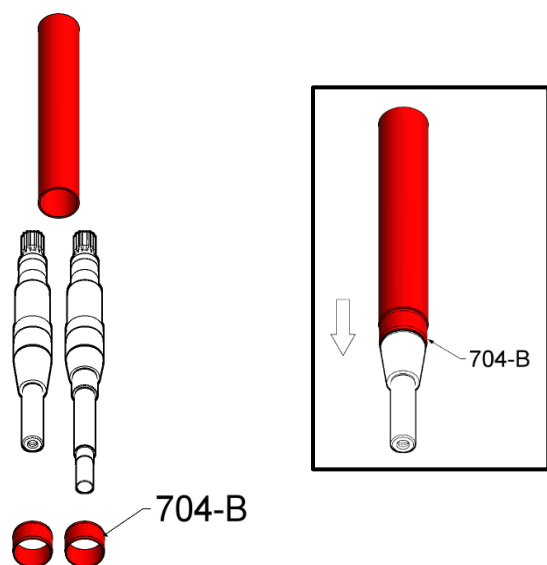


10.9 / 16

20. Remove the inner rings of the roller bearings (**704-B**) from the shafts. To achieve this, use a buffer to push the rings out of place.


NOTE!

The positioning of the buffer at the beginning of the procedure is shown in the figure in the box.

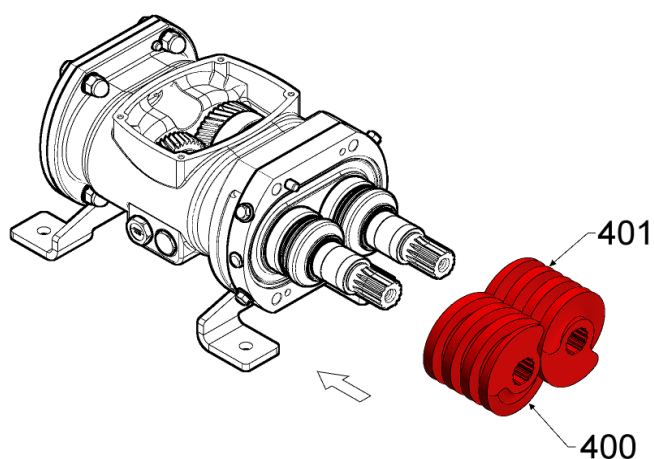


10.9 / 17

10.10 Assembly of rotors and pump casing

To assemble the rotors and the pump casing, perform the following operations in order:

1. Insert the rotors (**400, 401**) on the shafts.



10.10 / 1

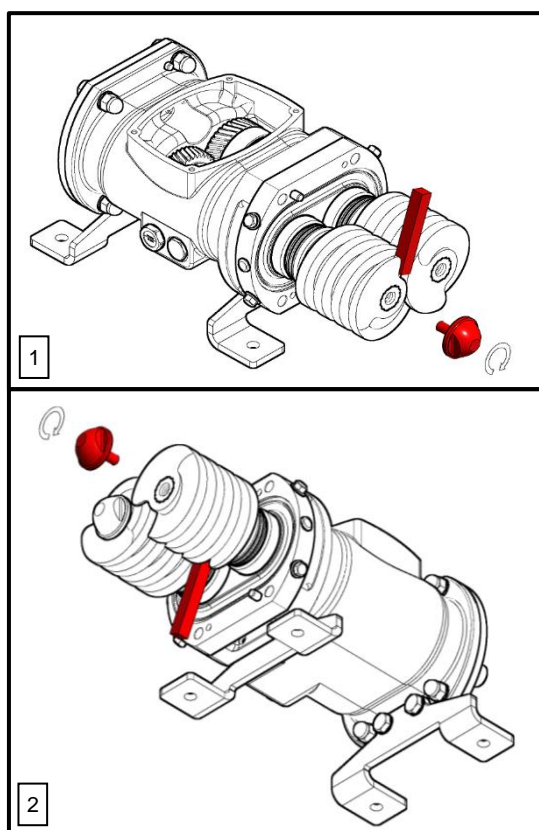
2. Disassemble the pump casing (**300**) and remove the lip O-ring (**205**).



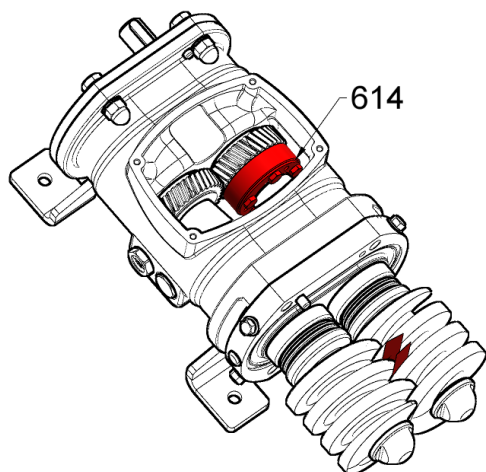
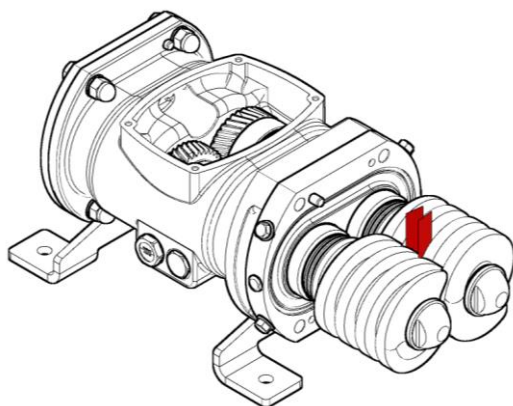
NOTE!

During the operation, be sure to block rotation of the rotors using a dedicated parallelepiped.

- 2.1 Use a dedicated parallelepiped to block the rotation of the left rotor (**400**) at the tip. Then loosen the nut screw (**404**) (Figure 1).
- 2.2 With a dedicated parallelepiped block the rotation of the right rotor (**401**) at the start of the rotor. Then loosen the nut screw (**404**) (Figure 2).



10.10 / 2



3. Gap the rotors (**400, 401**). Follow these steps for adjustment:


NOTE!

During the operation use shims to ensure the correct flank gap between the rotors.

- 3.1 Be sure to have evenly divided the flank gap between the rotors.
- 3.2 Insert 2 shims between the helicoids of the rotors to ensure that the flank gap is maintained during tightening of the locking device (**614**).
- 3.3 Tighten the locking device by tightening the screws (**614-A**) (Figure 1, Figure 2).


NOTE!

To tighten the locking set, proceed by tightening the screws several times, until the correct tightening torque is obtained.


NOTE!

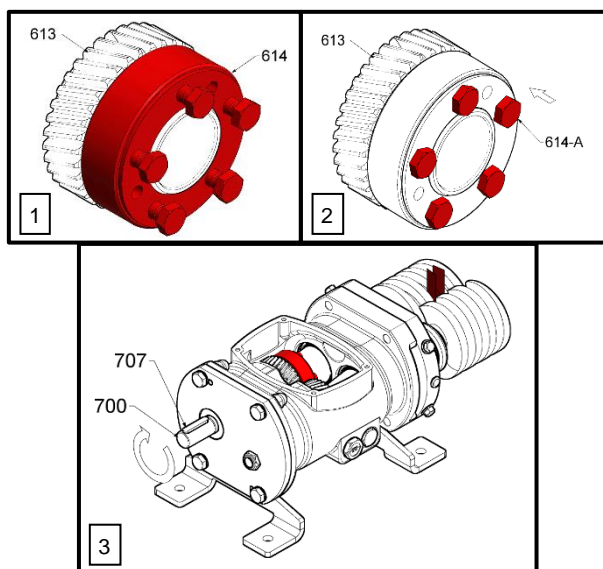
When tightening the locking set make sure that the shims are always present between the helicoids of the rotors to maintain the correct flank gap.


NOTE!

When tightening the locking set, turn the shaft drive (**700**) using the wrench (**707**) (Figure 3).

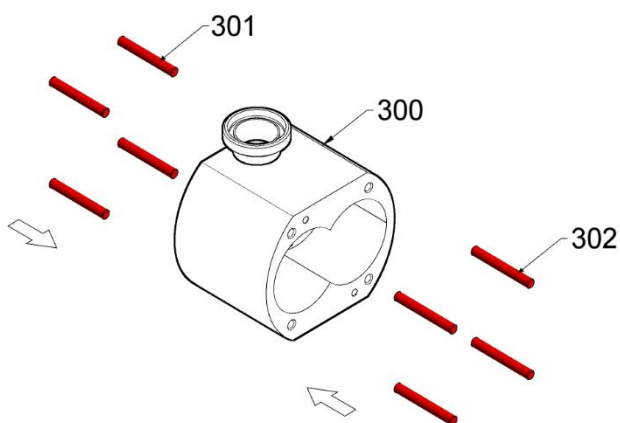

NOTE!

If, during tightening of the locking set, it is necessary to loosen it to recalibrate the flank gap between the helicoids of the rotors, refer to section 11 of the paragraph "Gear casing disassembly" to perform the operation.



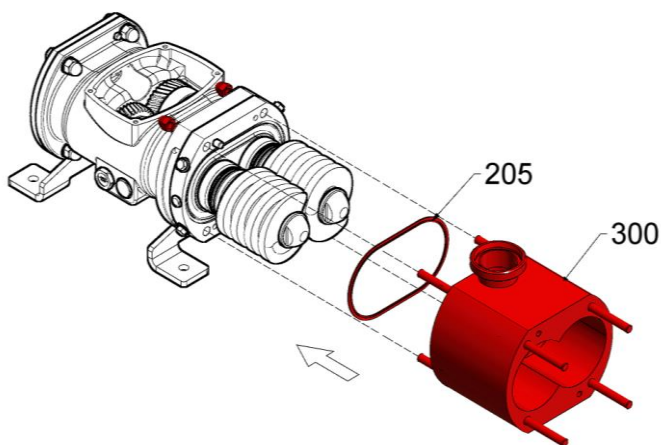
10.10 / 3

4. Insert the studs (**301**, **302**) into the appropriate holes in the pump casing (**500**).



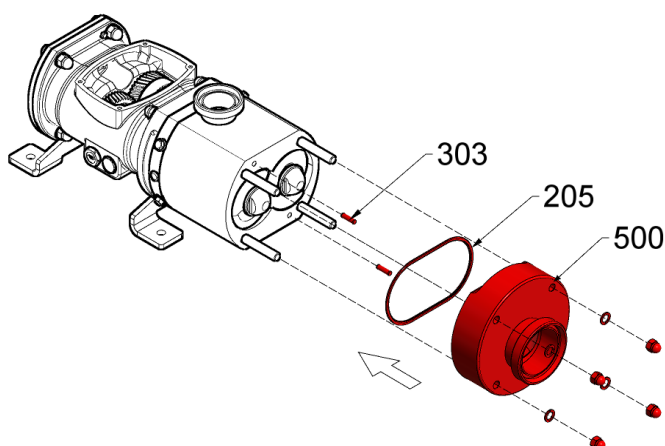
10.10 / 4

5. Fit the lip O-ring (**205**) and pump casing (**500**).

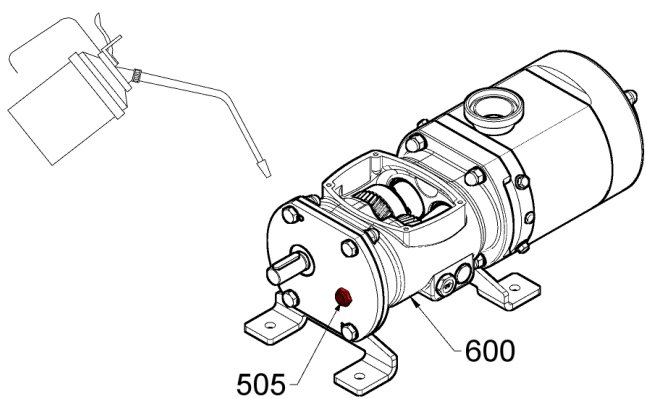


10.10 / 5

6. Insert the pins (**303**) into the appropriate seats of the pump casing.
7. Fit the lip O-ring (**205**) and front cover (**500**).



10.10 / 6

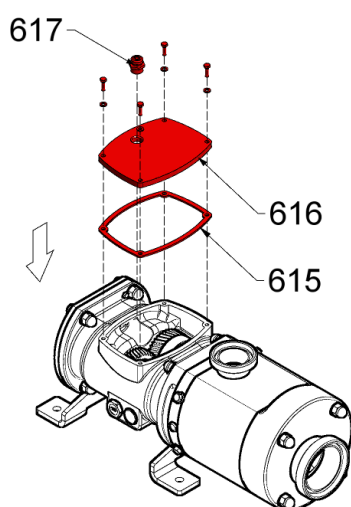


8. Pour the lubricating oil into the gear casing (600).


NOTE!

Pour oil until it covers approximately half the oil sight glass (505), fitted on the gearbox cover.

10.10 / 7



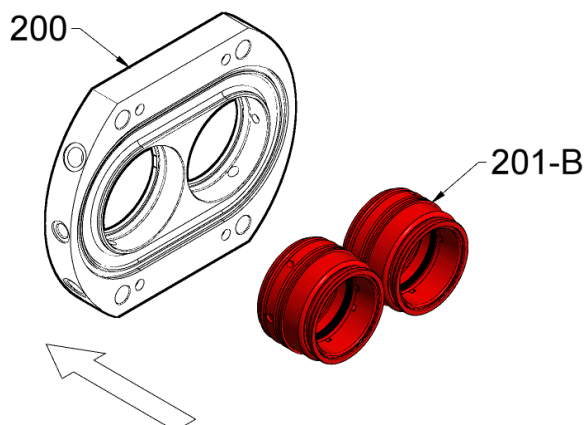
9. Pre-assemble the breather plug (617) on the inspection port (616).

10. Close the gear casing, fitting the gasket inspection port (615) and inspection port (616).

10.10 / 8

10.11 Assembly of the single mechanical seals BFH

To assemble the single mechanical seals, perform the following operations in order:



1. Insert the stationary elements of the single mechanical seals **(201-B)** into the dedicated seats of the back flange **(200)**.

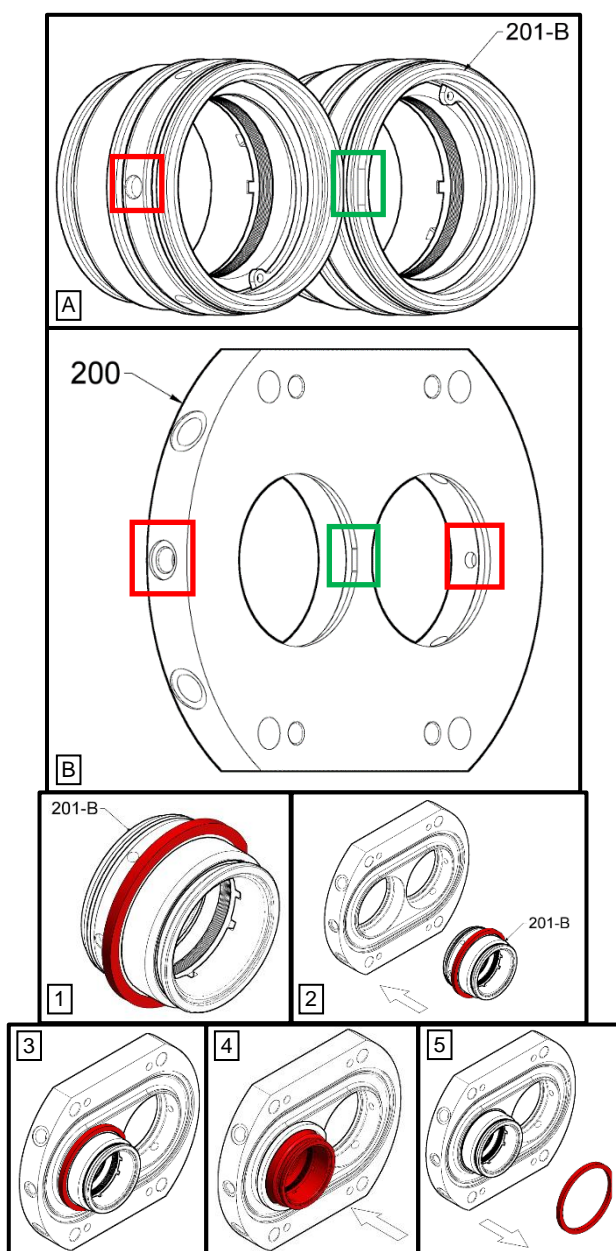
To insert the stationary element it is advisable to use a buffer (see Fig.1). The pad has the task of compressing the external lip o-ring to facilitate insertion into the dedicated seat of the back flange.

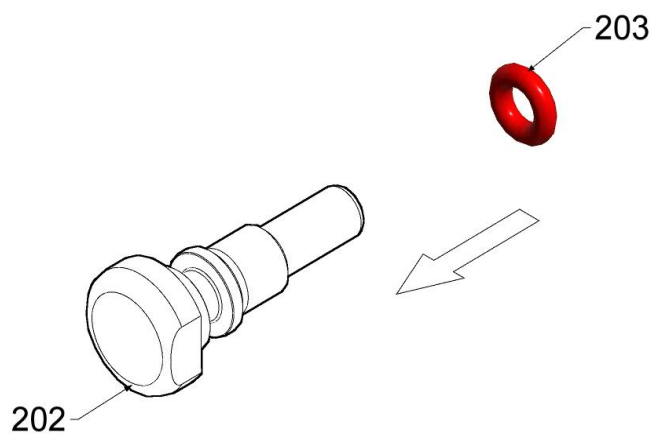
- 1.1 Insert the seal stationary element in the buffer, at the external lip o-ring position (Fig.1).
- 1.2 Position the stationary element assembly with buffer on the back flange seat (Fig.2, Fig.3).
- 1.3 Push the seal stationary element inside the back flange (Fig.4).
- 1.4 Remove the buffer (Fig.5).
- 1.5 Repeat steps 1.1 - 1.5 for assembly of the second seal stationary element.



NOTE!

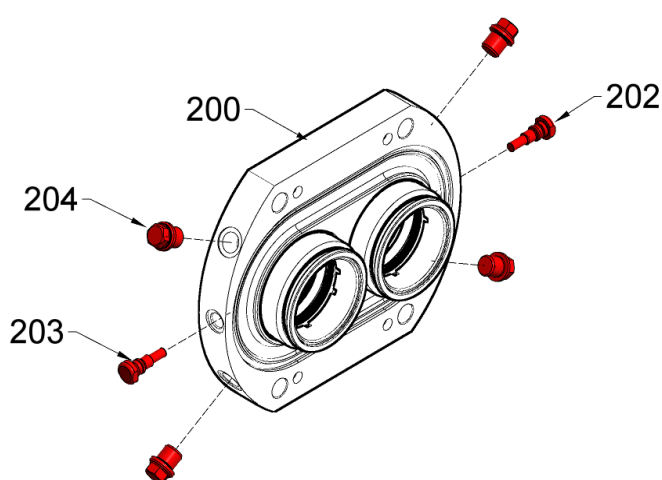
When inserting the seal stationary elements **(201-B)** pay attention to the coupling of the surface and the holes for the seal block pins **(202)** on the stationary elements and back flange (indicated in the boxes of figures A and B).





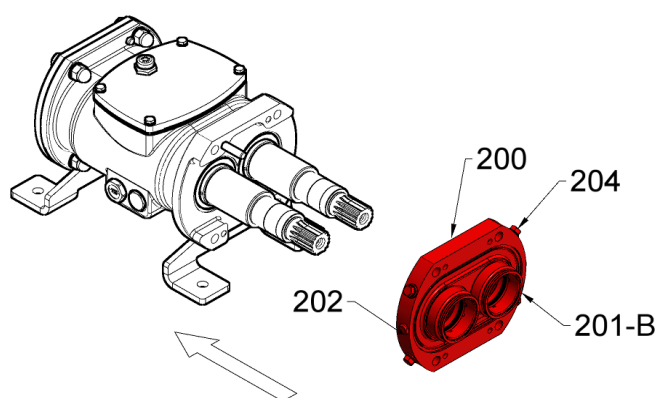
2. Insert the O-rings (203) on the appropriate seats of the pin seal blocks (202).

10.11/ 2



3. Insert the pin seal blocks (202), with their O-rings (203), and the threaded caps (204) into the back flange.

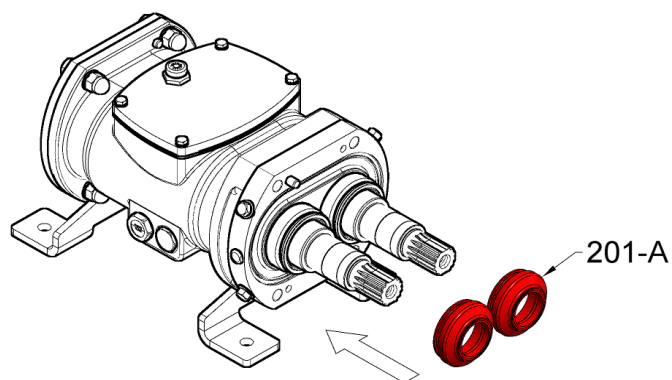
10.11 / 3



4. Mount the back flange (200) on the gear casing.

10.11 / 4

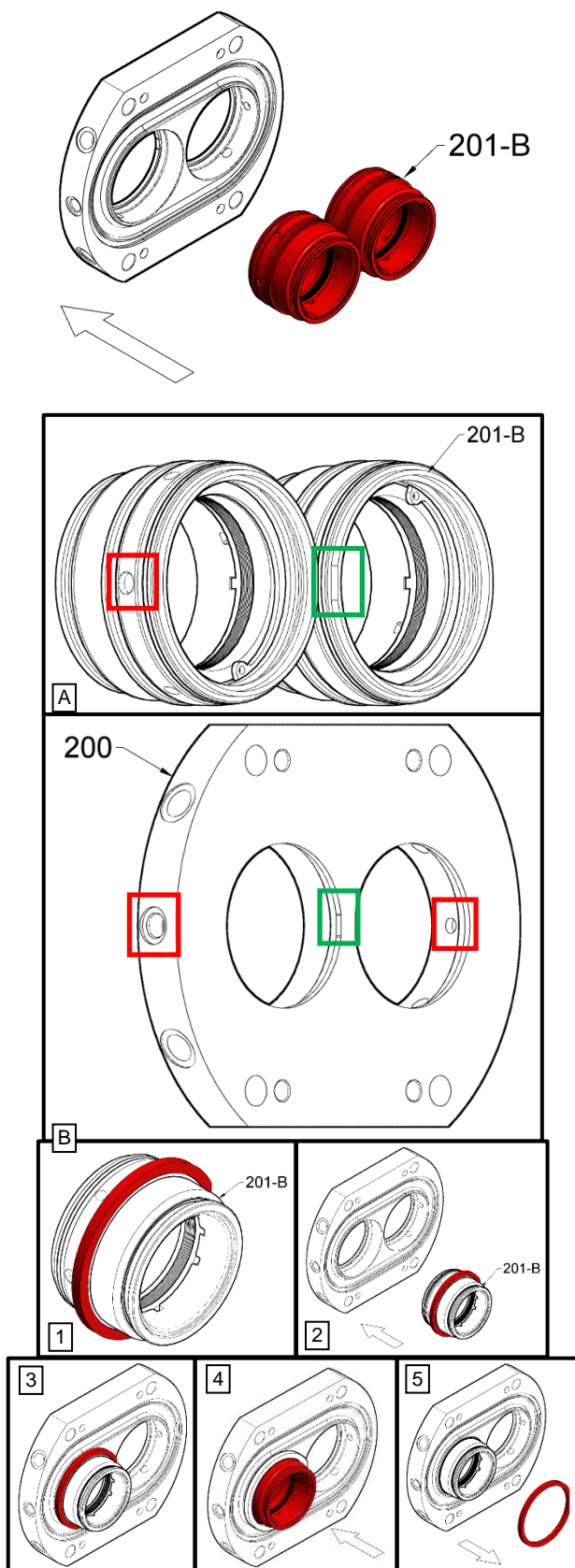
5. Fit the seal rotary elements (**201-A**).

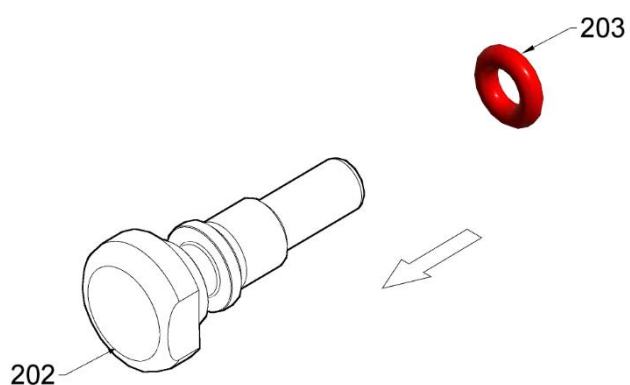


10.11 / 5

10.12 Assembly of the double mechanical seals BCH

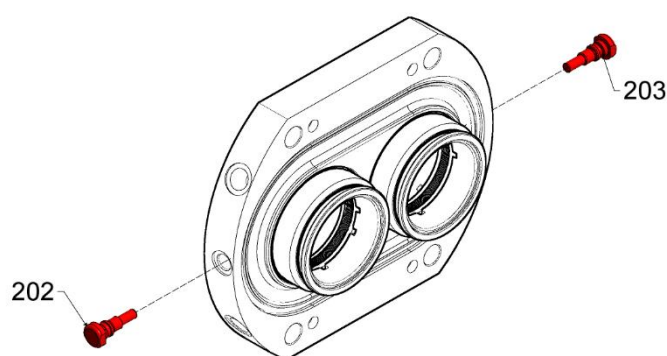
To assemble the double mechanical seals, perform the following operations in order:





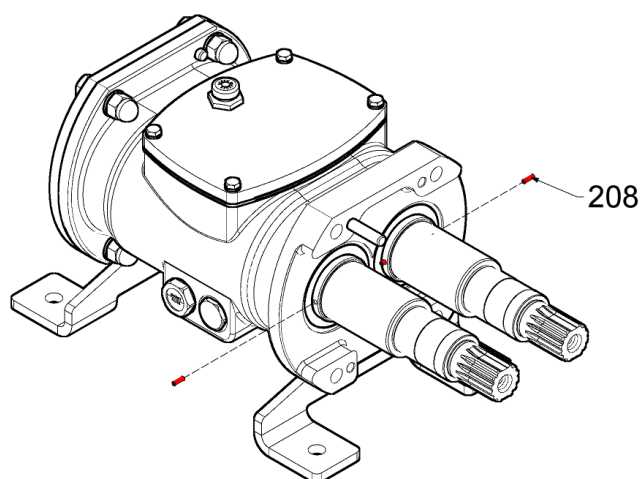
2. Insert the O-rings **(203)** on the appropriate seats of the pin seal blocks **(202)**.

10.6 / 2



3. Insert the pin seal blocks **(202)**, with relative O-rings **(203)**, into the back flange.

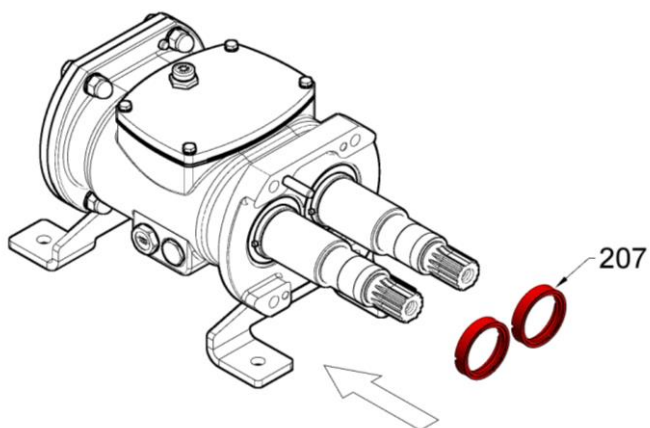
10.6 / 3



4. Insert the recessed hexagon head screws **(208)** into the appropriate shaft seats. 2 screws are fitted for each shaft.

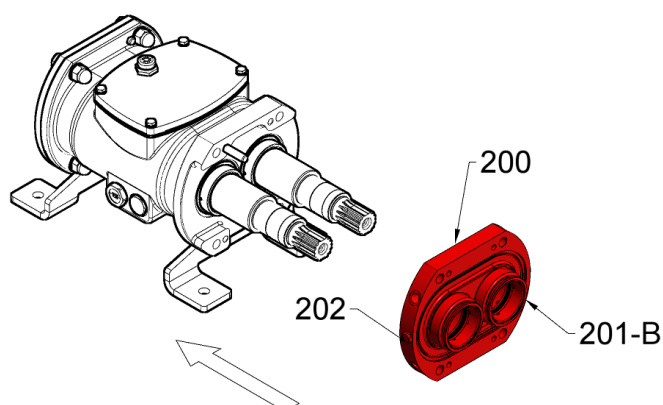
10.6 / 4

5. Insert the rotary part of the secondary seals (**207**) into the shafts.



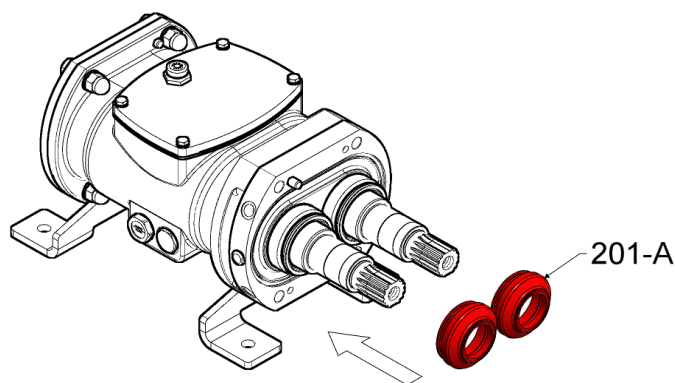
10.6 / 5

4. Mount the back flange (**200**) on the gear casing.



10.6 / 4

5. Assemble the primary seal rotary elements (**201-A**).



10.6 / 5

10.13 Assembly of pump casing centering pins

2 different positioning configurations of the centering pins (103) are possible, which will be described in the current paragraph. The configuration to be chosen depends on the working conditions of the pump. The pin holes are numbered from 1 to 4, starting from the one at the top left in the Fig.10 and proceeding clockwise:

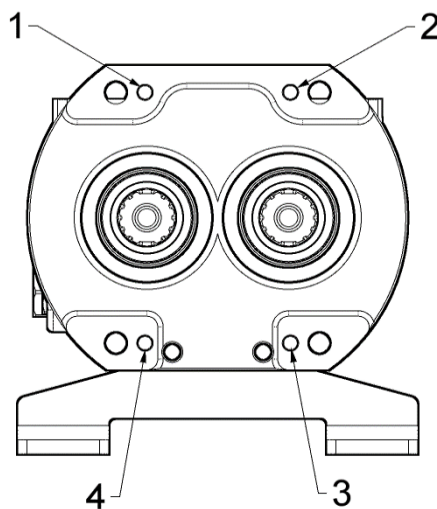


Fig.10 - Pin numbering

10.13.1 Configuration with suction from tangential opening and delivery from radial opening

With this mode of operation of the pump, a rotation of the rotors will be required as shown in the following figures:

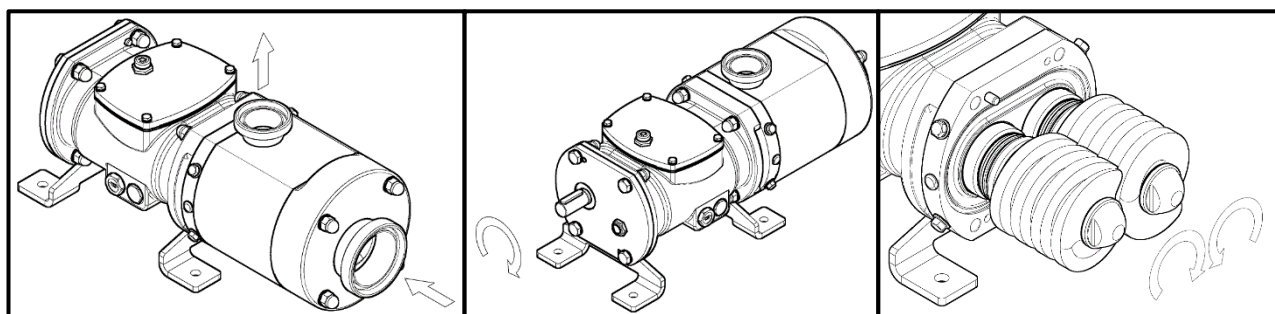


Fig.11 – Pump operating conditions

The pins (103) mounted must be no.1 and no.3:

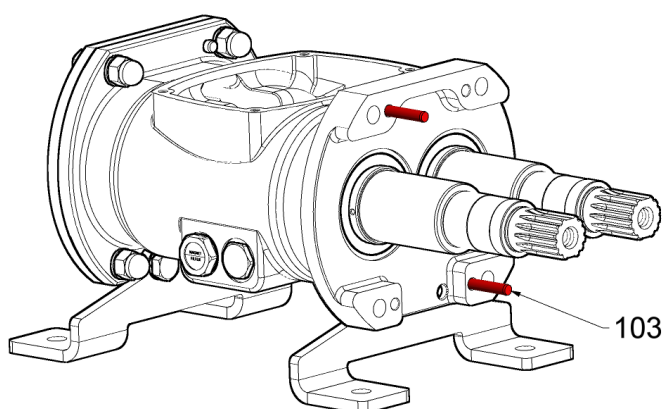


Fig. 12 - Assembly of pins no. 1 and no. 3

10.13.2 Configuration with suction from radial opening and delivery from tangential opening

With this mode of operation of the pump, a rotation of the rotors will be required as shown in the following figures:

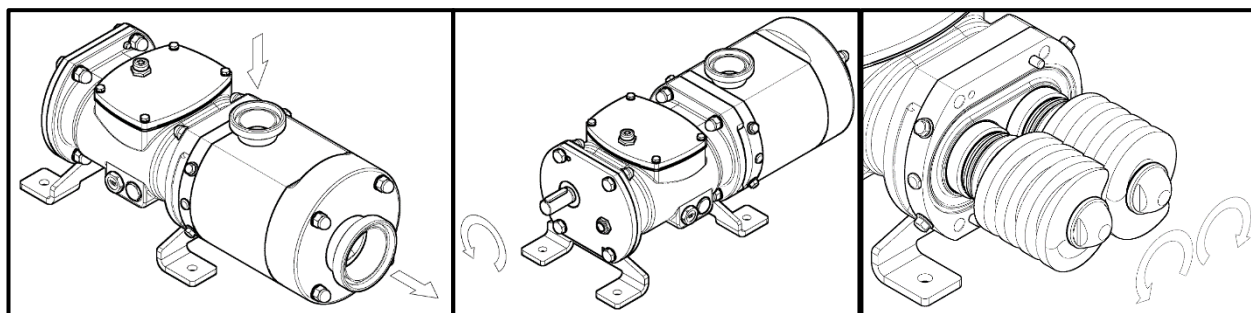


Fig.13 – Pump operating conditions

The pins (103) mounted must be no.2 and no.4:

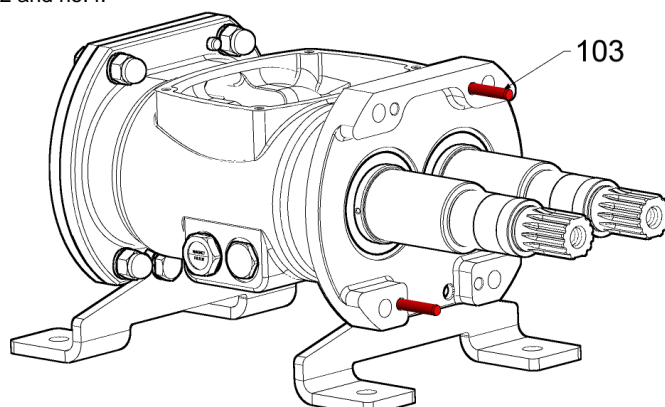
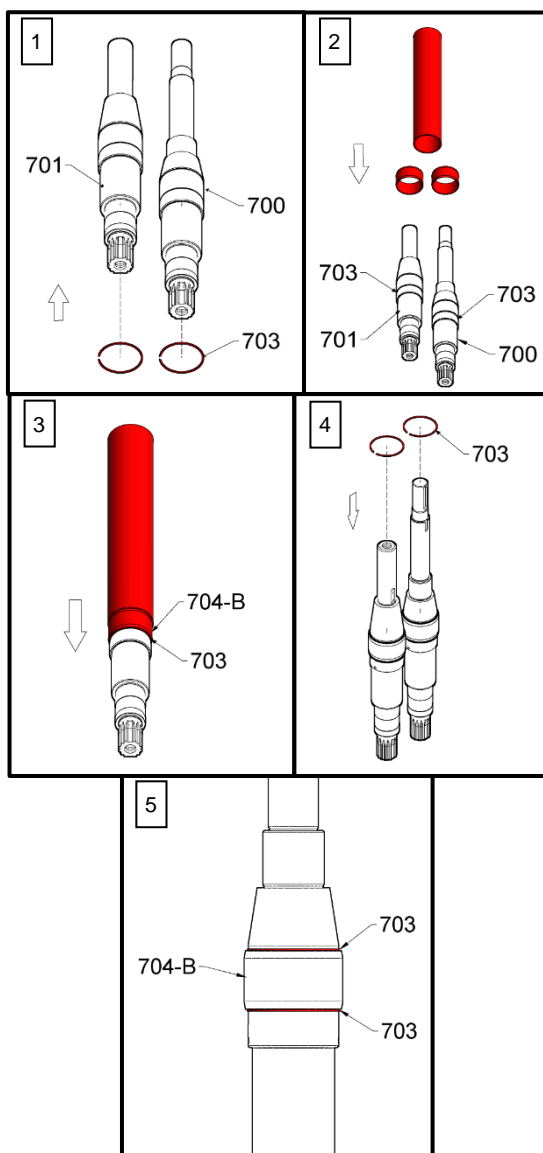


Fig.14 - Assembly of pins no. 2 and no. 4

10.14 Gear casing assembly

To assemble the gear casing, perform the following operations in the order:



1. Mount the internal rings of the roller bearing (704-b) on the shaft (700,701) following the next steps:

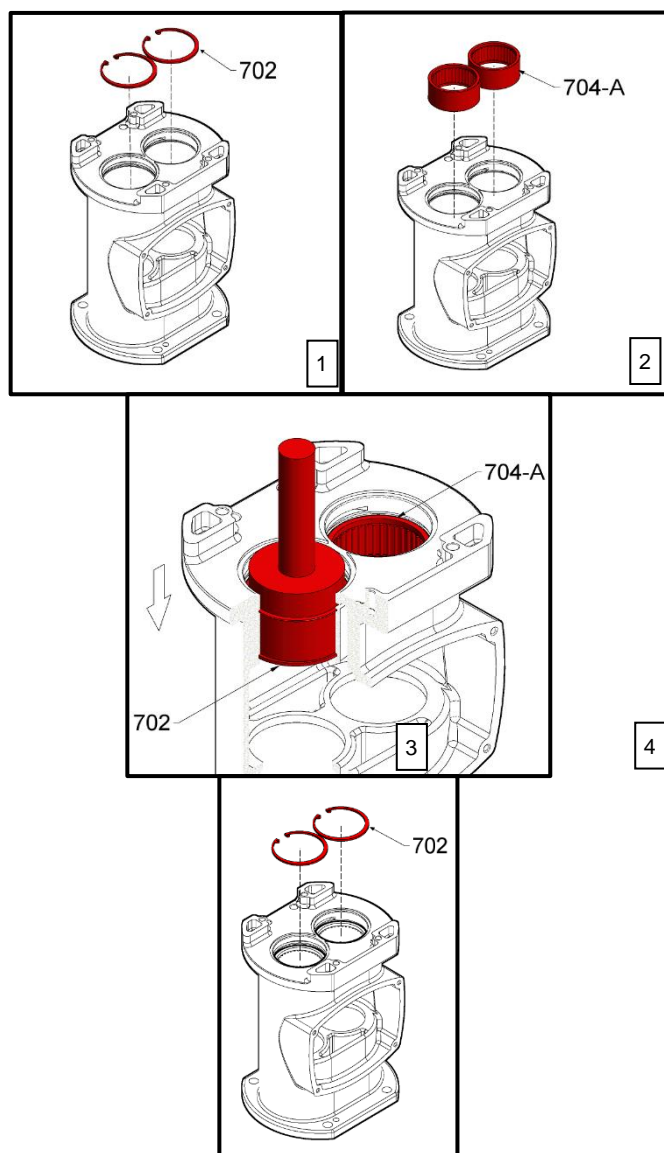
- 1.1 Insert 2 stop rings (**703**) into the appropriate shaft drive (**700**) and shaft driven (**701**) seats (Figure 1).
- 1.2 From the opposite head of the shafts insert the inner rings of the needle bearings (**704-B**) until they come into abutment on the rings inserted in step 1.1 (Figure 2). To achieve this, it is possible to use a dedicated buffer.



NOTE!

The positioning of the buffer at the end of the procedure is shown in Figure 3.

- 1.3 Lock the inner rings of the needle bearings with the remaining 2 stop rings (**703**) (Figure 4). The final configuration must be that of Figure 5.



2. Mount the external rings of the roller bearing (704-A) on the bearing support following the next steps:

2.1 Using the appropriate gripper, place 2 seeger rings (**702**) on the appropriate gearbox cover side seats of the gear casing (Figure 1).

2.2 Using a buffer, push the outer rings of the needle bearings (**704-A**) into place until they come into abutment on the seeger rings mounted in step 2.1 (Figure 2).

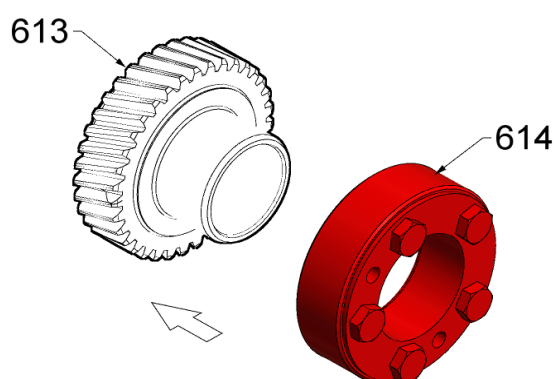


NOTE!

The positioning of the buffer at the end of the procedure is shown in Figure 3.

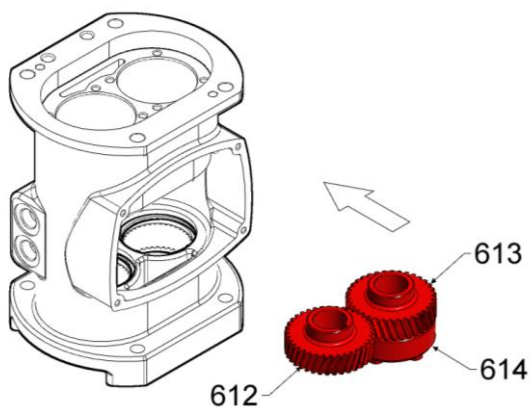
2.3 Position the remaining 2 seeger rings (**702**), thus locking the outer rings of the needle bearings (Figure 4).

10.14 / 2



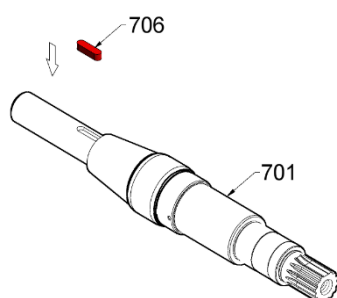
3. Insert the locking device (**614**) into the gear drive seat (**613**).

10.14 / 3



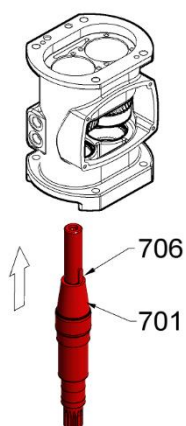
4. Insert the gear drive (613), gear driven (612) and locking device (614) into the gear casing through the inspection port.

10.14 / 4



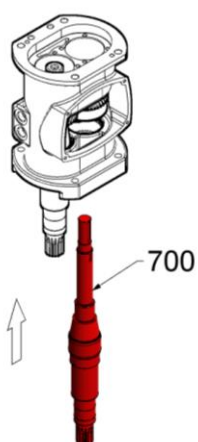
5. Fit the key (706) in the appropriate shaft driven seat (701).

10.14 / 5



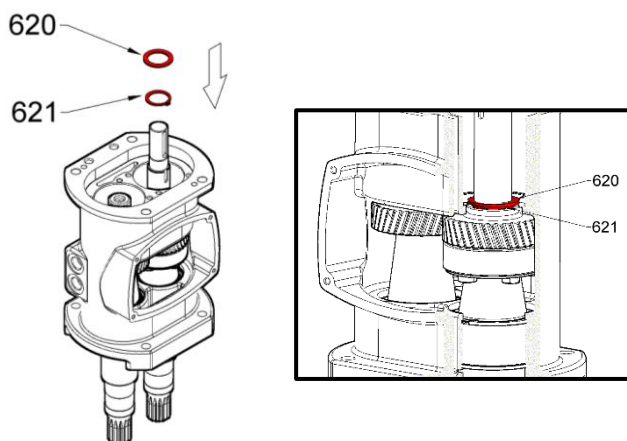
6. From the back flange side face of the gear casing (600), insert the shaft driven (701) and bring it into place.

10.14 / 6



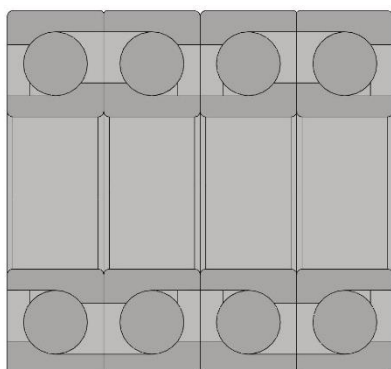
7. Repeat the previous step, inserting the shaft drive (700) into the gear casing (600) through the back flange side face.

10.14 / 7

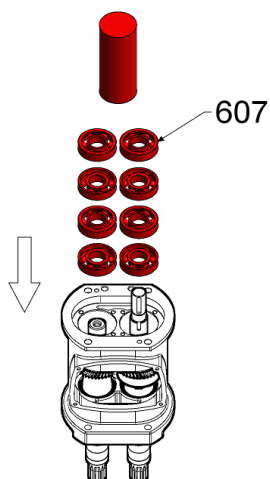


8. Insert the seeger ring **(621)** into the Shaft drive and push it into its place. Then insert the support washer **(620)**. The final position of the 2 rings is shown in the box.

10.14 / 8



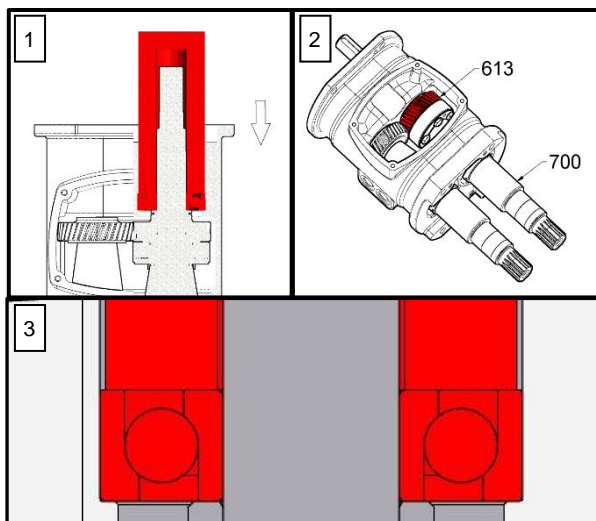
Cuscinetti montati con conformazione a doppia "X"



9. Mount the ball bearing (08) in the appropriate place beside the support cover. It should be mounted in a double X form.
 - 9.1 Push the first bearing into place starting from the shaft drive **(700)**. The buffer must be pushed simultaneously on the inner crown and on the outer crown of the bearing (Figure 1, Figure 3).
 - 9.2 Before preparing to insert the second bearing, make sure that the rotation of the gear drive **(613)** takes place independently of the rotation of the shaft drive **(700)** (Figure 2).
 - 9.3 Push the second shaft drive side bearing into place. In this case also pushing of the buffer must take place simultaneously both on the inner crown and on the outer crown of the bearing.
 - 9.4 Before preparing to insert the third bearing, make sure that the rotation of the gear drive **(613)** takes place regardless of the rotation of the shaft (Figure 2).
 - 9.5 Repeat steps 8.1 - 8.4 for the third and fourth shaft drive side bearings.
 - 9.6 Repeat steps 8.1 - 8.4 for 4 shaft driven side ball bearings.

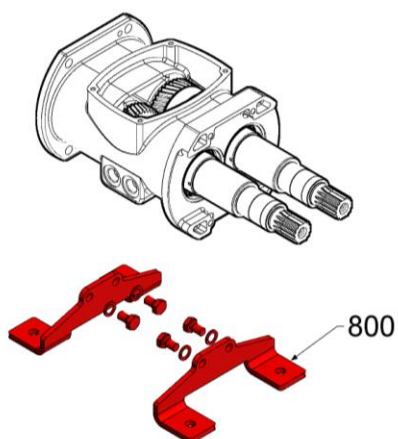

NOTE!

To perform the operations, the gear casing must be brought under press.



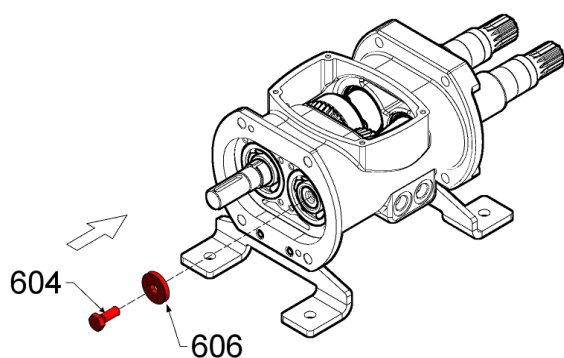
10.14 / 9

10. Fit the foot mountings (**800**).

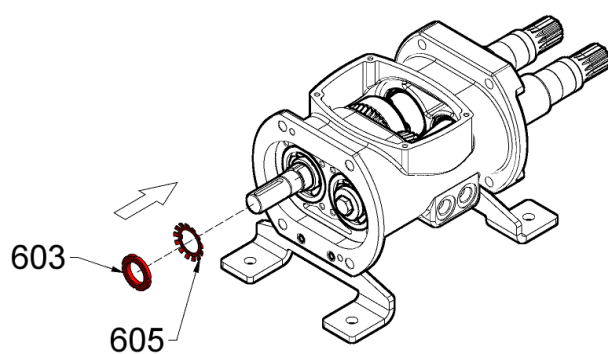


10.14 / 10

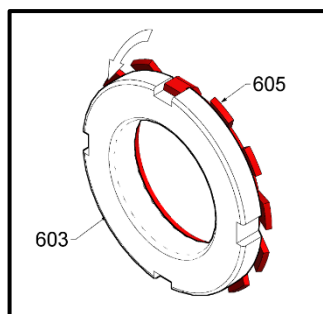
11. Lock the ring bearing retainer (**606**) on the shaft driven head on the gearbox cover side by screwing the hex head screw (**604**).



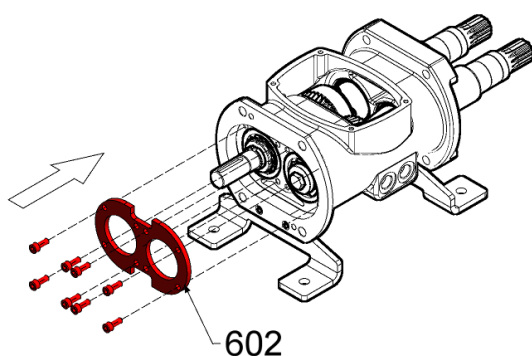
10.14 / 11



12. Insert the safety washer **(605)** on the gearbox cover side head of the shaft drive and then tighten the ring nut **(603)** until it locks.
13. Close the safety washer tooth **(605)** to lock the ring nut **(603)**.

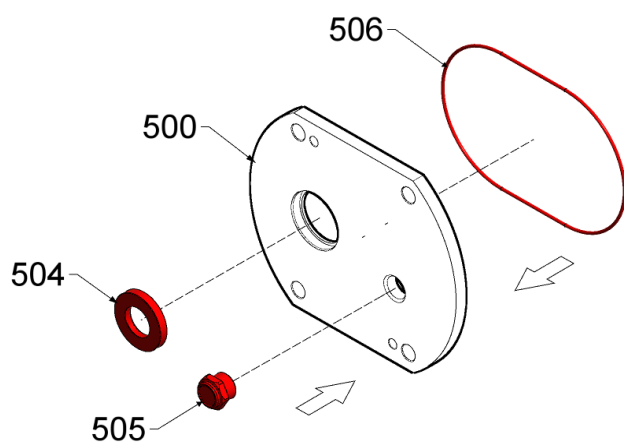


10.14 / 12



14. Fit the gear bearing retainer **(602)**.

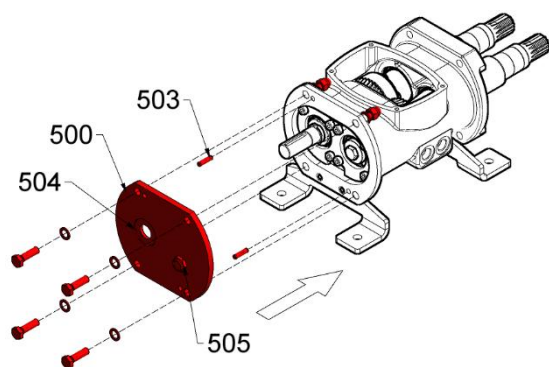
10.14 / 13



15. Pre-assemble the O-ring **(506)**, the lip seal **(504)** and the oil sight glass **(505)** on the gearbox cover **(500)**.

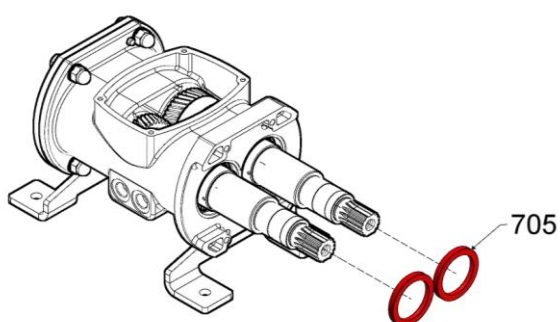
10.14 / 14

16. Insert the pins **(503)** on the appropriate gear casing seats.



17. Mount the gearbox cover (**500**), complete with the components pre-assembled during step 14, on the gear casing by centring it on the 2 pins mounted during step 15.

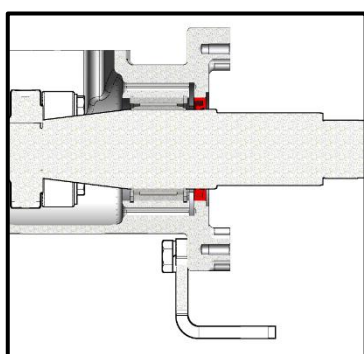
10.14 / 15



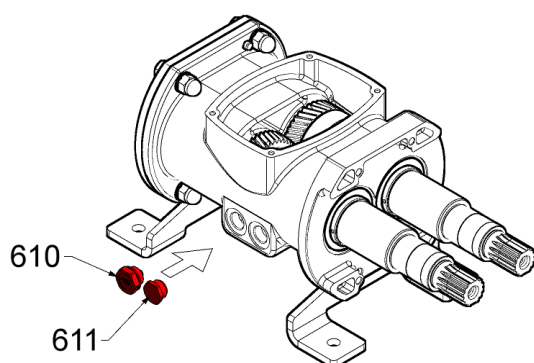
18. Insert the lip seals (**705**) into the dedicated seats on the back flange side seats.


NOTE!

The oil seals must not touch the needle bearings, but simply insert them to the limit of the specific seat set. This makes it possible to avoid covering the oil recirculation channels on the back flange side (Figure in the box).

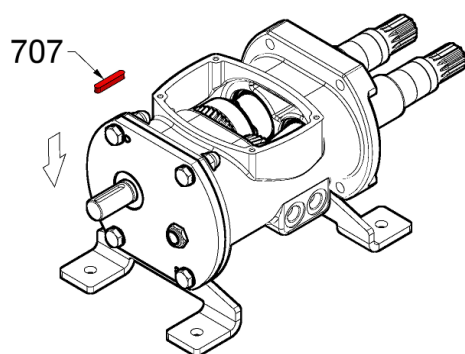


10.14 / 16



19. Screw on the magnetic threaded cap (**610**) and threaded cap (**611**).

10.14 / 17



20. Fit the key **(706)** in the appropriate shaft drive seat **(700)**.

10.14 / 18

11 TROUBLESHOOTING

	MALFUNCTION																PROBABLE CAUSE	SOLUTION
	THE PUMP DOES NOT START	THE FLOW RATE IS NIL	THE FLOW RATE IS LOW	THE FLOW IN DELIVERY IS IRREGULAR	THE DELIVERY PRESSURE IS LOW	THE PUMP DOES NOT PRIME	LOSS OF PRIMING AFTER STARTING	THE PUMP STOPS AFTER STARTING	PUMP OVERHEATING	MOTOR OVERHEATING	EXCESSIVE NOISE AND VIBRATIONS	EXCESSIVE PUMP WEAR	SEIZURES	LEAKAGE OF FLUID FROM THE SEALS	ROTOR ROTATION BLOCKED	HIGH ABSORPTION RATES		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P		
1	•															•	Presence of foreign objects in the pump casing	Remove foreign objects from the pump casing
2		•				•											Incorrect direction of rotation	Reverse the rotation of the motor shaft
3		•															The pump does not prime	Eject the gas from the suction line and introduce fluid
4		•	•	•	•		•				•						Insufficient NPSHa	Simplify the suction line, reduce its length and/or increase its diameter Reduce the pump rotation speed
5			•	•	•		•				•						Vaporisation of the suction fluid	Simplify the suction line, reduce its length and/or increase its diameter. Reduce the pump rotation speed
6		•	•	•		•	•						•				Entry of air into the pipeline before suction	Check the pipeline upstream of the pump
7			•				•	•	•	•	•					•	Higher than expected fluid viscosity	Increase the fluid temperature Decrease the pump rotation speed
8		•	•		•												Lower than expected fluid viscosity	Decrease the fluid temperature Increase the pump rotation speed
9									•		•	•				•	Fluid temperature higher than expected	Check that there are no obstructions inside the pipeline before the pump Reduce the fluid temperature Check the compatibility of the elastomers and seal faces with the actual measured fluid temperature
10								•		•						•	Lower than expected fluid temperature	Increase the fluid temperature
11											•	•	•	•			Presence of unenvisaged solids within the gear casing	Clean the system Insert a filter upstream of the pump
12		•	•	•		•	•	•	•	•	•	•	•	•		•	Delivery pressure higher than expected	Check that there are no obstructions inside the pipeline Simplify the pipeline after delivery to decrease the pressure
13														•			Inadequate seal flushing system	Increase the flow rate of the flushing fluid Check that the flushing fluid flows freely into the sealing chamber
14		•								•	•					•	Pump rotation speed higher than expected	Decrease the pump rotation speed
15		•	•														Pump rotation speed lower than expected	Increase the pump rotation speed
16									•		•	•	•				Joint misaligned	Check current alignment and, if necessary, realign the joint
17									•	•	•	•	•			•	Loosening of the pump and/or motor fasteners	Tighten the fixing screws to the pump and/or motor base
18									•	•	•	•	•	•		•	Bearing wear or breakage	Refer to the manufacturer for maintenance or for the supply of required spare parts
19									•	•	•	•	•			•	Insufficient gear lubrication	Check the oil level inside the gear casing and, if necessary, top up until the optimum level is reached
20		•		•		•											Wear of components	Assemble new components
21									•	•	•	•	•			•	Metal-metal contact between pump components	Check the operating pressure Contact the manufacturer
22		•				•											Suction positioned too high	Position the pump at a lower height or increase the level of the aspirated fluid
23														•			Pumped fluid not compatible with the selected materials	Change the seal materials
24														•			Dry operation of the pump in the presence of single seals	Avoid dry operation of the pump Fit double flush seals
25											•					•	Motorisation malfunction	Check and replace the motor bearings if necessary

12 SPARE PARTS

The spare parts are divided into 2 lists:

spare parts for the machine

spare parts for the seal systems

12.1 Spare parts for machine

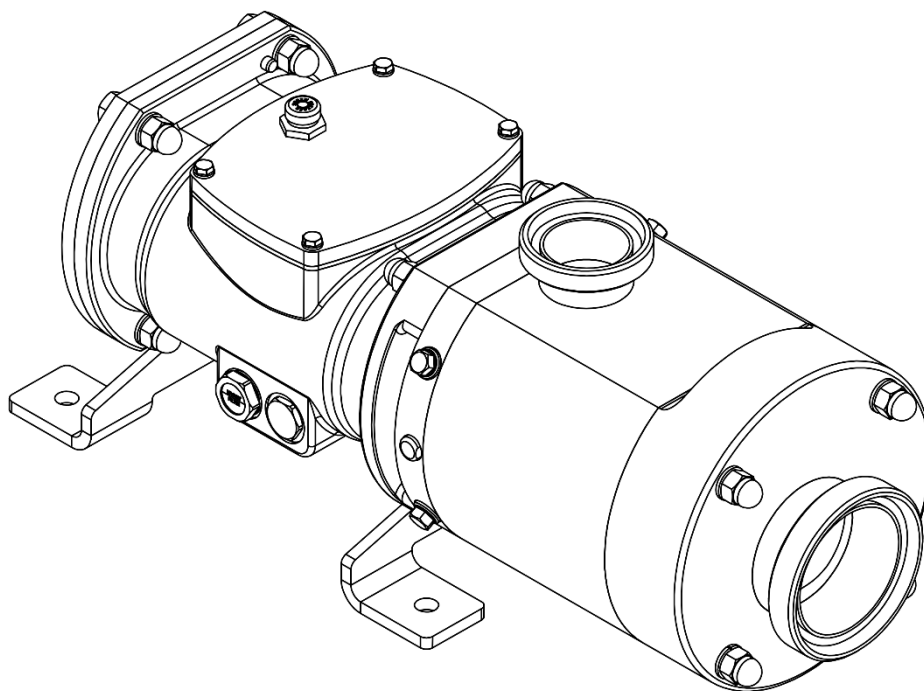
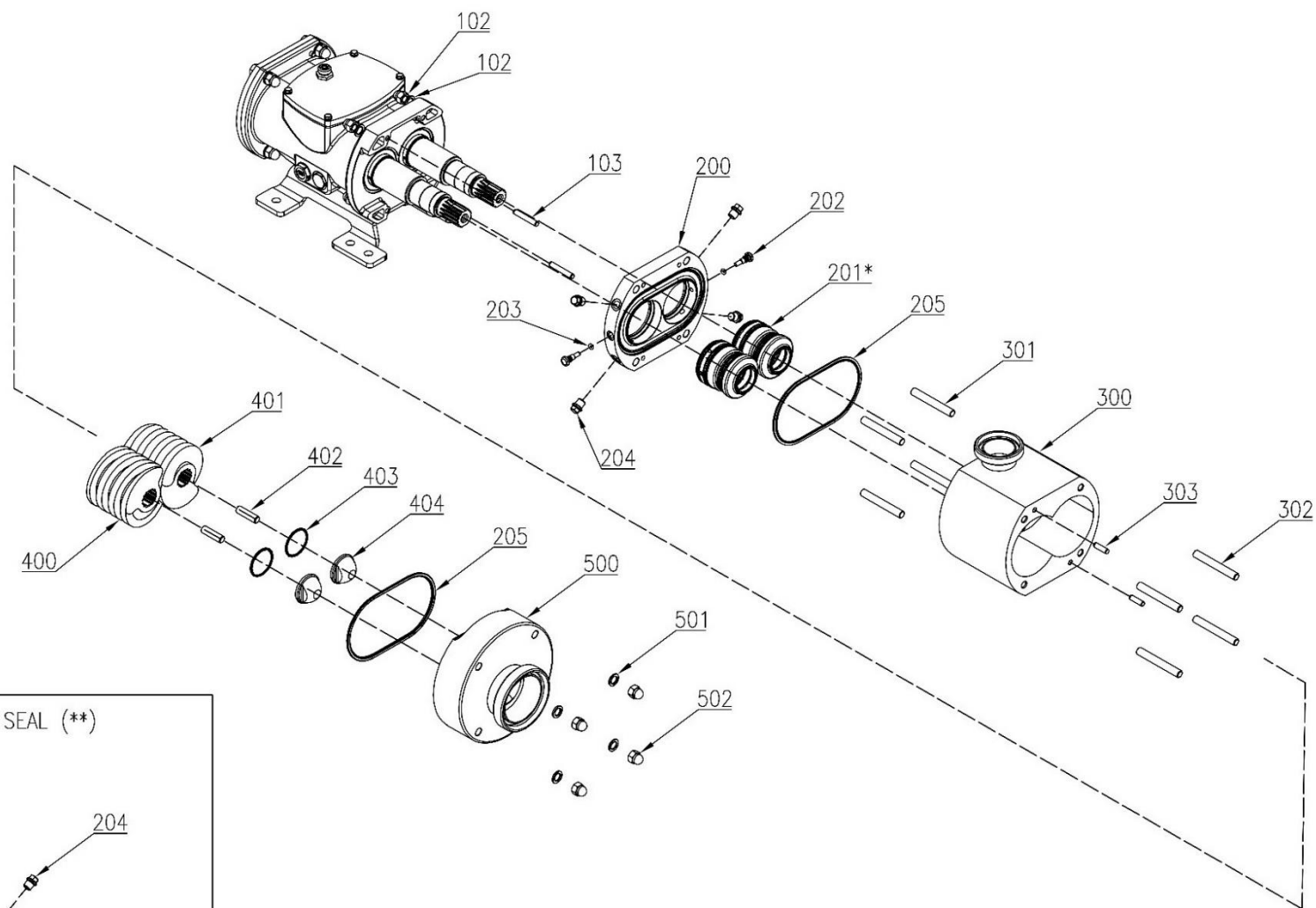
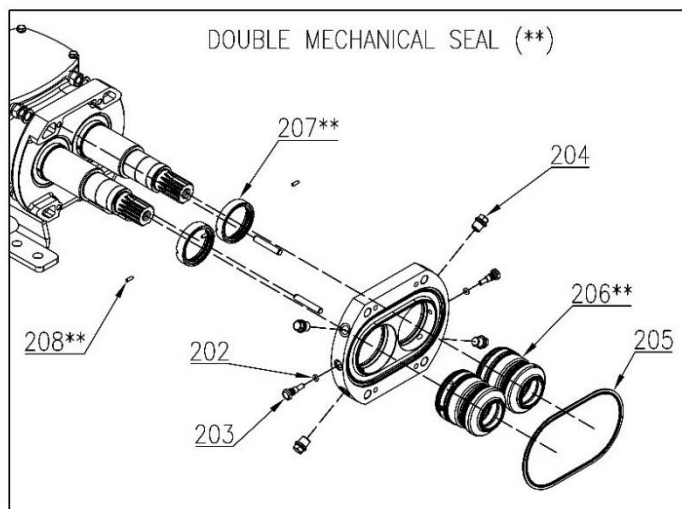


Fig.15 – Machine

SINGLE MECHANICAL SEAL (*)



DOUBLE MECHANICAL SEAL (**)



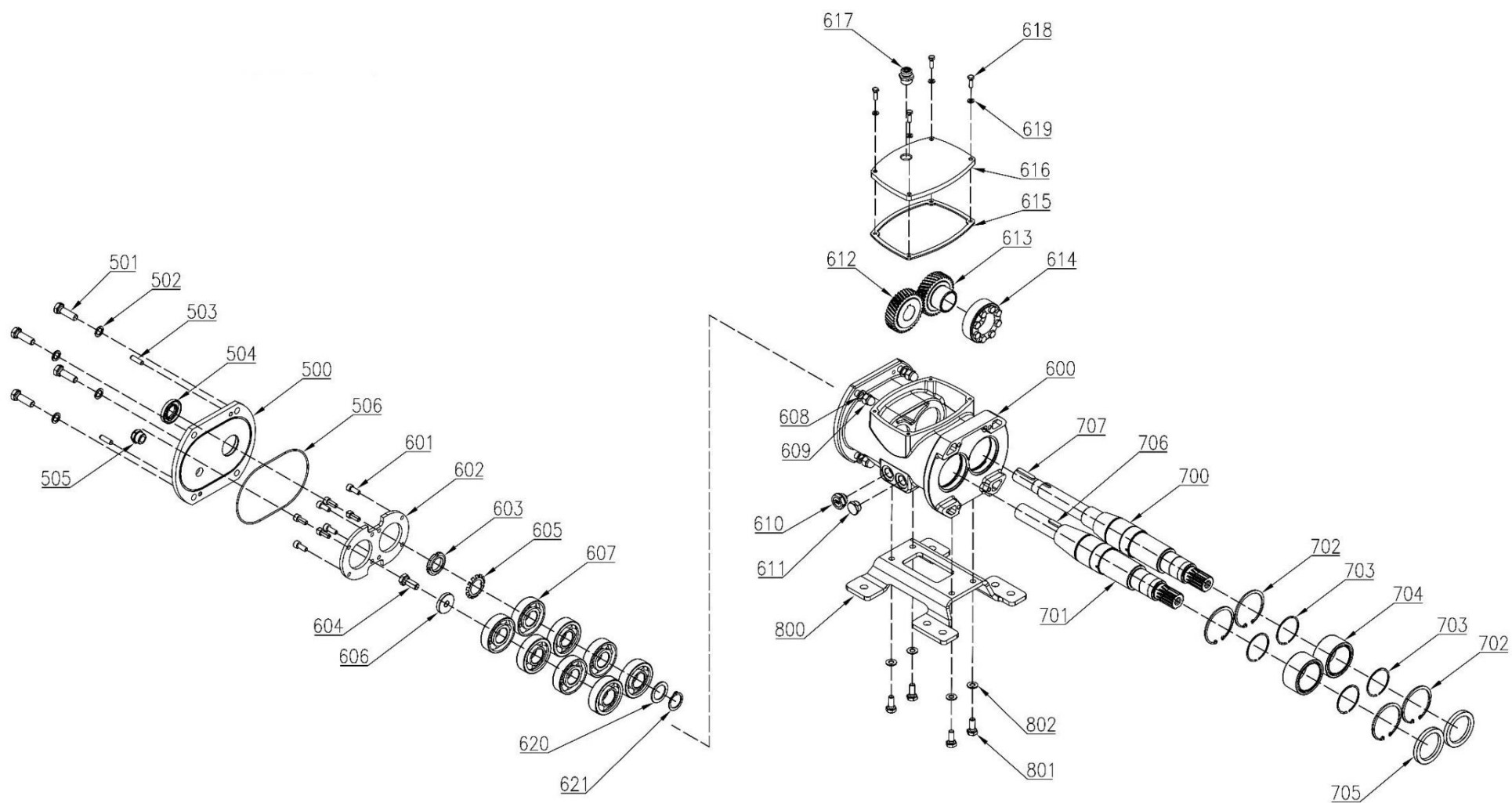
13 SPARE PARTS LIST DCH+ - 1/2

KEY

R = RECOMMENDED REPLACEMENT FOR HIGH WEAR PART

r = RECOMMENDED REPLACEMENT FOR PART NOT SUBJECT TO WEAR OR HIGH WEAR

POS.	Qty	Denomination	NOTES
101	4	HEX CAP NUT	
102	4	SPRING LOCK WASHER	
103	2	CENTERING PIN	
200	1	BACK FLANGE	
201	2	SINGLE MECHANICAL SEAL	
202	2	PIN SEAL BLOCK	
203	2	O-RING	
204	4	THREADED PLUG	
205	2	LIPORING	
206 - 207	2	DOUBLE MECHANICAL SEAL	
208	4	HEX SOCKET SET SCREW	
300	1	PUMP CASING	
301	4	STUD	
302	4	STUD	
303	2	SPRING PIN	
400	1	SCREW - LEFT	
401	1	SCREW - RIGHT	
402	2	STUD	
403	2	LIPORING	
404	2	NUT SCREW	
500	1	FRONT COVER	
501	4	SPRING LOCK WASHER	
502	4	HEX CAP NUT	



14 SPARE PARTS LIST DCH+ - 2/2

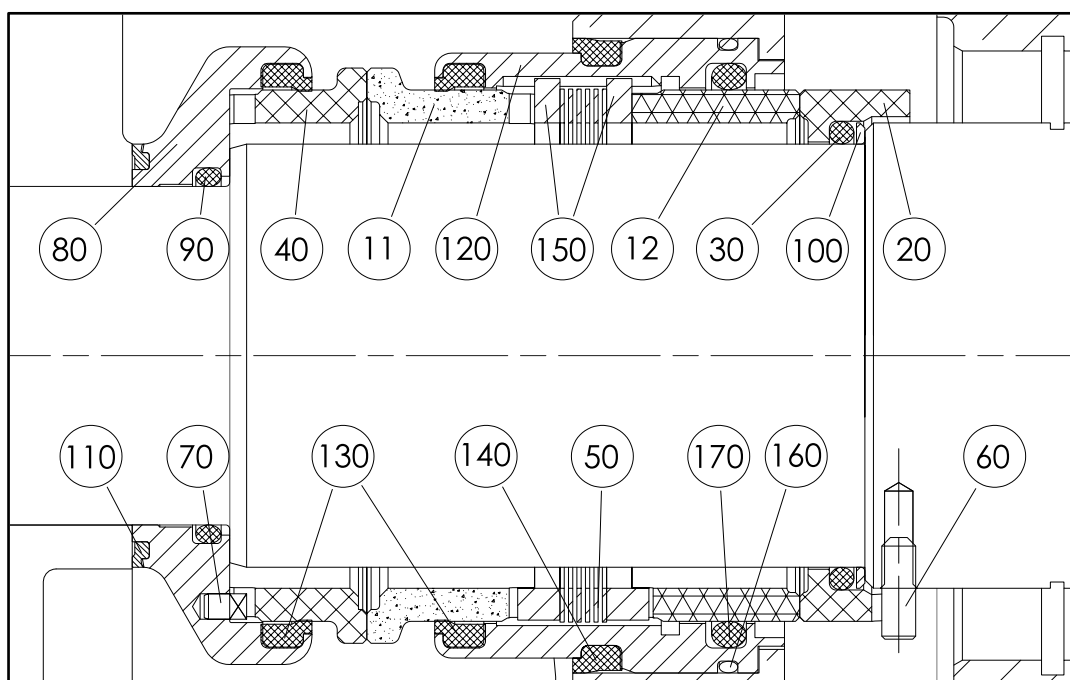
KEY

R = RECOMMENDED REPLACEMENT FOR HIGH WEAR PART

r = RECOMMENDED REPLACEMENT FOR PART NOT SUBJECT TO WEAR OR HIGH WEAR

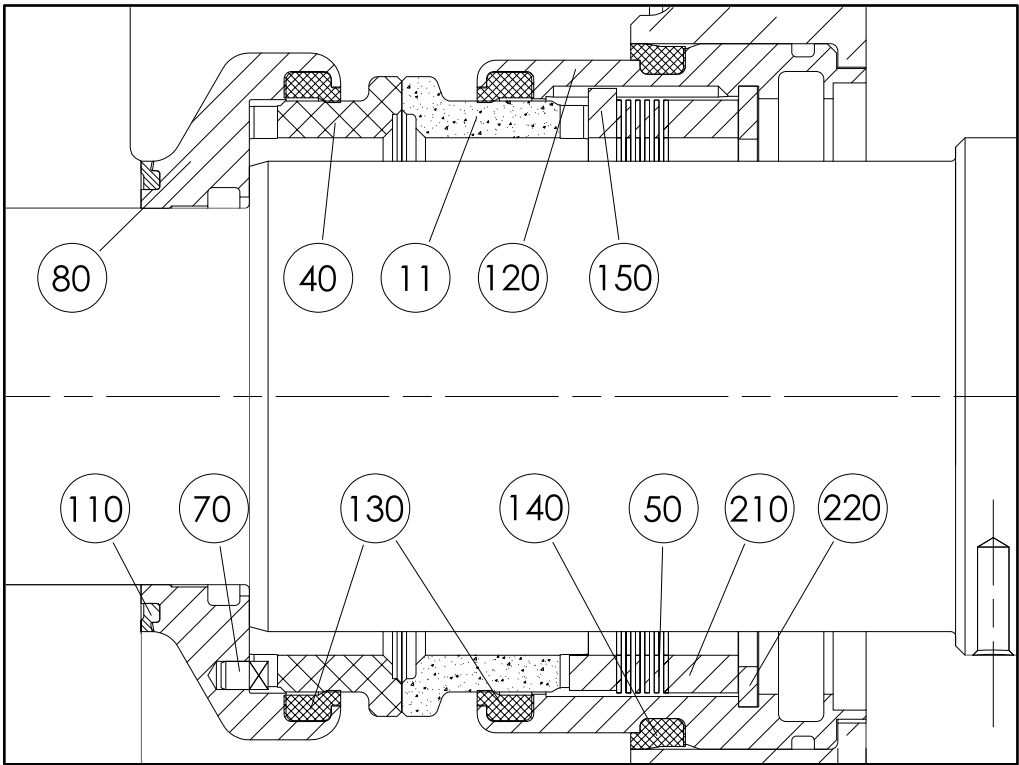
POS.	Qty	Denomination	NOTES
500	1	COVER GEARBOX	
501	4	HEXAGONAL HEAD SCREW	
502	4	SPRING LOCK WASHER	
503	2	CENTERING PIN	
504	1	LIP SEAL	
505	1	OIL SIGHT GLASS	
506	1	O-RING	
600	1	GEAR CASING	
601	1	CAP SCREW	
602	1	PLATE BEARING RETAINER	
603	1	THREADED LOCKING NUT	
604	1	HEXAGONAL HEAD SCREW	
605	1	SAFETY WASHER	
606	1	RING BEARING RETAINER	
607	8	BALL BEARING	
608	4	HEX CAP NUT	
609	4	SPRING LOCK WASHER	
610	4	MAGNETIC THREADED PLUG	
611	4	THREADED PLUG	
612	1	GEAR DRIVEN	
613	1	GEAR DRIVE	
614	1	KEYLESS LOCKING DEVICE	
615	1	GASKET INSPECTION PORT	
616	1	INSPECTION PORT	
617	1	BREATHING PLUG	
618	4	HEXAGONAL HEAD SCREW	1
619	4	PLAIN WASHER	1
700	1	SHAFT DRIVE	
701	2	SHAFT DRIVEN	
702	2	SEEGEER RING	
703	2	RETAINING RING	
704	2	NEEDLE BEARING	
705	2	LIP SEAL	
706	1	KEY	
707	1	KEY	
800	1	FOOT MOUNTING	
801	4	HEXAGONAL HEAD SCREW	
802	4	SPRING LOCK WASHER	

1 QUANTITY EQUAL TO 4 FOR DCH+ 1, DCH+ 2 AND DCH+ 3. QUANTITY EQUAL 6 FOR DCH+ 4

14.1 **Section and spare parts list - Double mechanical seal BCH**

POS.	Qty	Denomination
11	1	SEAL FACE
12	1	OUTBOARD STATOR
20	1	OUTBOARD ROTOR
30	1	O-RING
40	1	SEAL FACE
50	1	WAVE SPRING
60	2	SOCKET SET SCREW, CUT POINT
70	2	DRIVE PIN
80	1	INBOARD ROTOR HOLDER
90	1	O-RING
100	1	WASHER
110	1	LIPORING HFO
120	1	INBOARD FLANGE
130	2	LIPORING HRI
140	1	LIPORING HRO
150	2	DRIVE DISC
160	1	O-RING
170	1	O-RING

14.2 Section and spare parts list - Single mechanical seal BFH



POS.	Qty	Denomination
11	1	SEAL FACE
40	1	SEAL FACE
50	1	WAVE SPRING
70	2	DRIVE PIN
80	1	INBOARD ROTOR HOLDER
110	1	LIPORING HFO
120	1	INBOARD FLANGE
130	2	LIPORING HRI
140	1	LIPORING HRO
150	1	DRIVE DISC
210	1	SPACER
220	1	RETAINING RING

14.3 **Recommended maintenance equipment****QUALIFIED TECHNICIAN - Mechanical Maintenance Technician**

The maintenance operations of the machine are the responsibility of a **Mechanical Maintenance Technician**.

During maintenance of the twin screw pumps, certain tools and buffers must be used, which we will list in this paragraph

14.3.1 **Tightening torques**

The following **Tab.6** shows the tightening torques and the dimensions of the wrenches required to perform the operations indicated.

Description	Necessary tool	Pump model			
		DCH+ 1	DCH+ 2	DCH+ 3	DCH+ 4
Front cover and pump casing studs (101, 502)	Wrench size (mm)	13	19	19	24
	Tightening torque (Nm)	25	90	90	200
Nut screw studs (404)	Wrench size (mm)	32	32	36	50
	Tightening torque (Nm)	100	120	120	250
Plate bearing retainer screws (601)	Hexagon size (mm)	5	6	6	10
	Tightening torque (Nm)	12	22	22	80
Ring bearing retainer screw (604)	Wrench size (mm)	13	19	19	24
	Tightening torque (Nm)	25	90	90	200
Gearbox cover screws (501)	Wrench size (mm)	13	19	19	24
	Tightening torque (Nm)	25	90	90	200
Locking set screws (614)	Wrench size (mm)	10	13	13	17
	Tightening torque (Nm)	12	30	30	59

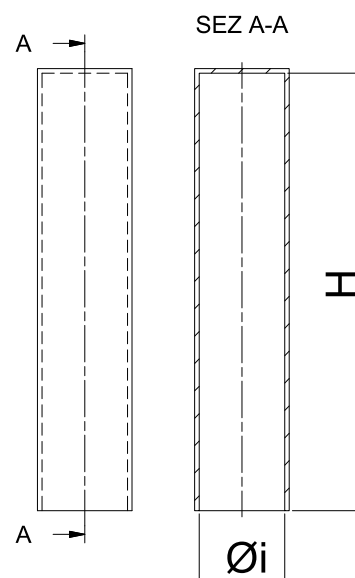
Tab.6 - Tightening torques

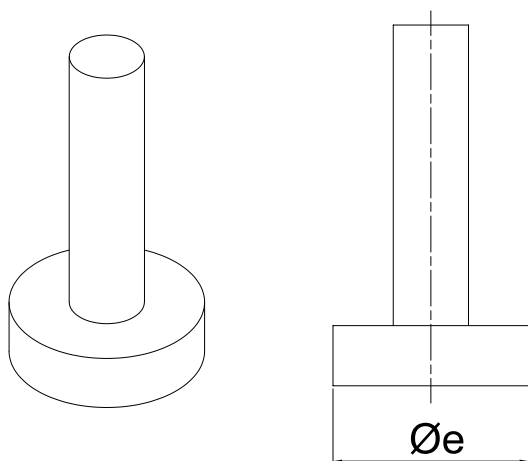
14.3.2 **Size of buffers for assembly and disassembly**

The current paragraph indicates the characteristic and mandatory dimensions of the buffers for correct assembly of the pump. Any dimensions and shapes not indicated remain at the discretion of the customer.

Refer to the specific assembly and disassembly instructions for correct use of the buffers

Buffer for assembly/disassembly of the inner rings of the needle bearings on shafts		
Pump model	Øi [mm]	H min [mm]
DCH+ 1	36	217
DCH+ 2	56	261
DCH+ 3	66	323
DCH+ 4	86	459



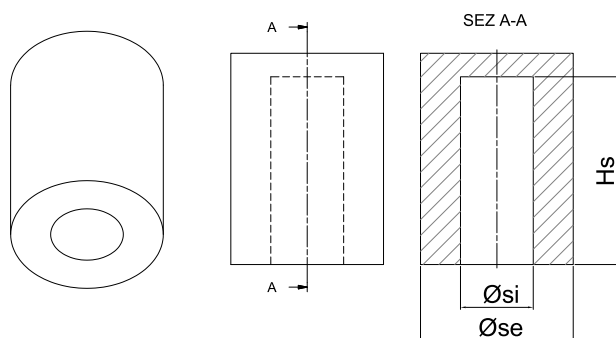
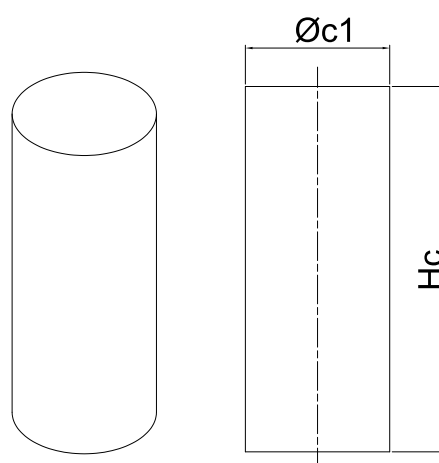


Buffer for assembly/disassembly of the outer rings of the needle bearings on the gear casing

Pump model	Øe [mm]
DCH+ 1	49
DCH+ 2	71
DCH+ 3	89
DCH+ 4	114

Cylindrical buffer for disassembly of the shafts from the gear casing

Pump model	Øc1 [mm]	Hc min [mm]
DCH+ 1	19	61
DCH+ 2	29	77
DCH+ 3	39	93
DCH+ 4	54	116



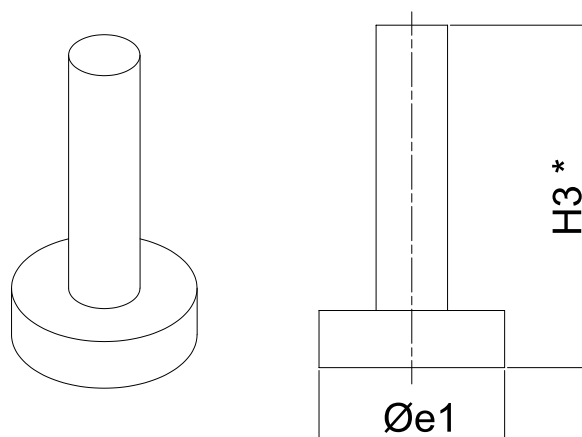
Ball bearing assembly buffer

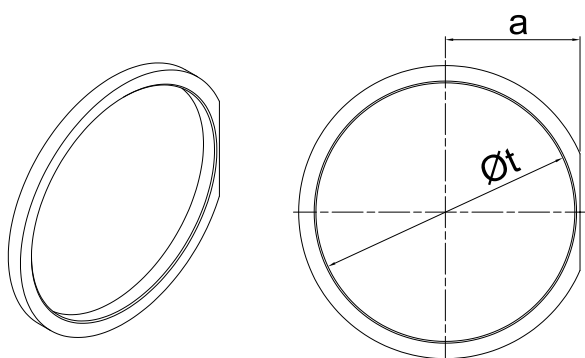
Pump model	Øsi [mm]	Øse [mm]	Hs min [mm]
DCH+ 1	22	50	130
DCH+ 2	32	70	162
DCH+ 3	42	88	200
DCH+ 4	57	118	270

Ball bearing disassembly buffer

Pump model	Øe1 [mm]	H3 * min [mm]
DCH+ 1	44	194
DCH+ 2	64	230
DCH+ 3	73	270
DCH+ 4	110	368

* the height H3 of the buffer takes into account the fact that it must be inserted from the back flange side face and the bearings must be pushed until they are extracted from the opposite side (front cover side). Then the buffer will need to slide along the entire length of the gear casing



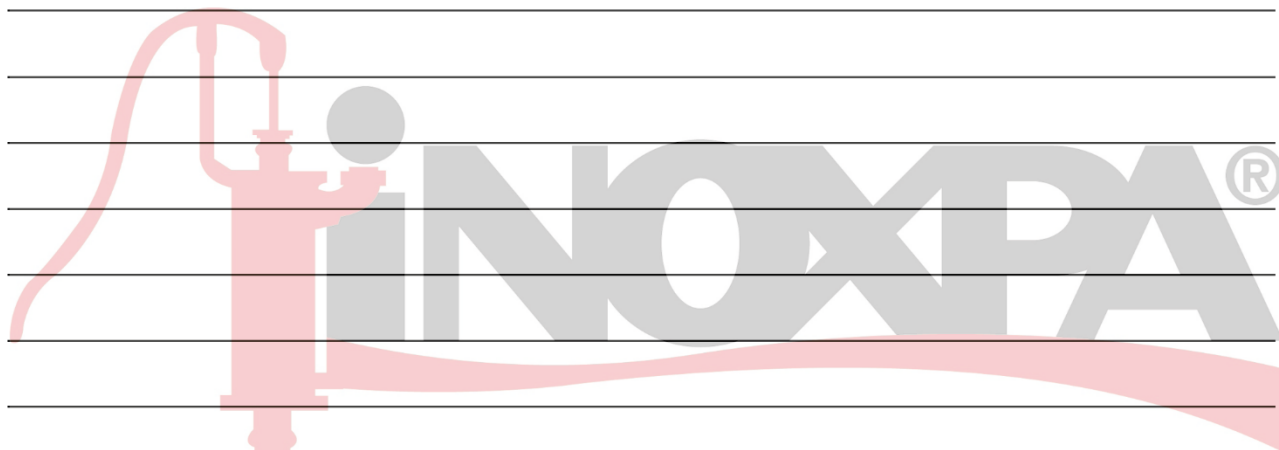


Buffer for assembly of
primary seal stationary elements on back flange

Pump model	Øt [mm]	a [mm]
DCH+ 1	50	28
DCH+ 2	75	39.5
DCH+ 3	90	47.5
DCH+ 4	120	66

It is advisable to use a 0.5x45 chamfer to facilitate
insertion of the buffer at the lip o-ring of the primary seal
stationary elements

NOTES



How to contact INOXPA S.A.U.:

Contact details for all countries are
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