Hart Engineering Corporation

SUBMITTAL:
11305-02

PROJECT: 9722. - Veolia/Taunton WWTP Solids Handling Improvements **DATE: 03/08/2022**

SUBMITTAL: 11305-02 - Thickened Sludge Pump O&M Manual
REVISION: 0
STATUS: Eng
SPEC #: 11305

TO:
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Item	Revision	Description	Status	Date Sent	Date Returned
11305-02	0	Thickened Sludge Pump O&M Manual	Eng	03/08/2022	
Notes:					

Additional Notes:

Status Codes
1-APP – No Exceptions Taken
2-ANR – Make Corrections Noted
3-R&R – Revise and Resubmit
4-REJ – Rejected
5-IPO – For Information Purposes Only
6-NRR – Not Required for Review
ENG – Submitted to Engineer

Sincerely,
Hart Engineering Corporation

_____ DATE: 03/08/2022

SEEPEX.
ALL THINGS FLOW

Progressive Cavity Pump Operation & Maintenance Manual

Supply of **SEEPEX Inc**. pumps & accessories: consisting of engineering drawings, descriptive literature, operating data and related

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To:
Hart Engineering Corp.
800 Scenic View Dr.
Cumberland, RI 02864
Phone: 401-658-4600

Taunton, MA-Veolia
PO #: 9722.101

SEEPEX Job #: P02010844

Submittal for partial fulfillment of specification section:
11305 Thickened Sludge Pumps

Equipment List

Application	Pump Type	Commission #
Thickened Sludge	BN 52-6LS	881591-881592

Represented Locally By:
Aqua Solutions
154 W. Grove St.
Middleboro, MA 02346
Phone: 508-861-0733

Prepared By:
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Enon, OH 45323
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March 2022

PRELIMINARY

SEEPEX.
ALL THINGS FLOW

Table of Contents

1.0
General

1.1
Application

These operating instructions contain basic information on the installation, commissioning and maintenance of seepex machines. Compliance with the work steps described in the individual sections is essential.

1.2
Details of the seepex machines

1.2.1
Operating Instructions

The Commission Number (comm. no) assigns the operating instructions to a particular seepex machine. The operating instructions are produced in relation to a specific job/commission and are valid only for the machine whose comm. no. is identical with that indicated on the cover sheet and possessing the associated data sheet, Tab 9.

1.2.2
Manufacturer

The machines were manufactured by seepex.

1.2.3
Range, Size, Version

of the machines are stated in the appended data sheet, Tab 9.

1.2.4
Machine Comm. No. and Year of Construction

are stated on the type plate at the machine.

1.2.5
Release Date of the Operating Instructions

is stated on the cover sheet of the operating instructions.

1.2.6
Modifications, Notes of Modification

If modifications to the machines are carried out in agreement with seepex, a new set of operating instructions will be provided, or the existing operating instructions will be supplemented by an additional sheet together with a new cover sheet. The date of modification and modification index will be noted on the new cover sheet.

1.2.7
EEC Machine Directive

1.2.7.1
Manufacturer's Declaration

seepex Manufacturer's Declaration as required by the EEC Machine Directive 89/392/EEC, Appendix II B:

The seepex machines delivered in accordance with our design are intended to be fitted in one machine or assembled together with other machines to form one machine/plant. The commissioning of the machine is forbidden until such a time as has been established that the entire machine/plant satisfies the requirements of the EEC Directive for Machines as amended 91/368/EEC and 93/44/EEC.

Particular attention must be paid to the safety requirements specified in EN809 (s and Equipment for Fluids) as well as the information in these operating instructions.

1.2.7.2
Declaration of Conformity

seepex machines possessing no safety accessories do not fulfill the requirements of the EEC Machine Directive 89/392/EEC as amended 91/368/EEC and 93/44/EEC.

For this reason, no Declaration of Conformity as required by the EEC Machine Directive 89/392/EEC, Appendix IIA can be issued before appropriate safety devices have been installed/mounted on the machine and/or plant with due regard to the information given in these operating instructions.

The following harmonized standards are particularly applicable:
EN 809, EN292T1, EN292T2
Applicable national standards and specifications must be taken into consideration.

Following assessment of the conformity of the machine/plant with the EEC Machine Directive, customers may on their own initiative place on the full machine/plant the EEC symbol 'CE' as defined in Identification Directive 93/68/EEC.

CAUTION

This documentation must be kept available for at least 10 years.

1.2.8
Copyright and Industrial Property Rights

These operating instructions are copyrighted. The reproduction, in particular by photocopying, of these instructions is not permitted (§§ 54, 54 UrhG) and constitutes a criminal offence (§ 106 UrhG). Proceedings will be instituted if the copyright is violated.

1.2.9
Specifications Required for Inquiries and Orders

The following information must be included when inquiring about replacement parts or placing orders:
- comm. no.
- / machine type
This information is given on the type plate mounted the machine.

1.2.10
Technical Data Sheet
see Tab 9.

1.2.11
Performance Data, Load Index, Power Consumption

are indicated in the associated data sheet, Tab 9.

1.2.12
Sound Pressure Level

The sound pressure level and/or noise characteris-tics of the seepex machines are ascertained in accordance with DIN 45635. The measuring guidelines are largely identical with the international standards ISO 3740-1980 and ISO 3744-1981.

1.2.13
Operating Range

Employment of the machine is not permissible for purposes other than those stated in the data sheet, see Tab 9. seepex cannot accept liability for damage arising through failure to comply with this operating range.

1.3
Supplementary Information

1.3.1
Accessories, Optional Extras

Please refer to the data sheet, Tab 9.

1.3.2
Company Address, Service Addresses

see Tab 11

2.0
Safety

These operating instructions contain basic requirements to be observed during the installation, operation and maintenance of the machine. Therefore, the instructions must be read by the mechanical fitter and by the technical personnel/operator responsible for the machine prior to assembly and commissioning, and kept available at the operating site of the machine/plant at all times.

Compliance is required not only with the general safety instructions given in this section but also with the detailed instructions, e.g. for private usage, given under the other main headings in these operating instructions.

2.1
Labeling of Advice in the Operating Instructions

In these operating instructions safety advice whose non-observance could lead to danger for life or limb is labeled with the following general hazard symbol:

safety symbol acc. to ISO 3864 - B.3.1

Warnings regarding electric power are labeled with:

safety symbol acc. to ISO 3864 - B.3.6

Safety instructions whose non-observance could jeopardize the machine and its functions are labeled by the word

CAUTION

Always comply with instructions mounted directly on the machine, e.g.
- rotational direction arrow
- fluid connection indicators

and ensure that the information remains legible.

2.2
Personnel Qualifications and Training

Personnel charged with operation, maintenance, inspection and assembly must be in possession of the appropriate qualifications for the tasks.
The company operating the machine must define exact areas of responsibility, accountabilities and personnel supervision schemes. Personnel lacking the required skills and knowledge must receive training and instruction. If necessary, the opera-ting company may commission the manufacturer/ supplier to conduct these training courses. Furthermore, the operating company must ensure that the personnel fully understand the contents of the operating instructions.

2.3
Dangers Resulting from Failure to Observe Safety Instructions

Failure to comply with the safety instructions may lead to hazards to life and limb as well as dangers for the environment and the machine. Non-observance of safety instructions can invalidate the right of claim to damages.

The following are just some **examples** of possible dangers resulting from failure to comply with the safety instructions:

- Failure of important machine/plant functions
- Failure of prescribed methods of service and maintenance
- Danger to life and limb due to electrical, mechanical and chemical influences
- Danger to the environment due to the leakage of hazardous substances

2.4
Safety-conscious Working

Always comply with the safety instructions listed in this document, the existing national accident prevention regulations and any company-internal work, operating and safety rules.

2.5
Safety Instructions for the Operating Company/Machine Operator

- Any potentially hazardous hot or cold machine parts must be provided with protection against accidental contact at the customer´s premises.

- Protective guards for moving parts (e.g. coupling) must never be removed while the machine is in operation.

- Leakages (e.g. in the shaft seal) of hazardous conveying liquids (e.g. explosive, toxic, hot) must be drained in such a way that no danger arises for persons or for the environment. Always observe the relevant statutory requirements.

- The risk of exposure to electrical power must be eliminated (for details, see the VDE regulations, for example, or those of the local power supply company).

2.6
Safety Instructions for Maintenance, Inspection and Assembly Work

The operator must ensure that all maintenance, inspection and assembly tasks are carried out by authorized and qualified personnel who have studied the operating instructions closely and become sufficiently familiar with the machine.

As a basic rule, the machine must be brought to a standstill before work is carried out. Always comply with the de-commissioning procedure described in this document.

Any machiness or assemblies conveying media that are detrimental to health must be decontaminated.

Immediately following completion of work, all safety and protective devices must be replaced in position and, where applicable, re-activated.

Before re-starting the machine, observe the points listed under the heading "Initial Startup".

2.7
Unauthorized Modification and Manufacture of Replacement Parts

Conversions or modifications of the machine are permissible only in consultation with the manufacturers. Original manufacturer replacement parts and manufacturer-approved accessories enhance the operational safety of the machine. The usage of unauthorized parts may lead to the nullification of the manufacturer's liability for any resultant damages.

2.8
Impermissible Modes of Operation

The operational safety of the machines supplied is warranted only for employment in accordance with the intended use as defined in Section 1 - General - of these operating instructions. Never allow the threshold values specified in the data sheet to be exceeded.

3.0
Transport and Intermediate Storage

3.1
Safety Precautions

Employ appropriate transport means, hoists and tools when transporting and storing the machine, always observing the safety instructions.

3.2
Transport

Depending on its weight, the seepex machine must be transported manually or with appropriate transport means. Comply with the transport instructions on the packing.

3.3
Unpacking

The design of the packing is such that the equip-ment can be removed manually or, if demanded by the weight, by means of appropriate hoists.

Any screw fittings between the machine and the packing must be undone. Comply with the attached information notices and symbols.

3.4
Intermediate Storage/Preservation

Unless otherwise indicated in the data sheet, seepex machines are provided with preservation only for the duration of transport. If a long period of intermediate storage is foreseen before the machine is commissioned, it is necessary to pro-vide supplementary preservation. If necessary, the appropriate measures should be drawn up in consultation with seepex.

Intermediate storage in extreme climatic conditions is permissible only for machine whose design is appropriate to the circumstances. If necessary, seepex must be consulted.

CAUTION

Pumps of the range MAP
If the period from supply and subsequent storage until the commissioning is more than 4 weeks, the hoses should be dismantled, refer to Tab 7.

3.5
Protection against Environmental Influences

To afford protection against environmental influences, the intermediate storage location must be dry, enclosed and free from frost.

4.
Description of the seepex Progressive Cavity Pump and Accessories

4.1
General Description, Design and Mode of Operation

Like all progressive cavity pumps, seepex pumps belong to the rotating positive-displacement pump family. The characteristic attribute of these pumps is the special formation and arrangement of the two conveying elements, namely the rotor and the stator.

The difference in the number of threads possessed respectively by the rotor and stator produces a chamber that opens and closes alternately in line with the constant turning motion of the rotor, effecting the continuous transportation of the conveying product from the suction side to the pressure side.

The geometrical formation of the two conveying elements combined with the constant contact that exists between them result in sealing lines that effect an airtight seal between the suction and pressure side in every position of the eccentric screw, even when the pump is stationary. The pump owes its high suction capacity to this
sealing between the suction and pressure sides.

4.2
Mechanical Design

Please consult the sectional drawing, Tab 9,
for the mechanical design of the pump. The data sheet, Tab 9, gives information on the design of the pump housing, stator, rotor and rotating components.

Refer to document OM. SEA. 02e , for information on the design of the shaft seal.

The data sheet, specifies details of the design of the drive engine. Further details are
given in the appended manufacturer's documents, Tab 10.

4.3
Accessories

Consult the data sheet for information.

4.4
Dimensions, Weight

Consult the appended dimensional drawing,

4.5
Design Variants

Refer to the data sheet, Tab 9, for the design of the seepex progressive cavity pump. Other design variants are possible, whereby seepex must first check whether a particular pump is suitable for the intended purpose.

4.6
Operating Site Specifications

Operating site specifications are listed in the data sheet, Tab 9. Details of the space required for installation, operation and maintenance are given in Section 5.2.1.

5.0 Assembly / Installation

5.1 Mounting Tools / Hoists

No special tools are required for the assembly and installation of the pump.

The customer must check the dimensions and weight of the seepex progressive cavity pump to ascertain whether the available hoisting apparatus is sufficient for the assembly and fitting of the pump.

5.2 Initial Assembly

5.2.1 Inspection Prior to Commencement of Assembly

5.2.1.1 Location

The place of installation for the pump must con-form with the site stated in the data sheet in Tab 9. Any change of location must be checked and approved by seepex.

5.2.1.2 Space Requirements

Customers are responsible for determining the space requirements; the following factors must be taken into consideration:

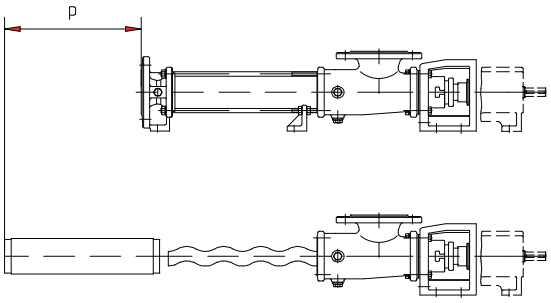
- dimensions and weight of the machine
- required transport and hoisting equipment
- possible piping layout with allowance for the space allowing disassembly of the rotor as defined in 5.2.1.3
- freedom of movement to:
  operate the drive /
  speed regulation
  read speed and pressure indicators
  adjust a stator retensioning device, if fitted
  operate a buffer fluid supply unit, if fitted
- space required for lubrication / renewal of lubricants
- disassembly of mechanical protective devices, e.g. V-belt or coupling protection
- space required for handling the mounting tools, e.g. sufficient wall clearance

5.2.1.3 Space Allowing Disassembly of Stator P

A specific space must be allowed for exchanging the stator. The required dimension "P" is indicated on the GA drawing, Tab 9.

CAUTION

Ensure also that the pipe work can be dismounted at this location too.



5.2.2 Installation of the Fully Assembled Pump

- Installation in conformity with data sheet
  Installation of the pump is permissible only in accordance with the data sheet specifications and the associated basic drawing, see Tab 9. Any change in the position must be checked and approved by seepex.

- Tension-free mounting of pump
  This rule applies to pumps with and without drives, to versions with and without baseplate, for mounting on the foundation or other bearing elements. The entire area of all bearing surfaces of the machine must rest on the ground. Any unevenness must be corrected by appropriate supports.

- Correct seating of drives
  All drives have been aligned ready for operation and mounted by seepex. However, displace-ments may occur during transport or installation. For this reason, check that the alignment and fastening of the drive and coupling are correct.

- Protective devices
  On completion of the assembly and installation work, immediately mount all safety and protective devices in their proper locations and set them in operation.

5.2.3 Protective and Controlling Equipment

Information on equipment of this nature, where fitted, is provided in the data sheet, Tab 9. Consult the attached manufacturer's specifications, Tab 10, for instructions on assembly and installation.

5.2.4 Electric Connection of Electric Motor and Frequency Converter

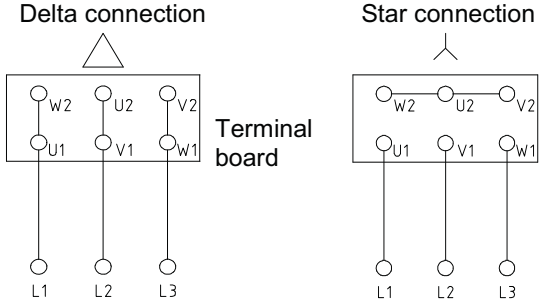
The electric connections must be established in accordance with the manufacturer's specifications, Tab 10, as well as the safety specifications applying at the installation site. The mains voltage and frequency must match the ratings indicated on the type and rating plates.

□ Switch on electric motor „direct-on-line“

CAUTION

An increased starting torque is necessary due to the clamping between the rotor and stator conveying elements. This means the electric motors that drive the progressive cavity pumps must always be switched on directly. As a rule, star-delta startup is not possible unless special arrangements have been made with seepex.

Three-phase cage motor



low . . . high . . .
. . . voltage indicated on rating plate

□ Speed regulation via frequency inverter
When progressive cavity pumps with frequency-controlled drives are started up problems may occur due to unsuitable or wrongly set frequency inverters. For this reason we recommend the purchase of the complete drive, including frequency inverter, from seepex, so that the frequency inverter can be tuned on the seepex test field along with a trial run.

Ensure that customer-supplied frequency inverters comply with the starting torque and running power specified in the appended data sheet, Tab 9.

CAUTION

Consult the appended document TI.FRU.01, see Tab 9, for further information on the electric connection and the setting of frequency inverter and variable-speed motor.

5.2.5 Piping

5.2.5.1 Suction and Pressure Flanges

The position, nominal width and standard of the suction and pressure flange of the progressive cavity pump are specified in the dimension drawing, Tab 9, and data sheet, Tab 9. Always observe the rotational direction and flow direction defined in section 6.2.5.

5.2.5.2 Piping Dimensioning

CAUTION

The pipe diameters on the suction and pressure sides must be dimensioned in accordance with the customer's pressure-loss calculation in such a way that the pressures specified in the data sheet, Tab 9, are not exceeded. The nominal width of the suction pipe should at least match that of the pump suction flange.

5.2.5.3 Residue-free Piping

CAUTION

Prior to starting up the pump, ensure that all pipelines are free from foreign bodies. Installation residues (such as weld spatter, screws, steel chips etc.) will lead to damage of the **seepex** pump for which guarantee claims will not be accepted.

5.2.5.4 Tension-free Mounting

CAUTION

Pipelines and other components requiring to be connected with the pump must be mounted without stresses.

5.2.5.5 Fluid Connections for Optional Extras

Consult the data sheets, Tab 9, for information regarding the optional extras, if any, that are fitted. The technical description is given under Tab 9.

6.0
Commissioning/De-commissioning

6.1
Engineering Data

Details regarding all technical specifications and operating conditions are given in these operating instructions together with the data sheet, Tab 9.

To guarantee the correct assignment of documentation to pump, the commission number on the
- cover sheet
- and data sheet of these operating instructions must match the commission number stated on
- the nameplate of the pump.

6.1.1
See section 7.2.2 for Lubricant Chart

6.2
Preparation for Operation

6.2.1
Bearing

6.2.1.1
See section 7.2.1.4 for pump bearing.

6.2.1.2
See manufacturer's documents, Tab 10, for drive bearings.

6.2.2
Shaft Sealing

See document OM.SEA.02e

6.2.3
Filling Up of Suction Side to Avoid Dry Running at Startup

CAUTION

Before switching on the pump, fill the suction-sided pump casing with fluid so that the first rotations will lubricate the conveying elements immediately. A small quantity of fluid is sufficient for lubrication; the subsequent operation of the pump is self-priming, even if an air column up to the liquid level remains.

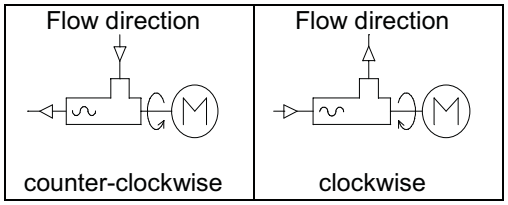
6.2.4
Electric/Hydraulic Connections

The connections are listed in the appended manufacturer's documents, Tab 10.

The risk of exposure to electrical hazards must be ruled out. Always observe the safety regulations valid at the site of installation.

6.2.5
Checking Direction of Rotation

The rotational direction of the pump determines the flow direction of the conveying medium.



Prior to commissioning the rotational direction of the pump must be checked for compliance with the data sheet specification and the rotational direction arrow on the type plate of the pump.

6.3
Control and Monitoring Equipment

Where applicable, please refer to the associated documents, Tab 10, for information on commissioning.

6.3.1
Performance Check

Any optional extras must be subjected to a performance check in conformity with the specifications by seepex or other manufacturers, see manufacturer's documents.

6.3.2
Setting

Unless already performed in the factory, setting must be carried out in accordance with the appended manufacturer's specifications, Tab 10. Pay attention to the operating specifications in the data sheet.

6.4
Equipment for Protection of Persons

Machines must be fitted with mechanical protective devices complying with DIN EN 809.

- Moving or working parts must be protected against accidental contact.
- However, safety considerations demand it be possible at all times to check without hindrance whether the shaft seal is fully functional. A protective guard is necessary in this area only if components are mounted on the rotating, smooth shaft.

- If pumps are operated with an open suction flange/feed hopper, a suitable protective guard complying with DIN EN 294 must be mounted.
- Country-specific protective regu-lations must be observed at the site of installation. Prior to activation of the pump, check the proper function of all protective equipment.

6.5
Commissioning

6.5.1
Initial Startup/Re-starting

CAUTION

Every seepex progressive cavity pump is designed for the specific operating conditions documented in the data sheet. Commissioning is permissible only if the operating conditions conform with those indicated in the data sheet. Although the potential usages of the seepex pump are not confined to the specified operating conditions, any change in the original conditions must be checked and approved by seepex.

The right to make claims under the warranty agreement will be annulled if operating conditions are changed without prior approval by seepex.

6.5.2
Avoid Dry Running of Pump

CAUTION

The dry running of a pump increases the friction between rotor and stator, quickly causing an unacceptably high temperature to develop on the inner surface of the stator. This overheating leads to burning of the stator material and the total failure of the pump.

For this reason it is necessary to ensure that the suction-sided flow never dries up completely. If a continuous flow cannot be guaranteed for the plant, it is essential to fit the seepex dry running protection device TSE, available as an optional accessory.

6.5.3
Check Pressure at Suction and Pressure Flanges

6.5.3.1
Safeguard Pump Against Excessive Pressure at the Suction Flange

The seepex pump is designed to operate with the pressure at the suction flange (suction head or inlet pressure) specified in the data sheet. Deviating pressure conditions may lead to the failure and/or destruction of the shaft seal or entire pump.

For this reason the suction pressure specified in the data sheet must be guaranteed. Appropriate monitoring devices are oil-filled contact mano-meters that deactivate the pump.

6.5.3.2
Safeguard Pump Against Excessive Pressure at the Pressure Flange

The seepex pump operates according to the positive displacement principle. Operation of the pump against an excessive pressure caused by closed valves, by high pressure losses in the piping or by product sedimentation will lead to the destruction of the pump, drive, pipe work and/or downstream equipment. Every progressive cavity pump must therefore be protected against overpressure. Safety valves with bypass pipes or oil-filled contact manometers that disactivate the pump are appropriate protective devices.

6.5.4
Drive Engine

Consult the attached manufacturer's operating instructions, Tab 10, for information on commissioning the drive engine.

6.5.5
Establish Clear Passage Through Pipelines

CAUTION

To prevent damage to the pump the unhindered flow of liquid must be guaranteed between the points of entry to and exit from the pipeline. For this reason, open all relevant valves etc. prior to activation of the pump.

6.6
De-commissioning

6.6.1
De-activation

The electric connections must be switched off and protected against accidental re-activation. Observe the safety regulations applying to the plants.

6.6.2
Stationary Pump

The pump and all optional equipment must be provided with the following protection modes while at a standstill:

- Frost protection
- Protection against solid particle deposits
- Protection against sedimentation of the medium
- Corrosion protection for parts in contact with the medium

We recommend that the pipeline and pump be emptied for the duration of the plant standstill. Following evacuation, the pump should be preserved.

6.6.3
Evacuation of the Pump

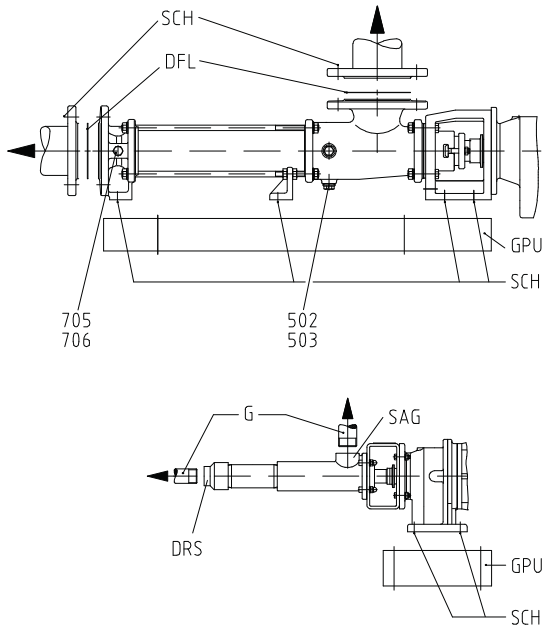
The pipeline must be evacuated on the suction and pressure side or shut-off directly behind the pump connections. Drain any residual liquid in the pump casing by opening/ removing the screwed sealing plugs (705) and (502), sealing rings (706) and (503). Casings without screwed plug must be evacuated by the connection branch (SAG and DRS). Refer to the data sheet and the sectional drawing of the associated operating instruction, Tab 9, for information on the pump design. Conveying medium residues always remain in the rotor/ stator chambers and may run out during transport or disassembly of the pump. If conveying aggressive or hazardous media, therefore, wear appropriate protective gear during all installation work.

6.6.4
Disassembling the Pump

Dismantle the pipe work by removing the flange bolts (SCH) and flange seals (DFL) or the threaded connections (G).

Disassemble the pump together with the baseplate (GPU) or, as applicable, without the baseplate (GPU) following removal of the bolts (SCH) at the pump feet.

Block-design pumps with direct flange-mounted drive engine are liable to become unstable during disassembly. Stability can be restored by propping up the drive engine.



6.6.5
Preservation/Storage

The pump must be preserved prior to storage. Appropriate preservation measures must be agreed with **seepex**. Always state the pump commission number when making inquiries.

These operating instructions are valid for range BN size 05-24 to 300-6L

7.0 Service and Maintenance

Contents

The sectional drawing and parts list relevant for section 7.3 and 7.4 can be found in Tab 9.

7.1 General Instructions

A requirement for the reliable operation of any pump is service and maintenance in compliance with instructions. Maintenance personnel must therefore have access to these operating instruc-tions and adhere to them meticulously. seepex will accept no liability for damages arising through non-observance of these operating instructions.

7.2 Maintenance and Inspection

7.2.1 Lubrication

7.2.1.1 Rotor and Stator

The rotor and stator are lubricated by the conveying medium.

7.2.1.2 Shaft Sealing

Consult document OM.SEA.02e for information on lubricating the shaft seal.

7.2.1.3 Pin Joint

The pin joints are filled with special grease and lubricated for the expected duration of service. The seepex joint grease should be used exclusively for any required maintenance work.

CAUTION

Usage of other grease types will lead to premature joint failure and render invalid any right to claims under guarantee.

7.2.1.4 Bearing of the Pump/Drive Engine

The bearing of the rotating pump parts is effected by the drive engine. Lubrication instructions are therefore included in the appended drive engine operating instructions, Tab 10.

7.2.2 Lubricant Filling Levels

Details are specified in the equipment sections.

7.2.3 Drives and Optional Extras

For maintenance and inspection specifications, see the appended manufacturer's documents, Tab 10.

7.2.4 Supervision during Operation

7.2.4.1 Shaft Sealing

See document OM.SEA.02e .

7.2.4.2 Optional Extras

These must be monitored in accordance with the separate documents, Tab 9/Tab 10.

7.2.4.3 Drive Engines

These must be monitored in accordance with the separate manufacturer's documents, Tab10.

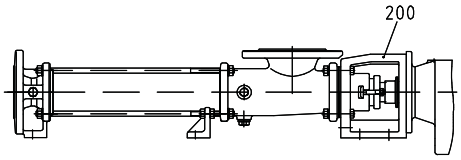
7.2.5 Preventive Measures

To avoid the expenses incurred by lengthy stop periods of the pump, seepex recommends the acquisition of a set of wearing parts and a set of gaskets.

7.3
Dismantling the seepex Progressive Cavity Pump

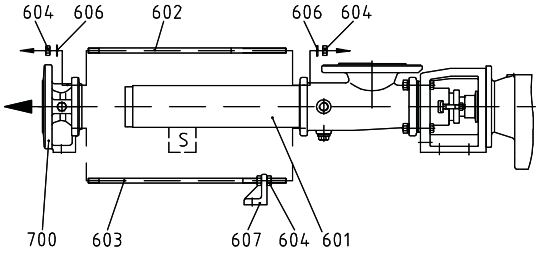
The stator (601) and the rotating pump parts can be exchanged in site. The rotating pump parts can be dismantled as a complete rotating unit (RTE) (section 7.3.4) or as individual components (section 7.3.5).

Before commencing the dismantling of pump parts, safeguard the pump against tipping over or falling down by fastening it at the lantern (200).



7.3.1
Pressure Flange (700) - Dismantling

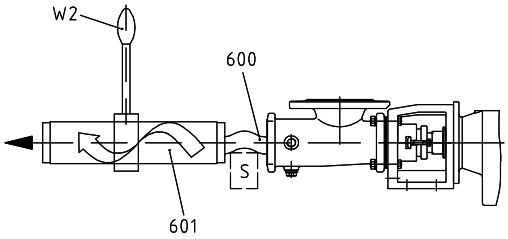
Prior to dismantling see section 7.3.2
Before dismantling the stator (601), provide it with a support (S) to prevent it from falling.



7.3.2
Stator (601) - Dismantling

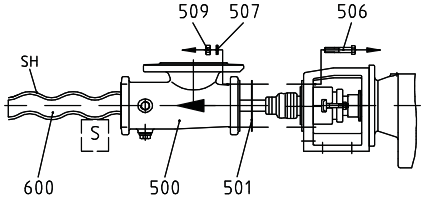
Maintenance tip:
Disassembly of the stator can be made considerably easier by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap). Before removing the pressure flange (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange side. Several clockwise (see section 6.2.5) revolutions of the rotor will then distribute the antiseize agent over the inner surface of the stator and reduce the friction between rotor and stator considerably.

Lock drive shaft against rotation.
While dismantling the stator (601) prop up the rotor (600) with support (S) to prevent it from falling.



7.3.3
Suction Casing (500) - Dismantling

Fit the rotor (600) with a protective cover (SH) and underprop it with support (S) to prevent it from falling down.



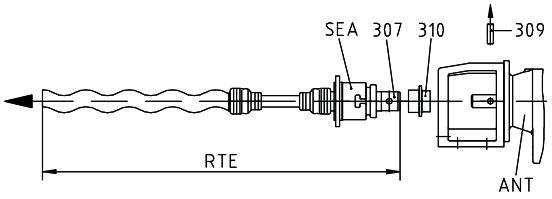
7.3.4
Rotating Unit (RTE) - Dismantling

CAUTION

Before dismantling the rotating unit it is essential to comply with the specifications in document OM.SEA.02e (Shaft Seal Dismantling).

Remove flushing connections at shaft seal housing (SEA).
Raise/shift splash ring (310) and eject plug-in shaft pin (309) in horizontal direction.
Remove rotating unit (RTE)/plug-in shaft (307), together with shaft seal (SEA) from output shaft of the drive (ANT).

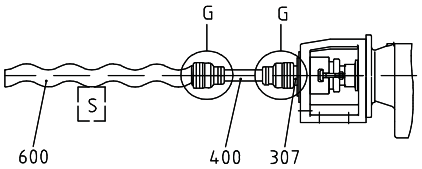
See in document OM.SEA.02e, for removal of the shaft seal (SEA) from the plug-in shaft (307).



7.3.5
Rotating Pump Parts - Dismantling

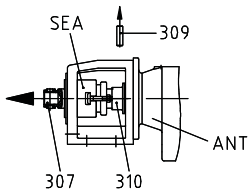
7.3.5.1
Rotor (600), Coupling Rod (400)

Detach the rotor (600) and coupling rod (400) from the plug-in shaft (307) by dismantling the joint (G) in accordance with document OM.PJT.02.



7.3.5.2
Plug-in Shaft (307)

The plug-in shaft (307) is removed in the same way as the rotating unit (RTE), see Point 7.3.4.



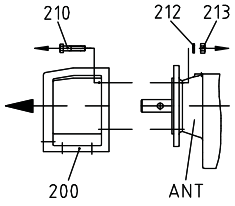
7.3.6
Dismantling of Joint

see document OM.PJT.02

7.3.7
Shaft Sealing

See document OM.SEA.02e, for information on dismantling the shaft sealing.

7.3.8
Lantern (200)/Drive (ANT) - Dismantling

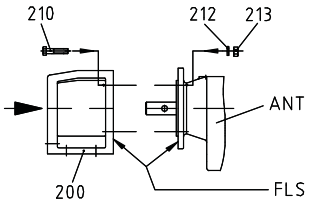


7.4
Re-assembly

Before commencing the re-assembly, fasten the lantern (200) in such a way that it cannot tip over or fall down during the re-assembly of the drive and all pump components.

7.4.1
Lantern (200)/Drive (ANT) - Assembly

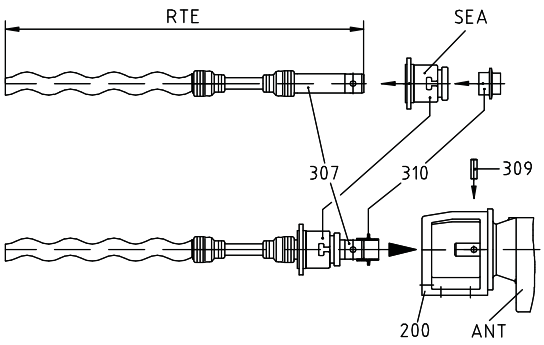
Clean flange bearing surfaces (FLS), centering diameter and output pivot of the drive (ANT).



7.4.2
Rotating Unit (RTE) - Re-assembly

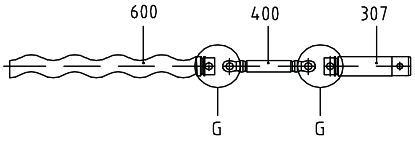
The rotating unit (RTE) has been assembled in accordance with the description in document OM.PJT.02.

Mount shaft seal (SEA) on plug-in shaft (307) in the way described in document OM.SEA 02e.
Moisten splash ring (310) and plug-in shaft (307) with joint grease and slide splash ring (310) onto plug-in shaft (307), observing the fitting position of the splash ring, (see writing on the splash ring).
Apply antiseize graphite petroleum to the output pivot of the drive (ANT) and slide on the rotating unit (RTE). Insert plug-in shaft pin (309) horizontally.
Splash ring position (310)
The collar of the splash ring should be mounted at a distance of 0.5 mm from the lantern (200).



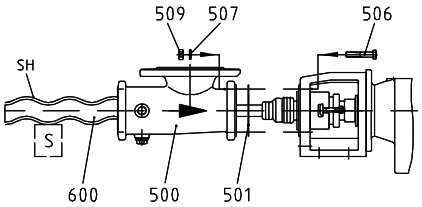
7.4.3
Rotating Pump Parts - Re-assembly

Prepare main components:
Prepare rotor (600), coupling rod (400) and plug-in shaft (307) as described in document OM.PJT.02, Point 2. to 2.3
Joint (G) re-assembly as described in document OM.PJT.02, Point 3.



7.4.4
Suction Casing (500), Casing Gasket (501) - Re-assembly

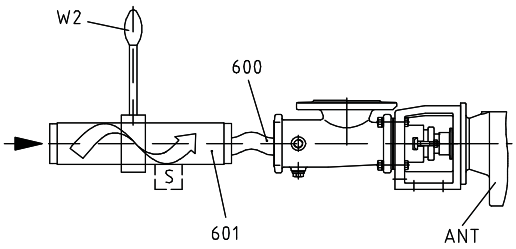
Fit protective cover (SH) on rotor (600) and prop it up with support (S).



7.4.5
Stator (601) - Assembly / Re-assembly

Maintenance tip:
Disassembly of the stator can be facilitated considerably by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap). Before removing the pressure flanges (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange side. Several clockwise (see Point 6.2.5) revolutions of the rotor will then distribute the antiseize agent over the inner surface of the stator and reduce the friction between rotor and stator considerably.

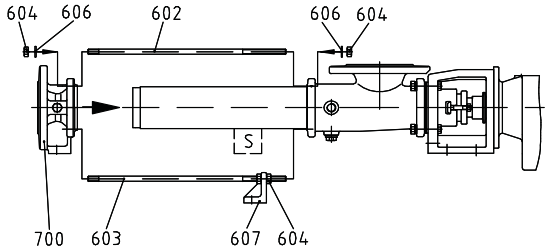
Lock drive (ANT) shaft against rotation. Turn stator (601) clockwise and simultaneously push it over rotor (600), propping up stator with support (S) at the same time.



7.4.6
Pressure Flange (700) - Assembly

CAUTION

Tighten tie bolts (602 and 603) in equally.



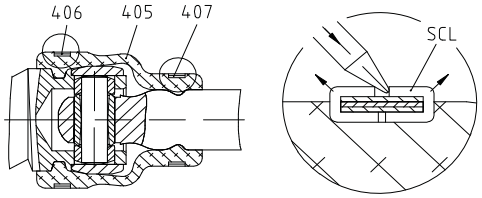
1.0
Dismantling of Joint

1.1
Holding Band (406, 407) and Universal Joint Sleeve (405)

Cut through loop (SCL) of the holding bands (406 and 407) with a metal saw.

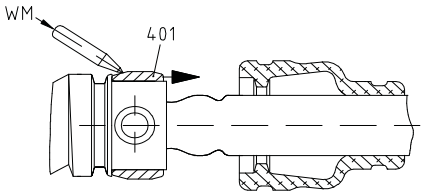
Wear protective goggles when squeezing out the two halves of the holding band loop (SCL).

Remove holding bands (406,407). Pull universal joint sleeve (405) off joint.

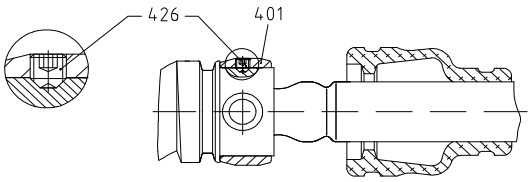


1.2
Retaining Sleeve (401) - Dismantling

- For rotors and plug-in shafts made of hardened and unhardened materials, knock back retaining sleeve (401)



- For rotors made of synthetic material, release set screw (426).

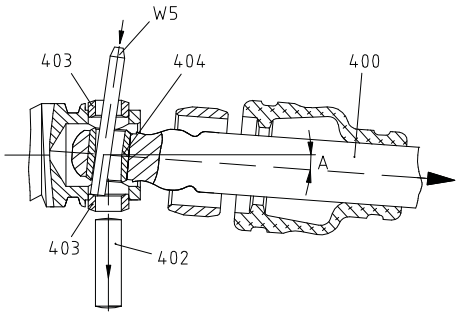


1.3
Separation of Joint

Eject coupling rod pin (402). Position coupling rod (400) at the correct angle (A) and drive both guide bushes (403) outwards. This releases the coupling rod (400), which can then be extracted.

CAUTION

To guarantee the proper function of the joints, it is advisable to renew the coupling rod pins (402), guide bushes (403) and coupling rod bushes (404) all at the same time.

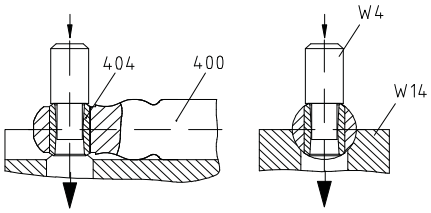


1.4
Coupling Rod Bushes (404) - Dismantling

CAUTION

As a precaution against incorrect re-assembly of coupling rod bushes (404), we recommend the employment of coupling rods (400) whose coupling rod bushes (404) have been pressed in by seepex.

The coupling rod bush (404) is pushed out of the coupling rod (400)



2.0
Prepare main components for Re-assembly

2.1
Rotor (600) - Preparation for Joint Assembly

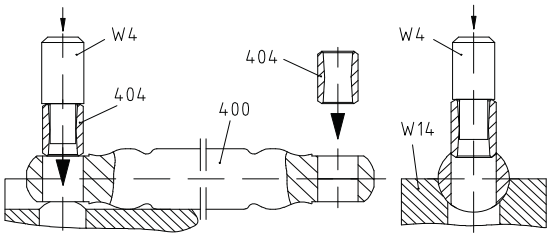
First remove any burr, flaws or similar defects from the rotor, then clean it.

2.2
Coupling Rod (400) - Preparation for the Joint Assembly

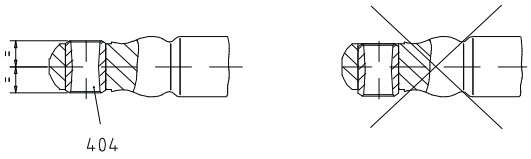
CAUTION

As a precaution against the incorrect re-assembly of coupling rod bushes (404), we recommend the employment of coupling rods (400) whose bushes (404) have been pressed in by seepex.

Press in new coupling rod bushes



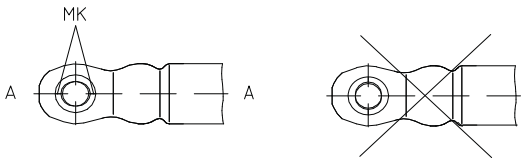
□Position of coupling rod bush (404)



correct
pressed in centrically

incorrect
pressed in eccentrically
result: joint fracture

Marking notches in (MK) in A-A axis
permissible rotation 1,5°



correct
pressed into A-A axis

incorrect
pressed in rotated
result: joint fracture

2.3
Plug-in Shaft (307) - Preparation for Joint Assembly

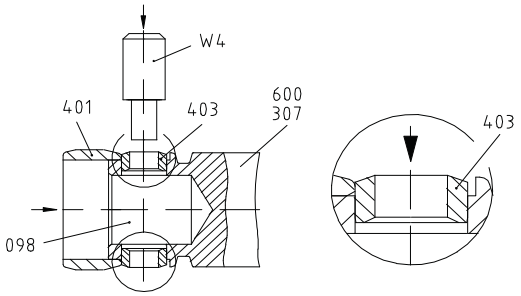
Remove any burr, flaws or similar defects from the plug-in shaft (307), then clean it.

3.0
Joint - Re-assembly

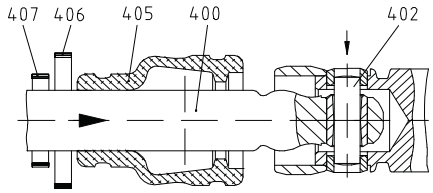
CAUTION

To guarantee the proper function of the joints, it is advisable to renew the coupling rod pins (402), guide bushes (403) and coupling rod bushes (404) all at the same time.

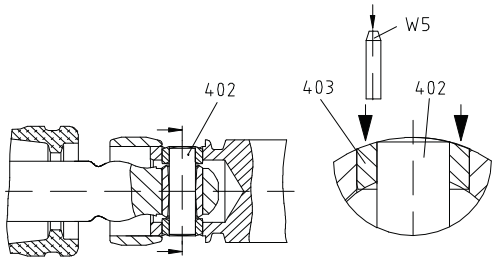
□Joint head on rotor (600) and plug-in shaft (307)
- Press guide bushes (403) in by only 2/3 of their length
- Fill joint head with joint grease (098)
- Slip on joint sleeve (401)



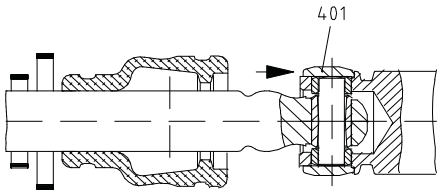
□Coupling rod (400)
Slide holding bands (406/407).
Moisten inner surface of universal joint sleeve (405) with joint grease and slide it.
Push coupling rod (400) into joint head.
Push in coupling rod pin (402).



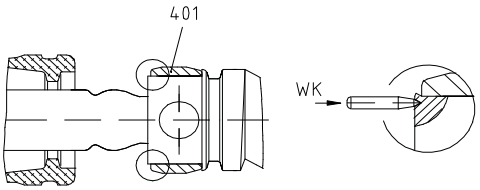
□Guide bush (403)
Press in



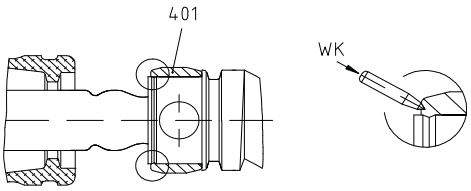
Retaining sleeve (401)



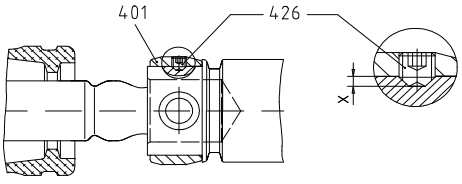
Securing of retaining sleeve
For drive shafts, plug-in shafts and rotors made of unhardened materials such as St 70, AISI 304, AISI 316, Hastelloy C, secure 2 x 180° offset indents



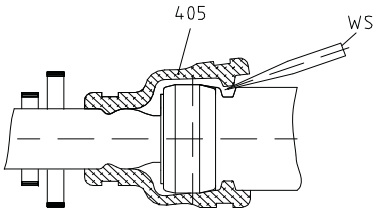
For rotors made of hardened materials such as tool steel (AISI D6), 1.2842, secure 2 x 180° offset indents



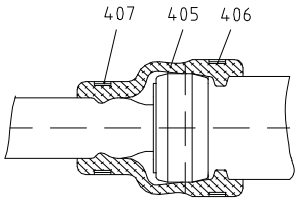
- For rotors made of synthetic material, secure using set screw (426). During this process, point of set screw presses into the synthetic surface (X). Set screw (426) is medium strengh secured by screw locking device /adhesive.



Universal joint sleeve (405)
Remove air from interior of joint



Holding bands re-assembly
Mount holding bands (406 and 407) as described in document OM.HBD.01.



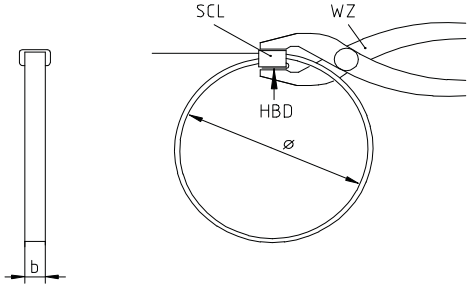
Holding Band (HBD) - Assembly

Prepare holding band

Only prefabricated double-band holding bands should be used. The diameter (∅) and in particular the breadth (b) of the holding band is matched to the universal joint sleeve.

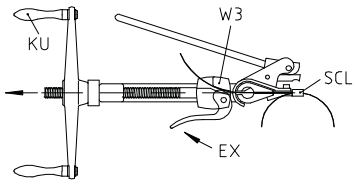
Test holding band

The bent holding band (HBD) must fit against the holding band loop (SCL), if necessary apply pressure

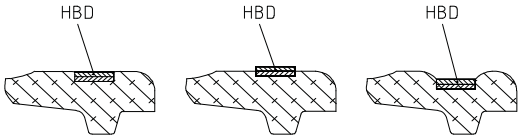


Assembly of holding band

While holding one end of the holding band, hold free end with control lever (EX), turn crank (KU) until the holding band is strained and fitting against the holding band loop (SCL). Carefully contract holding band until it fits inside the circular groove of the universal joint sleeve.



Correct holding band tension (HBD)



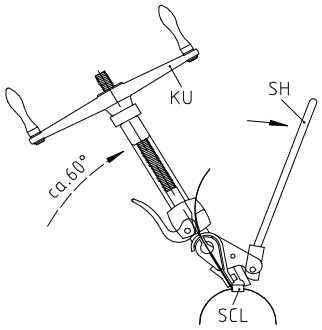
Correct
Holding band (HBD) has slightly con-tracted outer form of univers-al joint sleeve and is stuck in position.

Incorrect
Holding band (HBD) is too slack and liable to slip.

Incorrect
Holding band (HBD) is too tight. Universal joint sleeve will be damaged/sheared off.

Folding back the holding band (HBD)

Slowly swivel mounting tool upward by 60°, at the same time slackening the crank (KU) by approximately one half revolution. Swivel cutting lever (SH) forward until the pressure plate fits against the holding band loop (SCL).

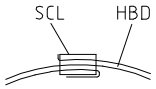


Shearing off holding band (HBD) made of material AISI 304 and AISI 316

A blow with the palm of the hand against the cutting lever (SH) causes the end of the holding band behind the loop (SCL) to be folded back and sheared off. If the holding band on the sheared off side is slightly raised as a result, it must be straightened carefully.

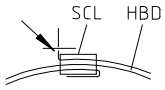
CAUTION

Never tap or hammer against the loop of the holding band (SCL), otherwise damage to the universal joint sleeve may occur.



Shearing off holding band (HBD) made of Hastelloy C

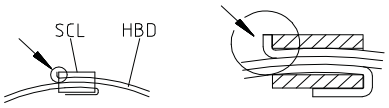
The high strength of this material makes it impossible to shear off the holding band (HBD) with the cutting lever (SH). Once the end of the holding band is folded back, cut off the holding band (HBD), file off projecting edges and remove burr.



Check after mounting of holding band

The holding band must run all the way round the groove of the universal joint sleeve.

The holding band (HBD) must be bent back and sheared off at the holding band loop (SCL) in such a way that the holding band (HBD) is unable to slip back through the holding band loop (SCL). If this has not been accomplished, then the holding band (HBD) must be replaced by a new one.



Breakdown										seepex progressive cavity pumps will operate trouble-free if they are used in accordance with our data sheet (see item 9) and our operating and maintenance instructions:	
pump has no suction	pump conveys irregularly	the conveying capacity is not achieved	pressure is not achieved	pump does not start	pump has seized or has stopped conveying	pump operates noisily	motor becomes too warm	the stator wears out early	shaft sealing leaks		
1	2	3	4	5	6	7	8	9	10		Reasons / Remedies
				X			X			a	Adhesion between rotor and stator excessive (as delivered). Lubricate (soft soap, genuine soap) between stator and rotor. Then turn the pump by means of the tool W2 .
X										b	Check rotational direction of the pump per data sheet and nameplate. In case of wrong direction, change wiring of motor.
X	X	X			X	X				c	Suction pipe or shaft sealing leak. Eliminate the leakage.
X	X	X				X				d	Suction head too high (item 6.5.3.1). Check suction head with vacuum gauge. Increase the suction pipe diameter and fit larger filters. Open the suction valve fully.
X	X	X								e	Viscosity of the liquid too high. Check and accommodate per data sheet.
		X		X			X			f	Wrong pump speed. Correct pump speed per data sheet.
	X	X								g	Avoid inclusions of air in the conveying liquid.
		X		X	X		X	X		h	Pressure head too high (point 6.5.3.2). Check pressure head with manometer. Reduce the pressure head by increasing the pressure pipe diameter or by shortening the pressure pipe.
X	X	X			X			X		i	Pump runs partially or completely dry (point 6.5.2). Check flow in the suction chamber. Install dry running protection TSE.
						X	X			j	Check coupling, possibly pump shaft is misaligned to drive. Check whether coupling gear is worn. Realign coupling. The coupling gear has perhaps to be replaced.
X		X								k	Speed too low. Increase the speed when high suction performances are required and when the liquid is very thin.
X	X					X				l	Speed too high. Reduce the speed when pumping products with high viscosities - danger of cavitation.
						X				m	Check the axial play in the coupling rod linkage. Check that the bush has been installed correctly see document OM.PJT.__.
X		X		X	X			X		n	Check for foreign substances in the pump. Dismantle the pump, remove foreign substances and replace worn parts.
X		X	X		X					o	Stator or rotor worn. Dismantle the pump and replace defective parts.
X		X			X	X				p	Joint parts worn. Replace worn parts and fill with special pin joint grease .
X		X			X			X		q	Suction pipework partially or completely blocked. Clean suction pipework.
X				X	X		X	X		r	Temperature of the pumping liquid too high. Excessive expansion of the stator. Check temperature and install rotor with diameter smaller than specified.
X		X		X			X		X	s	Gland packing too strongly tightened or worn. Ease or tighten stuffing box. Replace defective packing rings.
X				X	X			X		t	Solid contents and/or size of solids too large. Reduce pump speed and install perhaps a screen with suitable meshes. Increase fluid share.
X				X				X	X	u	When the pump is non operational the solids settle out and become hard. Clear and flush the pump immediately.
X				X	X			X	X	v	The liquid becomes hard when temperature falls below a certain limit. Heat the pump.
				X	X		X	X		w	Stator swollen and unsuitable for the pumped liquid. Select a suitable stator material. Use perhaps rotor with diameter smaller than specified.
						X			X	x	The bearing in the drive casing of the pump or in the drive engine is defective. Replace bearing.
									X	y	Mechanical seal defective. Check seal faces and O-rings. If necessary replace corresponding defective parts.

9.0

Auxiliary SEEPEX Documentation

Order No.	**P02010844**
Data sheet	**881591-881592**
Version 1	**Item 10**

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SEEPEX Inc.
511 Speedway Drive
Enon, OH 45323
Phone (937) 864-7150
sales.us@seepex.com
www.seepex.com

SEEPEX

Order No.	P02010844
Date	7/14/2021
Commission no.	881591-881592
Offer No.	500214077/2 - 10

Customer

	Hart Engineering Corporation
Purchase order no.	9722.101
Project	Taunton, MA - Veolia

qty.: 2

Progressive cavity pump

BN 52-6LS / A1-C1-L8-F0-GA

Application data

U 000 SLB003

Conveyed product	thickened sludge
Flowability	flowable
Viscosity	low viscosity (< 500 cP/mPas)
Solids content	2-5 %
Size of solids	≤ 2 mm
Density	unknown, 1 kg/dm³ assumed
Product temperature	32°F - 113°F
pH value	5-9
Kind of operation	continuous
Operating hours	8 h/day
Location	indoor, dry atmosphere
Altitude of installation	up to 1000 m assumed
Surrounding temperature	normal (32-104 °F)

Performance data

	Capacity	**Pressure**	**Speed**	
	50 USGPM	22 psi	87 rpm	min
	140 USGPM	22 psi	240 rpm	norm
	190 USGPM	22 psi	325 rpm	max
Starting torque	285 lb.ft			
Req. operating power at pump shaft	6 HP			
Inlet pressure	flooded suction (up to 0,5bar)			
NPSHr	15.77 ft			

Tolerances according to SEEPEX standards.

Materials and executions

Installation	horizontal
Direction of rotation	counter clockwise (left)
Lantern - Design	with cover plates
Lantern - Material	EN-JL 1040 (gci-25)
Lantern - Flange diameter	250 mm
Suction casing - Design	cleanouts on both sides
Suction casing - Material	EN-JL 1040 (gci-25)
Pressure branch - Design	standard
Pressure branch - Material	EN-JL 1040 (gci-25)
Position of branch	position 1
Suction connection	NPS 5, drilled acc. to ASME B 16.5, Class 150, RF
Pressure connection	NPS 5, drilled acc. to ASME B 16.5, Class 150, RF
Joint - Design	rotorsided UJ-sleeve prot. 1.4404, divided
Joint - Material	standard, holding bands 1.4301
Joint - Universal joint sleeve: material	NBR - Perbunan

Joint - Joint Grease	joint grease SEEPEX 30321
Coupling rod - Design	standard
Coupling rod - Material	1.4021 / AISI 420
Rotor - Design	Smart Rotor-design
Rotor - Undersize	Smart Rotor-design
Rotor - Material	1.0503 (C45) / AISI 1045
Rotor - Coating	ductile chromium coating
Stator - Design	smart stator design, with TSE, sensor sleeve 1.4404
Stator - Material	NBR - Perbunan
Shaft sealing	mechanical seal
Code	GA - single acting mechanical seal
Shaft diameter	70 mm
Make	SEEPEX
Rotating/stationary seal face	SiC SiC
Elastomers	FPM
Spring	1.4571 / AISI 316Ti
Metal parts	1.4571 / AISI 316Ti
Type	GA Q1Q1 VGG
Casing - material	1.4408 / ASTM A351 grade CF8M
Casing - connection standard	NPT
Plug-in Shaft - Design	standard
Plug-in Shaft - Material	1.4021 / AISI 420
Plug-in Shaft - Drilling diameter	40
Plug-in Shaft - Drilling depth	75
Bolting - Design	standard
Painting - Number of colors	single-colored standard
Painting - Painted components	complete combination
Painting - Color	Standard Enamel (SEEPEX Blue)
Painting - Surface protection	std. surface protection C2 (NDFT 95 µm)

Drive

Drive Type	Gear motor at freq. inv.
Type	Gearmotor
Make	Nord
Model	SK42F-132MP/4
Mounting position	M1
Ratio (i)	5.1
Speed	346 rpm
Flange diameter	250 mm
Shaft diameter	40 mm
Shaft length	80 mm
Shaft drawing	716/0170-002B4

	Norm	Min	Max
Speed	184 rpm	87 rpm	325 rpm
Motor speed	1236 rpm	459 rpm	1677 rpm
Frequency	42 Hz	15 Hz	56 Hz

Rated output	10 HP
Power factor	0.77
Rated speed	1765 rpm
Starting	direct on frequency inverter
Efficiency class	premium efficiency
Voltage	230/460 V
Frequency	60Hz
Rated current	26,7 / 13,4

Thermal class	F
Enclosure	IP55

Baseplate

Design	baseplate for block pump, design with side feet
Material	steel, painted
GPU Type Code	B-ST-LS

TSE

Design	standard design, complete - sensor sleeve fitted to the stator of the pump with integrated temperature sensor - connection head (IP55) - separate TSE control device suitable for mounting inside a control panel
Voltage	110-115 V / 50-60 Hz
Temperature coefficient	NTC
Material sensor sleeve	1.4404 / AISI 316L
Material connection head	aluminium

Quality Assurance

Design	HI Hydrostatic Test (150% working pressure for 5 minutes)
Document Standard	SEEPEX form FO.QA.35e
QA Testing Mode	SEEPEX standard

Quality Assurance

Design	API Performance Test (test at 30%, 60%, 90% & 100% of rated capacity)
Document Standard	SEEPEX form FO.QA.42e
QA Testing Standard	API 676
QA Testing Mode	SEEPEX standard

Documentation

Dimensional drawing	262-C18/0520-S-721A4
Sectional drawing	062-062D1
Mechanical seal drawing	262-0GA/0170-0-084A3
Operation Manual	2 x Print English (US)

Characteristic Curves
Size
52–6LS

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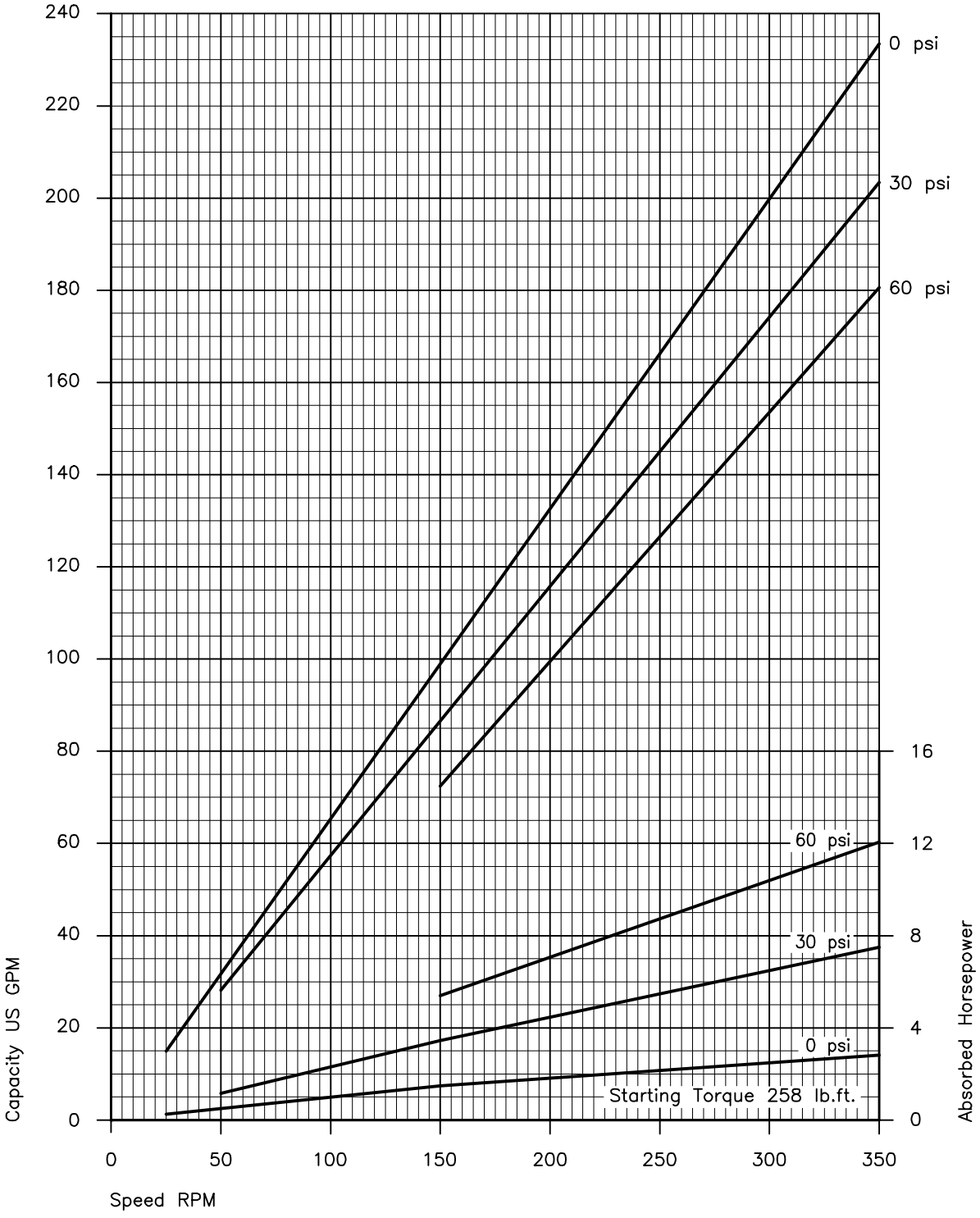
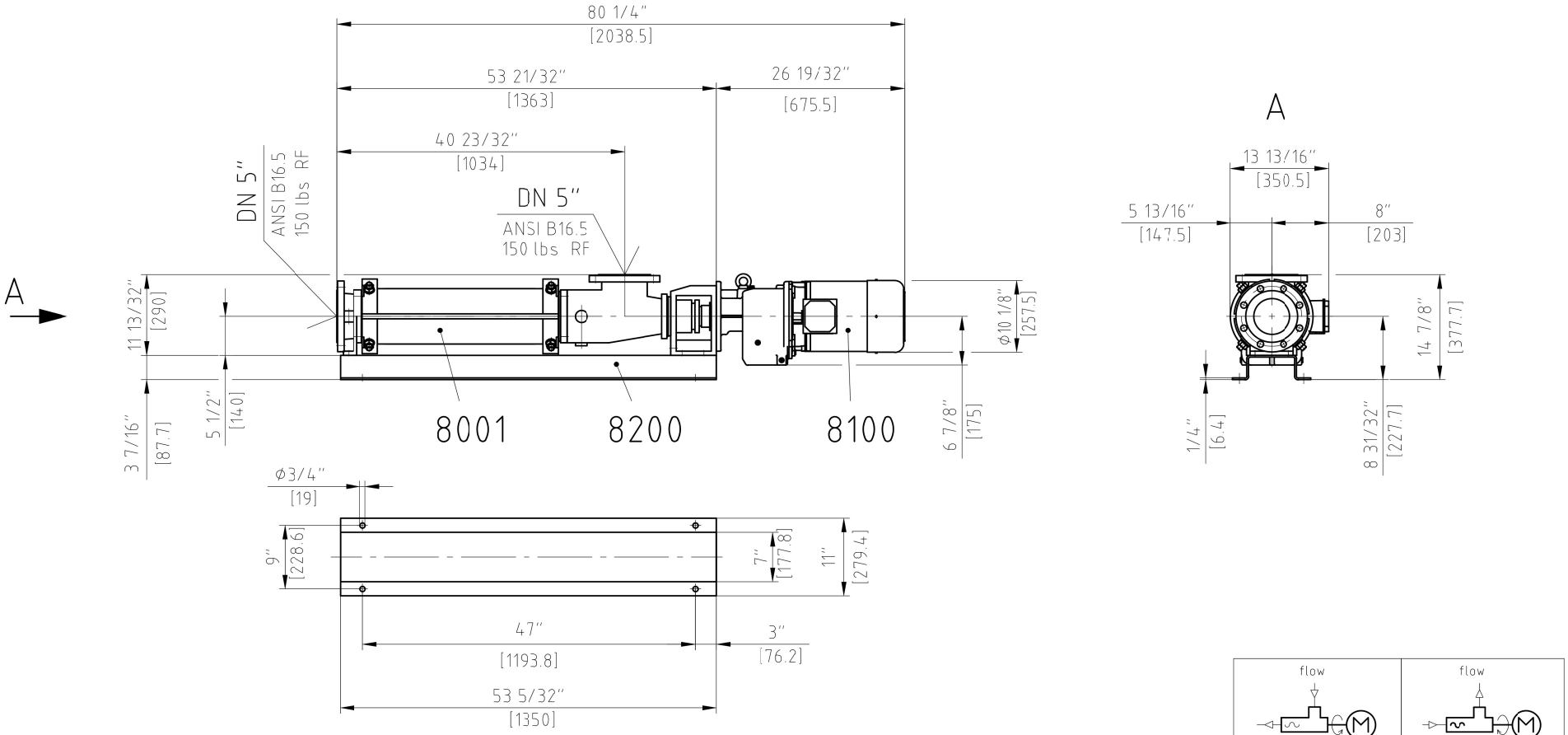


Values based upon water 68°F ; For notes on drive selection refer to PER

CHA.52–6LS_4, C 05.15us

verbindlich für Kommissions-Nr.:
binding for comission-no.: 881591-881592



dimensions in [...] are in millimeter

Quant.	Denomination	Item	Material	Note	Weight / kg
1	baseplate:	8200		Var.: 801-200/0520-A-100	22
1	drive: Nord SK42F-132MP	8100			112
1	pump: BN 52-6LS	8001			166

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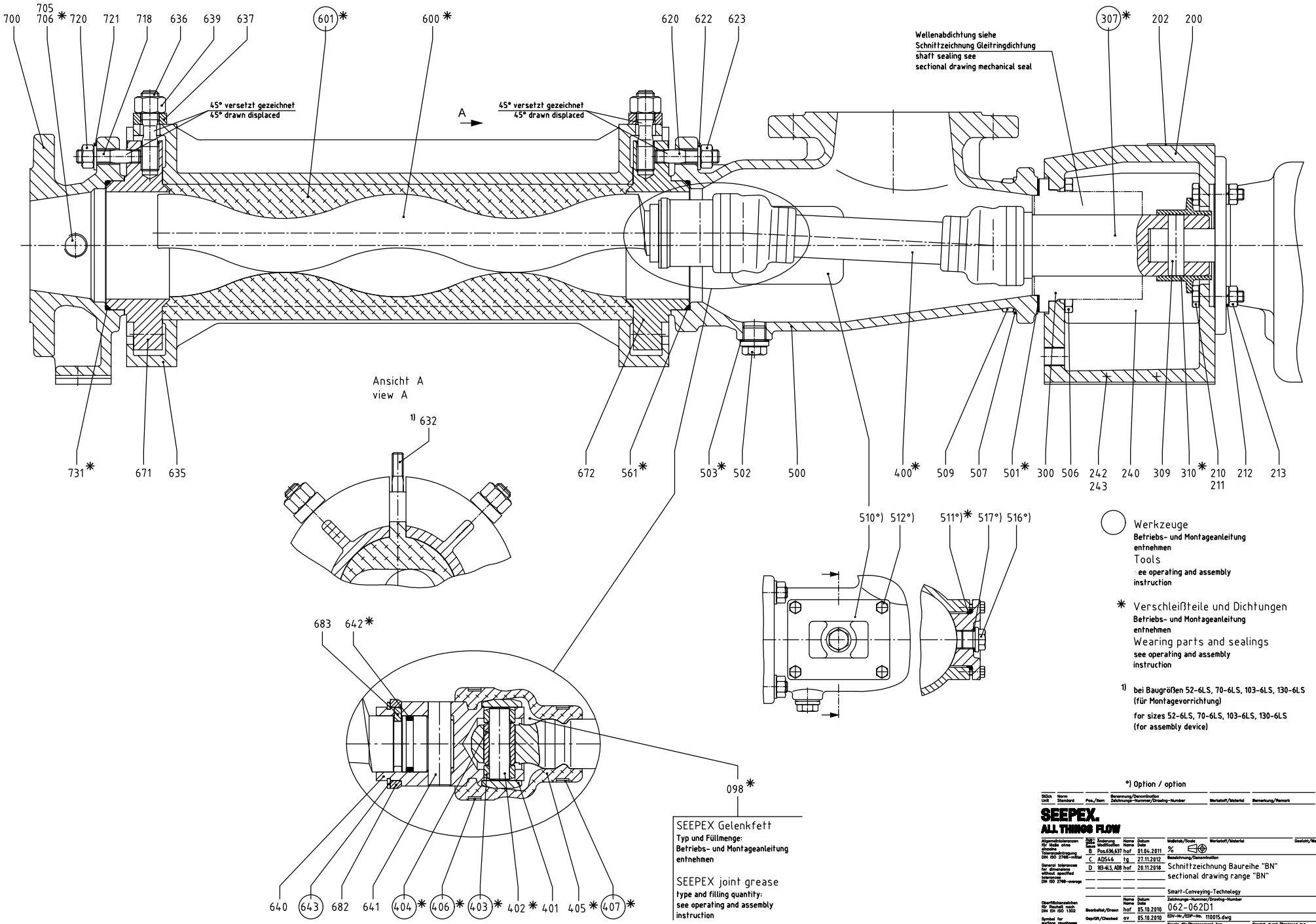
		Name	Day	Scale	Weight	Denomination
2017	Drawn	eba	12.04.	1:20	300 kg	dimensional drawing
	Checked	lsh	13.04.	EDP-No. 162477.dwg		Drawing-no. 262-C18/0520-S-721A4

General tolerances for dimensions without specified tolerances acc. to DIN ISO 2768-v



Werkzeuge
Betriebs- und Montageanleitung entnehmen
Tools
see operating and assembly instruction

* Verschleißteile und Dichtungen
Betriebs- und Montageanleitung entnehmen
Wearing parts and sealings
see operating and assembly instruction

1) bei Baugrößen 52-6LS, 70-6LS, 103-6LS, 130-6LS (für Montagevorrichtung)
for sizes 52-6LS, 70-6LS, 103-6LS, 130-6LS (for assembly device)

°) Option / option

SEEPEX Gelenkfett
Typ und Füllmenge:
Betriebs- und Montageanleitung entnehmen

SEEPEX joint grease
type and filling quantity:
see operating and assembly instruction

Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs-Nummer/Drawing-Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg

SEEPEX.
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Allgemeintoleranzen für Maße ohne einzelne Toleranzeintragung DIN ISO 2768-mittel	Index Status Basis	Änderung Modification	Name Name	Datum Date	Maßstab/Scale	Werkstoff/Material	Gewicht/Weight
General tolerances for dimensions without specified tolerances DIN ISO 2768-average	B	Pos.636,637	hof	01.04.2011	%		
	C	AD546	tg	27.11.2012	Bezeichnung/Denomination		
	D	103-6LS, ADB	hof	20.11.2018	Schnittzeichnung Baureihe "BN" sectional drawing range "BN"		
					Smart-Conveying-Technology		
Oberflächenzeichen für Rauheit nach DIN EN ISO 1302			Name Name	Datum Date	Zeichnungs-Nummer/Drawing-Number		
	Bearbeitet/Drawn		hof	05.10.2010	062-062D1		
Symbol for surface roughness acc. to DIN EN ISO 1302	Gepr/Ch/Checked		ov	05.10.2010	EDV-Nr./EDP-No. 110015.dwg		
	Normiert/Standard				Ersatz für/Replacement for:	Ersetzt durch/Replaced by:	
	Gedruckt/Printed						

Stückliste
Parts List
Liste des pièces

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Stck.	Pos.	DE Baureihe BN Schnittzeichnung Nr. 062-062D1 Benennung Stck. / Pos.	EN Range BN sectional drawing no. 062-062D1 denomination Qty. / Item	FR Série BN plan no. 062-062D1 désignation Qté. / Poste
1	200	Laterne	lantern	lanterne
1	202	Typenschild	type plate	palque signalitique
4	210	6kt-Schraube	hexagon bolt	vis
	211	6kt-Schraube	hexagon bolt	vis
4	212	Federring	spring washer	rondelle frein
4	213	6kt-Mutter	hexagon nut	écrou
2	240	Abdeckblech	cover plate	tôle de protection
4	242	Zylinderschraube	socket screw	vis à tête cylindrique
4	243	Federring	spring washer	rondelle frein
1	307	Steckwelle	plug-in shaft	arbre à broche
1	309	Steckwellenbolzen	plug-in shaft pin	cheville pour arbre à broche
1	310	Spritzring	splash ring	bague de projection
1	400	Kuppelstange	coupling rod	barre d' accouplement
2	401	Gelenkhülse	retaining sleeve	douille d' articulation
2	402	Kuppelstangenbolzen	coupling rod pin	axe d' articulation
4	403	Führungsbuchse	guide bushing	douille de guidage
2	404	Kuppelstangenbuchse	coupling rod bushing	chemise d' axe
2	405	Manschette	universal joint sleeve	manchette
2	406	Halteband	holding band	collier de serrage
2	407	Halteband	holding band	collier de serrage
1	500	Sauggehäuse	suction casing	carter d' aspiration
1	501	Sauggehäusedichtung	casing gasket	étanchéité du carter d' aspiration
3	502	Verschlussschraube	screwed plug	bouchon de vidange
3	503	Dichtring	sealing ring	joint d' étanchéité
4	506	6kt-Schraube	hexagon bolt	vis
4	507	Fächerscheibe	fan type lock washer	rondelle à dents chevauchantes extérieures
4	509	6kt-Mutter	hexagon nut	écrou
2	°) 510	Reinigungsdeckel	cleanout	couvercle de nettoyage
2	°) 511	Dichtung	gasket	étanchéité
8	°) 512	6kt-Schraube	hexagon bolt	vis
2	°) 516	Verschlussschraube	screwed plug	bouchon de vidange
2	°) 517	Dichtring	sealing ring	joint d' étanchéité
1	561	O-Ring	o-ring	joint torique
1	600	Rotor	rotor	rotor
2	601	Statorhälfte	statorhalf	stator moitié
4	620	Stiftschraube	stud bolt	boloun fileté
4	622	Scheibe	washer	rondelle
4	623	6kt-Mutter	hexagon nut	écrou
2	[1] 632	Stiftschraube	stud bolt	boloun fileté
4	635	Einstellsegment	adjusting segment	segment d'ajuster
8	636	Stiftschraube	stud bolt	boloun fileté
8	637	Scheibe	washer	rondelle
8	639	6kt-Mutter	hexagon nut	écrou
1	640	Rotorkopf	rotor head	tête de rotor
1	641	Rotorkopfbolzen	rotor head pin	boulon de tête de rotor
1	642	O-Ring	o-ring	joint torique
1	643	Sicherungsring	circlip	circlip
1	682	Stützring	support ring	bague d'appui
1	683	Sicherungsblech	locking plate	arrêt à aileron
1	671	Segmentaufnahme	segment retainer	réception de segment
1	672	Segmentaufnahme	segment retainer	réception de segment

Stückliste
Parts List
Liste des pièces

SEEPEX.
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Stck.	Pos.	DE	EN	FR
		Baureihe BN	**Range BN**	**Série BN**
		Schnittzeichnung Nr. 062-062D1	**sectional drawing no. 062-062D1**	**plan no. 062-062D1**
Stck.	**Pos.**	**Benennung Stck. / Pos.**	**denomination Qty. / Item**	**désignation Qté. / Poste**
1	700	Druckstutzen	pressure branch	bride de refoulement
1	705	Verschlussschraube	screwed plug	bouchon de vidange
1	706	Dichtring	sealing ring	joint d' étanchéité
4	718	Stiftschraube	stud bolt	boloun fileté
4	720	6kt-Mutter	hexagon nut	écrou
4	721	Scheibe	washer	rondelle
1	731	O-Ring	o-ring	joint torique
	098	SEEPEX Gelenkfett Typ und Füllmenge: Betriebs- und Montageanleitung entnehmen	SEEPEX joint grease type and filling quantity: see Operating and Assembly Instruction	SEEPEX graisse d' articulations sommaire pour type et quantité: voir Instructions de montage et de fonctionement
		Verschleißteile und Dichtungen: Betriebs- und Montageanleitung entnehmen	Wearing parts and sealings: see Operating and Assembly Instruction	pièces d'usure et étanchéités: voir Instructions de montage et de fonctionement
		Werkzeuge: Betriebs- und Montageanleitung entnehmen	Tools: see Operating and Assembly Instruction	Outils: voir Instructions de montage et de fonctionement
		Wellenabdichtung siehe Schnittzeichnung Gleitringdichtung	shaft sealing see sectional drawing mechanical seal	dispositif d' etanchéité voir vue éclatée garniture mécanique
	[1)]	bei Baugrößen 52-6LS, 70-6LS, 103-6LS, 130-6LS	for sizes 52-6LS, 70-6LS, 103-6LS, 130-6LS	pour taille 52-6LS, 70-6LS, 103-6LS, 130-6LS
		versetzt gezeichnet	drawn displaced	plan separé
	°)	Option	option	option

SEEPEX.
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When ordering parts from SEEPEX, call ahead and get a quote.
The Commission No. is needed.
Phone: 937-864-7150
Fax: 937-864-7157

Predicted Life / Recommended Spare Parts

Part Designation	2 Years	5 Years	Gasket Set	Corresponding Part Number to Sectional Pump Drawing
	Number			
Plug-in shaft		1		_307_
Plug In Shaft Pin		1		_309_
Splash ring		1		_310_
Mechanical Seal	*Subject to use and application*			_330_
Coupling Rod w/ coupling rod bushing		1		_400_
Universal Joint Kit		2		_401-407_
Casing Gasket			1	_501_
Rotor		1		_600_
Stator Half	1	1		_601_
Stator Half/w TSE	1	1		_601_
Holding Band Tool			1	_spec_

1. Intended application of universal joint protector (408)

The universal joint protector prevents irreparable damage of the joint seal (universal joint sleeve) when unpermitted solid particles enter the suction casing of the pump via the pumping flow.

2. Installation conditions for the universal joint protector (408)

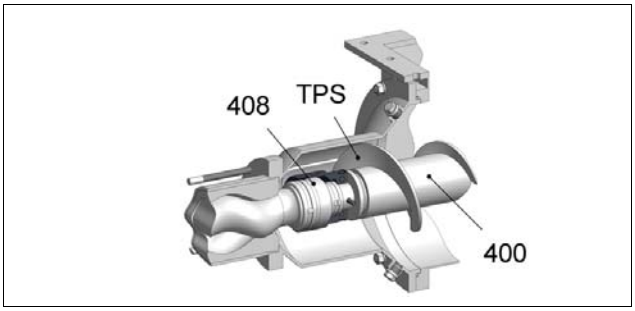
The following conditions must be fulfilled when installing the universal joint protector:

- Suction casing with enlarged cross section
  - Use a design with enough space in the area of the rotor-sided joint.

3. Universal joint protector (408) - divided version

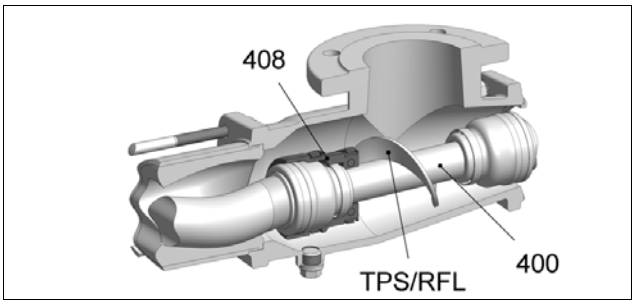
3.1 Use with pumps of series T

- Design applies to coupling rod **(400)** with auger feed screw **(TPS)**.
- Installation without joint separation possible.



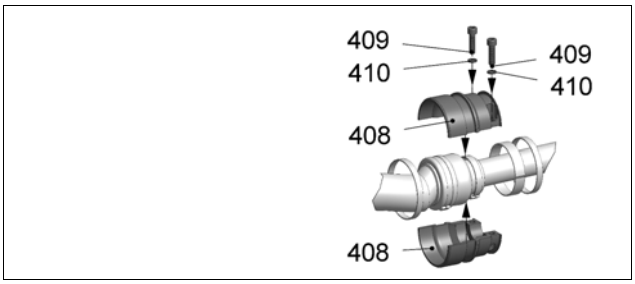
3.2 Use on pumps of size N with special coupling rod

- Design applies to coupling rod **(400)** with impeller **(RFL)** or auger feed screw **(TPS)**.
- Installation without joint separation possible.

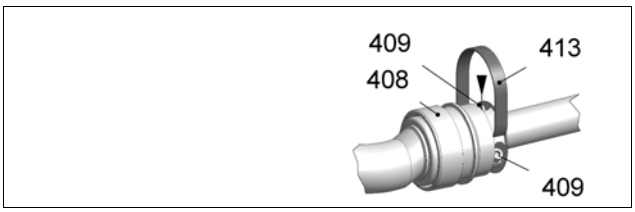


4. Assemble universal joint sleeve (408)

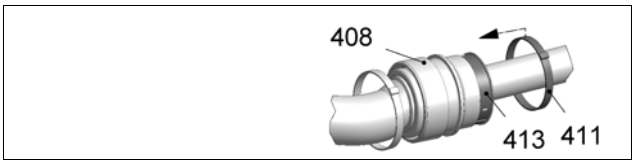
➢ Mount and secure universal joint protector **(408)** with screw fitting **(409, 410)**.
  – Use bolt locking agent/glue "medium-hard".



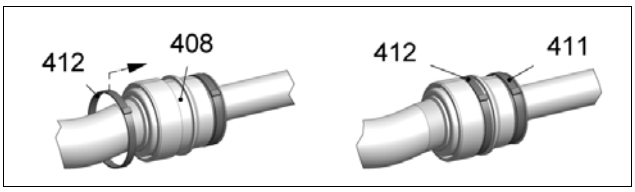
➢ Cover screw fitting **(409)** with rubber base **(413)**.



- Assemble holding band **(411)** on rubber base **(413)**.



- Mount additional holding band **(412)** on the universal joint protector **(408)** to secure it.



9.1 Pump with Smart Conveying Technology - SCT

Range: BN

Size: 52-6LS to 130-6LS

Version: New pump

Table of contents:

- For rotor/stator dismantling/reassembly, see chapters 9.1.1 and 9.1.2.
- For pump dismantling/reassembly, see chapters 9.1.3 and 9.1.4.

9.1.1 Stator (601), rotor (600) - dismantling - SCT

9.1.1.1 Preparing the pump for dismantling

DANGER

Dangerous voltage.
Death or serious injury can occur.

- Note safety regulations.
- Disconnect pump from all sources of energy.
- Secure electrical connections against restarting.

- Allow pipelines to cool.
- See chapter 6 of the operating and assembly instructions for instructions regarding decommissioning.

No space needs to be left for stator removal when dismantling/reassembling the stator and rotor.

9.1.1.2 Stator (601) - Dismantling

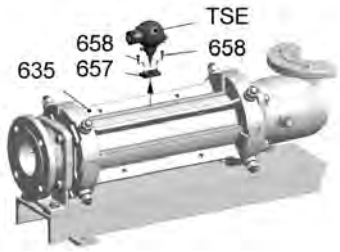
Pump with dry-running protection option (TSE)

- The holding device for the dry running protection (TSE) can get in the way when dismantling the adjusting segments (635).
- If this is the case, remove the holding device (657) and the self-tapping screws (658).

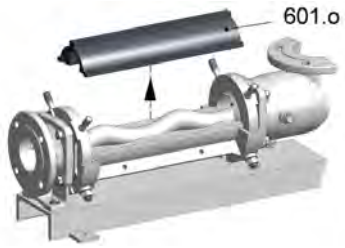
- Remove upper adjusting segments (635.o).
  - Conveying product can escape.

Pump with dry-running protection option (TSE)

- Mount self-tapping screws (658) and holding device (657).

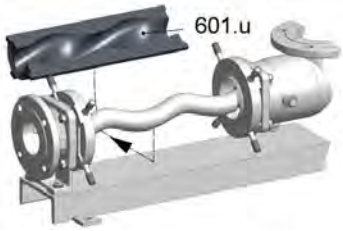


- Remove upper half of the stator (601.o).
  - Conveying product can escape.



- Dismantle adjusting segments (635.u).
  - Secure adjusting segments (635.u) to prevent them from falling down.

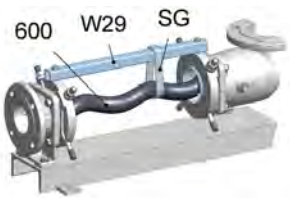
- Remove lower half of the stator (601.u) smoothly.
  - Conveying product can escape.



9.1.1.3 Rotor (600) - dismantling

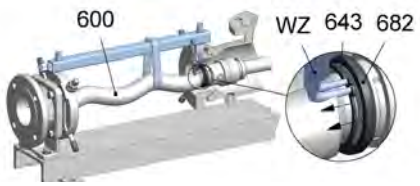
Tool (W29/lifting equipment incl. lashing strap)

- Secure rotor (600).
  - Use tool (W29).

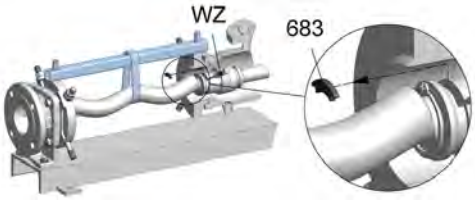



Tool (WZ/circlip tongs 45°)

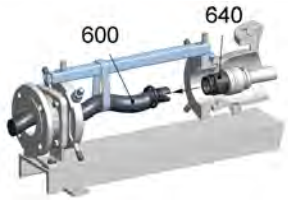
- Spread the circlip (643) wide enough so that it can be released.
  - Use tool (WZ).
- Slide circlip (643) towards rotor (600).
- Slide support ring (682) towards rotor (600).



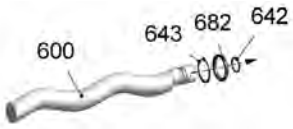
- Remove the lock washer (683).
  - Use a suitable tool (WS).



- Remove rotor (600) from rotor head (640).



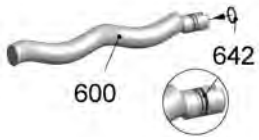
- Remove support ring (682), circlip (643) and O-ring (642) from rotor (600).



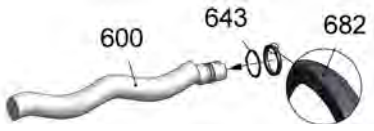
9.1.2 Rotor (600), stator (601) - reassembly - SCT

9.1.2.1 Rotor (600) - reassembly

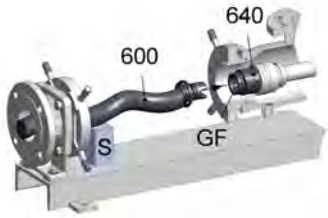
- Insert O-ring (642) in rotor (600) groove.



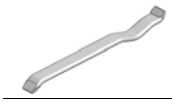
- Slide circlip (643) and support ring (682) onto rotor (600).
  - Note the fitting position of support ring (682).



- Coat the inner surfaces of the rotor head (640) with graphite petroleum.
- Slide rotor (600) into rotor head (640).

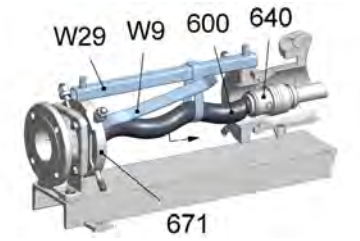


Tool (W29/lifting equipment incl. lashing strap)

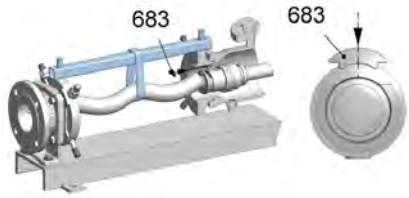


Tool (W9/mounting lever)

- Secure rotor (600).
  - Use tool (W29).
- Press rotor (600) on the rotor head (640) with tool (W9/mounting lever).
  - Protect segment mount (671) against possible deformation.
  - Ensure lock washer (683) is installed.

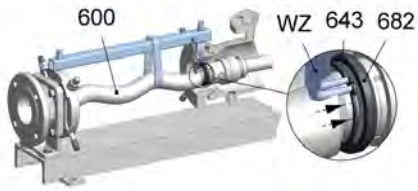


- Insert the lock washer (683).



Tool (WZ/circlip tongs 45°)

- Push on support ring (682).
- Spread the circlip (643) wide enough that it can be pushed on.
  - Use tool (WZ).
- Secure support ring (682) with circlip (643).



9.1.2.2 Stator (601) – Reassembly

- For easier assembly, moisten sealing surfaces, geometry of the stator halves and rotor with soft soap.
  - Do not moisten the outer surfaces of the stator with soft soap.

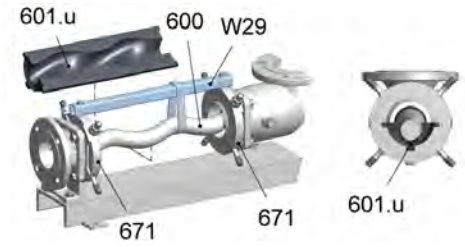
NOTICE

Coating the stator outer surfaces
Damage to property can occur

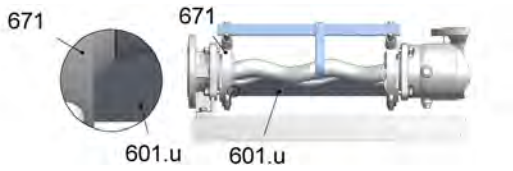
- Remove any coating on the stator outer surfaces.
- Coat only the stator internal surfaces.

Tool (W29/lifting equipment incl. lashing strap)

- Secure rotor (600).
  - Use tool (W29).
- Attach the lower half of the stator (601.u).
- Press the stator half (601.u) onto the tapered surfaces of the segment receiver (671) and align it.



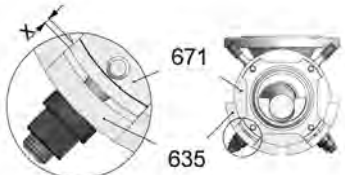
- Avoid damage to the stator surfaces.
- The tapered stator surface (601.u) is in contact with the segment retainer (671) tapered surface.



- Observe the segment order.
  - * = A-A, B-B, C-C, D-D

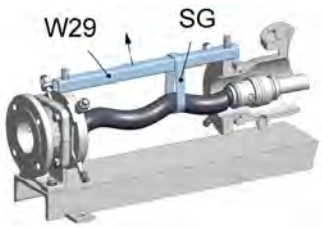
- Secure the lower half of the stator (601.u).
  - Fix the lower adjusting segments (635) to the segment retainer (671).

- Tighten the screws until the adjusting segments (635) interlock with the guide of the segment retainer (671) (detail x).

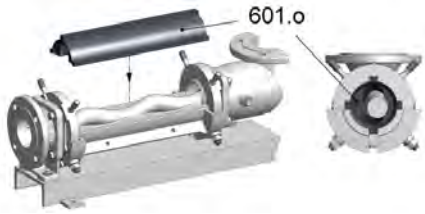


Tool (W29/lifting equipment incl. lashing strap)

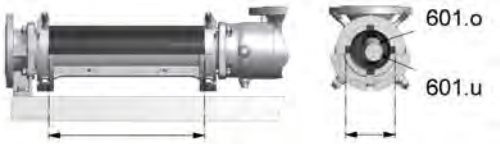
- Remove the tool (W29).



➢ Attach the upper half of the stator (601.o).

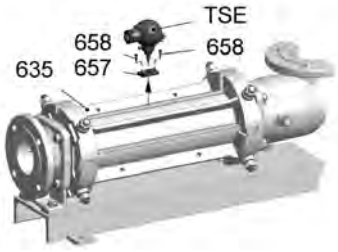


➢ Align the long side of the upper half of the stator (601.o) to the lower half of the stator (601.u).



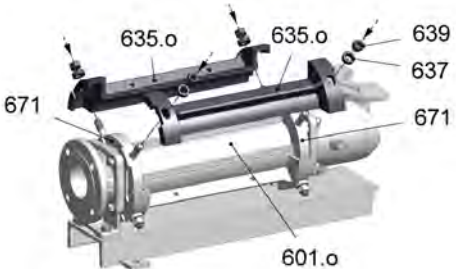
Pump with dry-running protection option (TSE)

- The holding device for the dry running protection (TSE) can get in the way when dismantling the adjusting segments (635).
- If this is the case, remove the holding device (657) and the self-tapping screws (658).



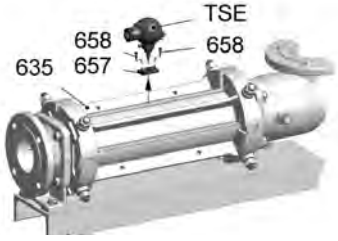
➢ Observe the segment order.
  – * = A-A, B-B, C-C, D-D

➢ Secure upper half of the stator (601.o).
  – Fix the upper adjusting segments (635) on the segment retainer (671).

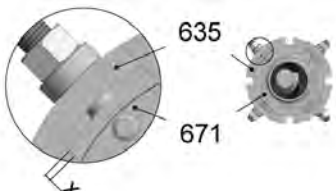


Pump with dry-running protection option (TSE)

➢ Mount self-tapping screws (658) and holding device (657).



➢ Tighten the screws until the adjusting segments (635) interlock with the guide of the segment retainer (671) (detail x).

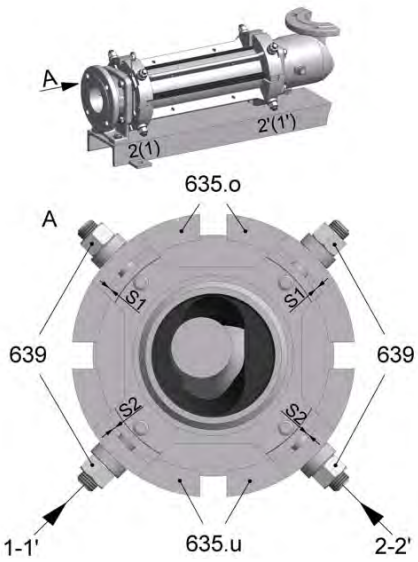


9.1.2.3 Smart Stator setting

NOTICE
Stator is leaky! Damage to property can occur. ➢ A gap between the stator halves is not allowed.

Alignment of the adjusting segments (635)

- ➢ Align the gap (S2) of the lower adjusting segments (635.u) to the gap (S1) of the upper adjusting segments (635.o).
- ➢ Tighten screws of the adjusting segments (635.u) evenly using the hexagon nuts (639) in 180° / 90° steps.
- ➢ Observe the order.
  - – 1-1', 2-2'



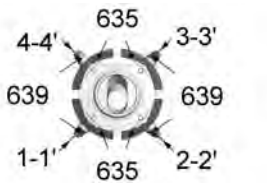
Adjusting segment basic setting

Tool (W30/feeler gauge).

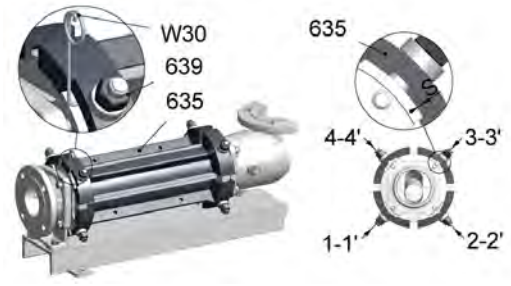
5-6LS, 10-6LS => 3 mm

17-6LS - 130-6LS => 4 mm

- ➢ Tighten screws of the adjusting segments (635) evenly using the hexagon nuts (639) in 180°/90° steps.
- ➢ Observe the order.
  - – 1-1', 2-2', 3-3', 4-4'



- ➢ Use tool (W30) for setting the gap (S) at the setting nuts (639).
- ➢ Tighten the screws of the adjusting segments (635) until there is resistance from the tool (W30).

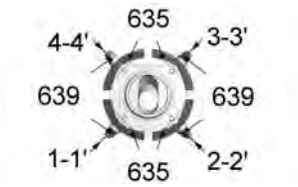


Fine adjustment of the pump parameters:

Fine adjustments for the pump parameters can be made by evenly adjusting the nuts at the adjusting segments (635).

- +10° = increases clamping.
- -10° = reduces clamping.

➢ Observe the order.
  – 1-1', 2-2', 3-3', 4-4'



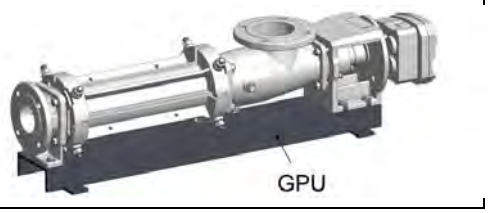
NOTICE
Motor overload Damage to property can occur. ➢ Do not exceed motor's maximum power consumption.

9.1.3 Pump - dismantling - SCT

WARNING

Risk of pump tipping or falling.
Death or serious injury can occur.

- Fasten the base plate (GPU) to secure the pump.



9.1.3.1 Preparing the pump for dismantling

DANGER

Dangerous voltage.
Death or serious injury can occur.

- Note safety regulations.
- Disconnect pump from all sources of energy.
- Secure electrical connections against restarting.

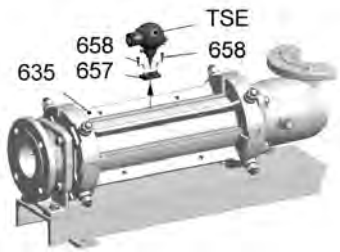
- Allow pipelines to cool.
- See chapter 6 of the operating and assembly instructions for instructions regarding decommissioning.

No space needs to be left for stator removal when dismantling/reassembling the stator and rotor.

9.1.3.2 Stator (601) - Dismantling

Pump with dry-running protection option (TSE)

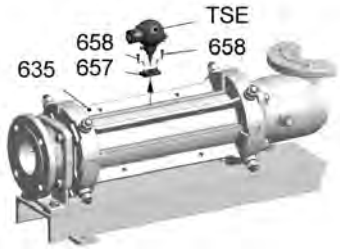
- The holding device for the dry running protection (TSE) can get in the way when dismantling the adjusting segments (635).
- If this is the case, remove the holding device (657) and the self-tapping screws (658).



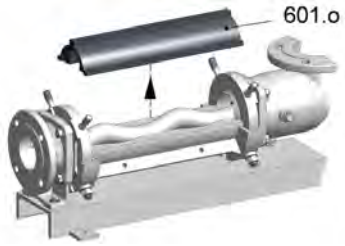
- Remove upper adjusting segments (635.o).
  - Conveying product can escape.

Pump with dry-running protection option (TSE)

- Mount self-tapping screws (658) and holding device (657).

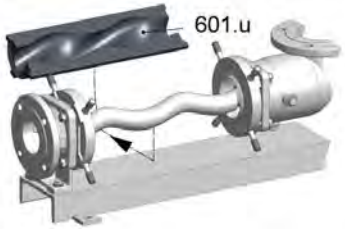


- Remove upper half of the stator (601.o).
  - Conveying product can escape.



- Dismantle adjusting segments (635.u).
  - Secure adjusting segments (635.u) to prevent them from falling down.

- Remove lower half of the stator (601.u) smoothly.
  - Conveying product can escape.



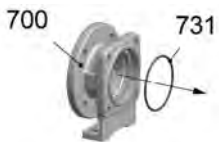
9.1.3.3 Pressure branch (700) - Dismantling

- Prop up the rotor (600) with lining plate (S).
- Dismantle the pressure branch (700).

Segment retainer (671) - dismantling - pressure branch

- Dismantle the segment retainer (671) on the pressure branch (700).

- Remove the O-ring (731) from the centring recess on the pressure branch (700).



9.1.3.4 Suction casing (500) - Dismantling

- Fit rotor (600) with protective cover (SH).
- Prop up the rotor (600) with lining plate (S).
- For shaft seals with cartridge units, see chapter 9.4 of the operating and assembly instructions for instructions on how to dismantle the shaft seal.
- Remove the suction casing (500).

9.1.3.5 Segment retainer (671) - dismantling - pressure branch

- Dismantle the segment retainer (671) on the suction casing (500).

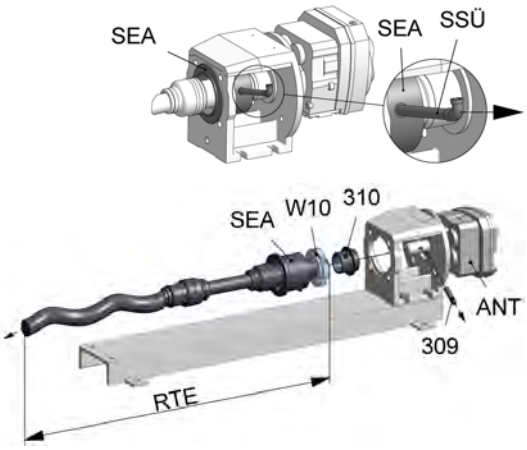
- Remove the O-ring (731) from the centring recess on the suction casing (ZA, 500).

9.1.3.6 Rotating unit (RTE) – Dismantling

with flush connection

Tool (W10/dismantling tool)

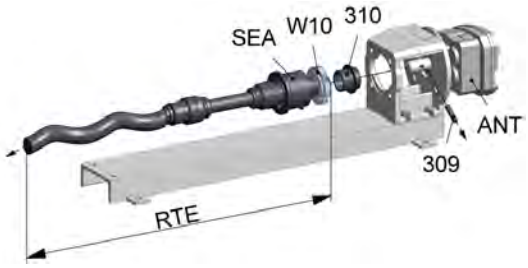
- Remove the flushing connection (SSÜ) on the casing of the shaft seal (SEA).
- Lift/slide splash ring (310) and turn out plug-in shaft pin (309).
- Pull the rotating unit (RTE) with shaft seal (SEA) off from the output shaft of the drive (ANT).
- Dismantle shaft seal (SEA).
  - Note dismantling the shaft seal (chapter 9._).



without flush connection

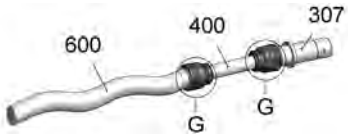
Tool (W10/dismantling tool)

- Lift/slide splash ring (310) and turn out plug-in shaft pin (309).
- Pull the rotating unit (RTE) with shaft seal (SEA) off from the output shaft of the drive (ANT).
- Dismantle shaft seal (SEA).
  - Note dismantling the shaft seal (chapter 9._).



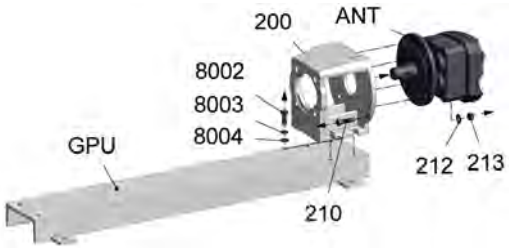
9.1.3.7 Rotor (600), coupling rod (400), plug-in shaft (307) - Dismantling

- Joint (G) dismantling note rotating unit - individual parts (chapter 9.2).



9.1.3.8 Lantern (200)/drive (ANT) - Dismantling

- Disconnect the drive (ANT) from the lantern (200).
- Remove the lantern (200) from the base plate (GPU).

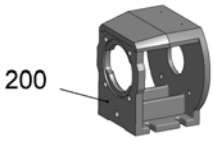


9.1.4 Pump - reassembly (SCT)

WARNING

Risk of pump tipping or falling.
Death or serious injury can occur.

- Fasten the lantern (200) to secure the pump.



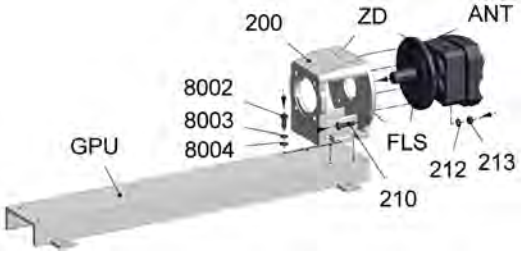
CAUTION

Risk of fingers being trapped.
Minor injuries can occur.

- Do not reach in between connections.

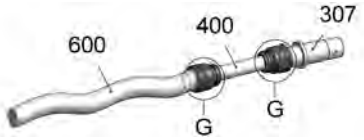
9.1.4.1 Base plate (GPU), lantern (200), drive unit (ANT) – reassembly

- Assemble the lantern (200) on the base plate (GPU).
- Clean the flange bearing surfaces (FLS), bolt circle (ZD) and output shaft of the drive (ANT).



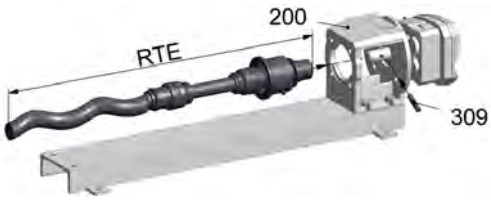
9.1.4.2 Rotor (600), coupling rod (400), plug-in shaft (307) - Reassembly

- Joint (G) reassembly note rotating unit - individual parts (chapter 9.2).



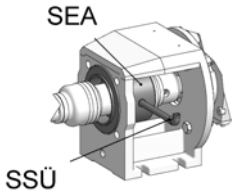
9.1.4.3 Rotating unit (RTE) - Reassembly

- Push on the shaft seal (SEA).
  - Note shaft seal reassembly. See chapter 9.4 of the operating and assembly instructions.
- Coat the splash ring (310)/plug-in shaft (307) with pin joint grease.
- Push the splash ring (310) onto the plug-in shaft (307).
  - Observe the fitting position of the splash ring (splash ring marking).
- Apply antiseize graphite petroleum to the drive unit's (ANT) drive shaft. Push on the rotating unit (RTE).
- Push in the plug-in shaft pin (309).
- Install the splash ring collar at a distance of 0.5 mm from the lantern (200).



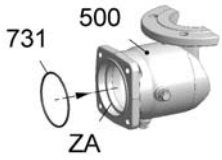
with flush connection

- Mount the flush connection.



9.1.4.4 Segment retainer (671), suction casing (500) - pre-assembly

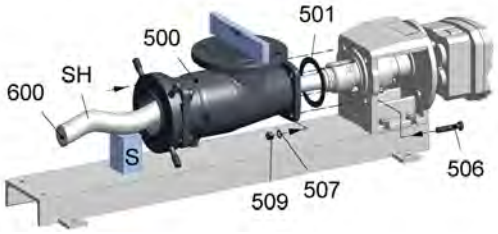
- Remove contaminants such as paint and corrosion from all seal faces/centring recesses (ZA).
- Coat O-ring (731) with soft soap.
- Insert the O-ring (731) into the centring recess on the suction casing (ZA, 500).



- Assemble the segment retainer (671) on the suction casing (500) and align it using a spirit level (W).

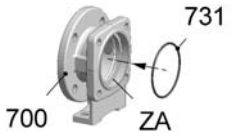
9.1.4.5 Suction casing (500) - Reassembly

- Provide rotor (600) with protective cover (SH).
- Prop up rotor (600) with support (S).
- Slide on casing gasket (501).
- Mount pre-assembled suction casing (500) and adjust (using spirit level).

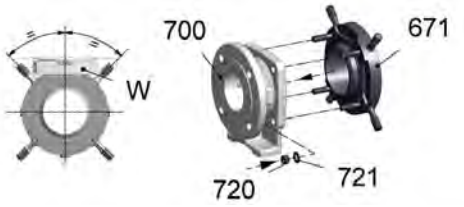


9.1.4.6 Segment retainer (671), pressure branch (700) – pre-assembly

- Remove contaminants such as paint and corrosion from all seal faces/centring recesses (ZA).
- Coat O-ring (731) with soft soap.
- Insert the O-ring (731) into the centring recess on the suction casing (ZA, 500).



- Assemble the segment receiver (671) on the pressure branch (700) and align it using a spirit level.



9.1.4.7 Pressure branch (700) – Reassembly

- Observe the segment order.
  - * = A-A, B-B, C-C, D-D

- Prop up the rotor with lining plate (S).
- Align the pressure branch (700)/lantern (200) axially and radially on the base plate (GPU).
  - If necessary, undo the connection to the base plate (GP).
  - Use at least 2 adjusting segments (635) opposite each other for the alignment. To secure, gently tighten the hexagon nuts (639).
- Assemble the pressure branch (700)/lantern (200) on the base plate (GPU).
- Remove adjusting segments (635).

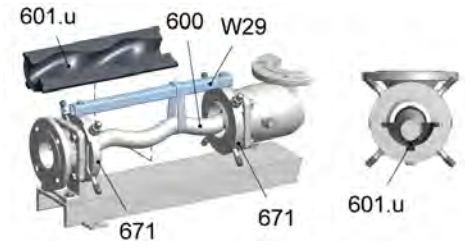
9.1.4.8 Stator (601) – Reassembly

- For easier assembly, moisten sealing surfaces, geometry of the stator halves and rotor with soft soap.
  - Do not moisten the outer surfaces of the stator with soft soap.

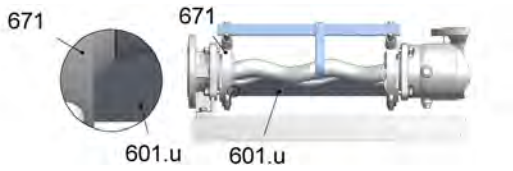
NOTICE
Coating the stator outer surfaces Damage to property can occur ➢ Remove any coating on the stator outer surfaces. ➢ Coat only the stator internal surfaces.

Tool (W29/lifting equipment incl. lashing strap)

- Secure rotor (600).
  - Use tool (W29).
- Attach the lower half of the stator (601.u).
- Press the stator half (601.u) onto the tapered surfaces of the segment receiver (671) and align it.



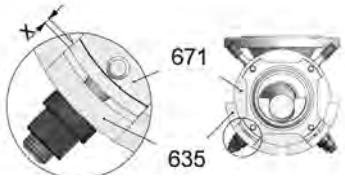
- Avoid damage to the stator surfaces.
- The tapered stator surface (601.u) is in contact with the segment retainer (671) tapered surface.



- Observe the segment order.
  - * = A-A, B-B, C-C, D-D

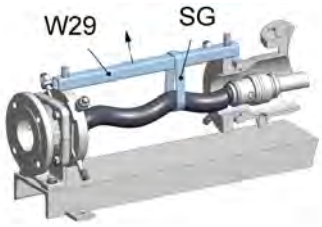
- Secure the lower half of the stator (601.u).
  - Fix the lower adjusting segments (635) to the segment retainer (671).

- Tighten the screws until the adjusting segments (635) interlock with the guide of the segment retainer (671) (detail x).

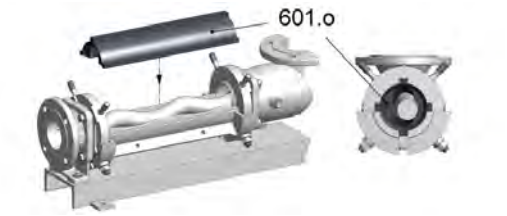


Tool (W29/lifting equipment incl. lashing strap)

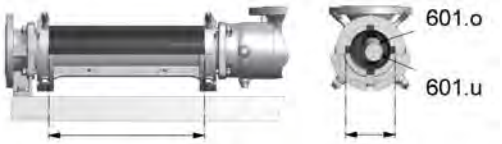
- Remove the tool (W29).



➢ Attach the upper half of the stator (601.o).

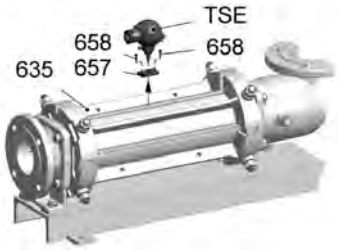


➢ Align the long side of the upper half of the stator (601.o) to the lower half of the stator (601.u).



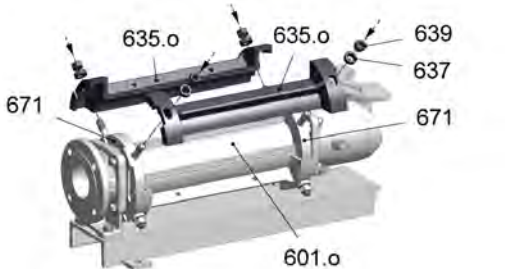
Pump with dry-running protection option (TSE)

- The holding device for the dry running protection (TSE) can get in the way when dismantling the adjusting segments (635).
- If this is the case, remove the holding device (657) and the self-tapping screws (658).



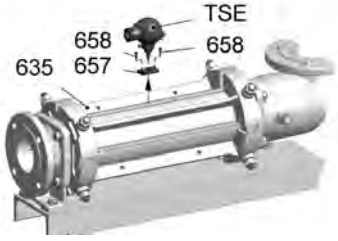
➢ Observe the segment order.
  – * = A-A, B-B, C-C, D-D

➢ Secure upper half of the stator (601.o).
  – Fix the upper adjusting segments (635) on the segment retainer (671).

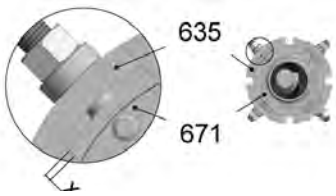


Pump with dry-running protection option (TSE)

➢ Mount self-tapping screws (658) and holding device (657).



➢ Tighten the screws until the adjusting segments (635) interlock with the guide of the segment retainer (671) (detail x).

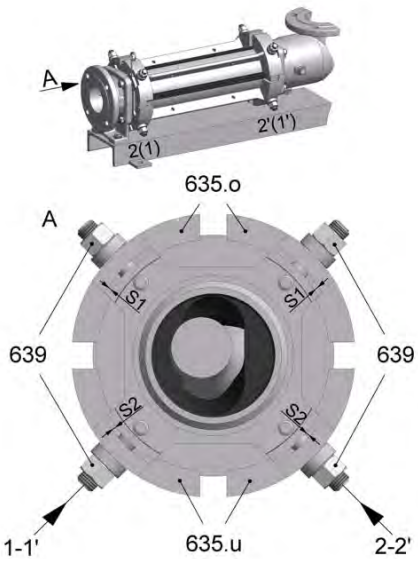


9.1.4.9 Smart Stator setting

NOTICE
Stator is leaky! Damage to property can occur. ➢ A gap between the stator halves is not allowed.

Alignment of the adjusting segments (635)

- ➢ Align the gap (S2) of the lower adjusting segments (635.u) to the gap (S1) of the upper adjusting segments (635.o).
- ➢ Tighten screws of the adjusting segments (635.u) evenly using the hexagon nuts (639) in 180° / 90° steps.
- ➢ Observe the order.
  - – 1-1', 2-2'



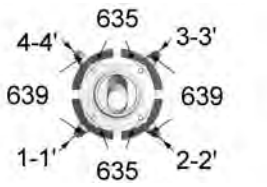
Adjusting segment basic setting

Tool (W30/feeler gauge).

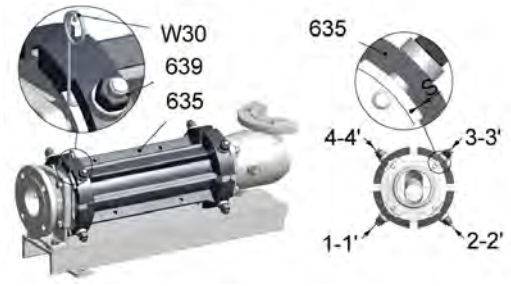
5-6LS, 10-6LS => 3 mm

17-6LS - 130-6LS => 4 mm

- ➢ Tighten screws of the adjusting segments (635) evenly using the hexagon nuts (639) in 180°/90° steps.
- ➢ Observe the order.
  - – 1-1', 2-2', 3-3', 4-4'



- ➢ Use tool (W30) for setting the gap (S) at the setting nuts (639).
- ➢ Tighten the screws of the adjusting segments (635) until there is resistance from the tool (W30).

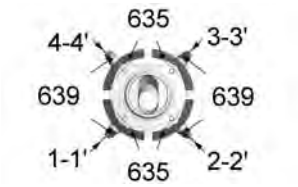


Fine adjustment of the pump parameters:

Fine adjustments for the pump parameters can be made by evenly adjusting the nuts at the adjusting segments (635).

- +10° = increases clamping.
- -10° = reduces clamping.

➢ Observe the order.
  – 1-1', 2-2', 3-3', 4-4'



NOTICE
Motor overload Damage to property can occur. ➢ Do not exceed motor's maximum power consumption.

1. Functioning of the dry-running protection device (TSE)

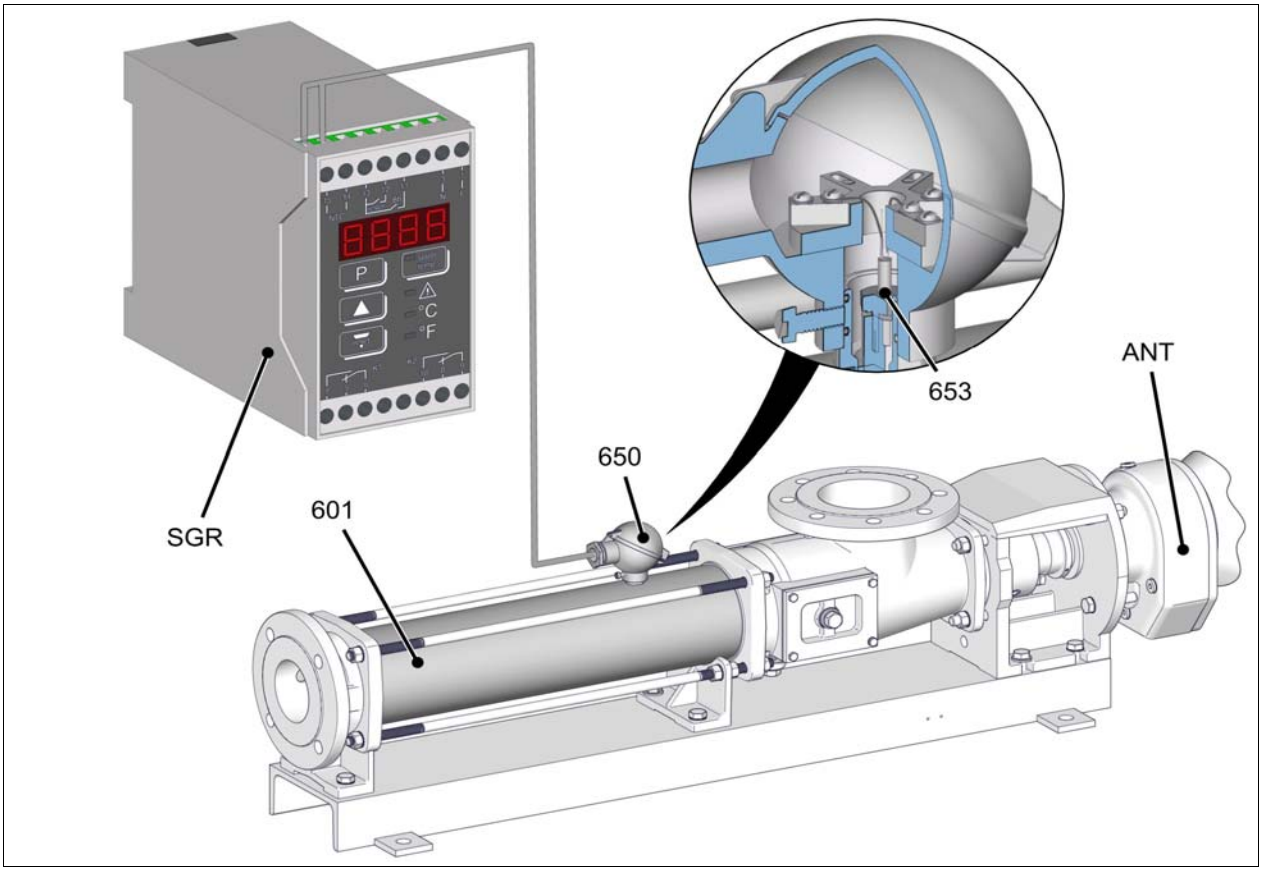


Figure similar

Item	Designation	Item	Designation
SGR	Control device	653	Thermistor sensor
601	Stator	ANT	Drive
650	Connection head		

- The temperature in the stator **(601)** is continuously compared with the set shut-off temperature at the TSE control device **(SGR)**.
- The temperature in the stator **(601)** is measured using a thermistor sensor **(653)** in the connection head **(650)**.
- Two relays switch in parallel within the TSE control device **(SGR)** on reaching the shut-off temperature.
  - An error message is triggered and the drive **(ANT)** of the pump can be shut off using potential-free change-over contacts.
- Automatic restart of the pump is prevented by a necessary acknowledgement of the error message.

2. Technical data of the dry-running protection device (TSE)

2.1. Structural design connection head (650)

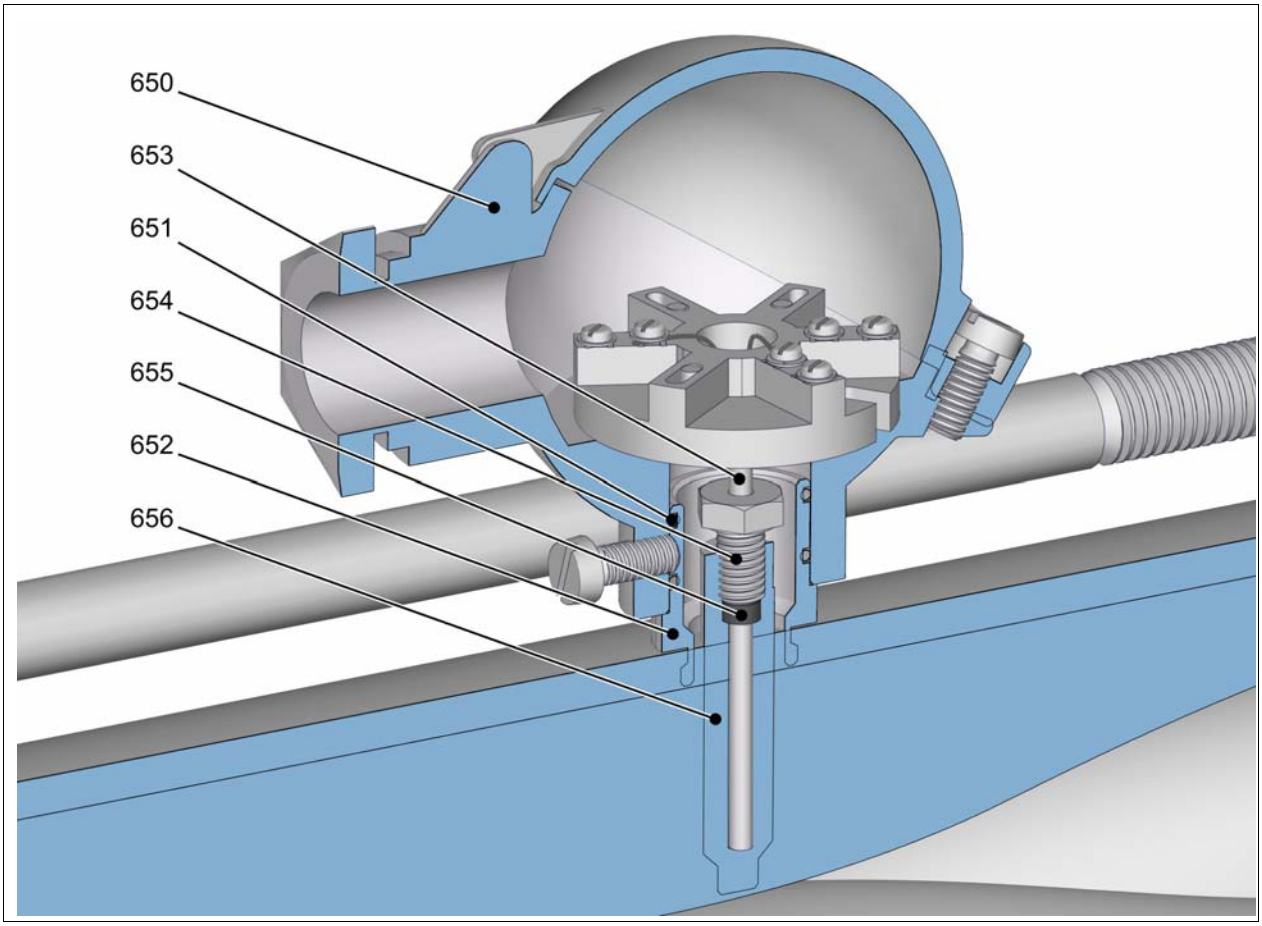


Figure similar

Item	Designation	Item	Designation
650	Connection head	654	Clamping screw
651	O-ring	655	Rubber ring
652	Screw socket	656	Sensor sleeve
653	Thermistor sensor		

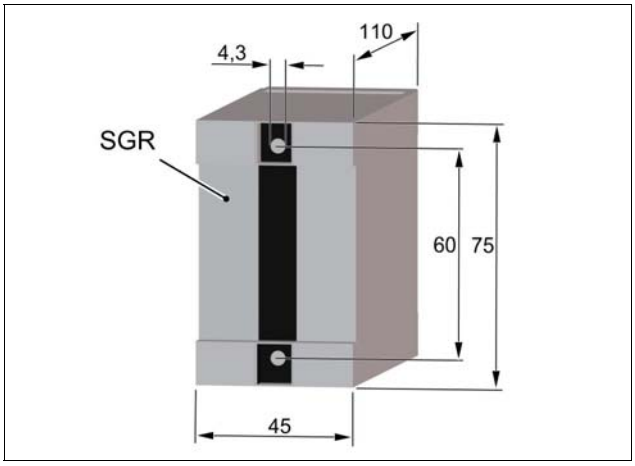
Thermistor sensor

- The temperature is measured at the stator through an NTC resistor (thermistor sensor) with a protective sleeve.
  - Permissible temperature range: 0-150 °C
  - Standard resistor: 10 kΩ at 25 °C
- For more thermistor sensor resistance values (→ chapter 9.).

2.2. TSE control device

➢ Install TSE control device **(SGR)** on the basis of the IP protection in a suitable casing (e.g., switch cabinet).

➢ Install TSE control device **(SGR)** on DIN rail or with screw connection on mounting plate in the switch cabinet.



Types:	– SGRTSE 230 V ACB – SGRTSE 115 V ACB – SGRTSE 24 V ACB – SGRTSE 24 V DCB
Relay output:	2 potential-free changeover contacts (K1, K2), switching capacity 500 VA at 110-230 V resistive load
Input:	NTC thermistor sensor 10 kΩ at 25 °C, with sensor breakage guard at -25 °C
Temperature range:	0 to 150 °C
Power consumption:	maximum 4 VA
Sensor circuit:	– Open-circuit voltage maximum 2.5 V DC – Short-circuit current maximum 0.5 mA DC
Display at the device:	– Malfunction (dry running) – Shut-off temperature
Operation at the device:	– Setup shut-off temperature – Reset alert
Protection:	– Casing IP 40 – Terminals IP 20
Ambient temperature:	0 to 50 ° C

3. Connect TSE control device

DANGER

Risk of fatal injury from electrical current.
There is an immediate danger of fatal electric shock as a result of contact with live parts.
- Observe safety regulations.
- Disconnect the control device from all energy sources before working on terminals.
- Prevent electrical connections from being switched on again.
- Ensure that residual voltage is not present at any electrical connections of the pump.

3.1. Check line voltage

- Check the line voltage/nominal voltage according to type plate of the control device before connecting and commissioning.
  - Permissible mains voltage variations of the nominal device voltage +/- 10 %.

NOTICE

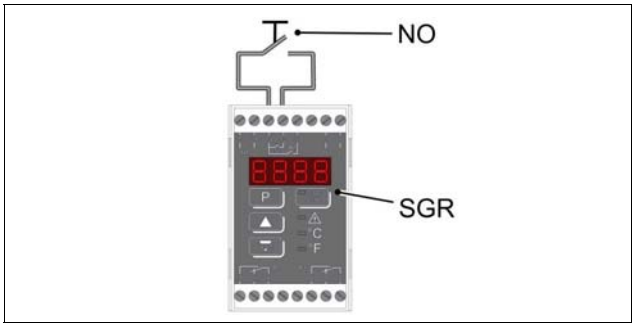
Mains power failure.
Malfunction and/or irreparable damage to the pump.
- Install the thermistor sensor leads shielded.
- Ground the shield on one side.

3.2. Terminal connections

1, 3	Operating voltage
11, 13	Operating hours counter of potential-free contact
12, 13	Button (NO) - external fault reset
14, 15	Thermistor sensor
5, 6, 7	Relay output K1 (malfunction message)
8, 9, 10	Relay output K2 (malfunction message)

3.3. Connecting button (NO) (optional)

- Connect button **(NO)** to terminal 12 and 13 of the TSE control device **(SGR)**.
- After dry running, release TSE control device **(SGR)** with button **(NO)**
  - See chapter Operation of the dry-running protection device (→ chapter 5.).



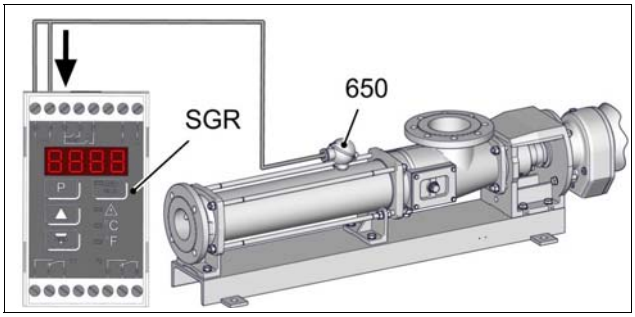
3.4. Use relay function

Actual temperature > shut-off temperature	Malfunction (dry-running)
Contact 6, 5 and 9, 8	closed
Contact 6, 7 and 9, 10	open

- Relays K1 and K2 are in parallel and they work together.
  - K1: Switch-off condition integrated in motor contactor control.
  - K2: optional connection to the fault sensor or process computer (reserve).

3.5. Connect thermistor sensor

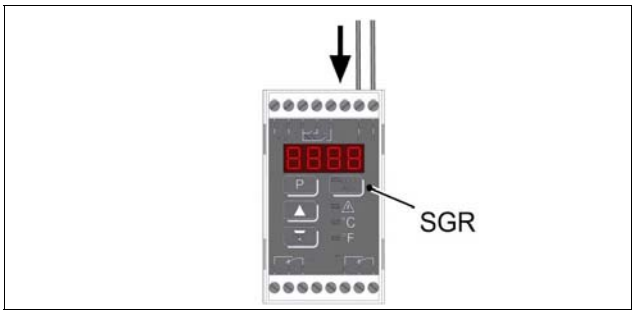
- Connect the connection cable of thermistor sensor of the connection head **(650)** to terminals 14 and 15 of the TSE control device **(SGR)**.



Similar illustration

3.6. Connect operating voltage

- Connect operating voltage to terminals 1 and 3 of the TSE control device **(SGR)**.
  - See technical data of TSE control device **(SGR)** (→ chapter 2.2.).
  - Note the regulations of the local power supply company and country-specific regulations.



4. Commissioning the dry-running protection device (TSE)

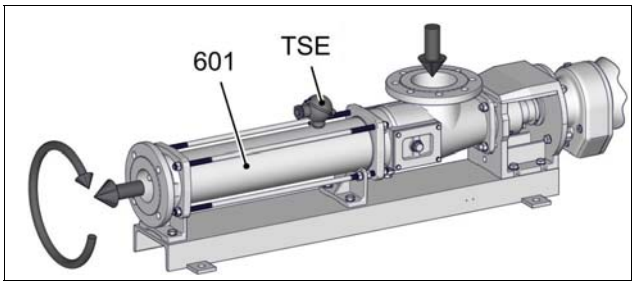
NOTICE

Conveying product temperature different from technical pump data (→ chapter 3).
Malfunction and/or irreparable damage to the pump can occur.
➢ Consult with SEEPEX.

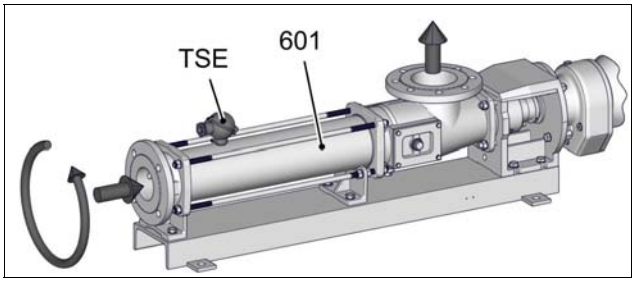
4.1. Note the fitting position of the dry-running protection device (TSE)

- The dry-running protection device **(TSE)** is always installed on the suction side during delivery.

DANGER Installation of the dry-running protection device **(TSE)** on the pressure side.
➢ Note the fitting position of the dry-running protection device **(TSE)**.
– The drilling for the dry-running protection device **(TSE)** in the stator **(601)** should always be on the suction side.



counter clockwise rotating pump

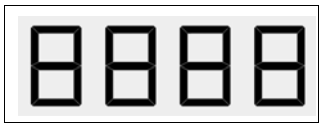


clockwise rotating pump

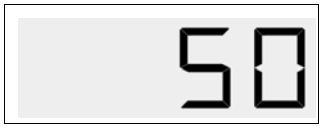
Figures similar

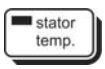
Check the functionality

➢ Switch on TSE control device.
– Digital display lights up.

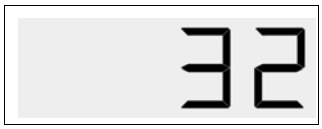


➢ TSE control device starts self-test.
– Currently set shut-off temperature is displayed.





➢ Keep **(stator temp.)** button pressed.
➢ Read temperature value.



- Functionality is present if the display is in accordance with the existing temperature.

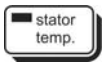
➢ In the case of any discrepancies and functional failures, see chapter Malfunctions, Causes and Rectification (→ Chapter 8).

Set the switch-off temperature

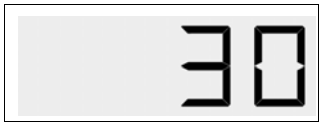
Determining stator operating temperature

- Shut-off temperature is set at 50 °C when delivered.
- During commissioning, maintain shut-off temperature of 50 °C.

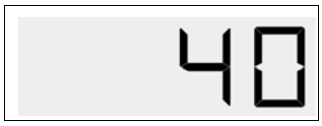
➢ Commission the pump for 30 to 60 minutes to stabilise the stator operating temperature.



➢ Hold **(stator temp.)** button with the pump running.
– Read operating temperature to set the final shut-off temperature.



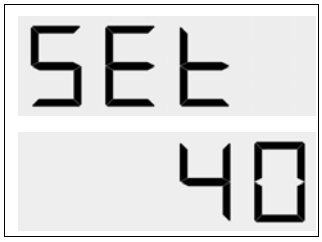
➢ Set shut-off temperature at the TSE control device.
– Set shut-off temperature 10 °C higher than the displayed or maximum operating temperature during operation.



Fine adjustments

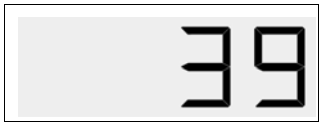
- Confirm modification of the corrected shut-off temperature within 10 seconds with button **(P)** , otherwise TSE control device will change without saving the corrected shut-off temperature.

➢ Press button **(P)** briefly.
– Setup mode is displayed.
– The display shows alternating "SET" and the category temperature set last.



➢ Increase shut-off temperature.
– Value changes initially by +1 °C at a time, after approx. 3 s in +10 °C steps.

➢ Reduce shut-off temperature.
– Value changes initially by -1 °C at a time, after approx. 3 s in -10 °C steps.

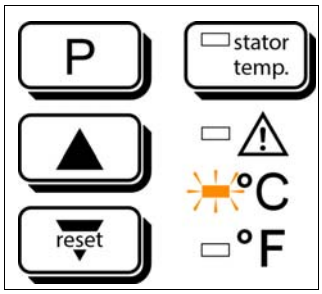


➢ Press button **(P)** briefly.
– Operating mode is displayed.
– Adjusted shut-off temperature is transmitted to the permanent memory and shown on the display.

Change the temperature unit

- Changing the temperature unit from °C (degree Celsius) to °F (Fahrenheit):

➢ To change the temperature unit from °C to °F, press **(▲)** button for 10 s.
➢ Yellow LED next to the symbol °C or °F lights up.

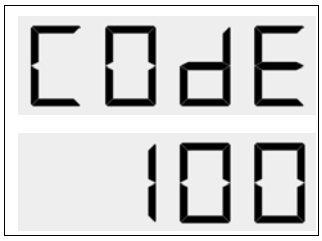


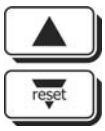
5. Operation of the dry-running protection device (TSE)

5.1. Call operating hour counter

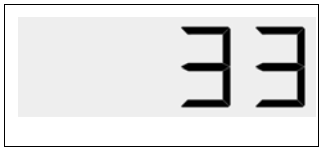
- The TSE control device includes an operating hour counter.
➢ Activate operating hour counter.
  – Bridge terminal 11 and 13.
- The operating hours can be called on the service level. The access to the service level is possible only after a code number has been entered.

➢ Press **(P)** button for approx. 5 s, until display “CodE” appears.
  – The display shows alternating "CodE" and “100”.





➢ Using the arrow keys **(▼/▲)** set code “33”.



➢ Press button **(P)** briefly.
  – Code will be acknowledged.
  – Access into the service level.

Display alternating: “¯Hi¯” and “value” • No function

➢ Press button **(P)** briefly.
  – Change to next parameter/display value.

Display alternating: “bh.Hi” and “value” • Operating hour counter (displayed value x 10000)

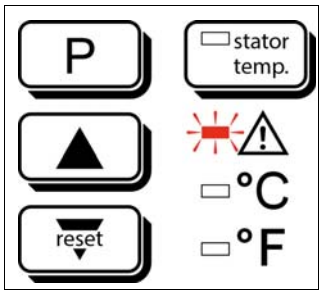
➢ Press button **(P)** briefly.
  – Change to next parameter/display value.

Display alternating: "bh.Lo" and “value” • Operating hour counter (displayed value x 1)

➢ Press button **(P)** briefly.
– Change to the operating mode.

5.2. Release TSE control device after dry running

➢ The installed relays switch off and remain locked in this position if the set shut-off temperature at the TSE control device is exceeded.
– Red LED lights up and signals an alert.



➢ Acknowledge alert/release relay:
– Press button on the TSE control device or external button (closer) on terminal 12 and 13 for at least 1 s, in order to release TSE control device.

➢ Shut-off operating voltage at the TSE control device (terminal 1 and 3).
– Press external contact (button, closed for at least 1 s).

6. Functional failure

NOTICE Thermistor sensor or wire break. Short-circuit in the thermistor sensor or in the line. Overshooting or undershooting of the measuring range (-25-150 °C). Alert **(Err I)** is displayed and drive of the pump shuts off.

➢ Inspection of the TSE control device and sensor circuit including thermistor sensor.

6.1. Thermistor sensor performance check

➢ Remove thermistor sensor supply line from the connection head **(650)**.

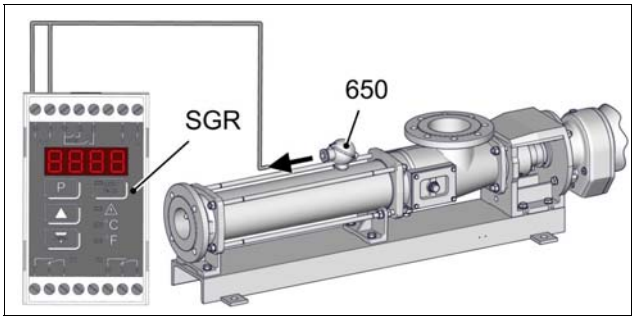


Figure similar

➢ Connect resistor measuring unit **(MTT)** to connection head **(650)**.

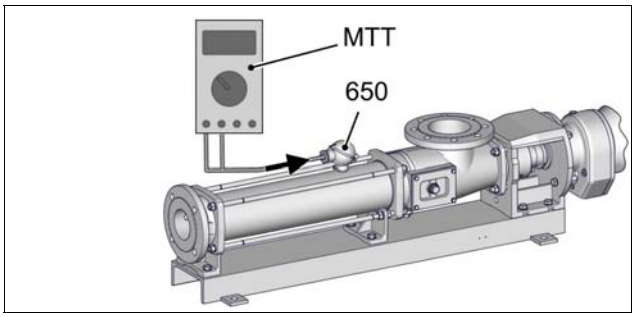


Figure similar

➢ Determine electrical resistance and compare with temperature of the pump:

Ttemperature °C	0	10	20	25	30	40	50	60
Resistor Ω	32650	19900	12490	10000	8057	5327	3603	2488

Ttemperature °C	70	80	90	100	110	120	130	140
Resistor Ω	1752	1255	950	678	510	389	301	235

- For more thermistor sensor resistance values (→ chapter 9.).
- In the case of discrepancies in the resistor value > 10 % of the set value, there is a defect in the thermistor sensor.
  – Replace thermistor sensor (→ chapter 7. /8. , Dismantling/Assembly of Dry-running protection device).
- In the case of correct values, there is a defect in the thermistor sensor supply line or the connection terminals.
  – Check connections.

6.2. Performance check TSE control device

➢ Disconnect thermistor sensor supply line from terminals 14 and 15 of the TSE control device **(SGR)**.

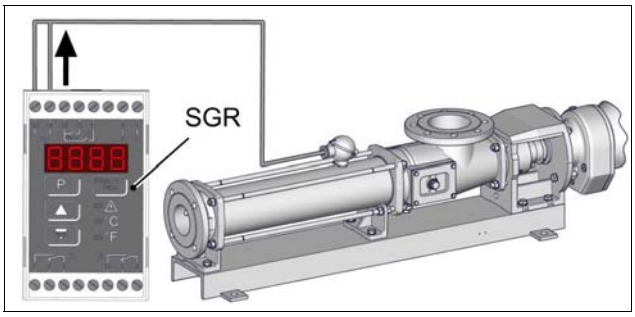
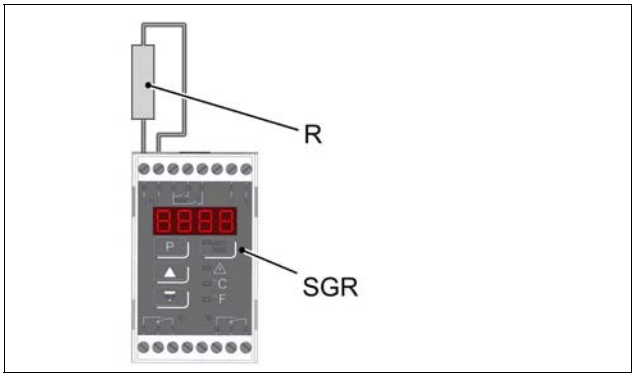


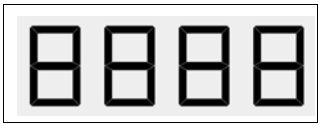
Figure similar

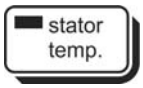
➢ Connect commercially available carbon film or metal film resistor **(R)** in accordance with the following values to terminals 14 and 15 of the TSE control device **(SGR)**:



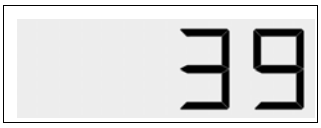
Resistor Ω	10000	5600	2200	1000	560	220
Switching temperature °C	25	39	63	87	107	143

➢ Switch on TSE control device.
  – Digital display lights up.





➢ Keep **(stator temp.)** button pressed and read temperature value.
  – Read value must correspond with the switching temperature allocated to the resistor used.



➢ In the case of a display deviation of more than 5-10 °C or in the case of no display, replace TSE control device.

7. Dismantle pump-sided parts of dry-running protection device (TSE)

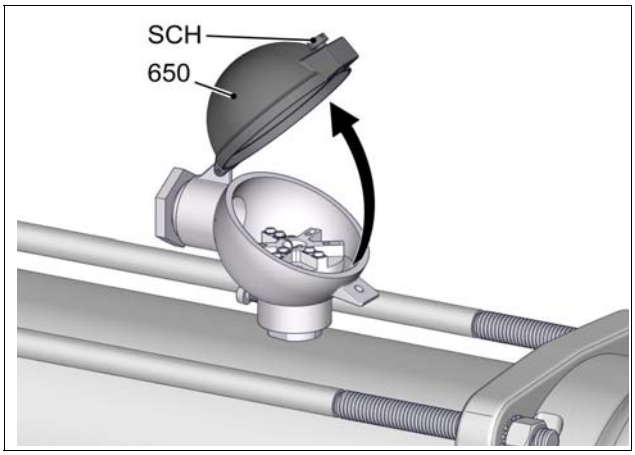
➢ Follow the instructions in the chapter Shut-down (→ chapter 6).

NOTICE

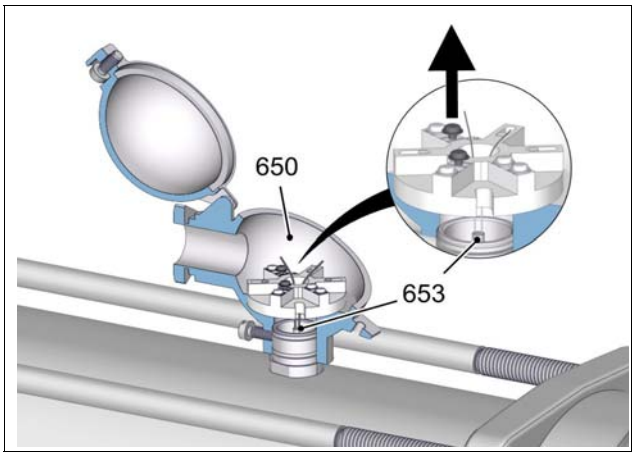
Adjusting the sensor sleeve (656) assembled at the factory.
Damage caused by incorrect readings of the dry-running protection device **(TSE)**.
➢ Retain the location and position of the sensor sleeve **(656)**.
➢ The pump-side parts of the dry-running protection device **(TSE)** should be assembled / dismantled only by SEEPEX trained personnel.

7.1. Dismantle connection head (650) and thermistor sensor (653)

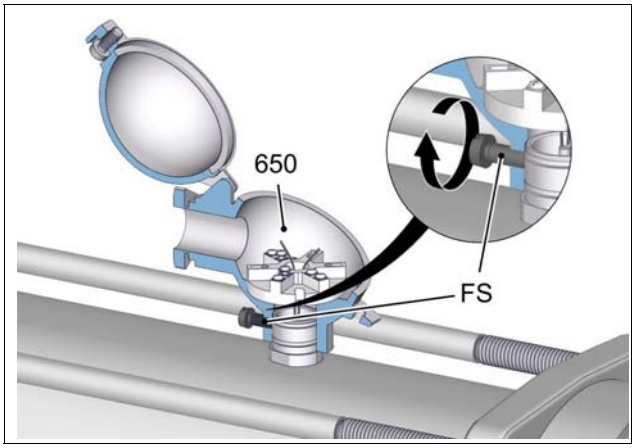
➢ Loosen screw **(SCH)** on the cover of the connection head **(650)**.
➢ Open the cover of the connection head **(650)**.



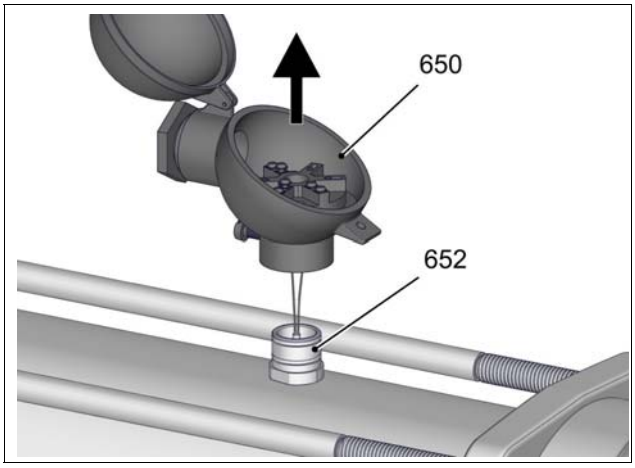
- Loosen connection wires of the thermistor sensor **(653)** on the terminal board of the connection head **(650)**.



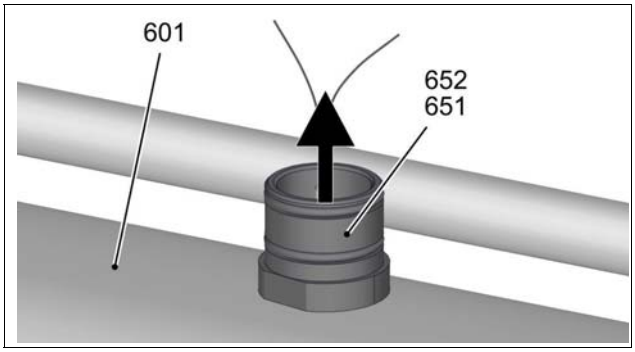
- Loosen fixing screw **(FS)** on the connection head **(650)**.



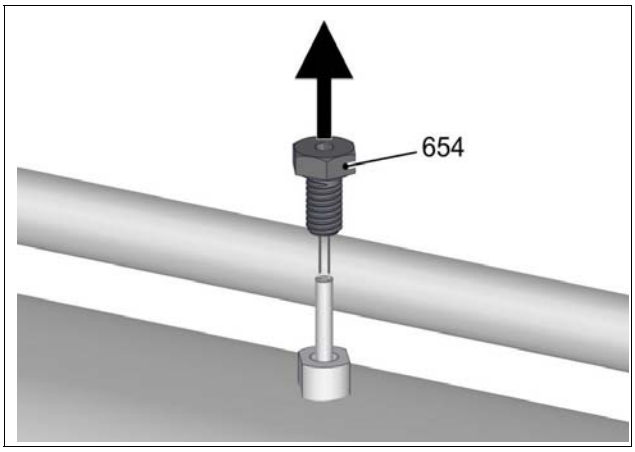
- Remove connection head **(650)** from screw socket **(652)**.



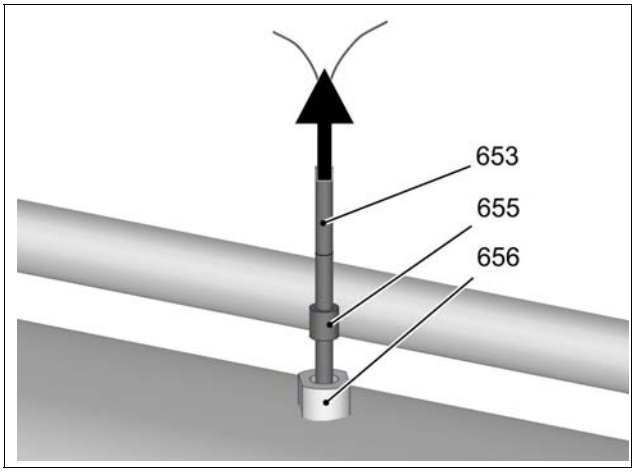
- Dismantle screw socket **(652)** together with two O-rings **(651)** from stator **(601)**.



- Remove clamping screw **(654)**.



- Remove thermistor sensor **(653)** together with rubber ring **(655)** from sensor sleeve **(656)**.

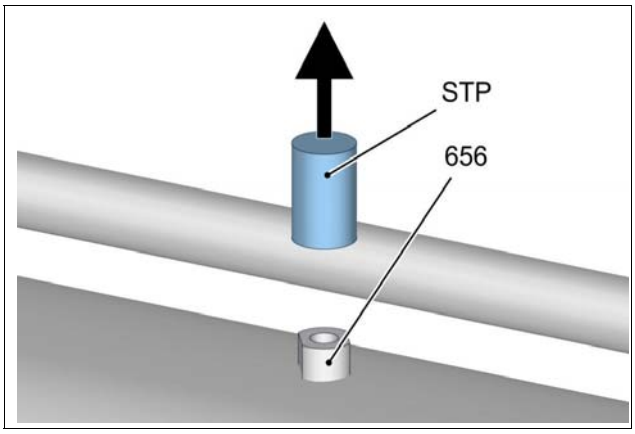


8. Assemble pump-sided parts of dry-running protection device (TSE)

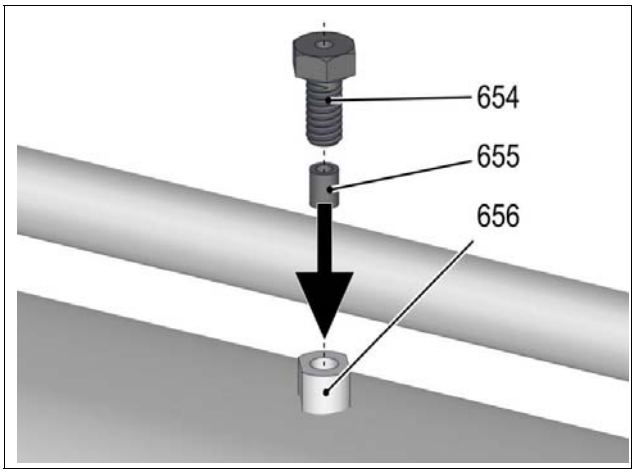
NOTICE

Adjusting the sensor sleeve (656) assembled at the factory.
Damage caused by incorrect readings of the dry-running protection device **(TSE)**.
- Retain the location and position of the sensor sleeve **(656)**.
- The pump-side parts of the dry-running protection device **(TSE)** should be assembled / dismantled only by SEEPEX trained personnel.

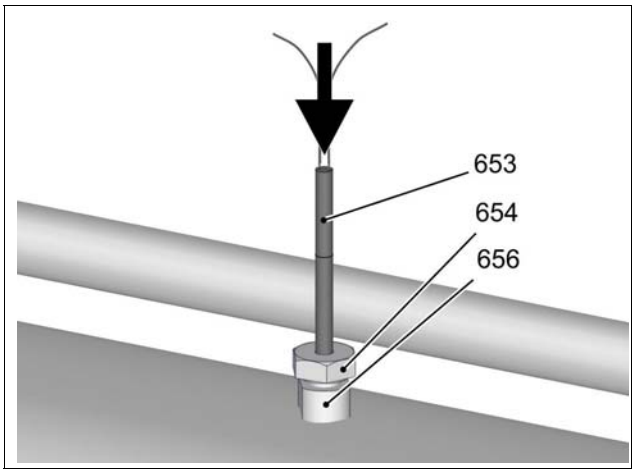
- Remove the transport locks **(STP)** (if available) from sensor sleeve **(656)**.



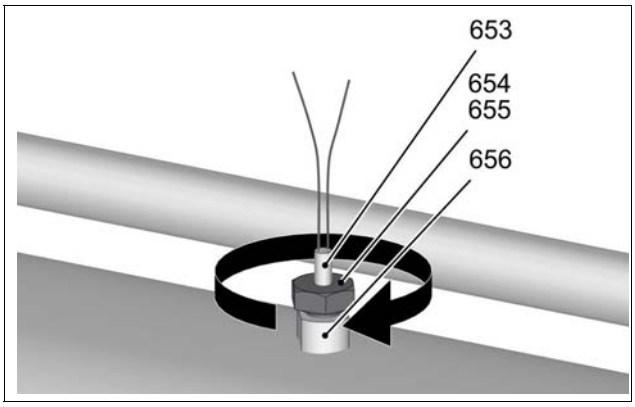
- Mount the clamping screw **(654)** and rubber ring **(655)** onto the sensor sleeve **(656)** and tighten slightly.



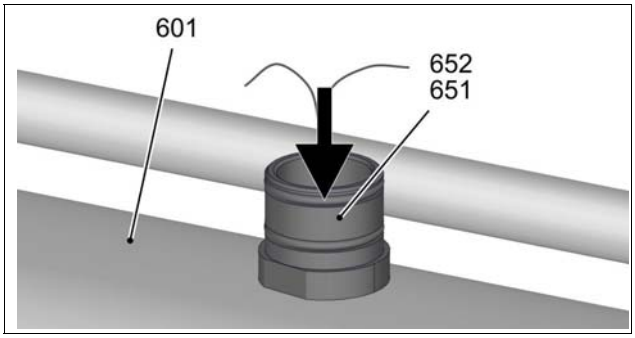
- Insert the thermistor sensor **(653)** through the opening of the clamping screw **(654)** down to the bottom of the sensor sleeve **(656)**.



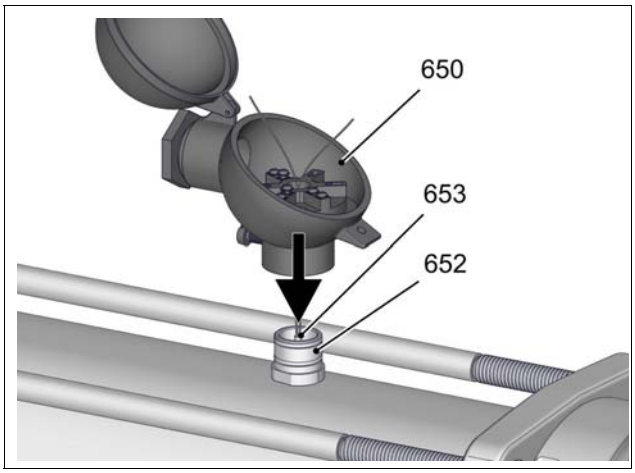
- Tighten the thermistor sensor "finger tight" **(653)** using clamping screw **(654)** and rubber ring **(655)**.



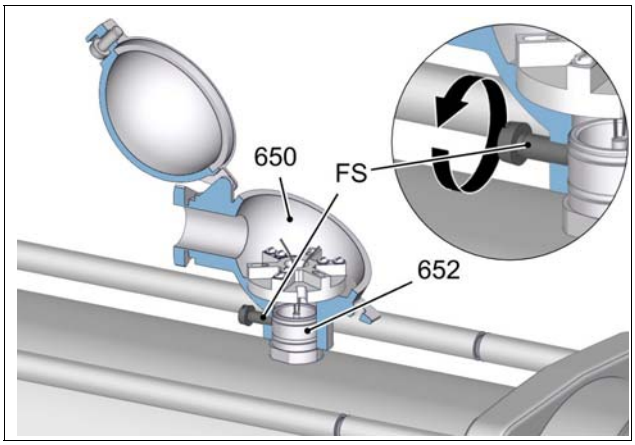
- Assemble screw socket **(652)** together with two O-rings **(651)** on stator **(601)**.



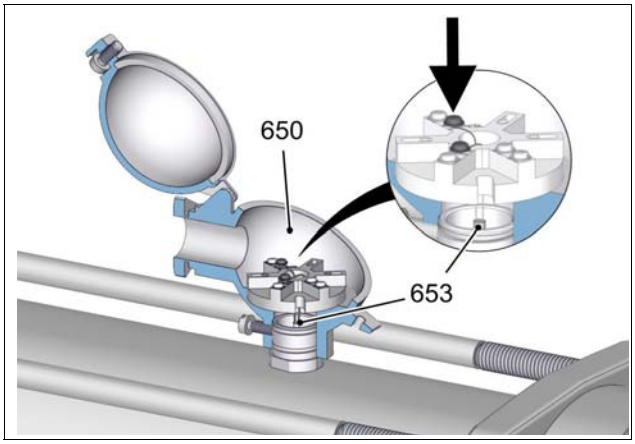
- Install connection head **(650)** on screw socket **(652)**.
  - Route connection wires of the thermistor sensor **(653)** from below through the opening in the terminal board.



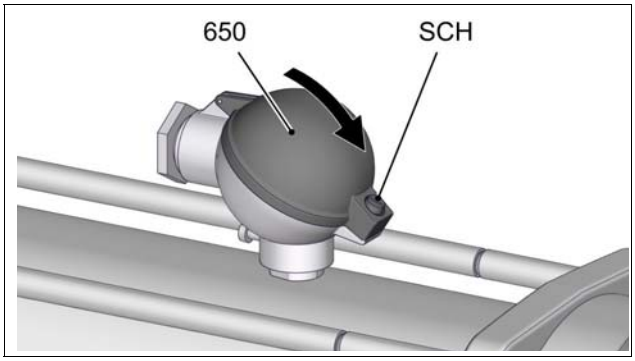
- Fix connection head **(650)** with fixing screw **(FS)** on screw socket **(652)**.



- Secure connection wires of the thermistor sensor **(653)** on the terminal board of the connection head **(650)**.
  - Note the sectional drawing of the TSE connection head (→ chapter 2.1).



- Close the cover of the connection head **(650)**.
- Tighten screw **(SCH)** on the cover of the connection head **(650)**.



9. Thermistor sensor resistor values

NTC thermistor sensor with stainless steel protective sleeve:
Standard resistor: 10 kΩ at 25 °C

Temperature °C	Resistor Ω	Temperature °C	Resistor Ω
-20	97080	16	15000
-19	91610	17	14320
-18	86490	18	13680
-17	81690	19	13070
-16	77180	20	12490
-15	72950	21	11940
-14	68980	22	11420
-13	65240	23	10920
-12	61730	24	10450
-11	58430	25	10000
-10	55330	26	9573
-9	52400	27	9167
-8	49650	28	8777
-7	47060	29	8407
-6	44620	30	8057
-5	42330	31	7723
-4	40160	32	7403
-3	38110	33	7097
-2	36190	34	6807
-1	34370	35	6530
0	32650	36	6267
1	31030	37	6017
2	29500	38	5777
3	28050	39	5547
4	26690	40	5327
5	25390	41	5117
6	24170	42	4917
7	23010	43	4727
8	21920	44	4543
9	20880	45	4370
10	19900	46	4200
11	18970	47	4040
12	18090	48	3890
13	17250	49	3743
14	16460	50	3603
15	15710	51	3467
52	3340	91	887.7
53	3217	92	861

Temperature °C	Resistor Ω
54	3099
55	2986
56	2878
57	2774
58	2675
59	2579
60	2488
61	2400
62	2316
63	2235
64	2157
65	2083
66	2011
67	1942
68	1876
69	1813
70	1752
71	1693
72	1636
73	1582
74	1530
75	1479
76	1431
77	1384
78	1340
79	1297
80	1255
81	1215
82	1177
83	1140
84	1104
85	1070
86	1036
87	1004
88	973.7
89	944
90	915.3
130	300.93
131	293.47
132	286.32
133	279.17
134	272.03

Temperature °C	Resistor Ω
93	835.3
94	810.3
95	786.7
96	763.3
97	741
98	719.3
99	698.7
100	678.3
101	659
102	640
103	622
104	604
105	587
106	571
107	555
108	539.7
109	525
110	510.3
111	496.7
112	483
113	470
114	457.3
115	445
116	433.3
117	421.7
118	410.7
119	400
120	389.3
121	379.3
122	369.7
123	360
124	350.6
125	341.7
126	333.1
127	324.7
128	316.5
129	308.6
141	229.70
142	224.30
143	219.00
144	213.90
145	208.87

Temperature °C	Resistor Ω
135	265.7
136	259.3
137	253
138	246.93
139	241.03
140	235.27

Temperature °C	Resistor Ω
146	204.03
147	199.33
148	194.77
149	190.33
150	185.97

Single acting mechanical seal

1 Safety

WARNING

Shaft seal is leaky.
Leakage may escape into the atmosphere.

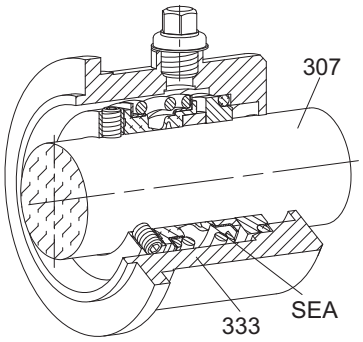
- ➢ Take safety measures to protect persons and the environment.
- ➢ Wear suitable protective clothing.
- ➢ Dispose of leakage appropriately.
- ➢ Note applicable regulations when handling hazardous substances.

2 Operating conditions and and material combination

- Adjust to the relevant application
  - – Refer to technical data (chapter 3).

3 Design

- Single acting mechanical seal



4 Commissioning

NOTICE

Dry running of the mechanical seal.
Damage to property may result.

- ➢ The mechanical seal must be laid in liquid medium before being commissioned.

Circulation, flushing and/or flushing pipe

- Additional flushing or circulation pipes are not required where shaft sealing lies in medium.
- Flushing pipes may be possible under special circumstances and after speaking to seepex.

NOTICE

Shaft seal is not leakage free.
Damage to property through leakage.

- ➢ Components which come into contact with leakage must be corrosion-resistant or otherwise suitably protected.

Adjust shaft seal

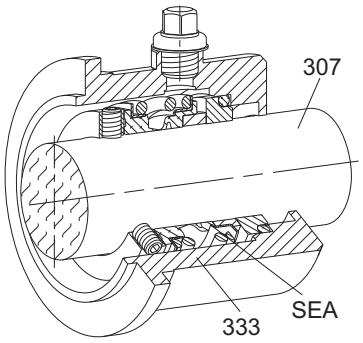
- ➢ It is absolutely vital to adjust at the application site in a manner appropriate for the operating conditions.
- ➢ Refer to the sectional drawing of the shaft seal for setting measurements.
- ➢ Set the setting measurements of the shaft seal to the plug-in shaft (307).

5 Monitoring during operation

NOTICE

Shaft wear.
Damage to property may result.

- Conduct a daily visual inspection.
- Install a new shaft seal (SEA).
- Possibly replace the plug-in shaft (307).

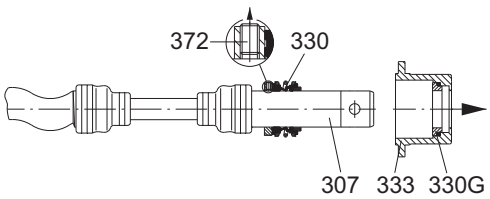


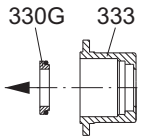
6 Dismantling of the mechanical seal

Refer to data sheet (chapter 3.1) and sectional drawing of the shaft seal (chapter 9._) for design.

With axial locking device

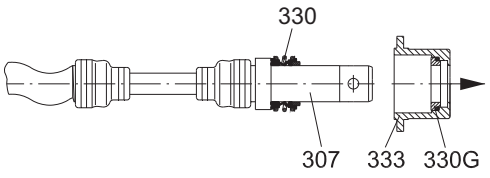
- Clean plug-in shaft (307), remove edges/ burrs.
- Moisten plug-in shaft (307) with lubricant (thinned liquid soap).
- Pull mechanical seal casing (333) from the plug-in shaft (307).
- Loosen the axial locking device of the mechanical seal (330/372); pull mechanical seal (330) from the plug-in shaft (307).
- Push counter ring of the mechanical seal (330G) with seal out of the mechanical seal casing (333).

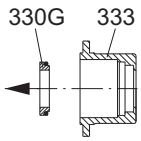




Without axial locking device

- Clean plug-in shaft (307), remove edges/ burrs.
- Moisten plug-in shaft (307) with lubricant (thinned liquid soap).
- Pull mechanical seal casing (333) from the plug-in shaft (307).
- Pull the mechanical seal (330) from the plug-in shaft (307).
- Push counter ring of the mechanical seal (330G) with seal out of the mechanical seal casing (333).





7 Reassembly of mechanical seal

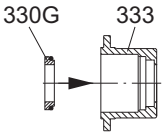
Shaft sealings are high-quality precision parts.

Their installation is therefore to be undertaken with care.

Careful handling and the utmost of cleanliness are prerequisites.

➢ Assembly aids such as oil/grease are not permitted.

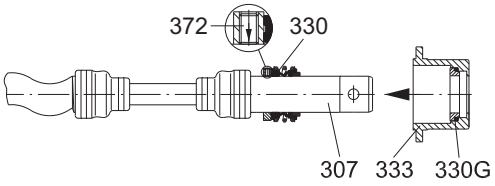
With axial locking device



➢ Clean the mechanical seal casing (333).

➢ Moisten the seal with lubricant (thinned liquid soap).

➢ Attach the counter ring and seal using even pressure into the mechanical seal casing (333).



➢ Clean the plug-in shaft (307), remove edges/burrs.

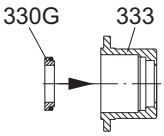
➢ Adjust the set collar (372) in accordance with sectional drawing of shaft seal (chapter 9._).

➢ Stick the set screw in and determine.
  – Use "medium-strength" adhesive.

➢ Moisten plug-in shaft (307) and elastomer parts of the mechanical seal (330) with lubricant (thinned liquid soap).

➢ Slide mechanical seal (330) onto the plug-in shaft (307) until the installation edge has been reached.

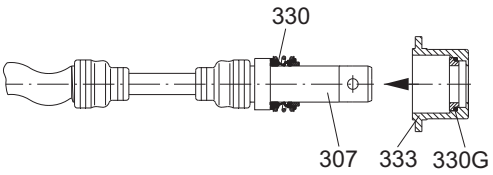
Without axial locking device



➢ Clean the mechanical seal casing (333).

➢ Moisten the seal with lubricant (thinned liquid soap).

➢ Attach the counter ring and seal using even pressure into the mechanical seal casing (333).



➢ Clean the plug-in shaft (307), remove edges/burrs.

➢ Adjust mechanical seal (330).
  – Note sectional drawing of shaft seal (chapter 9._).

➢ Moisten plug-in shaft (307) and elastomer parts of the mechanical seal (330) with lubricant (thinned liquid soap).

➢ Slide mechanical seal (330) onto the plug-in shaft (307) until the installation edge has been reached.

SEEPEX.
ALL THINGS FLOW

OPERATING MANUAL

SEEPEX MECHANICAL SEAL

Type GA-60

These instructions are intended for assembly, operating and control personnel and should be kept on site.

PLEASE READ this manual carefully and OBSERVE the information contained as to:

- □ **Safety**
- □ **Transport / Storage**
- □ **Information about the product**
- □ **Installation**
- □ **Operation**
- □ **Servicing**

If there are any unclear points, please contact SEEPEX!

Table of Contents

Keywords and Symbols

The following symbols are used for particularly important information:

"Attention, please pay special attention to these sections of text".

DANGER! Draws attention to a direct hazard that will lead to injury or death of persons.

WARNING! Draws attention to the risk that a hazard could lead to serious injury or death of persons.

CAUTION! Draws attention to a hazard or unsafe method of working that could lead to personal injury or damage to equipment.

ATTENTION! Identifies a potentially dangerous situation. If it is not avoided, the product or something in its vicinity could be damaged.

IMPORTANT! Identifies tips for use and other particularly useful information.

GENERAL SAFETY NOTES

Any person being involved in assembly, disassembly, start up, operation and maintenance of the SEEPEX Mechanical Seal must read and understand this instruction manual and in particular the safety notes.

SEEPEX Mechanical Seals are manufactured on a high quality level, and they keep a high working reliability. Yet, if they are not operated within their intended purpose or handled inexpertly by untrained personnel, they may cause risks.

The pump has to be set up in such a way that seal leakage can be led off and disposed of properly and that any personal injury caused by spurting product in the event of a seal failure is avoided.

Any operation mode that affects the operational safety of the mechanical seal is not permitted.

Unauthorized modifications or alterations are not permitted as they affect the operational safety of the mechanical seal.

SEEPEX mechanical seals must be installed, operated, maintained, removed or repaired by authorized, trained and instructed personnel only.

The responsibilities for the respective jobs to be done have to be determined clearly and observed in order to prevent unclear competencies from the point of security.

Any work to be done on the mechanical seal is generally only permitted when the seal is neither operating nor pressurized.

WARNING!

Seals that have been used with hazardous substances must be properly cleaned so that there is no possible danger to people or to the environment.

Apart from the notes given in this manual, the general regulations for worker's protection and those for prevention of accidents have to be observed.

Instructions for worker's protection

WARNING!

If the medium to be sealed and/or the supply liquid is subject to the Hazardous Substances Regulation (GefStoffV), the instructions for handling dangerous substances (safety data sheets to EU Directive 91/155/EEC) and the accident prevention regulations have be observed.

Medium to be sealed and/or supply medium may escape if the seal fails. Injury of persons and environment may be prevented by the user providing for splash protection and wearing safety goggles. Care has to be taken by the user for proper disposal of the leakage. The user has to control these measures.

The user has to check what effects a failure of the mechanical seal might have and what safety measures have to be taken to prevent personal injury or damage to the environment.

TRANSPORT / STORAGE

Transport

If not specified differently, the SEEPEX standard packing is used which is suitable for dry transport by truck, train or plane. The warning signs and notes on the packing must be observed.

In addition, seaworthy packing may become necessary.

Notes for incoming inspection:
• Check packaging for visible damages.
• Open packaging carefully. Do not damage or lose parts supplied separately.
• Check if consignment is complete (delivery note). Inform the supplier. immediately in writing if parts are damaged or missing.

The mechanical seal has to be protected from damage during transport and storage. The transport case in which the seal is supplied is well suited for this purpose and should be kept for a possible return transport.

ATTENTION!

If the machine as well as the mechanical seal installed into the machine are transported together, the shaft has to be protected from deflection and shocks.

Packing and storage

The following recommendations apply to all SEEPEX mechanical seals which have been supplied and stored in their undamaged original packaging, as well as to seals which have been installed in the pump but have not yet been put into operation.

SEEPEX mechanical seals and spare parts are super finished and repeatedly tested machine elements. For storage, special conditions have to be followed.

Sliding materials and elastomers are subject to material-specific and time-based alterations (distortion, aging) which might reduce the full efficiency of the mechanical seals. Yet, this may be avoided by observing the storage instructions.

For the stock keeping of elastomers, special conditions are required. For all rubberelastic parts, the rules of DIN 7716 resp. of ISO 2230-1973 (E) are valid.

The best suited environment for storing mechanical seals is characterized as follows:
• dust free.
• moderately ventilated.
• constantly tempered.
  - relative air humidity below 65 %.
  - temperature between 15 °C and 25 °C.

Protect the seal from:
• direct exposure to heat (sun, heating).
• ultraviolet light (halogen or fluorescent lamps, sunlight, arc welding).
• presence or development of ozone (arc welding, mercury vapour lamps, highvoltage devices, electric motors).
➢ risk of embrittlement of elastomeric materials.

It has to be differentiated between:
- M.S. stored in the stock room.
- M.S. installed in the machine, but not yet in operation.

▪ M.S. in the stock

IMPORTANT!

Store the seal in the original packing lying on a flat surface. Check the packaging periodically for damages.

Duly stored mechanical seal:
- Lasts 3 years after delivery of the mechanical seal.

▪ M.S. installed into the machine

ATTENTION!

A preservation of SEEPEX mechanical seals is not allowed.

In the case of preservation of complete machines with mechanical seals installed, SEEPEX must be contacted.
- Do not use corrosion protection agents.

➢ Risk of deposition and possibly chemical attack of the secondary seals.

Due to longer erecting times of new designed plants, the period between delivery of the mechanical seal and its installation and start up may exceed the period of 2-3 years.

If planned start-up of the plant is after 3 years of storage, a replacement seal may need to be considered.

Damages caused by improper storage may not be claimed with reference to the standard SEEPEX warranty.

INFORMATION ABOUT THE PRODUCT

Type designation

SEEPEX Mechanical Seal Type GA-60

Designated use

This mechanical seal is exclusively designed for the use in the specified application. A different utilization or a utilization going beyond the specification is considered contrary to its designated use and excludes a liability by the manufacturer.

Operation under conditions lying outside those limits stated in paragraph "Operating limits" is considered contrary to its designated use.

Should the seal be operated under different conditions or at a different application, SEEPEX has to be asked for recognition as safe in advance.

- Changes to operating conditions have to be documented.

Operating limits

ATTENTION!

Operating limits depend on the materials, the media to be sealed and the diameter of the sealing (if there are any unclear points, please contact SEEPEX).

Shaft diameter	(dw)	: 25 - 100 mm
Pressure to be sealed	(p1)	: 10 bar g
Temperature to be sealed	(t1)	: -20 ... 120° C
Max. sliding speed	(vg)	: 10 m/s

Operation under several limit values simultaneously should be avoided as higher loads (pressure, temperature, speed) can increase wear or lead to damage of sliding faces or elastomers. This could result in a shorter service life and the risk of a sudden seal failure endangering men and environment.

The selection of the mechanical seal (type, suitability, materials) should be done by SEEPEX staff or other authorized persons.

Further information about the operating conditions can be found in the SEEPEX pump data sheets.

Materials

The materials of the mechanical seal depend on the application and are fixed in the order.

Description and function

- single seal.
- unbalanced.
- bi-directional .
- rubber cup seat.
- stationary seal face.
- rotating seal face.
- elastomeric bellow.
- cylindrical single spring.
- no glued joints.
- for media containing solids (e.g. sewage applications).
- rotating, torsion-free elastomeric bellows serving as:
    - face housing.
    - secondary sealing element.
    - drive collar.

Supply of M.S.

The mechanical seal has to be constantly wetted by liquid medium. The medium to be sealed must not damage the M.S. neither chemically (e.g. corrosion, embrittlement) nor physically (e.g. erosion, abrasion).

For a safe operation of the mechanical seal, we recommend to apply at inboard the most suitable type of circulation described in API 610 / 682. This measure protects the seal cavity from deposition of solids.

To operate multiple seals, special supply systems are required. Please contact SEEPEX.

Emissions

A mechanical seal is a dynamic seal that cannot be free of leakage due to physical and technical reasons. Seal design, manufacture tolerances, operating conditions, running quality of the machine, etc. mainly define the leakage value. In fact, compared to other sealing systems, there is few leakage.

WARNING!

If the medium to be sealed and/or the supply liquid is subject to the Hazardous Substances Regulation (GefStoffV), the instructions for handling dangerous substances (safety data sheets to EU Directive 91/155/EEC) and the accident prevention regulations have to be observed.

A possibly increased leakage during start-up will decrease to a normal quantity after the running-in period of the sliding faces.

If this is not the case or if there are other malfunctions, the mechanical seal has to be shut down, removed and checked for reasons of safety.

The leakage can be liquid or gaseous. Its aggressiveness corresponds to that of the medium to be sealed.

Leakage of mechanical seal at outboard side has to be drained and disposed of properly.

IMPORTANT!

Components which may get in contact with the leakage have to be corrosion-resistant or have to be adequately protected.

INSTALLATION

Assembly utilities

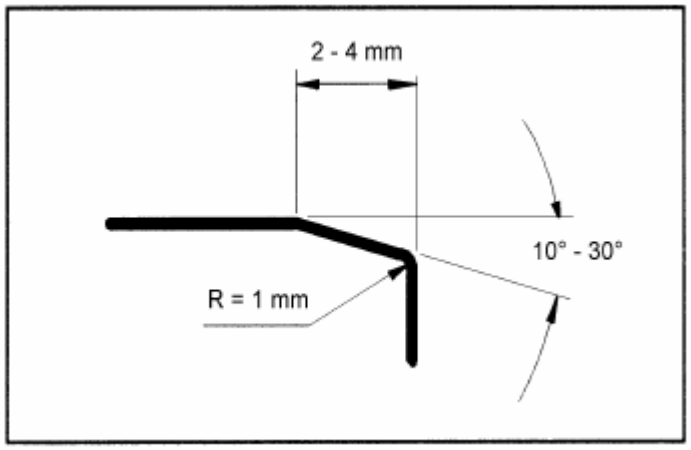
- ethyl alcohol.
- cellulose-tissue (no rag, no cloth!).
- o-ring lifter.
- water and washing up liquid.
- cardboard discs.

Preparation for assembly

ATTENTION!

The seal should remain packed until the following working steps have been completely terminated.

Check the parts of the pump for:



- **chamfered edges** (sliding cones i.e. 2 mm / 30° or in accordance with EN 12756).
- radiused transition.
- **mating fits** and o-ring surfaces: fine finished **Rz 10 µm** (= N7 = CLA 63).

- Shaft surface in the area of the mechanical seal finished according to EN 12756: Ra = 0.8 µm (= N6 = CLA 32).
- Shoulder or stop device for the bellows of the mech. seal to take up axial forces.

Check at the pump:
- Damage of connecting surfaces to the M.S.
- Mating dimensions, rectangularity and concentricity to the shaft axis.

Run-out accuracy of the shaft (acc. to DIN ISO 5199):
- Shaft diameters up to 50 mm: max. 0.05 mm.
- Shaft diameters 50 mm - 100 mm: max. 0.08 mm.
- Prepare the place of assembly, take away any non-required tool, cuttings, dirty cleaning wool, etc.
- Cover the work bench with a piece of clean, non-fibrous cardboard.

Assembly / installation

SEEPEX mechanical seals are super-finished and repeatedly tested machine elements whose handling during assembly in particular of sliding materials and elastomers requires special care during several procedures.

For installation, the assembly drawing of mechanical seal has to be observed.

IMPORTANT!

The mechanical seal has to be installed under the cleanest conditions and very carefully.

- Unpack the seal and check seal face, seat and elastomer bellows for possible damages.
- Never place the seal faces or seats on their sliding faces without having covered them adequately.

- Check before starting assembly:
  - complete availability of all components by means of the drawing.
  - all components have to be clean and in perfect condition.

Sprinkle the elastomer bellows and the shaft with low-surface-tension water (add washing up liquid) or ethyl alcohol to decrease frictional force during assembly of the seal.

Oil or grease as assembly agent is not permitted in any case.

ATTENTION!

Never force the seal during installation.

ATTENTION!

Avoid unnecessary rotation of the shaft (damage of the sliding faces is possible).

ATTENTION!

Avoid knocking the seal! Damage to mechanical seals has an adverse effect on their safe operation.

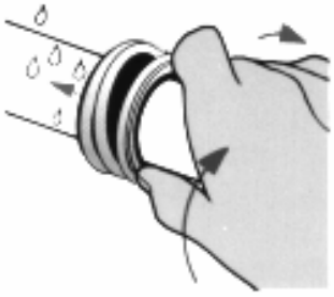
Possible installation order:

- Feed the degreased sealing element (rubber cup) onto the seat.

If present:

- At the seat mark the position of the rear slot beside the sliding face.
- Align the seat with the torque transmission pin.
- Cover the sliding face of the seat with a cardboard washer.
- Press the seat slowly and without interruption into its position.
  - ➢ Use plenty of water or alcohol as lubricant.
  - ➢ Use a distance sleeve, if necessary.
- Remove the cardboard washer from the sliding face.
- Check the rectangular position of the seat to the shaft axis.
- Mount the seal cover with the seat installed before.
- Clean the sliding faces thoroughly with ethyl alcohol and paper tissues (no fabric, no cloths!).

➢ In case of material "BUKO" (carbon graphite) wipe it until the paper tissues stay clean.
➢ Do not touch the sliding faces any more with bare fingers.
➢ Mount the sliding faces absolutely dry, dust-free and clean. Do not use any lubricants!



- Push rotating seal unit (bellows unit) with a slow clockwise turn onto the shaft.
- Stick to the dimensions in the assembly drawing!

➢ If necessary use a mounting sleeve.
➢ For long pushing distances add liquid several times.

- Check "L" rings, spring and seal face for correct fit.
- Mount stop device for bellows unit to take up axial forces.

➢ Stick to the dimensions in the assembly drawing by all means!

- Further assembly of the pump in accordance with the instructions from SEEPEX.

OPERATION

Instructions for safe operation

For a single mechanical seal the pressure in the seal chamber (stuffing box pressure) has to be higher than the ambient pressure at the pump at any time. Otherwise the pump will suck in air via the sliding faces, which will result in dry-running and consequent failure of the mechanical seal.

Damages due to dry-running are excluded from the warranty.

During every state of operation the mechanical seal has to be constantly wetted by the medium to be sealed in its liquid form, in particular when the pump is started or stopped.

If the medium to be pumped builds deposits or tends to solidify during cooling down or standstill of the pump the stuffing box has to be flushed with suitable clean liquid. The flow and the liquid should be determined by the user.

If the operation limit values and the instructions given in this manual are followed a trouble-free operation of the mechanical seal can be expected.

Instructions for start up

Safety checks before start up

- Torque transmission between mechanical seal and shaft duly installed.
- Supply connections tightened pressure-sealed.
- Disposal connections installed environmentally safe.

For a safe operation of the mechanical seal we recommend to apply at inboard the most suitable type of circulation described in API 610 / 682. This measure protects the seal cavity from deposition of solids.

- Flood machine and seal cavity (stuffing box) with medium and vent thoroughly.
  - Now the seal is ready for operation.

SERVICING

Maintenance

A correctly operated mechanical seal needs low maintenance.

A duly operation includes a regular check of the following parameters:
• Temperature.
• Leakage (drainage) rate of the mechanical seal.

An inspection of the mechanical seal should be carried out during a revision of the complete plant. We recommend to have this inspection be performed by responsible SEEPEX personnel.

If the mechanical seal is removed during a revision of the plant it has to be replaced by a new one.

Directives in case of failure

Try to define the kind of failure and record it.

- In the event of excessive leakage, note changes in the leakage amount and switch the pump off if necessary.
- If a constant amount is leaking in a steady flow, the mechanical seal is damaged.
- In the event of a inadmissible temperature rise, the pump has to be stopped for safety reasons.

If there is a malfunction which you cannot correct on your own or if the cause of malfunction is not clearly recognizable, please immediately contact SEEPEX.

Disassembly / removal

- Stop the pump as instructed, allow to cool, depressurize and ensure that pressure cannot build up again.
- Work on the M.S. is only permitted when the pump is at a standstill and depressurized.
- There must be no product on the M.S. ⇒ if necessary drain the pump and rinse it out.
- Isolate the pump to prevent it starting up unexpectedly.
- Comply with the safety notes (safety data sheets).

IMPORTANT!

When removing, please observe by all means:
- current accident prevention regulations.
- regulations for handling hazardous substances.

WARNING!

Seals that have been used with hazardous substances must be properly cleaned so that there is no possible danger to people or to the environment.

IMPORTANT!

The packaging used to transport the seal must:
- be identified with the relevant hazard symbol.
- include the safety data sheet for the product and/or supply medium.

Remove the seal in the reverse sequence as described for assembly (set up).

Disposal of the SEEPEX mechanical seal

Usually, the SEEPEX mechanical seals can be easily disposed of after a thorough cleaning:
- Metal parts (steels, stainless steels, non-ferrous heavy metals) divided into the different groups belong to scrap metal waste.
- Ceramic materials (synthetic carbons, ceramics, carbides) belong to waste products. They can be separated from their housing materials, as are physiologically recognized as safe.
- Synthetic materials/plastics (elastomers, PTFE) belong to special waste.

CAUTION!

Material containing fluorine must not be burnt.

IMPORTANT!

Some of the synthetic materials, divided into the different groups can be recycled.

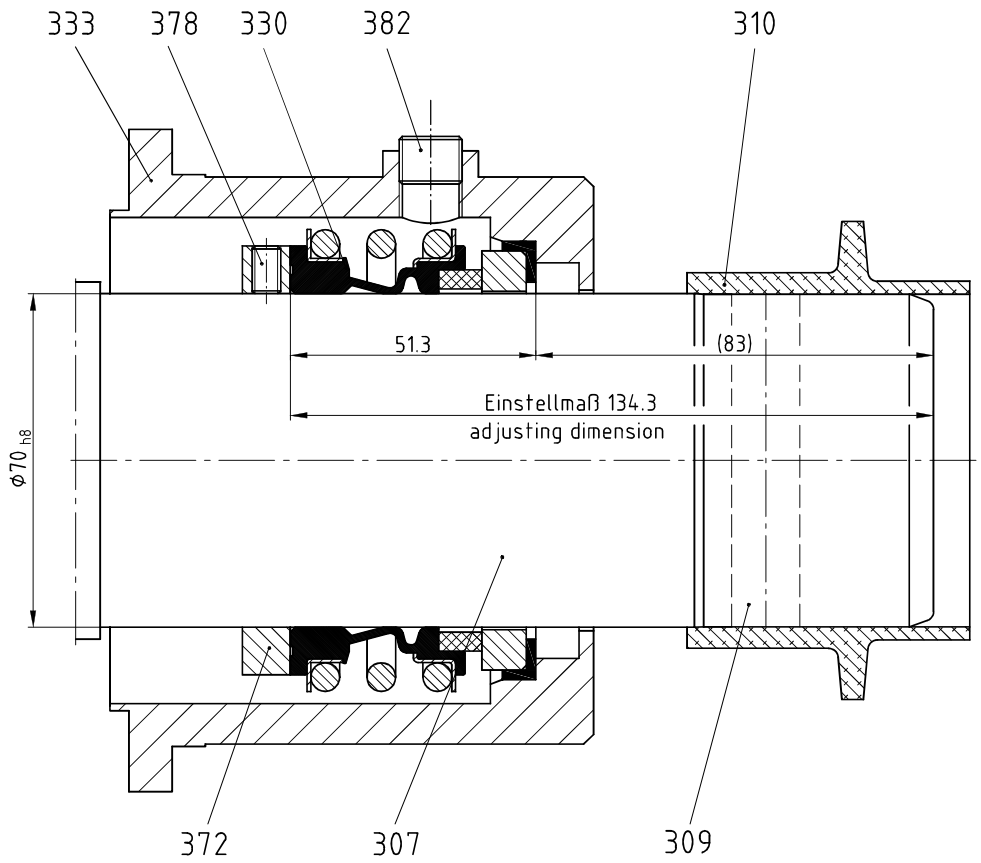
Required details for inquiries and orders

For inquiries and orders the following details are required:

- SEEPEX pump commission no.
- Part item no., designation, material, number of pieces with reference to the drawing if available.

SEEPEX Inc.
511 Speedway Drive
Enon, OH 45323
USA

Phone: 1-937-864-7150
Fax: 1-937-864-7157



Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs-Nummer/Drawing-Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg
1		382	Verschlußschraube / screwed plug		1/4"NPT	
3		378	Gewindestift / set screw		M6 x 10	
1		372	Stellring / set collar 062-372/0170-0-001_4			
1		333	GLRD-Gehäuse / mechanical seal casing 262-333/0170-0-043_4			
1		330	GLRD / mechanical seal GA-Φ70		Fabrikat / make : SEEPEX	
1		310	Spritzring / splash ring 062-310/0170-0-001_4			
1		309	Steckwellenbolzen / plug-in shaft pin 062-309/0170-0-001_4			
1		307	Steckwelle / plug-in shaft 262-307/0170-0-001_3			

SEEPEX.
ALL THINGS FLOW

Allgemeintoleranzen für Maße ohne einzelne Toleranzeintragung DIN ISO 2768-mittel
General tolerances for mass without individual tolerance entry DIN ISO 2768-average
Rauheit für Oberflächenzeichen DIN ISO 1302 Reihe 2
Roughness for surface finish indication DIN ISO 1302 Reihe 2

Ausgabe Issue	Änderung Modification	Name Name	Datum Date

	Name Name	Datum Date
Bearbeitet/Drawn	jar	18.06.2014
Geprüft/Checked	kno	18.06.2014
Normiert/Standard		
Gedruckt/Printed		

Maßstab/Scale: 1:1
Werkstoff/Material:
Gewicht/Weight:
Bezeichnung/Denomination:
GLRD - Schnittzeichnung
mechancial seal sectional drawing
SEEPEX GA- Φ70 cup seat
NPT
Zeichnungs-Nummer/Drawing-Number: 262-0GA/0170-0-084A3
EDV-Nr./EDP-No.: L:\LFDZCHNG.1390\139019.dwg
Ersatz für/Replacement for:
Ersetzt durch/Replacement by:

10.0

Manufacturer's Documents from Sub-supplier

Intelligent Drivesystems

B1000

Operating & Instruction Manuals For Gear Units

100200112

NORD DRIVESYSTEMS

Spanning the Globe to Serve You

Since 1965, NORD Gear has grown to global proportions on the strength of product performance, superior customer service, and intelligent solutions to a never-ending variety of industrial challenges.

All mechanical and electrical components of a drive are available from NORD Gear. Our products cover the full range of drive equipment: helical in-line, helical shaft-mount, helical bevel, helical worm gearboxes, motors and AC drives from 1/6 hp to 250 hp, with torques from 90 lb-in to 900,000 lb-in.

But NORD Gear does far more than manufacture the world's finest drive components. We provide our customers with optimum drive configurations for their specific purposes, providing each and every one of them with truly complete and efficient systems at a price/quality ratio unmatched in today's fast-changing markets.

NORD Gear makes its wide range of products easily available through a global network that provides all customers with prompt delivery and expert support services to consistently exceed customer expectations. We are firmly committed to being totally responsive to the ideas and specifications of every customer, anywhere in the world.

TABLE OF CONTENTS

1. Importance of the operating instructions

These operating instructions are intended to provide general information and safety guidelines. It is the responsibility of the buyer, machine builder, installer and user of the NORD product to make sure that all the proper safetynotes and operating instructions have been reviewed and understood. If the contents of this instruction or any applicable operating instructions are not understood, please consult NORD.

⚠ *WARNING*

Electric motors, gearmotors, electrical brakes, variable frequency drives, and gear reducers contain potentially dangerous high-voltage, rotating-components and surfaces that may become hot during operation. All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians.

2. Inspect incoming freight

Before accepting shipment from the freight company, thoroughly inspect the NORD equipment for any shipping and handling damage. If any goods called for in the bill of lading or express receipt are damaged, or if the quantity is short, do not accept until the freight express agent makes an appropriate notation on your freight bill or express receipt. If any concealed loss or damage is discovered later, notify your freight carrier or express agent at once, and request a formal review of your claim.

Claims for loss or damage in shipment must not be deducted from the NORD invoice, nor should payment of the NORD invoice be withheld awaiting adjustment of such claims, as the carrier guarantees safe delivery. NORD will try to assist in collecting claims for loss or damage during shipment; however, this willingness on our part does not remove the transportation company's responsibility in reimbursing you for collection of claims or replacement of material.

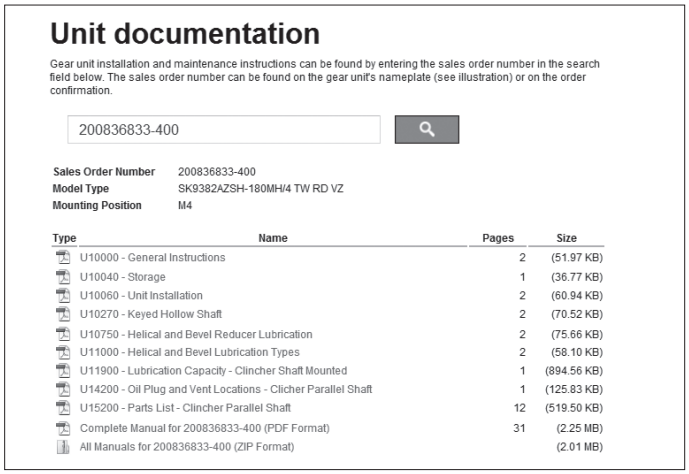
3. Obtaining detailed operating instructions

One can receive the detailed installation and maintenance instructions by entering a serial number (or NORD order number) at the appropriate location on the NORD web site.

i. Record the serial number from your gearmotor, gear reducer, or motor nameplate, or record the serial number found on your order confirmation.

ii. Go to **www.nord.com/docs** to download the appropriate operating instructions.

EXAMPLE: www.nord.com/docs



Unit documentation

Gear unit installation and maintenance instructions can be found by entering the sales order number in the search field below. The sales order number can be found on the gear unit's nameplate (see illustration) or on the order confirmation.

200836833-400

Sales Order Number 200836833-400
Model Type SK9382AZSH-180MH/4 TW RD VZ
Mounting Position M4

Type	Name	Pages	Size
	U10000 - General Instructions	2	(51.97 KB)
	U10040 - Storage	1	(36.77 KB)
	U10060 - Unit Installation	2	(60.94 KB)
	U10270 - Keyed Hollow Shaft	2	(70.52 KB)
	U10750 - Helical and Bevel Reducer Lubrication	2	(75.66 KB)
	U11000 - Helical and Bevel Lubrication Types	2	(58.10 KB)
	U11900 - Lubrication Capacity - Clincher Shaft Mounted	1	(894.56 KB)
	U14200 - Oil Plug and Vent Locations - Clicher Parallel Shaft	1	(125.83 KB)
	U15200 - Parts List - Clincher Parallel Shaft	12	(519.50 KB)
	Complete Manual for 200836833-400 (PDF Format)	31	(2.25 MB)
	All Manuals for 200836833-400 (ZIP Format)		(2.01 MB)

4. Intended use

NORD is a supplier of electric motors, gearmotors, reducers, electromechanical brakes, mechanical variators, and electrical variable frequency drives that are intended for commercial installations on larger systems and machines.

⚠ *WARNING*

NORD does not accept any liability for damage or injury caused by:

- Inappropriate use, operation or adaptation of the drive system.
- Unauthorized removal of housing covers, safety and inspection covers, guarding, etc.
- Unauthorized modifications to the drive system.
- Improper servicing or repair work on the drive system.
- Damage caused during shipment or transportation.
- Disregard of the important Safety Notes or Operating Instructions.

5. Notes concerning warranty and liability

All units are supplied according to the terms described in our standard "Conditions of Sale." The unit limited warranty is also defined in our "Conditions of Sale" and is located in the back of our product catalogs as well as the back of your order invoice.

All NORD Safety Notes and all related NORD Operating instructions shall be considered up-to-date at the time in which they were compiled by the buyer, machine builder, installer or user. NORD reserves the right to incorporate technical modifications and information updates to any safety/operating instructions that are within the scope of providing additional knowledge or clarification, communicating design changes, or product enhancements. Information updates may include any NORD product, or subsequent products purchased and supplied by NORD; No specific claims can be derived from the information or illustrations and descriptions contained in the safety notes or related operating instructions.

⚠ *WARNING*

NORD assumes no liability for personal injury, equipment damage or malfunctions resulting from failure to comply with any installation safety notes. The applicable national, regional, and local work regulations and safety requirements must also be complied with. Failure to comply with any safety notes or regulations may result in serious injury, damage to property, or even death.

6. Checklist for installation and operation

☑ Verify that the purchased NORD product has been supplied with the expected accessories & options. Check the received goods and packing slip to make sure items are properly received.

☑ Make sure that you have all of the required Operating Instructions for your NORD electric motor, gearmotor, reducer, electromechanical brake, mechanical variable speed drives, or electrical variable frequency drives.

☑ Consult NORD if you feel you are missing any documentation or if you have questions.

1. Safety & information symbols

All work including transportation, storage, installation, electrical connection, commissioning, servicing, maintenance and repair must be performed **only by qualified specialists or personnel**. It is recommended that repairs to NORD Products are carried out by the NORD Service Department. Instructions related to operational safety will be emphasized as shown.

Symbol	Meaning
⚠	**Danger, Caution or Warning -** Severe risk or danger of personal injury or death by working around dangerously high electrical voltage or moving machinery. Proper safety precautions must be taken.
NOTICE	**Notice -** Care must be taken to avoid the possibility of damaging the drive unit, driven machine, or the environment.
ℹ	**Important Note -** Useful note or tip to help assure trouble-free operation.
♻	**Material Disposal Note -** Important note concerning suggested material disposal.

2. Safety warnings

⚠ DANGER

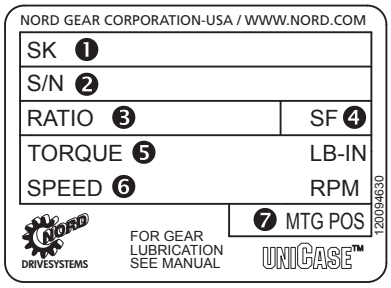
- All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians. All applicable national, regional, and local work regulations and safety requirements must also be complied with. **NORD assumes no liability for personal injury, accidental death, or equipment damage and malfunctions resulting from failure to comply with installation or operating instructions, safety notes, or any work regulations and laws!**
- Gear unit installation and maintenance work may only be performed when no power is available to the prime mover or motor. Electric motors, electrical brakes, and variable frequency drives, contain potentially dangerous high-voltage. Prior to installation or maintenance, shut down the power at the circuit breaker or power switch. **While working on the drive, make sure the power from the prime mover is isolated or secured on "lock-out" to prevent accidental start-up and to safeguard against injury!**
- Surfaces of motors and gear units may become hot during operation or shortly after start-up. In some instances additional protection against accidental contact may be necessary. **Use caution to avoid burns or serious injury!**

3. Observe published performance range & nameplate data

NOTICE

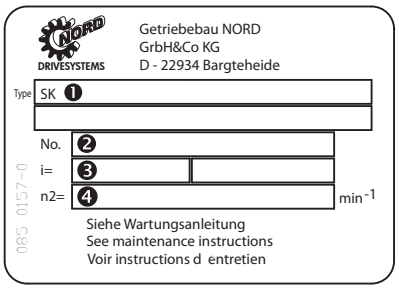
Observe the data on all reducer nameplates and verify published ratings for the NORD item/s in question. Do not operate any NORD equipment outside the published performance range. Failure to comply may result in damage to the drive unit, driven machine, or the environment.

U.S. Nameplate



❶ Model/Type
❷ Serial Number
❸ Gear Ratio
❹ Service Factor
❺ Torque Rating
❻ Output Speed RPM
❼ Mounting Position

European Nameplate



❶ Model/Type
❷ Serial Number
❸ Gear Ratio
❹ Speed

4. Transportation and handling

Make sure that all eyebolts and lifting lugs are tight and lift only at designed points. Protect the mounting surface from possible damage during transportation.

⚠ WARNING

Do not attach other machinery or loads to the NORD assembly, the supplied lifting bolts are not designed for this purpose and may result in drive damage or personal injury.

If the gearmotor or assembly is equipped with two suspension eye bolts, then both locations should be used for transportation and placement of the unit; in this case the tension force of the slings must not exceed a 45° angle.

In some instances it may be appropriate to use additional lifting straps or slings in order to assure safe transportation of the assembly. Always use sufficiently rated handling equipment and ensure that adequate safety measures are taken to protect personnel from injury during transportation. Once the NORD assembly is properly installed, remove the transportation fixtures.

7. DISPOSAL

MATERIAL DISPOSAL

Properly dispose of all used gear units and internal parts in accordance with all local regulations. In particular, all lubricants must be properly collected and disposed.

For confirmation of specific materials used in a specific reducer or gearmotor assembly, please consult NORD with the appropriate unit identification or serial number.

Components	Material
Gear wheels, shafts, rolling bearings, parallel keys, snap rings, spacers, shims, etc.	Steel
Gear housing and housing components	Cast iron or Aluminum (depending on type and size)
Worm gears	Bronze alloy
Radial seals, sealing caps, and rubber components	Elastomers with some steel
Coupling components	Plastic or Elastomer with Steel
Housing gaskets and flat oil seals	Asbestos-free sealing or gasket material (various types used)
Gear Oil	Mineral, SHC-Synthetic or PG-Synthetic (can vary)

1. Storage

IMPORTANT NOTE

For storage periods longer than 9 months, or for storage in less than desirable conditions, please consult NORD for recommendations.

Storage for up to 9 months is possible, so long as the following conditions are observed:

- Store the gear unit in its actual mounting position in accordance with the specified oil fill-level, in a clean and dry temperature controlled area. Avoid temperature fluctuations within the range of 0°C and 40°C (32°F to 104°F) and avoid relative humidity conditions in excess of 60%.
- Protect all exposed or unpainted shaft and flange surfaces with an anti-corrosion agent or grease.
- Store in a location free from shock and vibration, to avoid false brinelling of bearing elements and raceways.
- Whenever possible, rotate the shafts periodically, by hand if necessary, to help prevent brinelling (bearing damage) and to help keep the shaft seals pliable.
- Avoid direct exposure to the sun or UV light and aggressive or corrosive materials in the environment (ozone, gases, solvents, acids, caustic solutions, salts, radioactivity, etc.

2. Commissioning

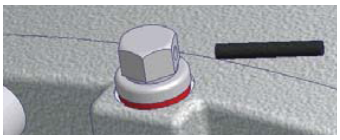
Prior to gear unit start-up, complete the following:

- Please check your gear unit for a vent and if applicable to your product, remove the sealing plug to activate.

NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal gearbox components and leakage.

Sealed vent



Activated vent

- Check the lubricant and be sure the gear unit is filled with the proper oil type, to the proper level, as determined by the mounting position.

IMPORTANT NOTE

Some smaller gear units are supplied as maintenance free/ lubricated for life gear units. Oil level may not be checked on some of these units.

- Check the condition of all shaft seals and all assembled flange gasket areas. If any change is detected in the shape, color, hardness or permeability, or if any leaks are detected, the corresponding shaft seals and/or gaskets must be replaced.
- Remove all anti-corrosive metal protectant from otherwise bare metal surfaces. Follow product manufacturers directions and warnings during surface protection removal.
- Check the resistance of all motor and brake windings to verify the integrity of the winding insulation and inspect all terminal box openings and wire connection areas to verify that all components are dry and free of corrosion.

3. Long-Term Storage

By taking special precautions, problems such as seal leakage and reducer failure due to the lack of lubrication, improper lubrication quantity, or contamination can be avoided. The following precautions will protect gear reducers during periods of extended storage:

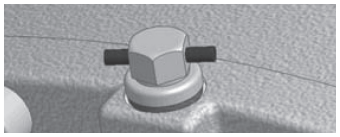
- Store the gear unit in its actual mounting position in accordance with the specified oil fill-level, in a clean and dry temperature controlled area. Avoid temperature fluctuations within the range of 0°C and 40°C (32°F to 104°F) and avoid relative humidity conditions in excess of 60%.
- Fill the reducer full with oil that is compatible with the product normally used or recommended during service.
- Apply grease to all unpainted or unprotected shafts, bores, keyways, flange surfaces, tapped holes, and to the exterior of all oil seals.
- Store in a location free from shock and vibration, to avoid false brinelling of bearing elements and raceways.
- Once every few months rotate the input shaft approximately 10-20 revolutions to redistribute the weight of gears and shafts and to prevent brinnelling of the bearings and drying of the seal track.
- Avoid direct exposure to the sun or UV light and aggressive or corrosive materials in the environment (ozone, gases, solvents, acids, caustic solutions, salts, radioactivity, etc.)

4. Commissioning After Long-Term Storage

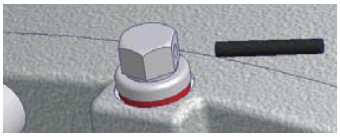
• Please check your gear unit for a vent and if applicable to your product, remove the sealing plug to activate.

NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal gearbox components and leakage.



Sealed vent



Activated vent

- Remove all anti-corrosive metal protectant from otherwise bare metal surfaces. Follow product manufacturers directions and warnings during surface protection removal.
- Drain the reducer and refill it with the proper type and amount of lubricant.
- Observe start-up and initial operation to make sure there are no seal or gasket leaks, or unusual sounds, vibration or heat rise during operation.
- Check the resistance of all motor and brake windings to verify the integrity of the winding insulation and inspect all terminal box openings and wire connection areas to verify that all components are dry and free of corrosion.

1. Installation site

Drives must be properly installed if they are to produce the rated torque. Improper installation may lead to oil leaks, reduced life, or even catastrophic failure. NORD gear drives and motors are intended to be installed at a suitable mounting site under the following conditions:

- Unimpeded airflow to and around the units.
- Accessibility to oil drain, level and breather plugs.
- On brakemotors, allow adequate space for removing the fan guard and replacing and adjusting the brake.
- Mounting surfaces must be flat, torsionally rigid, and dampened against vibration.
- Unless special measures are taken, the immediate vicinity around the gear drive or motor should not be exposed to any aggressive or corrosive substances, contaminated air, ozone, gases, solvents, acids, alkalis, salts, radioactivity, etc.

2. Mounting position

Reducer mounting position charts illustrate the standard mounting positions for horizontal and vertical mounting. All gear units are assembled with the oil fill-level, oil-drain and vent plugs installed in their proper locations, **according to the customer-specified mounting position**. For mounting orientations other than shown consult NORD Gear.

NOTICE

Improper oil levels may lead to premature component wear and diminished service life. The gear reducer may not receive proper lubrication if the unit is not mounted in the position for which it is designed. Observe the mounting position designated on the reducer nameplate, or specified in the order acknowledgement. Consult NORD prior to changing mounting position in the field. While it is often possible to simply relocate the oil fill-level and vent locations, and adjust the oil fill amount, in some cases, different mounting positions may lend themselves to different internal construction features.

3. Reducer mounting

- The support foundation must be straight, level and flat. Whether the gear unit is foot-mounted or flange-mounted, NORD recommends that the straightness and flatness of the customer-supplied support foundation follow **Table 1**.
- The gear unit must be properly aligned with the driven shaft of the machine in order to prevent additional stress or load forces from being imposed upon the gear unit.
- To facilitate oil drainage it may be desirable to elevate the gear box foundation above the surrounding support structure.
- All bolting surfaces must be clean and free from contamination and corrosion.

Table 1: Recommended Straightness and Flatness of Customer-Supplied Support Foundation

Above (in)	To & Including (in)	General Tolerance on Straigtness & Flatness ISO 2768-2, Tolerance Class K
0.00	0.39	+/- 0.002 in
0.39	1.18	+/- 0.004 in
1.18	3.9	+/- 0.008 in
3.9	11.8	+/- 0.016 in
11.8	39	+/- 0.024 in
39	118	+/- 0.031 in

Above (mm)	To & Including (mm)	General Tolerance on Straigtness & Flatness ISO 2768-2, Tolerance Class K
0	10	+/- 0.05 mm
10	30	+/- 0.1 mm
30	100	+/- 0.2 mm
100	300	+/- 0.4 mm
300	1000	+/- 0.6 mm
1000	3000	+/- 0.8 mm

Straightness: Based upon the length of the corresponding line.

Flatness: Based upon the longer lateral surface or the diameter of the circular surface.

IMPORTANT NOTE

The responsibility for the design and construction of the support foundation is with the user. The foundation must be adequate to withstand normal operating loads and possible overloads while maintaining alignment to attached system components under such loads. ***Motors and drive components mounted on prefabricated base plates can become misaligned during shipment. Always check alignment after installation.***

4. Steel foundation

An engineered structural steel foundation should be designed to provide adequate rigidity and prevent loads from distorting the housing or causing misalignment of internal gears and shafts. When foot-mounting the gear reducer, a base plate or sole plate with suitable thickness (generally equal or greater than the thickness of the drive feet) should be securely bolted to steel supports and extend under the entire gear drive assembly. When flange-mounting the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear unit or gear motor.

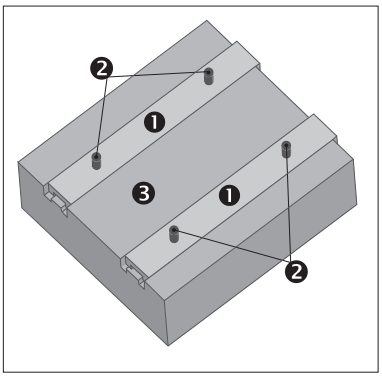
NOTICE

Do not weld on the gear unit or use the gear unit as an earth or ground connection for any welding procedure as this may cause permanent damage to the bearings and gears.

5. Concrete foundation

If a concrete foundation is used, allow the concrete to set firmly before bolting down the gear drive. Grout structural steel mounting pads and bolts of sufficient size into the concrete, to adequately distribute the load stress onto the concrete foundation.

Figure 1: Concrete Foundation



❶ Grouted Structural Steel Mounting Pads
❷ Mounting Bolts
❸ Concrete Foundation

6. Bolt connections for footed & flange mounted units

NORD footed reducers and flange-mount reducers (with B5 flange) have clearance designed into the mounting holes to allow for some minor adjustments in alignment. Bolt size, strength and quantity should be verified to insure proper torque reaction capacity whatever the mounting arrangement. Tightening torque for gear reducer mounting bolts, and recommended fastener grades, are provided in Table 2.

Table 2A: Tightening Torque for Inch Reducer Mounting Bolts

Thread Size	Grade SAE 5 / ASTM A449		Grade SAE 8	
(in)	(lb-ft)	(Nm)	(lb-ft)	(Nm)
1/4-20	7.1	9.6	10.0	13.6
5/16-18	16	21	22	30
3/8-16	28	37	39	53
1/2-13	69	93	98	132
5/8-11	138	188	195	264
3/4-10	247	334	348	472
7/8-9	396	537	558	757
1-8	592	802	833	1,130
1 1/8-7	-	-	1,233	1,672
1 1/4-7	-	-	1,717	2,327
1 3/8-6	-	-	2,267	3,073
1 1/2-6	-	-	2,983	4,045
1 3/4-5	-	-	4,458	6,045

- Calculated tightening torques are based a conventional 60°, clean and dry (un-lubricated) thread, with thread-friction and head-friction equal to 0.15.
- When using inch-fasteners, NORD recommends a minimum Grade SAE 5 (ASTM A-449) for sizes up to 1-8 UNC, and Grade SAE 8 for all larger sizes.

Table 2B: Tightening Torque for Metric Reducer Mounting Bolts

Above	ISO Grade 8.8		ISO Grade 10.9		ISO Grade 12.9	
(mm)	(lb-ft)	(Nm)	(lb-ft)	(Nm)	(lb-ft)	(Nm)
M4	2.4	3.2	3.5	4.7	4.1	5.5
M5	4.7	6.4	6.9	9.3	8.1	11
M6	8	11	12	16	14	19
M8	20	27	29	39	34	46
M10	39	53	58	78	67	91
M12	68	92	100	135	110	155
M14	107	145	159	215	180	250
M16	170	230	247	335	290	390
M18	240	325	343	465	400	540
M20	339	460	487	660	570	770
M22	465	630	664	900	770	1,050
M24	583	790	848	1,150	960	1,300
M27	848	1,150	1,217	1,650	1,440	1,950
M30	1,180	1,600	1,660	2,250	1,950	2,650
M36	2,050	2,780	2,884	3,910	3,470	4,710
M42	3,297	4,470	4,639	6,290	5,560	7,540
M48	4,940	6,700	7,010	9,500	8,260	11,200

- Calculated tightening torques are based on a conventional 60°, clean and dry (un-lubricated) thread, with thread-friction and head-friction equal to 0.15.
- When using metric-fasteners, NORD recommends a minimum ISO Grade 8.8 bolt.

7. Mounting the prime mover

When the motor is not flange mounted or integrally mounted to the gearbox, it is important to properly secure and align the gear drive with respect to the driven machine before attempting to align the prime mover or motor.

A. After the main gear drive is properly aligned and bolted in place, align the prime mover with respect to the reducer input shaft.

B. Use shims under the feet of the prime mover as needed, and secure in place with the proper mounting bolts. Dowel pins may be field-installed to help prevent misalignment and ensure proper realignment if removed for service.

IMPORTANT NOTE

When using a high speed coupling connection between the prime mover and the reducer, check alignment per the coupling manufacturers recommendations. If the coupling is misaligned, the reducer alignment or shimming is incorrect. Re-align the gear reducer and re-check the high-speed coupling alignment before re-aligning the motor.

1. Solid shaft diameter tolerance

Reducer input and output shaft extensions have a diameter tolerance as specified in **Table 1**.

Table 1: Solid Shaft Diameter Tolerance

Above ø (in)	To & Including ø (in)	Tolerance (in)
0.375	1.750	+0.0000 / -0.0005
1.750	7.500	+0.0000 / -0.0010

Above ø (mm)	To & Including ø (mm)	Tolerance (mm)	ISO 286-2 Fit Class
10	18	+0.012 / +0.001	k6
18	30	+0.015 / +0.002	k6
30	50	+0.018 / +0.002	k6
50	80	+0.030 / +0.011	m6
80	120	+0.035 / +0.013	m6
120	180	+0.040 / +0.015	m6
180	190	+0.046 / +0.017	m6

2. Fitting drive elements onto the reducer solid shaft

Solid input and output shaft extensions are provided with a drill and tap feature as indicated in Table 2. When installing drive elements such as coupling hubs, pulleys, sprockets, or gears, NORD recommends using the threaded hole in the end of the shaft, along with a suitable assembly device fitted into the threaded hole.

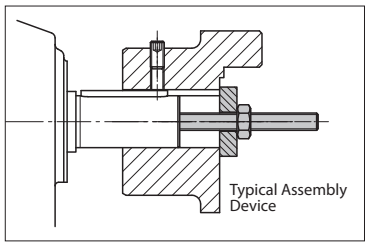


Table 2: Solid Shaft End - Threaded Holes

Above ø (in)	To & Including ø (in)	Tap Size & Depth (in)
0.375	0.500	10-24 x 0.43 in
0.500	0.875	1/4-20 x 0.59 in
0.875	0.938	5/16-18 x 0.71 in
0.938	1.100	3/8-16 x 0.87 in
1.100	1.300	1/2-13 x 1.10 in
1.300	1.875	5/8-11 x 1.42 in
1.875	3.500	3/4-10 x 1.73 in
3.500	7.500	1-8 x 2.63 in
5.125	8.875	1 1/4 - 7 x 3.15*
6.000	8.875	1 3/8 - 6 x 3.46**

Above ø (mm)	To & Including ø (mm)	Tap Size & Depth (mm)
10	13	M4 x 10 mm
13	16	M5 x 12.5 mm
16	21	M6 x 16 mm
21	24	M8 x 19 mm
24	30	M10 x 22 mm
30	38	M12 x 28 mm
38	50	M16 x 36 mm
50	85	M20 x 42 mm
85	130	M24 x 50 mm
130	225	M30 x 60 mm*
130	225	M36 x 74 mm**

* Only used on the SK9096.1 Helical-Bevel Gear Unit.

** Only used on the SK10382.1 & SK11382.1 CLINCHER™ gear units.

NOTICE

DO NOT DRIVE or **HAMMER** the coupling hub, pulley, sprocket, or gear into place. An endwise blow to the reducer shaft can generate damaging axial forces and cause damage to the reducer housing, bearings or internal components.

⚠ WARNING

To avoid serious injury the user must provide suitable safety guards for all rotating shafts and shaft components such as couplings, chain drives, belt drives, etc. All guarding must adhere to local regulations and safety standards.

3. Installing interference-fit hubs to the reducer shaft

Prior to installing any interference-fit hubs to the reducer shaft, consult with the manufacturer to determine proper assembly and fit. Interference-fits usually require heating the coupling, sprocket or gear hub, per the manufacturer's recommendations. Coupling hub installation typically follows ANSI/AGMA 9002-A86. Always make sure the reducer shaft seals are protected from the heat source. Apply uniform heat to the drive element hub to prevent distortion. NORD does not recommend heating the drive element hub beyond 212°F to 275°F (100°C to 135° C).

⚠ WARNING

When using heat to mount a drive element hub, do not use open flame in a combustible atmosphere or near flammable materials. Use suitable protection to avoid burns or serious injury.

IMPORTANT NOTE

When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close to the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tighten the belts or chains.

4. Coupling installation

The performance and life of any coupling depends upon how well it is installed. Coupling hubs are typically mounted flush with the shaft ends, unless specifically ordered for overhung mounting. Shaft couplings should be installed according to the coupling manufacturer's recommendations for gap, angular and parallel alignment. To help obtain critical shaft alignment coupling hubs may be installed to the machine shafts prior to final shimming or tightening of the foundation bolts. Proper coupling alignment allows for thermal and mechanical shaft movement during operation and ensures that only torque (no radial load) is transmitted between the mating shafts.

Coupling gap and angular alignment

The shaft gap must be sufficient to accommodate any anticipated thermal or mechanical axial movement. When setting the coupling gap, insert a spacer or shim stock equal to the required spacing or gap between the coupling hub faces. Measure the clearance using feeler gauges at 90-degree intervals, to verify the angular alignment.

Parallel (or offset) alignment

Mount a dial indicator to one coupling hub, and rotate this hub, sweeping the outside diameter of the other hub. The parallel or offset misalignment is equal to one-half of the total indicator reading. Another method is to rest a straight edge squarely on the outside diameter of the hubs at 90° intervals and measure any gaps with feeler gauges. The maximum gap measurement is the parallel or offset misalignment.

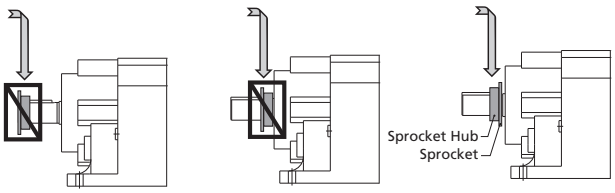
Check alignment

After both angular and parallel alignments are within specified limits, tighten all foundation bolts securely and re-check critical alignment. If any of the specified limits for alignment are exceeded, realign the coupling.

5. Installing sheaves (pulleys), sprockets and gears

To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, gears, etc.) so that the applied load center is as close to the gear housing as possible, as shown in **Figure 2**.

Figure 2: Sprocket or Gear Mounting



Preferred Mounting of Sprocket or Gear

Align the driver sheave or sprocket with the driven sheave or sprocket by placing a straight-edge length-wise across the face of the sheaves or sprockets. Alignment of bushed sheaves and sprockets should be checked only after bushings have been tightened. Check horizontal shaft alignment by placing one leg of a square or a level vertically against the face of the sheave or sprocket.

Always check component alignment and tension any belts or chains per the manufacturer's recommendation. The ideal belt or chain tension allows proper wrap of the driver and driven wheels, while maintaining the lowest possible tension of the belts or chain, so that no slipping occurs under load conditions. Check belt or chain tension frequently over the first 24 to 48 hours of operation.

IMPORTANT NOTE

When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tension the belts or chains.

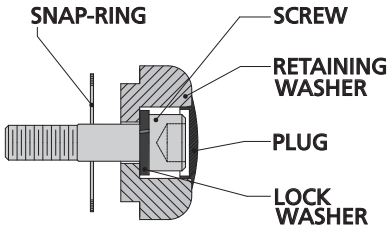
6. Outboard pinion gear alignment

Align outboard pinion gears and adjust the gear tooth clearance according to the manufacturer's recommendations, checking for acceptable outboard pinion tooth contact. The foundation bolts may have to be loosened and the gear unit moved slightly to obtain proper gear tooth contact. After the unit is moved to correct tooth contact, the prime mover may need to be realigned.

1. Shaft fixing kit - basic design

The NORD Fixing Kit provides a method for securing the reducer in an axial direction, after the keyed-hollow shaft reducer is mounted onto the machine shaft. The fixing kit prevents the reducer from shifting or walking out of place during operation. NORD offers a variety of standard fixing kits, based upon bore size, as shown on Page 2 of this manual.

Figure 1 – Fixing kit components



IMPORTANT NOTE

For installation of the keyed-hollow bore reducer to the machine-shaft, see user manual U10270.

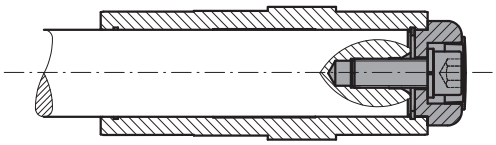
2. Assembly types

There are two types of assembly methods commonly used for securing the fixing kit.

Figure 2 – Fixing kit assembly methods

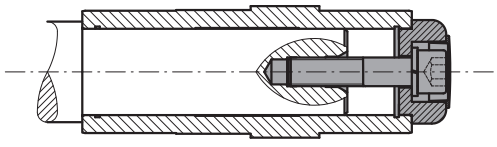
Type 1

The machine-shaft is located against a fixed snap-ring located inside the bore of the reducer.



Type 2

The machine shaft is shouldered and is pulled tight against the hollow-shaft; the snap-ring is no longer required.



NOTICE

The maximum edge break on the solid machine shaft must not exceed the values shown on Page 2 of this manual. Otherwise the load-bearing capacity of the snap-ring will be reduced and may result in failure.

3. Assembly

A. If using a Type 1 assembly, secure the appropriate snap-ring into the bore of the reducer. With Type 2 assembly, no snap-ring is required.

B. Draw the hollow bore gear reducer onto the machine shaft as instructed in U10270. Remember to apply a suitable assembly paste or anti-seize compound to the mating shafts.

C. Install the retaining washer over the end of the hollow bore.

D. Secure the appropriate cap-screw into the machine shaft and tighten the screw based upon the assembly type, as noted below. Then install the protective plug over the screw hole.

Type 1 - Screw tightening

Tighten until lightly snug and secure the screw with a thread-locking compound to prevent the screw from backing out.

NOTICE

Over tightening the retaining screw may cause the snap ring to be pulled out of its seating groove, causing damage to the hollow-bore or snap ring.

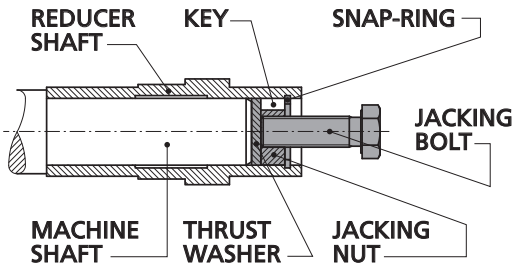
Type 2 - Screw tightening

Follow the cap screw manufactures guidelines and tighten the screw to the proper torque, based upon the bolt grade and material. For reference tightening torque values, also see manual U10060, Table 2.

4. Disassembly

When using Type 2 assembly, it is possible to design a simple disassembly tool to allow easier removal of the hollow-bore reducer. The solid shaft is shouldered to rest against the hollow-bore of the reducer. The machine shaft is supported in both of the hollow bore land areas, but the overall length is reduced compared to Type 1 assembly.

Figure 3 – Disassembly Tool



IMPORTANT NOTE

For suggestions on how to construct a disassembly tool for a particular reducer and bore size, please consult NORD's application engineering department.

5. Standard fixing kit size offerings

NORD offers a variety of standard fixing kit sizes as shown by the following tables.

Table 1 - Standard fixing kit size offerings

Shaft Bore [in]	Bolt Size	Allowable Thrust Groove ❷ lb [N]	Allowable Thrust Ring ❸ lb [N]	Max. Edge Break ❹ in [mm]
0.500	10-32	730 [3255]	520 [2300]	0.02 [0.5]
0.750	1/4-20	1800 [7905]	560 [2500]	0.04 [1]
1.000	3/8-16	2900 [13020]	1000 [4600]	0.04 [1]
1.188	7/16-14	5100 [22630]	1000 [4700]	0.04 [1]
1.250	7/16-14	5100 [22630]	1000 [4700]	0.04 [1]
1.375	5/8-11	6500 [29140]	1400 [6400]	0.06 [1.5]
1.438	5/8-11	6900 [30690]	1500 [6500]	0.06 [1.5]
1.500	5/8-11	7800 [34875]	1500 [6700]	0.06 [1.5]
1.625	5/8-11	9900 [44020]	1900 [8400]	0.08 [2]
1.688	5/8-11	10500 [46810]	1800 [8200]	0.08 [2]
1.938	5/8-11	11100 [49600]	1900 [8400]	0.08 [2]
2.000	5/8-11	14100 [62775]	2700 [12100]	0.08 [2]
2.063	5/8-11	14100 [62775]	2700 [12100]	0.08 [2]
2.188	5/8-11	16800 [74865]	2900 [13000]	0.08 [2]
2.375	3/4-10	17400 [77190]	2900 [13000]	0.08 [2]
2.438	3/4-10	17400 [77190]	2900 [13000]	0.08 [2]
2.750	3/4-10	19600 [87110]	4700 [21000]	0.10 [2.5]
2.938	3/4-10	20900 [93000]	4700 [21000]	0.10 [2.5]
3.188	3/4-10	27700 [123225]	7000 [31200]	0.12 [3]
3.438	3/4-10	29300 [130200]	7000 [31400]	0.12 [3]
3.625	3/4-10	30900 [137330]	7000 [31400]	0.12 [3]
3.938	7/8-9	32400 [144305]	6900 [30800]	0.12 [3]
4.000	7/8-9	39000 [173600]	16400 [73000]	0.12 [3]
4.063	7/8-9	39000 [173600]	16400 [73000]	0.12 [3]
4.375	7/8-9	41500 [184450]	16200 [72000]	0.12 [3]
4.438	7/8-9	41500 [184450]	16200 [72000]	0.12 [3]
4.750	7/8-9	44200 [196850]	15700 [70000]	0.12 [3]
4.938	7/8-9	48000 [213900]	15500 [69000]	0.12 [3]

Upon request, additional hollow-bore sizes & fixing kit sizes may be offered.

Shaft Bore [mm]	Bolt Size	Allowable Thrust Groove ❷ N [lb]	Allowable Thrust Ring ❸ N [lb]	Max. Edge Break ❹ mm [in]
16	M5	Not applicable ❶		
20	M6	8370 [1900]	5600 [1300]	1.0 [0.04]
25	M10	12400 [2800]	7300 [1600]	1.0 [0.04]
30	M10	17515 [3900]	7200 [1600]	1.0 [0.04]
35	M12	29140 [6500]	8700 [1900]	1.5 [0.06]
40	M16	41850 [9400]	10900 [2400]	2.0 [0.08]
45	M16	46810 [10500]	10700 [2400]	2.0 [0.08]
50	M16	62775 [14100]	19000 [4300]	2.0 [0.08]
60	M20	74865 [16800]	29200 [6600]	2.0 [0.08]
70	M20	87110 [19600]	30300 [6800]	2.5 [0.10]
80	M20	115630 [26000]	56000 [12600]	2.5 [0.10]
90	M24	130200 [29300]	56000 [12600]	3.0 [0.12]
100	M24	144305 [32400]	55000 [12400]	3.0 [0.12]
110	M24	181350 [40800]	71000 [16000]	3.0 [0.12]
120	M24	196850 [44300]	70000 [15700]	3.0 [0.12]

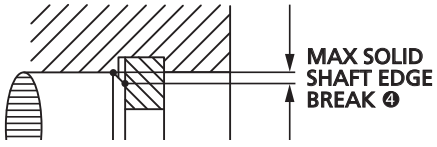
Upon request, additional hollow-bore sizes and fixing kit sizes may be offered.

❶ This fixing kit is not supplied with a snap-ring. A Type 2 machine shaft is required.

❷ Thrust load-bearing capacity of the groove is based upon using a hollow-shaft material with a yield-strength of at least 45,000 psi (310 N/mm²).

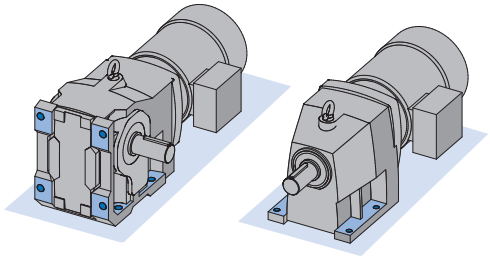
❸ Thrust load-bearing capacity of the snap-ring is based upon a typical snap-ring material with a yield-strength of at least 30,500 psi (210 N/mm²).

❹ On the solid machine shaft, observe the maximum edge break (radius or chamfer) shown. A larger edge break will result in reduced load-bearing capacity of the snap-ring.



1. Foot-mounted reducers

When installing the foot-mounted gear unit, observe the flatness specifications and bolt tightening torque guidelines provided in U10060 and make sure the mating mounting surface and reducer feet are clean and free of debris. Use of shims under the feet of the gear unit may be required in order to align the output shaft to the driven equipment. Make sure that all feet are supported so that the housing will not distort when it is bolted down. Improper shimming will cause mis-alignment and may reduce the life of the gear unit or cause component failure. Dowel pins may be field-installed to help prevent misalignment and ensure proper realignment if removed for service.



IMPORTANT NOTE

Gear units may be subjected to radial loads or side pull, caused by external chain drives or belt drives. In these instances it is recommended that the mounting base be designed with a slide-plate adjustment to accommodate extra slack in the chain or the belt after the feet are loosened. When using an external chain or belt drive, make sure the reducer is sized so that the shaft and bearings have adequate capacity.

2. Flange-mounted reducers (with B5 flange)

When using the B5 flange to mount the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear reducer or gearmotor. When the mating hole is designed with the proper fit, the flange pilot tenon provides a means of accurately positioning the reducer while the hold-down bolts are properly secured; once the reducer is secured, the tenon helps prevent movement of the reducer and it helps locate the center of the reducer output shaft. The flange centering shoulder tolerance for standard units is listed in table 1. For units with NSD Tuph please see table 2 on the following page.

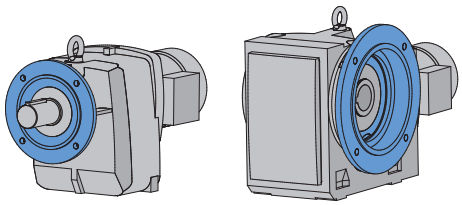


Table 1 : Flange Centering Shoulder Tolerance

Above ø (in)	To & Including ø (in)	Tolerance (in)	ISO 286-2 Fit Class
1.969	3.150	+0.0005 / -0.0003	j6
3.150	4.724	+0.0005 / -0.0004	j6
4.724	7.087	+0.0006 / -0.0004	j6
7.087	9.055	+0.0006 / -0.0005	j6
9.055	9.843	+0.0000 / -0.0011	h6
9.843	12.402	+0.0000 / -0.0013	h6
12.402	15.748	+0.0000 / -0.0014	h6
15.748	19.685	+0.0000 / -0.0016	h6
19.685	21.654	+0.0000 / -0.0017	h6

Above ø (mm)	To & Including ø (mm)	Tolerance (mm)	ISO 286-2 Fit Class
50	80	+0.012 / -0.007	j6
80	120	+0.013 / -0.009	j6
120	180	+0.014 / -0.011	j6
180	230	+0.016 / -0.013	j6
230	250	+0.000 / -0.029	h6
250	315	+0.000 / -0.032	h6
315	400	+0.000 / -0.036	h6
400	500	+0.000 / -0.040	h6
500	550	+0.000 / -0.044	h6

When installing the flange mounted gear unit, observe the flatness specifications and bolt tightening torque guidelines provided in U10060. Make sure the mating mounting surface and reducer flange are clean and free of debris. Use a straight edge or parallel bar to check for high spots on the mating mounting surface and remove any raised material around the mounting holes.

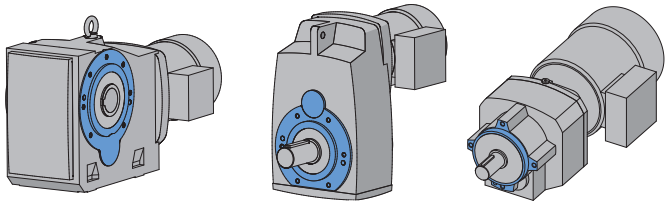
Set the gear unit into place and tighten the bolts until they are snug. Before final bolt-tightening check for any material gaps between the mating surfaces and if shimming is required, use “U” shaped shims at least 2 times the width of the bolt. Avoid over shimming a very irregular surface as this will make it very difficult to achieve proper alignment.

IMPORTANT NOTE

For heavy shock applications, it is advisable to field-install dowel pins through the mounting flange connection (in addition to the mounting bolts). This will help control flange movement or flange rotation and relieve the mounting bolts from this additional stress.

3. Flange-mounted reducers (with B14 flange)

When using the B14 flange to mount the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear reducer or gearmotor. When properly installed, the output flange of the reducer housing is designed to enable the permissible torques and radial forces to be reliably transmitted by the bolt connections. The flange centering shoulder tolerance for standard units is listed in table 1 on the previous page. For units with NSD Tuph please see table 2 below.



IMPORTANT NOTE

When using the B14 flange-face for mounting, if dowel pin holes are provided in addition to the threaded holes, then it is advisable to also use the proper dowel pins, to help control flange movement or flange rotation and relieve the mounting bolts from this additional stress This is especially important for heavy shock applications.

Table 2 : Flange Centering Shoulder Tolerance on NSD Tuph Units

Above ø (in)	To & Including ø (in)	Tolerance (in)
1.969	3.150	+0.0020 / +0.0013
3.150	4.724	+0.0021 / +0.0012
4.724	7.087	+0.0021 / +0.0011
7.087	9.055	+0.0022 / +0.0011

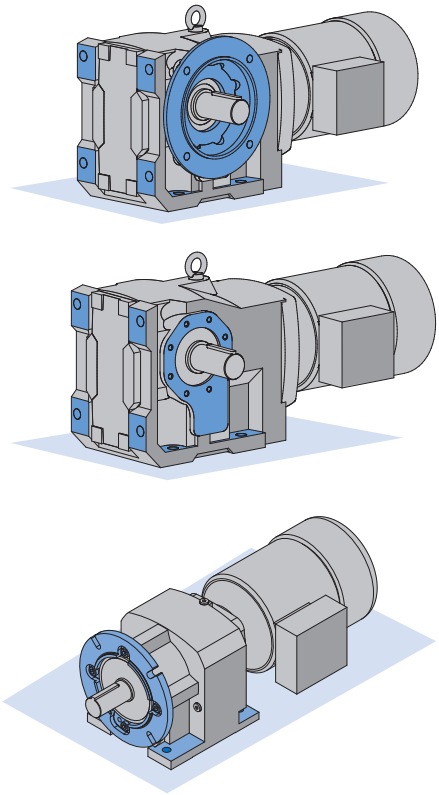
Above ø (mm)	To & Including ø (mm)	Tolerance (mm)
50	80	+0.052 / +0.033
80	120	+0.053 / +0.031
120	180	+0.054 / +0.029
180	230	+0.056 / +0.027

4. Foot & flange reducer housings

Some gear reducer housings are available with a foot and an output flange. Units with a foot and a B5 Flange are designated with the suffix XF after the primary model number and units with a B14 face-flange are designated with the suffix XZ after the primary model number. When a gear unit is provided with both a foot and a flange, the foot is consider the primary mounting surface. The flange is generally considered to be the secondary mounting option and it is intended that this surface be used for auxiliary add on elements that place minimal load stress on the reducer housing.

NOTICE

To prevent overstress on the main gear unit housing, never tighten the reducer mounting feet and the mounting flange against one-another. Auxiliary add-on elements that are mounted to the reducer flange, must not transmit excessive force, torque or vibration to the main gear housing.



HELICAL & BEVEL REDUCER LUBRICATION

1. Importance of proper lubrication

Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective "fluid boundary" between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise.

Most NORD reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position.

2. Standard oil type

The following tables indicate the standard oil fill type used. Please see user manual U11000 for more specific information and for optional helical and bevel gear lubricants:

Serviceable Gear Units	
Helical In-line	Standard Oil Fill: ISO VG 220, Mineral Oil
Clincher Parallel-Shaft	
Right-Angle Bevel	
NORDBLOC® Series In-line	
NORDBLOC®.1 Series In-line	
Standard Series In-line	

IMPORTANT NOTE

For shipping purposes, the following large Clincher™ gear units are supplied without oil:
- Clincher™ Sizes SK11282, SK11382, SK11382.1 and SK12382

Maintenance-free / Lubricated For Life Gear Units	
Clincher™ sizes SK0182NB, SK0282NB & SK1382NB	Standard Oil Fill: ISO VG220 SHC/PAO Synthetic Oil
NORDBLOC® Sizes SK172, SK272, SK371F, SK372, SK373, SK320	

IMPORTANT NOTE

Maintenance-free units are supplied as sealed units with no vent-plug. Consult NORD prior to ordering if interested in ordering any of the above sizes as serviceable gear units.

IMPORTANT NOTE

Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Some units have special lubricants designed to operate in certain environments or intended to extend the service life or service temperature range of the lubricant. If in doubt about which lubricant is needed for a certain application, please contact NORD Gear.

3. Lubrication replacement

If the gear unit is filled with mineral oil, the lubricant should be replaced at least after every 10,000 operating hours or after every two years. If the gear unit is filled with synthetic oil, the lubricant should be replaced at least after every 20,000 operating hours or after every four years. Often gear reducers are exposed to extreme ambient conditions, hostile environments, wet conditions, or dirty and dusty operating areas. Especially in these situations, it is important to establish a condition-based oil service interval.

4. Oil viscosity

Viscosity, or the oil's resistance to shear under load, is often considered the single most important property of any gear oil.

- Often one will consider making a viscosity correction to the oil to improve the performance when operating the gear unit at low temperature or high temperature.
- In cases of extreme load conditions, gear pairs and antifriction bearings may be more susceptible to sliding or scuffing wear. In these operating conditions, it may also be beneficial to consider an increased lubrication viscosity and/or a lubrication with improved antiwear additive packages.

IMPORTANT NOTE

The user should consult with their primary lubrication supplier before considering changes in oil type or viscosity.

5. Maximum oil sump temperature limit

To prevent reducer overheating, the reducer's maximum oil sump temperature limit must not be exceeded for prolonged periods of operation (up to 3 hours continuous operation depending upon reducer size).

Oil Type	Maximum Oil Temperature Limit	
	NORD	AGMA 9005-D94
Mineral	80-85°C (176-185°F)	95°C (203°F)
Synthetic	105°C (220°F)	107°C (225°F)

IMPORTANT NOTE

Use caution when specifying gear reducers for high temperature service. If there is concern about exceeding the allowable safe operating temperatures, please consult NORD to discuss alternatives.

6. The importance of routine oil analysis

Routine oil analysis, sound lubrication practices, and good tracking of oil performance trends will help establish proper lubrication maintenance and change-out intervals. To maximize equipment reliability, NORD Gear generally recommends a condition-based lubrication maintenance program. One may take exceptions to this general recommendation on sealed-for-life or maintenance-free gear units or smaller and less costly gear units. In these instances, the replacement cost of the gear unit is often small compared to the costs associated with this type of oil analysis program.

NOTICE

NORD suggests replacing the gear oil if oil analysis indicates any of the following. Failure to replace the oil may cause internal damage to gearbox and diminished performance:

- Viscosity has changed by approximately 10% or more.
- Debris particles (silicon, dust, dirt or sand) exceed 25 ppm.
- Iron content exceeds 150-200 ppm.
- Water content is greater than 0.05% (500 ppm).
- The total acid number (TAN) tests indicate a significant level of oxidative break-down of the oil, and a critical reduction in performance; If the TAN number measured changes by more than 5% over the new oil, then an oil change would be recommended.

7. Mounting position and oil fill quantity

All NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. ***For additional information, please see the seperate mounting position diagrams and the corresponding oil fill quantity tables for the specified gear unit.***

The gearbox nametag will indicate the mounting position that was provided. ***For mounting orientations other than shown in the mounting position charts, please consult NORD Gear.***

IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

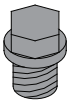
8. Oil plug locations

All gear units are assembled with the oil fill-level, oil-drain and vent plugs installed in their proper locations, according to the specified mounting position. All standard plugs are metric and utilize sealing gaskets between the head of the plug and the reducer housing.

9. Drain and fill-level plugs

All reducer drain plugs are metric socket head cap screws. For easier identification, it is NORD's standard practice to provide a hex-head screw for the fill-level plug. For ease of draining the used oil from the gear reducer, use the socket head screw located at the lowest part of the gearbox.

Drain Plug



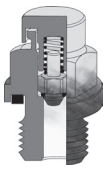
Fill Level Plug

10. Vent plug locations

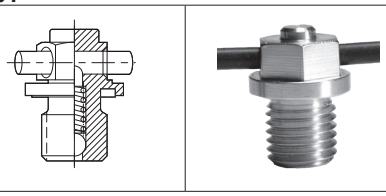
Reducer venting allows for air pressure differences that occur during operation, between the inner space of the reducer and the atmosphere, while ensuring leak-free operation. The AUTOVENT™ is standard for all vented gear units, unless otherwise noted.

AUTOVENT™ - The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material and prevent lubrication contamination from dust particles, moisture and air-borne process chemicals. The breather opens at approximately 0.3-0.9 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid conditions and wash-down environments, helping to maintain proper oil cleanliness, while reducing foaming and oxidation.

Figure 1 AUTOVENT™ Types



Type 1

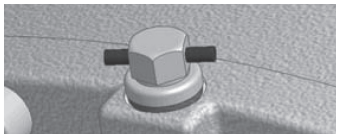


Type 2 with transportation plug

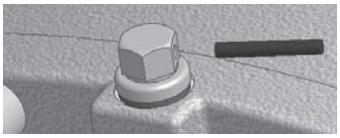
Open Vent - An optional open vent can be supplied by NORD. The open vent comes closed upon delivery with a transportation sealing plug (see Warning).

NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal components and cause leakage.



Sealed vent



Activated vent

Filtered Vent - NORD may offer an optional filtered vent, which allows gases to permeate, but does not allow dust and debris to pass through the vent.

HELICAL & BEVEL REDUCER LUBRICATION TYPES

Lubrication Tables – Helical and Bevel Gear Units

Standard Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG220	MIN-EP	0 to 40°C (32 to 104°)	Mobilgear 600XP220	♦❶
	PAO-EP	-35 to 60°C (-31 to 140°F)	Mobil SHC Gear 220	♦❷
	FG	-5 to 40°C (23 to 104°F)	Fuchs FM220	♦

Optional Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG460	PAO-EP	-35 to 80°C (-31 to 176°F)	Mobil SHC Gear 460	-
	FG-PAO	-35 to 80°C (-31 to 176°F)	Mobil SHC Cibus 460	-
VG220	FG-PAO	-35 to 60°C (-31 to 140°F)	Mobil SHC Cibus 220	S
VG150	PAO-EP	-35 to 25°C (-31 to 77°F)	Mobil SHC Gear 150	-

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2	Li-Complex	MIN	-30 to 60°C (-22 to 140°F)	Mobil Grease XHP222	♦❶
	Li-Complex	PAO	-40 to 80°C (-40 to 176°F)	Mobil / Mobilith SHC 220	♦❷
	Polyurea	FG-PAO	-30 to 80°C (-22 to 176°F)	Mobil SHC Polyrex 222	♦

♦ Stocked Lubricants

❶ Standard product on serviceable gear units

❷ Standard product on maintenance free gear units

IMPORTANT NOTE

- The "Ambient Temperature" is intended to be an operation guideline based upon the typical properties of all the lubricant. The viscosity and other properties of the lubricant change based upon load, speed, ambient conditions, and reducer operating temperatures. The user should consult with their lubrication supplier & NORD gear before considering changes in oil type or viscosity.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:
  Mineral Oil: 80-85 °C (176 – 180 °F).
  Synthetic Oil: 105 °C (225 °F).
- In the following instances, please consult NORD for specific recommendations:
  - √ Gear units will operate in high ambient temperature conditions exceeding 40 °C (104 °F).
  - √ Gear units will operate in cold ambient temperature conditions approaching 0 °C (32 °F) or lower.
  - √ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.
  - √ Fluid grease is required for lubricating the gear unit.
- Observe the general lubrication guidelines outlined in user manual U10750.

Oil Formulation Codes

MIN-EP - Mineral Oil with EP Additive
PAO-EP - Synthetic Polyalphaolefin Oil with EP Additive
PAO - Synthetic Polyalphaolefin Oil
PG - Synthetic Polyglycol Oil
FG - Food-Grade Oil
FG-PAO - Food-Grade, Synthetic Poyalphaolefin Oil
FG-PG - Food-Grade, Synthetic Polyglycol Oil

Lubrication Notes

- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, check with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.
- Do not to mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral oil or polyalphaolefin (PAO) synthetic oil.

HELICAL & BEVEL REDUCER LUBRICATION TYPES

Oil Cross-reference Chart

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG150	MIN-EP	0 to 25°C (32 to 77°F)	Mobilgear 600XP150	Omala S2 G 150	Alpha SP150	Renolin EP150	Klüberoil GEM 1-150N
	PAO-EP	-30 to 25 °C (-22 to 77 °F)	Mobil SHC Gear 150	Omala S4 GX 150	Alphasyn EP150	Gearmaster SYN150/NA	Klübersynth EG 4-150
	PAO	-30 to 25°C (-22 to 77°F)	Mobil SHC629	Morlina S4 B 150	Alphasyn T150	N/A	Klübersynth GEM 4-150N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	Omala S4 WE 150	Alphasyn PG150	Renolin PG150	Klübersynth GH 6-150
	FG	0 to 25°C (32 to 77°F)	Mobil DTE FM 150	N/A	N/A	N/A	N/A
	FG-PAO	-15 to 25°C (5 to 77°F)	Mobil SHC Cibus 150	N/A	N/A	Cassida GL150	Klüberoil 4 UH 1-150N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	N/A	N/A	N/A	Klübersynth UH1 6-150
VG220	MIN-EP	0 to 40°C (32 to 104°)	Mobilgear 600XP220	Omala S2 G 220	Alpha SP220	Renolin EP220	Klüberoil GEM 1-220N
	PAO-EP	-30 to 60 °C (-22 to 140 °F)	Mobil SHC Gear 220	Omala S4 GX 220	Alphasyn EP220	Gearmaster SYN220/NA	Klübersynth EG 4-220
	PAO	-30 to 60°C (-22 to 140°F)	Mobil SHC630	Morlina S4 B 220	Alphasyn T220	N/A	Klübersynth GEM 4-220N
	PG	-25 to 60°C (-13 to 140°F)	Mobil Glygoyle 220	Omala S4 WE 220	Alphasyn PG220	Renolin PG220	Klübersynth GH 6-220
	FG	0 to 40°C (32 to 104°F)	Mobil DTE FM 220	N/A	N/A	Fuchs FM220	N/A
	FG-PAO	-25 to 60°C (-13 to 140°F)	Mobil SHC Cibus 220	N/A	N/A	Cassida GL220	Klüberoil 4 UH 1-220N
	FG-PG	-25 to 60°C (-13 to 140°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220	Klübersynth UH1 6-220
VG460	MIN-EP	0 to 40°C (32 to 104°F)	Mobilgear 600XP460	Omala S2 G 460	Alpha SP460	Renolin EP460	Klüberoil GEM 1-460N
	PAO-EP	-20 to 80°C (-4 to 176°F)	Mobil SHC Gear 460	Omala S4 GX 460	Alphasyn EP460	Gearmaster SYN460/NA	Klübersynth EG 4-460
	PAO	-20 to 80°C (-4 to 176°F)	Mobil SHC 634	Morlina S4 B 460	Alphasyn T460	N/A	Klübersynth GEM 4-460N
	PG	-20 to 80°C (-4 to 176°F)	Mobil Glygoyle 460	Omala S4 WE 60	Alphasyn PG460	N/A	Klübersynth GH 6-460
	FG	0 to 40°C (32 to 104°F)	Mobil DTE FM460	N/A	N/A	Fuchs FM460	N/A
	FG-PAO	-20 to 80°C (-4 to 176°F)	Mobil SHC Cibus 460	N/A	N/A	Cassida GL460	Klüberoil 4 UH 1-460N
	FG-PG	-20 to 80°C (-4 to 176°F)	Mobil Glygoyle 460	N/A	N/A	Cassida WG460	Klübersynth UH1 6-460

Low-end service temperature limit may vary for a specific lubricant; Please also see the important notes on Page 1.

HELICAL IN-LINE FLANGED OIL FILL QUANTITIES

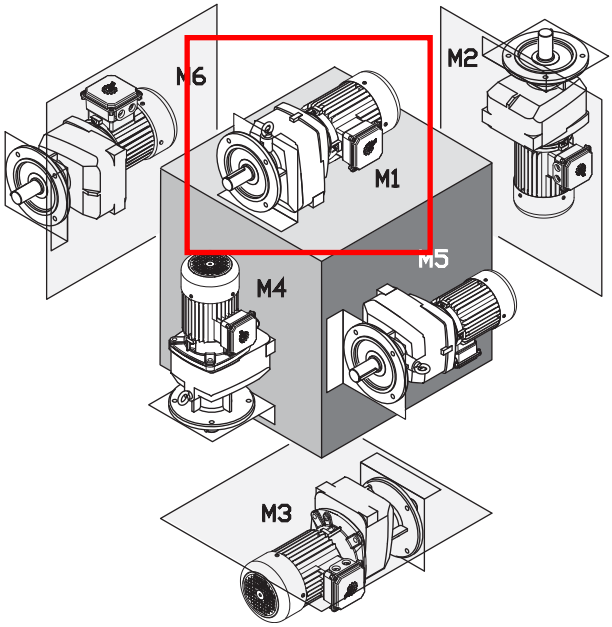
Helical In-line flanged lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add addition oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

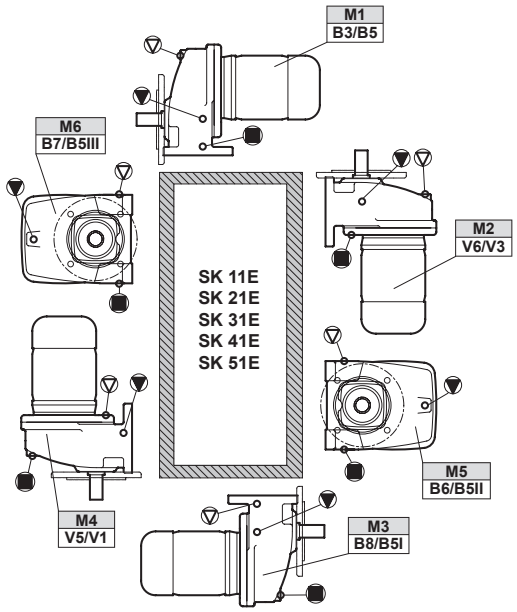


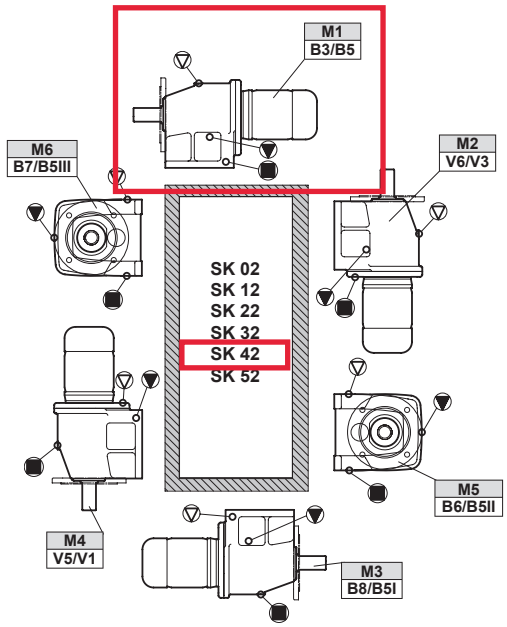
Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK02F	0.26	0.25	0.74	0.70	0.74	0.70	0.74	0.70	0.53	0.50	0.53	0.50
SK 03 F	0.58	0.55	1.00	0.95	0.95	0.90	1.27	1.20	0.95	0.90	0.95	0.90
SK11E F	0.32	0.30	0.53	0.50	0.53	0.50	0.48	0.45	0.42	0.40	0.42	0.40
SK12F	0.37	0.35	0.90	0.85	0.95	0.90	0.95	0.90	0.74	0.70	0.74	0.70
SK 13 F	1.06	1.00	1.37	1.30	1.37	1.30	1.27	1.20	1.06	1.00	1.06	1.00
SK21E F	0.53	0.50	1.27	1.20	1.37	1.30	0.63	0.60	0.95	0.90	0.95	0.90
SK22F	0.74	0.70	1.90	1.80	1.90	1.80	1.90	1.80	1.48	1.40	1.48	1.40
SK 23 F	1.48	1.40	2.75	2.60	2.43	2.30	2.96	2.80	2.96	2.80	2.96	2.80
SK31E F	0.95	0.90	1.90	1.80	1.74	1.65	1.37	1.30	1.32	1.25	1.32	1.25
SK32F	1.27	1.20	2.96	2.80	3.28	3.10	3.28	3.10	2.32	2.20	2.32	2.20
SK 33N F	2.32	2.20	3.17	3.00	3.59	3.40	4.44	4.20	2.43	2.30	2.43	2.30
SK41E F	1.27	1.20	2.43	2.30	2.85	2.70	2.11	2.00	2.01	1.90	2.01	1.90
SK42F	1.90	1.80	4.65	4.40	4.76	4.50	4.23	4.00	3.91	3.70	3.91	3.70
SK 43 F	3.70	3.50	6.02	5.70	5.28	5.00	6.45	6.10	4.33	4.10	4.33	4.10
SK51E F	1.90	1.80	3.70	3.50	4.33	4.10	3.17	3.00	4.02	3.80	4.02	3.80
SK52F	3.17	3.00	7.19	6.80	6.55	6.20	7.82	7.40	5.92	5.60	5.92	5.60
SK 53 F	5.49	5.20	8.88	8.40	7.40	7.00	9.40	8.90	7.08	6.70	7.08	6.70
SK 62 F	7.40	7.00	15.9	15.0	14.8	14.0	19.5	18.5	16.9	16.0	16.9	16.0
SK 63 F	14.3	13.5	14.8	14.0	16.4	15.5	19.0	18.0	14.8	14.0	14.8	14.0
SK 72 F	10.6	10.0	24.3	23.0	19.5	18.5	29.6	28.0	24.3	23.0	24.3	23.0
SK 73 F	23.2	22.0	23.8	22.5	24.3	23.0	29.1	27.5	21.1	20.0	21.1	20.0
SK 82 F	15.9	15.0	39.1	37.0	30.6	29.0	47.6	45.0	36.5	34.5	36.5	34.5
SK 83 F	32.8	31.0	35.9	34.0	37.0	35.0	42.3	40.0	35.9	34.0	35.9	34.0
SK 92 F	27.5	26.0	77.0	73.0	49.7	47.0	82.0	78.0	55.0	52.0	55.0	52.0
SK 93 F	56.0	53.0	74.0	70.0	62.0	59.0	78.0	74.0	52.0	49.0	52.0	49.0
SK 102 F	42.3	40.0	86.0	81.0	70.0	66.0	110	104	76.0	72.0	76.0	72.0
SK 103 F	73.0	69.0	82.0	78.0	82.0	78.0	105	99.0	71.0	67.0	71.0	67.0

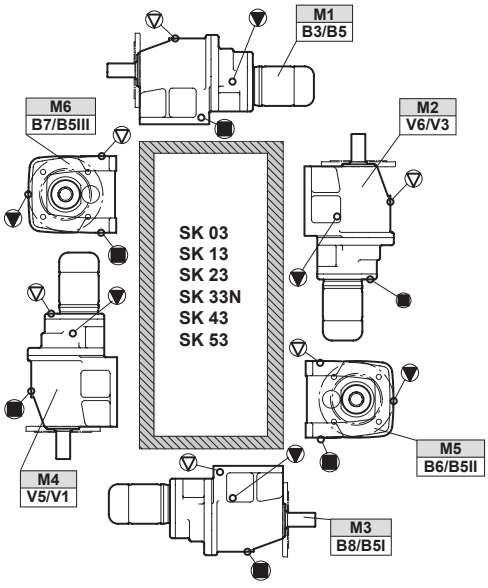
HELICAL IN-LINE OIL PLUG & VENT LOCATIONS

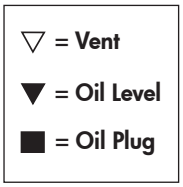
Oil plug connections

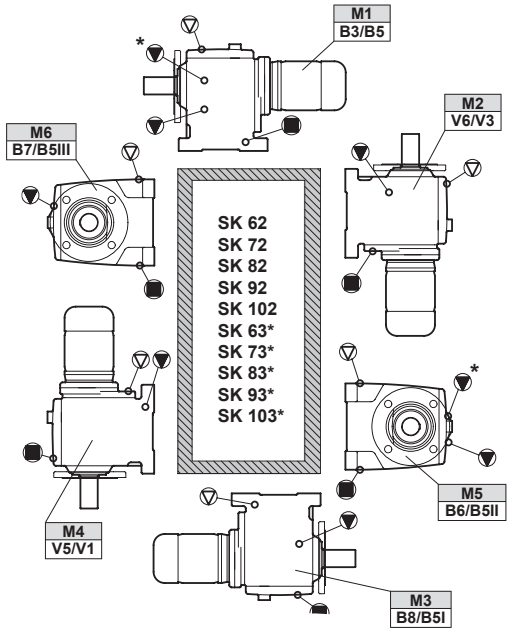
Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. ***For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.***











*** Oil level for 3 stage gear units.**

Troubleshooting

This section identifies some of the most common issues involved with NORD Gear speed reducers , and provides recommendations to assist you in defining and answering your questions as you work with our products. You may also contact our Engineering/Application departments if your questions are not answered in the table below.

Problem With the Reducer		Possible Causes	Suggested Remedy
Runs Hot	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce the load.
	Improper lubrication	Insufficient lubrication	Check lubricant level and adjust up to recommended levels
		Excessive lubrication	Check lubricant level and adjust down to recommended levels.
		Wrong lubrication	Flush out and refill with correct lubricant as recommended
Runs Noisy	Loose foundation bolts	Weak mounting structure	Inspect mounting of reducer. Tighten loose bolts and/or reinforce mounting and structure.
		Loose hold down bolts	Tighten bolts
	Failure of bearings	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload	Check rated capacity of reducer.
	Insufficient lubricant	Level of lubricant in reducer not properly maintained.	Check lubricant level and adjust to factory recommended level.
Output shaft does not turn	Internal parts are broken or missing	Overloading of reducer can cause damage	Replace broken parts. Check rated capacity of reducer.
		Key missing or sheared off on input shaft.	Replace key.
		Coupling loose or disconnected	Properly allign reducer and coupling. Tighten coupling.
Oil Leakage	Worn seals	Caused by dirt or grit entering seal.	Replace seals. Autovent may be clogged. Replace or clean.
	Unit runs hot or leaks	Overfilled reducer	Check lubricant level and adjust to recommended level.
		Vent clogged.	Clean or replace, being sure to prevent any dirt from falling into the reducer.
	Incorrect fill level	Improper mounting position, such as wall or ceiling mount of horizontal reducer.	Check mounting position on the name tag & verify with mounting chart in manual.

1. Overview

This user manual applies to NORD Motor products and it provides general information for motor operation, installation, maintenance, inspection, repair, and trouble shooting, which is relevant to most of the motor products shipped by NORD. Information and instructions provided in this manual, safety and commissioning information and all other manuals applicable to any items supplied by NORD must be observed.

This instruction manual is not intended to include comprehensive details and information related to all possible design variations or accessories options available with NORD motors. If there is any uncertainty about specific procedures, instructions or motor details, then please refer these questions to NORD for additional information or clarification.

Before installing, operating, or performing maintenance on any electrical motor become familiar with the following:

- The detailed operating instructions and wiring diagrams.
- All applicable national, local and system-specific regulations, codes and practices.
- The national / regional regulations governing safety and accident prevention.
- The proper use of any tools, transportation or hoisting equipment, and safety equipment needed to complete the installation.
- To avoid serious injury or possible damage to the equipment or machine, compliance with all safety and information notes is mandatory!

⚠ *WARNING*

All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians. All applicable national, regional, and local work regulations and safety requirements must also be complied with. NORD assumes no liability for personal injury, accidental death, or equipment damage and malfunctions resulting from failure to comply with installation or operating instructions, safety notes, or any work regulations and laws!

⚠ *DANGER*

To avoid electrocution, injury or death, make certain the motor is properly grounded, completely de-energized and brought to a no-voltage condition prior to working on any electrical connections.

2. Motor Types

NORD AC electric induction motors described in this manual generally include the following types:

- Single speed or two-speed design.
- Three phase alternating current or single phase design.
- Enclosure types: TEFC, TENV, and TEBC.

3. Enclosure Types

Totally enclosed fan cooled (TEFC).

TEFC motor designs rely on fan that is mounted on the motor's rotor shaft so the cooling capacity can vary based upon the motor's operating speed.

Totally enclosed, non-ventilated (TENV)

The TENV motor designs rely purely on convection cooling and they have no fan. Often TENV designs are labeled for intermittent or periodic duty or at a lower power rating than is typical for the given motor frame size.

Totally enclosed, blower cooled (TEBC)

The TEBC design uses separate blower or ventilator fan, with its own low wattage motor and a separate power supply, to provide continuous airflow and cooling. The blower can be used to extend the speed range of the motor and allow extreme slow speed operation without causing a concern for overheating. Blower data is provided in Table 6, page 11.

4. Voltage and Frequency Variation

Voltage and frequency variations are based upon the assumption that the nameplate horsepower will not be exceeded and that the motor temperature may increase. Standard allowable deviations are based upon the type of motor labeling.

NEMA and CSA Labeled Motors

Variations are based upon the nominal utilization voltage, and not the service (supply) voltage as per ANSI C84.1.

Service Voltages	Utilization Voltages
120V, 208V, 240V, 480V, 600V	115V, 200V, 230V, 460V, 575V

- Voltage variation at rated frequency = ±10%.
- Frequency variations at rated voltage = ±5%.
- Combined voltage/frequency variation = ±5%.

CE Labeled Motors

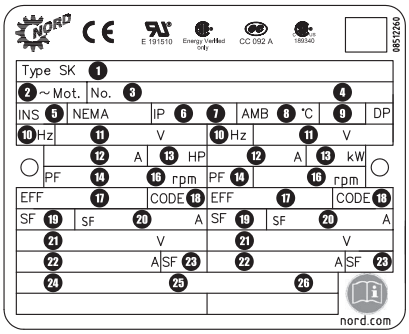
Per IEC 60038, allowable service voltage variations on in the current system, compared to the previous system, are as indicated.

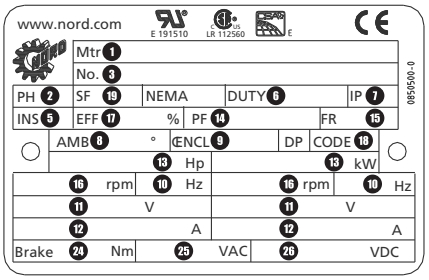
Previous Service Voltages	Current Service Voltages
220V, 380V, 660V	230V, 400V, 690V +6/-10%
240V, 415V	230V, 400V +10/-6%

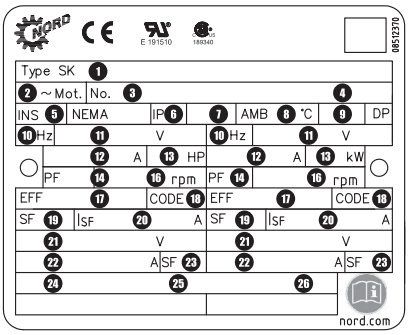
- Per EN 60034-1 a ±5% voltage variation and a ±2% frequency variation can be tolerated.
- The allowed variations are based upon the voltage (or voltage range) indicated on the motor nameplate.

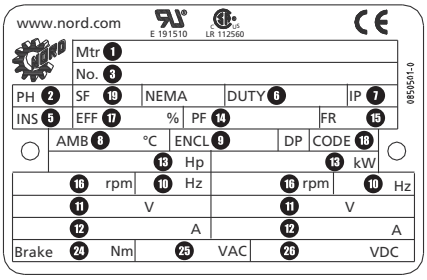
5. Motor Nameplate Information

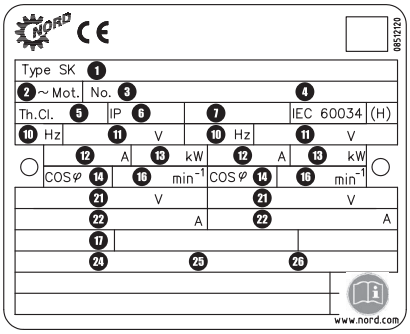
The motor nameplate and the display of technical information may vary slightly depending upon the global standard/s that the motor conforms to and the efficiency level. Please reference the examples below.











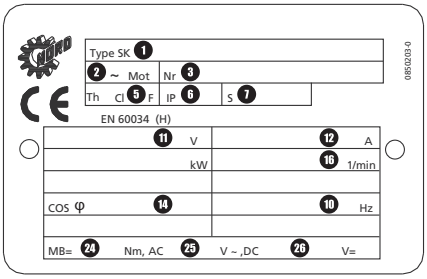


Table 1. Nameplate Data

Field	Definition
1	Model / Type
2	Number of Phases
3	Order Number
4	Serial Number
5	Insulation Class
6	IP (Ingress Protection) Enclosure Rating
7	Duty Cycle
8	Ambient Temperature Rating (°C)
9	Enclosure Type
10	Motor Frequency (Hz)
11	Voltage Rating (V)
12	Current Rating (A)
13	Rated Power (HP or kW)

Field	Definition
14	Power Factor
15	Motor Frame Size
16	Full Load Speed (rpm or 1/min^2)
17	Efficiency
18	NEMA Code Letter
19	Service Factor
20	Current Rating (If Service Factor ≥ 1.15)
21	Operating Voltage Rage (A)
22	Current Rating at Operating Voltage Range (A)
23	Service Factor at Operating Voltage Range (A)
24	Brake Rating (Nm)
25	Brake Supply Voltage (VAC)
26	Brake Coil Voltage (VDC)

6. Motor Options And Nomenclature

NORD offers many options for its motors. The option code will be shown in the motor nomenclature. Below are commonly used options.

Code	Description
AICM	Additional Internal Insulation Coating Applied
BRE	With Brake
EAR	Single Phase, Start Cap/Run Cap
ECR	Single Phase, Start Cap/Run Cap Increased SF
EHB	Single Phase, Run Capacitor Only
EP	Epoxy Dipped Windings
F	Blower Cooling Fan - 3ph & 1ph
FC	Blower Cooling Fan - 1ph
FHL	Brake – Lockable Manual Release
H	Energy Efficient
HL	Brake – Manual Hand Release
IG	Incremental Encoder
IP66	IP66 Environmental Protection
IR	Brake – Current Sensing Relay
KB	Condensation Holes - Removable Plugs
KD	Condensation Holes - Open
MIK	Brake – Microswitch
MS	Power Plug Connector

Code	Description
OL	TENV Motor – Without Fan / With Cover
OL/H	TENV Motor - Without Fan & Cover
P	Premium Efficient Motors
RD	Canopy Cover
RDD	Double Canopy Cover
RG	Brake – Corrosion Protected
RLS	Backstop
SH	Motor Space Heater
SR	Brake – Dust Protected
TF	Thermistor
TW	Thermostat
VN	10:1 Constant Torque Rated Motor
VR	5:1 Constant Torque Rated Motor
VW	20:1 Constant Torque Rated Motor
VZ-F	1000+:1 Constant Torque Rated Motor
WE	2nd Motor Shaft End
WU	High Slip Rotor
Z	High Inertia Motor Fan

Motor Nomenclature

100LP / 4 BRE 40 ...

- **...** — Other Options
- **40** — Brake Size Nm
- **BRE** — Brake
- **4** — Number of Poles
- **100LP** — Frame Size

Ordering Examples

100LP / 4 BRE 100 HL RG

- **RG** — Corrosion Protection
- **HL** — Hand Release Lever
- **100** — 100 Nm Brake Torque
- **BRE** — Brake
- **4** — 4 Poles
- **100LP** — Motor Frame Size

100 Frame Motor with 4 poles, Brake, 100 Nm with a hand release lever, corrosion protected brake, and a current sensing relay.

63L / 4 BRE 40 FHL SR

- **SR** — Dust & Corrosion Prot.
- **FHL** — Locking Hand Release Lever
- **40** — 40 Nm Brake Torque
- **BRE** — Brake
- **4** — 4 Poles
- **63L** — Motor Frame Size

63 Frame motor with 4 poles, a 40 Nm Brake with a locking hand release lever and dust & corrosion protection.

7. Application Conditions

Standard NORD motors are designed to operate in dusty or moist environments and have anti-fungal, thermal class F insulation.

- Enclosure Protection Rating = IP55 (minimum).
- Maximum Installation Height = 3300 ft (1000 m).
- Ambient Temperature = -4 to 104°F (-20 to 40 °C).
- Tropical-proof, Thermal Class F insulation.

The protection level and maximum ambient temperature are stated on the motor nameplate.

IMPORTANT NOTE

NORD can provide motors for an expanded range of applications and service conditions including higher protection levels, extreme ambient conditions and, higher altitudes.

IMPORTANT NOTE

Consult NORD for recommendations if motors are operated under extreme loading conditions, exposed to high inertia loads, or need to operate under unusually high cycling conditions with high starting and stopping frequency.

DANGER

Special design and assembly considerations are needed if NORD motors are subject to any of the following conditions. Environmental conditions may lead to premature damage and/or failure without the proper protective features. Consult NORD for design considerations:

- Outdoor installation with motor in a vertical position.
- Direct contact with aggressive or corrosive materials (acids, bases, salts, certain gases, etc.).
- Exposure to extreme high or low temperatures, high relative humidity, condensation moisture or very wet environments.
- Subject to extreme material build-up on the unit (dirt, dust, sand, etc.).
- Hazardous Locations (risk of fire or explosion).

8. Transportation

During transportation observe the following:

- Make sure that all eyebolts and lifting lugs are tight and firmly against their supporting surface.
- Use all the lifting eyes that are intentionally supplied with the motor.
- Lift only at designed points.
- Protect the mounting surface from possible damage during transportation.
- Always use sufficiently rated handling equipment, lift mechanisms and lifting straps.
- With heavier objects or unbalanced loads, it may be appropriate to use more than one lifting point or an additional strap or sling to assure safe transportation of the assembly. This is especially true of assembled gearmotors and motorized reducers.
- Once the NORD motor or assembly is properly installed, remove the transportation fixtures completely or make certain they are properly re-secured and tightened.

WARNING

Transportation – Use of Lifting Devices

To avoid death, serious injury or equipment damage…

- Hoisting lugs or lifting eyes attached to the motor are designed for the weight of the motor only! Do not attach any additional loads!
- The motor must only be transported and lifted using the lifting eyes, in a position that is appropriate for its type of construction. Otherwise, it could fall over or slip in the lifting tackle.
- During suspended transport, two straps must be able to carry the entire load weight safely.
- When required use additional, suitable means of support for transportation, installation or removal.
- Always secure the support equipment to prevent it from slipping.

9. Storage

If the motor is not in service, store it according to the following conditions:

- Store the motor in a clean, dry, dirt-free, vibration free area.
- Storage temperatures of 10°C (50°F) to 50°C (120°F) must be maintained.
- Relative humidity must not exceed 60%.
- If vibration in the area exceeds 0.002 inch (0.05 mm) at 60 hertz, then vibration isolation pads are suggested to prevent brinelling of the bearings.
- Treat the unprotected shaft end and mating flange surfaces with a corrosion inhibitor that can be cleaned off prior to commissioning.
- Before placing the motor into service, visually inspect the motor exterior for evidence of deterioration during storage. Turn the motor shaft by hand to make sure the shaft turns freely.
- Motor space heaters, when provided, are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional. Remove motor from the storage container when the heater is energized.
- If the motor needs to be stored for extended periods, or if it is stored in less than favorable conditions, it is recommend that the winding insulation resistance be checked prior to commissioning (page 7).
- Even if stored in favorable conditions, the antifriction motor bearings and motor shaft seals may need to be replaced if the storage period is more than 4 years.

10. Safety Considerations

When installing, servicing or replacing electric motors it is important to be working in a “voltage-free” state. Observe the following safety rules.

Safety Rules

1. Disconnect the system. Disconnect the auxiliary circuits (brakes, space heaters, etc.).
2. Prevent reconnection (follow safe lock-out/tag-out practices).
3. Make sure that the equipment is at zero voltage.
4. Make certain the equipment is properly grounded and short-circuited.
5. Cover or isolate nearby components that are still electrically live.

To energize the system, apply the measures in reverse order.

Qualified Personnel

All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians.

For the purpose of this documentation, a qualified personnel is taken to mean a person or 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 machine by the appropriate person responsible.
- They are responsible for knowing and complying with all applicable national, regional, and local work regulations and safety requirements.

10. Safety Considerations Ctd.

General Warnings and Cautions

⚠ DANGER

To avoid electrocution, injury or death, make certain all electrical devices (motors, brakes, variable frequency drives, etc.) are properly grounded, completely de-energized, and brought to a no-voltage condition prior to working on any electrical connections. Remember that most of these devices carry potentially dangerous energy levels for a period of time after power is removed. Always follow proper lock-out/tag-out procedures.

⚠ DANGER

Electrical machines contain dangerous voltage levels, electrically live parts, rotating surfaces and hot surfaces. To prevent injury, death or possible equipment damage always observe the following:

- Keep all safety covers and guards in place during operation. Remove and replace covers in compliance with the applicable safety regulations.
- Allow the machine to cool down before starting any work on it.
- Operate the machines properly.
- Perform regular maintenance on the machine.
- Secure and guard free-standing shaft extensions.

⚠ DANGER

Electrically Live Parts

Electrical machines contain electrically live parts. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.

⚠ WARNING

Rotating Parts

Electrical machines contain dangerous rotating parts. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.

⚠ WARNING

Hot Surfaces

Electrical machines have hot surfaces. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly. Allow the machine to cool down before starting any work on it.

⚠ WARNING

Maintain Proper Cooling

Operating the motor without the intended cooling fan may cause overheating and result in very hot surfaces, personal injury and material damage. Never commission a motor intended to be fan cooled when it is missing the shaft-driven fan or external blower assembly.

⚠ DANGER

Condensation Drain Holes (Optional)

Inserting objects into the condensation drain holes can damage the winding and can result in death, serious injury and damage to property!

- Before opening sealed drain holes, make sure the motor is in a no-voltage condition. Close the condensation drain holes before re-commissioning.
- Exercise caution around drain holes that are intended to be left open, especially when the motor is energized.

IMPORTANT NOTE

Before start-up check the following:

- All electrical connections are secure, well grounded and properly made.
- The motor is rotating in the correct direction (when de-coupled from the driven load).
- There are no temperature-sensitive parts (cables etc.), in contact with motor enclosure.
- Condensation drain holes are always located at the lowest point of the motor.

11. Checking the Insulation

Before putting the motor into operation for the first time, after a lengthy period of storage or standstill (approx. 6 months), the insulation resistance of the winding should be checked.

WARNING

During or directly after measurement the motor connection terminals carry hazardous voltages. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.

A. Control

The insulation resistance of new, cleaned, or repaired motor windings against the grounded housing and against one another should be > 200 Mega-Ohms.

B. Measurement

Using a Mega-Ohm meter apply a DC voltage of 500 VDC to the motor winding for a period of 60 seconds and record the winding insulation resistance compared to ground.

- The 500 VDC test voltage is applicable to low voltage motors up to 1000 VAC.
- When performing this test the temperature of the windings should be 25°C ± 15°C (77°F ± 27°F).

C. Verification

- If the insulation resistance of the winding is less than 50 Mega-Ohms, the cause may be moisture. The windings should be dried and the test should be repeated.
- After any lengthy period of operation the insulation resistance may drop. So long as the measured value does not fall below the critical value of 50 Mega-Ohm, the motor may continue to be operated.
- If the measured value falls below the critical 50 Mega-Ohm level, the cause must be established and the windings or winding sections must be cleaned, dried, repaired, or replaced as needed.

12. Bearing Lubrication

NORD motor frame sizes 63 up to and including 225 are normally supplied with internally grease lubricated bearings and require no lubrication during normal operation.

NORD motor frame sizes 250 and larger are supplied with grease fittings for re-greasing the motor bearings.

IMPORTANT NOTE

Motors with grease fittings are normally supplied with a label indicating the grease type used, the suggested re-lubrication interval, and the amount of new grease to be applied. General bearing maintence guidelines are listed in Table 3.

Typical motor bearing grease is an NLGI No. 2 consistency, high grade product with a polyurea base thickener, synthetic or blended mineral/synthetic oil, and stabilizing agents to protect against heat and oxidation.

Table 3 – Motor Bearing Maintence Guidelines

Frame Size	Power	Poles	Re-greasing Interval
63-225	0.16-60 HP (0.12-45 kW)	All	Maintence Free
250 to 280	75-125 HP (55-75 kW)	2	4000 h
		4 to 8	8000 h
315	150-250 HP (132-200 kW)	2	3000 h
		4 to 8	6000 h

NOTICE

When re-greasing motor bearings do not to mix different greases without verifying the compatibility with a reputable grease lubrication supplier. Mixing incompatible products can lead to bearing failure.

13. Mechanical Installation

Integral motors, NEMA C-face motors, and IEC flange mounted motors must be rigidly secured to their mating connection surface using all fastening screws tightened to the proper bolt torque. It is good practice to apply a medium strength thread- locking agent (Loctite® 242) to the mounting screws.

Foot mounted motors must be securely installed to a rigid and level foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. All mounting hole locations must be utilized. Tighten all hold down screws or bolts to the proper bolt torque.

NOTICE

Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Accurate alignment and proper balancing of output devices (couplings, belts, pulleys, etc.) is required to assure quite, low vibration, trouble free operation. When the motor is directly coupled to a gear drive or a driven machine make sure that the motor shaft and driven machine shaft are aligned with one another axially.

NOTICE

Inaccurate alignment may lead to bearing damage, excessive vibrations and shaft breakage.

IMPORTANT NOTE

For motor replacement guidelines see section 20 on page 15 and section 21 on page 16.

14. Electrical Connections

⚠ DANGER

To avoid electrocution, injury or death, make certain all electrical devices (motors, brakes, variable frequency drives, etc.) are properly grounded, completely de-energized, and brought to a no-voltage condition prior to working on any electrical connections. Remember that most of these devices potentially dangerous energy levels for a period of time after power is removed. Always follow proper lock-out/tag-out procedures.

IMPORTANT NOTE

External motor brakes have their own connection requirements as indicated in the appropriate brake instruction manuals.

⚠ WARNING

If the motor has an integral brake, make certain there is no load connected to the driven equipment before releasing the brake. Otherwise serious injury, death, or damage to the equipment may result.

- The supply voltage and frequency must agree with the motor nameplate data.
- Always feed the connecting leads into the terminal box using appropriate mating cable glands. The mating connection cables and cable glands should be suitable for temperatures ≥ 194°F (90°C).
- Provide the ends of the connecting leads and ground lead with cable lugs or curved ring eyelets before connecting them to the terminal board.
- Make certain that the wiring connections and arrangement of the terminal board jumpers conform to the appropriate wiring diagram as provided in the motor terminal box and/or page 9 of this manual.
- Tighten the terminal board screw connections on the on the main terminal board per the table below.

Table 4 – Tightening Torque: Terminal Board and Grounding Screws

Thread Size	Nut Size [mm]	Tightening Torque [lb-ft]	Tightening Torque [Nm]
M4	7	0.6-0.9	0.8-1.2
M5	8	1.3-1.8	1.8-2.5
M6	10	2.0-3.0	2.7-4
M8	13	4.0-5.9	5.5-8
M10	17	6.6-9.6	9-13
M12	19	11.8-14.8	16-20

- Upon final assembly, the terminal box cover must be sealed so that it is dust-tight and water-tight.

Table 5 – Tightening Torque: Terminal Box Cover Screws

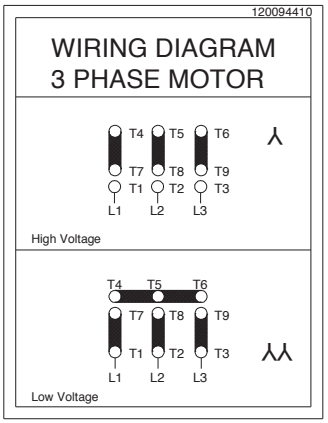
Thread Size	Tightening Torque [lb-ft]	Tightening Torque [Nm]
M4	0.6-0.9	0.8-1.2
M5	0.9-1.3	1.2-1.8
M6	1.1-1.8	1.5-2.5
M8	2.2-3.7	3.0-5.0

15. Direction of Rotation

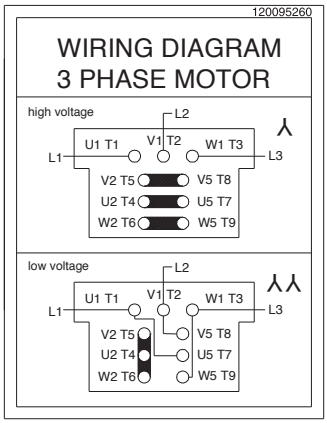
The motor shaft rotation is defined per IEC 600034, Part 8. The motor shaft rotation can be controlled by the way the incoming line power is connected. When connecting the incoming line power in phase order to the terminal block posts, T1 (U1), T2 (V1), and T3 (W1) respectively, the motor shaft rotation will be clockwise when viewing the motor shaft at the drive-end.

15. Wiring Diagrams - Motor & Motor Option Connection Diagrams

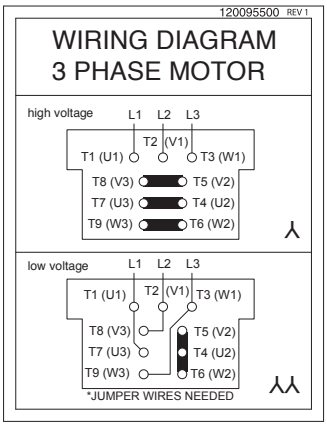
NORD Frames 63-225
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø



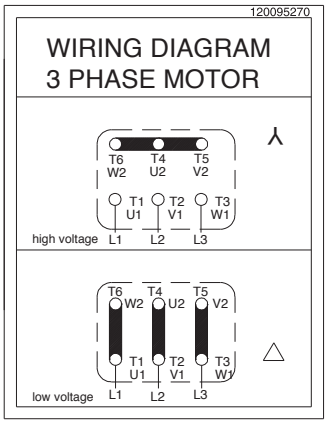
NORD Mfg by Siemens - Frames 200+
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø
190 / 380V, 60Hz, 3Ø



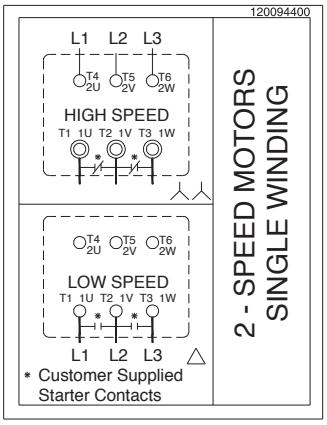
NORD Mfg by Siemens - Frames 200+
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø
190 / 380V, 60Hz, 3Ø



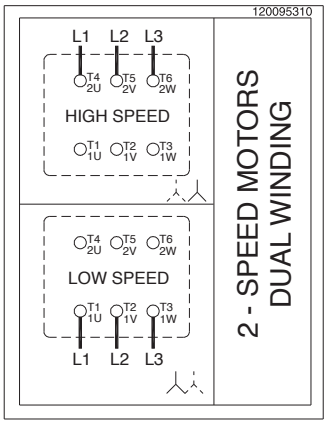
NORD Frames 63-225
460 / 800V, 60Hz, 3Ø | 230 / 400V, 50Hz, 3Ø
208 / 360V, 60Hz, 3Ø | 400 / 690V, 50Hz, 3Ø
332 / 575V, 60Hz, 3Ø

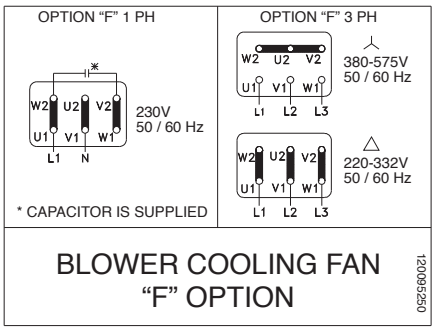


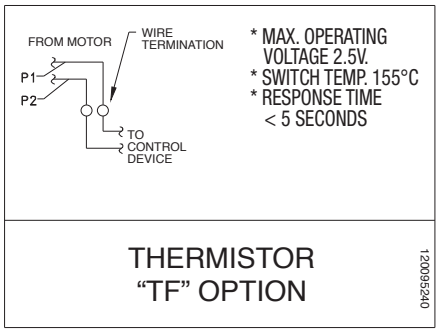
NORD 2 - SPEED MOTORS
SINGLE WINDING (4-2 & 8-4 POLE)

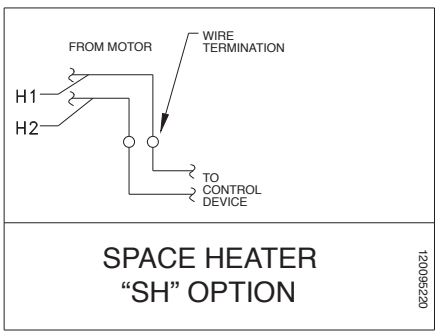


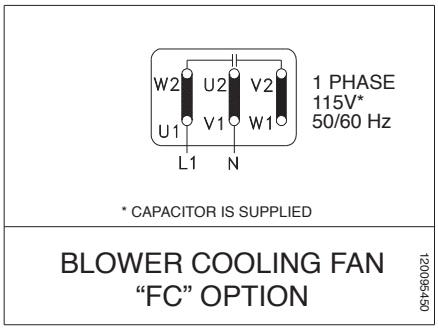
NORD 2 - SPEED MOTORS
DUAL WINDING (8-2 POLE)

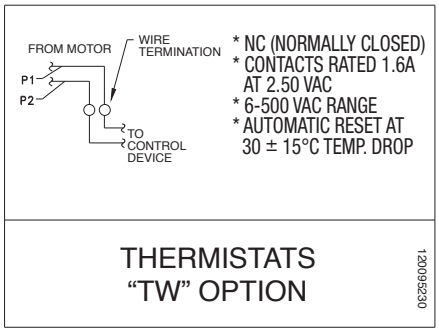












17. Inspection

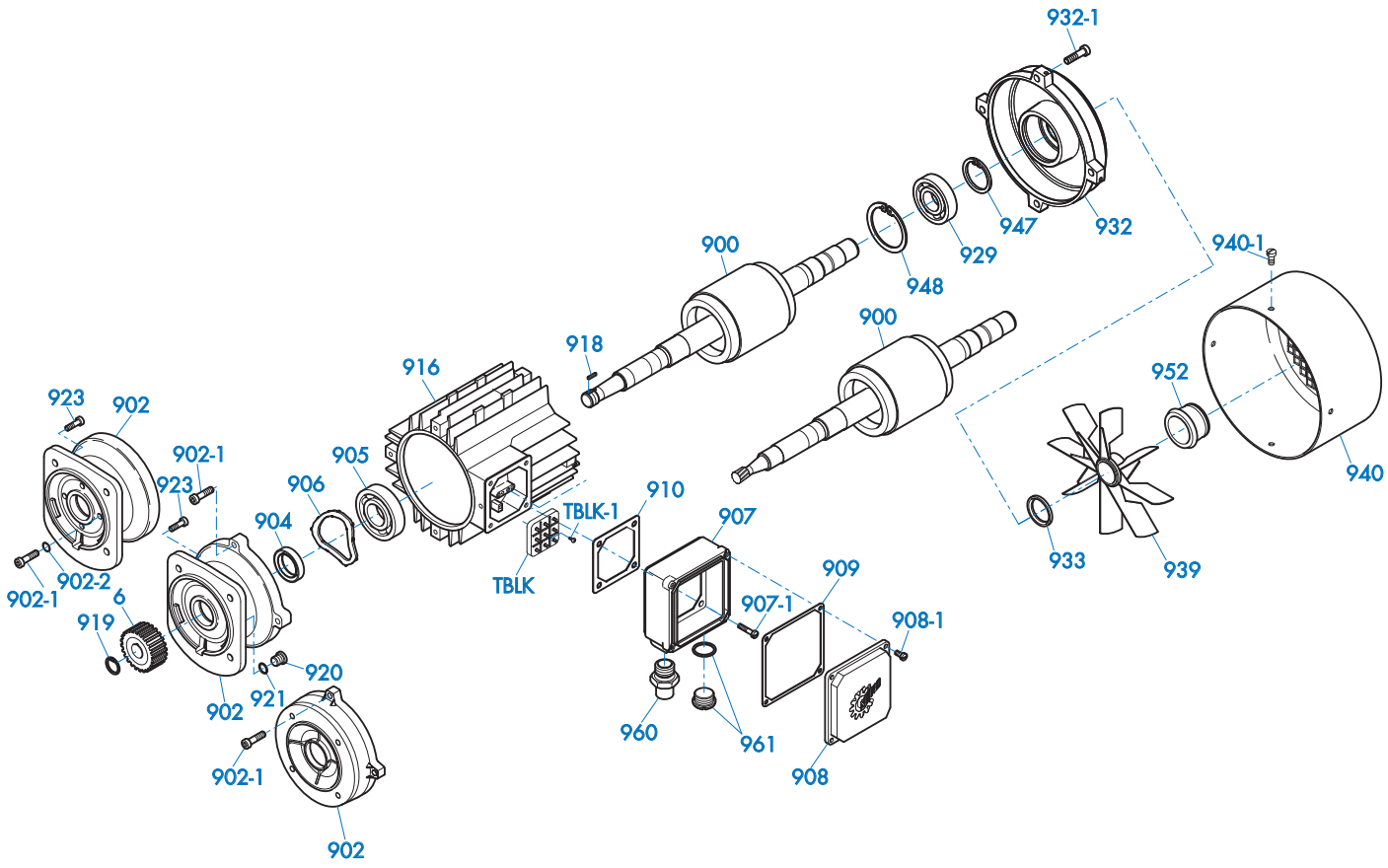
Inspect the motor after every 500 operating hours. Please use table 12 below for inspection guidelines.

⚠ CAUTION

If it is necessary to clean the motor exterior, do not use shop air. Shop air can force contaminents into the motor and may cause parts damage or result in blowing debris causing injury.

Table12. - Motor Inspection Guidelines

Inspect	Check	Action
Motor Exterior	Check the external surfaces for contamination. Accumulation of dirt and fibrous deposits must be removed.	Clean the motor external surfaces using clean, lint-free cloths.
		Clean deposits from between cooling fins using a vacuum cleaner and a stiff-bristled nylon brush.
	Check the external surfaces for oil film and greasy deposits.	Clean the oil film and greasy deposits from the motor surface using clean, lint-free cloths.
		If necessary, moisten the cloth with an approved non-flammable, residue-free solvent. Do not pour solvent on the motor.
	Check for evidence of damage or overheating.	If the motor has physical damage, replace the motor.
Motor Mountings	Make sure the mounting hardware is secure.	If the mounting hardware is not secure, check the motor/gearbox alignment, and tighten the mounting hardware.
Motor Electrical Connections	Check that all electrical connections are secure.	If the electrical connections are not secure, tighten them.
	Check the electrical connections for evidence of arcing.	Loose electrical connections can cause arcing, which is evident by discoloration and charring. If you find evidence of arcing, replace the damaged connections.
Insulation Resistance	Using an ohmmeter, check and record the resistance of motor winding insulation.	Compare the current resistance reading to previous readings. If the resistance drops significantly, perform an internal inspection for insulation damage or deterioration.
Motor Brake	On motors that have a brake, use a feeler gauge to check the air gap in between the brake pad and the rotor according to the appropriate user manual.	If the air gap exceeds the maximum allowed for that brake configuration provided in the manual, adjust the air gap or replace the brake pad according to user manual U35000.



Part Number	Part Description	Qty per Assembly
6	Input Pinion	1
900	Rotor Assembly	1
902	A-Endbell	1
902-1	Screw	4
902-2	Dubo Seal	4
904	Oil Seal	1
905	Bearing	1
906	Preload Spring	1
907	Terminal Box Frame	1
907-1	Screw	4
908	Terminal Box Cover	1
908-1	Screw	4
909	Gasket - Terminal Box Frame	1
910	Gasket - Terminal Box Cover	1
916	Stator	1
918	Key	1
919	Retaining Ring	1
920	Oil Plug	1

Part Number	Part Description	Qty per Assembly
921	Gasket	1
923	Screw	4
929	Bearing	1
932	B-Endbell	1
932-1	Screw	4
933	Oil Seal	1
939	Fan	1
940	Fan Cover	1
940-1	Screw	4
947	Retaining Ring	1
948	Retaining Ring	1
952	Fan Clip	1
960	NPT Thread Adapter	1
961	Plug (includes O-ring)	1
TBLK	Terminal Block	1
TBLK-1	Screw, Terminal Block Mounting	2
	Jumper Bar (not illustrated)	AR

19. Repair

Reference the parts list drawing on page 14 for clarification.

A. Disassemble the motor according to the general exploded view in PARTS INFORMATION. Disassemble only as far as necessary to replace the failed parts.

B. Whenever the motor is disassembled, clean all dust and contamination from the motor interior using a vacuum cleaner and a soft-bristled nylon brush.

C. The following parts must be replaced if they are removed:

- Oil seal (904), Oil seal (933)
- Gasket (909), Gasket (910), Gasket (921)
- Gasket on plug (961)
- Self-locking screws (907-1, 908-1, 923, 932-1, 940-1)
- Dubo Seals (902-2)

D. If the following parts are removed, inspect them, and replace them if they are deformed or damaged:

- Retaining ring (919), Retaining ring (947), Retaining ring (948)
- Fan clip (952)

20. Removing and Replacing Integral Motors

Reference the parts list on Page 14 for clarification.

A. Disconnect the power to the electric motor. Make certain the motor is properly grounded, de-energized and secured with a lock-out/tag-out device.

B. Drain the oil from the mating gearbox, or rotate the motor/gearbox assembly so that the motor is up, to prevent oil from spilling from the gearbox when the motor is removed.

C. Support the motor and prepare it for removal. Steady the motor and support it. For larger motors, use of mechanical lifting or support devices to may be appropriate.

D. Remove the fastening screws that hold the motor to the reducer input.

IMPORTANT NOTE

Most integral motor installations have mounting bolts accessible from the motor exterior. If the bolts are not clearly visible, unbolt the input flange from the gearbox. Remove the bolts securing the motor to the reducer input flange, and discard the old DUBO sealing rings that were under the screw heads.

E. Maintain motor shaft alignment and move the motor directly away from its mounting surface until the motor shaft and mating input gear clear both the internal gear mesh and reducer input.

F. Remove and discard the old flange gasket.

G. Clean the gasket faces on the motor and gearbox, making sure no cleaning debris enters the gearbox.

H. Check the replacement motor to make sure the motor flange, motor shaft, and motor pinion are identical to the motor that was removed.

I. Place a new gasket between the gearbox and new motor.

J. Position the motor on the gearbox, making sure the input pinion meshes with the input gear. Rotate the motor as necessary to align the bolt holes and seat the motor flange. Make sure the gasket remains properly aligned and seated

K. Apply a medium strength thread locking compound to the bolt threads. Install the bolts and tighten them to the appropriate torque.

IMPORTANT NOTE

If the motor/gearbox installation uses an input flange, first mount the input flange to the motor using the four mounting bolts and NEW DUBO sealing rings under the head of each fastening screw. Make sure the fastening screws are clean and apply new thread sealant if necessary.

L. Check the gearbox oil level in accordance with the appropriate User Manual/s. If necessary fill or add oil to the gearbox.

NOTICE

Do not mix oil types. Mixing oil types may lead to component damage and diminished performance. Consult NORD for assistance or reference oil type listed on gearbox tag.

M. Re-establish the electrical connection to the motor.

N. Observe the subsequent start-up closely to make certain the equipment is operating properly and there are no seal or gasket leaks.

21. Removing and Replacing NEMA C-Face or IEC Fange-Mounted Motors

For further clarification of these instructions, reference the parts list on Page 14 of this manual.

A. Disconnect the power to the electric motor. Make certain the motor is properly grounded, de-energized and secured with a lock-out/tag-out device.

B. Support the motor and prepare it for removal. Steady the motor and support it. For larger motors, use of mechanical lifting or support devices to may be appropriate.

C. Remove the fastening screws that hold the motor to the C-face or IEC mounting flange.

D. Maintain motor shaft alignment, and move the motor directly away from its mounting surface until the motor shaft and mating coupling clear the mounting flange surface of the driven equipment.

E. Measure and record the proper placement of the motor shaft coupling prior to removing it from the old motor.

F. Make sure the new motor shaft, key and key slot are free of all nicks, burrs, and lubrication or grease.

G. Install the new shaft key on the new motor. If the shaft key is not captured or if an open-ended key slot is utilized it is good practice to secure the key into the key slot with a medium strength thread locking agent or alternatively one may stake the key in place.

H. Re-install the coupling on the new motor shaft, making sure the placement of the coupling is in the same location as it was on the old motor (See Step E).

I. Clean all old gasket material, sealants, contamination, and corrosion from the flange surface on the driven equipment.

J. If the motor is utilized in a wet or wash down environment apply a sealing gasket or gasket eliminating compound to the mating flange surface, as would seem most appropriate for the application.

K. Support the new motor and mount it flush against the mating flange surface of the driven equipment.

L. Apply a medium strength thread locking agent to the bolt threads.

M. Install the bolts and tighten them to the appropriate torque.

N. Re-establish the electrical connection to the motor.

O. Observe the subsequent start-up closely to make certain the equipment is operating properly.

22. Testing

IMPORTANT NOTE

NORD electric motors do not require periodic testing. However, if a motor is removed from its installation, NORD recommends that the motor be checked according to the following static and dynamic testing procedures before it is reinstalled. Finding a condition that will require future repair before the motor is reinstalled decreases the overall maintenance time.

This section provides general test information and functional checks for the types of motors covered by this manual. Read and understand the tests and checks before performing them on your motor.

Record and date all measurements taken.

If the motor fails any of the test procedures provided below, use the troubleshooting guide to determine the motor problem.

Static Testing

A. The motor can only be static tested if it is disconnected from the component it drives and securely mounted on a fixture or mounting plate. These tests are usually conducted when a motor has been removed for any reason other than failure

B. Turn the motor shaft slowly by hand. Feel and listen for evidence of a failed bearing, which is indicated by a rough feel as the shaft rotates, and by noise.

C. Check for smooth rotation, with no evidence of binding or catching. If the shaft does not rotate smoothly, or binds or catches, the bearings are worn or failing, lack lubrication, or are contaminated.

D. Check the motor shaft for side play by applying pressure at right angles to the shaft in several places around the circumference. If the shaft moves perceptibly, the front bearing may be worn.

Dynamic Testing

A. Find the motor voltage and rated load current values as listed on the motor nameplate.

B. Using a volt-ohmmeter, verify that the motor power supply is in the correct range.

C. Run the motor with no load. As the motor is operating, listen for unusual motor noise and check for excessive vibration. Vibration and motor noise are indications of bearing contamination, lack of lubrication, damage, or failure.

D. Use an ammeter to measure the no-load current. Record the no-load current for comparison with previous readings, and for reference during future testing.

E. If the motor passes the no-load test, operate the motor at rated load and check and record the current.

F. Check the motor operating temperature at rated load. If the motor operates at a higher than normal temperature, the motor may be damaged, overloaded or failing.

23. Troubleshooting

Fault	Likely Cause	Corrective Action
Motor fails to start.	• Motor is mis-wired • Brake is may not be releasing. • Fan guard damaged and contacting fan. • Motor protection device has tripped or does not switch • 1-Ph Capacitor or start switch has failed.	• Verify and correct motor wiring. • Troubleshoot brake per User Manual U35000. • Replace damaged fan guard. • Check motor protection device for correct setting and correct error. • Discharge capacitor and use a volt-ohm meter to check the capacitor for an open circuit - replace if needed. Inspect switch and connections. Replace if contacts look burned or pitted.
Fuses blow or motor protection faults immediately.	• Short circuit in line. • Lines connected incorrectly. • Fuse or circuit breaker tripped. • Motor is overloaded or equipment jammed. • Stator is shorted or went to ground.	• Rectify short circuit. • Check circuit diagram and make corrections. • Replace fuse or circuit breaker. • Make sure load is free. Verify motor amp draw compared to nameplate rating. • A damaged or blown stator will show a burn mark. Stator must be repaired or replaced.
Motor hums and has high current consumption	• Brake may not be releasing. • Rotor may be rubbing stator. • Defective or incorrect stator winding.	• Troubleshoot brake per User Manual U35000. • Send motor to a repair specialist.
Severe speed loss under load or excessive acceleration time.	• Overload. • Excessive voltage drop. • Damaged or failing motor bearings. • Damaged or worn gear unit. • 1-Ph Capacitor or start switch has failed.	• Check load conditions and make certain system is unobstructed. Reduce load or consider a larger motor. • Verify service voltage is within specification. Check if nearby equipment is affecting incoming power. Make sure connection harness and wiring is adequate. • Replace motor bearings. • Replace or repair damaged gear unit. • See instructions under "Motor fails to start".
Motor runs the incorrect direction.	• Incorrect wiring.	• Rewire motor according to system schematic and/or switch two incoming motor phases.
Motor heats up excessively or thermal overload protection trips	• Overload. • Ambient temperature is too high. • Inadequate cooling. • Operation is outside the allowed duty cycle. • Motor protection device may be defective. • Excessive supply voltage. • System short or damaged stator.	• Make sure load is free. Verify motor amp draw compared to nameplate rating. Reduce load or consider a larger motor. • Do not operate above the rated conditions. • Correct cooling air supply. Open and clear cooling air passages. Retrofit with forced ventilator fan if needed. • Adjust operating duty cycle or contact a specialist to select a suitable motor or drive. • Replace motor protection device. • Adapt motor supply voltage. • Check for loose, cut or damaged wires. Check stator winding for defects or burn damage.
Excessive Noise or Vibration	• Motor bearings contaminated or damaged. • Excessive motor shaft end play. • Misaligned or imbalanced load.	• Test motor by itself. If bearings are bad noise may be heard or roughness detected. Replace bearings. Add lubrication if bearings have grease fittings. • Check shaft endplay with motor and system power disconnected. If shaft movement is excessive replace motor shaft bearings. • Check all mating shaft connections for proper alignment and correct all imbalanced load conditions.
1 Ph Start Capacitor Failures	• Motor is not coming up to speed quickly enough. • Motor is being cycled frequently • Start switch is defective or damaged.	• Verify motor size to load conditions. Motor should come up to speed in no more than 2-3 seconds. • Verify duty cycle and consult specialist for recommendations. • Replace start switch.
1 Ph Run Capacitor Failures	• Possible power surge to motor caused by transient voltage or lightening. • Excessive ambient temperature.	• Install proper surge protection. • Verify ambient conditions do not exceed nameplate value.

Items included in the touch-up kit

I. No Rinse Alodine® Touch-N-Prep pen.

II. Color matched sealer pen

IMPORTANT NOTE

- Always wear Personal Protective Equipment (PPE), including gloves and safety glasses with side shields.
- When opening individual pens, pull safety caps straight out from pen. Do not twist or torque the cap to avoid damaging the applicator assembly.
- Do not use fingers to prime the applicator tip. Priming takes 15-30 seconds.
- Make sure the surface is clean and dry.

IMPORTANT NOTE

I. Metal temperature must be above 50° F

II. Do not excessively use abrasive pad while removing surface oxidation. Oxidation only needs to be removed from areas with exposed aluminum.

III. Use enough product to wet surface but avoid pooling.

IV. Do not rinse or wipe Alodine coating before the product is allowed to dry.

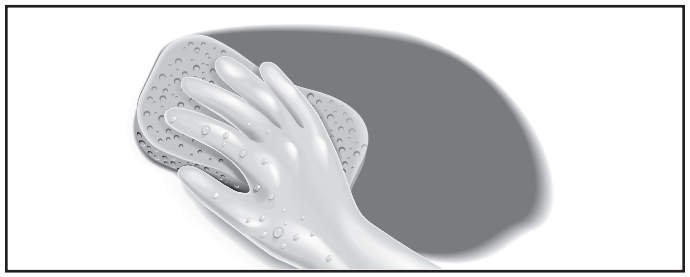
V. Allow to air dry or use a blow dryer. Do not use a heat gun. Maximum drying temperature is 140°F.

VI. Dry color will appear opaque.

Part I: Allodine® 871 Touch-N-Prep® Pen Instructions

Touch-N-Prep® pens are designed for easy and safe repair of clean, bare, or previously painted aluminum surfaces. It is a non-rinse, dry-in-place application that can be applied using the following steps:

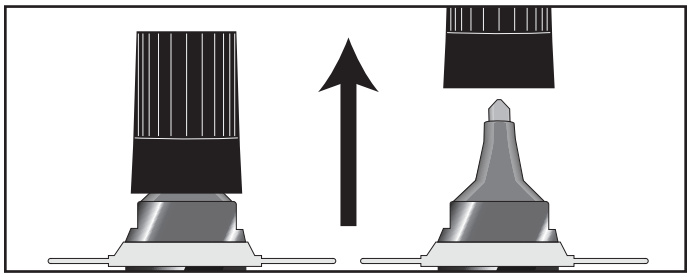
1. Surface Preperation



Before applying the coating, the treated surface must be cleaned using the following process:

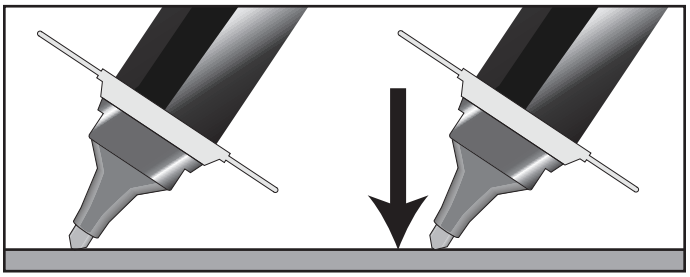
- If the scratch is more than 24 hours old use a moistened abrasive pad to remove oxides from the surface of the metal.
- Wipe substrate with a damp lint-free cloth to ensure complete removal of soils and dislodged oxides generated from the previous step.
- Allow Surface to dry before Touch-N-Prep® application.

2. Prime Applicator Tip

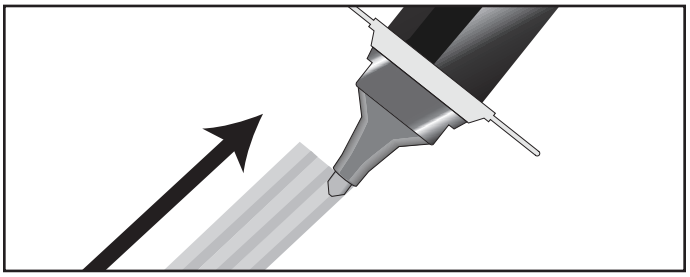


To activate, hold the Touch-N-Prep® pen upright and pop off the cap. Do not twist or turn to remove the cap, since this may result in the pen leaking. Hold the pen tip down onto a clean surface to begin the flow of solution to the tip.

3. Application

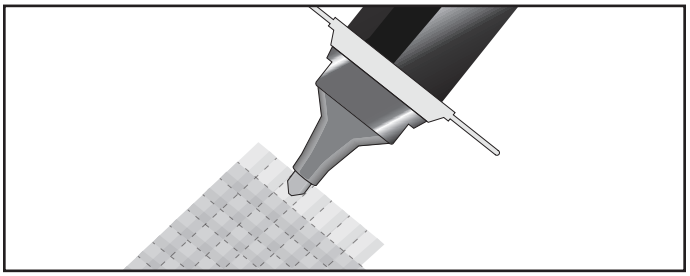


Press the pen tip down on the surface until solution fills the pen tip. Apply the Alodine® 871™ solution to the metal surface with firm, smooth, even strokes, covering all of the edges. Overlap each stroke and allow to dry.



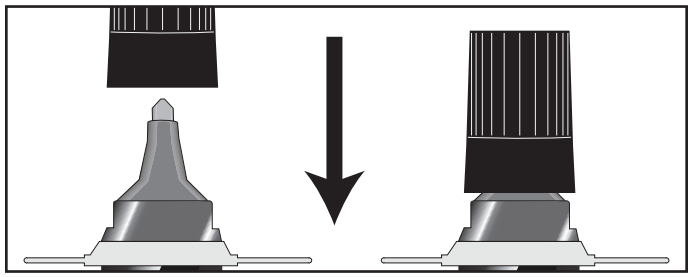
Frequent short jabs to re wet the application rip are preferred to maintain constant coating weights and avoid over-wetting the felt tip.

4. Re-Application



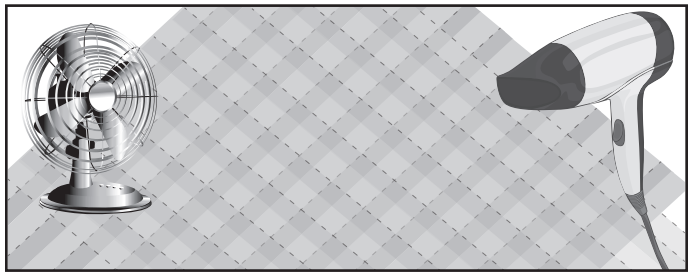
Within 5 minutes of the first coat, apply a second coat at a 90° angle to the first coat with the same smooth, firm stroke.

5. Prepare the Pen for Storage



Always immediately replace the cap when not in use to avoid evaporation and contamination.

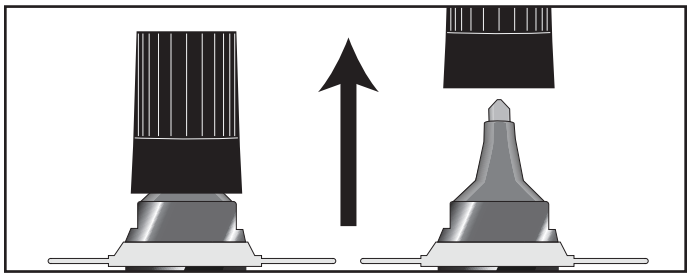
6. Drying



Allow the Alodine Touch-N-Prep® coating to air dry thoroughly.

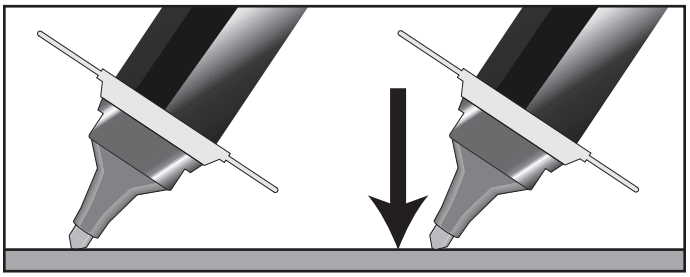
Part II: Sealer Application

1. Prime Applicator Tip



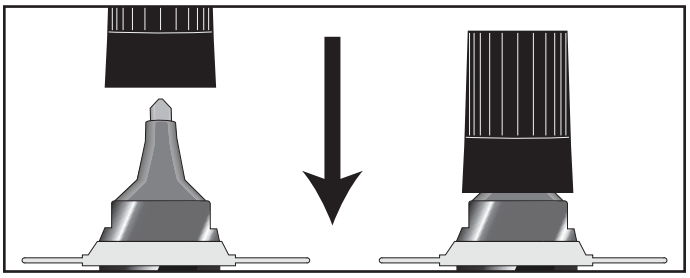
To activate, hold the pen upright and pop off the cap. Do not twist or turn to remove the cap, since this may result in the pen leaking. Hold the pen tip down onto a clean surface to begin the flow of solution to the tip.

2. Application



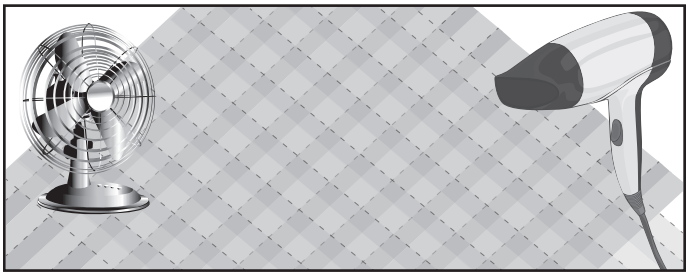
Press the pen tip down on the surface until solution fills the pen tip. Apply the sealer pen solution to the metal surface with firm, smooth, even strokes, covering all of the edges. Overlap each stroke and allow to dry.

3. Prepare the Pen for Storage



Always immediately replace the cap when not in use to avoid evaporation and contamination.

4. Drying



Allow the sealer pen coating to air dry thoroughly.

1. CONTRACT

Any contract between Nord Gear Corporation, hereinafter designated as Seller, and the Buyer is subject to the terms and conditions of sale hereinafter set forth. Any deviation from such terms and conditions must be specifically set forth in writing and consented to by Seller. Accordingly, the Buyer and Seller acknowledge and agree that the terms and conditions set forth below and on the face hereof shall govern Buyer's purchase of the goods described on the face hereof and shall take precedence over and represents the final agreement between Buyer and Seller, notwithstanding any inconsistent, contradictory or other prior or further conditions contained in any oral or written request or purchase order issued by Buyer or any other document furnished by Buyer in connection with its purchase of the Goods, regardless of whether such document or documents are exchanged simultaneously with this Invoice or prior or subsequent thereto. Any additional or different terms or conditions which may appear in any communicaiton, oral or written, from Seller, its officers, employees, agents or representatives, are hereby expressly rejected and shall not be effective or binding upon the Seller, unless specifically hereafter agreed to in writing by Seller and no such additional or different terms or conditions in any document submitted to Seller by Buyer shall become part of the contract between Buyer and Seller, unless such written acceptance by Seller specifically recognizes and assents to their inclusion. Any objection by Buyer to the terms and conditions hereof shall be ineffective unless Seller is advised in writing thereof within two (2) days of the date of this Invoice.

2. CONFIRMATION

An order shall be deemed accepted only when duly confirmed by Seller, at Nord Gear Corporation's home office in Waunakee, Wisconsin, and upon such confirmation the order shall become a contract binding upon the parties hereto, their successors and assigns.

3. PRICES

Prices shown are list prices and may be subject to applicable discounts. Unless otherwise agreed upon in writing, prices are FOB factory Waunakee, Wisconsin. Prices and discounts are subject to change without notice until order is accepted. Seller's prices do not include cost of any inspection permits required.

4. LIMITED WARRANTY

Seller hereby warrants that the goods sold hereunder shall be free from material defects in material and workmanship, if properly installed and used under normal operating conditions, for a period of twelve (12) months from the date of installation or eighteen (18) months from date of shipment, whichever comes first (the "Warranty Period"). With respect to gears and housings only, the Warranty Period is extended to thirty-six (36) months from the date of invoice or twenty-four (24) months from the date of installation, whichever comes first. The limited warranty shall not apply to any components or parts which are subject to normal operational wear and tear, including, but not limited to, belts and traction discs. Should any goods fail to comply with the foregoing limited warranty, Buyer shall provide written notice to Seller of the claimed defect and all relevant details within thirty (30) days of Buyer's discovery of the claimed defect. Buyer shall return the allegedly defective goods to Seller at its facilities in Waunakee, Wisconsin or to such other location within the USA as may be designated by Seller in its sole discretion, with all shipping and transportation charges prepaid by Buyer. Seller shall then examine the returned goods to determine if the claimed defect is covered by the limited warranty. If the claimed defect is covered by the limited warranty, Buyer's sole and exclusive remedy shall be to have Seller repair or replace, at Seller's option, the defective goods or components in accordance with the terms of this limited warranty. Seller shall have a commercially reasonable time to make such repairs or replacements and may use new or reconditioned components. Any repair or replacement shall not extend the Warranty Period unless otherwise agreed by Seller. Buyer shall pay all shipping costs and any costs of removal and re-installation of goods or components.

The foregoing limited warranty shall not apply with respect to any goods or components (i) which are not installed, used, operated, serviced or maintained in accordance with manufacturer's instructions or which are otherwise not properly installed, used, operated, serviced or maintained, or (ii) which are misused, neglected, damaged, altered, repaired, reconfigured or incorrectly wired. Seller makes no representations as to the specifications, capacity or performance of the goods sold hereunder, except as may be specifically set forth in the invoice's written specifications, and any such representations are expressly conditioned upon the accuracy and completeness of the data and information furnished by the buyer and upon the goods being properly installed, used, serviced and maintained by Buyer. Any description or model of the goods is for identification or illustrative purposes only and shall not be deemed to create any warranty, express or implied.

THE FOREGOING LIMITED WARRANTY SHALL EXTEND SOLELY TO BUYER AND NOT TO ANY OTHER PARTY. THE FOREGOING LIMITED WARRANTY IS IN LIEU OF ANY AND ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED. SELLER HEREBY EXCLUDES AND DISCLAIMS ANY AND ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IF BUYER SHALL FAIL TO PAY WHEN DUE ANY PORTION OF THE PURCHASE PRICE OR ANY OTHER PAYMENT REQUIRED FROM BUYER TO SELLER UNDER THIS CONTRACT, ALL WARRANTIES AND REMEDIES SET FORTH HEREIN SHALL BE DEEMED NULL AND VOID, AB INITIO. THE PARTIES ACKNOWLEDGE AND AGREE THAT THE EXCLUSIVE REMEDY UNDER THE FOREGOING LIMITED WARRANTY SHALL NOT HAVE FAILED OF ITS ESSENTIAL PURPOSE (AS THAT TERM IS USED IN THE UNIFORM COMMERCIAL CODE) PROVIDED THAT SELLER REMAINS WILLING TO REPAIR OR REPLACE DEFECTIVE GOODS WITHIN A COMMERCIALLY REASONABLE TIME. BUYER SPECIFICALLY ACKNOWLEDGES AND AGREES THAT THE PRICE CHARGED BY SELLER FOR THE GOODS IS BASED UPON THE LIMITATIONS OF SELLER'S WARRANTY OBLIGATIONS AND OTHER LIABILITIES AS SET FORTH HEREIN.

LIMITATION OF LIABILITY. NOTWITHSTANDING ANY OTHER PROVISION HEREOF, IN NO EVENT SHALL SELLER BE LIABLE TO BUYER OR TO ANY OTHER PARTY FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOST PROFITS, OR FOR ANY LOSSES, CLAIMS OR DAMAGES RELATING TO OR ARISING FROM THE USE OR OPERATION OF THE GOODS, AND IN NO EVENT SHALL ANY CLAIM OR RECOVERY OF ANY KIND EXCEED THE PURCHASE PRICE OF THE GOODS IDENTIFIED IN THE RELATED INVOICE.

5. SHORTAGE AND NONCONFORMITY

Any claim of shortage or that the goods do not conform with the specifications of the order or model must be made in writing within ten (10) days after delivery of the goods (as to which such claim is made) to Buyer or its nominees, but in no event shall the claim be later than within the time limit provided by the carrier or insurance company, otherwise such claim shall be deemed waived. Buyer may not return any goods claimed to be in non-conformity without Seller's prior written authorization. Goods returned without permission will not be accepted, including for credit, and will be returned to Buyer, F.O.B. Sellter's plant. Any claim based on the receipt of damaged Goods must be filed with the carrier which delivered the goods. The samples, measurements, dimensions and weights contained in the Seller's catalogs, sales manuals, photographs and drawings constitute only an approximate guide. The Seller reserves the right to make any change which the Seller, in its absolute discretion, considers necessary. While the goods will be delivered principally according to specifications or standards or quantities agreed upon, insignificant deviations or insignificant changes in construction are permissible. The same applies to partial deliveries, In the event that Buyer has a verified claim of shortage or nonconformity of the goods to the specifications of the order or the model, and if such claim has been submitted within the required time limit as set forth above, the Seller shall, at its own expense, make up for the shortage of the goods, or replace or repair the goods, as the case may be, but in no event shall Seller be or become liable to Buyer or to any other person or persons for any loss in damage, direct or indirect, arising out of or caused by such incidents or for the loss of profits, business or good will. The liability of the Seller to Buyer, if any hereunder, for breach of warranty, contract, negligence or otherwise, shall in no event exceed the amount of the purchase price of the goods sold with respect to which any damages are claimed. Shipping dates are estimates unless parties expressly agree on time of the essence.

6. FORCE MAJEURE

The obligation of the Seller shall be modified or excused, as the case may be, for reasons of Acts of God, war, governmental law regulations, strikes or lock-outs, fire, breakdown of machinery, whether in its own business enterprise, or if for any other cause beyond Seller's control, the goods cannot be delivered or their delivery becomes delayed in whole or in part. In the above instances time for delivery shall be extended for the period of the delay caused, with the proviso, however, that either party may cancel in writing the undelivered portion of the order or contract if the delay exceeds six (6) months from the delivery date originally confirmed by Seller. In no event shall Seller become liable in the aforesaid instances to Buyer or any third party for consequential damages or business loss.

7. SHIPMENT AS UNIT

Each shipment by Seller shall be treated as a separate and distinct unit with respect, but only with respect to forwarding, terms of payment, and the making of claims by the Buyer: provided, however, that if the Buyer defaults in the payment of any obligation to Seller or any installments thereof, under any agreement between Buyer and Seller, or if Buyer refuses to accept any goods when tendered for delivery, the Seller may, on fifteen (15) days written notice to the Buyer, without prejudice to Seller's other lawful remedies, either defer further performance until the defaulted payments are made in full, or make future deliveries for cash in advance only, or treat the entire contract or contracts with Buyer as breached by the Buyer and pursue its remedies for breach.

8. BUYER'S REFUSAL OF DELIVERY

If Buyer refuses to accept delivery of any goods tendered for delivery, then Seller, without prejudice to Seller's other lawful remedies, may either store or cause such goods to be stored in a warehouse, for buyer's account and at Buyer's cost, risk and expense, or sell such goods (without notice) to any purchases at public or private sale, and hold the Buyer liable for any difference between (a) the contract price of the goods, and (b) the price at which goods are resold less the costs and expense of such resale including brokerage commissions, or restocking charges.

9. GOODS IN TRANSIT

If prior to delivery or while the goods are in transit, Buyer or Seller becomes bankrupt or insolvent, or any petition in bankruptcy or for the reorganization or for a state court receivership is filed against Buyer or Seller, as the case may be, then the other party hereto may forthwith terminate this contract by giving written notice of such termination. Such termination shall not affect any claim for damages available to the Buyer, provided that if Buyer is then indebted to Seller, the amount of any such damage claim shall be abated to the extent that the indebtedness of Buyer to Seller, as actually paid in money, is abated by any order of judgement entered or any plan adopted in any bankruptcy, reorganization, receivership, or similar proceeding. Such termination shall not prejudice the Seller's rights to any amounts then due under the contract. If Buyer becomes bankrupt or insolvent or any petition in bankruptcy or for reorganizing or if a state court receivership is filed against Buyer, then, at its option Seller may take possession of any goods theretofore sold to Buyer, in connection with which the full purchase price has not been paid, analogous to the terms and provisions set forth in Paragraphs 11 and 12 hereinafter.

10. DELIVERY

(a) Any indicated dates of delivery are approximate only, but NORD Gear will attempt to meet them whenever possible. (b) NORD Gear will not be liable for any penalty clausess contained in any specifications or order submitted unless agreed to in writing by an authorized officer of NORD Gear Corporation. (c) Unless otherwise agreed, delivery of the goods to any carrier shall constitute delivery to the Buyer, and thereafter the risk of loss or damage to the goods shall be upon the Buyer. (d) If the Buyer does not give delivery instructions to the Seller at least (10) days prior to the delivery date ex factory confirmed by the Seller, the Seller may deliver the goods to a carrier of its own choosing, at Buyer's cost and risk, or, at Seller's option, may store the goods on the pier or any warehouse, at Buyer's cost and risk. Any purchase price in such event becomes due and payable within ten (10) days of such storage.

11. PAYMENT OF PURCHASE PRICE

Time of payment is of the essence under the contract. Unless otherwise provided, terms of payment are 30 days net from the date of invoice with a 1% discount if paid within 10 days of date of invoice. Upon default in any of the terms of the contract, or failure to comply with any of the conditions thereof, or upon seizure of the property under execution or other legal process, or if the Buyer becomes bankrupt or insolvent, or any petition for reorganization or for a state court receivership is filed against Buyer, or if the Buyer makes any assignment for the benefit of it's creditors or otherwise sells, encumbers or disposes of the goods, or if for any other reason the Seller should deem itself insecure, the full amount of the purchase price then remaining unpaid shall at once become due and payable at the option of the Seller.

12. BUYER'S DEFAULT

Upon the Buyer's default, the Seller may dispose of the merchandise in any manner that it deems fit and, if it desires to resell same, may do so at private or public sale, with or without notice, and with or without the property being at the place of sale, subject, however, to applicable laws. The Seller or its assigns shall have the right to bid at such sale and may become the purchaser of the property. The proceeds of the sale shall first be applied to the expenses incurred in retaking, repairing, storing and selling the goods, reasonable attorney's fees included, and then shall be applied to the payment of the balance due under the contract. Any surplus amount shall be paid to the Buyer. If a deficiency results after the resale, the Buyer agrees to pay such forthwith, together with reasonable attorney's fees, for the recovery of the goods incurred by the Seller. If upon the Buyer's default, the Seller elects not to resell any goods which it may repossess, then the cost of repossession, including reasonable attorney's fees, shall forthwith be due and payable from Buyer to Seller. Buyer agrees to pay all reasonable costs and reasonable attorneys' fees incurred by Seller in enforcing Seller's rights against Buyer, including Seller's right to payment of the purchase price of the goods and Buyer's payment of all other amounts owing to Seller required under this Invoice and Conditions of Sale.

13. SECURITY INTEREST AND TITLE

In states and localities which are governed by the Uniform Commercial Code, this contract shall serve as security agreement, reserving in Seller a security interest until full payment of purchase price. The provisions of the Uniform Commercial Code regarding security interest shall have preference and apply if inconsistent with other terms of the conditions of sale. In states and localities where the Uniform Commercial Code does not apply, title to the goods shall remain in the Seller or its assigns until full payment of the purchase price. Buyer agrees to execute forthwith any and all documents in such a way and form as Seller may need for filing or recording the security interest under the Uniform Commercial Code with the proper registers or offices, or for filing or recording the conditional sales contract.

14. SALES AND USE TAX

Buyer agrees to bear and pay any sales or use tax in connection with the purchase herein, and to hold the Seller harmless from payment. At the option the Seller, Buyer shall give evidence of payment or of exemption certificate.

15. INSURANCE

The Buyer shall keep the goods insured against damage by fire, water or other casualty as required by Seller, with a company acceptable to Seller, with loss payable to Seller for the total purchase price until the Seller is fully paid. Seller, if it so elects, may place said insurance at Buyer's expense; Seller may cancel such insurance at any time and without notice and may receive the return premium, if any.

16. MODIFICATION BY SELLER

Any contract may be assigned or transferred by the Seller, or the time for the making of any payment due by Buyer may be extended by Seller without derogation of any of the rights of the Seller or its assigns. Waiver by any party of any default shall not be deemed a waiver of any subsequent default.

17. RETURNED GOODS

No goods will be accepted for return unless authorized in writing by Seller. In all cases, transportation and restocking charges will be borne by Buyer.

18. PACKING

The Buyer will be charged for export packaging or other special packing desired. Cost for cartage to ship or transfer express will be added to the invoice. No credit will be allowed if no packing is required.

19. CHANGES/CANCELLATION

NORD Gear will not accept changes in specifications to a confirmed order unless such changes are requested in writing and confirmed back in writing. In addition, the purchaser must to agree to any additional charges that may arise from the change. Placing orders on hold or cancellation of orders require Seller's written approval, and are subject to cancellation and/or restocking charges.

20. BUYER'S RESPONSIBILITY AS TO MAINTENANCE

Buyer shall use and shall require its employees and agents to use all safety devices and guards and shall maintain the same in proper working order. Buyer shall use and require its employees and agents to use safe operation procedures in operating the equipment and shall further obey and have its employees and agents obey safety instructions given by Seller. If Buyer fails to meet the obligations herein, Buyer agrees to defend, indemnify and save Seller harmless from any liability or obligation with regard to any personal injuries or property damages directly or indirectly connected with the operation of the equipment. Buyer further agrees to notify Seller promptly and in any event not later than ten (10) days after notice or knowledge of any accident or malfunction involving Seller's equipment which has caused personal injury or property damages and to cooperate fully with Seller in investigating and determining the causes of such accident and malfunction. In the event that Buyer fails to give such notice to Seller or to cooperate with Seller, Buyer shall be obligated to defend, indemnify and save Seller harmless from any such claims arising from such accident.

21. MISCELLANEOUS PROVISIONS

(a) If for any reason a provision of a contract is legally invalid, then in such event the rest of the contract shall remain in full force and affect, except that the parties shall try to replace such invalid provision closest to their original mutual intentions. (b) This Invoice and these Conditions of Sale constitute the entire agreement between the parties regarding the subject matter hereof and supercedes all prior agreements, understandings and statements, whether oral or written, regarding such subject matter. No modification to, change in or departure from, the provisions of this Invoice and Conditions of Sale shall be valid or binding on Seller, unless approved in writing by Seller. No course of dealing or usage of trade shall be applicable unless expressly incorporated into this Invoice and Conditions of Sale. Any amendments to any contract or contracts between the parties shall be valid only upon the written consent of both parties.

22. NON ASSIGNMENT BY BUYER

Contract or contracts may not be assigned by the Buyer without prior written consent of the Seller.

23. APPLICABLE LAW AND VENUE

All contracts and their interpretation are governed by the applicable, substantive laws of the State of Wisconsin. Any litigation brought by the Buyer regarding this Invoice or goods purchased hereunder may only be brought in the Circuit Court for Dane County, Wisconsin.

1. CONTRACT
Any contract between Nord Gear Limited, hereinafter designated as "Seller", and the party or parties accepting these terms and conditions of sale and any agent, officer, servant, employee or subcontractor of such party or parties, hereinafter designated as "Buyer", is subject to the terms and conditions of sale hereinafter set forth. Any deviation from such terms and conditions must be specifically set forth in writing and consented to by Seller.

2. CONFIRMATION
An order shall be deemed accepted only when duly confirmed by Seller, at Nord Gear Limited's home office in Brampton, Ontario, and upon such confirmation the orders shall become a contract binding upon the parties hereto, their successors and assigns.

3. PRICES
Prices shown are list prices and may be subject to applicable discounts. Unless otherwise agreed upon in writing, prices are FOB factory Brampton, Ontario. Prices and discounts are subject to change without notice until the order is accepted. Seller's prices do not include cost of any inspection permits required.

4. LIMITED WARRANTY
Seller warrants the goods sold hereunder to be free from defects in material and workmanship under normal use and service not arising from misuse, negligence, or accident, including but not limited to the use, installation, and transportation of the goods by Buyer, its agents, servants, employees, or by carriers. This warranty shall pertain to any part or parts of any goods to which Buyer or its assigns has within one year from date of delivery given written notice of claimed defects to Seller. Buyer shall be required to furnish Seller with details of such defects and this warranty shall be effective as to such goods which Seller's examination shall disclose to its satisfaction to have been defective and which at Seller's option shall promptly thereafter be returned to Seller or its nominees. EXCEPT FOR THE EXPRESS WARRANTIES SET FORTH ABOVE, SELLER HAS MADE NO WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, AS TO THE GOODS SOLD HEREUNDER, INCLUDING, BUT NOT LIMITED TO THEIR MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. ANY DESCRIPTION OR MODEL OF THE GOODS IS FOR IDENTIFICATION OR ILLUSTRATIVE PURPOSES ONLY AND SHALL NOT BE DEEMED TO CREATE AN EXPRESS WARRANTY. The Buyer's exclusive remedy for claims arising from defective or nonconforming goods shall be limited to the repair or replacement thereof at the Seller's sole option. THE SELLER SHALL NOT BE RESPONSIBLE OR LIABLE FOR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE SALE, DELIVERY, USE, PERFORMANCE, OR SERVICE OF THE GOODS SOLD UNDER THIS AGREEMENT. SELLER SHALL NOT BE LIABLE FOR ANY LOST PROFITS OR FOR ANY CLAIM OR DEMAND AGAINST SELLER BY ANY PARTY. IN NO EVENT WILL SELLER BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, EVEN IF SELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. SELLER'S AGGREGATE LIABILITY FOR DAMAGES UNDER THIS AGREEMENT, WHETHER ARISING FROM OR BASED UPON BREACH OF WARRANTY, BREACH OF CONTRACT, TORT OR OTHER CAUSE OF ACTION, SHALL IN NO CASE EXCEED THE PURCHASE PRICE THAT BUYER PAYS FOR THE PARTICULAR GOODS INVOLVED. Seller shall in no event be liable to any person or firm (including any assignee or Buyer) except Buyer and its successors. Unless specifically authorized by Seller in writing, Seller shall not become responsible for any repair work done by Buyer or any other party on any goods sold. Any costs of the return of such goods to Seller shall be borne by Buyer. Goods sold but not manufactured by Seller are being warranted as to defects in material and workmanship consistent with the limited warranty policy of the original manufacturer of the goods and if there is not such a limited warranty policy, the warranty shall be limited to the provisions of Article 4 herein. Standards for the operating characteristics of the gearboxes and the gear motors are in conformity with Seller's tests. THIS WARRANTY IS IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE SELLER DOES NOT ASSUME, NOR DOES IT AUTHORIZE ANY PERSON TO ASSUME, ON ITS BEHALF, ANY OTHER OBLIGATION OR LIABILITY.

5. SHORTAGE AND NONCONFORMITY
Any claim of shortage or that the goods do not conform with the specifications of the order or model must be made in writing within ten (10) days after delivery of the goods (as to which such claim is made) to Buyer or its nominees, but in no event shall the claim be later than within the time limit provided by the carrier or insurance company, otherwise such claim shall be deemed waived. The samples, measurements, dimensions and weights contained in Seller's catalogs, sales manuals, photographs and drawings constitute only an approximate guide. Seller reserves the right to make any changes which Seller, in its absolute discretion, considers necessary. While the goods will be delivered principally according to specifications of standards or quantities agreed upon, insignificant deviations or insignificant changes in construction are permissible. The same applies to partial deliveries. In the event that Buyer has a verified claim of shortage or nonconformity of the goods to the specifications of the order or the model, and if such claim has been submitted within the required time limit as set forth above, Seller shall, at its own expense, make up for the shortage of the goods, or replace or repair the goods, as the cause may be, but in no event shall Seller be or become liable to Buyer or to any other person or persons for any loss in damage, direct or indirect, arising out of or caused by such incidents or for the loss of profits, business of good will. Shipping dates are estimates unless parties expressly agree on time of the essence.

6. FORCE MAJEURE
The obligation of Seller shall be modified or excused, as the case may be, for reasons of Acts of God, war, governmental law regulations, strikes or lock-outs, fire, breakdown of machinery, whether in its own business enterprise, or if for any other cause beyond Seller's control, the goods cannot be delivered or their delivery becomes delayed in whole or in part. In the above instances time for delivery shall be extended for the period of the delay caused, with the proviso, however, that either party may cancel in writing the undelivered portion of the order of contract if the delay exceeds six (6) months from the delivery date originally confirmed by Seller. In no event shall Seller become liable in the aforesaid instances to Buyer or any third party for consequential damages or business loss.

7. SHIPMENT AS UNIT
Each shipment by Seller shall be treated as a separate and distinct unit with respect, but only with respect to forwarding, terms of payment, and the making of claims by Buyer; provided, however, that if Buyer defaults in the payment of any obligation to Seller or any installments thereof, under any agreement between Buyer and Seller, or if Buyer refuses to accept any goods when tendered for delivery, Seller may, on fifteen (15) days written notice to Buyer, without prejudice to Seller's other lawful remedies, either defer further performance until the defaulted payments are made in full, or make future deliveries for cash in advance only, or to treat the entire contract or contracts with Buyer as breached by Buyer and pursue its remedies for breach.

8. BUYER'S REFUSAL OF D ELIVERY
If Buyer refuses to accept delivery of any goods tendered for delivery, then Seller, without prejudice to Seller's other lawful remedies, may either store or cause such goods to be stored in a warehouse, for Buyer's account and at Buyer's cost, risk and expense, or sell such goods (without notice) to any purchaser at public or private sale, and hold Buyer liable for any difference between (A) the contract price of the goods, and (B) the price at which goods are resold less the costs and expense of such resale including brokerage commissions, or restocking charges.

9. GOODS IN TRANSIT
If prior to delivery or while the goods are in transit, Buyer or Seller becomes bankrupt or insolvent, or any petition in bankruptcy or for the reorganization or for appointment of a receiver is filed against Buyer or Seller, as the case may be, then the other party hereto may forthwith terminate this contract by giving written notice of such termination. Such termination shall not affect any claim for damages available to Buyer, to Seller, as actually paid in money, is abated by any order of judgment entered or any plan adopted in any bankruptcy, reorganization, receivership, or similar proceeding. Such termination shall not prejudice Seller's rights to any amounts then due under the contract. If Buyer becomes bankrupt or insolvent or any petition in bankruptcy or for reorganization or if a state court receivership is filed against Buyer, then, at its option, Seller may take possession of any goods theretofore sold to Buyer, in connection with which the full purchase price has not been paid, analogous to the terms and provisions set forth in Paragraphs 11 and 12 hereinafter.

10.DELIVERY
(A)Unless otherwise agreed, delivery of the goods to any carrier shall constitute delivery to Buyer, and thereafter the risk of loss or damage to the goods shall be upon Buyer. (B) If Buyer does not give delivery instructions to Seller at least ten (10) days prior to the delivery date ex factory confirmed by Seller, Seller may deliver the goods to a carrier of its own choosing, at Buyer's cost and risk, or, at Seller's option may store the goods on the pier or on any warehouse at Buyer's cost and risk. Any purchase price in such event becomes due and payable within ten (10) days of such storage.

11. PAYMENT OF PURCHASE PRICE
Time of payment is of the essence under the contract. Upon default in any of the terms of the contract, or failure to comply with any of the conditions thereof, or upon seizure of the property under execution or other legal process, or if Buyer becomes bankrupt or insolvent, or any petitions for reorganization or for appointment of a receiver is filed against Buyer, or if Buyer makes any assignment for the benefit of its creditors or otherwise sells, encumbers or disposes of the goods, or if for any other reason Seller should deem itself insecure, the full amount of the purchase price then remaining unpaid shall at once become due and payable at the option of Seller. Interest on the delinquent payment from the due date thereof until paid shall be at a rate of two (2%) percent per month.

12. BUYER'S DEFAULT
Upon Buyer's default, Seller may dispose of the merchandise in any manner that it deems fit and, if it desires to resell same, may do so at private or public sale, with or without notice, and with or without the property being at the place of sale, subject, however, to applicable laws. Seller or its assigns shall have the right to bid at such sale and may become the purchaser of the property. The proceeds of the sale shall first be applied to the expenses incurred in retaking, repairing, storing and selling the goods; reasonable solicitor's fees included, and then shall be applied to the payment of the balance due under the contract. Any surplus amount shall be paid to Buyer. If a deficiency results after the sale, Buyer agrees to pay such forthwith, together with reasonable solicitor's fees, for the recovery of the goods incurred by Seller. If upon Buyer's default, Seller elects not to resell any goods which it may repossess, then the cost of repossession, including reasonable solicitor's fees, shall forthwith be due and payable from Buyer to Seller.

13. SECURITY INTEREST AND TITLE
In provinces which are governed by a Personal Property Security Act, this contract shall serve as a security agreement, reserving in Seller a security interest until full payment of the purchase price. The provisions of the Personal Property Security Act regarding security interest shall have preference and apply if inconsistent with other terms of the conditions of sale herein. In provinces where a Personal Property Security Act does not apply, title to the goods shall remain in the Seller or its assigns until full payment of the purchase price. Buyer agrees to execute forthwith any and all documents in such a way and form as Seller may need for filing or recording the security interest under a Personal Property Security Act with the proper registers or offices, or for filing or recording the Conditional Sales Contract herein.

14. SALES AND USE TAX
Seller's prices do not include sales, use, excise or other taxes payable to any governmental authority in respect of the sale of Seller's goods. Buyer shall pay, in addition to Seller's price, the amount of any such taxes or shall reimburse Seller for the amount thereof that Seller may be required to pay. At the option of Seller, Buyer shall give evidence of payment or of exemption certificate.

15. INSURANCE
Buyer shall keep the goods insured against damage by fire, water or other casualty as required by Seller, with a company acceptable to Seller, with loss payable to Seller for the total purchase price until Seller is fully paid. Seller, if it so elects, may place said insurance at Buyer's expense; Seller may cancel such insurance at any time and without notice and may receive the return premium, if any.

16. MODIFICATION BY SELLER
Any contract may be assigned or transferred by Seller, or the time for the making of any payment due by Buyer may be extended by Seller without derogation of any of the rights of Seller or its assigns. Waiver by any party of any default shall not be deemed a waiver of any subsequent default.

17. RETURNED GOODS
No goods will be accepted for return unless authorized in writing by Seller. In all cases, transportation and restocking charges will be borne by Buyer.

18. PACKING
Seller does not charge for standard packaging for domestic shipment. Buyer will be charged, however, for export packaging or other special packing desired. Cost for cartage to ship or transfer express will be added to the invoice. No credit will be allowed if no packing is required.

19. EXPORT ORDER
Export orders are to be accompanied by a confirmed irrevocable Letter of Credit in Seller's favor, in Canadian currency, with an accredited Canadian bank, subject to Seller's draft, with shipping documents attached.

20. CANCELLATION
Placing orders on hold or cancellation of orders require Seller's written approval, and are subject to cancellation and/or restocking charges.

21. BUYER'S RESPONSIBILITY AS TO MAINTENANCE
Buyer shall use and shall require its employees and agents to use all safety devices and guards and shall maintain the same in proper working order. Buyer shall use and require its employees and agents to use safe operating procedures in operating the equipment and shall further obey and have its employees and agents obey safety instructions given by Seller. If Buyer fails to meet the obligations herein, Buyer agrees to indemnify and save Seller harmless from any liability or obligation with regard to any personal injuries or property damages directly or indirectly connected with the operation of the equipment. Buyer further agrees to notify Seller promptly and in any event not later than ten (10) days after notice or knowledge of any accident or malfunction involving Seller's equipment which has caused personal injury or property damages and to cooperate fully with Seller in investigating and determining the causes of such accident and malfunction. In the event that Buyer fails to give such notice to Seller or to cooperate with Seller, Buyer shall be obligated to indemnify and save Seller harmless from any such claims arising from such accident.

22. MISCELLANOUS PROVISIONS
(A)If for any reason a provision of a contract is legally invalid, then in such event the rest of the contract shall remain in full force and affect, except that the parties shall try to replace such invalid provision with a provision closest to their original mutual intentions. (B) Any amendments to any contract or contracts require the consent in writing by both parties. Headings in this document are for ease of reference only.

23. NON ASSIGNMENT BY BUYER
Contract or contracts may not be assigned by Buyer without prior written consent of Seller.

24. APPLICABLE LAW
This agreement shall be governed by the laws of the Province of Ontario and the applicable laws of Canada. Buyer and Seller agree that any judicial proceeding with respect to this agreement must be brought and maintained in the City of Toronto, In the Province of Ontario.

25.
This instrument sets forth the entire understanding and agreement of the parties hereto in respect of the subject matter hereof, and all prior undertaking between the parties hereto, together with all representations and obligations of such parties in respect of such subject matter, shall be superseded by and merged into this instrument.

26.
The provisions of this agreement shall bind and ensure to the benefit of the parties hereto and their respective heirs, executors, administrators, successors and (subject to any restrictions or assignment herein above set forth) assigns, as the case may be.

27.
The parties acknowledge that they have requested this document and all notices or other documents relating thereto be drafted in the English language.

Les parties reconnaissent qu'ils ont requis que ce contrat et tous les avis ou autres documents qui s'y rapportent soient rédiges en langue anglaise.

"Terms and Conditions in French available upon request."

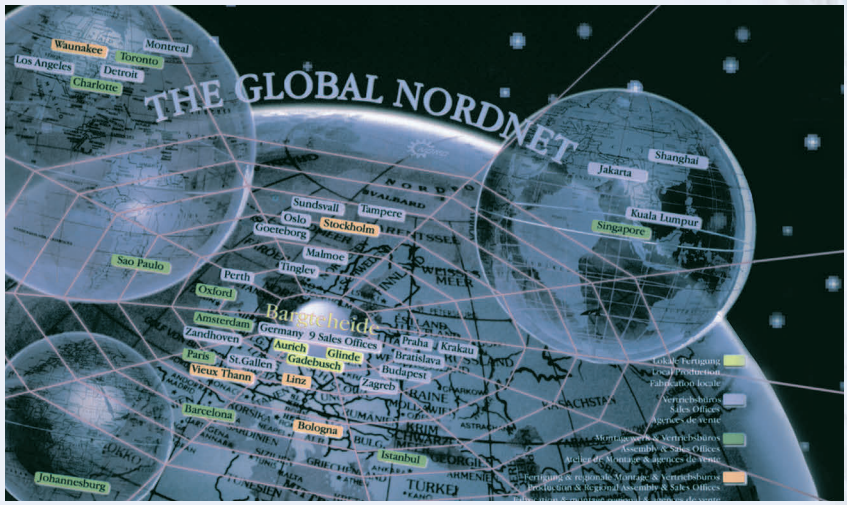
For Increased Satisfaction

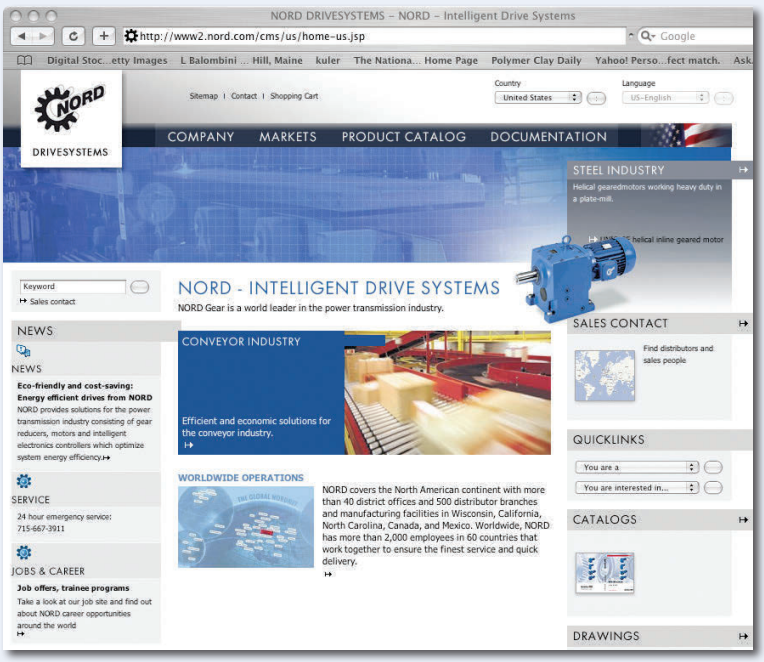
NORD 911

Trouble? Just call **715-NORD-911** (in Canada, 905-796-3606). Emergency service is available 24 hours a day, 7 days a week. We'll answer your call, ship the parts, or build a unit and have it shipped directly to you to provide what you need, when you need it.

Global Availability

From Shanghai to Charlotte, and all points between, NORD reaches customers around the world. Deliveries, service, and product support are close at hand, regardless of your location.





Online Tools

NORD offers comprehensive, searchable product information online. The Internet makes it possible for our customers to reach us anytime, anywhere — 365 days a year, 24 hours a day.

- Online order tracking
- Parts list and maintenance schedules
- Online drive selection software
- DXF scale drawing

Worldwide Standards

NORD products are designed and manufactured based on the latest North American and global standards.

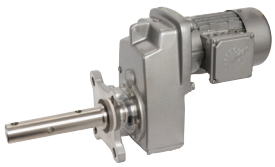
Product Overview

UNICASE™ SPEED REDUCERS

HELICAL IN-LINE
- Foot or Flange Mount
- Torque up to 205,000 lb-in
- Gear ratios – 1.82:1 to over 300,000:1

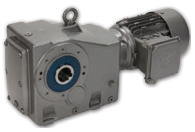
NORDBLOC®.1 HELICAL IN-LINE
- Foot or Flange Mount
- Torque up to 26,550 lb-in
- Gear ratios – 1.88:1 to over 370:1

PARALLEL HELICAL CLINCHER™
- Shaft, Flange or Foot Mount
- Torque up to 797,000 lb-in
- Gear ratios – 4.26:1 to over 300,000:1

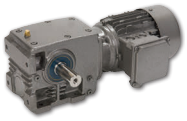


SCP SCREW CONVEYOR PACKAGE
- Shaft, or Flange Mount
- Torque up to 53,100 lb-in
- Gear ratios – 4.32:1 to over 1500:1

RIGHT ANGLE HELICAL-BEVEL 2-STAGE
- Foot, Flange or Shaft Mount
- Torque up to 5,840 lb-in
- Gear ratios – 4.1:1 to 70:1



RIGHT ANGLE HELICAL-BEVEL
- Foot, Flange or Shaft Mount
- Torque up to 283,000 lb-in
- Gear ratios – 8.04:1 to over 300,000:1



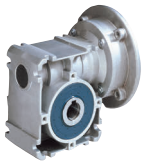
RIGHT ANGLE HELICAL-WORM
- Foot, Flange or Shaft Mount
- Torque up to 27,585 lb-in
- Gear ratios – 4.40:1 to over 300,000:1

HIGH PERFORMANCE MOTORS & BRAKEMOTORS

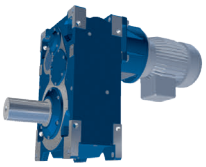
INVERTER/VECTOR DUTY
- Standard or Energy Efficient
- Integral, NEMA or Metric IEC
- 1/6 to 250 hp

UNICASE™ SPEED REDUCERS

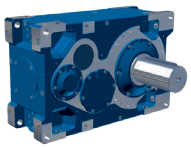
MINICASE™ RIGHT ANGLE WORM
- Foot, Flange or Shaft Mount
- Torque up to 3,540 lb-in
- Gear ratios – 5:1 to 500:1



FLEXBLOC™ WORM
- Modular bolt-on options
- Torque up to 4,683 lb-in
- Gear ratios – 5:1 to 3,000:1



MAXXDRIVE™ LARGE INDUSTRIAL GEAR UNITS PARALLEL HELICAL
- Modular bolt-on options
- Torque up to 2,027,000 lb-in
- Gear ratios – 5:1 to 1,600:1



MAXXDRIVE™ LARGE INDUSTRIAL GEAR UNITS HELICAL-BEVEL
- Modular bolt-on options
- Torque up to 2,027,000 lb-in
- Gear ratios – 5:1 to 1,600:1

NORDAC AC VECTOR DRIVES

SK180E FAMILY
- Distributed, simple speed control
- 380-480V, 3-phase to 3.0 hp
- 200-240V, 3-phase to 1.5 hp
- 200-240V, 1-phase to 1.5 hp
- 100-120V, 1-phase to 0.75 hp

SK200E **FAMILY**
- Distributed, high performance
- 380-480V, 3-phase to 30 hp
- 200-240V, 3-phase to 15 hp
- 200-240V, 1-phase to 1.5 hp
- 100-120V, 1-phase to 1 hp

SK500E FAMILY
- Compact, cabinet mount, high performance
- 380-480V, 3-phase, to 125 hp
- 200-240V, 3-phase, to 25 hp
- 200-240V, 1-phase, to 3 hp
- 100-120V, 1-phase, to 1.5 hp

DRIVESYSTEMS

www.nord.com

NORD Gear Corporation
National Customer Service Toll-Free: 888.314.6673
info.us@nord.com

NORD Gear Limited
Toll-Free in Canada: 800.668.4378
info.ca@nord.com

WEST
Corona, CA (Los Angeles)
Phone: 951.393.6565

MIDWEST
Waunakee, WI (Madison)
Phone: 608.849.7300

EAST
Charlotte, NC
Phone: 980.215.7575

CANADA
Brampton, ON (Toronto)
Phone: 905.796.3606

INTELLIGENT DRIVESYSTEMS, WORLDWIDE SERVICES

B 1091 – en

Motors

Operating and Assembly Instructions

NORD DRIVESYSTEMS

Safety and operating instructions for electric motors

(according to: Low Voltage Directive2006/95/EEC (as of 20/04/2016: 2014/35/EU

1 General

During operation, devices may, depending on their protection class, have live, bare, moving or rotating parts or hot surfaces.

Unauthorised removal of covers, improper use, incorrect installation or operation causes a risk of serious personal injury or material damage.

Further information can be found in this documentation.

All transportation, installation commissioning and maintenance work must be carried out by qualified personnel (compliant with IEC 364 or. CENELEC HD 384 or DIN VDE 0100 and IEC 664 or DIN VDE 0110 and national accident prevention regulations).

For the purposes of these basic safety instructions, qualified personnel are persons who are familiar with the assembly, installation, commissioning and operation of this product and who have the relevant qualifications for their work.

2. Proper use in Europe

The devices are components intended for installation in electrical systems or machines.

When installed in machines, the devices must not be commissioned (i.e. commencement of the proper use) until it has been ensured that the machine meets the provisions of the EC Directive 2006/42/EEC (Machinery Directive); EN 60204 must also be complied with.

Commissioning (i.e. implementation of proper use) is only permitted if the EMC directive (2004/108/EEC) is complied with (as of 20/04/2016: 2014/30/EU)).

Devices with a CE label meet the requirements of the Low Voltage Directive 2006/95/EEC (as of 20/04/2016: 2014/35/EU). The stated harmonized standards for the devices are used in the declaration of conformity.

Technical data and information for connection conditions can be found on the rating plate and in the documentation, and must be complied with.

The devices may only be used for safety functions which are described and explicitly approved.

3. Transport, storage

Information regarding transport, storage and correct handling must be complied with.

4. Installation

The installation and cooling of the equipment must be implemented according to the regulations in the corresponding documentation.

The devices must be protected against impermissible loads. Especially during transport and handling, components must not be deformed and/or insulation distances must not be changed.

Electrical components must not be mechanically damaged or destroyed (this may cause a health hazard!).

5. Electrical Connection

When working on live devices, the applicable national accident prevention regulations must be complied with (e.g. BGV A3, formerly VBG 4).

The electrical installation must be implemented according to the applicable regulations (e.g. cable cross-section, fuses, earth lead connections). Further instructions can be found in the documentation.

Information regarding EMC-compliant installation – such as shielding, earthing, location of filters and installation of cables – can be found in the documentation for the devices. These instructions must be complied with even with CE marked devices. Compliance with the limiting values specified in the EMC legal regulations is the responsibility of the manufacturer of the system or machine.

6. Operation

Where necessary, systems in which the devices are installed must be equipped with additional monitoring and protective equipment according to the applicable safety requirements, e.g. legislation concerning technical equipment, accident prevention regulations, etc.

The parameterisation and configuration of the devices must be selected so that no hazards can occur.

All covers must be kept closed during operation.

7. Maintenance and repairs

The following applies in particular for operation with frequency inverters:

After the devices are disconnected from the power supply, live equipment components and power connections should not be touched immediately, because of possible charged capacitors. Observe the applicable information signs located on the device.

Further information can be found in this documentation.

These safety instructions must be kept in a safe place!

Documentation

Title: **B 1091**

Order – No.: **6051302**

Series: **Asynchronous motors / Synchronous motors**

• 1 and 3-phase asynchronous motors

SK 63*1)/*2) *3) up to SK 315*1)/*2) *3)

1) Power code: S, SA, SX, M, MA, MB, MX, L, LA, LB, LX, R, X, Y, A, W
- optionally supplemented with: H, P
2) Pole number labelling: 2, 4, 6, 8, …
3) further options

• 3-phase synchronous motors

SK 63*1)*2)/*3) *4) up to SK 132*1)*2)/*3) *4)

1) Winding version: T, F, …
2) Power number: 1 to 9
3) Pole number labelling: 4, 6, 8, …
4) further options

• Three-phase asynchronous motors

SK 63*1)/*2) 2D *3) up to SK 200*1)/*2) 2D *3)

1) Power code: S, SA, SX, M, MA, MB, MX, L, LA, LB, LX, R, X, Y, A, W
- optionally supplemented with: H, P
2) Pole number labelling: 2, 4, 6
3) Options

with ATEX labelling II 2D Ex tb IIIC T . . . °C Db

SK 63*1)/*2) 3D *3) up to SK 200*1)/*2) 3D *3)

1) Power code: S, SA, SX, M, MA, MB, MX, L, LA, LB, LX, R, X, Y, A, W
- optionally supplemented with: H, P
2) Pole number labelling: 2, 4, 6
3) Options

with ATEX labelling II 3D Ex tc IIIB T . . . °C Dc

SK 63*1)/*2) 2G *3) up to SK 200*1)/*2) 2G *3)

1) Power code: S, SA, SX, M, MA, MB, MX, L, LA, LB, LX, R, X, Y, A, W
- optionally supplemented with: H, P
2) Pole number labelling: 2, 4, 6
3) further options

with ATEX labelling II 2G Ex eb IIC T3 Gb

SK 63*1)/*2) 3G *3) up to SK 200*1)/*2) 3G *3)

1) Power code: S, SA, SX, M, MA, MB, MX, L, LA, LB, LX, R, X, Y, A, W
- optionally supplemented with: H, P
2) Pole number labelling: 2, 4, 6
3) further options

with ATEX labelling II 3G Ex ec IIC T3 Gc

Version list

Title, date	Order number	Comments
B 1091, January 2015	**6051302** / 0215	-
B 1091, March 2016	**6051302** / 1016	• General corrections • Structural adjustments to document
B 1091, December 2016	**6051302** / 4816	• General corrections
B 1091, June 2017	**6051302** / 2417	• Technical supplements
B 1091, August 2017	**6051302** / 3517	• Technical supplements
B 1091, June 2018	**6051302** / 2318	• General corrections • Update of EU/EC Declaration of Conformity 2D/3D
B 1091, August 2018	**6051302** / 3118	• General corrections • Section for operation with frequency inverter removed • Section for special operating conditions, permissible surrounding area supplemented • Ignition protection type labelling and type plates updated • Update of EU/EC Declaration of Conformity 2G/3G

Copyright notice

Publisher

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Member of the NORD DRIVESYSTEMS Group

Table of Contents

1 General

These operating instructions must be read before NORD motors are transported, installed, commissioned, serviced or repaired. All persons who are involved in these tasks must observe these operating instructions. In order to prevent injury or damage, all of the safety information in these operating instructions must be strictly observed.

The information and instructions in the instructions, safety and commissioning information which is supplied, as well as all other instructions must be observed.

This is essential to prevent injury and damage.

The applicable national, local and plant-specific regulations and requirements and regulations must be observed.

Technical details may vary for special designs and constructions. In case of doubt, we urgently recommend that the manufacturer is contacted, giving details of the type designation and the motor number.

Qualified personnel are persons who due to their training, experience and instruction, and their knowledge of the relevant standards, accident prevention regulations and operating conditions are authorised to carry out the necessary activities.

This also includes knowledge of first aid measures and the local emergency services.

It is assumed that the work for transport, assembly, installation, commissioning, maintenance and repair will be performed by qualified staff.

In particular, the following must be observed:

- Technical data and information regarding permissible use, installation, connection, ambient and operating conditions, which are contained in the catalogue, the order documents and other documentation for the product.
- Local and plant-specific regulations and requirements
- Correct use of tools, lifting and transportation equipment
- Use of personal protective equipment

For reasons of clarity, the operating instructions do not contain detailed information about possible versions and therefore do not consider all possible cases of installation, operation or servicing.

Because of this, these operating instruction essentially only contain the information which is necessary for proper use by qualified personnel.

In order to prevent faults it is necessary that the prescribed service and inspection work is carried out by appropriately qualified personnel.

- For the operation on an inverter, the planning guideline B1091-1 forms a part of these operating instructions.
- The supplementary operating instructions must be observed if an external fan is present.
- For braking motors, the supplementary brake operating instructions must be observed..

If the operating instructions or the planning guide are lost for any reason, these documents must be obtained from NORD.

1.1 Safety and installation notes

The devices are operating materials intended for use in industrial high voltage systems, and are operated at voltages that could lead to severe injuries or death if they are touched.

The device and its accessories must only be used for the purpose which is intended by the manufacturer. Unauthorised modifications and the use of spare parts and additional equipment which has not been purchased from or recommended by the manufacturer of the device may cause fire, electric shock and injury.

All of the associated covers and protective devices must be used.

Installation and other work may only be carried out by qualified electricians with strict adherence to the operating instructions. Therefore keep these Operating Instructions at hand, together with all supplementary instructions for any options which are used, and give them to each user.

Local regulations for the installation of electrical equipment and accident prevention must be complied with.

1.1.1 Explanation of labels used

DANGER	Indicates an immediate danger, which may result in death or serious injury.
WARNING	Indicates a possibly dangerous situation, which may result in death or serious injury.
CAUTION	Indicates a possibly dangerous situation, which may result in slight or minor injuries.
NOTICE	Indicates a possibly harmful situation, which may cause damage to the product or the environment.
Note	Indicates hints for use and useful information.

1.1.2 List of safety and installation notes

DANGER! — **Electric shock**

The motor is operated with a dangerous voltage. Touching certain conducting components (connection terminals and supply cables) will cause electric shock with possibly fatal consequences.

Even when the motor is at a standstill (e.g. due to the electronic block of a connected frequency inverter or a jammed drive unit) the connection terminals and supply cables may carry a dangerous voltage. A motor standstill is not identical to electrical isolation from the mains.

Even if the drive unit has been disconnected from the mains, a connected motor may rotate and possibly generate a dangerous voltage.

Installation and work must only be carried out when the motor is at a standstill and is **disconnected** (all phases disconnected from the mains).

Follow the **5 Safety Rules** (1. Switch off the power, 2. Secure against switching on, 3. Check for no voltage, 4. Earthing and short circuiting, 5. Cover or fence off neighbouring live components).

WARNING — **Hazard due to heavy loads**

The large weight of the motor must be taken into account during any transportation or installation work.

Incorrect handling may cause the motor to fall or swing without control and therefore cause severe, and possibly fatal injuries due to impact, crushing and other physical injuries. In addition, severe damage to the motor and its surroundings are possible.

Therefore:

- Do not stand under suspended loads
- Only use the attachment points provided
- Check that lifting equipment and lashings have and adequate load capacity and are undamaged
- Avoid hectic movements
- Use personal protective equipment

WARNING — **Injury due to movement**

Under certain conditions (e.g. switching on the power supply, releasing a holding brake) the motor may start to move. The machinery which it drives (press / chain hoist / roller / fan etc.) may then make an unexpected movement. This may cause various injuries, including to third parties.

Before switching on, secure the danger area by warning and removing all persons from the danger area.

WARNING — **Hazard due to loose parts**

Care must be taken that there are no loose parts on the motor. Otherwise, these may cause injury during transportation and installation work, or when the motor in in operation.

Loose carrying or lifting eyes may cause the motor to fall during transportation.

Parallel keys on the motor shaft may be thrown out when the motor shaft rotates.

Fasten or remove loose parts and carrying or lifting eyes; secure or remove free parallel shaft keys on the motor shaft(s).

CAUTION **Danger of burns**

The surface of the motor may heat up to temperatures in excess of 70°C.

Touching the motor may cause local burns to the affected parts of the body (hands, fingers, etc.).

To prevent such injuries, allow sufficient time for cooling down before starting work - the surface temperature should be checked with suitable measuring equipment. In addition, keep sufficient distance from adjacent components during installation, or install protection against contact.

1.2 Field of use

Use of the motors:

The motors may only be used for their intended purpose (to drive machinery).

The motors are constructed with at least protection class IP55 (for the protection class: see rating plate). They may be installed in dusty or damp environments.

In principle the conditions of use and the ambient conditions determine the necessary protection class and any other additional measures. For outdoor installation and vertical versions, e.g. V1 or V5 with the shaft pointing downwards, Getriebebau NORD recommends the use of the double fan cover option [RDD].

Motors must be protected against intensive sunlight, e.g. by the use of a protective cover. The insulation is tropicalised.

Installation altitude:	≤ 1000 m
Ambient temperature:	-20°C...+40°C

For standard motors an extended ambient temperature range from -20°C...**+60**°C is permissible.. In this case, the rated power must be reduced to **82**% of the value stated in the catalogue. If the maximum ambient temperature is between +**40**°C and +**60**°C, the power output should be inversely linearly interpolated between **100**% and **82**%.

The motor connection cables and the cable glands must be suitable for temperatures ≥ 90°C.

1.3 Correct handling of electric motors

All work must only be carried out with the power to the system switched off.

1.3.1 Transport, storage

⚠ WARNING **Danger of falling**

Incorrect handling during transport may cause the motor to fall or swing without control and therefore cause severe, and possibly fatal injuries due to impact, crushing and other physical injuries. In addition, severe damage to the motor and its surroundings are possible.

Therefore:

- Use all available carrying eyes on the motor during transport
- Do not attach any additional loads The lifting eyes are only designed for the weight of the motor
- Only use the intended carrying eyes or bolts for transporting attached machinery (e.g. gear unit attachments)
- Sets of machinery must not be lifted by suspension from the individual machines.

To prevent damage to the motor, the motor must always be used with suitable lifting equipment. The roller bearings should be replaced if the time from delivery to commissioning of the motor exceeds 4 years in good conditions (storage in dry, dust and vibration-free areas). This time is greatly reduced in case of unfavourable conditions. If necessary, unprotected machined surfaces (flange surfaces, shaft ends) must be treated with corrosion inhibitors. If necessary, the insulating resistance of the windings must be checked (🕮 1.3.8 "Checking the insulation resistance").

Changes in comparison with normal operation (higher current consumption, higher temperatures or vibrations, unusual noises or smells, triggering of monitoring devices, etc.) are indications that the function is impaired. To prevent injury and damage, the responsible maintenance personnel must be informed of these changes.

In case of doubt, switch off the motor as soon as the state of the plant permits.

1.3.2 Installation

- After installation, screwed-on lifting lugs must be tightened or removed.
- Smooth running: Precise alignment of the clutch and a well-balanced drive element (clutch, pulleys, fan, etc.) are prerequisites for smooth vibration-free running.
- Complete balancing of the motor and the drive elements may be necessary.
- The top section of the terminal box and the position of the terminal box can be rotated by 4 x 90 degrees.
- Even if not required, on IEC B14 motors **all four** fixing screws, must be screwed into the flanged bearing plate! The fixing screw threads must be inserted with a sealant, e.g. Loctite 242.

WARNING **Electric shock**

The **maximum** depth for screwing into the type plate is **2** x d. There is a danger that the motor windings may be damaged if longer screws are used. This creates a danger of potential transfer to the housing and danger of electric shock if touched.

- The motor must be inspected for damage before installation and commissioning. A damaged motor must not be commissioned.
- Rotating shaft ends and unused shaft ends must be protected against contact. Unused parallel shaft keys must be secured against being thrown out.
- The motor must be suitable for the installation location. (requirements prescribed by standards, ambient conditions, installation altitude)
- Motor surfaces may become very hot during operation. Suitable protective measures must be taken if there is a danger of contact or a hazard to the vicinity of the installation.

1.3.3 Balancing, drive elements

The fitting and removal of drive elements (clutch, pulley, gear wheel,…) must be performed with suitable equipment. As standard the rotors are balanced with half key balancing. **The appropriate form of balancing must be observed if drive elements are installed on the motor shaft. Drive elements must be balanced according to ISO 1940.**

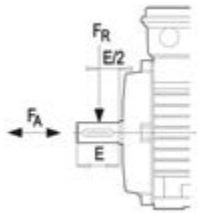
The generally required measures for protection against touching the drive elements must be observed. If a motor is started without a drive element, the parallel key must be secured against being thrown out. This also applies for any second shaft end. Alternatively, the parallel shaft key must be removed.

1.3.4 Alignment

In particular with direct coupling, the motor shafts and the driven machine must be axially and radially aligned to each other. Incorrect alignment may result in damage to the bearings, excessive vibration and breakage of the shaft.

1.3.5 Output shafts

The maximum permissible axial (F_A) and radial forces (F_R) for the A side end of the motor shaft can be obtained from the table below. Getriebebau NORD should be consulted if the radial force (F_R) is applied at a distance which is greater than the length E/2.



Type	F_R [N]	F_A [N]
63	530	480
71	530	480
80	860	760
90	910	810
100	1300	1100
112	1950	1640
132	2790	2360
160	3500	3000
180 .X	3500	3000
180	5500	4000
200 .X	5500	4000
225	8000	5000

No axial (F_A) and radial forces (F_R) are permissible for the B side shaft end.

NOTICE! Attachments must not cause rubbing (danger of excessive temperatures and sparking) or impair the necessary flow of cooling air.

1.3.6 Electrical connection

The connection cables must be passed through the cable glands in the terminal box. The terminal box must be sealed against dust and water. The mains voltage and frequency must conform to the data on the rating plate. ±5 % voltage or ±2 % frequency deviations are permissible without reduction of the power. The connection and configuration of the jumpers must be made according to the circuit diagram in the terminal box.
Please refer to the following table for the labelling of the auxiliary terminals

Auxiliary terminal designation		
Additional equipment	**Labelling of auxiliary terminals** **New: EN 60034-8**	**Comments**
Thermistor	TP1 – TP2 1TP1 – 1TP2 2TP1 – 2TP2 3TP1 – 3TP2 4TP1 – 4TP2	Switch-off Warning Winding 1 Switch-off Winding 1 Warning Winding 2 Switch-off Winding 2
Option: TF	5TP1 – 5TP2	Brake
Bi-metal temperature sensor **Normally closed** Option: TW	1TB1 – 1TB2 2TB1 – 2TB2 3TB1 – 3TB2 4TB1 – 4TB2	Warning Winding 1 Switch-off Winding 1 Warning Winding 2 Switch-off Winding 2
Bi-metal temperature sensor, normally open	1TM1 – 1TM2 2TM1 – 2TM2 3TM1 – 3TM2 4TM1 – 4TM2	Warning Winding 1 Switch-off Winding 1 Warning Winding 2 Switch-off Winding 2
PT100	1R1 – 1R2 2R1 – 2R2 3R1 – 3R2	Winding 1 (Phase U) Winding 1 (Phase V) Winding 1 (Phase W)
KTY **Silicon temperature sensor**	(+) 4R1 – 4R2 (-) (+) 5R1 – 5R2 (-)	Winding 1 Winding 2
Standstill heating Option: SH	1HE1 – 1HE2 2HE1 – 2HE2	Motor heater Brake heater
Capacitor Motor version: EAR/EHB/EST	1CA1 – 1CA2 2CA1 – 2CA2 3CA1 – 3CA2 4CA1 – 4CA2	with operating capacitor 1 with operating capacitor 2 with starting capacitor 1 with starting capacitor 2
Direct current brake Option: BRE...	BD1 – BD2	
Option: DBR…	Brake 1: BD1-BD2 Break2: BD3-BD4	

1.3.7 Operation with frequency inverter

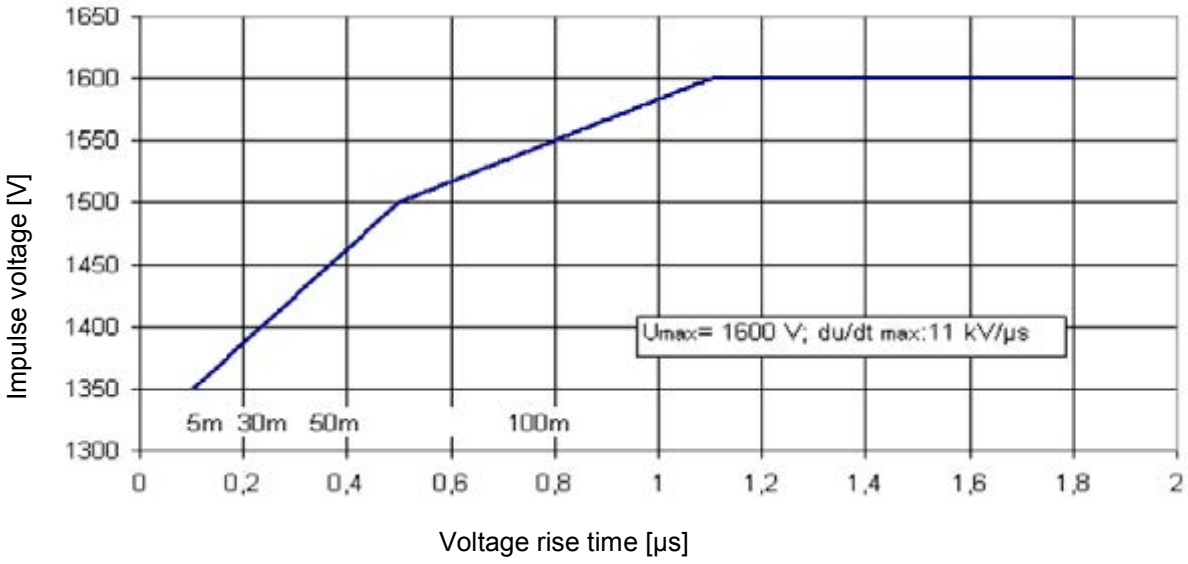
Type SK 63 ./. – SK 225 ./. three phase asynchronous motors are qualified for operation with link circuit inverters according to DIN EN 60034-18-41 (2014).

Please also observe the operating instructions for the frequency inverter which is used.

The insulation system used by NORD consists of suitable varnished copper wire, phase insulation, homogeneous impregnation and groove lining as insulation against earth, and in the standard version is designed for the increased requirements for link circuit inverters.

The maximum permissible FI input voltage is 500 V +10%. Link circuit voltages in excess of 750 V DC are not permissible. When the motor is warm due to operation, the peak voltages due to the system, the inverter, the cable or the motor must not exceed the following values.

Permissible impulse voltages depending on voltage rise-time



If the values are outside of the permissible range, du/dt or sine wave filters may be used (not the additional voltage drop).

The cable lengths shown in the diagram are for guidance only and may deviate according to the specific conditions.

For additional information for operation with a frequency inverter, especially with regard to information about the maximum speed, thermal design and possible torques, please refer to the current NORD motor catalogue M7000.

1.3.8 Checking the insulation resistance

Prior to initial commissioning of the motor after a long period of storage or standstill (approx. 6 months) the insulation resistance of the windings must be checked. During and immediately after the measurements, the terminals have voltages which can be dangerous, and must not be touched.

Insulation resistance

The insulation resistance of new, cleaned, repaired windings against the housing and against each other is > 200 MΩ.

Measurement

The insulation of the windings against the housing for operation voltages up to 400 V must be measured with 500 V DC. For operating voltages up to 725 V the measurement must be made with 1000 V DC. The temperature of the windings should be 25°C ± 15°C.

Testing

If the minimum insulation resistance of the winding against earth is less than 50 MΩ, this may be due to moisture. The windings must then be dried.

The insulation resistance may reduce after long periods of operation. As long as the measured value does not fall below the calculated value for the critical insulation resistance of < 50 MΩ, operation of the motor may continue. If the value is less than this, the cause must be established and if necessary the windings or parts of the windings must be repaired, cleaned or dried.

1.3.9 Commissioning

Information — **Electromagnetic compatibility**

NORD motors comply with the EU-Directive 2014/30/EU. Assembly or installation work must not cause impermissible interference. Immunity from interference must still exist.

Production of interference: In cases of large differences of torque (e.g. when driving a piston compressor) a non-sine wave motor current is induced, whose harmonics can cause an impermissible effect on the mains and therefore impermissible production of interference.

With supply by frequency inverters, various strengths of interference are produced according to the design of the frequency inverter (type, interference suppression, manufacturer). The EMC information of the inverter manufacturer must be observed. If a shielded motor supply cable is recommended, the shielding is most effective if a large area is electrically connected to the metal terminal box of the motor (with metal EMC cable gland). With motors with integrated sensors (e.g. thermistors) interference voltages due to the inverter may be produced in the sensor cables.

Interference immunity: For motors with integrated sensors (e.g. thermistors) the operator must ensure adequate immunity to interference by the selection of a suitable sensor cable (possibly with screening, with connection as for the motor supply cable) and evaluation device. The information and instructions in the operating instructions for the inverter and all other instructions must be observed before commissioning. After installation of the motor, it must be checked for correct functioning. In the case of brake motors, the correct function of the brake must also be checked.

1.3.10 Disposal

NOTICE	Environmental damage

Incorrect disposal of the product may cause damage to the environment.

- Ensure correct disposal
- Comply with current local regulations

Content: aluminium, iron, electronic components, copper

Please observe the additional documentation for the attachments

2 Maintenance and servicing

DANGER! **Electric shock**

The motor is operated with a dangerous voltage. Touching certain conducting components (connection terminals and supply cables) will cause electric shock with possibly fatal consequences.

Even when the motor is at a standstill (e.g. due to the electronic block of a connected frequency inverter or a jammed drive unit) the connection terminals and supply cables may carry a dangerous voltage. A motor standstill is not identical to electrical isolation from the mains.

Even if the drive unit has been disconnected from the mains, a connected motor may rotate and possibly generate a dangerous voltage.

Installation and work must only be carried out when the motor is at a standstill and is **disconnected** (all phases disconnected from the mains).

Follow the **5 Safety Rules** (1. Switch off the power, 2. Secure against switching on, 3. Check for no voltage, 4. Earthing and short circuiting, 5. Cover or fence off neighbouring live components).

WARNING **Injury due to movement**

Under certain conditions (e.g. switching on the power supply, releasing a holding brake) the motor may start to move. The machinery which it drives (press / chain hoist / roller / fan etc.) may then make an unexpected movement. This may cause various injuries, including to third parties.

Before switching on, secure the danger area by warning and removing all persons from the danger area.

2.1 Safety measures

Before starting any work on the motor or the device, but especially before opening the covers of active components, the motor must be isolated according to regulations. In addition to the main power circuits, any additional or auxiliary circuits must be taken into account.

The usual "5 Safety Rules" e.g. according to DIN VDE 0105 are:

- Disconnect
- Secure to prevent reactivation
- Check for no voltage on all poles
- Earth and short circuit
- Cover or cordon off adjacent live components

These measures may only be removed when the maintenance work is complete.

Motors must be properly inspected at regular intervals; current national standards and regulations must be complied with. In particular, special attention must be paid to any mechanical damage, free path of the cooling air, abnormal noises and correct electrical connection.

Only original parts may be used as spare parts with the exception of standardised, commercially available and equivalent parts.

Swapping parts between motors of the same type is not permissible.

Information **Condensation outlets**

If the motors are designed with closed condensation outlets, these must be opened occasionally in order to allow any accumulated condensation to drain off. Condensation outlets must always be located at the lowest point of the motor. During installation of the motor care must be taken that the condensation outlets point downwards and are closed. Open condensation outlets cause a reduction of the protection class.

2.2 Bearing replacement intervals

Under normal operating conditions, with horizontal installation of the motor, depending on the coolant temperature and the motor speed, the bearing replacement interval [h] for IEC motors is:

	25°C	40°C	60°C
up to 1,800 rpm	approx. 40,000 h	approx. 20,000 h	approx. 8,000 h
up to 3,600 rpm	approx. 20,000 h	approx. 10,000 h	approx. 4,000 h

Under special operating conditions, e.g. vertical motor installation, large stresses due to vibration and shock, or operation with frequent reversing, the operating hours stated above are significantly reduced.

2.3 Maintenance intervals

The motor must be checked weekly, or every 100 operating hours for unusual running noise and/or vibrations.

Please check the roller bearings at an interval of at least 10,000 h and replace them as required. In addition, the electric connections, cables and wires as well as the fan are firmly fastened and free from damage. Furthermore, the function of the insulation system must be checked.

Replace the shaft sealing rings every 10,000 hours.

The surface of the motor must not have any dirt deposits which could impair cooling.

A general overhaul of the motor must be carried out every 5 years.

2.4 General overhaul

For this the motor must be dismantled. The following work must be carried out:

- All components of the motor must be cleaned
- All components of the motor must be examined for damage
- All damaged components must be replaced
- All roller bearings must be replaced
- All seals and shaft sealing rings must be replaced

The general overhaul must be carried out by qualified personnel in a specialist workshop with appropriate equipment. We urgently recommend that the general overhaul is carried out by NORD Service.

If the drive unit is subjected to special operating conditions, the intervals stated above may be considerably reduced.

4 Synchronous motors – special information

The following supplementary or special information applies for these motors.

DANGER! **Electric shock**

The motor is operated with a dangerous voltage. Touching certain conducting components (connection terminals and supply cables) will cause electric shock with possibly fatal consequences.

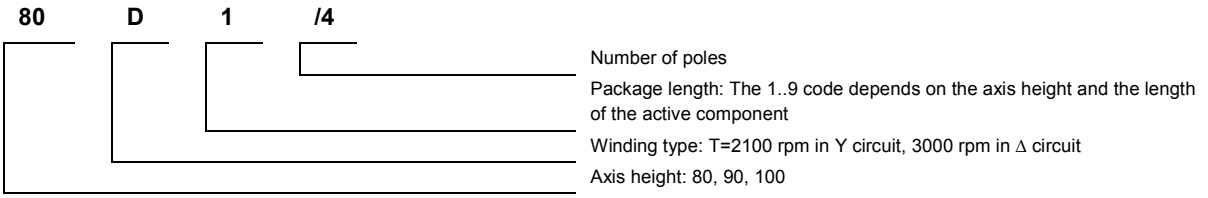
Even when the motor is at a standstill (e.g. due to the electronic block of a connected frequency inverter or a jammed drive unit) the connection terminals and supply cables may carry a dangerous voltage. A motor standstill is not identical to electrical isolation from the mains.

Even if the drive unit has been disconnected from the mains, a connected motor may rotate and possibly generate a dangerous voltage.

Installation and work must only be carried out when the motor is at a standstill and is **disconnected** (all phases disconnected from the mains).

Follow the **5 Safety Rules** (1. Switch off the power, 2. Secure against switching on, 3. Check for no voltage, 4. Earthing and short circuiting, 5. Cover or fence off neighbouring live components).

4.1 Type designation



4.2 Connection

Notice! Hazardous voltages occur at the motor terminals when the motor shaft is rotating!

The motors must only be operated with suitable inverters For energy-efficient operation, the inverter must detect the position of the rotor. Various methods both with and without encoders are available for this. See also TI80_0010

Motors are normally supplied with a star circuit. Some operating points can only be used in a delta circuit. For this, the bridges must be changed according to the circuit diagram in the terminal box cover.

4.3 Encoders

Incremental encoder with zero track

The incremental encoder is located under the fan cover and is attached to this. After installation, the zero point offset is measured in the final test. The offset is provided with an adhesive label in the terminal box.

Absolute encoders

The synchronisation of the encoder is adjusted by NORD prior to delivery of the geared motor and does not require determination of the offset.

If the encoder is not synchronised, or has come out of adjustment due to an impact or removal of the motor, the zero track of the encoder must be synchronised to the rotor position.

4.4 Commissioning

The choice of inverter must be checked with regard to the motor allocation. In addition to the information in Section 1 "General" the operating manual for the frequency inverter must be observed. Further information can be obtained from TI80_0010.

4.5 Maintenance and servicing

CAUTION! The motors contain magnetic components Dismantling without specialist knowledge and suitable aids may result in injuries. This type of work must only be carried out by trained personnel.

5 Replacement parts

Please note our spare parts catalogue PL 1090 under www.nord.com.

We will be pleased to send you the spare parts catalogue on request.

6 Declarations of Conformity

GETRIEBEBAU NORD
Member of the NORD DRIVESYSTEMS Group

NORD DRIVESYSTEMS

Getriebebau NORD GmbH & Co. KG
Getriebebau-Nord-Str. 1 . 22941 Bargteheide, Germany . Fon. +49(0)4532 289 - 0 . Fax +49(0)4532 289 - 2253 . info@nord.com

EC/EU Declaration of Conformity

In the meaning of the directive 2014/34/EU Annex VII, 2014/30/EU Annex II, 2009/125/EG Annex IV and 2011/65/EU Annex VI

Getriebebau NORD GmbH & Co. KG as manufacturer in sole responsibility hereby declares, that the three-phase asynchronous motors from the product series

- **SK 63*[1]/*[2] 2D *[3] to SK 200*[1]/*[2] 2D *[3]**
  1) Power code: S, SA, SX, M, MA, MB, MX, L, LA, LB, LX, R, X, Y, A, W -optionally supplemented by: H, P
  2) Number of poles: 2, 4, 6
  3) Additional options

  with ATEX labeling Ex **II 2D Ex tb IIIC T . . . °C Db**

comply with the following regulations:

ATEX Directive for products	**2014/34/EU**	**OJ. L 096 vom 29.3.2014, S. 309–356**
Eco-design Directive	**2009/125/EG (VO Nr. 640/2009)**	**OJ. L 285 vom 31.10.2009, S. 10–35**
EMC Directive	**2014/30/EU**	**OJ. L 96 vom 29.3.2014, S. 79–106**
RoHS Directive	**2011/65/EU**	**OJ. L 174 vom 1.7.2011, S. 88–110**

Applied standards:

EN 60079-0:2012 + A11:2013	EN 60079-31:2014	EN 60529:1991+A1:2000+A2:2013
EN 60034-1:2010+AC:2010	EN 60034-2-1:2014	EN 60034-5:2001+A1:2007
EN 60034-6:1993	EN 60034-7:1993+A1:2001	EN 60034-8:2007+A1:2014
EN 60034-9:2005+A1:2007	EN 60034-11:2004	EN 60034-14:2004+A1:2007
EN 60034-30-1:2014	EN 55011:2009+A1:2010	EN 61000-6-3:2007+A1:2011
EN 61000-6-4:2007+A1:2011	EN 60204-1:2006+A1:2009+AC:2010	EN 50581:2012

EU-Type-Examination Certificates: BVS 04 ATEX E 037

Notified body for the assessment of the quality management system:

Physikalisch-Technische Bundesanstalt PTB) Bundesallee 100
Identity number: 0102 38116 Braunschweig

Notified body to issue for the EU-Type-Examination Certificate:

DEKRA EXAM GmbH Dinnendahlstraße 9
Identity number: 0158 44809 Bochum

First marking was carried out in 2004.

Bargteheide, 27.03.2018

U. Küchenmeister
Managing Director

Dr. O. Sadi
Technical Director

GETRIEBEBAU NORD

Member of the NORD DRIVESYSTEMS Group

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- **SK 63*[1]/*[2] 3D *[3] to SK 225*[1]/*[2] 3D *[3]**

  [1] Power code: S, SA, SX, M, MA, MB, MX, L, LA, LB, LX, R, X, Y, A, W -optionally supplemented by: H, P

  [2] Number of poles: 2, 4, 6

  [3] Additional options

  with ATEX labeling Ⓔx II 3D Ex tc IIIB T . . . °C Dc

comply with the following regulations:

ATEX Directive for products	**2014/34/EU**	**OJ. L 096 vom 29.3.2014, S. 309–356**
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EN 60034-9:2005+A1:2007	EN 60034-11:2004	EN 60034-14:2004+A1:2007
EN 60034-30-1:2014	EN 55011:2009+A1:2010	EN 61000-6-3:2007+A1:2011
EN 61000-6-4:2007+A1:2011	EN 60204-1:2006+A1:2009+AC:2010	EN 50581:2012

First marking was carried out in 2011.

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  2) Number of poles: 2, 4, 6
  3) Additional options

with ATEX labeling Ex II 2G Ex eb IIC T3 Gb

Comply with the following regulation

ATEX Directive for products	**2014/34/EU**	**ABl. L 096 vom 29.3.2014, S. 309–356**
Eco-design Directive	**2009/125/EG (VO Nr. 640/2009)**	**ABl. L 285 vom 31.10.2009, S. 10–35**
EMC-Directive	**2014/30/EU (ab 20. April 2016)**	**ABl. L 96 vom 29.3.2014, S. 79–106**
RoHS-Directive	**2011/65/EU**	**ABl. L 174 vom 1.7.2011, S. 88–110**

Applied standards:

EN 60079-0:2012+A11:2013	EN 60079-7:2015	EN 60529:1991+A1:2000+A2:2013
EN 60034-1:2010+AC:2010	EN 60034-2-1:2014	EN 60034-5:2001+A1:2007
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EN 61000-6-4:2007+A1:2011	EN 60204-1:2006+A1:2009+AC:2010	EN 50581:2012

EC-Type-Examination Certificates:
PTB 14 ATEX 3030, PTB 14 ATEX 3032, PTB 08 ATEX 3024-2, PTB 14 ATEX 3034, PTB 14 ATEX 3036, PTB 14 ATEX 3038, PTB 14 ATEX 3040, PTB 14 ATEX 3042 PTB 14 ATEX 3044, PTB 14 ATEX 3046

Notified body for the assessment of the quality management system:
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Identity number: 0102 38116 Braunschweig

Notified body to issue for the EC-Type-Examination Certificate:
Physikalisch-Technische Bundesanstalt (PTB) Bundesallee 100
Identity number: 0102 38116 Braunschweig

First marking was carried out in 2008.

Bargteheide, 01.08.2018

U. Küchenmeister
Managing Director

Dr. O. Sadi
Technische Geschäftsleitung

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  - 2) Number of poles: 2, 4, 6
  - 3) Additional options

with ATEX labeling Ex II 3G Ex ec IIC T3 Gc

comply with the following regulations:

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EN 60079-0:2012+A11:2013	EN 60079-7:2015	EN 60529:1991+A1:2000+A2:2013
EN 60034-1:2010+AC:2010	EN 60034-2-1:2014	EN 60034-5:2001+A1:2007
EN 60034-6:1993	EN 60034-7:1993+A1:2001	EN 60034-8:2007+A1:2014
EN 60034-9:2005+A1:2007	EN 60034-11:2004	EN 60034-14:2004+A1:2007
EN 60034-30-1:2014	EN 55011:2009+A1:2010	EN 61000-6-3:2007+A1:2011
EN 61000-6-4:2007+A1:2011	EN 60204-1:2006+A1:2009+AC:2010	EN 50581:2012

First marking was carried out in 2014.

Bargteheide, 01.08.2018

U. Küchenmeister
Managing Director

Dr. O. Sadi
Technische Geschäftsleitung

11.0

Miscellaneous

SEEPEX.
ALL THINGS FLOW

TERMS & CONDITIONS OF SALE AND/OR REPAIR
8.21

The following terms and conditions shall apply to an order for all or any part of the articles covered by the accompanying offer unless a specific exception is included therein. Acceptance of any order by SEEPEX Inc. is expressly made conditional upon Buyer/Customer's acceptance of SEEPEX Inc. Terms and Conditions of Sale and/or Repair. All prior or future terms, conditions or negotiations (whether written or oral) by Buyer/Customer will therefore be considered void and inapplicable unless otherwise agreed in writing. SEEPEX Inc. reserves the right, in its sole discretion, to refuse any order, unconditionally, for any reason including but not limited to: expiration of the validity of the offer, errors in the offer, unacceptable payment risks, conflicts with contractual commitments made to other potential customers and the chance that a customer may try to enforce an implied warranty or merchantability of the products offered.

1.0 PRICES

1.1. Any prices quoted shall only be valid for orders placed within 30 days from the date of issue of the offer. Prices are Ex-Works SEEPEX Inc. plant (Enon, Ohio USA) in U.S. dollars, unless otherwise agreed. SEEPEX Inc. reserves the right to correct typographical or clerical errors.

2.0 TERMS

2.1. All orders are subject to approval by the SEEPEX Inc. Credit Department. Unless otherwise agreed, if payment for the invoice due is not made in full within thirty (30) days after shipment, late fees of eighteen percent (18%) per year (equivalent to a nominal monthly interest rate of 1.5%) will be applied on the unpaid balance until paid in full. The terms and conditions herein set forth are based upon tariffs, taxes, foreign exchange rates, delivery, and other conditions in effect on the date of the Buyer/Customer's order. In the event that such tariffs, taxes, foreign exchange rates, delivery, and/or other conditions should change prior to delivery of the goods, SEEPEX Inc. reserves the right to charge such increased duties, taxes, or charges to the Buyer/Customer.

2.2. Unless the order includes the appropriate exemption certificates and/or licenses, duties and taxes levied by Federal, State, or other governments are required to be charged automatically at the rate imposed at time of importation/shipment. Any change in law, regulations, or Government practice which causes a variation of any kind in the applicable charges from the amounts stated in the offer shall result in an equivalent change in the price quoted.

2.3. Until payment is made in full, SEEPEX Inc. shall retain the right, without notice, to repossess and/ or retain the items, and/or dispose of them, for its benefit and hold the Buyer/Customer responsible for any loss. Buyer/Customer agrees to enter into any agreements, contracts, or notices required confirming such rights.

2.4. Except where prohibited by law, all products and services paid with a credit card will be subject to a 2.5% convenience fee added to the price of the order. This fee will not exceed our cost of acceptance and will not apply to orders placed through an online platform.

3.0 SECURITY

3.1. In order to secure any obligations due to SEEPEX Inc. from the Buyer/Customer, the Buyer/Customer grants to SEEPEX Inc. a security interest in:

a. The merchandise covered by the Buyer/Customer's order (s), and

b. All property and funds of the Buyer/Customer now or hereafter in SEEPEX Inc.'s possession, and in all additions and proceeds of such merchandise and/or property. The Buyer/Customer hereby authorizes SEEPEX Inc. to sign alone any financing statement or statements and to do all and any other things which may be necessary to perfect such security interest.

4.0 CANCELLATION

4.1. After acceptance, orders may be canceled only with the express approval of SEEPEX Inc. In the event of an approved cancellation, the Buyer/Customer shall remain responsible for payment for all work performed and/or material expenses incurred by SEEPEX Inc. as of the time of cancellation. SEEPEX Inc. reserves the right to cancel the order if SEEPEX Inc. determines, in its sole discretion, that the Buyer/Customer's financial condition renders the Buyer/Customer unable or unlikely to pay for the order as agreed.

5.0 RETURN

5.1. No credit will be allowed for returns unless SEEPEX Inc. has authorized such returns in writing in advance. A copy of this authorization must be returned with the item as the packing slip. All returns are subject to re-stocking charges and to the SEEPEX Inc. Return Goods Authorization (RGA) Policy, which is available on www. seepex.com, and is incorporated herein by reference. SEEPEX Inc. will only issue credits for items that are covered under warranty or can be resold. Items that are specially produced for a specific Buyer/Customer, including but not limited to: special hoppers, baseplates, electrical panels, gear reducers and electric motors are specifically excluded from consideration for credit. Any items not received in good, clean and uncontaminated condition or items that cannot be put back into stock will not be accepted. Any elastomer material with over three (3) years of fabrication will not be accepted for return and/or credit. Buyers/Customers must pay for all freight associated with any return, including parts or equipment that may be considered to be covered by the limited warranty protection clause below. If an item is deemed to be covered under warranty, the value of the item, and freight associated with the replacement of the item, will be reimbursed by the issuance of a credit to the Buyer/Customer's account. Outstanding RGA's that have declined repair will be scrapped automatically after ninety (90) days if no other written instructions are provided.

6.0 SHIPMENT

6.1.

a. Handling Charge: Buyer/Customer shall be responsible for making all arrangements for shipment of the order with a suitable carrier. In the event that Buyer/Customer requests that SEEPEX Inc. make arrangements for shipment, then Buyer/Customer agrees to pay to SEEPEX Inc., in addition to the applicable shipping charges, a handling charge in the amount of 10% of the shipping charges with a minimum $5.00 to a maximum charge of $150.00, with special services requiring additional charges.

b. New Articles: Where shipping instructions dictate no specific routing, SEEPEX Inc. will utilize its best judgement in determining routing but shall not be liable for any charges once the goods have reached their agreed upon point of delivery. If changes are made at Buyer/Customer's request in a) the agreed upon point of delivery, or b) in the routing selected by SEEPEX Inc. and if such changes involve additional costs to be incurred, such costs shall be borne exclusively by the Buyer/Customer, unless otherwise agreed in writing.

c. Repair Work: All items for which the Buyer/Customer requests repair or other services by SEEPEX Inc. shall be delivered to and picked up from the SEEPEX Inc. plant (Enon, Ohio USA) unless other- wise agreed in writing. All costs of delivery shall be paid by the Buyer/Customer unless otherwise agreed to in writing prior to shipment. Items returned to SEEPEX Inc. must be returned in good, clean and uncontaminated condition. Any cost of cleaning or decontamination will be charged back to the Buyer/Customer's account at the standard service rate. SEEPEX Inc. has the right to refuse acceptance of any dirty or contaminated shipment that may be suspected of being hazardous.

d. All Orders: On collect freight shipments, cart- age charges from plant to carrier are the responsibility of the Buyer/Customer. Title to articles passes to Buyer/Customer upon delivery to carrier acting as Buyer/Customer's agent subject to any right of retention by SEEPEX Inc. All claims for shortage in, and damages in, shipment or otherwise must be reported to carrier immediately upon receipt with copy or report to ourselves within five (5) business days.

7.0 WARRANTIES & LIABILITY LIMITATIONS

7.1.

a. New Articles: SEEPEX Inc. warrants articles of our manufacture against defects in material and/ or workmanship for a period of one (1) year from date of delivery, provided that the articles have been installed, maintained, and operated in strict accordance with SEEPEX Inc. recommendations and instructions. For any pump that Buyer/Customer registers with SEEPEX Inc., the warranty period, as expressed above, shall be extended by two (2) additional years for a total of three (3) years from date of delivery, and provided that the articles are installed, maintained and operated in strict accordance with SEEPEX Inc. recommendations and instructions for the duration of such warranty period. Registration must be confirmed and can be completed online at http://warranty.seepex.us.

b. Repair Work: Defined herein as work and services performed by SEEPEX Inc. SEEPEX Inc. warrants all repair work and services that it performs against defects in workmanship and/or materials for a period of one (1) year from the date of delivery of the repaired articles or for the remainder of the applicable original warranty period under Section 7.1.a., if not yet expired, whichever period is longer.

c. All Orders: All warranty claims shall be submitted promptly in writing to SEEPEX Inc. Any warranty replacement and/or repair shall be made Ex-Works SEEPEX Inc. plant (Enon, Ohio USA). SEEPEX Inc.'s warranty obligation shall be limited to the replacement and/or repair only of defective material and/or workmanship.

7.2. In no event shall SEEPEX Inc. be liable for any incidental or indirect/consequential loss or damage of whatever kind of nature including but not limited to loss of business income or profits, revenue or loss of production or damage resulting from delay in manufacture or delivery, loss of use or damage to any installation into which the article may be installed, whether arising out of contract or tort.

7.3. Force Majeure: SEEPEX Inc. shall not be liable or responsible to Buyer/Customer or any other party, or be deemed to be in default or breach of its obligations to Buyer/Customer or any other party, for any failure or delay in fulfilling or performing any of its obligations, when and to the extent such failure or delay is caused by or results from acts beyond SEEPEX Inc.'s reasonable control, including, without limitation, war, invasion, hostilities, calamity, riot, civil commotion or disorder, act of civil disobedience, threats or acts of terrorism, plague, epidemic, pandemic, outbreaks of infectious disease, including but not limited to COVID-19, or any other public health crisis, quarantine or other work-related restrictions, act of authority whether lawful or unlawful, compliance with any law or governmental order, rule, regulation or direction, embargoes or blockades, national or regional emergency, act of God or natural disaster, explosion, fire, destruction, general labor disturbance such as but not limited to boycott, strike and lock-out, or shortage or inability to obtain critical labor, material or supplies, telecommunication breakdowns, power outages or shortages, lack of warehouse, dock, cargo container or storage space, inadequate shipment or transportation services, port delays or backups such as but not limited to shortage of labor, equipment, trailers, trucks, vehicles or other services to unload ships or haul cargo away, or inability or delay in obtaining supplies of adequate or suitable materials, or any other event which is beyond the reasonable control of SEEPEX Inc. that renders its performance inadvisable, commercially impracticable, illegal, or impossible ("Force Majeure Event"). Upon the occurrence of any Force Majeure Event, SEEPEX Inc., in its sole discretion and without prior notice to Buyer/Customer or any other party, shall be entitled to terminate the performance of its obligations immediately without Buyer/Customer or any other party having recourse against SEEPEX Inc., or otherwise suspend performance of its obligations to Buyer/Customer or any other party, including without limitation the payment of any funds, monies, wages, compensation or remuneration to Buyer/Customer or any other party, and such performance shall be deemed permanently excused and released hereunder or otherwise suspended until such time that SEEPEX Inc. in its sole discretion determines that it can and should resume performance of its obligations, whether in full or in part.

7.4. Notwithstanding anything herein to the contrary, SEEPEX Inc.'s liability to Buyer/Customer on any cause of action shall be limited to the amount paid by the Buyer/Customer on the subject order. SEEPEX Inc. makes no warranties, express or implied, with respect to articles or products manufactured or provided by any party other than SEEPEX Inc., except to transfer to the Buyer/Customer, where permissible, any warranty provided to SEEPEX Inc. by the original manufacturer. On any claims for repairs and/or re- placement under such warranty, all costs incurred by SEEPEX Inc., which are not underwritten by the original manufacturers, shall be borne by the Buyer/Customer. Except as provided herein, SEEPEX Inc. expressly disclaims all representations, promises, or warranties, express or implied, with respect to any products, articles, work, or services, including any warranties of merchantability and of fitness for a particular purpose. All warranties made by SEEPEX Inc. shall be void where the goods have been subject to misuse, neglect, damage or alteration. SEEPEX Inc. shall be held free and harmless from any dispute or claim anywhere arising from and relating to infringement of patent, design, trademark, or copy- right of items, sold or repaired under this contract.

8.0 PROPERTY RIGHTS AND RISKS

8.1. SEEPEX Inc. disclaims any liability or responsibility whatsoever with regard to loss or damages to the Buyer/Customer's property while in the possession, custody or control of SEEPEX Inc. for requested repairs or other services, and the Buyer/Customer expressly agrees to indemnify and hold SEEPEX Inc. harmless against any and all claims for such loss or damage.

9.0 HAZARDOUS MATERIALS

9.1. Any hazardous materials or the existence of any hazards relative to the condition of any product tendered to SEEPEX Inc. for service or repair work must be disclosed by Buyer/Customer in writing in the RGA Request Form, whether or not required to be disclosed per federal law on the MSDS sheet. Buyer/Customer shall defend, indemnify and hold SEEPEX Inc. harmless from and against any and all claims of injury or damage, including attorney's fees, caused by any hazardous condition or material on or about products accepted for service/ repair. This obligation includes but is not limited to claims of bodily injury or death suffered by SEEPEX Inc. employees, or by other parties.

10.0 GENERAL CONDITIONS

10.1. No modification, amendment, rescission, discharge, abandonment or waiver of these terms and conditions shall be binding upon SEEPEX Inc. unless set forth in writing and signed by a duly authorized officer or representative of SEEPEX Inc.. In any action or proceeding to enforce these terms and conditions against Buyer/Customer or any other party, SEEPEX Inc. shall be entitled to recover all of its costs and expenses, including reasonable attorney's fees and expenses incurred in connection with such action or proceeding. These terms and conditions shall be governed by and construed in accordance with the laws of the State of Ohio, and any contract resulting here from shall be deemed to be made in the State of Ohio, and SEEPEX Inc. and Buyer/Customer hereby consent to the exclusive jurisdiction of the courts of the State of Ohio located in Clark County, with respect to any controversy or claim arising out of, or relating to, any contract resulting from these terms and conditions.

SEEPEX Inc.
511 Speedway Drive
Enon, Ohio 45323
USA

T +1 937 864-7150
sales.us@seepex.com
www.seepex.com

SEEPEX.
ALL THINGS FLOW

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Service Contacts (listed in order of contact):

Representative

Aqua Solutions
154 W. Grove St., Unit D
Middleboro, MA 02346
Phone#: 508-947-5777
Fax#: 508-861-0733

SEEPEX Sales Manager

Chris Davis
c/o SEEPEX Inc.
511 Speedway Dr.
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SEEPEX Parts & Service

Andrew Dempsey
511 Speedway Dr.
Enon, OH 45323
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Fax#: 937-864-7157
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Installation Checklist

Customer	
Project Name	
Customer PO No.	
Pump Tag No.'s	
SEEPEX Commission No.	
SEEPEX Order No.	
Pump Type Code	

Note: The following needs to be completed, signed, and returned to above location prior to **START-UP.**

Installation Checklist – complete prior to start-up			
No.	Description	Completed by	Date
1	Pumps, motors, and bases have been installed per instructions and secured to the pump foundation.		
2	Pumps and motors are aligned if separated during installation.		
3	All piping connections are completely tightened.		
4	All piping, valves, and gauges relating to the pumps are installed correctly and securely anchored.		
5	The suction and discharge lines are ready for operation.		
6	All seal flush and drain connections are complete.		
7	Gearboxes/motors have been checked for proper lubrication and supplied breathers installed.		
8	Suction lines have been flushed and clear of all foreign objects.		
9	Pumps have been bumped (motors jogged) to verify proper rotation.		
10	Optional equipment needed for proper operation of pumps to ensure they are functioning properly (i.e. – control panels, pressure switches, dry run protection, etc.).		
11	The power supply to the pump and controls has been completed and is the correct voltage.		
12	Fluid is available. The pumps can be operated sufficiently to complete the test.		
13	All safety guards and shields are in place.		
14	If a piping pressure test is required, check pump accessories for compatibility. Remove if necessary.		

All parts are covered against defects in material and workmanship per SEEPEX Inc.'s warranty. See O&M for specific details. The below date signifies data of installation.

_____	_____	_____
Name	Contractor's Company Name	Date
_____	_____	_____
Name	Name of Owner's Organization	Date
_____	_____	_____
Name	SEEPEX Inc. or SEEPEX Inc.'s Representative	Date

SEEPEX Inc.
511 Speedway Dr.
Enon, OH 45323
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Fax (937) 864-7157
www.seepex.com

Start-Up Plan

Customer	
Project Name	
Customer PO No.	
Pump Tag No.'s	
SEEPEX Commission No.	
SEEPEX Order No.	
Pump Type Code	

Note: Make certain that signed **Installation Checklist** has been completed and signed before proceeding.

Start-Up Checklist			
No.	Description	Completed by	Date
1	Installation checklist is complete and signed.		
2	Open all valves on suction and discharge.		
3	Fluid is available (especially for suction lift applications).		
4	Prime the pump.		
5	Verify that gearbox lubrication and vents are correct.		
6	Turn on seal flush – tighten packing if leaking is excessive.		
7	Check mechanical seals for proper installation. Clips removed.		
8	Jog pump motor to verify proper rotation.		
9	Turn on pump.		
10	Check motor amps.		
11	Check discharge pressure.		
12	Check flow rate.		
13	Check TSE and sensor, verify set temperature.		
14	VFD Controlled - check pump in Auto Mode and Manual Mode.		

Note: This is to be signed by a qualified SEEPEX Inc.employee or representative. The below date signifies the date that the start-up was completed.

_____/_____ _____

SEEPEX Inc. / SEEPEX Representative Date Company

_____/_____ _____

Owner or / Owner Representative Date Company

Signature confirms that to the best of your knowledge, all of the parameters have been met for the successful start-up and operation of the pump listed by commission number/(s) above.

SEEPEX Inc.
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Enon, OH 45323
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www.seepex.com

Shut-Down Plan

Customer	
Project Name	
Customer PO No.	
Pump Tag No.'s	
SEEPEX Commission No.	
SEEPEX Order No.	
Pump Type Code	

Shut-Down Checklist			
No.	Description	Completed by	Date
1	**Short term:**		
1.1	Disconnect power to pump driver local or as required.		
1.2	Close all valves on suction and discharge.		
1.3	Shut off seal water (if applicable).		
2	**Long-term: (also follow long term storage per O&M)**		
2.1	Follow short term instructions.		
2.2	Rotate pump shaft once per week.		
2.3	Remove drain plug to facilitate drying suction housing.		
2.4	Drain suction housing to prevent freezing.		
2.5	For packing; fill stuffing box with grease.		
2.6	For mechanical seal; fill stuffing box with light oil.		
2.7	If pump is not installed place covers over suction and discharge openings to prevent ingress of foreign substances.		
2.8	Store pump in a cool dry atmosphere.		
2.9	Energize motor heaters if installed.		

Note: This is to be signed by a qualified SEEPEX Inc.employee or representative. The below date signifies the date that the shut-down was completed.

_____/_____ _____
SEEPEX Inc. / SEEPEX Representative Date Company

_____/_____ _____
Owner or / Owner Representative Date Company

Signature confirms that to the best of your knowledge, all of the parameters have been met for the successful shutdown of the pump listed by commission number/(s) above.

Table of Contents

1. Storage period

- > 3 months to 3 years (→chapter 5.3)
- > 3 months to 5 years (→chapter 5.4)

2. Scope

SEEPEX pumps for which a storage period > 3 months is planned.

3. Terms

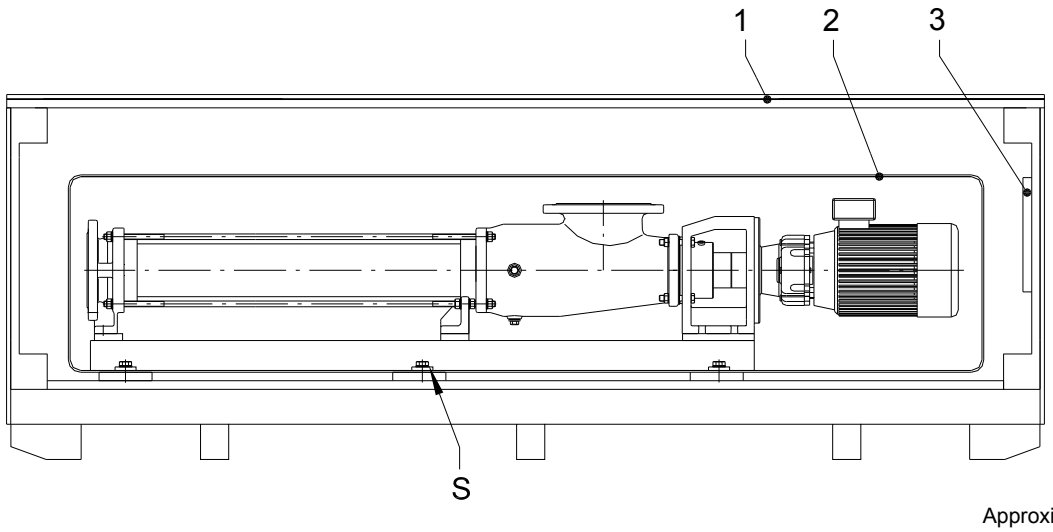
VCI Volatile Corrosion Inhibitor

4. Preparation of SEEPEX pumps for long-term storage

SEEPEX pumps intended for a storage period of >3 months are prepared for long-term storage before delivery by means of appropriate preservation and packaging measures.

For purposes of preservation and packaging, SEEPEX uses VCI materials. The VCI molecules these contain evaporate continuously and form an invisible film on the metal surfaces, which interrupts the electrochemical processes that lead to corrosion. The protective film disappears without residue after the stored materials are unpacked.

4.1 Overview – SEEPEX packaging



Approximate illustration

1 Outer packaging: wooden crate

2 Inner packaging: ALU/VCI film for protection against corrosion and ozone

3 Resealable bag of VCI foam pads for subsequent VCI supply

S Fastening screws to secure the pump in the shipping crate

4.2 Preservation and packaging by SEEPEX

- Pump is completely assembled.
- The original stator is wrapped in VCI bubble wrap, and is included with the delivery.
- Additional disassembled components are wrapped in VCI bubble wrap and included with the delivery.
- The interior of the pump is protected from corrosion with VCI liquid.
- The gear box and motor are protected from corrosion by the protective atmosphere in the inner packaging.
- The complete unit, including the parts delivered loose, is enclosed in the inner packaging of ALU/VCI film, and is thus protected against corrosion and ozone.
- A resealable bag containing VCI foam pads is attached to the interior of the shipping crate. After any opening of the ALU/VCI film, placing these foam pads in the inner packaging will maintain the corrosion-protection atmosphere.

5. Storage at customer's location

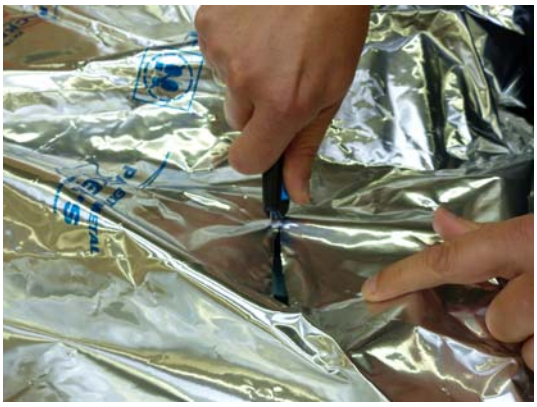
5.1 Handling of the VCI packaging

NOTICE

Damage to the inner packaging.
The corrosion-protection atmosphere can escape, the corrosion protection will become less effective.
- Avoid damage to the inner packaging, or reseal immediately with adhesive tape.
- Avoid opening the inner packaging.

If opening the inner packaging is unavoidable (e.g. for goods inspection or to remove parts), comply with the following procedure:

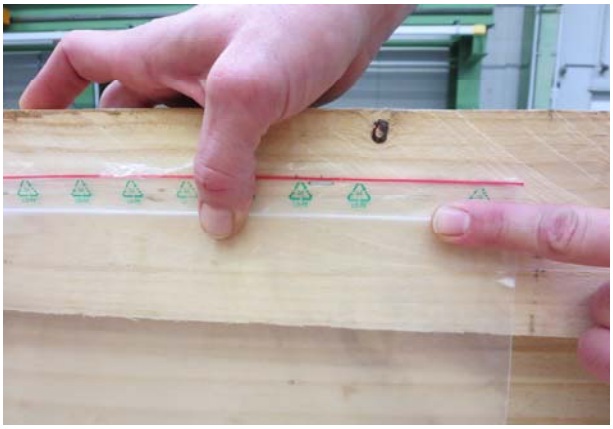
- Open inner packaging. Select the smallest opening possible.



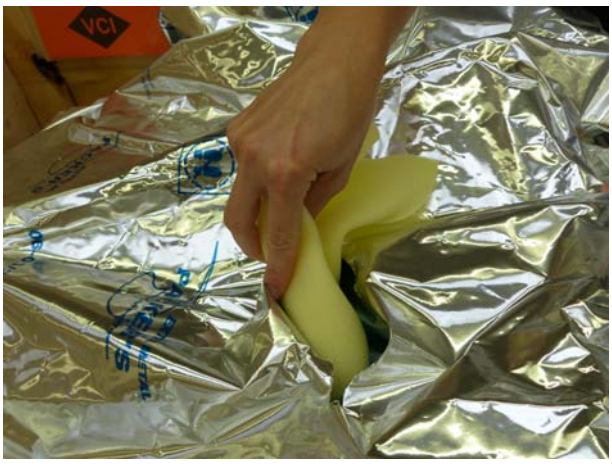
- Perform goods inspection / removal of parts.

- Remove 1 VCI foam pad from the resealable bag.
- Then carefully reseal the resealable bag.

When using VCI foam, no hand protection is necessary. Preventive skin protection through the use of skin protection products is recommended!



- Place VCI foam pad through the opening and into the inner packaging.



- Heat-seal the opening in the inner packaging using the handheld film sealer.
  - Alternatively: Seal the film using adhesive tape.

- Carefully seal the outer packaging (crate/cardboard box).
  - Screw down the cover of the wooden crate.

5.2 Storage of the pump

- in closed, dry rooms.
- permissible relative humidity < 60%.
- permissible temperature range -5°C to +40°C.
- low-vibration, permissible vibration speed ≤ 7.1 mm/s.

Deviating storage conditions and environmental influences must be specified by the customer and checked and approved by SEEPEX before storage.

5.3 Storage period > 3 months to 3 years

When correctly stored (→chapter 5.2) and with undamaged/unopened packaging, the pump can be stored without further measures for up to **max. 3 years**.

5.3.1 Recommissioning after a storage period of > 3 months to 3 years

NOTICE

Incorrectly assembled components.
Damage to property can occur.
➢ Before assembly work and recommissioning, observe the operating and assembly instructions for the pump.

➢ Remove the packaging/protection materials.

➢ Assemble components included loose in delivery.
- Observe operating and assembly instructions for pump.

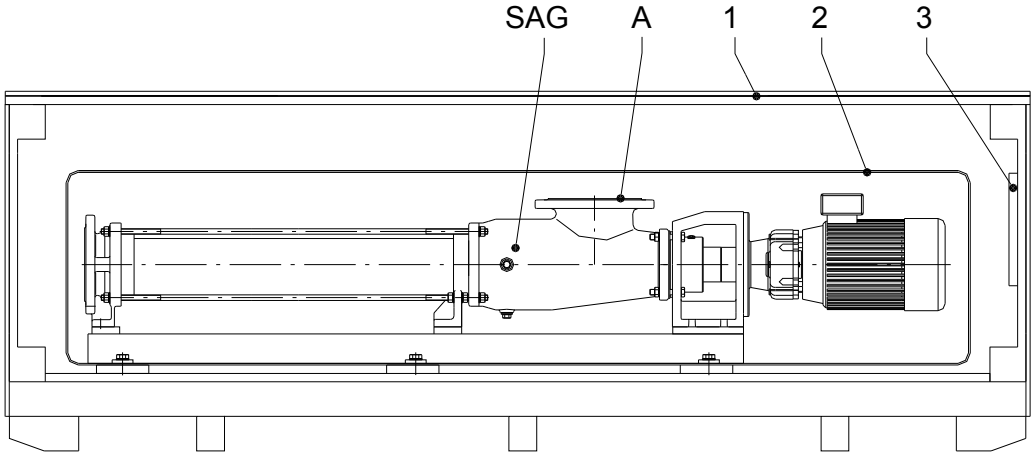
5.4 Storage period > 3 years to 5 years

When correctly stored (→chapter 5.2) and taking into consideration the measures described in chapter 5.4.1, it is possible to extend the storage period to **up to max. 5 years**.

Storage of the pump for longer than 5 years is not recommended due to natural ageing of the elastomers, greases and oils!

5.4.1 Replace VCI corrosion protection

After a storage period of 3 years, replace the VCI packaging and the internal VCI corrosion protection.



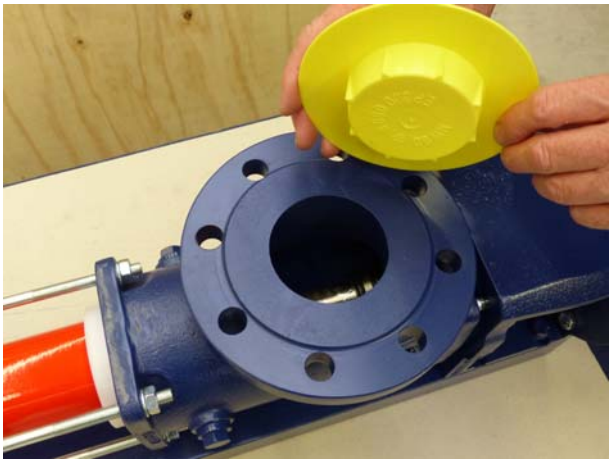
Approximate illustration

1 Outer packaging: wooden crate
2 Inner packaging: ALU/VCI film for protection against corrosion and ozone
3 Resealable bag of VCI foam pads for subsequent VCI supply
A Casing covers
SAG Suction casing

NOTICE

Contaminants and grease on metallic surfaces.
VCI corrosion protection will become less effective.
➢ Only touch metallic surfaces with clean, chloride-free gloves.

➢ Carefully open outer packaging (crate/cardboard box).
➢ Open inner packaging of ALU/VCI film.
➢ Remove casing covers from suction casing (SAG).



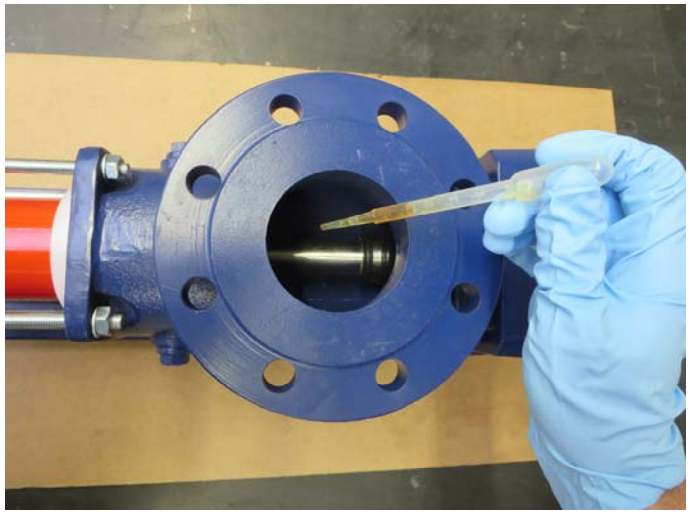
➢ Pour VCI liquid (approx. 40 ml) into the suction casing (SAG).

⚠ CAUTION

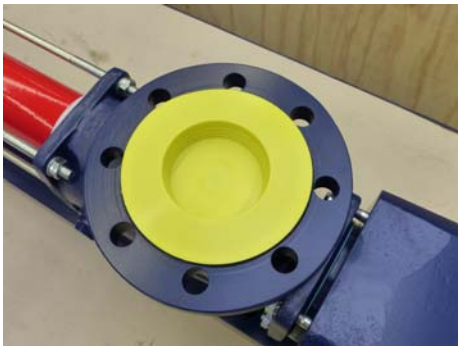
Irritant liquid
In the event of contact with skin/eyes, injuries are possible.

➢ Avoid contact with skin.
➢ Wear protective clothing and protective gloves.

➢ Avoid contact with eyes.
➢ Wear safety goggles.

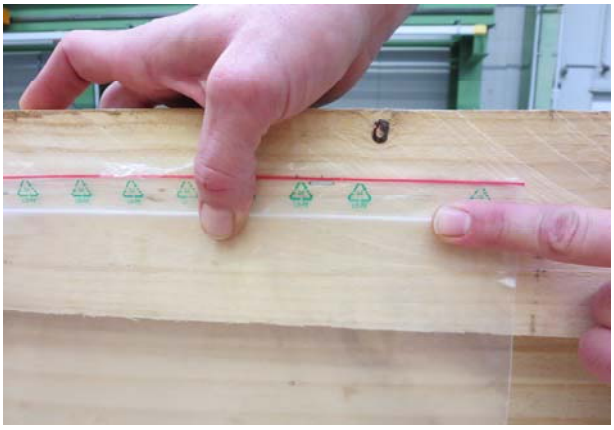


➢ Close casing openings.



- Remove 1 VCI foam pad from the resealable bag.
- Then carefully reseal the resealable bag.

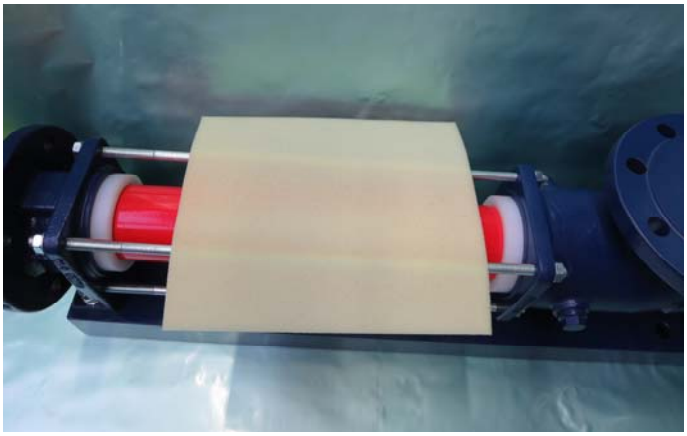
When using VCI foam, no hand protection is necessary. Preventive skin protection through the use of skin protection products is recommended!



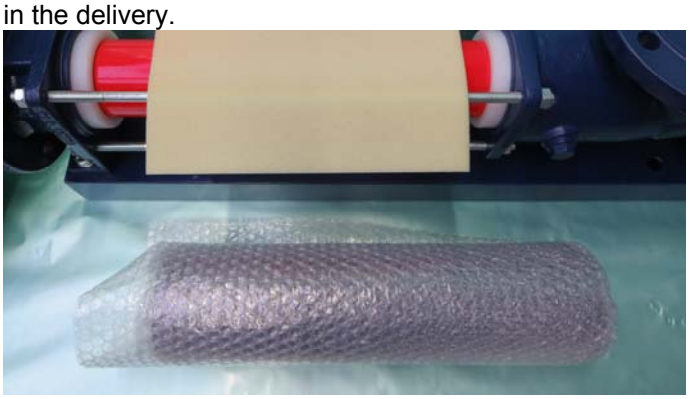
- Place VCI foam pad loose onto the pump.

NOTICE

Contact between the VCI foam and painted surfaces.
Discolouration of the painting is possible. The surface protection is not impaired.
- Avoid direct contact between the VCI foam and painted surfaces.



- Replace the VCI bubble wrap around the original stator and other components included loose in the delivery.



NOTICE

After saturation, desiccant bags return the moisture to the environment.
The corrosion protection will become less effective.

- Do not use desiccant bags.

- Lay ALU/VCI film loosely around the pump at a slight distance.

- Heat-seal the opening in the inner packaging using the handheld film sealer.
  - Alternatively: Seal the film using adhesive tape.

NOTICE Damaging the inner packaging can allow the corrosion-protection atmosphere to escape.
The corrosion protection will become less effective.

- Avoid damage to the inner packaging, or reseal immediately.

➢ Carefully seal the outer packaging (crate/cardboard box).
- Screw down the cover of the wooden crate.

5.4.2 Recommissioning after a storage period of > 3 years to 5 years

Elastomers, seals, grease and oil are subject to natural ageing. SEEPEX therefore recommends assessment and recommissioning by SEEPEX Customer Service.

NOTICE

Incorrectly assembled components.
Damage to property can occur.
➢ Before assembly work and recommissioning, observe the operating and assembly instructions for the pump.

➢ Remove the packaging/protection materials.

➢ Assemble components included loose in delivery.
- Observe operating and assembly instructions for pump.

6. Notices

6.1 VCI materials used by SEEPEX

- ALU/VCI flat film
  SEEPEX ID no.: BDMCOR519000
- VCI bubble wrap
  SEEPEX ID no.: BDMCOR514054
- VCI foam pads 270x230mm
  SEEPEX ID no.: BDMCORB514091
- VCI liquid, AVILUB VCI 1410
  SEEPEX ID no.: BDMCOR141040

NOTICE VCI packaging materials can be used for 1 year if stored in sealed packaging and at room temperature.
➢ Opened packaging must be closed again carefully after use.

6.2 Dispose of packaging in an environmentally friendly manner

When disposing of packaging material:

- Observe country-specific regulations.
- Packaging materials such as VCI materials, cardboard, synthetic materials, metals, wood or wood shavings should be sent for recycling or reused.

7. Relevant documents

Operating and assembly instructions

12.0

Test Report(s)

SEEPEX.
ALL THINGS FLOW

API Performance Test
Variable Speed

Document: FO.QA.42e
Issue: G/ 03/30/2016
Page: 1 of 1

SEEPEX Inc. order no. P02010844
Commission No. 881591
Pump Type Code BN 52-6LS
Customer Tag No. n/a
Customer Name Hart Engineering Coorporation
Project Name Taunton, MA - Veolia
Customer P.O. 9722.101
Max. test condition[4] ☑ GPM ☐ GPH psi
Test Liquid / Temp. Water / 64 °F

This report conforms to SEEPEX Inc. interpretation of DIN 55 350-18-4.2.2 (Test Inspection Certificate) and API 676 testing requirements.

% Rated flow	Speed	Freq	Motor current	Motor volts	Motor power[1]	Suction pressure	Discharge pressure	Standard flow[2]	Actual flow	Flow variance[1]	Acceptable variance[3]
PCT	RPM	HZ	AMPS	VOLTS	HP	PSIG	PSIG	GPM	GPM	PCT	PCT
30%	97.5	17	9.9	139	2.71		22	57.00	52.1	-8.6%	+/- 10
			9.8	139							
			9.9	139							
60%	195	33.7	9.6	259	4.98		22	114.00	113.8	-0.2%	+/- 10
			9.8	259							
			9.8	259							
90%	292.5	50.1	10.2	382	7.74		22	171.00	174.1	+1.8%	+/- 10
			10.4	382							
			10.2	382							
100%	325	55.8	10.3	426	8.72		22	190.00	195.7	+3.0%	+/- 10
			10.4	426							
			10.4	426							

1 - Shaded fields are calculated values.
2 - Standard flows taken from SEEPEX performance program.
3 - Acceptable variance is defined in SEEPEX document TI.031.01e.
4 - Maximum test condition based on pump data sheet.

Shaft seal leak test

Seal Test Pressure: 25 psig
Leak check result: ☑ Pass ☐ Fail ☐ N/A
All pumps with mechanical shaft seals capable of running in reverse rotation must be run in reverse and checked for leaks. Reverse rotation = clockwise rotation viewed from motor end of pump. 25 psi max test pressure for suction casings with standard clean out doors.

Other checks

Shaft run-out measured at seal: 0.002 TIR (in.)
TSE dry-running protection device: ☑ Set ☐ N/A
Stator retention device: ☐ Set ☑ N/A
Pressurize suction casing: ☑ Yes ☐ No ☐ N/A

Drive information

Gearbox: Mfr: NORD Serial No. 50476421 Ratio: 5.1
Motor: Mfr: NORD Serial No. 38784437
Motor data: 10 HP 460 / 3 / 60 Volts/Phase/Hz 12.4 Full load amps
Motor enclosure: X TEFC TENV Explosion proof

Remarks:

P.E. Stamp below (if req'd)

Assembled by: KF Date: 1/5/2022
Tested by: JL Date: 1/5/2022
Approved by: VLL Date: 1/12/2022
Witnessed by: Date:

created: dm 03.28.13 *changed: jr 03.30.16* *checked bf 03.30.16* *released bf 03.30.16*

SEEPEX.
ALL THINGS FLOW

STD - Hydrostatic Test Certificate

ITEM

Part name	Branch	Material code	A1
Part number	DRSA10600520AN04XX	Material type	Cast

CUSTOMER ORDER INFO

SEEPEX Inc. order #	P02010844	Commission No:	881591
Pump Type Code	BN 52-6LS	Customer Tag No.	n/a
Customer Name	Hart Engineering Corporation	Project name	Taunton, MA - Veolia
Customer PO	9722.101		

SEEPEX INC. VENDOR (IF APPLICABLE)

SEEPEX Inc. Vendor	n/a	SEEPEX Inc. PO	n/a

TEST INSTRUMENTS

Gauge Brand	SPAN	Pressure Range	0-300
Gauge Model	03-0014-T		
Calibration Number	TB 203	Calibration due	8-13-22

TEST DATA – Per ANSI/HI 3.6 - Test pressure is 1.5 times the Maximum Allowable Working Pressure or 51 psig whichever is greater. Test time is 5 minutes. Not applicable to suction casings with standard clean out doors as doors are rated <2 bar.

Actual Test Pressure	51	psig
Actual Test Time	5	min.
Actual Water Temperature	64	°F
Actual Air Temperature	69	°F

Built by:	KF	Date	1-5-22
Tested by:	JL	Date	1-5-22
Approved by:	VLL	Date	1-12-22
Witnessed by:		Date	

(PE stamp here)

(Witness & PE stamp optional)

SEEPEX.
ALL THINGS FLOW

STD - Hydrostatic Test Certificate

ITEM

Part name	Casing	Material code	A1
Part number	SAGA10600520AB04BX	Material type	Cast

CUSTOMER ORDER INFO

SEEPEX Inc. order #	P02010844	Commission No:	881591
Pump Type Code	BN 52-6LS	Customer Tag No.	n/a
Customer Name	Hart Engineering Corporation	Project name	Taunton, MA - Veolia
Customer PO	9722.101		

SEEPEX INC. VENDOR (IF APPLICABLE)

SEEPEX Inc. Vendor	n/a	SEEPEX Inc. PO	n/a

TEST INSTRUMENTS

Gauge Brand	SPAN	Pressure Range	0-60
Gauge Model	03-0010-T		
Calibration Number	TB 170	Calibration due	9-5-22

TEST DATA – Per ANSI/HI 3.6 - Test pressure is 1.5 times the Maximum Allowable Working Pressure or 51 psig whichever is greater. Test time is 5 minutes. Not applicable to suction casings with standard clean out doors as doors are rated <2 bar.

Actual Test Pressure	51	psig
Actual Test Time	5	min.
Actual Water Temperature	64	°F
Actual Air Temperature	69	°F

Built by:	KF	Date	1-5-22
Tested by:	JL	Date	1-5-22
Approved by:	VLL	Date	1-12-22
Witnessed by:		Date	

(PE stamp here)

(Witness & PE stamp optional)

SEEPEX.
ALL THINGS FLOW

API Performance Test
Variable Speed

Document: FO.QA.42e
Issue: G/ 03/30/2016
Page: 1 of 1

SEEPEX Inc. order no. P02010844
Commission No. 881592
Pump Type Code BN 52-6LS
Customer Tag No. n/a
Customer Name Hart Engineering Coorporation
Project Name Taunton, MA - Veolia
Customer P.O. 9722.101
Max. test condition[4] ____ ☑GPM ☐GPH ____ psi
Test Liquid / Temp. Water / 64 °F

This report conforms to SEEPEX Inc. interpretation of DIN 55 350-18-4.2.2 (Test Inspection Certificate) and API 676 testing requirements.

% Rated flow	Speed	Freq	Motor current	Motor volts	Motor power[1]	Suction pressure	Discharge pressure	Standard flow[2]	Actual flow	Flow variance[1]	Acceptable variance[3]
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30%	97.5	17.1	10.1	141	2.83		22	57.00	54.1	-5.1%	+/- 10
			10.3	141							
			10.1	141							
60%	195	33.5	9.8	258	4.96		22	114.00	111.3	-2.4%	+/- 10
			9.6	258							
			9.8	258							
90%	292.5	49.9	10.4	381	7.82		22	171.00	170.2	-0.5%	+/- 10
			10.4	381							
			10.4	381							
100%	325	55.8	10.6	426	8.86		22	190.00	190.0	0.0%	+/- 10
			10.5	426							
			10.5	426							

1 - Shaded fields are calculated values.
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4 - Maximum test condition based on pump data sheet.

Shaft seal leak test

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Leak check result: ☑ Pass ☐ Fail ☐ N/A
All pumps with mechanical shaft seals capable of running in reverse rotation must be run in reverse and checked for leaks. Reverse rotation = clockwise rotation viewed from motor end of pump. 25 psi max test pressure for suction casings with standard clean out doors.

Other checks

Shaft run-out measured at seal: 0.002 TIR (in.)
TSE dry-running protection device: ☑ Set ☐ N/A
Stator retention device: ☐ Set ☑ N/A
Pressurize suction casing: ☑ Yes ☐ No ☐ N/A

Drive information

Gearbox: Mfr: NORD Serial No. 50476422 Ratio: 5.1
Motor: Mfr: NORD Serial No. 38784438
Motor data: 10 HP 460 / 3 / 60 Volts/Phase/Hz 12.4 Full load amps
Motor enclosure: X TEFC ____ TENV ____ Explosion proof

Remarks:

P.E. Stamp below (if req'd)

Assembled by: KF Date: 1/5/2022
Tested by: JL Date: 1/5/2022
Approved by: VLL Date: 1/12/2022
Witnessed by: ____ Date: ____

created: dm 03.28.13 *changed: jr 03.30.16* *checked bf 03.30.16* *released bf 03.30.16*

SEEPEX.
ALL THINGS FLOW

STD - Hydrostatic Test Certificate

ITEM

Part name	Branch	Material code	A1
Part number	DRSA10600520AN04XX	Material type	Cast

CUSTOMER ORDER INFO

SEEPEX Inc. order #	P02010844	Commission No:	881592
Pump Type Code	BN 52-6LS	Customer Tag No.	n/a
Customer Name	Hart Engineering Corporation	Project name	Taunton, MA - Veolia
Customer PO	9722.101		

SEEPEX INC. VENDOR (IF APPLICABLE)

SEEPEX Inc. Vendor	n/a	SEEPEX Inc. PO	n/a

TEST INSTRUMENTS

Gauge Brand	SPAN	Pressure Range	0-300
Gauge Model	03-0014-X		
Calibration Number	TB 203	Calibration due	1-5-22

TEST DATA – Per ANSI/HI 3.6 - Test pressure is 1.5 times the Maximum Allowable Working Pressure or 51 psig whichever is greater. Test time is 5 minutes. Not applicable to suction casings with standard clean out doors as doors are rated <2 bar.

Actual Test Pressure	51	psig
Actual Test Time	5	min.
Actual Water Temperature	64	°F
Actual Air Temperature	69	°F

Built by:	KF	Date	1-5-22
Tested by:	JL	Date	1-5-22
Approved by:	VLL	Date	1-12-22
Witnessed by:		Date	

(PE stamp here)

(Witness & PE stamp optional)

SEEPEX.
ALL THINGS FLOW

STD - Hydrostatic Test Certificate

ITEM

Part name	Casing	Material code	A1
Part number	SAGA10600520AB04BX	Material type	Cast

CUSTOMER ORDER INFO

SEEPEX Inc. order #	P02010844	Commission No:	881592
Pump Type Code	BN 52-6LS	Customer Tag No.	n/a
Customer Name	Hart Engineering Corporation	Project name	Taunton, MA - Veolia
Customer PO	9722.101		

SEEPEX INC. VENDOR (IF APPLICABLE)

SEEPEX Inc. Vendor	n/a	SEEPEX Inc. PO	n/a

TEST INSTRUMENTS

Gauge Brand	SPAN	Pressure Range	0-60
Gauge Model	03-0010-T		
Calibration Number	TB 170	Calibration due	9-5-22

TEST DATA – Per ANSI/HI 3.6 - Test pressure is 1.5 times the Maximum Allowable Working Pressure or 51 psig whichever is greater. Test time is 5 minutes. Not applicable to suction casings with standard clean out doors as doors are rated <2 bar.

Actual Test Pressure	51	psig
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Tested by:	JL	Date	1-5-22
Approved by:	VLL	Date	1-12-22
Witnessed by:		Date	

(PE stamp here)

(Witness & PE stamp optional)