INSTALLATION, OPERATION AND MAINTENANCE MANUAL FOR A HGT1 PUMP

CE

INTRODUCTION

This manual with installation and operation-instructions for your pump unit is written for an approved technician. The information given in this manual will result in a better performance of your pump unit, extend service-life, decrease maintenance-, and repair costs during the entire service-life. Following a careful planned and regularly performed maintenance program will extend your pump units life. A pump operating under rough and dirty conditions will need more attention than a similar pump operating under ideal conditions. The design of your 'Nijhuis'-pump will make it possible to perform quick and simple checks as well as quick and simple replacement of parts so that down-time and repair costs will be minimized during the entire service-life of your pump unit.

When a question arises regarding your 'Nijhuis' product, please contact our service-department. For questions about your pump or spare parts as well as for ordering spare parts, always give pump type and serial number with all your enquiries, thus we can help you better and faster.

GUARANTEE

Our responsibility goes only as far as written in our sales conditions. We are not responsible for damages resulting from ignoring the permitted operating-range of your pump unit, careless treatment of the installation and/or not obeying the instructions written in this manual. If you dismantle the pump during the guarantee-period without our written agreement the guarantee may be invalidated!

NOTE: All claims for guarantee that is the result of modifications, not using the pump in the manner for which it was originally intended or changes without written approval of Nijhuis Pompen BV will be rejected. The legal product liability will also be rejected when changes are made without written approval of Nijhuis Pompen BV.

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1 PRODUCT IDENTIFICATION

1.1 System Description

The HGT is a horizontal split case pump. The pump is split horizontally at centre line.

By raising the upper half of the pump casing, you can get access for inspection or maintenance work. The inlet and outlet flanges are installed on the lower half of the pump.

The pump casing is equipped with interchangeable wear rings.

The impellers are standard balanced in accordance with ISO 1940/1.

The pump shaft is made out of stainless steel. To protect the pump shaft against abrasion, shaft sleeves are installed.

A mechanical seal or stuffing box is installed for shaft sealing and is normally provided with a flushing connection.

The bearing is protected against spray water. Grease or oil is used to lubricate the bearings.

2 SAFETY

2.1 General

Read this manual before working on the pump unit. This chapter gives an overview of the risks involved when working on the pump unit. When working on the pump unit use all relevant safety precautions. Obey all instructions in this manual to ensure the safety of the user. By obeying the instructions there is no danger in working on the pump unit.

Your manual contains special messages to bring attention to potential safety concerns, machine damage as well as helpful operating and servicing information. Please read all the highlighted information carefully to avoid injury and machine damage.

CAUTION: Avoid Injury! This symbol and text highlight potential hazards. Death to the operator or bystanders may occur if the hazards or procedures are ignored.

IMPORTANT: Avoid damage! This text is used to tell the operator of actions or conditions that might result in damage to the machine.

NOTE: General information is given throughout the manual that may help the operator in the operation or service of the machine.

2.2 Qualified personnel

CAUTION: Avoid Injury! Be very careful when you work on the pump unit. It is of great importance that the safety of people is always secured. Before you start any work, read this manual and obey all instructions.

All work at the pump unit should be carried out by qualified personnel only. For the purpose of this documentation, qualified personnel is taken to mean people who fulfill the following requirements:

- Through appropriate training and experience, they are able to recognize and avoid risks and potential dangers in their particular field of activity.
- They have been instructed to carry out work on the pump unit by the appropriate responsible person.

2.3 Risks

When you do work on the pump unit you are exposed to several potential dangers. When you do not observe the instructions, potential dangers are:

- getting jammed by falling parts
- flooded pump sump
- getting jammed by moving parts
- burning by hot surfaces
- touching parts of the electrical system

CAUTION: Avoid Injury! Before you start working on the pump unit:

- ❑ **Close and secure against opening, the discharge valve and suction valve (if present).**
- ❑ **Make sure the electric controlled valves are shut off and cannot be operated while you are working on the pump unit.**
- ❑ **Take precautions to prevent the pump from being switched on, depending on the type of electrical cabinet. Remove the fuses and put a warning sign at the electrical cabinet. Obey the local safety regulations.**
- ❑ **Make sure no one can fill the pump or can start the motor.**

Make sure:

- ❑ There is proper illumination of the working area
- ❑ Wear proper clothing
- ❑ Wear gloves and safety goggles
- ❑ Remove spilled oil immediately
- ❑ It is very important to obey the safety precautions
- ❑ No smoking in the working area
- ❑ Do not start the pump without the mandatory safety guards

2.4 Safety Labels

There are several safety labels on the pump unit. The overview below shows the most frequently used labels together with their explanation.

Danger of voltage

Danger of squeezing by rotating parts

3 GENERAL

One of the most important factors for a successful operation and maintenance of your pump unit is a correct installation of the unit. A correct installed pump unit:

- will stay longer aligned
- will show less leakages of casing as well as flanges
- will show less vibrations
- will demand less servicing

Another effect of the pump unit installation is its service-life. A correct installation will increase the length of the pump's service-life and decrease the risk of failures in emergencies. An incorrect installation may damage a new pump unit severely within a relatively short time!

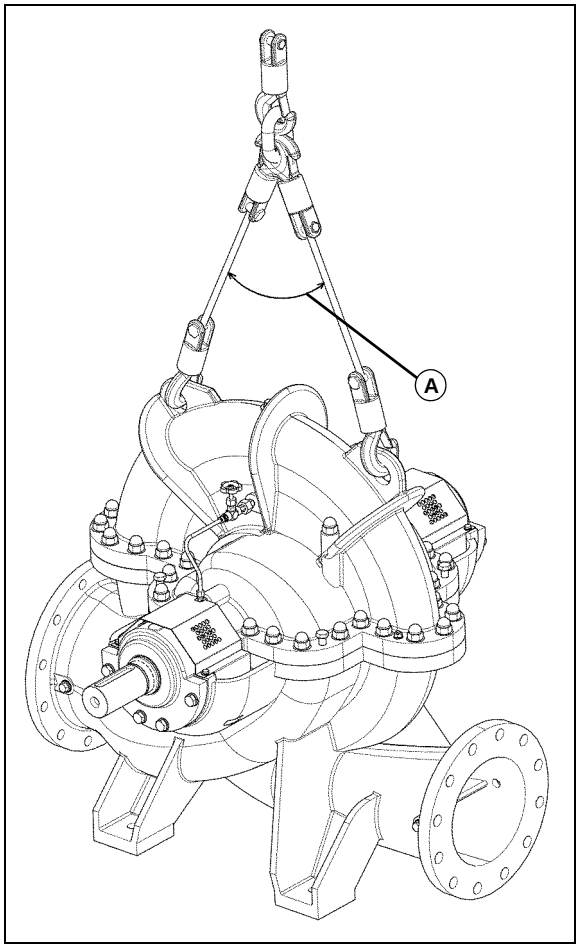
4 TRANSPORT

4.1 General

	**CAUTION: Avoid Injury! You must hoist the pump unit and/or components at suitable hoisting points. Use all suitable hoisting points! Refer to the next general instructions and/or local rules regarding hoisting and transporting when hoisting.** **DO NOT ALLOW ANYONE TO WALK OR WORK UNDER THE HOIST WHILE IT IS IN OPERATION.**

- ❑ The capacity of the hoisting-device and all other auxiliary components must be sufficient to carry the component safely.
- ❑ Refer to all applicable local laws / directions when hoisting.
- ❑ Only approved personnel can hoist and transport the pump unit.

4.1.1 Hoisting instructions pump only



N102

Picture Note: Hoisting pump only. Angle (A) max 90 degrees.

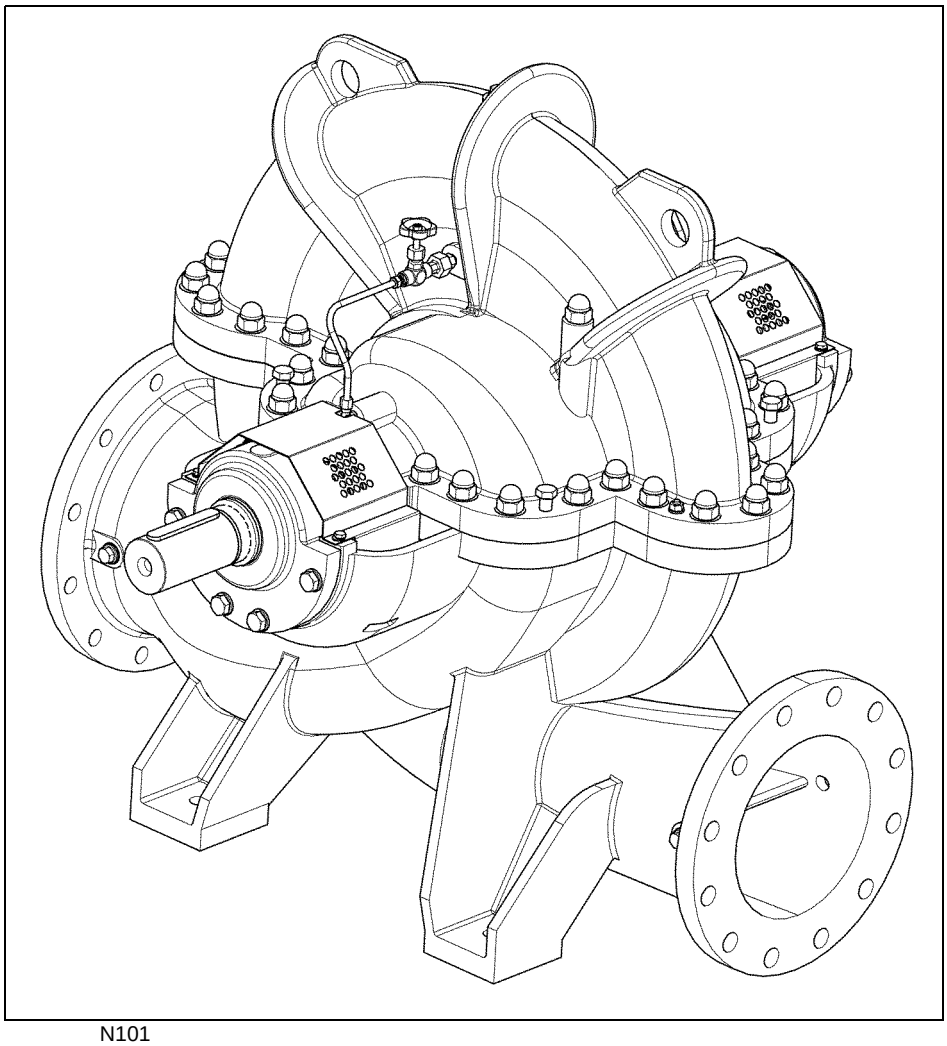
IMPORTANT: Avoid damage! When the driver is not assembled on a foundation frame it must be hoisted by putting a chain through the available eyebolts. It's not permitted to hoist the driver anywhere else, because if may cause damage to the driver.

5 INSPECTION

5.1 Delivery of the pump

Usually, horizontal fire fighting pump units will be delivered almost completely assembled with smaller components such as connecting materials gauges etc. separately packed.

Examine the components for damage. Check the packing-list. Contact the local agent of the company that is responsible for the transport of the unit if there are any damaged or missing parts. Mark the damaged / missing parts on the packing-list.



N101

6 STORAGE

6.1 General

Pump units are usually delivered and packed for immediate installation. The packaging depends on the method of transport, distance and duration. Units that are shipped within Europe are usually delivered without special storage provisions. For units shipped out of Europe special storage provisions are made for the duration of the transport. If the pump is not installed for a long time, special storage provisions must be made. Nijhuis Fire Protection provides this on special request only.

Obey following general procedures:

- ❏ Store all components in the proper position. Engine and all other non-Nijhuis manufactured components must be stored in accordance with the procedures given by the respective manufacturers; these are mentioned in the appendices of the operating and maintenance manuals of the components.
- ❏ Do not store components in a place with a high damage risk (places with intensive traffic (human as well as motorized)).
- ❏ Store the components in a dry, dust- and frost free and well-ventilated room.
- ❏ In order to avoid bearing damage because of vibration during storage, e.g. because of machines operating in close vicinity, components must be stored in rooms free of vibration.
- ❏ Do not remove the packaging until installation, if components are packed in undamaged seaworthy packaging and provisions are made for long-term storage.
- ❏ Remove the packaging from components packed in seaworthy packaging that are not protected for long-term storage. Protect the components for long-term storage on arrival. If possible, packaging must be applied again for protection.
- ❏ If the components are not packed correct, they must be covered entirely. If the components are stored in a room that is not waterproof, the components must be covered with a waterproof protection.
- ❏ Inspect and clean the components regularly (only if not fully packed in dust- and waterproof closed packaging). If packed, check the packaging regularly for damage and general condition.
- ❏ Make sure that provisions are made for long term storage, if components are stored for a long period (more than 3 months) before installation. The most important provision for this purpose is protecting corrodible parts. Protection is made by greasing these parts or better, by applying special preservation oil. If necessary re-grease or re-apply preservation-oil periodically, depending on the provisions taken, storage circumstances and the component.
- ❏ For auxiliary components always consult the procedures given by the manufacturer. Obey these procedures in addition to or instead of the procedures mentioned in this manual.

6.2 Pump

- ❑ Obey all applicable general procedures.
- ❑ Store all pump components in horizontal position.
- ❑ Protection against corrosion is made by greasing parts (shorter periods) or better, by applying a special preservation-oil[1]. If parts are stored for more than 6 months, or storage will take place under severe environmental circumstances, pump-parts must always be treated with preservation oil against corrosion. Greasing will not be sufficient in these cases. Change the preservation oil at intervals for extended storage periods:
    a. When stored indoors the preservation-oil must be re-applied every 18 months.
    b. When stored, covered, outdoors, the preservation-oil must be re-applied every 12 months.
- ❑ When the pump is stored for more than six months, the soft shaft seal packing-rings must be removed.

1. *Shell ENSIS liquid G or equivalent*

7 INSTALLATION

7.1 Pump unit installation

Choose the location for the pump unit carefully. It is very important for maintenance and for the operation of the pump unit. When choosing a location for your pump unit obey the next requirements:

- ❏ Install the pump as close as possible to the water supply.
- ❏ If possible, put the pump's centre-line below the water supply level. Gravitation will let the water flow into the pump.
- ❏ Make sure that both suction and discharge lines are kept as short and straight as possible to keep friction-losses as little as possible. Bends in suction and in discharge lines must have the largest (practicable) possible radius.
- ❏ Install the pump unit in such a way that the unit is easily accessible for maintenance, inspection and repair.
- ❏ Make sure that lighting and ventilation conditions in the pump room are good.
- ❏ Make sure there is space above and around the pump unit for a hoisting device such as a crane or a winch with sufficient capacity to hoist the complete unit.
- ❏ Install the unit, where possible, in a dry, dust free and well ventilated space.
- ❏ Do not install the pump unit at locations with a high damage risk. Thus, not at locations with extensive traffic (human as well as motorized). But when the unit is installed on a location with extensive traffic, make sure that there is sufficient space for human as well as for motorized traffic.

7.2 Foundation frame with anchor bolts

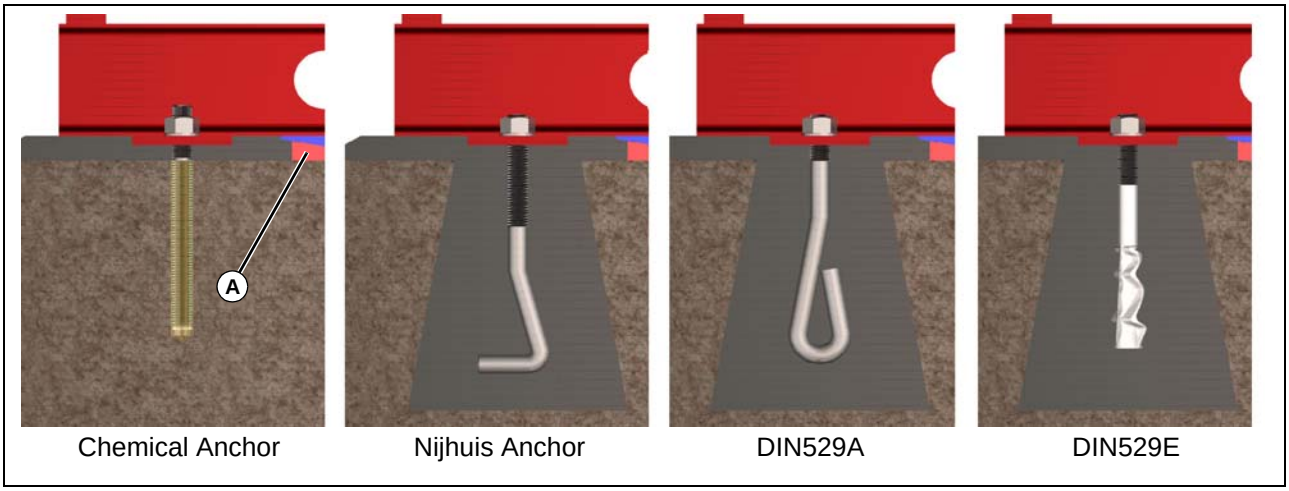
7.2.1 General

For a correct long-term functioning of the pump unit, the pump unit must be installed on a concrete foundation. Make sure the foundation can carry the weight of the entire pump unit sufficiently, as well as absorb vibration, generated by the pump unit. A solid foundation will guarantee a better unit-alignment in the long-term, which will result in a longer service-life and less wear.

7.2.2 Erection

Refer to the next steps to construct a foundation. These steps must be seen as guidelines and no more than that. Obey the procedure from e.g. the concrete-manufacturer, if available (for instance regarding hardening-times, mix-compositions). Nijhuis Pompen is not responsible for the pump unit foundation!

NOTE: Contact Nijhuis' service department for foundations made out of a material other than concrete.



N529

Picture Note: Foundation frame with wedges and different types of foundation bolts.

1. With a minimum of 4 locations, put the frame on wedges (A) or stacks of shims. The space between floor and frame must be about 20 - 40 millimeters.
2. Make sure that the foundation floor is sufficiently strong to carry the weight of the unit.
3. Make sure that the area of the bond is sufficiently rough.
4. To level the unit, adjust the wedges. In case the unit is installed on stacks of shims, add / remove shims. Adjust the unit to level in relation to the worked up planes of driver-supports on the foundation frame (these are the highest flat planes from the frame), and not to the frame itself, as the frame might not be 100% straight at all places.
5. Soak the floor. This is done to saturate the floor with water so it will soak less water from the concrete that is poured. The period during which the floor has to be soaked varies, depending on the age of the floor, between 12 - 24 hours. Use following guideline: a floor with an age of less than one month, must be soaked approximately 12 hours; a floor with an age of more than one month must be soaked approximately 24 hours.
6. Install the foundation bolts. Make sure the bolts are installed sufficiently below the frame. There must be sufficiently space for a thick layer of concrete above the hook of the anchor-bolts. Make sure that the nuts can be tightened sufficiently after the concrete has completely cured. Thus make sure that the nuts (and possible inclined plates) are tightened just that far that the screw thread rises just a few threads above the nut.
7. Pour the concrete.

   Use shrink-free grout only! Normal concrete will shrink, wich will lead to a situation where the frame is not supported by the concrate base.

   Make sure there is a good flow of concrete along the anchor-bolts. Air holes are not permitted.
8. The concrete must cure. Curing time depends on environmental circumstances and the exact composition of the concrete and will vary from days to over a month. Further information concerning the hardening time must be obtained from the concrete manufacturer.
9. After the hardening-process tighten the anchor-bolts, suction / discharge lines and other connections to the unit. You must tighten the bolts crosswise and in even steps.
10. Torque the anchor-bolts. Torque values depend on bolt quality as well as on the quality of the concrete. See “Torques” on page 43. If required Nijhuis can deliver complete sets of foundation bolts including, if necessary, inclined wedges that comply with DIN 529.

8 CUSTOMER CONNECTIONS

8.1 Suction pipes

The design and dimension of the supply pipe to the pump is of great importance to ensure reliable pump operation.

When designing a suction piping system special consideration shall be given to the NPSH ”Ä” available from the installation and NPSH “R” required by the pump. The available NPSH from the installation shall be sufficiently higher then NPSH required by the pump to ensure optimum pump operation. Each elbow, valve or other accessory introduce additional flow resistance adversely effect the available NPSH form the piping system.

The installation of elbows, valves and accessories shall be limited to an absolute minimum.

Select the dimension of the suction pipe minimal one size larger then inlet flange of the pump. There shall be an equivalent length of minimal 5 to 10 times pipe diameter of straight pipe installed upstream from the pump for flow stabilization purposes when;

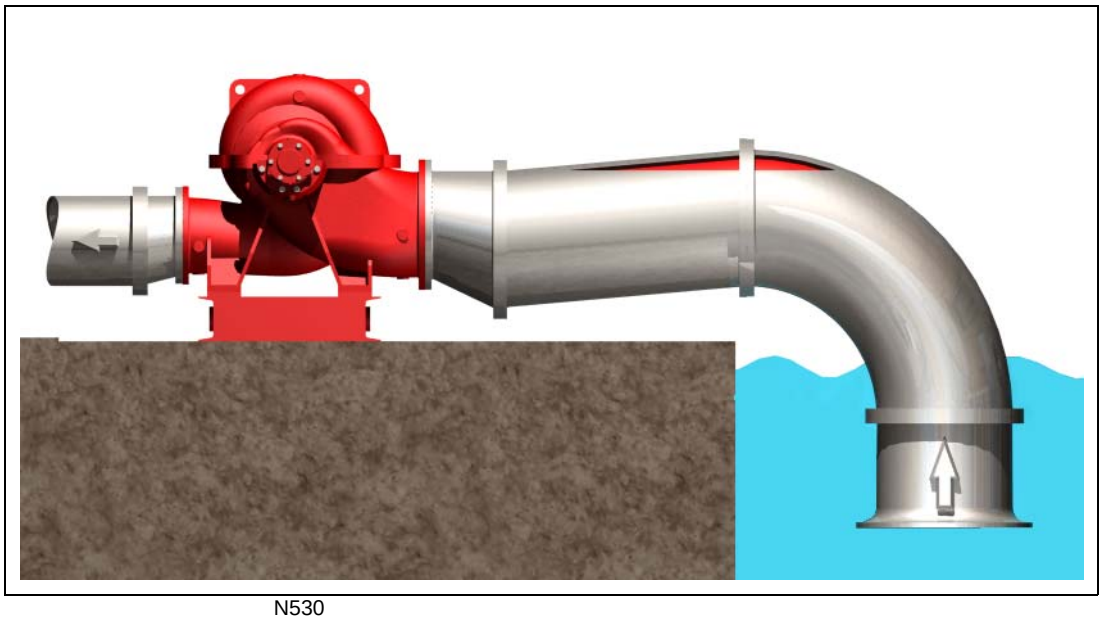
A - suction pipe routing is plane parallel with the pump axis, (see fig. 6).

B - suction valve or other accessory installed.

In case elbows are required these shall be of the so-called “long radius” type.

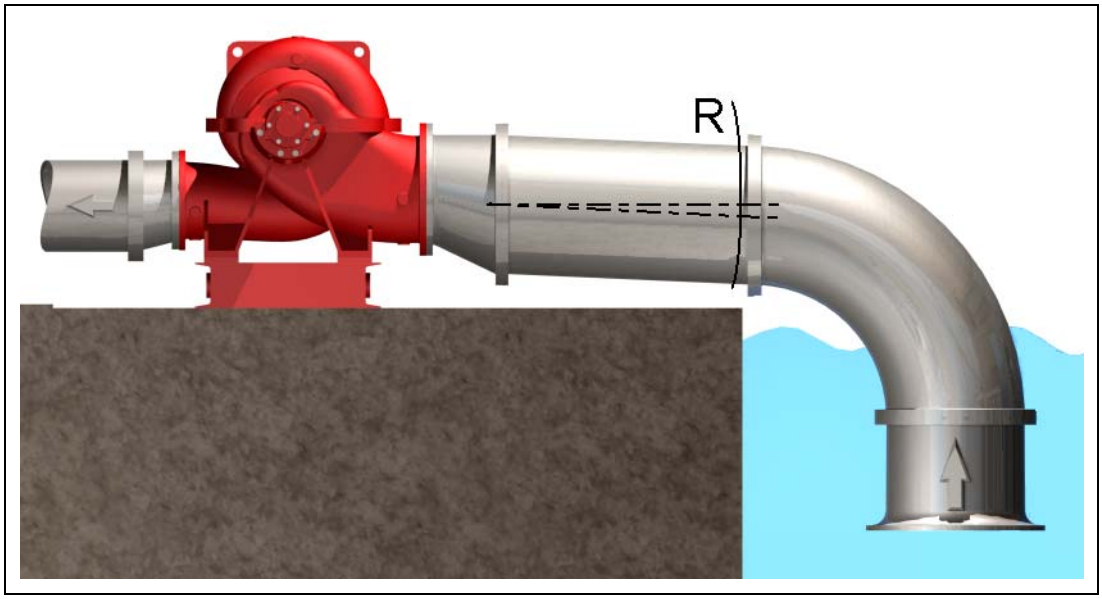
Each pump shall have an individual suction pipe directly connected to the main source in case of an multiple pump installation where by water is supplied by an common header system these header shall be sized to 150% of the rated capacity of al pumps operating simultaneously.

The suction pipe has to be designed such that air pockets are avoided.



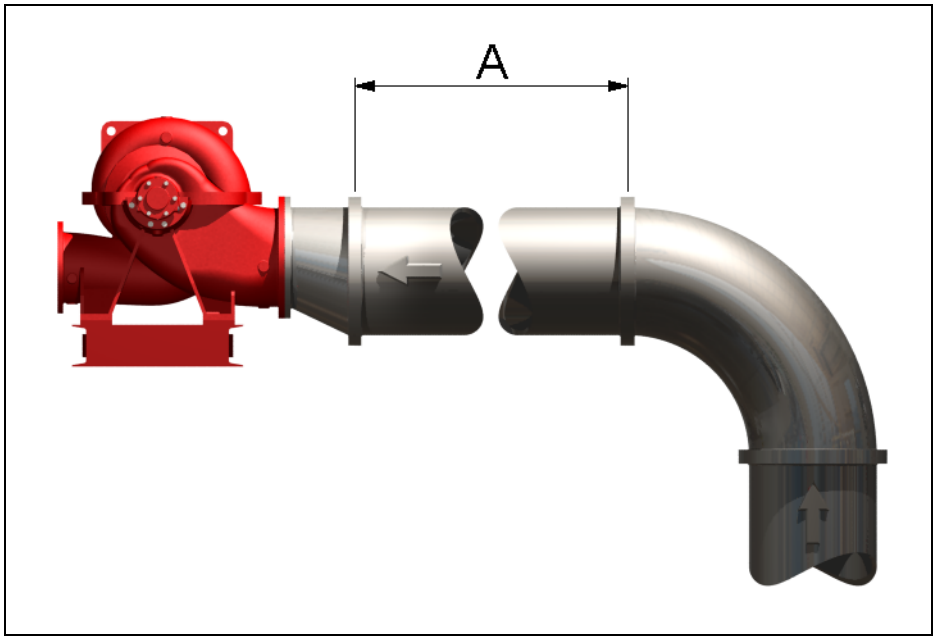
N530

Picture Note: Wrong design (Air pockets).



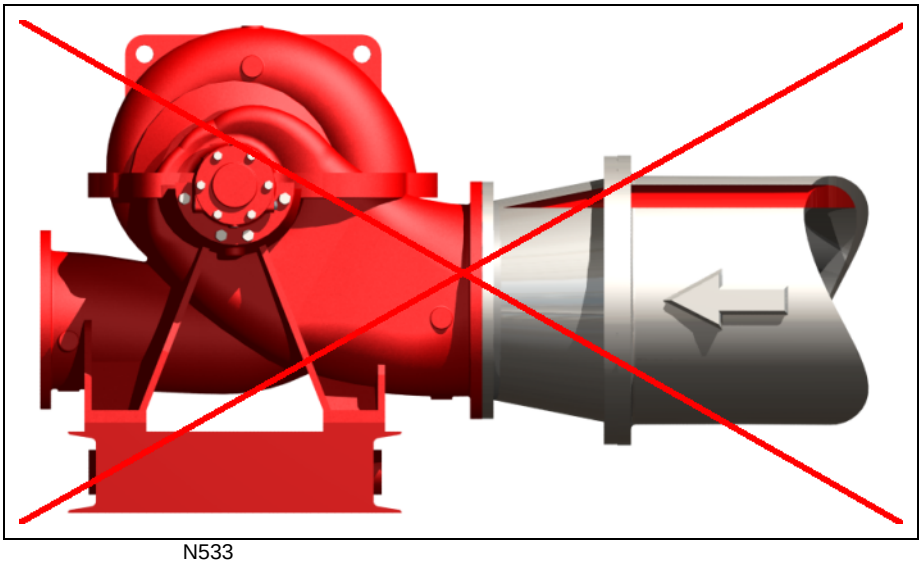
N531

Picture Note: Correct design (No air pockets).



N532

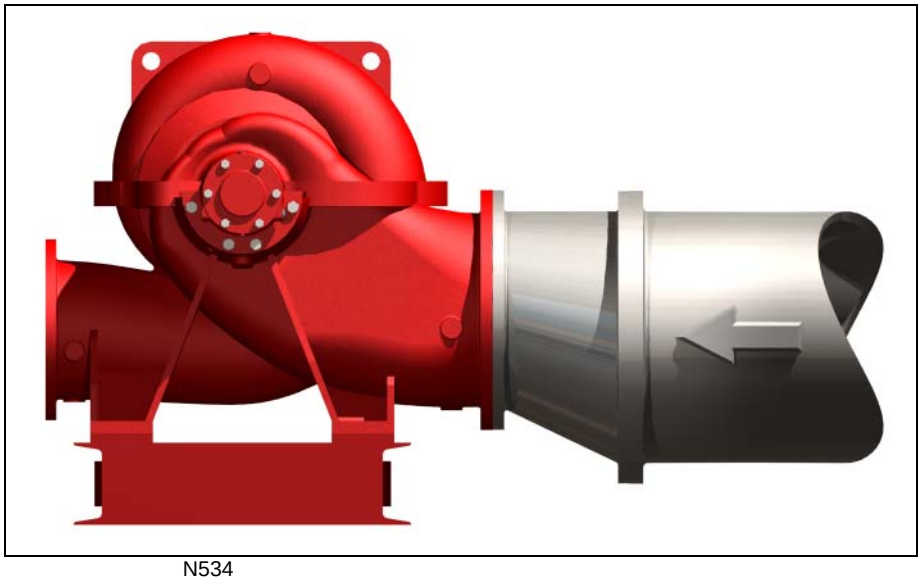
Picture Note: Straight pipe (about 5-10 * Times) immediately up stream of the pump.



N533

An eccentric reducer shall be installed to adapt suction pipe to pump inlet.

This reducer shall be installed with its straight ride facing up to avoid possibilities of air pockets. (see fig. N534).

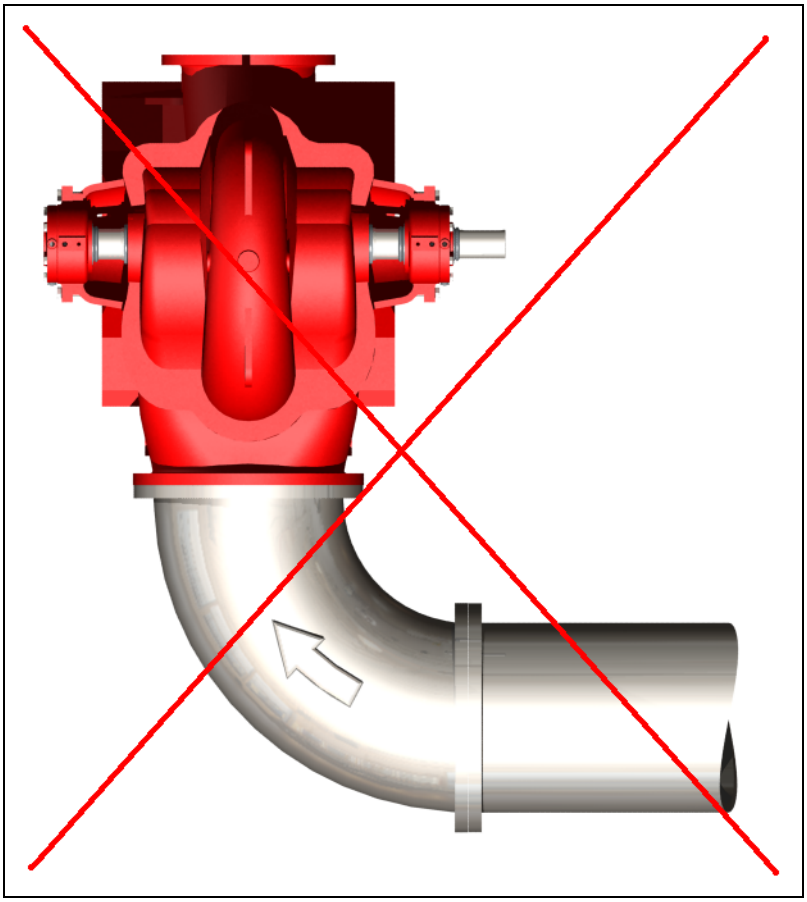


N534

It is absolutely unacceptable to install pumps provided with so-called “double suction” impeller design (HGT pump type), as outlined in fig. N535.

Each side will receive an unequal portion of the flow consequently disturbing the hydrodynamic balance between both sides and result in an exceptional high axial shaft load.

Operating the pump in this off balanced mode cause shaft bearings to deteriorate rapidly an immediate cause to further damage of the pump internals.



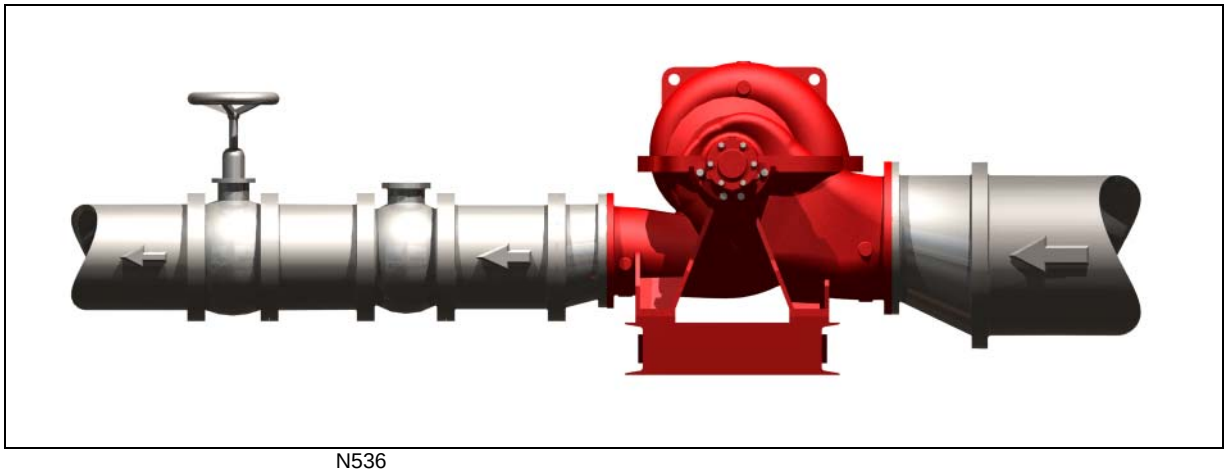
N535

8.2 Discharge pipes

The discharge pipe and accessories shall be adequately sized and of the appropriate pressure rating to cope with all possible operational conditions.

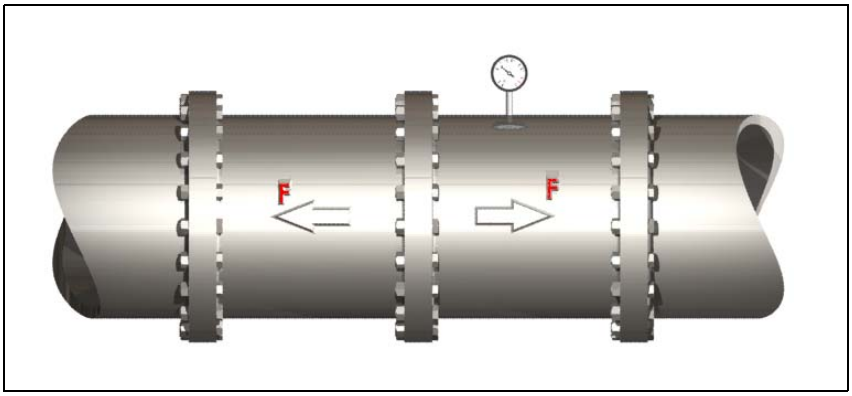
A nonreturn valve and a discharge valve shall be installed in installations when water is delivered to a common header system.

The non-return valve shall be installed up stream from the discharge valve. See fig. N536, to allow the discharge valve to be in open position while the pump is not in operation.



N536

Pressure containing parts have the tendency to separate when they are pressurized, see fig. N537, by the strain transmitted to the piping system. With the pump in operation additional strain is developed and transmitted to the piping system as a result of the pressure differential between suction and discharge of the pump. For this reason suction as well as discharge piping system shall be properly supported to avoid shifting of the pump and consequently disturbing pump unit alignment.



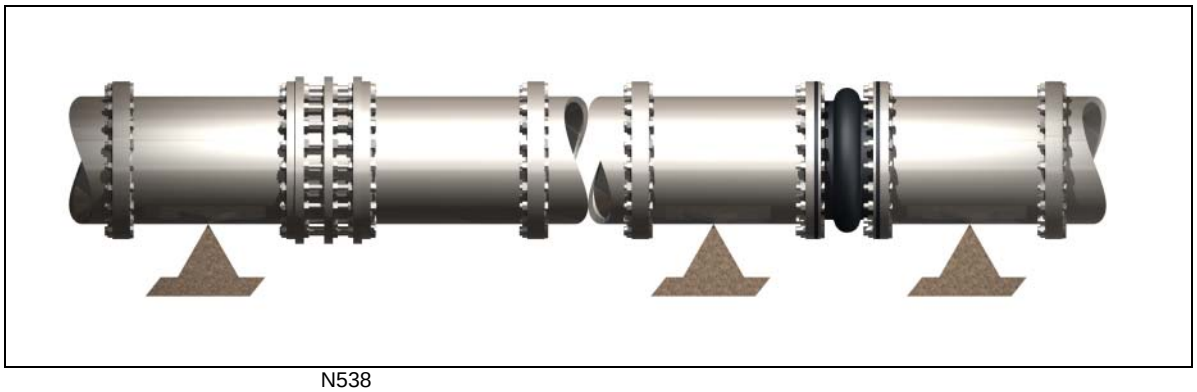
N537

In some installations compensators are installed to control among other things noise transmission, temperature fluctuations or pipe deflection. Compensators primarily comprise of a flexible element interrupting the continuity of the piping system.

There are two types of compensators available on the market shown in fig. N538. It illustrates an example by which tensile rods are used to limit pipe movements and a non-restricted compensator requiring rigid supporting to the surrounding structure.

Each type should receive special consideration to ensure pump nozzle loads within permissible limits and to maintain pump set alignment.

We recommend consulting the supplier to the compensators or Nijhuis Pompen for advice.



N538

8.3 Protection against overheating

The difference between gross power added to pump shaft and the absorbed power by the liquid is converted into heat causing the temperature of the medium to increase.

Normally this heat is discharged by the medium pumped.

Continuous operation at low pump capacities cause heat discharge to become critical and allow temperatures to increase. Without taking precautionary measures the pump may be subjected to serious damage or total destruction a result from overheating.

To safe guard the pump from thermal overheating it is recommended to ensure a minimal flow of 10% rated capacity (capacity in maximal efficiency point) back to the main reservoir. Each pump shall have its individual minimal flow arrangement.

9 ALIGNING PUMP UNIT

9.1 General

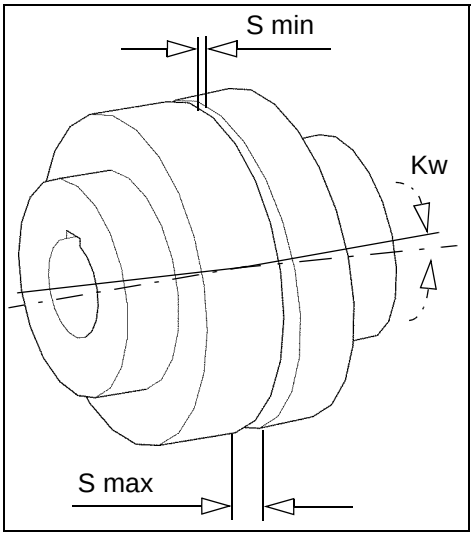
Align the pump unit after it is mounted on the foundation and pipelines are connected. Although pump units are aligned when assembled, it is necessary to check and if necessary, adjust the unit's alignment after installing. It is possible that the unit is misaligned because of transport and during the connection of suction- and discharge pipelines

9.2 Deviations

The position of both coupling halves gives you the alignment of the pump unit. Thus do the alignment by checking (adjusting) the coupling half positions in relation to each other. There are three possible types of deviations when aligning the coupling half positions:

1. **Angular misalignment of the shafts (coupling halves)**
2. **Radial misalignment of the shafts (coupling halves)**
3. **Clearance in axial direction between the coupling halves**

Ad 1) Angular misalignment of the shafts:



N126

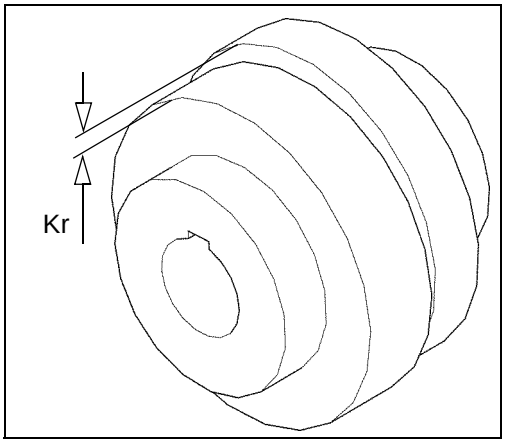
Picture Note: Angular misalignment

NOTE: Always check the angular deviation in both the horizontal and the vertical plane!

Checking both angles between the shafts (coupling halves) is done with the help of feeler gauges. Position these at four places equally divided (every 90°) around the circumference of the circle. The angle between the two shafts is measured by comparing the distances (in axial direction) between the coupling halves.

Keep the deviations within appr. 0.05 mm

Ad 2) Radial misalignment of the shafts:



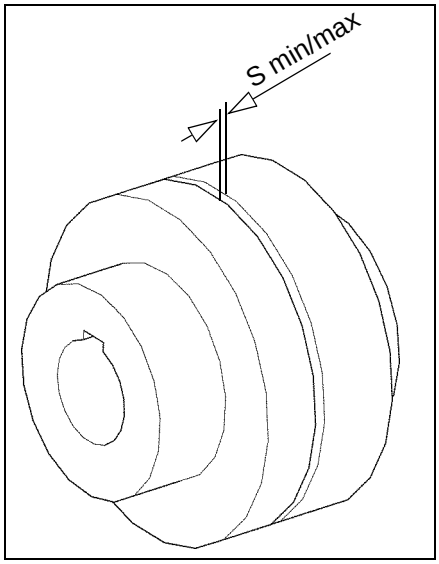
N127

Picture Note: Radial misalignment

Use a straight edge to check the deviation in the position of the centerline of both shafts (coupling halves) in relation to each other. Do a deviation check in radial misalignment in both the horizontal and the vertical plane.

Keep the deviations within appr. 0.05 mm

Ad 3) Clearance in axial direction between the coupling halves:



N128

Picture Note: Clearance in axial direction

The axial clearance must obey certain requirements.

Too small axial clearance is not permitted. This for allowing axial movements of the shafts in relation to each other. These movements are caused by expansion of the shafts due to temperature changes, or as a result of bearing wear. Too much axial distance is also not allowed. The forces will be transmitted by a too little portion of the coupling pins and rubbers. This will cause premature wear and decrease the service-life of the coupling.

10 FIRST TIME OPERATION

10.1 Before operating the pump for the first time

- ❑ Do a check of the mechanical and electrical installation.
- ❑ Make sure all bolts and nuts are correctly tightened.
- ❑ Do a check if the pump shaft can rotate freely.
- ❑ Do a check if the water level is sufficient for operating.
- ❑ Do a check if the direction of rotation is correct. The arrow on the pump discharge head indicates the correct direction of rotation. You can check the direction of rotation by quickly switching on and off the pump set (only a few revolutions of the driver).

10.2 First starting (on site)

1. Fill the pump.
2. De-aerate the pump.
3. Start the pump manually.
4. Monitor that the pump starts easily and runs without unusual vibration. If there is any starting difficulty or excessive vibration, stop the motor immediately and find the cause of interference.
5. Monitor leakage from seal.
6. During the first period of operation, monitor and write all gauge readings and compare them to the related values in the applicable manuals. If there are important deviations, find the cause of interference and correct.

10.3 After first operation

- ❑ After the first running-in period, check and, if necessary, adjust the position of the pump shaft again. See “Aligning Pump Unit” on page 20.

11 MAINTENANCE

11.1 Waste and recycling

During maintenance of the pump various parts will get into the waste disposal circuit. These products mainly consist of:

1. Used lubricants (oil or grease).
2. Worn out metal pump parts (bearings, wear rings, shaft sleeves etc.)
3. Various synthetic parts (O-rings, packing rings)

NOTE: All waste and rejected products have to be disposed, worked up or recycled according to the applicable national regulations.

11.2 Preventive maintenance procedure

This chapter gives the minimum requirements for inspection and maintenance as a part of a total preventive maintenance procedure. This procedure makes sure that the complete pump unit operates correctly and reduces maintenance costs to a minimum. This procedure is started after the pump unit passed the acceptance test.

Make a report from each inspection, maintenance and testing procedure. File these reports for future review. Store the latest inspection / maintenance report at the backside of controller panel door.

Obey the applicable safety procedures mentioned in chapter “Safety” on page 5.

11.2.1 General

- A carefully planned and regularly performed maintenance procedure is of essential importance for a correct long-term operation and a long service life of your pump unit.
- This procedure is only a guideline for the maintenance of a pump unit in average operating circumstances. Depending on the circumstances and the frequency your pump is operating, consider another procedure. Recording the results of previous inspections is an important guide for making the ideal maintenance procedure for your pump unit.
- Before, after and during all maintenance and inspection procedures it is very important that the pump unit’s environment conditions are kept as clean as possible.

11.2.2 Before taking into operation

Pump

- Walk around inspections: Do a visual check for leakages, loose bolts, corrosion and debris or foreign objects.

11.2.3 Weekly: during operation

Pump

- Noises / vibrations: Listen for unusual noises and check for vibrations
- Stuffing box: Check leakage from stuffing box. Leakage must be somewhere in between 40 to 60 drops / minute. Leakage is only permitted between shaft-sleeve and soft packing-rings; no leakage is permitted between stuffing box and soft packing rings. Adjust stuffing box leakage if necessary. See “Gland packing” on page 26 for adjusting the stuffing box.
- Stuffing box drains: Check free flow of stuffing box waste pipes.
- Bearings: Check bearing temperature. Bearing temperature must not be more than 45°C above ambient and must not be more than 95°C.

11.2.4 Yearly: during operation

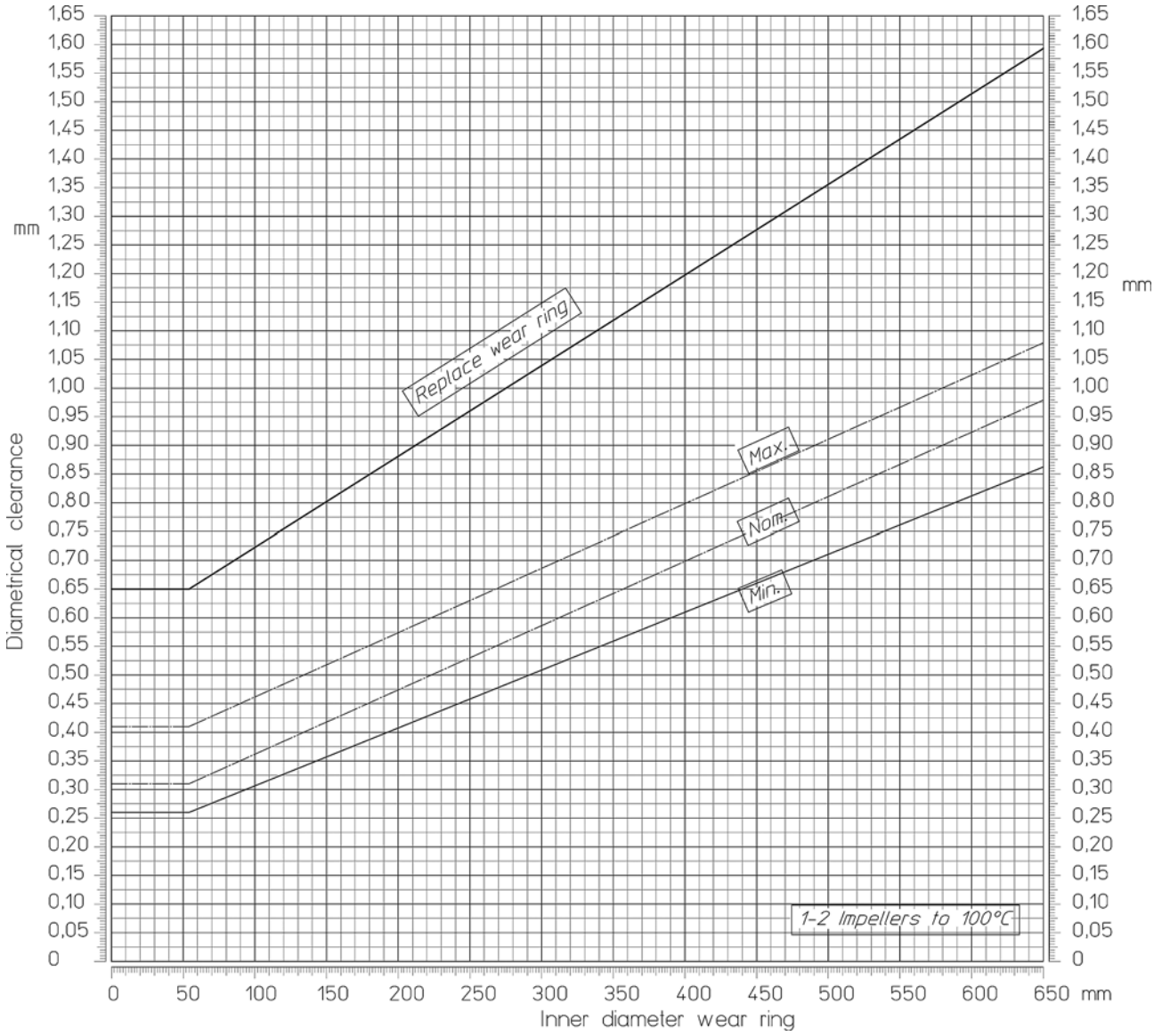
Pump

- Same as “Weekly: during operation” on page 23.

11.2.5 Every three years or 20.000 running hours

Pump

- General: The three yearly or 20.000 hours inspection includes all regular inspections.
- Bearings: Replace all bearings.
- Stuffing box: Replace all soft packing rings.
- Shaft sleeves: Check shaft sleeves for damage and wear. If necessary, replace them. Permitted wear and/or damage must be considered for each case separately. It is not necessary to replace shaft sleeves when small damage or wear is visible. Damage or wear that does (or can) cause pump performance is not permitted. If small damage or wear is visible and shaft sleeves are not replaced, do a more frequent inspection of the damaged or worn part.
- Oil seal: Check the ‘V’-ring beside the bearing housing on the coupling side and replace if necessary.
- Seal rings: Check the seal rings beside the bearing housings on the impeller side and replace if necessary.
- Miscellaneous: Fully clean the pump (inside / outside). Make sure to remove the old flange sealant between the two casing halves before you apply new sealant. Use Loctite® 128068 (See “Sealing” on page 40). Torque all casing bolts crosswise (See “Tightening nuts” on page 43).
- Wear rings: Check casing and impeller for wear. Maximum clearance permitted between impeller and casing diameter, depends on the impeller size and can be found in figure N129. Replace if necessary.



N129

Picture Note: Clearances Impeller-Casing Wear Ring. Single stage and two stages centrifugal pumps (Tmax=80°C)

11.3 Gland packing

11.3.1 General

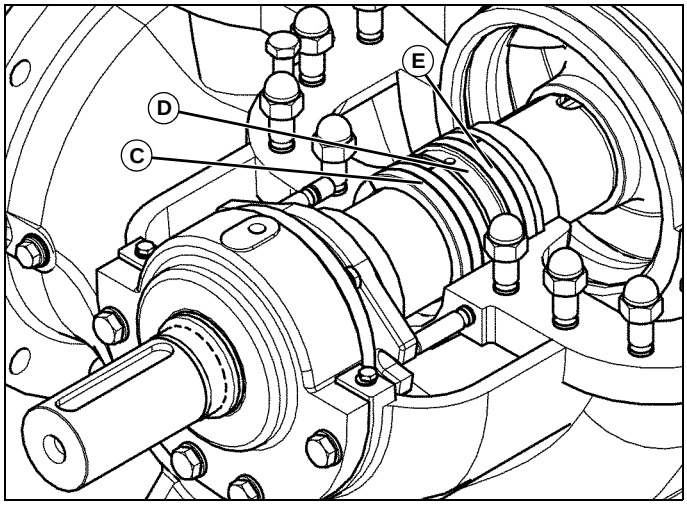
If there is a large leakage flow, or a leakage in the wrong location[2] and the gland has already been adjusted several times (or in case adjusting does not result in an improvement), the packing-rings most likely are worn or damaged so that replacement of the rings is necessary.

11.3.2 Removing old packing rings

NOTE: Make sure the stuffing box is not under pressure. For this purpose check:

- ❏ ***Readings of discharge pressure gauge***
- ❏ ***Water supply to lantern-rings[3]***

1. If possible, drain the water in the pump, until the water level has at least dropped below the lowest stuffing box level. Drain the water by removing one of the plugs from the discharge flange.
2. Remove the gland.
    1. Remove the gland nuts. See “Pump upper half” on page 33.
    2. Pull back the gland as far as possible, See “Pump upper half” on page 33.



N130

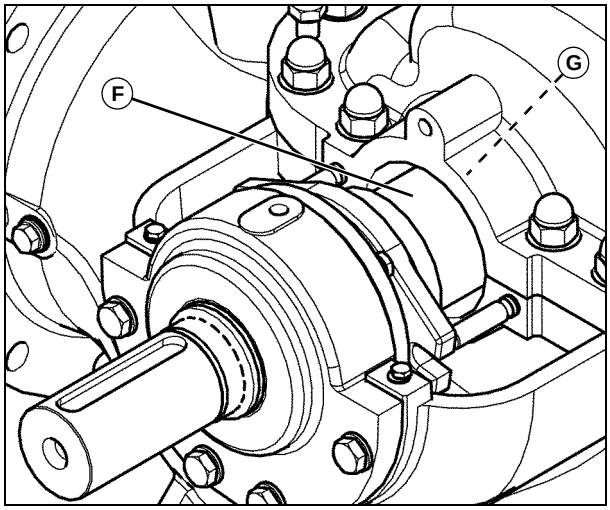
Picture Note: Upper pump halve is not shown for picture clarity.

3. Remove the first packing-rings (C). Always replace ALL packing-rings! Replacing only one or two rings will not give the correct result. Removing the packing-rings must be done with the help of a packing-extractor. Obey the precautions to prevent the risk of damaging to the stuffing box and/or shaft(sleeve). You must point the packing-extractor's sharp side towards the stuffing box and not towards the shaft(sleeve). Doing so does not cause damage to the shaft(sleeve).
4. Remove the lantern-ring (D). For this purpose, the lantern-ring is made with, usually, two savings through which hooks can be inserted. Pull the lantern-ring out with one hook in both the savings simultaneously so that the ring can be pulled straight out of the stuffing box. Obey the same precautions to prevent the risk of damaging.

---

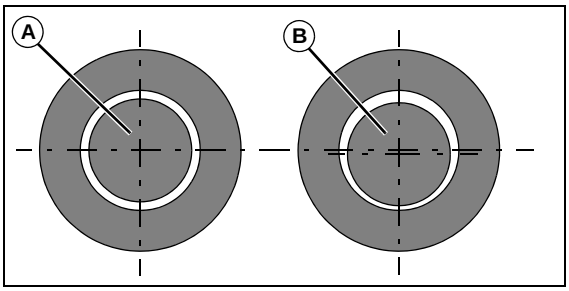
2. *Leakage must only occur between shaft (sleeve) and packing-rings. NO leakage should occur on other locations, such as between packing-rings and stuffing box.*
3. *Checking if the water supply to the lantern-rings is closed, is only to be done in case the lantern rings are supplied with water that is not coming from the pump’s discharge.*

5. Remove the last packing-rings (E).



N132

6. Clean the shaft sleeve (F) and stuffing box (G). Fully check for damage or wear. Correct the failures on the shaft sleeve and/or stuffing box if they show large[4] wear or damage.



A - Concentric and aligned
B - Unconcentric and unaligned

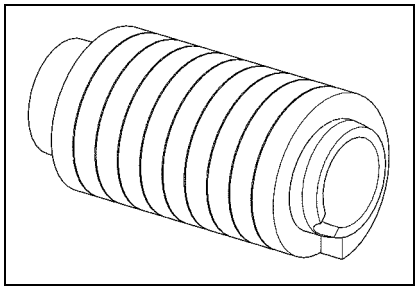
7. If there is to much packing-wear, check if the shaft(sleeve) and stuffing box are positioned concentric and aligned, apart from wear and damage to shaft(sleeve) and stuffing box. Also check the shaft run-out (< 0,025mm)

11.3.3 Installing new packing rings

NOTE: Only apply original packing-rings of the proper material and manufacturer.

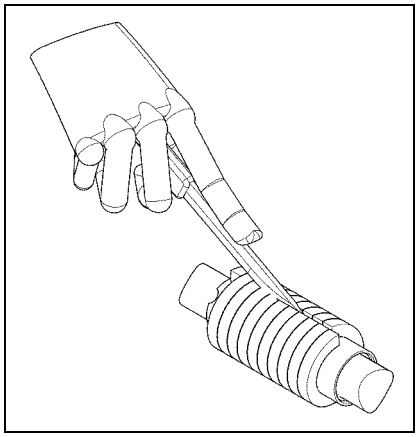
Packing usually is delivered in pre-formed rings of the proper sizes or in one spiral-formed length. In case packing is not delivered in one of the forms mentioned above, but in one length, (non-spiral formed) it is necessary to cut off the proper length that is needed for one ring. In these cases proceed as follows :

4. *Regarding permitted damages and/or wear to shaft (sleeve) and/or stuffing box it is not easy to apply a defined maximum. Pumps that are applied for Fire Fighting Duty usually will operate only little. Thus little damage/wear, that affect pump-efficiency and performance of the pump, are permitted for economic reasons. Do not permit wear and/or damage that might affect pump-reliability in whatever way. Do not permit wear and/or damage that can cause the pump-capacity to drop below the required capacity.*



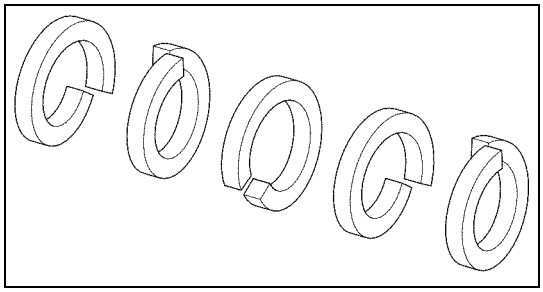
N134

1. Wind the packing-length tightly around a shaft with the same diameter as the shaft sleeve.



N133

2. Now cut rings out of the spiral in an angle of 90°.
3. Before mounting the new packing-rings;
   - ❑ Check if all packing-rings are the proper dimensions, before mounting them into the stuffing box.
   - ❑ check if the stuffing box and shaft sleeve are clean.
   - ❑ check if the old packing-rings are completely removed.
   - ❑ check that the pump-shaft can rotate freely.

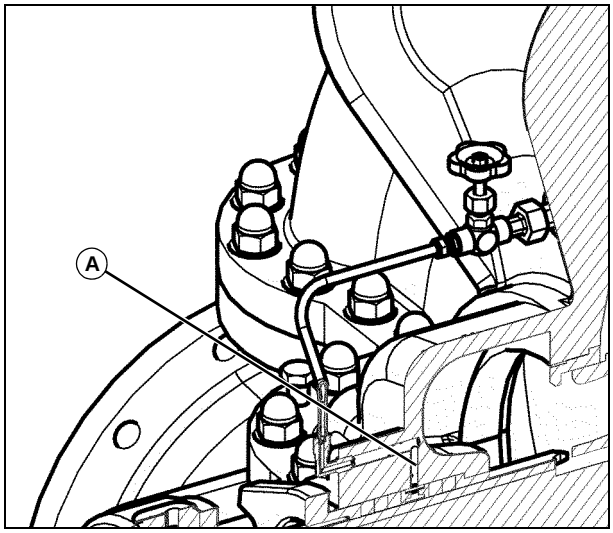


N135

Picture Note: Each packing ring is rotated 120°

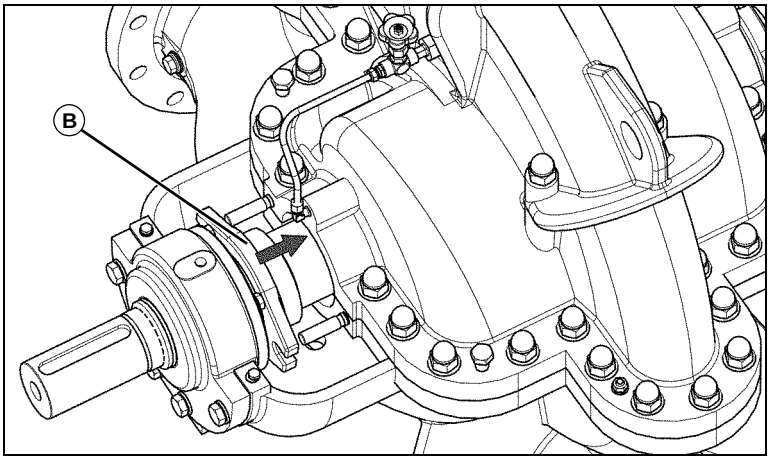
NOTE: Keep in mind to install the lantern ring. Do not install to much packing.

4. Always install one packing-ring at a time and mount each packing-ring about 120° rotated with respect to the previously mounted ring. Check after each ring if the shaft can rotate freely.



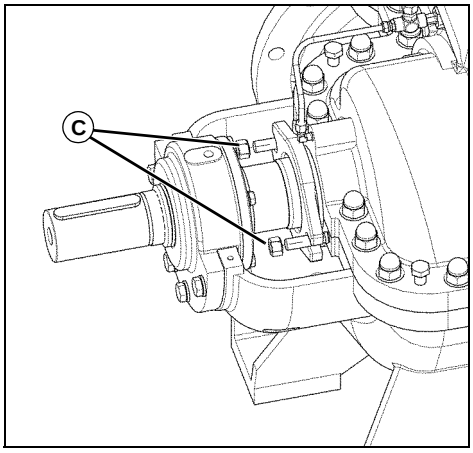
N136

5. Before installing the lantern-ring, make sure the ring is fully clean and is not damaged. Make sure that the lantern-ring will is positioned straight under the lantern-ring water-supply connections (A), after the gland is tightened.
6. Install the rest of the packing-rings. See for instructions step 4.



N137

7. Install the gland (B).



N105

NOTE: Gland-nuts must be tighten equally.

8. Tighten the gland-nuts (C) with your fingers. Check if the shaft can rotate freely.
9. Tighten gland-nuts. Do not tighten the nuts to much.

11.3.4 Adjusting / running-in the gland-packing.

1. Loosen the gland-nuts untill you can turn them by hand.

IMPORTANT: Avoid damage! DO NOT loosen the gland-nuts fully when the pump is in operation!

2. Start the pump.

A leakage must occur almost immediately between the packing-rings and the shaft sleeve[5]. If you see leakage (or not), read and apply the following steps:

If you see leakage:

If you see leakage between the packing and the shaft sleeve, the packing-rings are mounted properly. You can adjust the packing. When adjusting, use the next procedure:

- ❑ A leakage of 40 to 60 drops per minute is ideal. Usually, the leakage will be (much) more because the gland-nuts are tightened by hand.
- ❑ Let the pump operate approximately 10 minutes, before adjusting the gland. The leakage will stabilize and thus you can make a better estimate of the quantity.
- ❑ Tighten the gland-nuts. Do not tighten more than 1/16 turn at a time. After each 1/16 turn let the pump operate for 10 minutes before further adjustment (the next 1/16 turn). Repeat until leakage has stabilized to 40 - 60 drops per minute

5. *No leakage is permitted between packing and stuffing box.*

If you see no leakage[6]:

IMPORTANT: Avoid damage! If you see no leakage (or leakage at the wrong place) the packing can burn and damage to the pump can occur. Stop the pump and let it cool down.

1. Check if the gland-nuts can be turned by hand.
2. ***If you CAN turn the nuts by hand:*** Tighten the nuts approximately 1 complete turn
3. ***If you CAN NOT turn the nuts by hand:*** The packing was probably tightened too much when the gland was mounted. This resulted in an expansion of the packing during pump-test operation. Untighten the nuts until you can turn them by hand and tighten the nuts approximately 1 complete turn.

After you did procedure 2) or 3), start the pump again. After starting, a leakage must occur almost immediately. If you still see no leakage, or a leakage at the wrong place, immediately stop the pump again.

Let the pump cool down and disassemble the gland, lantern-ring and packing-rings again. Locate and correct the cause of failure.

6. *Or leakage at the wrong place*

11.4 Disassemble the pump

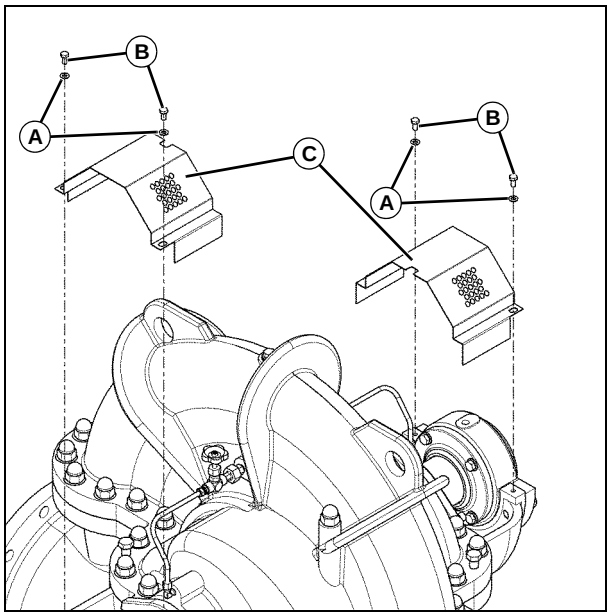
11.4.1 General

During the maintenance procedure and repairs, it will be necessary to disassemble the pump (partially). Disassembling and re-assembling the pump must be performed carefully in order to prevent damage due to an incorrect (dis-) assembling process. Therefore, disassembling and re-assembling of the pump are discussed in detail further in this paragraph. Obey these instructions when disassembling and assembling the pump!

NOTE:

- ***Use the Sectional Drawing in combination with this procedure to disassemble/assemble the pump.***
- ***You must get Nijhuis Pompen written permission, if the pump is disassembled during the guarantee-period. A failure to do so will invalidate the guarantee.***
- ***Only use original spare parts of the proper manufacturer. When you order parts or if you have questions about your pump, Nijhuis Pompen needs the serial number of your pump.***
- ***If dashed lines are used in the graphics, the part is hidden behind another part and thus not visible.***

11.4.2 Protection cover

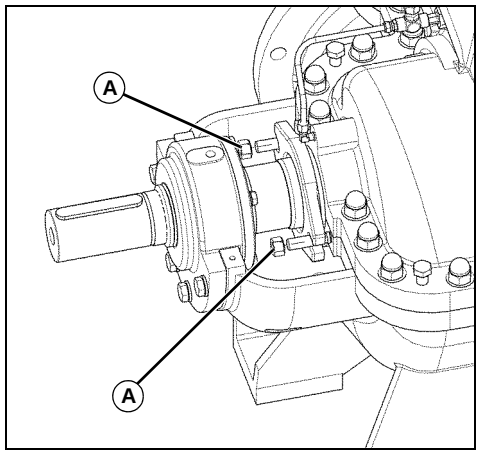


N104

1. Remove bolts (A) 4x and (B) 4x.
2. Remove protection cover (C) 2x.
3. Remove the external flushing. [7]

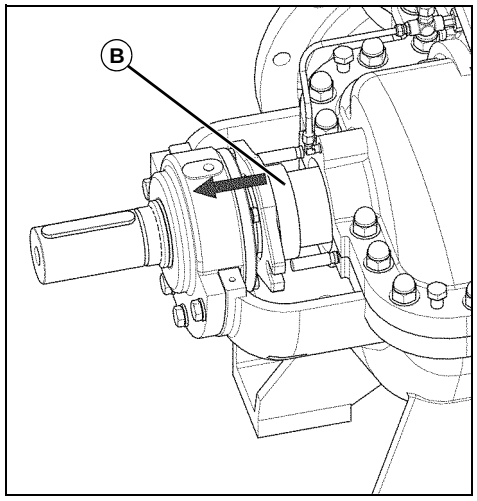
7. *Only if applicable*

11.4.3 Pump upper half



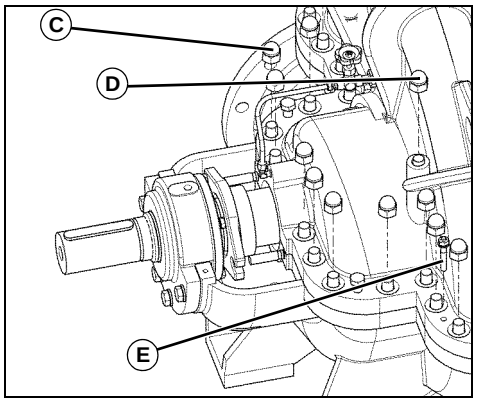
N105

1. Remove gland nuts (A) 2x. Repeat on other side.



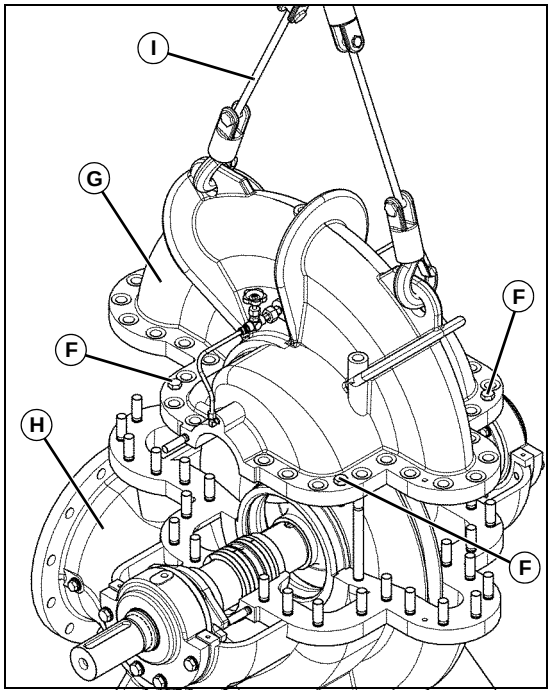
N106

2. Withdraw the gland (B) 2x as far as possible. Repeat on other side.



N107

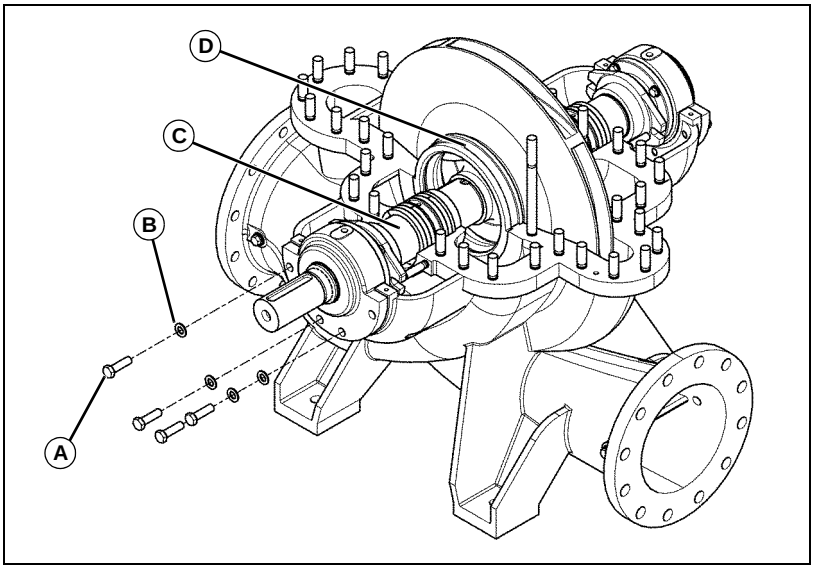
3. Remove all nuts (C) and (D) 2x and dowels (E) 2x.



N108

4. Turn forcing screws (F) 4x until the upper part (G) of the pump loosens from lower part (H). Lift the upperpart of the pump (G) with a hoist (I).

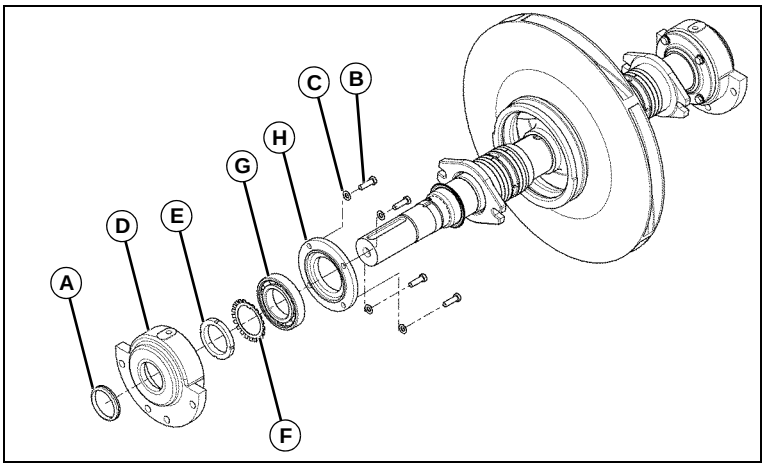
11.4.4 Pump shaft group



N109

1. Remove bearing mounting hardware (A)(B) 4x. Repeat on other side.
2. Remove complete pump shaft (C) including both wear rings (D) from pump housing with a hoist.

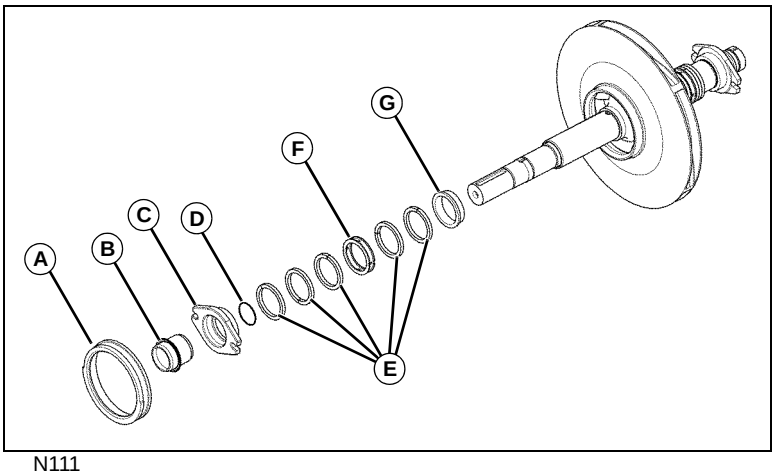
11.4.5 Bearing housing



N110

1. Remove V-ring (A).
2. Remove the hardware (B), (C) 4x.
3. Remove bearing-housing (D).
4. Remove bearing-nut (E). Make sure the lock washer-lip (F) is pressed back before removing the bearing-nut!
5. Remove lock-washer (F).
6. Remove bearing (G).
7. Remove cover (H).
8. Repeat all steps on other side. (V-ring (A) is last item to remove).

11.4.6 Wear ring / Gland packing

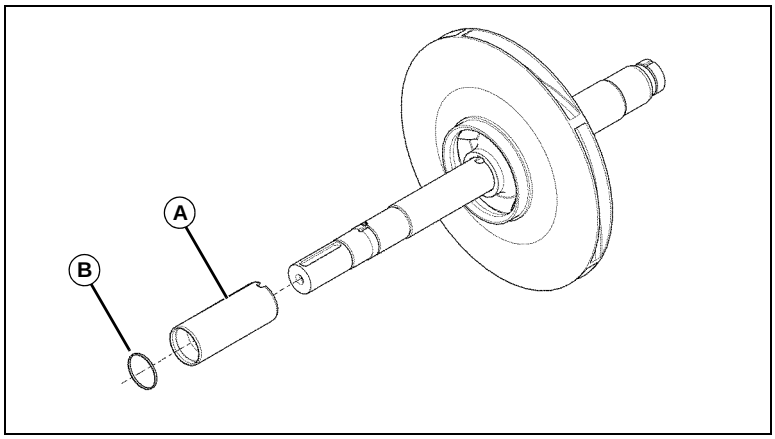


N111

1. Remove wear ring (A) from impeller.
2. Remove retainer sleeve with shaft seal ring (B).
3. Remove gland (C).
4. Remove muster-ring (D).

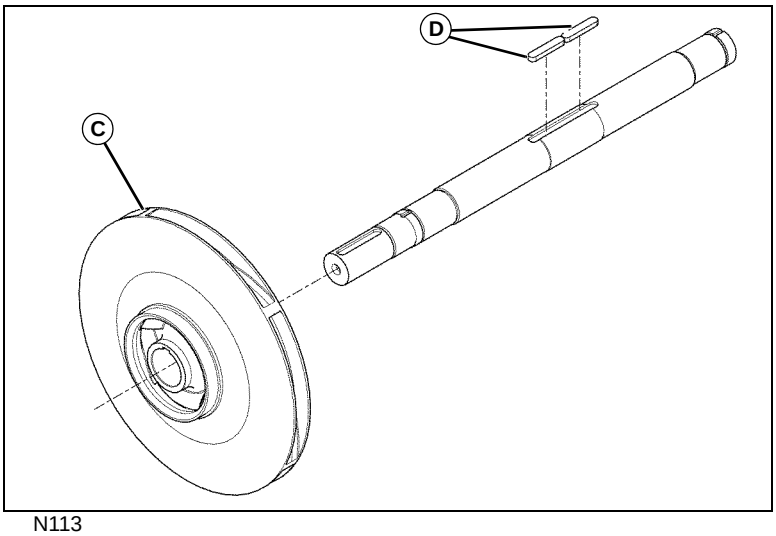
5. Remove Gland packing (E) and lantern ring (F).
6. Remove packing seating ring (G).
7. Repeat all steps on other side.

11.4.7 Impeller



N112

1. Remove shaft sleeve (A) and O-ring (B). Repeat on other side.



N113

2. Remove impeller (C) and impeller key (D) 2x.

11.5 After disassembling

After (partly) disassembling the pump, protect parts that can be damaged (due to weather or mechanical causes). If the pump, or parts of it, are to be stored: obey the instructions at See “Storage” on page 11.

Clean the (lubricated) bearings with white spirit or kerosene and dry them with dry, compressed air. Inspect the bearings for wear, fracture, corrosion and other damage. Replace if necessary. DO NOT SPIN DRY BEARINGS (at high speed during a longer period)! Grease or oil the bearings immediately after inspection, in order to prevent corrosion.

Examine the shaft sleeves for damage and wear. If scoring is not heavy, the shaft sleeves can be reground to provide a new surface. Shaft sleeves can be reduced up to maximum 0,75 mm below the initial diameter for this purpose. If this is not sufficient to eliminate scoring the sleeves must be renewed.

Check packing-rings, 'O'-rings and seal rings for damage and wear and, if necessary, renew them.

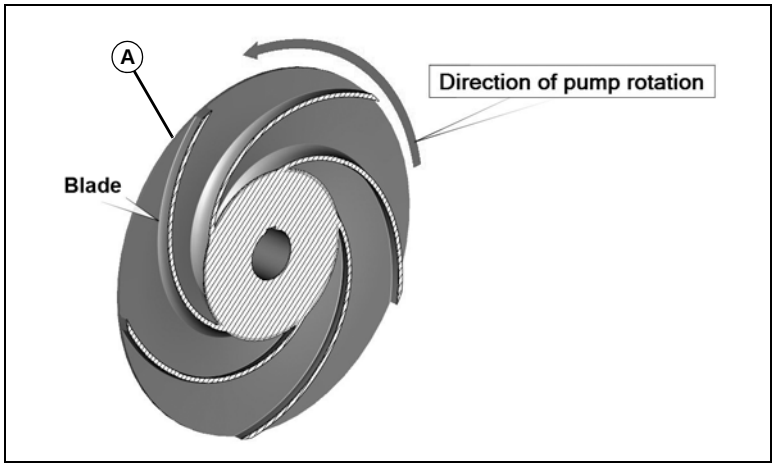
11.6 Before assembling

Fully clean the pump (inside / outside). Check the flanges accurately for damage and, if necessary flatten the flange surfaces. Make sure to remove the old flange sealant between the two casing halves.

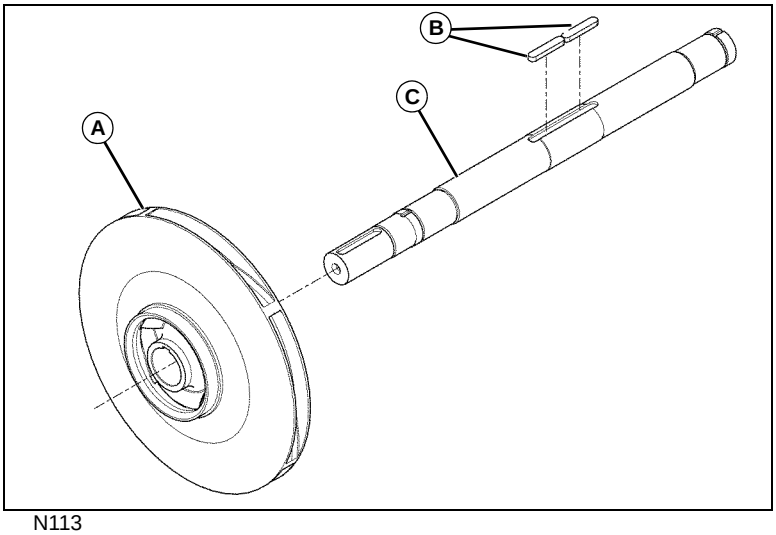
11.7 Assemble the pump

11.7.1 Impeller

IMPORTANT: Avoid damage! Make sure the impeller (A) is mounted correctly so that the impeller's direction of rotation is in accordance with the driver's direction of rotation.

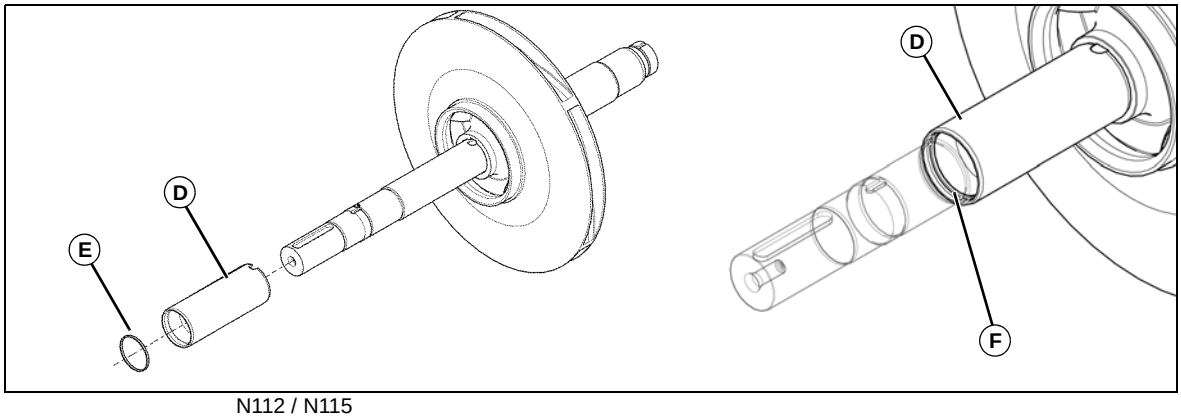


N114



N113

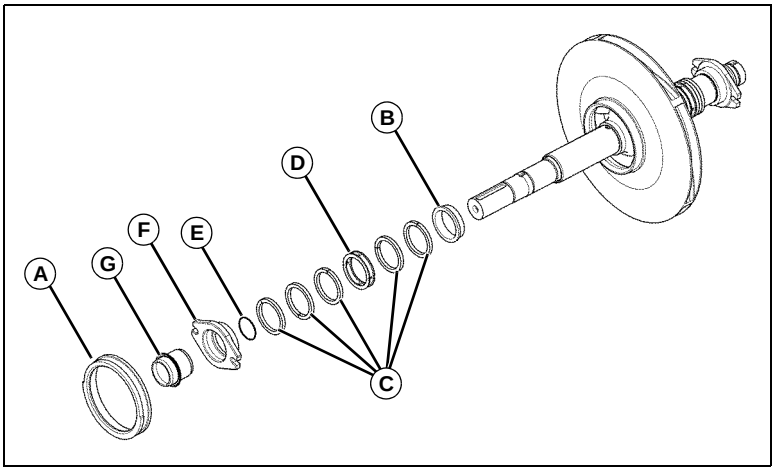
1. Mount key (B) 2x and impeller (A) onto the shaft (C).



N112 / N115

2. Mount shaft sleeve (D).
3. Mount O-ring (E). See also (F) for mounted O-ring.
4. Repeat all steps on other side.

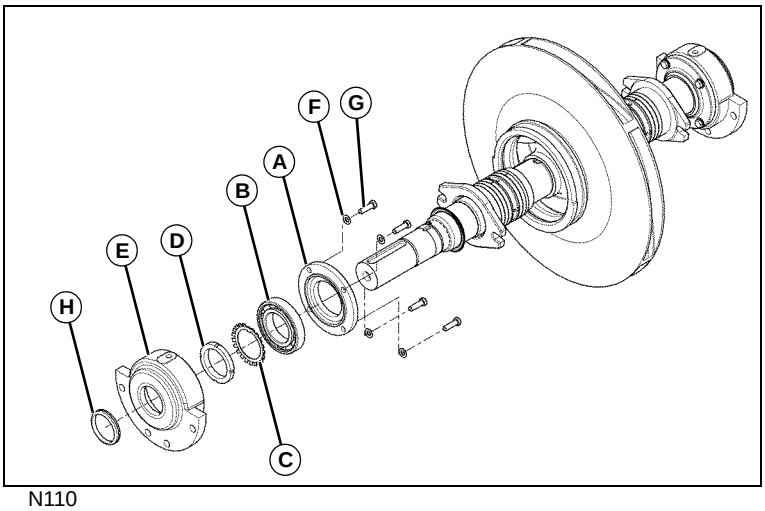
11.7.2 Wear ring / Gland packing



N111

1. Mount wear ring (A).
2. Mount packing seating ring (B).
3. Mount gland packing (C) (use new packing when worn) and lantern ring (D).
4. Mount muster-ring (E).
5. Mount gland (F).
6. Mount retainer sleeve with shaft seal ring (G).
7. Repeat all steps on other side.

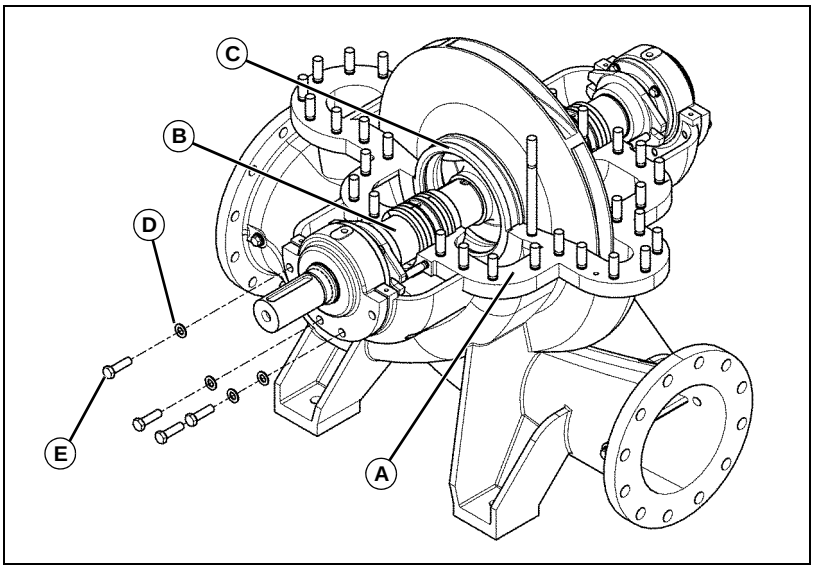
11.7.3 Bearing housing



N110

1. Mount cover (A).
2. Mount bearing (B). It is recommended to heat the inner ring of the bearing to about 80°C (NOT BY OPEN FIRE).
3. Mount lockwasher (C).
4. Mount locknut (D).
5. Press lockwasher-lip (C) backwards to lock the position of the locknut.
6. Mount hardware (F) (G) (4x).
7. Mount V-ring (H).
8. Repeat all steps on other side.

11.7.4 Pump shaft group

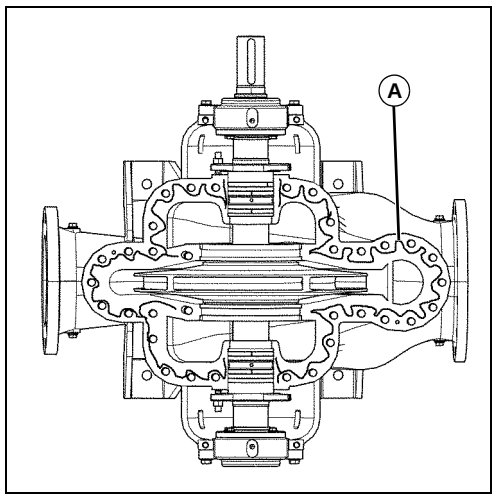


N109

1. Clean flange (A).
2. Make sure that the openings in the lantern rings are open.
3. Install complete pump shaft (B) including both wear rings (C) with a hoist.

4. Install bearing housing hardware (D)(E) 4x. Repeat on other side.

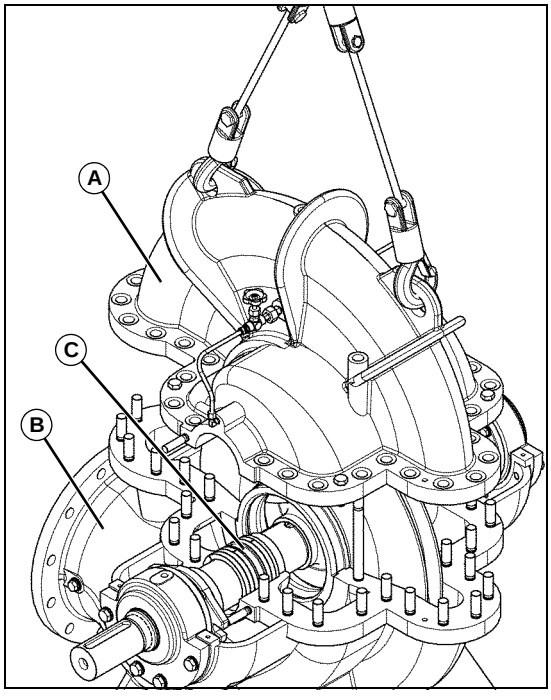
11.7.5 Sealing



N116

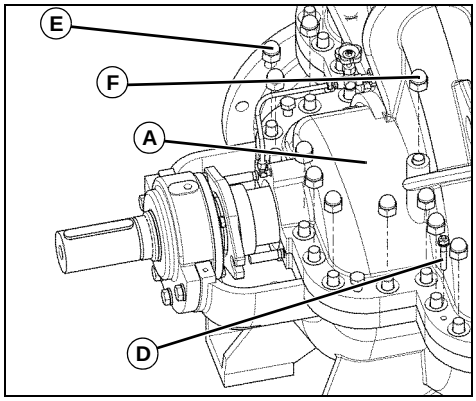
1. Apply sealant on the flange according routing (A). We recommend Loctite® 128068. Make sure the Loctite® is also applied around the studs!

11.7.6 Pump upper half



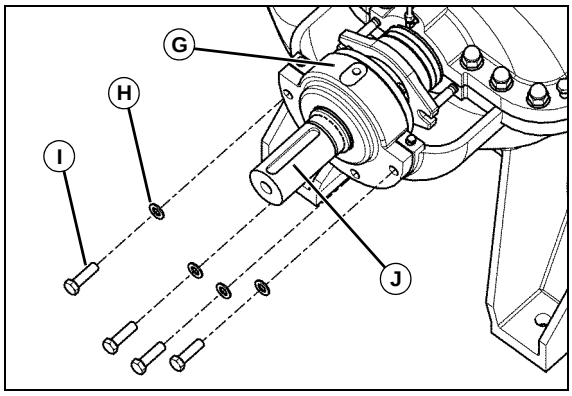
N108

1. Mount pump upper half (A) onto the pump body (B); keep the lantern ring and packing (C) outside the pump housing.



N107

2. Adjust the pump upper half (A) by the two dowels (D). Now fasten upper half onto the body by tightening nuts (E) and (F). The nuts (E) must be tightened in a special sequence. For instructions and torque values See “Torques” on page 43.



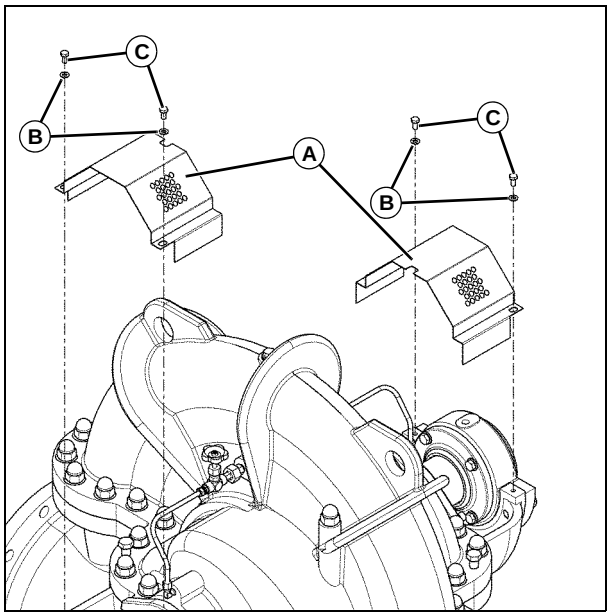
N119

3. Fasten the bearings-housing (G) with mounting hardware (H)(I) (4x). Repeat on other side. Check if pump shaft (J) rotates freely. After checked and approved the shaft's ability to rotate, the packing rings must be inserted. Install the packing rings, See “Gland packing” on page 26.

4. Install the external flushing. [8]

8. *Only if applicable*

11.7.7 Protection cover



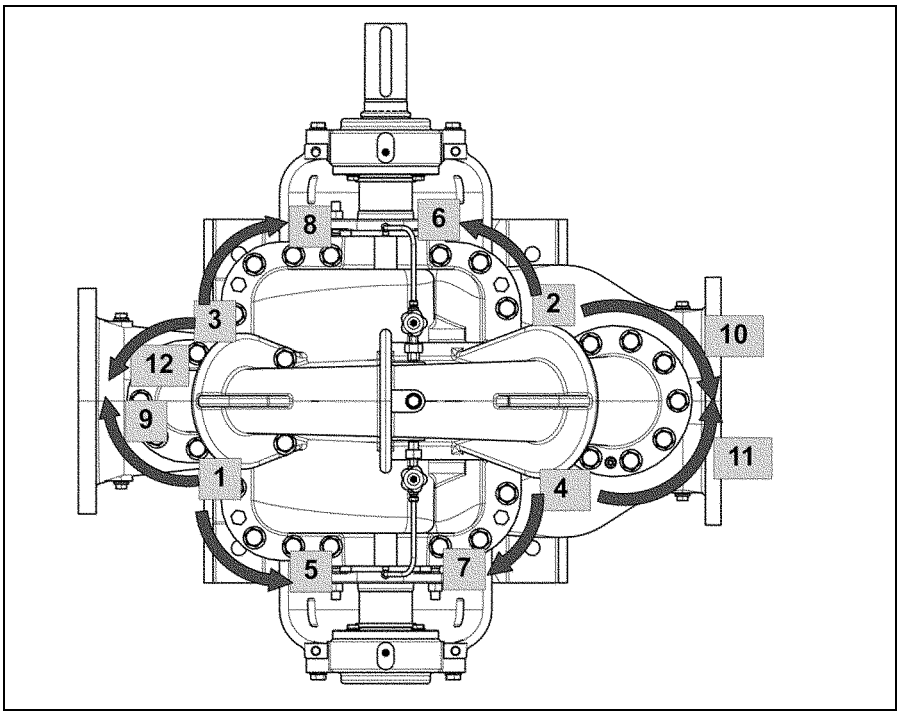
N104

1. Install protection covers (A) 2x.
2. Fasten mounting hardware (B) 4x and (C) 4x.

12 APPENDIX

12.1 Torques

12.1.1 Tightening nuts



N118

1. Tighten the 4 “corner” nuts marked in regions 1,2,3 and 4.
2. Work outward along shaft axis toward the seal houses in opposite quarters tightening nuts in regions 5, 6, 7 and 8.
3. Work outward along the branch and in opposite quarters tightening nuts in regions 9, 10, 11 and 12.
4. Repeat the full procedure.

12.1.2 Maximum torque values

Torque values are applicable for new bolts and nuts with use of lubrication. Use a chloroparaffin based lubrication for stainless steel bolts and nuts.

Class	4.6	5.6	8.8	10.9	12.9	F468-C63000	RVS A2-A4 Class 50	RVS A2-A4 Class 70	RVS A2-A4 Class 80
SIZE	N•m	N•m	N•m	N•m	N•m	N•m	N•m	N•m	N•m
						Rp 0.2 = 270 N/mm^2	Rp 0.2 = 210 N/mm^2	Rp 0.2 = 450 N/mm^2	Rp 0.2 = 600 N/mm^2
M8	9	11	24	34	40	10	7	15	20
M10	18	22	48	67	81	20	14	31	41
M12	31	39	82	116	139	35	25	53	70
M14	49	62	131	185	221	55	39	84	112
M16	74	93	198	278	333	83	59	126	168
M18	103	129	276	388	465	116	82	176	235
M20	144	180	384	540	648	162	114	245	327
M22	192	240	513	721	866	216	153	182*	437*
M24	248	310	661	929	1115	279	197	234*	563*
M27	361	451	963	1354	1624	406	286	341*	--
M30	492	615	1313	1846	2216	554	391	465*	--
M33	661	826	1762	2477	2973	743	524	--	--
M36	853	1066	2275	3199	3839	960	677	--	--
M39	1097	1371	2925	4113	4936	1234	869	--	--
M42	1391	1738	3708	5215	6257	1564	1100	--	--

* Rp 0.2 = 250 N/mm^2

DO NOT use these torque values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically. If you are not sure consult Nijhuis Pumps.

12.2 Trouble shooting list

CAUTION: Avoid Injury! Take all necessary safety precautions before starting the procedure to find the cause of the malfunction, The pump can be filled and under pressure. Bearings can be hot. Wear appropriate protective clothing, safety goggles etc. See “Safety” on page 5 for applicable safety precautions.

Keeping a logbook with all test data, maintenance and repair work is an important source of information in investigating a problem. Make sure to investigate all possible causes related to the malfunctioning.

Never jump to a conclusion concerning the cause of the malfunctioning; all available information must be taken into consideration.

Malfunctions	For cause refer to the numbers below
Pump supplies no liquid	1-2-3-5-8-26-27-28-30-31-35-40
Pump has insufficient capacity	2-3-4-5-7-8-14-15-16-26-27-28-30-31-34-35-40
Pump has insufficient pressure	2-7-8-14-15-16-28-34-35
Pump stops after starting	1-2-3-4-5-6-27-30-35-40
Pump takes too much power	7-8-9-11-12-14-15-18-21-22-34
Pump vibrates and is noisy	1-5-8-9-10-11-12-13-14-15-19-20-22-23-24-25-27-30-32
Stuffing box is leaking too much	9-11-17-18-19-20-33-40
Must replace shaft seal frequently	6-9-11-13-17-18-19-20-21-33-40
Bearings wear out too fast or get hot	9-11-12-19-20-22-23-24-25-38-39
Pump gets overheated and/or jams	9-12-13-19-20-22-23-24-25
Motor overloading	7-9-12-13-19-22-23-24-25-28-29-31-34-36-37-41

Descriptions of possible causes:

1. Pump and suction pipe are not fully filled
2. Gas or air evades from the liquid
3. Air pocket in the suction pipe
4. Air leaking in through stuffing box
5. Suction pipe inlet not sufficient immersed
6. Flushing line is blocked
7. Wrong direction of rotation
8. Impeller blocked by foreign object
9. Shafts not exactly in line
10. Alignment pump – motor not correct
11. Shaft is bent
12. Rotating parts hit stationary parts
13. Bearings are worn out
14. Wear rings, impeller or wear plates are worn out
15. Impeller is damaged
16. Casing gasket is leaking
17. Shaft or shaft sleeve worn out; possible packing damaged
18. Packing not correctly installed

19. The shaft rotates eccentrically because of worn out bearings or bad alignment
20. Rotating parts are out of balance
21. Gland is fastened too tight. Thus no liquid between shaft and packing
22. Improper lubrication of bearings because of lack of lubricant or too much lubricant
23. Insufficient lubrication
24. Wrong or contaminated lubricant
25. Corrosion of bearings because of penetration of liquid
26. Discharge head is calculated too low
27. Available NPSH too low
28. Speed too low
29. Speed too high
30. Suction line is obstructed
31. Discharge line is obstructed
32. Pump is not running on correct working point
33. Wrong kind of packing is used
34. The liquid is of a higher viscosity
35. Suction line is leaking
36. Mains voltage is not according to data plate E-motor
37. Wrong impeller diameter
38. Axial forces too high because of worn out blades on the backside of the impeller or discharge pressure too high
39. Bearings are not installed correctly
40. Lantern ring is not correctly installed in the stuffing box
41. One phase down in power supply E-motor

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