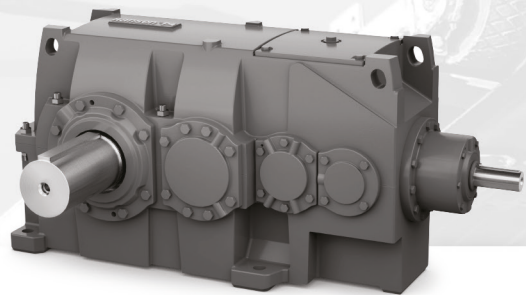
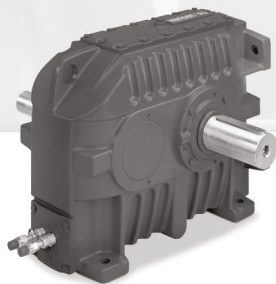
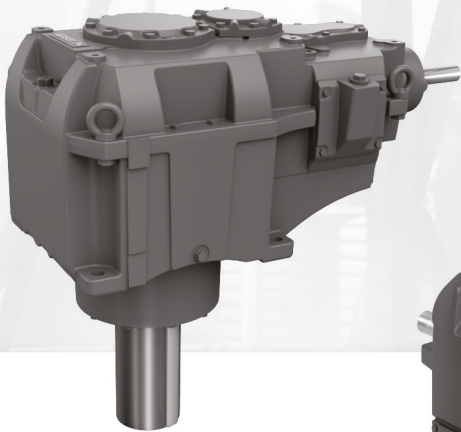


Sumitomo Drive Technologies



HANSEN P4 SERIES

Installation manual

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1 Customer data sheet

Customer References	
Name	
Project	
Application	

Hansen Industrial Transmissions References	
Manufacturing Number	
Order	
Gear Unit Type	

Technical Specifications	
AGMA Power Rating [kW]	
AGMA Torque Rating [kNm]	
Exact Ratio	
Input Speed(s) constant [RPM]	
Input Speed(s) variable [RPM]	
Output Speed(s) constant [RPM]	
Output Speed(s) variable [RPM]	
Shaft Arrangement	
Motor Power [kW]	
Motor Torque [kNm]	
Service Factor on Motor Power	
Absorbed Power [kW]	
Absorbed Torque [kNm]	
Service Factor on Absorbed Power	
Direction of Rotation (low speed shaft)	
Axial load (low speed shaft) [kN]	
Direction axial load (low speed shaft)	
Mass of the gear unit ¹ [kg]	

Important information	

ATEX / UKEX Specifications	
ATEX / UKEX marking Gear unit	
Calculated minimum bearing lifetime [Hrs]	

Paint	
Corrosion category according to ISO12944-2	
Colour	

¹ Estimated value, without gear oil, without drive package components

Lubrication		
Type of gear oil		
Oil viscosity grade [ISO VG]		
Minimum temperature for the oil bath for start-up [°C]		
Maximum ambient temperature [°C]		
Maximum continuous temperature of the gear oil in the oil bath, during operation [°C]		
Maximum peak temperature of the gear oil in the oil bath, during operation, [°C]		
Grease type		
Grease quantity type		

Storage and protection	
The gearbox is adequately treated for storage and corrosion protection up to ²	
1 year indoors	
2 years outdoors	
5 years indoors	

² The applicable value is marked with X

2 Manual Disclaimer

This Manual and its instructions and information do not purport to cover all details or variations in the gear unit and do not claim to provide for every possible contingency met in connection with handling, installation, operation, or maintenance. Hansen Industrial Transmissions does not make any representations, warranties or guarantees, express or implied, as to the accuracy or completeness of the Manual. Users must be aware that updates and amendments will be made from time to time to the Manual. It is the user's responsibility to determine whether there have been any such updates or amendments. Neither Hansen Industrial Transmissions nor any of its directors, officers, employees or agents shall be liable in contract, tort or in any other manner whatsoever to any person for any loss, damage, injury, liability, cost or expense of any nature, including without limitation incidental, special, direct or consequential damages arising out of or in connection with the use of the Manual. The user and/or purchaser bears all risks. Should further information be desired or should particular problems arise which are not covered sufficiently for the users' and/or purchaser's purposes, the matter should be referred to in writing to Hansen Industrial Transmissions.



Warning: Read and understand all instructions and information prior to any handling including maintenance, installing or starting the gear unit. Failure to follow instructions could lead to damage, serious injury, or death. If you have any further questions, please contact Hansen Industrial Transmissions.

- Only qualified and trained personnel should be involved with the storage (including transport), commissioning, operation, installation (including removal), inspection, maintenance and repairs of this gear unit.
- Make sure all your personnel, operators of this gear unit have been professionally and adequately trained for safe working practices.
- Operators must wear adequate personal protective equipment.
- Ensure all international, EU, national and local safety regulations and codes are followed when handling, maintaining, installing (including all related actions) the gear unit.
- Verify the compatibility of the gear unit with the installation it is meant for.



Important:

- The manufacturer / H.I.T. / Sumitomo (including all related companies) are released in full from any and all liability and any and all warranty in case ATEX / UKEX-guidelines, ATEX / UKEX-instructions, ATEX / UKEX-advice (and similar) mentioned in the Manual are not followed and/or are not respected.

3 About this document

3.1 Function of the document

The document is only applicable for the "Hansen P4" gear unit, from here on in the document referred to as the gear unit.

The document is for approved installation engineers and gives the information that is necessary to install and remove the gear unit.

3.2 Language

The original instructions of this document are in English. All other language versions are translations of the original instructions.

If there is any doubt, the English version of the document is binding.

3.3 Illustrations

It is not always possible to show the configuration of your gear unit as in the certified drawing. The illustrations in this document show a typical setup. They are for instruction or description only.

3.4 Use of steps, lists and titles in this document

- The steps in procedures have numbers (123) if the sequence is important.
- The lists and steps with bullets (•) are used if the sequence is not important.
- The lists with letters (abc) are used if the sequence is important.
- In titles of sections, the part between brackets () shows to which type of gear unit or component of the gear unit the section applies.

3.5 How to use this document

Procedure

1. Make sure that you know the structure and the contents of the related documents.
2. Read the safety chapter and make sure that you know all the instructions.
3. Do the steps in the procedures fully and in the correct sequence.

3.6 Warnings, cautions and notes used in the document

Type	Description	Icon
Warning	If you do not obey the instruction, this can cause injury.	
Caution	If you do not obey the instruction, this can cause damage to the gear unit, to equipment or to property.	

Type	Description	Icon
Important	If you do not obey the instruction, this can cause explosion.	
Note	A note gives more data.	

3.7

Related documents

Document name	Document code	Target audience
General conditions of sale	-	All personnel
Order acknowledgement	OA_	Approved installation engineers
Certified drawing		Approved installation engineers
Installation manual	IM_	Approved installation engineers
Maintenance manual	MM_	Approved maintenance engineers
Logbook		- Approved installation engineers - Approved maintenance engineers
Spare parts drawing		Approved maintenance engineers
Documentation	D_	- Approved installation engineers - Approved maintenance engineers

Document name	Document code	Target audience
Drive package documentation		• Approved installation engineers • Approved maintenance engineers

3.8 Storage of this document and the related documents

This document and the related documents are a part of the gear unit.

- Make sure that you keep the document and the related documents in a dry and clean location.
- Make sure that the document and the related documents are available to all personnel.

3.9 Abbreviations

Abbreviation	Description
HIT	Hansen Industrial Transmissions
LSS	Low-Speed Shaft
HSS	High-Speed Shaft

3.10 Customer support

Procedure

1. If more information is necessary, speak to HIT
2. Give the manufacturing number and gear unit type to HIT Refer to the type plate.

4 Description

4.1 Intended use

The gear unit is a part of a machine.

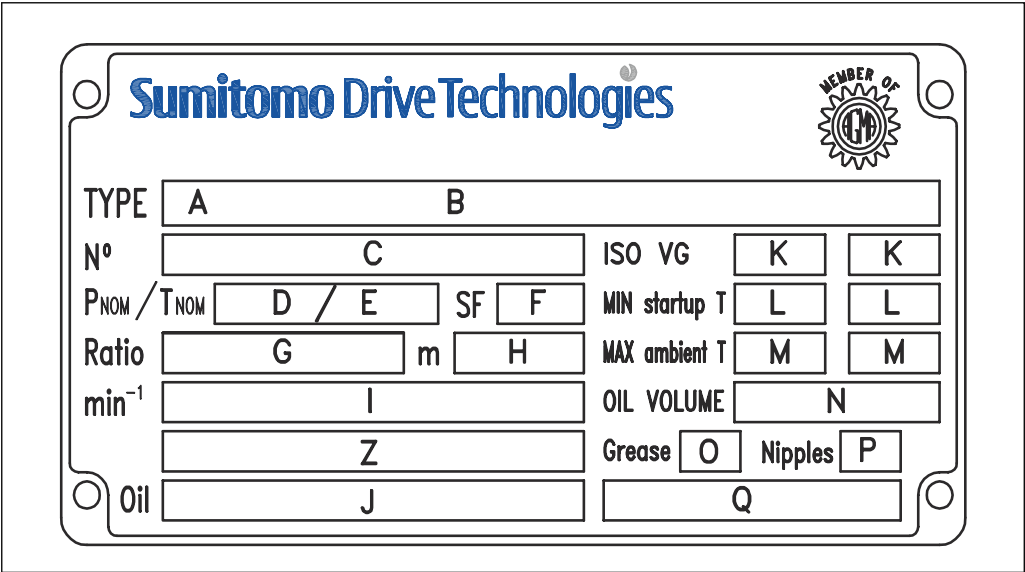
Only use the gear unit for the application, ambient conditions, operation conditions and other conditions of use shown in the order acknowledgement.

Resonant vibrations may cause severe overloads on components which may be several times higher than the nominal load. The responsibility for the vibration analysis which includes the total system of driver, gearbox, driven equipment, couplings, mounting conditions and sources of excitation rests with the owner of the installation. HIT is not responsible for system dynamics and related damage.

4.2 Type plate

4.2.1 Type plate

The type plate gives information about the gear unit.



- A Manufacturing number
- B Gear unit type
- C Production number
- D Nominal power rating at the HSS
- E Nominal torque rating at the LSS
- F Service factor
- G Exact ratio (R: reduction, M: multiplication)
- H Mass of the gear unit, without gear oil
- I Input speed n1 (output speed n2)
Input speeds n1/n1' (output speeds n2/n2')
Variable input speed n1-n1' (variable output speed n2-n2')

- J Type of gear oil
- K Viscosity of the gear oil
- L Minimum temperature for the oil bath for startup
- M Maximum ambient temperature for which the viscosity of the gear oil is applicable
- N Quantity of gear oil
- O Grease quantity type
- P Number of lubrication points
- Q Grease type
- Z Remarks

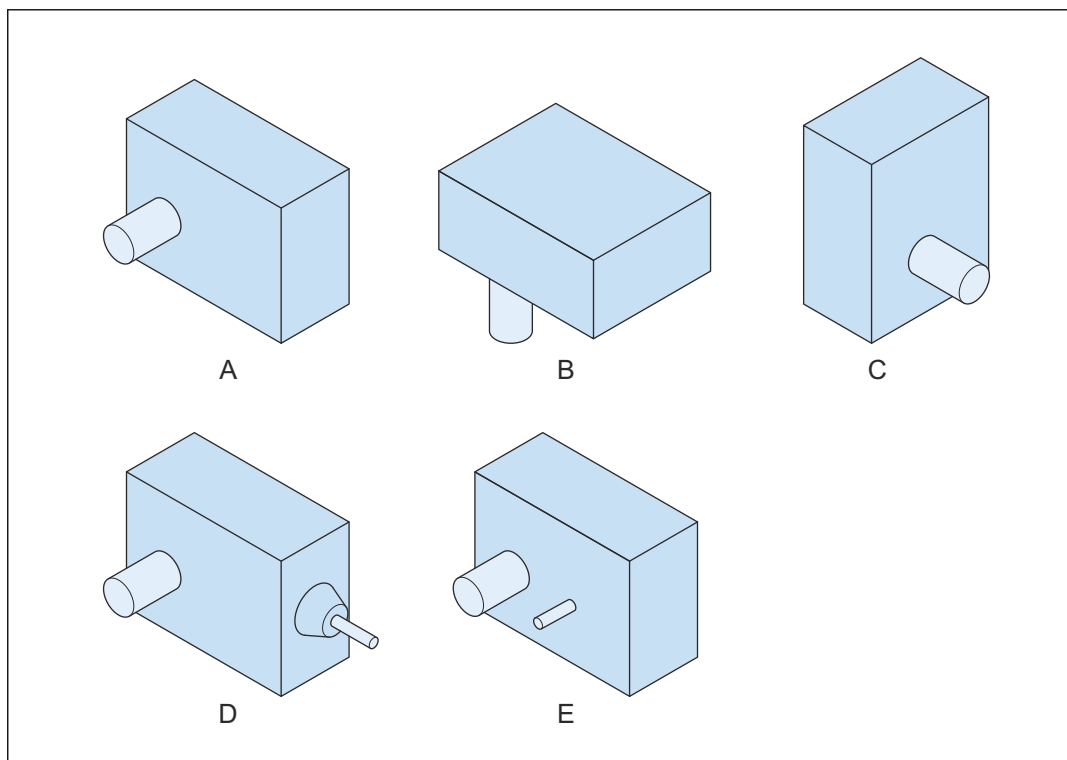


Note: The certified drawing shows more data:

- illustration of the gear unit type
- connection diagrams
- dimensions

4.3

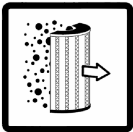
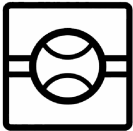
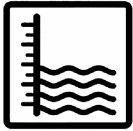
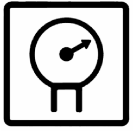
Gear unit configurations

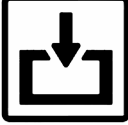


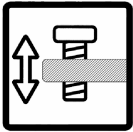
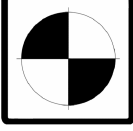
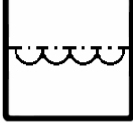
- A "Horizontal" installation
- B "Vertical" installation
- C "Upright" installation
- D "Right angle" shafts
- E "Parallel" shafts

4.4 Signs in the documentation and on the gear unit

Sign	Description
	Risk of hot surface
	Risk of rotating parts
	Risk of harmful substance
	Risk of electricity hazard
	Read and understand the installation and maintenance manual before any handling.
	Protective clothing is mandatory
	Hearing protection is mandatory
	Hand protection is mandatory
	Eye protection is mandatory
	Warning: only use the correct lifting point
	Warning: fan not covered Gear units with uncovered fans may only be used in shielded areas where no persons can enter during operation.

Sign	Description
	Clockwise rotation is mandatory
	Counterclockwise rotation is mandatory
	Oil level measurement with unscrewed dipstick is mandatory
	Oil level measurement with the dipstick screwed in is mandatory
	intrinsically safe connection is mandatory
	Filter
	Flow
	Level
	Pressure
	Speed
	Temperature

Sign	Description
	Vibration
	Inspection opening
	Oil
	Grease
	Moisture
	In (fill)
	Out (drain)
	Ventilation
	Backstop
	Bearing
	Labyrinth

Sign	Description
	Adjusting bolt
	Transmission element
	Brake
	Protection cap for bolt or nut
	Magnetic
	Ground connection
	Center of gravity
	External service piping
	Symbolic representation oil level
	Part of delivery
	Not part of delivery

Sign	Description
	Installation by customer
	Connection EYE equipment
	Caution, volatile corrosion inhibitor inside the gear unit!/...../..... : Date of filling.L : Volume of mixture in liter. : Type of products.

4.5 Description of the lubrication of the gear unit

4.5.1 Function of lubrication

Lubrication is necessary for these functions:

- To prevent metal-to-metal contact in gears and bearings
- To decrease friction losses
- To dissipate generated heat from the gears and the bearings
- To prevent corrosion

These parameters have an effect on the type of lubrication system for the gear unit:

- Gear speed
- Mounting position of the gear unit
- Operation conditions

The certified drawing shows the lubrication system that is used for your gear unit.

4.5.2 Splash lubrication

Splash lubrication is the standard for gear units with horizontal LSS of these types:

Number of stages	Speed at the HSS [min^{-1}]
1	750 to 1800
2	750 to 1800
3	750 to 1800
4	1000 to 1800

In other conditions, the lubrication system can be different. The type plate shows the approved speed of the HSS.

4.5.3 Force-feed lubrication

An oil pump lubricates all turning parts above the level of the oil bath. The oil pump pumps the oil through pressure lines.

There are different types of oil pumps:

- Integrated pump: one of the shafts of the gear unit operates the oil pump.
- Motor pump: a motor operates the oil pump.

The lubrication can be circulation lubrication or pressure lubrication.

Integrated pump

Refer to the certified drawing for the lubrication system for your gear unit. The lubrication system can have these parts:

- A pump
- A filter with bypass
- A flow switch

The pump can operate in two directions of rotation.

Motor pump

A sign on the pump shows the direction of rotation of the motor shaft of the motor pump.

4.6 Breather plug

A breather plug is installed to prevent a too high pressure in the gear unit.

4.7 Cooling system

A cooling system can be necessary to remove heat from the gear unit. Friction and churning of gears and bearings in the gear oil causes the heat.

The certified drawing shows the cooling system that is used for your gear unit, if any.

4.8 Direction of rotation of the shafts

As a standard, the shafts of the gear unit can turn in two directions. If the shafts of the gear unit can only turn in one direction, a sign on the gear unit and the certified drawing shows this.

5 Safety

5.1 Restrictions



Warning: Use of the gear unit in ways other than described in the related documents may result in injury, death, or property and equipment damage. Use the gear unit only as described in the related documents.

HIT cannot be held responsible for injuries or damages resulting from non-standard, unintended use of the gear unit. The gear unit is designed and intended only for the purpose described in the related documents.

Unintended use includes these actions:

- Making changes to the gear unit that have not been recommended in the related documents or using parts that are not replacement parts or accessories from HIT.
- Use of materials or equipment that are inappropriate or incompatible with the gear unit.
- Use of gear oils and grease that is not indicated on the type plate or the specifications in this document.
- Allowing unapproved personnel to perform any task on or with the gear unit.

5.2 Approved installation engineer

The term approved installation engineer is specified here as a person that fully knows the gear unit and its safe operation. Approved installation engineers obey all related safety regulations and are approved to safely install the gear unit.

It is the responsibility of the company that owns the system where the gear unit is part of to make sure that all installation engineers obey these requirements.

5.3 General safety instructions



Warning: Obey the specifications that the certified drawing shows. If specifications in this document and the certified drawing for the same item are different, only the specifications in the certified drawing are applicable.

- When you do work on or with the gear unit, obey all legislation and regulations that apply to safety and work requirements, that apply in the country and at the location where you do work on the gear unit.
- Obey the safety instructions of the manufacturer of all chemical materials, including gear oil and grease. Refer to the material data sheets of the chemical material. Make sure that all personnel that installs, does maintenance and servicing on the gear unit, receives these safety instructions.
- Do not open the gear unit near an open flame, spark or hot object. If not this can cause ignition of the fumes of the oil.
- If the gear unit is used as a part of a system that moves persons, obey all regulations and install all necessary safety devices.
- Do not use a gear unit that has damage.
- Do not use a gear unit that gives unexpected noise and vibrations.
- Do not cause a blockage of the air flow around the gear unit. For the dimensions, refer to the certified drawing.

5.4 Safety instructions for installation

- Make sure that the personnel that lift the gear unit are approved and obey state-of-the-art safety procedures and state-of-the-art lifting equipment.
- Obey the European Directives 2006/42/EG and the local safety regulations and install guards and other safety equipment.
- Make sure that the drive group the gear unit is a part of, cannot start when you install the gear unit.
- If safety devices are removed for installation, make sure they are correctly installed again before you start the gear unit.
- Make sure that the installation agrees with the EMC directive.

5.5 Special safety instructions (backstop)



Warning:

- Do not loosen a part of the backstop when there is load on the gear unit. In this condition, the gear unit can turn in the incorrect direction.
- Make sure that a failure of a backstop cannot cause injury or damage to the system.

5.6 Special safety instructions (auxiliary drive)



Warning:

If rotation of the clutch on the auxiliary drive is sensed, put the main motor of the gear unit to off .

5.7 Noise and vibrations

The drive group, which the gear unit is a part of, and the attached parts cause vibrations and noise.

To agree with local legislation, it can be necessary to decrease the noise of the drive group and the attached parts. Speak to HIT.

If you cannot do such procedures, all personnel that does work with or adjacent to the drive group must wear correct personnel protection equipment, to decrease the noise to the ears.

Make sure that the vibration agrees with ISO standard 10816-3.

5.8 Partly completed machine

The gear unit is a part of a drive group. Refer to the documentation of the drive group and obey all instructions of the drive group.

5.9 Instructions in case of a fire



Warning: After a fire, protective clothing and respiratory equipment are mandatory to handle the gear unit. After a fire, the gear unit can contain dangerous substances that cause injury when you touch or breath them.

- Do not start a gear unit that has burn marks. Speak to HIT.
- Hazardous substances of combustion can be generated in a fire involving materials in section *Materials of the gear unit* on page 52.

5.10 Disposal of the gear unit or parts of the gear unit

- When you discard the gear unit or the components of the gear unit, obey the local environmental regulations.
- At the end of the service life of the gear unit or the components of the gear unit, try to recycle to prevent environmental pollution.



- Obey the local environmental regulations when you discard used oil. Do not put it on garden soil, wooded areas, in streams or in sewage drains.
- Remove spilled oil immediately.
- Sort metal and electrical components correctly. Make sure that these components are recycled.
- Obey the environmental regulations to discard materials that you cannot recycle.

5.11 Warranty

The warranty clause of the general conditions of sale applies to gear units installed and maintained as per instructions contained in this document, including the related documents, and in any additional instruction leaflets supplied with the gear unit insofar as the gear unit operates within the service and rating conditions put forward in the order acknowledgment and on the certified drawing.

Non compliance with these instructions, injudicious choice of lubricant or a lack of maintenance will render warranty agreement invalid.

This warranty clause applies to all parts of the gear unit with the exception of those parts which are subject to wear.

6 Transport

6.1 Off-site transport



Caution: Prevent vibration of the gear unit. Vibration can cause damage to the gears and the bearings.

Procedure

1. If you move the gear unit with a train, prevent damage to gears and bearings. Use an anti-brinelling device.

6.2 On-site transport

6.2.1 Lift the gear unit

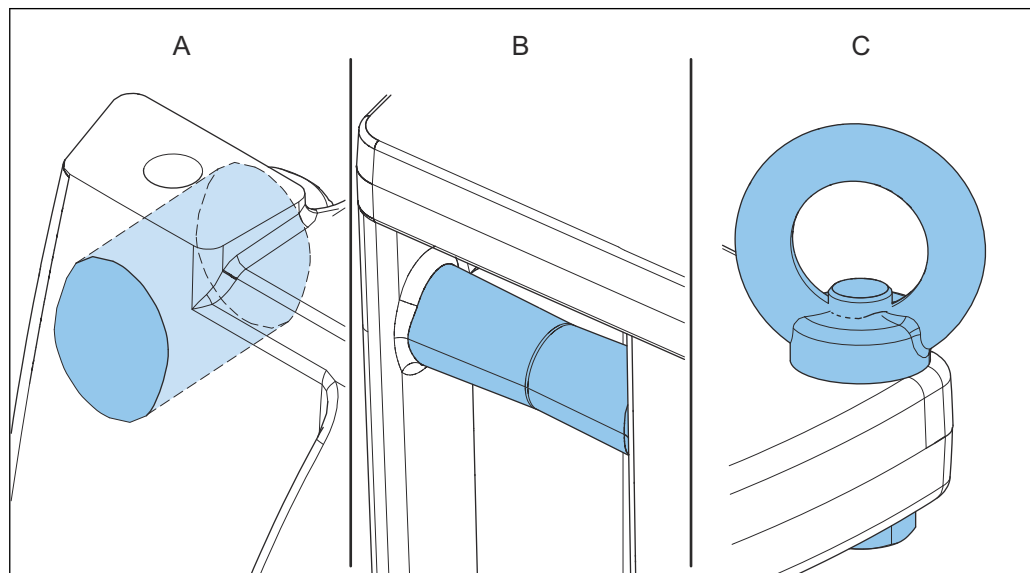


Note: The certified drawing shows more data:

- dimensions
- mass

HIT makes sure that all necessary lifting points are installed on the gear unit.

These are the possible lifting points:



- A Integrated lifting eye
- B Integrated bar
- C Lifting eye

Prepare to lift the gear unit

**Warning:**

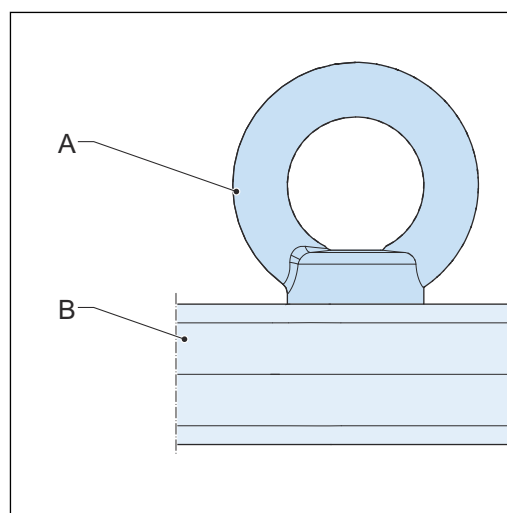
- Make sure that the personnel that lift the gear unit are approved and obey state-of-the-art safety procedures and use state-of-the-art lifting equipment.
- Do not connect the lifting equipment to other parts of the gear unit than the lifting points.
- If only the gear unit is supplied, use the lifting points to lift the gear unit.
- If the gear unit is supplied as a part of a drive group on a chassis, refer to the certified drawing for the correct lifting points.
- If the gear unit is supplied as a part of a drive group without chassis, only use the lifting points on the gear unit.



Caution: If parts of the gear unit are removed to move the gear unit, make sure that water or contamination cannot come into the lubrication system or the gear unit.

Procedure

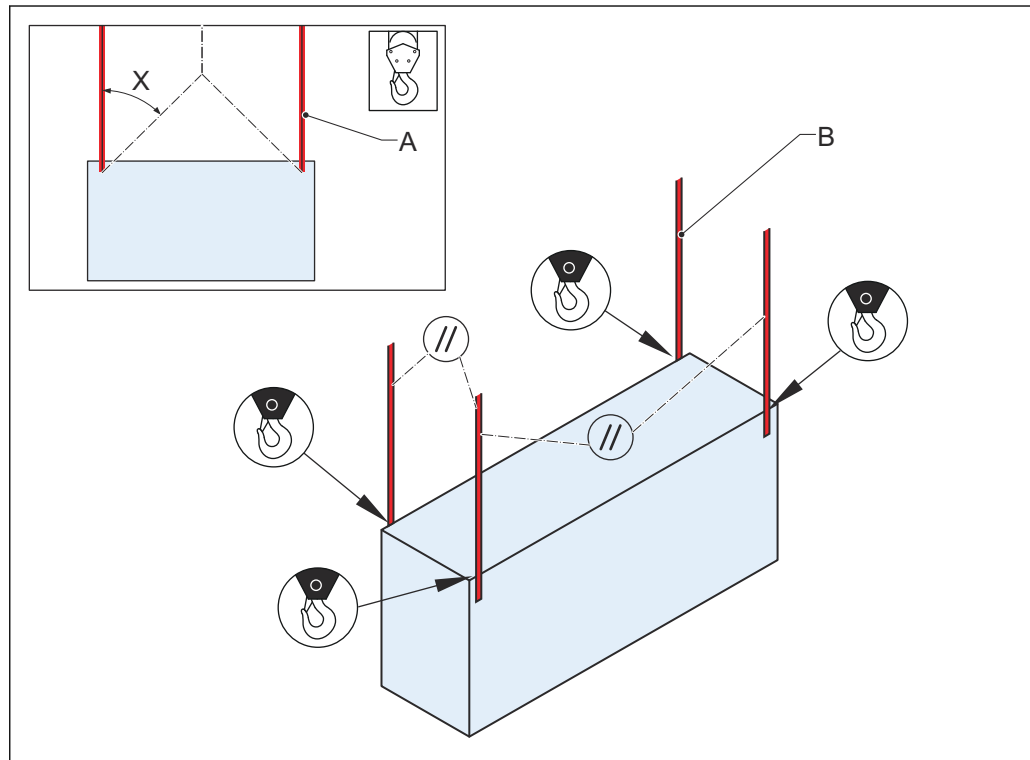
1. Do a check on the lifting points for these signs:
 - Fatigue
 - Cracks
 - Deformation
 - Rupture
 - Corrosion
2. If you see one of these signs, do not lift the gear unit.
3. For a gear unit with lifting eyes, make sure that the lifting eyes (A) are correctly installed on the housing of the gear unit (B).
4. Make sure that the lifting equipment agrees with all local regulations.



Lift the gear unit



Warning: Make sure that the lifting cables do not cause damage to external components of the gear unit.



Procedure

1. For gear units with horizontal LSS with integrated lifting eyes: make sure that the maximum angle (X) of the lifting cables (A) is 45° in the plane of the long side of the gear unit.
2. For all other gear units, make sure that all lifting cables (B) are vertical and parallel to each other.
3. Connect the lifting equipment to the gear unit. Use all lifting points of the gear unit.
4. Lift the gear unit. Use the safe lifting equipment.

7 Storage

7.1 General storage instructions

The storage period starts when the gear unit leaves HIT.

Procedure

1. Prevent vibration of the gear unit.
2. Make sure that:
 - The ambient conditions for storage are correct. Refer to section [Ambient conditions for storage](#) on page 54.
 - The gear unit is installed, started and in operation before the end of the maximum storage time.
3. If it is necessary to put the gear unit in storage for more than 1 year, speak to HIT.
4. If a longer storage period, than shown in this chapter, is necessary, speak to HIT.

7.2 Indoor storage for maximum 1 year

Procedure

1. Obey also these instructions:
 - Keep the gear unit in a dry area with a good airflow.
 - Make sure that weather conditions have no effect on the gear unit.

7.3 Extended storage outdoors for maximum 2 years (extended outdoor storage)

The storage period starts when the gear unit leaves HIT. For this date, refer to the dispatch form.

Procedure

1. Make sure that the gear unit is installed, started and in operation before the end of the maximum storage time.
2. Obey also these instructions during the complete storage:
 - a) Prevent vibration of the gear unit.
 - b) Do not remove the gear unit from its seaworthy packing case.
 - c) Make sure that the seaworthy packing case is above water level (no submersion allowed).
 - d) Put the seaworthy packing case on a stable and level ground.
 - e) Put a plastic cover on the seaworthy packing case to prevent contamination with dust and water.
 - f) Make sure that there is no damage of the seaworthy packing case. If you see damage to the seaworthy packing case, tell HIT Services immediately.

7.4 Extended storage indoors for maximum 5 years (extended indoor storage)

The storage period starts when the gear unit leaves HIT. For this date, refer to the dispatch document.

Procedure

1. Make sure that the gear unit is installed, started and in operation before the end of the maximum storage time.
2. Obey these instructions during the complete storage:
 - a) Prevent vibration of the gear unit.
 - b) The ambient conditions for storage are correct. Refer to section [Ambient conditions for storage](#) on page 54.
 - c) Keep the gear unit in a dry area with a good airflow.
 - d) Make sure that weather conditions have no effect on the gear unit.
 - e) Put the gear unit on a stable and level ground.
 - f) Put a plastic cover on the gear unit to prevent contamination with dust.
3. Each year, do these inspections on the gear unit:
 - a) Examine the paint on the gear unit for damage.
 - b) Examine all bare surfaces for damage.
 - c) Apply anti-oxidising waxy varnish on all bare machined surfaces. Refer to section [Corrosion protection by HIT](#) on page 53.
4. Each 2 years, fill the gear unit again with rust preventive mineral oil.
 - a) Drain the oil from the gear unit. Refer to section [Drain gear oil](#) on page 42.
 - b) Add a volatile corrosion inhibitor to the drained or new gear oil and mix well. Do not add more volatile corrosion inhibitor than specified in section [General specifications for lubricants](#) on page 62.
 - c) Fill the gear unit with the mixture.
 - d) Seal all openings of the gear unit.
 - e) With your hand, turn the HSS until the LSS made 2 complete turns.

7.5 Volatile corrosion inhibitor (if applicable)



Note: If the gear unit contains oil with volatile corrosion inhibitor, a sign on the gear unit shows this. Refer to chapter [Signs in the documentation and on the gear unit](#) on page 15.



After the storage period, do these steps:

- Follow the instructions for installation. Refer to chapter [Installation](#) on page 29.
- Replace the red plugs by the dipstick and breather. For the location and specifications, refer to the certified drawing.

8 Installation

8.1 Maximum time between installation and commissioning

Procedure

1. Make sure that the time between installation and commissioning is not more than 1 month. If this is not possible, speak to HIT.

8.2 Remove the packaging material

Procedure

1. Move the package to a dry area that has a good airflow.
2. Do a check for these items:
 - Damage to the package.
 - Damage to the protection of machined surfaces and shaft extensions. For the specification of the protection, refer to section [Corrosion protection by HIT](#) on page 53.
3. If you see damage, tell HIT immediately.
4. Remove the packaging material from the gear unit.
5. Do a check if the gear unit agrees with the shipping papers.
6. If the gear unit shows damage or does not agree with your order, tell HIT immediately.

8.3 Installation instructions for parts that are not part of the gear unit

Procedure

1. Make sure that all instruments are connected correctly and operate correctly.
2. For installation instructions of parts that are not included in this document: refer to the drive package documentation.
3. For installation of electrical components: refer to section [Related documents](#) on page 11.

8.4 Do a check for corrosion of internal parts of the gear unit

Procedure

1. Open the inspection cover. For the location of the inspection cover, refer to the certified drawing.
2. Do a check for corrosion of internal parts of the gear unit.
3. If there is a sign of corrosion of internal parts of the gear unit, do these steps:
 - a) Make a report.
 - b) Give the report to HIT.

8.5 Install the couplings

Prepare

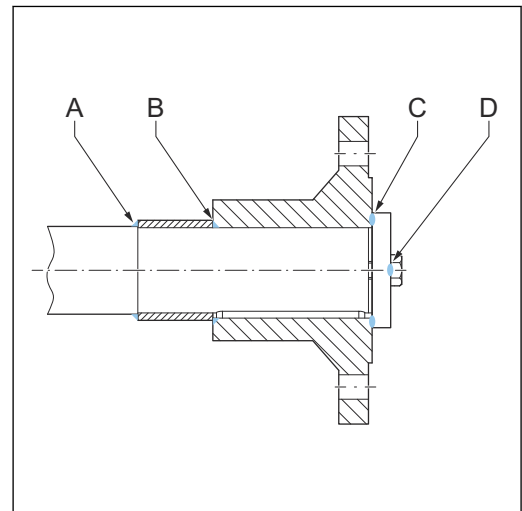
Procedure

1. Remove the grease and contamination from the shaft extensions and from the coupling.
2. Make sure that the specifications of the coupling agree with the specifications on the certified drawing.

Apply the sealing paste

Procedure

1. Apply a sealing paste to the contact surfaces A, B, C and D. For the type of the sealing paste, refer to your supplier of the sealing paste.
The sealing paste prevents moisture, which can cause corrosion, to come between the parts.



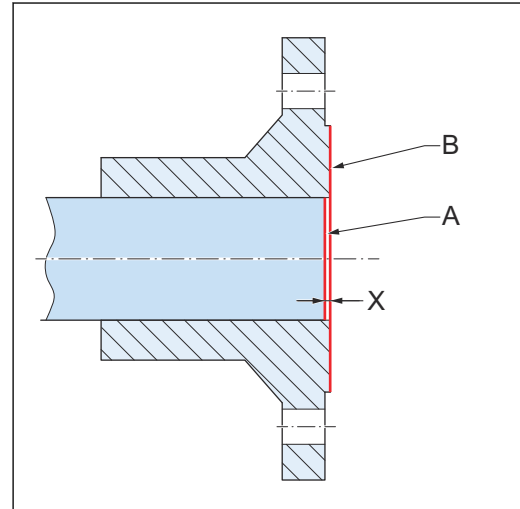
Install the coupling hubs



Caution: Make sure that the temperature of the shafts, during the installation of the coupling hubs, is lower than 100 °C .

Procedure

1. Install the spacer between the shaft shoulder and the coupling hub.
2. Install the coupling hubs on the shaft extensions. If necessary, apply heat on the couplings.
3. Make sure that the surface of the shaft extension (A) is flush with the surface (B) of the coupling or that the distance (X) is as low as possible (not negative). Obey the specifications of the supplier of the coupling.
4. If necessary, install more parts.
Refer to the certified drawing:
 - Thrust washer
 - Bolt
5. Make sure that the assembly of the coupling hub, the spacer, the thrust washer and the bolt agree with these specifications. Speak to HIT to get specifications.

**Remove unwanted sealing paste and apply paint**

Procedure

1. Remove the sealing paste from all surfaces that are not contact surfaces.
2. Do a check for openings between the parts.
3. If you see openings, apply sealing paste and do steps 1 and 2 again.
4. Apply paint on all parts but not on the oil seals. Make sure that the paint agrees with the correct atmospheric corrosion class. Refer to the order acknowledgement.



Caution: Do not apply the paint on the oil seals.

8.6**Install parts that give external loads to the gear unit**

Note: Only do the steps if it is necessary to install parts that give external loads on the gear unit.

Procedure

1. Make sure that the gear unit does not move during operation. Install thrust blocks.
2. Make sure that the distance between the external load and the housing of the gear unit is as small as possible.
3. Make sure that only the external loads that agree with the order acknowledgement or the certified drawing work on the gear unit. This includes the loads of the machine in operation.

8.7 Install gear units with a backstop

**Warning:**

- Do not loosen a part of the backstop when there is a load on the gear unit. In this condition, the gear unit can turn in the incorrect direction.
- Make sure that a failure of a backstop cannot cause injury or damage to the system.
- If the gear unit is used as a part of a system that moves persons, obey all regulations and install all necessary safety devices.



Caution: Do not turn the gear unit in the incorrect direction. This condition causes damage to the backstop.

Procedure

1. Make sure that the direction of rotation of the backstop shaft agrees with the direction of rotation of the machine shaft.



Note: For drive groups, use a phase meter to do a check on the direction of rotation of the machine shaft.

2. If it is necessary to change the direction of the backstop shaft, speak to HIT.

8.8 Align the gear unit

8.8.1 Align the gear unit in the horizontal plane

Procedure

1. Put the gear unit in the correct position, as shown in the certified drawing.
For instructions on how to lift the gear unit, refer to section [Transport](#) on page 24.
2. If it is necessary to install the gear unit in a position that is different from the position in the certified drawing, speak to HIT.
3. Put the gear unit on a rigid and stable bedplate or foundation.
4. Use 3 bolt holes and align the gear unit. Only use the bolt holes that are shown in the certified drawing.
5. Make sure that the inclination is correct. Refer to section [Position of the gear unit](#) on page 54.
6. Adjust the vertical position at the other bolt holes. Use spacers.
7. Make sure that the vertical adjustment of the other bolt holes agrees with the specification. Refer to section [Position of the gear unit](#) on page 54.

8.8.2 Align the LSS (multi-stage)



Caution: Obey the specifications. If not, the lifetime of the bearings and the couplings will be decreased.

Procedure

1. Make sure that only the external loads that agree with the order acknowledgement or the certified drawing work on the gear unit. This includes the loads of the machine in operation.
2. Make sure that the combination of the angular and radial misalignment agrees with the specification in section *Misalignment of the LSS* on page 54.

8.8.3 Align the LSS (single stage)

Procedure

1. Make sure that the misalignment is not more than specified. Refer to section *Misalignment of the HSS (couplings)* on page 54.
2. If you use a flexible gear coupling, speak to HIT and give all external causes that have an effect on the gear unit.
3. Wait until HIT gives specifications for the misalignment.
4. Make sure that the misalignment is not more than these specifications.

8.8.4 Align the HSS

Procedure

1. Make sure that the misalignment is not more than specified. Refer to section *Misalignment of the HSS (couplings)* on page 54.
2. If you use a flexible gear coupling, speak to HIT and give all external causes that have an effect on the gear unit.
3. Wait until HIT gives specifications for the misalignment.
4. Make sure that the misalignment is not more than these specifications.

8.9 Attach the gear unit with the bolts (solid shafts)



Warning: If safety devices are removed for installation, make sure that they are correctly installed again before you start the gear unit.

Attach the gear unit

Procedure

1. Install the applicable bolts at the bolt holes of the gear unit. For the dimension and quality of the bolts, refer to section *Bolt specifications (gear units with solid shafts)* on page 55.
2. Tighten the bolts. For the correct torque, refer to section *Bolt specifications (gear units with solid shafts)* on page 55.
3. Do a check on the position of the gear unit. Refer to section *Align the gear unit* on page 32.
4. If the position does not agree with the specifications:
 - a) Loosen the bolts.
 - b) Align the gear unit. Refer to section *Align the gear unit* on page 32. Start with step 2 until the position agrees with the specifications.

Install the safety cover

Procedure

1. Install the safety cover.

8.10 Attach the gear unit (hollow shafts)

8.10.1 Install the shrink disk



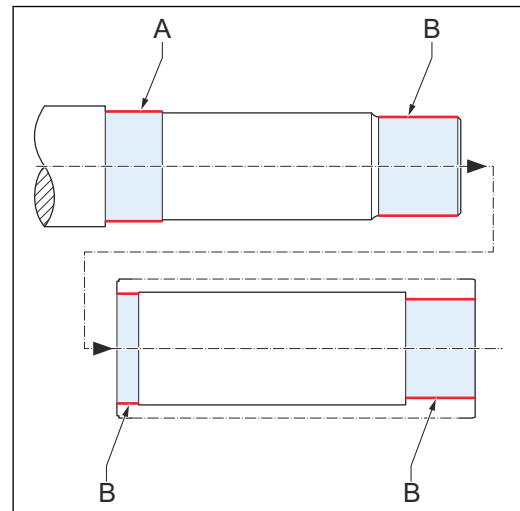
Warning:

- Do not disassemble the shrink disk. HIT prepared it for installation.
- Obey the specifications that the certified drawing shows. If specifications in this document and the certified drawing for the same item are different, the specifications in the certified drawing are applicable.

Lubricate the contact surface

Procedure

1. Clean and remove grease from the contact surfaces (A) and (B).
2. Apply lubricant, only to contact surface (A). For the lubricant specification, refer to section [Lubrication for installation \(hollow shaft\)](#) on page 59.
3. Do not apply lubricant to the surfaces (B). If there is lubricant on these surfaces, the friction between the machine shaft and the shaft of the gear unit will not be correct.
4. Wait until the lubricant is dry.



Attach the gear unit to the machine shaft



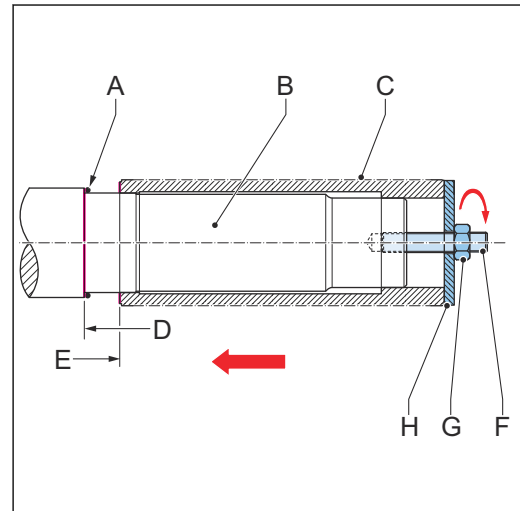
Caution: Make sure that there is no opening between the parts (A), (D) and (E). If there is an opening, water can come in and cause corrosion.



Note: The parts (F), (G) and (H) are not a part of the gear unit. Speak to HIT if it is necessary that HIT supplies these parts.

Procedure

1. Install the O-ring (A) on the machine shaft (B).
2. Move the gear unit (C) until the surfaces (D) and (E) tightly touch each other. Use the threaded rod (F), the nut (G) and the installation disk (H).



Install the shrink disk



Caution:

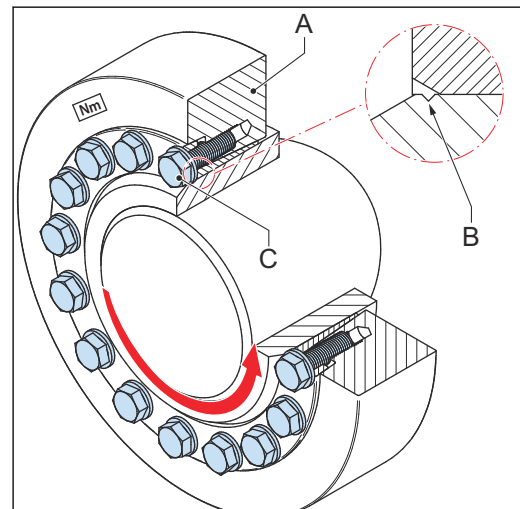
- Obey the instructions of the supplier of the shrink disk. Refer to the drive package documentation.
- Do not tighten the bolts crosswise.
- Do not tighten the bolts when the shrink disk is not at the correct location on the shaft.



Note: The instructions from this point in the procedure only apply to 2-part shrink disk of the types shown in section [Shrink disk specifications \(2-part shrink disk\)](#) on page 60.

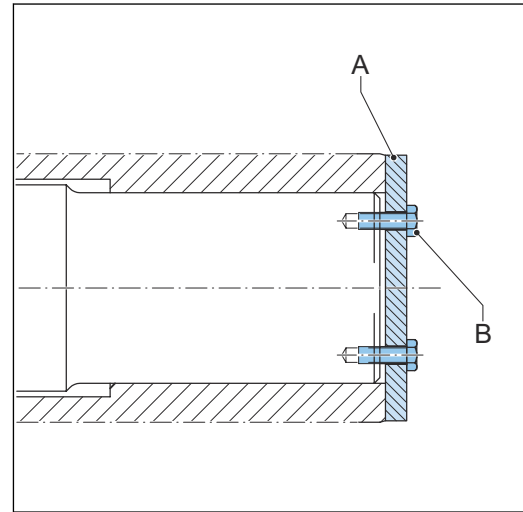
Procedure

1. Install the shrink disk (A) to the position marked with a locating groove (B).
2. Tighten 4 bolts (C), approximately equally spaced, 3/5 of the correct torque. Refer to section [Torque specifications](#) on page 60.
3. Tighten all screws in several steps clockwise and increase the torque gradually to the correct torque. Make sure to keep inner ring and outer ring parallel during the whole tightening process.
4. Remove the threaded rod, the nut and the installation disk that are used for installation.



Instructions if the shoulder of the machine shaft does not absorb the axial load**Procedure**

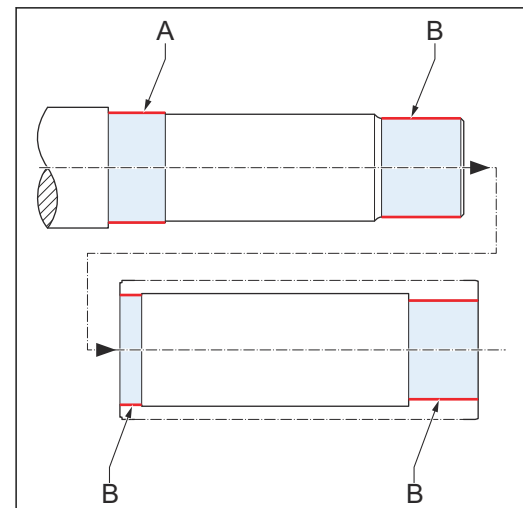
1. Install the locking disk (A) and the bolts (B).
2. Refer to the certified drawing for more instructions.

**Install the safety cover****Procedure**

1. Install the safety cover.

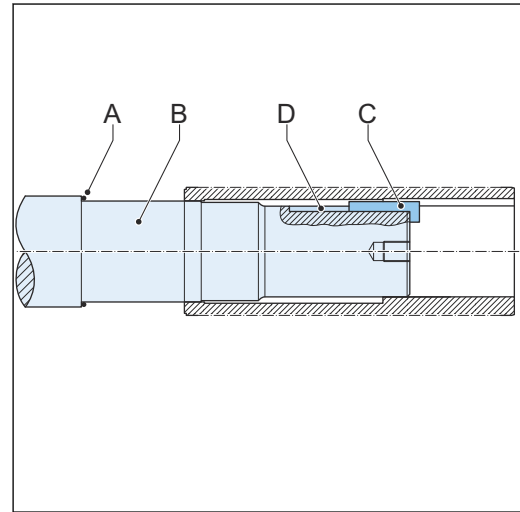
8.10.2**Install the shaft with keyway connection****Lubricate the contact surface****Procedure**

1. Clean and remove grease from the contact surfaces (A) and (B).
2. Apply lubricant, only to contact surfaces (A) and (B). For the lubricant specification, refer to section [Lubrication for installation \(hollow shaft\)](#) on page 59.
3. Wait until the lubricant is dry.



Install the installation key on the machine shaft**Procedure**

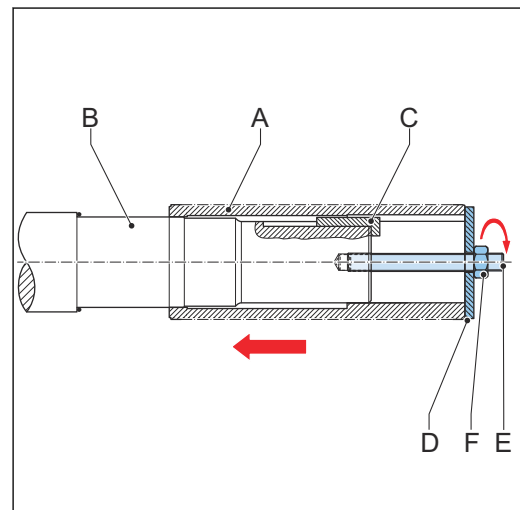
1. Install the O-ring (A) on the machine shaft (B).
2. Install the installation key (C) in the keyseat (D) of the machine shaft.
3. Make sure that the short leg of the installation key touches the end of the machine shaft.

**Install the gear unit on the machine shaft**

Note: The parts (D), (E) and (F) are not a part of the gear unit. Speak to HIT if it is necessary that HIT supplies these parts.

Procedure

1. Align the gear unit (A) with the machine shaft (B). Make sure that the keyways of the machine shaft and the hollow shaft align.
2. Move the gear unit until the installation key (C) and the installation disk (D) touch each other. Use the threaded rod (E), the nut (F) and the installation disk.
3. Remove these parts:
 - threaded rod
 - nut
 - installation disk
 - installation key

**Do a check on the final key****Procedure**

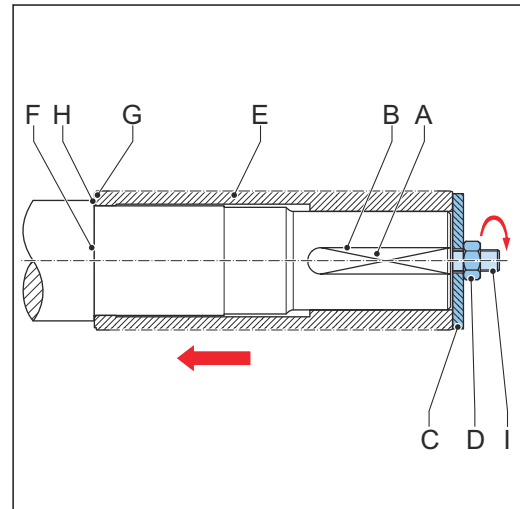
1. Measure the clearance between the final key and the keyway of the hollow shaft.
2. Compare the clearance with the specification. Refer to the certified drawing.
3. If the clearance is not correct, use a new final key.

Install the final key

Caution: Make sure that there is no opening between the parts (F), (G) and (H). If there is an opening, water can come in and cause corrosion.

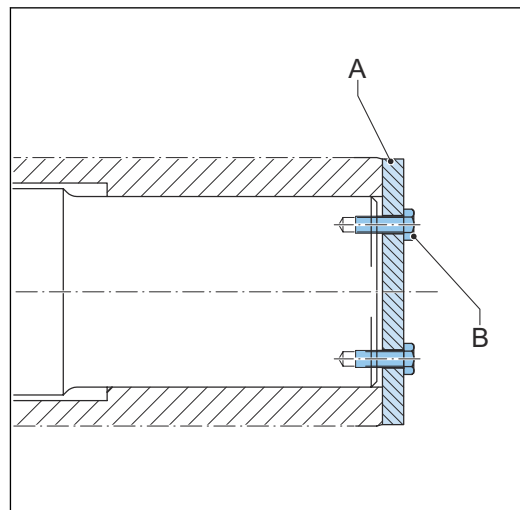
Procedure

1. Install the final key (A) in the keyway (B).
2. Install the installation disk (C), the nut (D) and the threaded rod (I).
3. Move the gear unit (E) until the surfaces (F) and (G) firmly touch each other. Use the threaded rod (I), the nut and the installation disk.
4. Remove the threaded rod, the nut and the installation disk that are used for installation.

**Install the locking disk**

Procedure

1. Install the locking disk (A) and the bolts (B).
2. Install the safety cover.

**Install the safety cover**

Procedure

1. Install the safety cover.

8.10.3**Install the torque arm****Install the torque arm**

Procedure

1. Attach the gear unit to a torque reaction point. Use a torque arm. Refer to the certified drawing for the location of the torque arm on the gear unit.

Prestress the disk springs of the torque arm

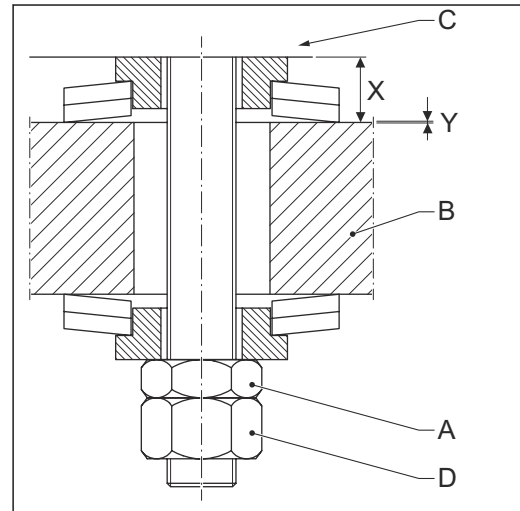
This is necessary to make sure that the connection between the torque arm and the torque reaction point stays flexible and resilient.

Procedure

1. Turn the nut (A) to decrease the distance (X) with a distance (Y). (X) is the distance between the torque reaction point (B) and the gear unit (C).
 - This step prestresses the disk springs.
 - For the specification of (Y), refer to section [Prestress specifications for the torque arm \(hollow shaft\)](#) on page 61.



Note: (Y) is the difference between the distance without load and the distance when the disk springs are prestressed.



2. Turn the nut (D) tightly against the nut (A).
3. Apply torque seal to the nuts. Refer to section [Torque seal specification](#) on page 52.

8.11

Install a ground connection



Warning: Do not use the gear unit as a part of a circuit to ground other machines.



Caution: Install a ground connection. If not, electric current can cause damage to the gears and the bearings.

**Note:**

- Conductive parts and electrical equipment must be equipotential bonded to each other and ground.
- The external ground connection must be applicable for a wire cross-section of minimum 6 mm².
- During the installation of the ground connection, a strain relief must be applied within 30 cm of the ground connection.
- Grounding resistance between all metal parts and ground must be measured before operation. The resistance must be maximum 1 MΩ between individual items, and between ground and the connected process structure. A grounding resistance higher than 10Ω shows a bad ground connection.

Procedure

1. Ground the gear unit.

8.12 Install the lubrication system

8.12.1 General instructions for the lubrication system



Warning: Obey the safety instructions of the manufacturer of all chemical materials, also of gear oil and grease. Refer to the material data sheets of the chemical material. Make sure that all personnel that installs, does maintenance and servicing on the gear unit, receives these safety instructions.



Caution: Make sure that during operation, the temperature of the gear oil is satisfactory. Refer to section *General specifications for lubricants* on page 62.



Note: For more information on and instructions for these parts of the gear unit, refer to the certified drawing and the service manual of the lubrication and cooling system:

- Lubrication system
- Instrumentation
- Settings

8.12.2 Instructions for force-feed lubrication (integrated pump)



Note: During startup, it is necessary to delay the alarm signal.

Procedure

1. Wire the control device and make sure that the motor that operates the gear unit stops when the oil flow is less than the alarm level.

8.12.3 Instructions for force-feed lubrication (pump with a motor)



Caution: Make sure that the motor of the pump turns in the correct direction. If not, the gear unit is not lubricated correctly. This condition causes damage to the gear unit.

Procedure

1. Refer to the service manual of the lubrication and cooling system.

8.12.4 Instructions for force-feed lubrication (pressure lubrication)

Procedure

1. Refer to the service manual of the lubrication and cooling system.

8.13 Fill the gear unit with gear oil

8.13.1 Select the gear oil

**Caution:**

- Only use the gear oil that agrees with the type plate and with section [Lubricants](#) on page 62. Do not use another type of gear oil.
- Only use the markings on the dipstick to measure the gear oil level.
- Make sure that all items that can cause draining of the gear oil by accident are secured

**Note:**

- HIT is not responsible or liable if the supplier of oil changes the composition of the gear oil.
- It can be necessary to rinse the gear unit. Speak to the supplier of the gear oil.
- Take an oil sample of the fresh oil from the drum and keep it as a reference for future analysis.

Procedure

1. For the correct type and viscosity of gear oil, refer to the type plate.
2. With the type and viscosity, select the gear oil from the tables in section [Lubricants](#) on page 62.
3. If the gear unit contains gear oil for storage, drain it.

8.13.2 Add gear oil (gear unit with motor base)

Only do the procedure the first time you install the gear unit.

Add oil at the top side of the gear unit.

Procedure

1. Open the gear unit at the oil fill plug at the top side of the gear unit. Refer to the sign on the gear unit and the certified drawing.
2. If you do not have access to the oil fill plug:
 - a) Remove the belt.
 - b) Lift the motor base.
3. Add 3 L of gear oil. If the certified drawing shows another quantity, add the quantity on the certified drawing. You can use an oil pump.
4. Lower the motor base.
5. Install the belt.

8.13.3 Add gear oil (QHR.4, QVR.3 and QVR.4)

Only do the procedure the first time you install the gear unit.

Add oil to the bearing housing.

Procedure

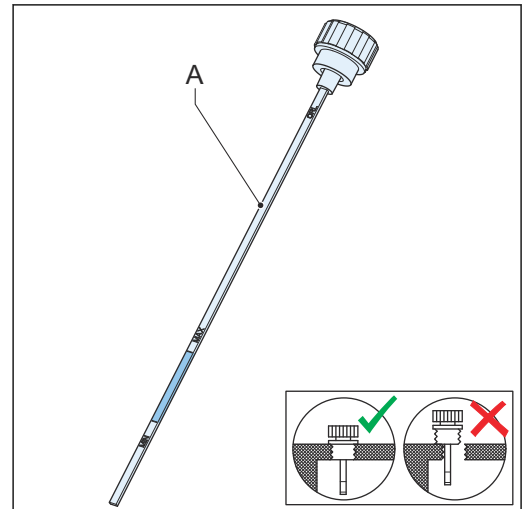
1. Open the gear unit at the oil fill plug for the bearing housing. Refer to the sign on the gear unit and the certified drawing.
2. Add 3 L of gear oil. If the certified drawing shows another quantity, add the quantity on the certified drawing. You can use an oil pump.

8.13.4

Measure the gear oil level

Procedure

1. Remove the dipstick (A). Refer to the sign on the gear unit.
2. Clean the dipstick.
3. Lower the dipstick fully.
4. Remove the dipstick.
5. Read the gear oil level on the dipstick.
6. If the gear oil level is below the minimum level indicated on the dipstick, add gear oil.
7. If the gear oil level is above the maximum level indicated on the dipstick, drain gear oil.



8.13.5

Add gear oil (all gear units)

Only do the procedure if it is necessary to add gear oil.



Caution: Before you use a different type of gear oil that is in the gear unit, speak to the supplier of the gear oil. Not all gear oils are compatible with each other. The supplier of the gear oil gives instructions. Obey these instructions.

Procedure

1. Open the gear unit at the oil fill plug. Refer to the sign on the gear unit.
2. Add gear oil.
3. If the gear unit has a motor pump, make sure that the pump goes on for minimum 3 minutes.
4. Measure the level of gear oil.

8.13.6

Drain gear oil

Only do the procedure if it is necessary to drain gear oil.

Procedure

1. Put a container below the oil drain. Refer to the sign on the gear unit.
2. Open the gear unit at the oil drain. Gear oil comes out of the opening at the oil drain.
3. If the gear unit has a magnetic plug, clean it.
4. Close the oil drain. For the correct torque, refer to [Torque values for oil drain screw](#) on page 59.
5. Discard the gear oil in the container. Obey the local regulations to prevent environmental pollution.
6. Measure the gear oil level.

8.14 Add grease to the lubrication points for grease

8.14.1 Select the grease type



Caution: Only use the grease type that agrees with the type plate and with section [Lubricants](#) on page 62. Do not use another grease type.



Note: If the supplier of grease changes the composition of the grease, HIT is not responsible or liable.

Procedure

1. For the correct grease type, refer to the type plate.
2. Use this data to select the grease from the tables in section [Lubricants](#) on page 62.

8.14.2 Add grease



Caution: Before you use a different type of grease that is in the gear unit, speak to the supplier of the grease. Not all greases are compatible with each other. The supplier of the grease gives instructions. Obey these instructions.

**Note:**

- The grease nipples agree with the standard DIN 71412 or optional DIN 3404.
- For the grease quantity, refer to chapter [Technical data](#) on page 52.

Procedure

1. Add grease to the grease nipples. Refer to the signs on the gear unit. Use a grease gun.

8.15 Install the oil-to-air cooler

Procedure

1. Obey the instructions for the cooling system. Refer to the service manual of the lubrication and cooling system.

8.16 Install the water cooling

8.16.1 Install the water cooling



Note: If the certified drawing does not show the cooling water temperature, the water flow on the certified drawing is applicable to water at 20 °C (70 °F).

Procedure

1. Obey the instructions for the water cooling system. Refer to the service manual of the lubrication and cooling system.

8.16.2 Install the oil-to-water cooler



Caution: Make sure that the quality of the cooling water agrees with the specification in the service manual of the lubrication and cooling system.

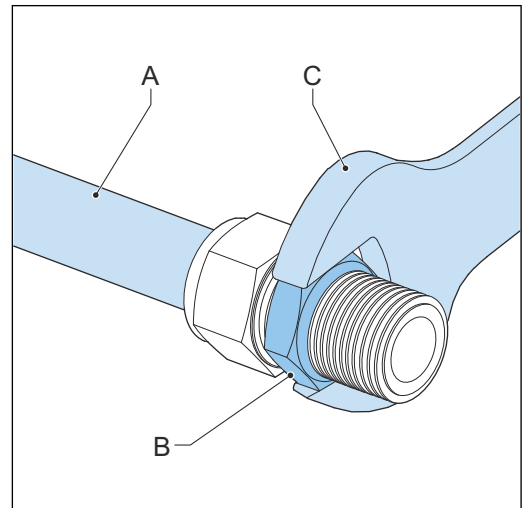
Procedure

1. Connect the oil-to-water cooler to the cooling water supply.

8.16.3 Install the cooling coils

Procedure

1. Connect the cooling coil to the cooling water supply.
2. Make sure that the quality and water pressure of the cooling water agrees with the specifications. Refer to section [Cooling water specifications](#) on page 71.
3. While you connect the cooling coil (A), hold the connection (B) with an open spanner (C), to prevent torsion on the cooling coil.



8.17 Installation instructions (heater)

Procedure

1. Make sure that the heater automatically goes off if the temperature of the gear oil has the correct temperature. For the specification, refer to [Additional gear oil specifications \(heater\)](#) on page 62.

9 Commissioning

9.1 Maximum time between commissioning and operation

Procedure

1. Make sure that the time between commissioning and operation is not more than 2 weeks. If this is not possible, speak to HIT.

9.2 Do a check on the gear unit

Procedure

1. Do a check on the gear oil level. Refer to [Measure the gear oil level](#) on page 42.
2. Make sure that all lubrication points for grease are filled.
3. Make sure that all safety covers are installed correctly.
4. Make sure that the clearance between the safety covers and the rotating parts is minimum 5 mm.

9.3 Start instructions (backstop)



Caution: Do not turn the gear unit in the incorrect direction. This condition causes damage to the backstop.

Procedure

1. Make sure that the backstop operates correctly.

9.4 Start instructions (heater)

Procedure

1. Do not start the gear unit if the temperature of the gear oil is not correct. For the specification, refer to section [Additional gear oil specifications \(heater\)](#) on page 62.

9.5 Start instructions (force-feed lubrication, pump with a motor)

Procedure

1. Make sure that the pump goes on minimum 60 s before the gear unit starts.
2. For more instructions, refer to the service manual of the lubrication and cooling system.

9.6 Start instructions (force-feed lubrication, integrated pump)

Procedure

1. Delay the alarm signal, to stop the motor that operates the gear unit when the oil flow is low, with 5 s. If not, unwanted alarms occur during startup.
2. For more instructions, refer to the service manual of the lubrication and cooling system.

9.7 Start instructions (drive group with a 2-speed motor)

Procedure

1. Before you change from the higher to the lower speed, decrease the speed below the lower speed.
Then, the motor must increase the speed to the lower speed. This condition prevents that the torque to the gear unit becomes too high.

9.8 Instructions after commissioning



Warning: Do not disassemble an "OIL-LOCK™" or the "OIL-GUARD™" system on the HSS. If you see leaks at this location, speak to HIT

Procedure

1. Do a check on the gear oil level. Refer to section [Measure the gear oil level](#) on page 42.
2. While the gear unit operates, listen for unexpected noise and vibrations.
3. If you hear unexpected noise and vibrations, remove the source of the unexpected noise and vibrations.



Warning:

- Do not remove the safety covers.
 - Do not use the gear unit before the source of the unexpected noise and vibrations is removed.
4. Examine the surface of the gear unit and the adjacent parts.
 5. If you see leakage: find and remove the cause of the leakage.
 6. Clean all parts that have gear oil or grease on the surface.
 7. Make sure that the gear unit operates until the temperature is constant ($\Delta T < 1\text{ °C} / 1\text{ h}$)
 8. Make sure that the gear unit is aligned correctly. Refer to section [Align the gear unit](#) on page 32.



Warning: Do not touch the gear unit. It is hot. Use protective clothing

10 Instructions for operation

10.1 General instructions for operation



Caution: If the instructions are not obeyed during operation, this causes damage to the gear unit.

Procedure

1. Give all the instructions in this chapter to the owner of the gear unit.
These instructions are a part of the instructions of a larger system in which the gear unit is one part.

10.2 Instructions (force-feed lubrication, pump with a motor)

Procedure

1. Make sure that a pump goes on minimum 60 s before the gear unit starts.

10.3 Instructions (water cooling)

Procedure

1. Drain the cooling water if the gear unit does not operate and the ambient temperature is below the freezing point.

10.4 Instructions (drive group with a 2-speed motor)

Procedure

1. Before you change from the higher to the lower speed, decrease the speed below the lower speed.
Then, the motor must increase the speed to the lower speed. This condition prevents that the torque to the gear unit becomes too high.

10.5 Instructions (auxiliary drive)

Procedure

1. When the sensors detect rotation of the clutch on the auxiliary drive, stop the main motor of the gear unit fully .

10.6 Instructions to change the direction of rotation of the shafts

Procedure

1. Stop the gear unit fully before you change the direction of rotation of the shafts.



Caution: If you change the direction when the shafts move, you cause damage to the gear unit.

10.7 Instructions if the gear unit does not operate more than 2 weeks

Procedure

1. Obey the general storage instructions. Refer to section [Ambient conditions for storage](#) on page 54.
2. Do one of these procedures:
 - Operate the gear unit for minimum 5 minutes each 2 weeks.
 - Protect the gear unit with a volatile corrosion inhibitor.
3. Before you start again, do all instructions in chapter [Commissioning](#) on page 45.

Operate the gear unit for 5 minutes each 2 weeks

Procedure

1. Operate the gear unit for minimum 5 minutes each 2 weeks. In this condition, the gear oil prevents corrosion of the internal parts of the gear unit.

Protect the gear unit with a volatile corrosion inhibitor

Procedure

1. Add a volatile corrosion inhibitor. Speak to the supplier of the gear oil for instructions. Do not add more volatile corrosion inhibitor than specified in section [General specifications for lubricants](#) on page 62.
2. Measure the gear oil level. Refer to section [Measure the gear oil level](#) on page 42.
3. Seal all openings of the gear unit.

11 Removal of the gear unit

11.1 General instructions for removal of the gear unit



Warning:

- Obey the instructions on how to move the gear unit when it is on-site. Refer to section [On-site transport](#) on page 24.
- Make sure that the gear unit cannot fall. Make sure that safe lifting equipment holds the gear unit.

Procedure

1. For removal instructions of parts that are not included in this document: refer to the drive package documentation.
2. Make sure that there is no load or torque on the gear unit.

11.2 Remove the gear unit (solid shafts, couplings)

Procedure

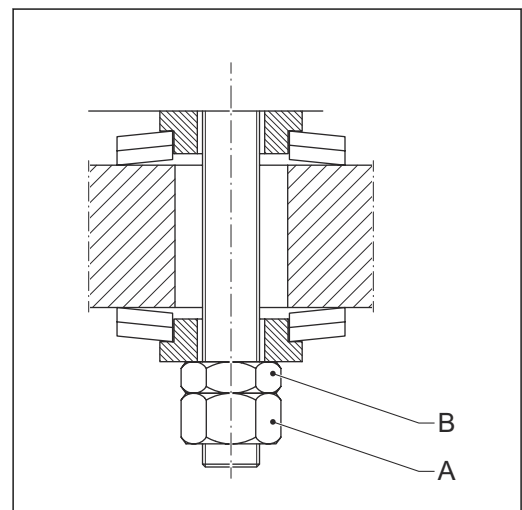
1. Disconnect the coupling. If HIT supplied the coupling, refer to the certified drawing. If HIT did not supply the coupling, refer to the instructions of the coupling.
2. Remove the bolts that connect the gear unit to the bedplate or foundation. Refer to the certified drawing.
3. To move the gear unit, refer to section [On-site transport](#) on page 24.

11.3 Remove the gear unit (hollow shafts)

11.3.1 Disconnect the gear unit from the torque reaction point

Procedure

1. Remove the nuts (A) and (B).

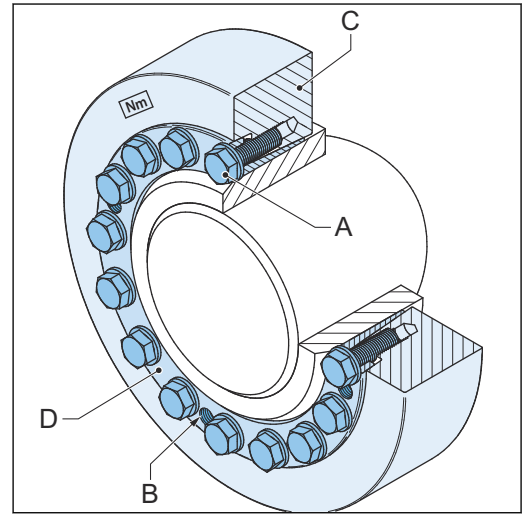


11.3.2 Remove the shrink disk (2-part shrink disk)

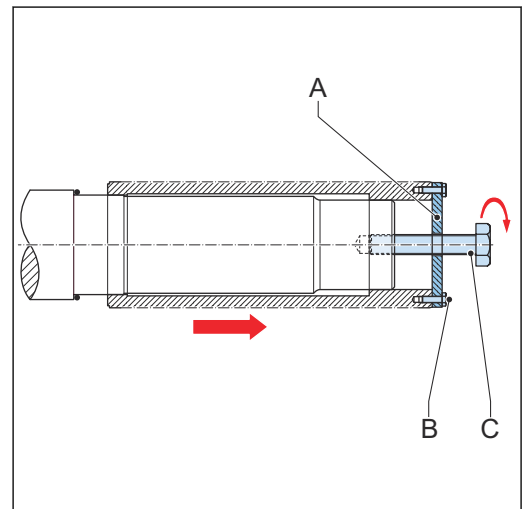
Remove the shrink disk*Procedure*

1. Remove the safety cover.
2. Loosen the bolts (A) 1/4 of a turn. Start with one bolt and continue counterclockwise until the last bolt.
3. Do the step 2 again until all bolts are loose. Do not remove the bolts.
4. If the shrink disk does not become loose, do these steps:
 - a) Remove four bolts (A), adjacent to each of the four holes (B).
 - b) Install the bolts in the holes (B) and tighten them.

This way, the inner ring (D) and the outer ring (C) are pushed away from each other.
5. Remove the shrink disk.
6. Install the four bolts (A) in the holes where you removed them from.
7. If the shrink disk is dirty:
 - Clean the shrink disk.
 - Apply a solid lubricant to the machined surfaces. Refer to section [Lubrication for installation \(hollow shaft\)](#) on page 59.

**Remove the gear unit***Procedure*

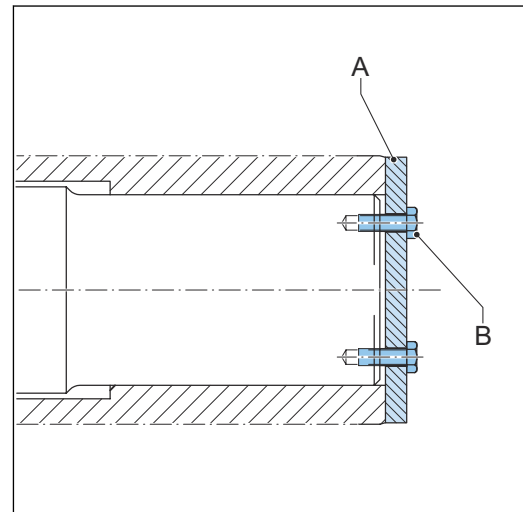
1. Install these parts:
 - Installation disk (A)
 - Bolts (B) (for the type of bolts, refer to the certified drawing)
 - Bolt to remove the gear unit (C)
2. To remove the gear unit from the machine shaft, tighten the bolt (C).
3. To move the gear unit, refer to section [On-site transport](#) on page 24.

**11.3.3****Disconnect the keyway connection**

Remove the locking disk

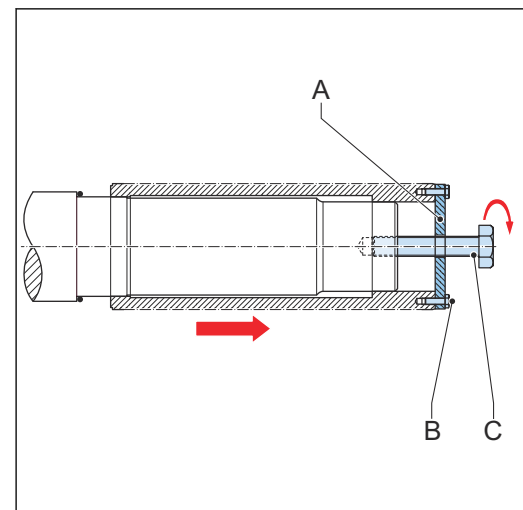
Procedure

1. Remove the safety cover.
2. Remove the bolts (B).
3. Remove the locking disk (A).

**Remove the gear unit**

Procedure

1. Install these parts:
 - Installation disk (A)
 - Bolts (B) (for the type of bolts, refer to the certified drawing)
 - Bolt to remove the gear unit (C)
2. To remove the gear unit from the machine shaft, tighten the bolt (C).
3. To move the gear unit, refer to section *On-site transport* on page 24.



12 Technical data

12.1 Dimensions and mass

Refer to the certified drawing.

12.2 Materials of the gear unit

- Gear oil
- Grease
- FKM (a type of fluoroelastomer)
- Copper
- Aluminium
- Polycarbonate (solid)
- Polypropylene (with embedded glass fibre or with carbon)
- Polyamide (solid)
- Polyphenol sulfide (solid)
- NBR (nitrile rubber)
- For information on the paint and other materials, refer to the drive package documentation.

12.3 Torque seal specification

Parameter	Specification
Torque seal	Loctite 7417 torque Marque or similar

12.4 Paint specification

Parameter	Specification
Primer	Two-component, polyamide-cured epoxy pre-fabrication primer (50µm)
Finish	Two-component, high build, polyamine adduct-cured epoxy coating (200µm)
Total average minimum dry film thickness	250µm

12.5 Paint specification

Parameter	Specification
Primer	Two-component, polyamide-cured epoxy pre-fabrication primer (50µm)
Finish	Two-component, high build, polyamine adduct-cured epoxy coating (300µm)
Total average minimum dry film thickness	350µm

12.6 Paint specification

Parameter	Specification
Primer	Two-component, polyamide-cured epoxy pre-fabrication primer (50µm)
Layer	Two-component, high build, polyamine adduct-cured epoxy coating (200µm)
Finish	Two-component, aliphatic acrylic polyurethane finish (50µm)
Total average minimum dry film thickness	300µm

12.7 Paint specification

Parameter	Specification
Primer	Two-component, polyamide-cured epoxy pre-fabrication primer (50µm)
Layer	Two-component, high build, polyamine adduct-cured epoxy coating (300µm)
Finish	Two-component, aliphatic acrylic polyurethane finish (50µm)
Total average minimum dry film thickness	400µm

12.8 Paint specification

Parameter	Specification
Primer	Two-component polyamide cured epoxy prefabrication primer (50µm)
Layer	Two-component high-solids epoxy coat based on zinc phosphate (150µm)
Layer	Two-component high-solids epoxy coat based on zinc phosphate (150µm)
Finish	Two-component polyurethane coat (50µm)
Total minimum dry film thickness	400µm

12.9 Corrosion protection by HIT

Parameter	Specification
Inner parts	Rust preventive mineral oil
Breather plug	Present but not sealed
Shaft extensions	Rust preventive grease
Hollow shafts	Anti-oxidising waxy varnish
Unpainted machined surfaces	Anti-oxidising waxy varnish

12.10 Ambient conditions for storage

Parameter	Specification
Temperature [°C]	Above dew point temperature
Relative humidity, non-condensing [%]	Maximum 60
General protection	Against corrosion and contamination
Vibration	Not allowed

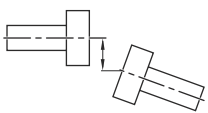
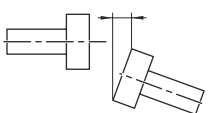
12.11 Position of the gear unit

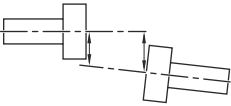
Parameter	Specification
Inclination	Maximum 5 mm per 1 m (5/32 inch per 3 feet or 5 mrad or 17 arc minutes)
Accuracy of the vertical position from the fourth connection point [mm] ([inch])	0.1 (0.004)

12.12 Misalignment of the LSS

Parameter	Specification
$\frac{dr}{\Delta r} + \frac{d\alpha}{\Delta \alpha}$ Misalignment equation, where • dr = measured radial misalignment [mm] • Δr = maximum permitted radial misalignment [mm] • $d\alpha$ = measured angular misalignment [mm] • $\Delta \alpha$ = maximum permitted angular misalignment [mm]	Smaller than or equal to 1

12.13 Misalignment of the HSS (couplings)

Type of coupling	Speed of the HSS [1/min]	Maximum permitted misalignment [mm] ([mils])
Short flexible coupling, radial misalignment 	750	0.19 (7.5)
	900	0.15 (6.0)
	1000	0.12 (4.8)
	1200	0.10 (4.0)
	1500	0.09 (3.5)
	1800	0.08 (3.0)
Angular misalignment for coupling diameter 100 mm (10 inch) 	750	0.13 (13.0)
	900	0.10 (10.0)
	1000	0.096 (9.6)
	1200	0.08 (8.0)
	1500	0.07 (7.0)
	1800	0.05 (5.0)

Type of coupling	Speed of the HSS [1/min]	Maximum permitted misalignment [mm] ([mils])
Radial misalignment for the spacer shaft and membrane (disk) coupling, spacer length 100 mm (1 inch) 	750	0.25 (2.5)
	900	0.20 (2.0)
	1000	0.18 (1.8)
	1200	0.15 (1.5)
	1500	0.12 (1.2)
	1800	0.10 (1.0)

12.14 Bolt specifications (gear units with solid shafts)

12.14.1 Bolt specifications (single-stage, horizontal LSS)

Table for bolts according to DIN 267 bolt quality grade 8.8

Gear unit type	Gear unit size	Bolt dimension [ISO]	Torque [Nm]
QHP.1	C	M20	335
	D	M24	675
	E	M24	675
	F	M30	1350
	G	M30	1350
QHP.1T	G	M36	2350
	H	M36	2350
	J	M36	2350
	K	M36	2350

Table for bolts according to SAE bolt quality grade 5

Gear unit type	Gear unit size	Bolt dimension [UNC]	Torque [lbf.in]
QHP.1	C	3/4"	2950
	D	7/8"	4850
	E	1"	6000
	F	1 1/8"	10300
	G	1 1/4"	12000
QHP.1T	G	1 1/2"	21000
	H	1 1/2"	21000
	J	1 1/2"	21000
	K	1 1/2"	21000

12.14.2 Bolt specifications (multi-stage, horizontal LSS)

Table for bolts according to DIN 267 bolt quality grade 8.8

Gear unit type	Gear unit size	Bolt dimension [ISO]	Torque [Nm]
QH...	A	M16	180
	B	M20	335
	C	M24	675
	D	M24	675
	E	M30	1350
	F	M30	1350
	G	M36	2350
	H	M36	2350
	J	M36	2350
	K	M36	2350
	L	M42	3800
	M	M42	3800
	N	M48	5700
	P	M48	5700
	Q	M48	5700
	R	M56	9150
	S	M56	9150
	T	M56	9150

Table for bolts according to SAE bolt quality grade 5

Gear unit type	Gear unit size	Bolt dimension [UNC]	Torque [lbf.in]
QH...	A	5/8"	1550
	B	3/4"	2950
	C	7/8"	4850
	D	1"	6000
	E	1 1/4"	12000
	F	1 1/4"	12000
	G	1 1/2"	21000
	H	1 1/2"	21000
	J	1 1/2"	21000
	K	1 1/2"	21000
	L	1 3/4"	33650
	M	1 3/4"	33650
	N	2"	50750
	P	2"	50750
	Q	2"	50750
	R	2 1/4"	81050
	S	2 1/4"	81050
	T	2 1/4"	81050

12.14.3 Bolt specifications (multi-stage, vertical LSS)

Table for bolts according to DIN 267 bolt quality grade 8.8

Gear unit type	Gear unit size	Bolt dimension [ISO]	Torque [Nm]
QV...	A	M16	180
	B	M20	335
	C	M24	675
	D	M30	1350
	E	M30	1350
	F	M36	2350
	G, 2-stage	M36	2350
	G, 3-stage and 4-stage	M42	3800
	H	M42	3800
	J	M42	3800
	K	M42	3800
	L	M48	5700
	M	M48	5700
	N	M48	5700
	P	M48	5700
	Q	M48	5700
	R	M56	9150
	S	M56	9150
	T	M56	9150

Table for bolts according to SAE bolt quality grade 5

Gear unit type	Gear unit size	Bolt dimension [UNC]	Torque [lbf.in]
QV	A	5/8"	1550
	B	3/4"	2950
	C	1"	6000
	D	1 1/8"	10300
	E	1 1/4"	12000
	F	1 1/2"	21000
	G, 2-stage	1 1/2"	21000
	G, 3-stage and 4-stage	1 3/4"	33650
	H	1 3/4"	33650
	J	1 3/4"	33650
	K	1 3/4"	33650
	L	2"	50750
	M	2"	50750
	N	2"	50750
	P	2"	50750
	Q	2"	50750
	R	2 1/4"	81050
	S	2 1/4"	81050
	T	2 1/4"	81050

12.15 Lubrication for installation (hollow shaft)

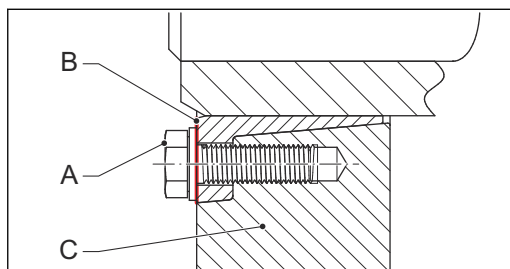
Parameter	Specification
Lubricant	Molykote D321R or similar (friction coefficient: 0.04)

12.16 Torque values for oil drain screw

Dimension of the drain screw	Torque	
G ½ "	56,5 Nm	500 lbf.in.
G ¾ "	73,4 Nm	650 lbf.in.
≥ G 1 "	79 Nm	700 lbf.in.

12.17 Shrink disk specifications (2-part shrink disk)

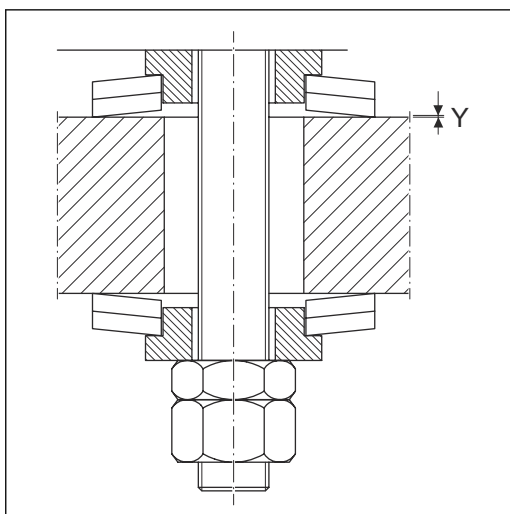
12.17.1 Torque specifications



Gear unit size	HIT part number of the shrink disk	Torque of the bolts (A), for the 2-part shrink disk [Nm] ³
A	901-SDA2D110001	120
B	901-SDA2D125001	120
C	901-SDA2D140001	190
D	901-SDA2D165001	290
E	901-SDA2D185001	290
F	901-SDA2D220001	570
G	901-SDA2D240001	570
H	901-SDA2D260001	570
J	901-SDA2D280001	570
K	901-SDA2D320001	990
L	901-SDA2D340001	990
M	901-SDA2D360001	990
N	901-SDA2D390001	1480
P	901-SDA2D420001	1480
Q	901-SDA2D440001	1480
R	901-SDA2D480001	1980
S	901-SDA2D500001	1980
T	901-SDA2D530001	1980

³ Torque values only valid for 'Sumitomo Drive Technologies' branded shrink disc. For other brands, obey the mounting instructions and torque values of the manufacturer.

12.18 Prestress specifications for the torque arm (hollow shaft)



Note: (Y) is the difference between distance without load and the distance when the disk springs are prestressed.

Gear unit type	Y	
	[mm]	[inch]
QH.A2	0.7	0.028
QH.B2	0.7	0.028
QH.C2	0.9	0.035
QH.D2	0.9	0.035
QH.E2	1.0	0.039
QH.F2	1.0	0.039
QH.G2	1.0	0.039
QH.H2	1.0	0.039
QH.C3	0.7	0.028
QH.D3	0.9	0.035
QH.D4	0.9	0.035
QH.E3	0.9	0.035
QH.E4	0.9	0.035
QH.F3	1.0	0.039
QH.F4	1.0	0.039
QH.G3	1.0	0.039
QH.G4	1.0	0.039
QH.H3	1.0	0.039
QH.H4	1.0	0.039
QH.J3	1.4	0.055
QH.J4	1.4	0.055

Gear unit type	Y	
	[mm]	[inch]
QH.K3	1.4	0.055
QH.K4	1.4	0.055
QH.L3	1.4	0.055
QH.L4	1.4	0.055
QH.M3	1.4	0.055
QH.M4	1.4	0.055

12.19 Lubricants

12.19.1 General specifications for lubricants

Parameter	Specification
Initial gear oil cleanliness	-/15/12 (or better) according to ISO 4406
Gear oil: maximum allowable water content (Karl Fischer) [%]	0,05
NLGI-Grade of grease	3 2 or 3, for labyrinth seals and lower bearing of the LSS
Nominal temperature of the gear oil in the oil bath, during operation [°C] ([°F])	60 - 80 (140 - 180)
Maximum volume concentration of corrosion inhibitor in the gear oil [%]	2
Working temperature range for corrosion inhibitor [°C] ([°F]) ⁴	15 - 70 (60 - 158)

General specifications for gear oil per viscosity grade

Viscosity grade	AGMA
ISO VG68	2EP
ISO VG100	3EP
ISO VG150	4EP
ISO VG220	5EP
ISO VG320	6EP
ISO VG460	7EP

12.19.2 Additional gear oil specifications (heater)

Parameter	Specification
Minimum gear oil temperature for startup	Refer to the type plate

⁴ Make sure to store the gearbox in this temperature range for at least 5 days after each fill of corrosion inhibitor. Afterwards the conditions for storage apply. Refer to [Ambient conditions for storage](#) on page 54

Parameter	Specification
Gear oil temperature at which the heater must stop [°C] ([°F])	15 (60), unless the certified drawing shows another specification. Then, refer to the certified drawing.

12.19.3

Mineral gear oil and related grease

Table 1: Mineral gear oil

Supplier	ISO VG150	ISO VG220	ISO VG320	ISO VG460
ADDINOL	Eco Gear 150 M	Eco Gear 220 M	Eco Gear 320 M	Eco Gear 460 M
CASTROL	Alpha SP 150	Alpha SP 220	Alpha SP 320	Alpha SP 460
FUCHS	Renolin CLP 150	Renolin CLP 220	Renolin CLP 320	Renolin CLP 460
KLÜBER	Klüberoil GEM 1-150 N	Klüberoil GEM 1-220 N	Klüberoil GEM 1-320 N	Klüberoil GEM 1-460 N
LUBRICATION ENGINEERS INC.		Duolec Vari-Purpose Gear Lubricant 1605	Duolec Vari-Purpose Gear Lubricant 1606	Duolec Vari-Purpose Gear Lubricant 1607
EXXON MOBIL	Mobilgear XMP 150	Mobilgear XMP 220	Mobilgear XMP 320	Mobilgear XMP 460
	Mobilgear 600 XP 150	Mobilgear 600 XP 220	Mobilgear 600 XP 320	Mobilgear 600 XP 460
REPSOL		Super Tauro FND 220	Super Tauro FND 320	
SHELL	Omala S2 GX 150	Omala S2 GX 220	Omala S2 GX 320	Omala S2 GX 460
SINOPEC		SINOPEC AP Gear Oil 220	SINOPEC AP Gear Oil 320	SINOPEC AP Gear Oil 460
STATOIL	LoadWay EP 150	LoadWay EP 220	LoadWay EP 320	LoadWay EP 460
TOTAL		Carter XEP 220	Carter XEP 320	Carter XEP 460
		Carter EP 220	Carter EP 320	Carter EP 460

Table 2: Related grease

Supplier	Related grease, NLGI grade 2	Related grease, NLGI grade 3
BP-CASTROL	Spheerol EPL-2	Spheerol EPL-3
FUCHS EUROPE SCHMIER-STOFFE	Renolit FEP 2	Renolit FEP 3
KLÜBER	Centoplex 2EP	-
(EXXON)MOBIL	-	Mobilux EP 3
SHELL	Gadus S2 V220 2	Gadus S2 V220 3
STATOIL	Uniway Li 62	-
TOTAL	-	Multis EP 3
ADDINOL	Multi-grade grease LM 2 EP	Multi-grade grease LM 3 EP

12.19.4 Synthetic gear oil and related grease

The synthetic oil must be of the poly-alpha-olefin type (SHF-type, Synthetic Hydrocarbon Fluid).

Table 3: Gear oil

Supplier	ISO VG150	ISO VG220	ISO VG320	ISO VG460
ADDINOL	Eco Gear 150 S	Eco Gear 220 S	Eco Gear 320 S	Eco Gear 460 S
	Eco Gear 150 W	Eco Gear 220 W	Eco Gear 320 W	Eco Gear 460 W
ANDEROL		ANDEROL 5220 Plus	ANDEROL 5320 Plus	ANDEROL 5460 Plus
	ANDEROL 5150 XEP	ANDEROL 5220 XEP	ANDEROL 5320 XEP	ANDEROL 5460 XEP
BEL-RAY	Synthetic Gear Oil 150	Synthetic Gear Oil 220	Synthetic Gear Oil 320	Synthetic Gear Oil 460
CARL BECHEM	Berusynth GPX 150	Berusynth GPX 220	Berusynth GPX 320	Berusynth GPX 460
CASTROL	Alphasyn EP 150	Alphasyn EP 220	Alphasyn EP 320	Alphasyn EP 460
CHEVRON PRODUCTS COMPANY	Meropa Elitesyn XM 150	Meropa Elitesyn XM 220	Meropa Elitesyn XM 320	Meropa Elitesyn XM 460
		Meropa Synthetic XL 220	Meropa Synthetic XL320	Meropa Synthetic XL 460
DEUTSCHE ÖL-WERKE LUBMIN GmbH	AVENO Gear Ultimate FLD 150	AVENO Gear Ultimate FLD 220	AVENO Gear Ultimate FLD 320	AVENO Gear Ultimate FLD 460
ENGEN		Gengear SPL A-220	Gengear SPL A-320	Gengear SPL A-460
EXXON MOBIL	Mobilgear SHC XMP 150	Mobilgear SHC XMP 220	Mobilgear SHC XMP 320	Mobilgear SHC XMP 460
	Mobil SHC Gear Series 150	Mobil SHC Gear Series 220	Mobil SHC Gear Series 320	Mobil SHC Gear Series 460
		Mobil SHC 630	Mobil SHC 632	Mobil SHC 634
FUCHS	Renolin Unisyn CLP 150	Renolin Unisyn CLP 220	Renolin Unisyn CLP 320	Renolin Unisyn CLP 460
	Renolin Unisyn XT 150	Renolin Unisyn XT 220	Renolin Unisyn XT 320	Renolin Unisyn XT 460
GAZPROMNEFT-LUBRICANTS, Ltd	Reductor F Synth 150	Reductor F Synth 220	Reductor F Synth 320	Reductor F Synth 460

Supplier	ISO VG150	ISO VG220	ISO VG320	ISO VG460
HABOT OIL (PTY) Ltd	H-3100 UP MP Series 150	H-3100 UP MP Series 220	H-3100 UP MP Series 320	H-3100 UP MP Series 460
INDIAN OIL COMPANY LIMITED	SERVOSYN-MESH GOLD 150	SERVOSYN-MESH GOLD 220	SERVOSYN-MESH GOLD 320	SERVOSYN-MESH GOLD 460
IPIRANGA LUBRIFICANTES		IPIRANGA SP ULTRATECH MPT 220	IPIRANGA SP ULTRATECH MPT 320	IPIRANGA SP ULTRATECH MPT 460
KLÜBER	Klübersynth GEM 4-150 N	Klübersynth GEM 4-220 N	Klübersynth GEM 4-320 N	Klübersynth GEM 4-460 N
LUBRICATION ENGINEERS INC.		Duolec Syn Gear Lubricant 9822	Duolec Syn Gear Lubricant 9832	Duolec Syn Gear Lubricant 9846
PETRO-CANADA		ENDURATEX Synthetic EP 220	ENDURATEX Synthetic EP 320	ENDURATEX Synthetic EP 460
PETRONAS LUBRICANTS INTERNATIONAL	PETRONAS Gear Syn Series 150	PETRONAS Gear Syn Series 220	PETRONAS Gear Syn Series 320	PETRONAS Gear Syn Series 460
	PETRONAS Pro-gear Syn PAO Series 150	PETRONAS Pro-gear Syn PAO Series 220	PETRONAS Pro-gear Syn PAO Series 320	PETRONAS Pro-gear Syn PAO Series 460
Q8 Oils	Q8 Galilei 150	Q8 Galilei 220	Q8 Galilei 320	Q8 Galilei 460
RAVENSBERGER SCHMIERSTOFFEN-VERTRIEB GmbH	RAVENOL Synthetic Wind Turbines SWT 150	RAVENOL Synthetic Wind Turbines SWT 220	RAVENOL Synthetic Wind Turbines SWT 320	RAVENOL Synthetic Wind Turbines SWT 460
REPSOL		SUPER TAURO SINTETICO 220	SUPER TAURO SINTETICO 320	SUPER TAURO SINTETICO 460
	SUPER TAURO GT 150	SUPER TAURO GT 220	SUPER TAURO GT 320	SUPER TAURO GT 460
SHELL	Omala S4 GXV 150	Omala S4 GXV 220	Omala S4 GXV 320	Omala S4 GXV 460
SINOPEC	SINOPEC AP-S Gear Oil 150	SINOPEC AP-S Gear Oil 220	SINOPEC AP-S Gear Oil 320	SINOPEC AP-S Gear Oil 460
TOTAL	Carter SH 150	Carter SH 220	Carter SH 320	Carter SH 460
YORK SAS	YORK 897 VG 150	YORK 897 VG 220	YORK 897 VG 320	YORK 897 VG 460

Table 4: Related grease



Note: For all synthetic gear oils, you can only use the grease type in the table below.

Supplier	Related grease, NLGI grade 2	Related grease, NLGI grade 3
FAG	-	Arcanol VIB3

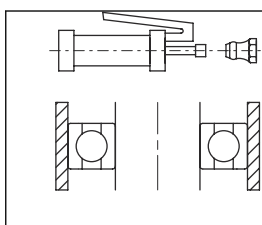
12.20

Grease quantity at lubrication points for bearings

12.20.1

Grease quantity type

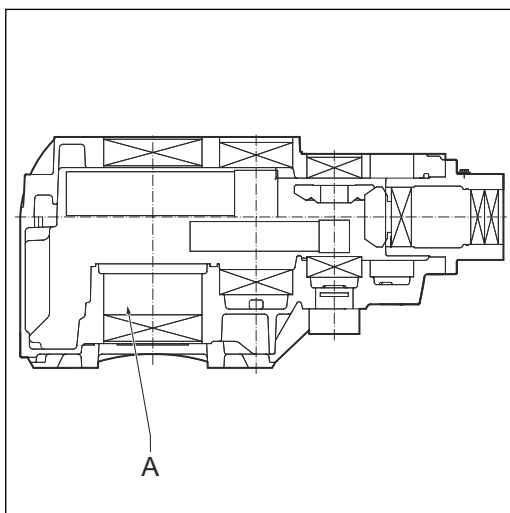
For the grease quantity type: refer to the type plate.



The grease quantities only apply to the lubrication points that are indicated on the gear unit with the sign for lubrication point for grease at bearings.

12.20.2

Grease quantity types Q1, Q2, Q3, Q6, Q7 and Q8

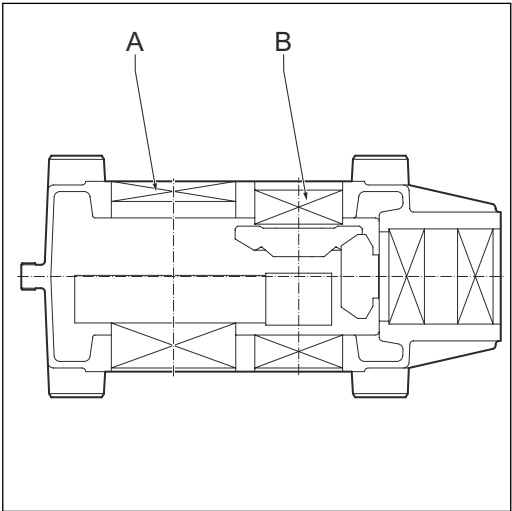


A Lubrication point

Gear unit size	Grease quantity type					
	Q1 [g]	Q2 [g]	Q3 [g]	Q6 [g]	Q7 [g]	Q8 [g]
C	50	60	50	100		
D	60	80	60	130	100	120
E	90	110	90	180	130	170
F	120	150	120	240	180	220

Gear unit size	Grease quantity type					
	Q1 [g]	Q2 [g]	Q3 [g]	Q6 [g]	Q7 [g]	Q8 [g]
G	170	200	170		220	320
H	180	230	180		280	400
J	220	280	220		320	410
K	260	320	260		320	500
L	320	400	320		410	590
M	340	410	340		370	700
N	380	380	290			
P	470	470	350			
Q	490	490	360			
R	500	500	380			
S	600	600	440			
T	620	620	470			

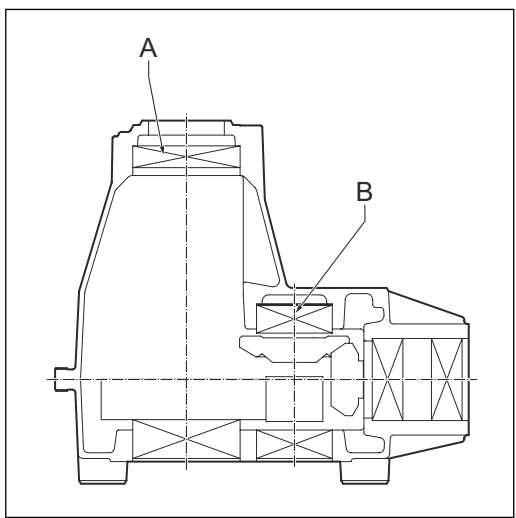
12.20.3 Grease quantity type Q4



- A Lubrication point
- B Lubrication point

Gear unit size	Lubrication point	
	A [g]	B [g]
Z	10	20
A	20	20
B	30	30

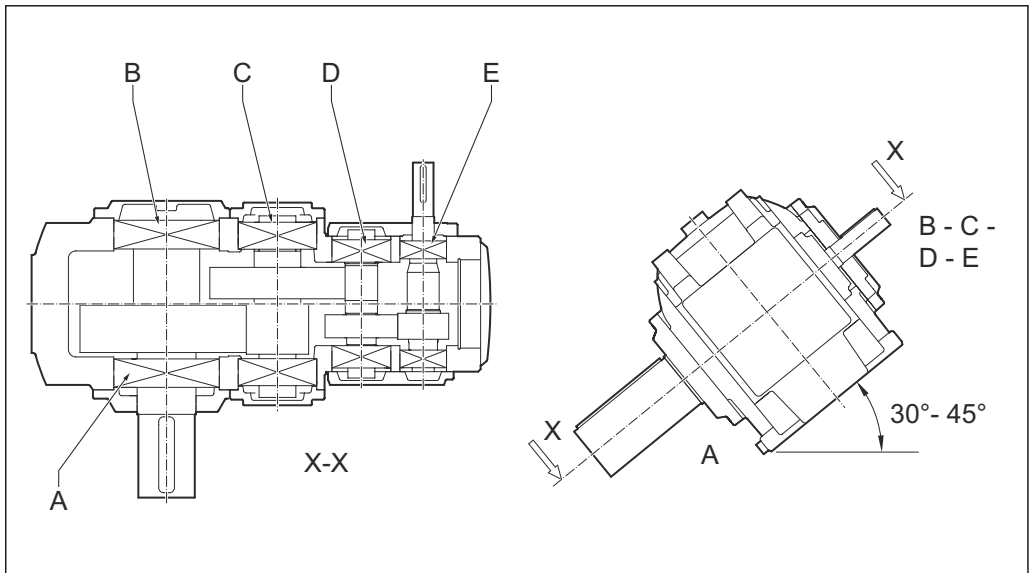
12.20.4 Grease quantity type Q5



- A** Lubrication point
- B** Lubrication point

Gear unit size	Lubrication point	
	A [g]	B [g]
Z	10	20
A	20	20
B	30	30

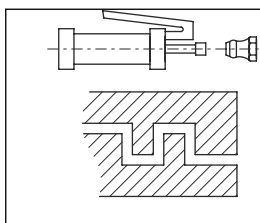
12.20.5 Grease quantity type Q9



- A** Lubrication point at the lower side
- B** Lubrication point at the upper side
- C** Lubrication point at the upper side
- D** Lubrication point at the upper side

E Lubrication point at the upper side

Gear unit size	Lubrication point				
	A [g]	B [g]	C [g]	D [g]	E [g]
C		50	30	20	10
D		60	40	30	20
E		90	50	40	20
F		120	80	50	30
H	180				
J	220				
K	260				
L	320				
M	340				
N	290				
P	350				
Q	360				

12.21 Grease quantity for lubrication points at labyrinth seals (LSS)**12.21.1 Grease quantity type**

The grease quantities only apply to the lubrication points that are indicated on the gear unit with the sign for lubrication point for grease at labyrinth seals.

12.21.2 Grease quantity (single-stage)

Gear unit type	Gear unit size	Grease quantity [g]
QHR.1Z-..N	C	75
	D	75
	F	45
QHP.1	C	10
	D	10
	E	15
	F	25
	G	35
QHP.1T	G	75
	H	110
	J	105
	K	130

Gear unit type	Gear unit size	Grease quantity [g]
QVP.1	Z	10
	B	10

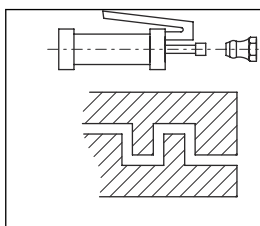
12.21.3 Grease quantity (multi-stage)

Gear unit type		Grease quantity [g]
Gear unit size	LSS type	
QVRZ2		50
QVRZ2L		30
QVRA2		70
QVRA2L		40
QVRB2		50
QVRB2L		55
A	Solid	15
	Hollow	10
B	Solid	22
	Hollow	16
C	Solid	25
	Hollow	25
D	Solid	35
	Hollow	25
E	Solid	55
	Hollow	30
EX	Solid	55
F	Solid	60
	Hollow	65
FX	Solid	60
G	Solid	75
	Hollow	65
H	Solid	60
	Hollow	120
J	Solid	60
	Hollow	130
K	Solid	130
	Hollow	145
L	Solid	135
	Hollow	155
M	Solid	145
	Hollow	160
N	Solid	215
P	Solid	230
Q	Solid	240
R	Solid	255
S	Solid	270

Gear unit type		Grease quantity [g]
Gear unit size	LSS type	
T	Solid	360
U	Solid	375

12.22 Grease quantity for lubrication points at labyrinth seals (HSS)

12.22.1 Grease quantity type



The grease quantities only apply to the lubrication points that are indicated on the gear unit with the sign for lubrication point for grease at labyrinth seals.

12.22.2 Grease quantity (single-stage)

Gear unit type	Gear unit size	Grease quantity [g]
QHP.1	C	10
	D	10
	E	20
	F	30
	G	40
QHP.1T	G	75
	H	75
	J	85
	K	85

12.22.3 Grease quantity (multi-stage)

Gear unit type	Grease quantity [g]
Z	10
A to H	10
J to T	20

12.23 Cooling water specifications

Parameter	Specification		
	[MPa]	[bar]	[psi]
Maximum water pressure on the cooling coils	0.8	8	116
Quality	Fresh water or salt water		



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