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Edition 07/2016
Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠️ **DANGER**
indicates that death or severe personal injury will result if proper precautions are not taken.

⚠️ **WARNING**
indicates that death or severe personal injury may result if proper precautions are not taken.

⚠️ **CAUTION**
indicates that minor personal injury can result if proper precautions are not taken.

**NOTICE**
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠️ **WARNING**
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.
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Introduction

Naming convention

This product, which can be used as a gear reduction box or multiplier gear box, is referred to below as the "gear unit".

1.1 General information

Purpose of the operating instructions

These operating instructions describe the gear unit and provide information about handling it - from assembly to maintenance.

Please keep these operating instructions for later use. Please read these operating instructions prior to handling the gear unit and follow the information in them.

Note

Disclaimer

Please make sure that every person who is commissioned to work on the gear unit has read and understood these operating instructions prior to handling the gear unit and adheres to all of the points. Failure to observe these operating instructions can cause product or property damage or personal injury.

Siemens does not accept any liability for damage or operating failures which are due to non-adherence to these operating instructions.

The gear unit described in these instructions reflects the state of technical development at the time these operating instructions went to print.

In the interest of technical advancements, Siemens AG reserves the right to make changes to the individual components and accessories which are considered necessary for improving their performance and safety, while maintaining their essential features.

Basic knowledge required

In order to understand these operating instructions, you will need the following general knowledge about gear units. You will also need a basic understanding of the following topics:

- Application planning
- Assembly
- Commissioning
- Maintenance
1.2 Lubricants

The oil used must meet the quality requirements specified in the separately enclosed operating instructions BA 7300 or else the warranty issued by Siemens will be invalidated. Siemens strongly recommends use of one of the oils listed in BA 7300 as these have been properly tested and meet the relevant quality requirements.

In order to avoid any misunderstandings, Siemens wishes to point out that this recommendation does not constitute an approval in the sense of a guarantee for the quality of the lubricant obtained from a supplier. Every lubricant manufacturer is required to guarantee the quality of his/her products.

Information such as oil type, oil viscosity and required oil quantity can be found on the rating plate of the gear unit and in the documentation supplied with the gear unit.

The oil quantity specified on the rating plate is an approximate value. The actual quantity of oil required is determined by the marking on the oil dipstick or oil sight glass.

The operating instructions for the lubricants currently recommended by Siemens AG can also be viewed on the Internet ([http://support.automation.siemens.com/WW/view/de/44231658](http://support.automation.siemens.com/WW/view/de/44231658)).

The oils listed there undergo continuous testing. As a result, the recommended oil types might in future be removed from the list or replaced by more advanced oils.

Siemens therefore advises users to check this list regularly to ascertain whether the selected lubricating oil is still recommended by Siemens. If it is not, another brand of oil should be selected instead.
2.1 Security notes

Siemens offers products and solutions with industrial security functions, which support the safe and secure operation of plants, systems, machines and networks.

In order to safeguard plants, systems, machines and networks against cyber threats it is necessary to implement (and continually maintain) a holistic industrial security concept that corresponds to the current state of the art. Siemens products and solutions undergo continuous development in this respect.

Customers are responsible for preventing unauthorised access to their plants, systems, machines and networks. Systems, machines and components shall only be connected to the company network or the Internet when and as far as this is absolutely necessary and appropriate protective measures (e.g. use of firewalls and network segmentation) shall be taken.

In addition the recommendations of Siemens regarding appropriate protective measures shall be observed. You can find further information about industrial security at http://www.siemens.com/industrialsecurity.

Siemens products and solutions undergo continuous development in order to make them even safer. Siemens expressly recommends that you regularly carry out any updates as soon as they are available and that you only use the current product versions. Use of older or no longer supported versions can increase the risk of cyber threats.

To keep yourselves informed of any updates to our products you can register for the Siemens Industrial Security RSS Feed at:
http://www.siemens.com/industrialsecurity

2.2 The five safety rules

In order to protect yourself and prevent any damage to property, always observe the safety relevant information and the following five safety rules (as per EN 50110-1 "Working on isolated equipment") when working on electrical components of the plant.

Prior to starting work on the machine, follow the safety rules listed below:

1. Disconnect
   - Also disconnect auxiliary circuits such as the anti-condensation heater
2. Safeguard against restart
3. Ensure that the system is de-energised
4. Earth and short circuit
5. Cover or cordon off adjacent live parts

When all the work is complete, cancel the safety measures in the reverse sequence.
2.3 General information

Introduction

All work on the gear unit should be performed with care and only by qualified personnel.

Symbols on the gear unit

The following symbols apply to the gear unit; some of which are found as coloured markings on the gear unit:

Table 2-1 Symbols and markings

<table>
<thead>
<tr>
<th>Points labelled on the gear unit</th>
<th>Symbol</th>
<th>Coloured markings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth connection point</td>
<td><img src="image1" alt="Symbol" /></td>
<td></td>
</tr>
<tr>
<td>Air relief point</td>
<td><img src="image2" alt="Symbol" /></td>
<td>yellow</td>
</tr>
<tr>
<td>Oil filling point</td>
<td><img src="image3" alt="Symbol" /></td>
<td>yellow</td>
</tr>
<tr>
<td>Oil draining point</td>
<td><img src="image4" alt="Symbol" /></td>
<td>white</td>
</tr>
<tr>
<td>Oil level indicator</td>
<td><img src="image5" alt="Symbol" /></td>
<td>red</td>
</tr>
<tr>
<td>Oil level measurement</td>
<td><img src="image6" alt="Symbol" /></td>
<td>red</td>
</tr>
<tr>
<td>Oil overflow</td>
<td><img src="image7" alt="Symbol" /></td>
<td></td>
</tr>
<tr>
<td>Connection point for vibration monitoring</td>
<td><img src="image8" alt="Symbol" /></td>
<td></td>
</tr>
<tr>
<td>Lubrication point</td>
<td><img src="image9" alt="Symbol" /></td>
<td>red</td>
</tr>
<tr>
<td>Apply grease</td>
<td><img src="image10" alt="Symbol" /></td>
<td></td>
</tr>
<tr>
<td>Lifting eye</td>
<td><img src="image11" alt="Symbol" /></td>
<td></td>
</tr>
<tr>
<td>Eye bolt</td>
<td><img src="image12" alt="Symbol" /></td>
<td></td>
</tr>
<tr>
<td>Do not unscrew</td>
<td><img src="image13" alt="Symbol" /></td>
<td></td>
</tr>
</tbody>
</table>
2.4 General warnings and symbols

The following table contains general warnings and their associated symbols.

Table 2-2 General warnings

<table>
<thead>
<tr>
<th>ISO</th>
<th>ANSI</th>
<th>Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td>⚠️</td>
<td>Warning - hazardous electrical voltage</td>
</tr>
<tr>
<td>⚠️</td>
<td>⚠️</td>
<td>Warning - explosive substances</td>
</tr>
<tr>
<td>⚠️</td>
<td>⚠️</td>
<td>Warning - entanglement hazard</td>
</tr>
<tr>
<td>⚠️</td>
<td>⚠️</td>
<td>Warning - hot surfaces</td>
</tr>
<tr>
<td>⚠️</td>
<td>⚠️</td>
<td>Warning - substances that can irritate or which are hazardous to health</td>
</tr>
<tr>
<td>⚠️</td>
<td>⚠️</td>
<td>Warning - caustic substances</td>
</tr>
<tr>
<td>⚠️</td>
<td>⚠️</td>
<td>Warning - suspended load</td>
</tr>
<tr>
<td>⚠️</td>
<td>⚠️</td>
<td>Warning - hand injuries</td>
</tr>
<tr>
<td>⚠️</td>
<td>⚠️</td>
<td>ATEX certification</td>
</tr>
</tbody>
</table>
2.5 Special types of danger and personal protective equipment

Requirements

Fulfil the following requirements before commencing work on the gear unit:

- Ensure that the oil pressure lines are depressurised.
- Only perform work on the gear unit when it is not in operation.
- Disconnect electrical systems from the power supply.

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric shock</td>
</tr>
<tr>
<td>Live parts can cause electric shock.</td>
</tr>
<tr>
<td>Ensure that the entire plant is de-energised before starting electrical installation work.</td>
</tr>
</tbody>
</table>

Protective equipment

Wear the following personal protective equipment when handling the gear unit:

- Safety shoes
- Overalls
- Helmet
- Safety gloves
- Safety goggles

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
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<tbody>
<tr>
<td>Risk of eye injury</td>
</tr>
<tr>
<td>Small foreign particles such as sand or dust can enter the cover plates of the rotating parts and be hurled back by them.</td>
</tr>
<tr>
<td>Wear safety goggles.</td>
</tr>
</tbody>
</table>

Dangers during operation

Damage to the gear unit is possible.
Switch the gear unit to standstill immediately if inexplicable changes are noticed during operation. Such changes may include unusual gear unit noise or a significant increase in operating temperature.

**WARNING**

**Risk of falling**
There is an increased risk of falling when standing or walking on the gear unit during operation. Only walk or stand on the gear unit and its mounted components for maintenance and repair work when it is at a standstill. Do not walk or stand on shaft ends, protection covers, mounted components or pipes.

**WARNING**

**Danger to life through rotating or moving parts**
There is danger that rotating or moving parts may catch hold of you or pull you in. Secure rotating and/or moving parts against contact using safeguards.

### Surface temperature

The surface temperatures of the gear unit can become very extreme depending on the operating conditions.

**WARNING**

**Risk of burns**
Possible risk of serious burn injury from hot surfaces (> 55 °C). Wear suitable protective gloves and protective clothing.

**WARNING**

**Risk of scalding**
Risk of serious injury possible through escaping hot operating media when these are being changed. Wear suitable protective gloves, safety goggles and protective clothing.

**WARNING**

**Danger due to low temperatures**
Possible risk of serious injuries due to frost (pain, numbness, frostbite) on cold surfaces (< 0 °C). Wear suitable protective gloves and protective clothing.
Chemical substances

Injuries can be sustained when using chemical substances.

**WARNING**

**Risk of chemical burns due to chemical substances**

There is a risk of chemical burns when handling aggressive cleaning agents. Please observe the manufacturer's guidelines on how to handle cleaning agents and solvents. Wear suitable protective equipment (gloves, safety goggles). Please use binding agents to immediately clear up any spilt solvent.

**CAUTION**

**Risk of injury due to chemically aggressive operating materials**

There is a risk of injury to eyes and hands when handling chemically aggressive operating materials. Please observe the safety instructions in the data sheets of the oil used. Wear suitable protective equipment (gloves, safety goggles). Use an oil-binding agent to immediately clean up spilt oil.

Danger of explosion

An explosion may occur in a potentially explosive atmosphere.

**DANGER**

**Danger of explosion through ignition of a potentially explosive atmosphere**

Danger to life through ignition of a potentially explosive atmosphere possible when operating the gear unit

Do not use the gear unit in potentially explosive atmospheres.

2.6 Intended use

Only use the gear unit according to the conditions specified in the service and delivery contract and the technical data in the annex (Page 109). Deviating operating conditions are considered improper use. The user or owner of the machine or plant is solely liable for any resulting damage.
When using the gear unit please specifically observe the following:

- Do not make any modifications to the gear unit which go beyond the permissible handling described in these operating instructions. This also applies to safety features designed to prevent accidental contact.
- Only ever use original spare parts. Other spare parts are not tested and approved by Siemens. Non-approved spare parts may possibly change the design characteristics of the gear unit and thus impair its active or passive safety. Siemens will accept no liability or warranty whatsoever for damage occurring as a result of the use of non-approved spare parts. The same applies to any accessories which were not supplied by Siemens.

If you have any queries, please contact Customer Services (Page 101).

<table>
<thead>
<tr>
<th>! WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk of falling</strong></td>
</tr>
<tr>
<td>Risk of possible serious injury through falling.</td>
</tr>
<tr>
<td>Only walk or stand on the gear unit for maintenance and repair work when it is at a standstill. Do not walk or stand on shaft ends, protection covers, mounted components or pipes.</td>
</tr>
</tbody>
</table>

**Gear unit use**

When using the gear unit, please observe the following basic rules:

- Ensure that the gear unit is operationally safe.
- The gear unit should only be operated, maintained or repaired by authorised, trained and suitably qualified personnel.
- The relevant work safety and environmental protection regulations must be complied with at all times during transport, assembly, dismantling, operation, maintenance and servicing.
- The outside of the gear unit must not be cleaned using high-pressure cleaning equipment.
- No welding work must be performed on the gear unit or on parts connected to it. The gear unit and any parts connected to it must not be used as an earthing point for electric-welding operations. Gearing and rolling-contact bearings might be irreparably damaged by welding.
- Perform potential equalisation in accordance with the applicable regulations and guidelines. If no threaded holes are available on the gear unit for an earth connection, please take suitable measures. This work must always be done by specialist electricians.
- In the case of gear units that are operated in combination with electrical machines that generate current or through which current flows (e.g. motors and generators), take measures to ensure that no current can flow through the gear unit. Current flowing through the gear unit can result in irreparable damage to rolling-contact bearings and gearing. Short circuits, voltage flashovers and deposits of conductive dust, for example, can all allow current to flow. Use insulators and earth the gear unit properly.
- When removing any protective devices, retain their fixings safely.
- Removed protective devices must be re-fitted prior to starting up.
• Pay attention to the notices attached to the gear unit such as the rating plate, direction arrow symbol etc. Notices must not be concealed by paint or dirt. Replace missing plates.

• Bolts which have been damaged during assembly or disassembly work must be replaced with new ones of the same strength class and type.

---

**DANGER**

**Danger to life due to live system**

Death or serious injury will occur.

Always shut down the gear unit and any oil supply system (whether separate or mounted on the gear unit) before you carry out any work. Secure the drive unit against being operated accidentally as follows:

- Turn off the key-operated switch.
- Remove the fuses in the power supply.
- Attach a notice to the start switch, clearly stating that work is being carried out on the gear unit.

Ensure that the entire unit is load-free so that no danger is posed when you start to dismantle components.

---

**Reactivating the gear unit**

When installing the gear unit in machines or systems, the machine or system manufacturers must ensure that the regulations, notes and descriptions contained in these operating instructions are incorporated in their own operating instructions.
3.1 General description

The FLENDER® gear unit (referred to below simply as "gear unit") described in these operating instructions has been developed to drive a wide range of machines in general machinery construction. This series of gear units is suitable for applications in the chemical, rubber, foodstuff and plastics industries, for example.

The helical gear unit is available as a two, three, or four-stage unit. The bevel-helical gear unit is available as a three or four-stage unit. These are designed for horizontal mounting. The gear unit is also available for other mounting positions on request.

It can essentially be operated in both directions of rotation. Gear units equipped with backstop or overrunning clutch are the exceptions in this case. Siemens must be consulted if, for these versions, the direction of rotation is to be reversed.

Designs

Various shaft arrangements (versions and directions of rotation) are possible. These are depicted schematically as a solid shaft below. The direction of rotation arrows indicate the dependency of the direction of rotation of the input and output shafts.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td><img src="#" alt="Diagram A" /></td>
<td><img src="#" alt="Diagram B" /></td>
<td><img src="#" alt="Diagram C" /></td>
<td><img src="#" alt="Diagram D" /></td>
<td><img src="#" alt="Diagram E" /></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td><img src="#" alt="Diagram A" /></td>
<td><img src="#" alt="Diagram B" /></td>
<td><img src="#" alt="Diagram C" /></td>
<td><img src="#" alt="Diagram D" /></td>
<td><img src="#" alt="Diagram E" /></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td><img src="#" alt="Diagram A" /></td>
<td><img src="#" alt="Diagram B" /></td>
<td><img src="#" alt="Diagram C" /></td>
<td><img src="#" alt="Diagram D" /></td>
<td><img src="#" alt="Diagram E" /></td>
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<tr>
<td>D</td>
<td></td>
<td><img src="#" alt="Diagram A" /></td>
<td><img src="#" alt="Diagram B" /></td>
<td><img src="#" alt="Diagram C" /></td>
<td><img src="#" alt="Diagram D" /></td>
<td><img src="#" alt="Diagram E" /></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td><img src="#" alt="Diagram A" /></td>
<td><img src="#" alt="Diagram B" /></td>
<td><img src="#" alt="Diagram C" /></td>
<td><img src="#" alt="Diagram D" /></td>
<td><img src="#" alt="Diagram E" /></td>
</tr>
</tbody>
</table>
### 3.2 Output shaft versions

The following versions of output shaft are available:

- **S** = solid shaft
- **D** = hollow shaft for shrink disk

The available versions of output shaft are illustrated in the diagram below:

![Diagram of output shaft versions]

- **S** Solid shaft  
- **D** Hollow shaft for shrink disk

Figure 3-1  Output shaft versions

---

**NOTICE**

**Destruction of the gear unit or parts of the gear unit due to incorrect direction of rotation is possible.**

Depending on the specific contract, the gear unit can have one direction of rotation if it is equipped with a backstop or overrunning clutch.

---

When an auxiliary drive is mounted (as maintenance or load drive), the assignment of the direction of rotation to the specific version is defined in the dimension drawing.
Further information

Additional information and a detailed illustrated description of the gear unit can be found in the dimension drawing provided in the complete gear unit documentation.

3.3 Housing

Introduction

The housing is made of cast iron. When specified, the housing can also be manufactured out of steel.

The gear unit housing has the following features:

- Attachment points for transporting the gear unit (from gear unit size 23 and higher, use a sling swivel (Page 53))
- Inspection cover for inspection
- Oil filling point for refilling with oil
- Oil sight glass, oil level indicator or dipstick for checking the oil level
- Oil drain screw or oil drain valve for changing the oil
- Air filter or wet-air filter for ventilation and bleeding

Further information

Additional information and a detailed illustrated description of the gear unit can be found in the dimension drawing provided in the complete gear unit documentation.

The lubrication points are designated using the following sign:

<table>
<thead>
<tr>
<th>○</th>
<th>Lubrication point</th>
<th>○</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lithium soap-based</td>
<td>grease</td>
</tr>
<tr>
<td>○</td>
<td>After operating hours</td>
<td>○</td>
</tr>
</tbody>
</table>

Figure 3-2 Sign: Lubrication point
Description

3.3 Housing

Gear unit equipment

The diagram below shows the available gear unit equipment on gear units of type H..H:

1. Sling swivel
2. Inspection and/or assembly cover
3. Housing
4. Alignment surfaces
5. Rating plate
6. Alignment thread
7. Cover
8. Gear unit fastening
9. Shaft seals
10. Fan cover
11. Fan

Figure 3-3 Gear unit equipment on gear units of type H..H

The diagram below shows the available gear unit equipment on gear units of type H..M:
The diagram below shows the available gear unit equipment on gear units of type H..M:

Figure 3-4  Gear unit equipment on gear units of type H..M

The diagram below shows the available gear unit equipment on gear units of type B..H:

Figure 3-5  Gear unit equipment on gear units of type B..H

The diagram below shows the available gear unit equipment on gear units of type B..M:
3.4 Oil supply to the gear unit

Introduction

The oil supply to the various gear unit components can be implemented using the following oil supply variants:

- Splash lubrication
- Pressure lubrication
- Combination of both oil supply variants

3.4.1 Splash lubrication

Unless otherwise agreed by contract, the gearing and rolling-contact bearings are supplied with an adequate quantity of oil by splash lubrication.

Further information

Additional information and a detailed illustrated description of the gear unit can be found in the dimension drawing provided in the complete gear unit documentation.
3.4.2 Pressure lubrication

At high input speeds or high gear circumferential velocities, depending on the particular contract, splash lubrication can be supplemented or replaced by pressure lubrication.

With pressure lubrication, the rolling-contact bearings and gears located above the oil level are adequately supplied with oil through pipes.

Designs

The following designs are possible:

- Mounted oil supply system
- Separate oil supply system

Further information

Additional information and a detailed illustrated description of the gear unit and the oil supply system can be found in the dimension drawing in the complete gear unit documentation.

Additional information about the oil supply system can be found in the separate data sheet, in the list of equipment and in the oil supply system operating instructions provided in the complete gear unit documentation.

Oil supply system with flange pump or motor pump

The oil supply system is mounted on the gear unit and comprises the following components:

- Flange or motor pump
- Double change-over filter
- Pressure monitor
- Piping

The diagram below shows a mounted oil supply system with flange pump or motor pump for type H...:
3.4 Oil supply to the gear unit

Figure 3-7 Mounted oil supply system with flange pump or motor pump for type H...

The diagram below shows a mounted oil supply system with flange pump or motor pump for type B...

Figure 3-8 Mounted oil supply system with flange pump or motor pump for type B...

**Note**

**Flow direction of the pump**

When connecting the valves, observe the flow direction of the pump.

Refer to the operating instructions to ascertain whether the flow direction of the pump used depends on the direction of rotation.

**Further information**

Additional information and a detailed illustrated description of the gear unit can be found in the dimension drawing provided in the complete gear unit documentation.
3.5 Bearing arrangement of the shafts

All shafts are mounted on rolling-contact bearings.

3.6 Shaft seal

Introduction

Depending on requirements, shaft seals prevent oil from escaping from the gear unit or dirt from entering the gear unit.

3.6.1 Rotary shaft sealing rings

Rotary shaft sealing rings are the standard seal used. Wherever possible, rotary shaft sealing rings are equipped with an additional dust lip which protects the actual sealing lip against external contaminants.

**NOTICE**

Irreparable damage to the rotary shaft sealing ring caused by high concentration of dust

A damaged rotary shaft sealing ring might not be able to effectively seal the gear unit. In very dusty atmospheres, do not use rotary shaft sealing rings unless they have additional protection.

The diagram below shows a rotary shaft sealing ring

![Rotary shaft sealing ring](image)

Figure 3-9  Rotary shaft sealing ring

3.6.2 Labyrinth seals

Labyrinth seals as non-contact seals prevent shaft wear. They do not require any maintenance and improve the temperature behaviour of the gear unit. Labyrinth seals can only be used with pressure lubrication and with a reduced oil level.
The spare parts drawing and spare parts list specify whether or not the gear unit is equipped with labyrinth seals.

A labyrinth seal is illustrated in the diagram below:

![Figure 3-10 Labyrinth seal](image)

To work reliably, labyrinth seals must be installed in stationary, horizontal positions without dirty water or any substantial amount of dust. Overfilling the gear unit can result in leaks, the same applies to oil with a high foam content.

### 3.6.3 Taconite seal

The taconite seal is a combination of two sealing elements:

- Rotary shaft sealing ring to prevent the escape of lubricating oil
- Grease-filled dust seal (comprising a labyrinth and a lamellar seal) to allow operation of the gear unit in extremely dusty environments

The taconite seal is ideal for use in dusty environments.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gear unit leaks caused by poor sealing</strong></td>
</tr>
</tbody>
</table>

Regrease the labyrinth seals at the specified regreasing intervals. The regreasing intervals are specified in the Maintenance schedule (Page 88).

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sparking, inadmissible temperature rise and shaft seal wear due to insufficient gap dimension</strong></td>
</tr>
</tbody>
</table>

Sparking, inadmissible temperature rise and shaft seal wear possible due to insufficient gap dimension

If the shaft is sealed by taconite seals, make sure that the set gap dimension of 1 mm at the grease labyrinth is not altered when the input and output elements (e.g. coupling components) are installed. Rotating and stationary parts must not touch.
3.6.4 Tacolab seal

**Application**

Only use Tacolab seals with pressure lubrication and with a reduced oil level.

**Features**

Tacolab seals are non-contact, low-maintenance seals that do not wear. It is not therefore necessary to interrupt operation in order to service or replace them.

The Tacolab seal is a combination of two sealing elements:

- Labyrinth seal comprising two labyrinth sealing rings to prevent the escape of lubricating oil
- Grease-filled dust seal (comprising a labyrinth and a lamellar seal) to allow operation of the gear unit in extremely dusty environments

A Tacolab seal is illustrated in the diagram below:

![Diagram of Tacolab seal]

**NOTICE**

Sparking, inadmissible temperature rise and shaft seal wear due to insufficient gap dimension

Sparking, inadmissible temperature rise and shaft seal wear possible due to insufficient gap dimension

If the shaft is sealed by Tacolab seals, make sure that the set gap dimension of 1 mm at the grease labyrinth is not altered when the input and output elements (e.g. coupling elements) are installed. Rotating and stationary parts must not touch.
For reliable operation, Tacolab seals require a stationary, horizontal installation position without any contact with dirty water - or high dust levels. Overfilling the gear unit can result in leaks, the same applies to oil with a high foam content.

**NOTICE**

**Gear unit leaks caused by poor sealing**

Gear unit leaks caused by poor sealing are possible.

Regrease the labyrinth seals at the specified regreasing intervals. The regreasing intervals are specified in the Maintenance schedule (Page 87).

---

**Further information**

Check in the spare parts drawing and the spare parts list as to whether the gear unit is equipped with Tacolab seals.

---

### 3.7 Backstop

#### Introduction

For some requirements, the gear unit can be equipped with a mechanical backstop. In operation, the backstop only permits the specified direction of rotation. The direction of rotation is specified at the gear unit input - and - output using an arrow.

The backstop is mounted to the gear unit through an intermediate flange creating an oil tight seal; the backstop is integrated in the gear unit oil circuit.
Principle of operation

The backstop is fitted with centrifugally-operated sprags. If the gear unit rotates in the specified direction, the inner ring rotates together with the sprag cage in the direction of rotation of the shaft, while the outer ring remains stationary. Above a certain speed (disengagement speed) the sprags disengage from the outer ring. In this operating state, the backstop operates without any wear.

**NOTICE**

**Damage to the backstop as a result of increased wear for operation below disengagement speeds**

Damage to the backstop as a result of increased wear for operation below disengagement speeds is possible.

Regularly replace the backstop when operating the gear unit with speeds below the disengagement speed of the backstop. Data indicating the replacement intervals is provided in the dimension drawing and on a plate attached to the gear unit. This plate is attached to the gear unit housing close to the backstop.

The diagram below shows a backstop:

![Diagram of a backstop showing parts labeled 1-6: cover, outer ring, inner ring, cage with sprags, residual oil drain, shaft]

**Figure 3-12 Backstop**

Before connecting the motor, identify the phase sequence of the three-phase mains using a phase sequence instrument. Connect the motor corresponding to the defined direction of rotation.
Description

3.8 Torque limiting backstop (special version)

The blocking direction of the backstop can be changed by turning over the cage. You must always contact Siemens in advance if you wish to change the blocking direction.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damage to the backstop and gear unit due incorrect direction of rotation</td>
</tr>
<tr>
<td>Damage to the backstop and gear unit due incorrect direction of rotation possible.</td>
</tr>
<tr>
<td>Do not operate the motor adversely to the blocking direction of the gear unit. Observe the note attached to the gear unit.</td>
</tr>
</tbody>
</table>

3.8 Torque limiting backstop (special version)

Introduction

A torque-limiting backstop is available for special applications, e.g. for multiple drives. This backstop is a combination of a backstop with centrifugally-operated sprags and a slip clutch.

Principle of operation

The sliding torque is adjusted using a number of springs. As a result of the "slippage", the gear unit and the sprags of the backstop are protected against inadmissibly high stresses when rotating backward. In addition, for multiple drives, the load is uniformly distributed across both gear units when rotating backwards.
The following diagram shows a torque-limiting backstop:

![Diagram of torque-limiting backstop]

1. Outer ring  
2. Guide screw with spring  
3. Locking wire  
4. Shaft (intermediate flange)  
5. Inner ring  
6. Cage with sprags  
7. Friction lining

Figure 3-13 Torque limiting backstop

Before connecting the motor, identify the phase sequence of the three-phase mains using a phase sequence instrument. Connect the motor corresponding to the defined direction of rotation.

You can change the blocking direction of the backstop by turning over the cage. You must always contact Siemens in advance if you wish to change the blocking direction.

**NOTICE**

*Damage to the backstop and gear unit due incorrect direction of rotation*

Damage to the backstop and gear unit due incorrect direction of rotation possible.

Do not operate the motor adversely to the blocking direction of the gear unit. Observe the note attached to the gear unit.

**Sliding torque**

The torque limiting backstop is mounted to the gear unit through an intermediate flange creating an oil tight seal; the backstop is integrated in the gear unit oil circuit.

The guide screws of the springs are locked using locking wire so that the slip torque that has been adjusted cannot be changed. The warranty is null and void if the locking wire for the screws is either missing or damaged.
Generally, the backstop operates without any wear. As a preventive measure, dimension \( x_{\text{min.}} \) should be checked each time that the backstop is actuated (only type FXRT) - and then it should be checked every 12 months.

It is not permissible that dimension \( x_{\text{min.}} \) specified on the backstop type plate is fallen below. Siemens must be contacted once this dimension is reached.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk of injury as a result of moving system parts</strong></td>
</tr>
<tr>
<td>There is a risk that after the motor is switched off the load cannot be securely kept in position, and that it can accelerate in the reverse direction. Do not change the value of the slipping torque. The slipping torque was set to the correct value in the factory.</td>
</tr>
</tbody>
</table>

### 3.9 Cooling

#### Introduction

The gear unit can be equipped with the following cooling equipment depending on requirements:

- Fan
- Cooling coil
- Separate oil supply system

When installing the gear unit, make sure that unhindered convection across the housing surface is possible in order to protect the gear unit against overheating.

#### 3.9.1 Fan

#### Principle of operation

Generally, the fan is mounted on the high-speed shaft of the gear unit and is protected from accidental contact using an air guide cover. The fan draws in air through the protective grille of the air guide cover and blows it along the lateral air ducts on the gear unit housing. The fan dissipates a certain amount of heat from the housing.
Improper use can damage the gear unit. Follow the instructions given below in order to protect the gear unit against overheating:

- When you install the protective device for the coupling or similar on gear units that are equipped with a fan, make sure that you leave sufficient clearance for cooling air to be drawn into the fan. The required clearance is specified in the dimension drawing in the complete documentation for the gear unit.
- Make sure that the air guide cover is correctly fastened.
- Protect the air guide cover against damage by external components.
- Make sure that there is no contact between the fan and the air guide cover.
- Note that the cooling effect can be significantly impaired if the fan is dirty or if the surface of the housing is covered with dust or contaminants that act as an insulating layer. Clean the fan and the gear unit. Observe the cleaning information in chapter Maintenance and servicing work (Page 89).

The diagram below shows a gear unit fan:

![Diagram of a gear unit fan]

The diagram below shows a gear unit fan:

Figure 3-14 Gear unit fan

Further information

Further information and a detailed illustration of the gear unit and the position of the mounted components can be found in the dimension drawings in the complete documentation for the gear unit.

3.9.2 Cooling coil

Introduction

The gear unit can be equipped with a cooling coil in the oil sump. The cooling coil is connected to a cooling water supply. The cooling water connection must be provided by the operator. The cooling water can be fresh water, sea water or brackish water.
Principle of operation

Heat from the gear unit oil is transferred to the cooling water as it flows through the cooling coil.

Note
To prevent the formation of condensation, make sure that the cooling coil is fully immersed in the oil.

Improper use can damage the cooling coil. Be sure to take the following precautions:

- Make sure that the cooling water pressure does not exceed 8 bar. The direction of water flow through the gear unit is optional.
- Make sure that the ends of the cooling coil are not twisted and that the reducer screws are not removed.
- If there is a risk of freezing temperatures, drain the cooling water out of the coil and blow the coil out with compressed air to remove any water residue.
- Use a suitable cooling water flow regulator (e.g. a pressure reducing valve or an appropriate isolation valve) in order to prevent excessive water pressure at the cooling water inlet.

WARNING
Risk of eye injury from compressed air
Water residue and dirt particles can cause damage to eyes.
Wear suitable safety goggles.

The diagram below shows the cooling coil connections:

![Diagram of cooling coil connections]

1. Output shaft
2. Cooling water connection
3. Reducer screw

Figure 3-15  Cooling coil connections

Further information
For further information and a detailed illustration of the gear unit and the connection dimensions, please refer to the dimension drawings in the complete gear unit documentation.
The required cooling water flow rate and the maximum permissible inlet temperature can be found in the separate data sheet, the list of equipment or the dimension drawing in the complete documentation for the gear unit.

3.9.3 Separate oil supply system

A separate oil supply system can be used for cooling the oil.

Further information

Further information about separate oil supply systems can be found in the oil supply system operating instructions in the complete documentation for the gear unit.

You can find additional information about the components of the oil supply system in the operating instructions for the components in the complete gear unit documentation.

You can find additional technical data in the separate data sheet and in the equipment list in the complete gear unit documentation.

3.10 Couplings

Flexible couplings or safety couplings are generally used at the input end of the gear unit.

Use of rigid couplings or other input or output elements that generate additional radial or axial forces (e.g. gear wheels, belt pulleys, flywheels or hydraulic couplings) must be agreed contractually.

Further information

You can find additional information about the couplings in the coupling operating instructions provided in the complete gear unit documentation.

3.11 Shrink disk

A shrink disk is provided as a frictional clamping connection between the gear unit hollow shaft and the driven machine on shaft-mounted gear units.

The shrink disk allows an interference fit to be created between a hollow shaft and a stub shaft (machine shaft), referred to hereafter as "stub shaft". The interference fit is capable of transferring torques, bending moments and forces. Crucial to the successful transmission of torques and/or power is the joint pressure between the hollow and stub shafts generated by the shrink disk.
Further information

Further information about the shrink disk can be found in the shrink disk operating instructions. These are included in the complete documentation for the gear unit.

3.12 Heating

Introduction

At low ambient temperatures it may be necessary to preheat the gear unit oil before switching on the drive or while it is in operation.

Heating elements

Heating elements can be used for these applications, for example. Heating elements convert electricity into heat and transfer this to the oil in which they are immersed. The heating elements are installed in protective tubes in the housing so that they can be replaced without draining off the oil first.

Complete immersion of the heating elements in the oil bath must be ensured by adhering to the installation position in accordance with the dimension drawings in the complete documentation and the oil level.

⚠️ WARNING

Explosion and fire hazard

Exposed heating elements pose a fire hazard.

Do not switch on the heating elements unless you have checked that they are completely immersed in the oil bath.

If heating elements are retrofitted, the heat output at the outer surface of the heating element must not exceed the maximum values stated in the table below.

The following table contains information about the specific heat output $P_{ho}$ as a function of ambient temperature:

<table>
<thead>
<tr>
<th>$P_{ho}$ in W/cm²</th>
<th>Ambient temperature in °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.9</td>
<td>10 to 0</td>
</tr>
<tr>
<td>0.8</td>
<td>0 to -25</td>
</tr>
<tr>
<td>0.7</td>
<td>-25 to -50</td>
</tr>
</tbody>
</table>
The diagram below shows gear unit heating:

![Diagram of gear unit heating with labels 1: Temperature monitor and 2: Heating element.]

Figure 3-16 Heating for gear units, type H... and B...

**Heating element control**

Heating elements can be controlled by a temperature monitor. The temperature monitor provides a signal to be amplified when the minimum and maximum temperatures are reached.

**Further information**

Further information about the position of the mounted components and a detailed illustration of the gear unit can be found in the dimension drawing in the complete documentation for the gear unit.

Further information about heating elements can be found in the separate data sheet, in the list of equipment and in the heating element operating instructions in the complete documentation for the gear unit.

Further information about the temperature monitor (such as control instructions) can be found in the temperature monitor operating instructions in the complete documentation for the gear unit.

**3.13 Oil level indicator**

The following components for visual monitoring of the oil level can be mounted on the gear unit:

- Oil sight glass
- Oil level indicator
- Oil dipstick

Check the oil level when the gear unit is stationary and with the oil in a cool state.
Further information

Further information about the oil level indicator and checking the oil can be found in the operating instructions BA 7300 in the complete documentation for the gear unit.

Further information and a detailed illustration of the gear unit and the position of the mounted components can be found in the dimension drawing in the complete documentation for the gear unit.

3.14 Oil-level monitoring system

Introduction

Depending on the order specification, the gear unit can be equipped with an oil-level monitoring system using a filling-level limit switch.

The oil-level monitoring system has been designed to check the oil level when the gear unit is at a standstill before it starts.

Mounting position

When using an oil-level monitoring system it is especially important to ensure that the gear unit is in a horizontal mounting position.

The diagram below shows the oil-level monitoring system for the gear unit:

![Diagram of oil-level monitoring system for gear units, types H... and B...](image)

Figure 3-17 Oil-level monitoring system for gear units, types H... and B...

Further information

Further information and a detailed illustration of the gear unit and the position of the mounted components can be found in the dimension drawing in the complete documentation for the gear unit.

Further information about oil level monitoring, control instructions and the technical data can be found in the operating instructions for the oil level monitor, in the list of equipment and in the separate data sheet in the complete documentation for the gear unit.
3.15 Oil temperature monitoring

Depending on the order specification, the gear unit can be fitted with a Pt 100 resistance thermometer for measuring the oil temperature in the oil sump.

To measure temperatures or temperature differences, connect the Pt 100 resistance thermometer to an evaluation unit (to be supplied by the customer). The resistance thermometer is fitted with a connector head for the wiring. A two-wire circuit is provided from the factory, but the customer can also install a three- or four-wire circuit.

The following diagram shows an oil temperature monitor mounted on the gear unit:

![Diagram of oil temperature monitoring system for gear units, types H... and B...]

Figure 3-18 Oil temperature monitoring system for gear units, types H... and B...

Further information

Further information and a detailed illustration of the gear unit and the position of the mounted components can be found in the dimension drawing in the complete documentation for the gear unit.

Further information about oil temperature monitoring (such as control instructions) and the technical data can be found in the operating instructions for the oil temperature monitor and in the list of equipment in the complete documentation for the gear unit.

3.16 Bearing monitoring

3.16.1 Bearing monitoring using a Pt 100 resistance thermometer

Depending on the order specification, the gear unit can be equipped with Pt 100 resistance thermometers to monitor the bearings.

You must connect the Pt 100 resistance thermometer to an evaluation unit provided by the customer to be able to measure temperatures or temperature differences. The resistance thermometer has a connection head for the wiring. A two-wire circuit is provided in the factory. However, customers can also configure a three or four-wire circuit.
The following diagram shows bearing monitoring using a Pt 100 resistance thermometer:

![Diagram of bearing monitoring using a Pt 100 resistance thermometer](image_url)

**Figure 3-19** Bearing monitoring using a Pt 100 resistance thermometer:

1. Pt 100 resistance thermometer

**Further information**

Further information and a detailed illustration of the gear unit and the position of the mounted components can be found in the dimension drawing in the complete documentation for the gear unit.

Further information about bearing monitoring using a Pt 100 resistance thermometer (such as control instructions) and the technical data can be found in the operating instructions for the Pt 100 resistance thermometer and in the list of equipment in the complete documentation for the gear unit.

### 3.16.2 Bearing monitoring by shock-pulse transducer

Depending on the order specification, the gear unit can be equipped with measuring nipples for monitoring the bearings.

These measuring nipples are used to attach shock-pulse transducers through a fast-release coupling; they are located on the housing close to the bearings to be monitored.
The following diagram shows a bearing monitoring system that uses a shock-pulse transducer:

![Diagram of bearing monitoring system with shock-pulse transducer](image)

1 Shock-pulse transducer

Figure 3-20  Bearing monitoring using shock-pulse transducer

Further information

Further information and a detailed illustration of the gear unit and the position of the mounted components can be found in the dimension drawing in the complete documentation for the gear unit.

3.16.3 Bearing monitoring by acceleration sensor

Depending on the order specification, the gear unit can be supplied with threaded holes in which acceleration sensors can be inserted. These threaded holes have an M6 or M8 thread depending on the variant.

The following diagram shows the fully assembled acceleration sensor (A), and the threaded connector (B) for variants 1 to 4:
3.16 Bearing monitoring

Figure 3-21  Fully assembled acceleration sensor (A), and threaded connector (B) for variants 1 to 4

The following diagram shows the fully assembled acceleration sensor (C), and the threaded connector (D) for variants 5A and 5B:

Figure 3-22  Fully assembled acceleration sensor (C), and the threaded connector (D) for variants 5A and 5B
Further information

Further information and a detailed illustration of the gear unit with attached sensors can be found in the dimension drawing in the complete documentation for the gear unit.

Further information about the sensors can be found in the operating instructions for the sensors.

3.17 Speed encoder

Depending on the order specification, an incremental speed encoder can be fitted. Customers must establish the wiring and provide the evaluation unit required.

The following diagram shows a speed encoder:

![Diagram of Speed Encoder]

Figure 3-23 Speed encoder

Further information

Further information and a detailed illustration of the gear unit and the position of the mounted components can be found in the dimension drawing in the complete documentation for the gear unit.

You can find further information about the speed encoder (such as control instructions) and technical data, in the speed encoder operating instructions and in the equipment list provided in the complete gear unit documentation.
3.18 Reversing mechanism

3.18.1 Overview

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger to life due to drive start-up</td>
</tr>
<tr>
<td>An electrical interlock with the limit switch must be provided to ensure that the drive assembly cannot be started up when the reversing mechanism is activated.</td>
</tr>
</tbody>
</table>

For specific applications, the gear unit can be equipped with a reversing mechanism. This can be used to reverse a driven machine (e.g. a sugar cane mill) that has become stuck or blocked in order to free it up again. In this case, the machine is reversed at a low input speed. The reversing mechanism comprises an auxiliary gear unit with motor and a clutch. It is connected to the main gear unit via a bell housing.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damage due to drive start-up</td>
</tr>
<tr>
<td>It must only be possible to start up the reversing mechanism motor at the machine (i.e. locally). Monitor the machine. React quickly to prevent damage caused by overloading.</td>
</tr>
<tr>
<td>If an oil supply system is mounted on the gear unit, it must be in operation.</td>
</tr>
</tbody>
</table>

The basic equipment configuration is shown in the following diagram:

![Diagram of reversing mechanism design](image)

A  Clutch "On"
①  Operating lever
②  Limit switch

B  Clutch "Off"
③  Locking bolt
④  Locking knob

Figure 3-24  Reversing mechanism design
Further information

Refer to the separate operating instructions for the auxiliary gear unit with motor and the clutch for more information about operating the reversing mechanism.

3.18.2 Operation

⚠️ DANGER

Danger to life through falling parts

If the drive starts up when the reversing mechanism is activated, pieces of equipment can become detached from the system and fall down.

An electrical interlock with the limit switch must be provided to ensure that the drive assembly cannot be started up when the reversing mechanism is activated.

The reversing mechanism can be switched on and off via the clutch. It is operated manually by the operating lever.

NOTICE

Damage to the gear unit and the reversing mechanism

The gear unit and the reversing mechanism might sustain damage. The reversing mechanism may only be activated when the drive is at a standstill.

Procedure

Proceed as follows to switch the reversing mechanism on and off via the clutch:

1. Before you operate the clutch, undo the locking bolt.
2. Pull the locking knob out of the retainer.
3. Switch on the reversing mechanism via the clutch.
   The switching operation actuates a limit switch. This limit switch prevents start-up of the drive assembly.
   The faces of the clutch teeth that engage as the clutch is actuated are bevelled so that the clutch rotates until it moves from "tooth to gap position" automatically when the connector ring is moved axially.
4. If the clutch does not rotate automatically, move the operating lever back into its starting position.
   By operating the motor of the reversing mechanism in inching mode or by handwheel adjustment, the wheels can be moved to a new position, so allowing the clutch to engage.

Further information

Refer to the separate operating instructions for the auxiliary gear unit with motor and the clutch for more information about operating the reversing mechanism.
3.18 Reversing mechanism
Application planning

4.1 Scope of delivery

The scope of delivery is listed in the shipping documents. Immediately upon receiving the gearbox, check that everything has been delivered. Report any damaged and/or missing parts to Customer Services (Page 101) immediately.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serious injury through defective product</td>
</tr>
<tr>
<td>Serious injury may occur.</td>
</tr>
<tr>
<td>If the gearbox exhibits any visible damage, you should not put it into operation.</td>
</tr>
</tbody>
</table>

4.2 Transport

General information

The gear unit is delivered fully assembled. Additional items such as shrink disks, couplings, oil coolers, pipework and valves may be delivered separately packaged, as necessary.

When transporting the gear unit, observe the following instructions to avoid damaging the gear unit:

- Always use suitable equipment to transport the gear unit.
- Transport the gear unit without oil filling and leave it in the transport packaging.
- Do not use incorrect attachment points.
  The threads in the end faces of the shaft ends may not be used for attaching lifting equipment.
- Do not use the pipework to move the gear unit.
- Ensure that the lifting equipment is adequately designed to accommodate the weight of the gear unit.
### WARNING

**Risk of crushing**

There is a risk of being crushed by a component that becomes detached because the hoisting gear and load suspension device are not suitable for handling it.

When lifting, please observe the load distribution information on the packaging.

When the product is in a raised position, transport it slowly and carefully to avoid injury to persons or damage to the gear unit.

### Attaching the gear unit

To transport the gear unit, only attach slings to the marked attachment points that are provided for this purpose.

Please observe the following when attaching slings to the load or raising, lowering or moving it:

- Do not exceed the specified load limits
- If you are using a load suspension device with several load hooks, make sure that the load is evenly distributed between them
- Note the eccentric centre of gravity
- Make sure that the lifting equipment is securely attached
- Keep your speed down when moving the load
- Do not allow the load to sway and do not attach the load to objects or structures inside the building
- Loads must not be suspended from the tip of a load hook
- Always place the products down on a level, non-slip and stable base

### DANGER

**Falling load**

There is a risk of fatal injury from falling loads if these have not been securely attached to the lifting equipment.

Never stand or sit under suspended loads. Do not exceed the load limits of the lifting equipment.

### Packaging

The gear unit is delivered fully assembled. Additional equipment is also delivered separately packaged, as necessary.

The gear unit may be packed in various forms, depending on the size of the unit and method of transport.
4.3 Attachment points

Sling swivels

Threads for screwing in transport lugs are provided on the gear unit to assist with its transportation during manufacture and installation.

The shear pulling must not exceed 45° when the lifting equipment is attached to sling swivels.

**Note**

**Damage to the gear unit during transport**

Using the wrong attachment points can cause damage when transporting large gear units.

Always use sling swivels for gear units larger than size 23.

Position of attachment points

The following diagram shows the position of the attachment points for gear units, type H.. with motor:

![Diagram showing attachment points]

**Figure 4-2** Position of the attachment points for gear units, type H.. with motor:

The following diagram shows the position of the attachment points for gear units, type B.. with motor:
4.3 Attachment points

The following diagram shows the position of the attachment points for gear units, type B.. with gear unit swing base:

Further information

Further information, a detailed illustration of the gear unit and the position of the attachment points can be found in the dimension drawings in the complete documentation for the gear unit.
5.1 General assembly instructions

The assembly work must be performed very carefully by authorised, trained and suitably instructed personnel. Liability will be disclaimed for damage caused by the incorrect performance of this work.

Requirements

Improper use can damage the gear unit. Be sure to take the following precautions:

- Protect the gear unit against falling objects and from becoming covered over.
- Do not perform any welding work anywhere on the drive.
- Do not use the gear unit as an earthing point for electric-welding operations.
- Use all of the fastening points fitted to the particular unit design.
- Replace any bolts that are no longer fit for use by new bolts of the same strength class and type.
- Make sure that sufficient hoisting gear is available.

Mounting position and attachment points

During the actual planning phase, be sure to allow for sufficient space around the gear unit to enable subsequent upkeep and maintenance work. Take suitable measures to ensure that unhindered convection across the housing surface is possible so that the gear unit does not overheat. Leave sufficient space to allow a free flow of air into gear units that are equipped with a fan.

The positions of the attachment points are shown in the dimension drawing. To ensure that the unit is properly lubricated during operation, please observe the mounting position specified in the dimension drawings.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating of the gear unit by external heat sources</td>
</tr>
<tr>
<td>The gear unit must not be heated by external heat sources (exposure to direct sunlight, for example) while it is in operation and measures must be taken where necessary to protect it.</td>
</tr>
<tr>
<td>You can take the following measures to protect the gear unit against this hazard:</td>
</tr>
<tr>
<td>• A sun shield</td>
</tr>
<tr>
<td>• An additional cooling device</td>
</tr>
<tr>
<td>• A temperature monitoring device with trip function in the oil sump</td>
</tr>
</tbody>
</table>

If you use a sun shield, this may cause a build-up of heat.
If you use a temperature monitoring device, it must be capable of issuing an alarm when the maximum permissible oil sump temperature is reached. It must also be capable of tripping the drive when the maximum permissible oil sump temperature is exceeded. The operator’s process might be interrupted when the drive is shut down.

**WARNING**

Ignition of vapours emitted from solvents.
There is a risk of injury due to ignition of vapours emitted from solvents when carrying out cleaning work.

Please note the following:
- Ensure adequate ventilation.
- Do not smoke.

### 5.2 Unpacking the gear unit

#### Introduction
The scope of delivery is listed in the shipping documents.

**WARNING**

Risk of serious injury due to defective product
A defective gear unit can result in serious injury.

Do not put the gear unit into operation if any damage is visible.

Contact Customer Services.

#### Requirement
Check that everything has been delivered immediately upon receipt.

**NOTICE**

Damage to the gear unit due to corrosion
Exposing the gear unit to moisture can result in damage from corrosion.

Do not damage or open the packaging prematurely if the packaging is designed to preserve the unit.
Procedure

To unpack and use the gear unit, proceed as follows:
1. Remove packaging and transport devices in accordance with regulations.
2. Perform a visual inspection for damage and accumulations of dirt.
3. Immediately report any damaged and/or missing parts to Customer Services.
4. Dispose of packaging material and transport devices in accordance with regulations.

5.3 Gear unit assembly

5.3.1 Foundation

Properties of the foundation
The foundation must have the following properties:
- Stability
- Designed for torsional rigidity
- Reaction forces from the gear unit must be braced

Requirements of the foundation
The foundation must meet the following requirements:
- Construct the foundation in such a way that it does not generate any resonance vibrations and that it is isolated against the transmission of vibrations from adjacent foundations.
- Design the foundation according to the relevant weight and torque, taking into account the forces acting on the gear unit.
- Align the foundation carefully with the equipment installed on the input and output sides of the gear unit.
- Take into account any elastic deformation that may be caused by operating forces.
- Install lateral stops to prevent displacement if external forces are acting on the gear unit.
Notice

Lack of stable foundation for the gear unit
Damage to the gear unit is possible if it is not mounted on a stable foundation.
Use bolts of at least strength class 8.8. Information and guidance on the tightening torque can be found in chapter Tightening procedure (Page 76). Tighten the fastening bolts and nuts to the specified tightening torque. When tightening the fastening bolts, make sure that the gear unit is free of mechanical stress.

Further information
Further information about dimensions, space requirements and arrangement of supply connections can be found in the complete documentation for the gear unit.

5.3.1.1 Mounting on a concrete foundation

Installation on a foundation frame

Use of incorrect attachment points
Use of incorrect attachment points may result in damage to the gear unit. To transport the gear unit, only attach slings to the attachment points provided for this purpose.
The threads in the end faces of the shaft ends may not be used for attaching lifting equipment. Lifting equipment must be adequately designed to accommodate the weight of the gear unit.

Requirements
The following requirements must be fulfilled before the assembly work commences:

- The foundation must be horizontal and level.
- When tightening the fastening bolts, make sure that the gear unit is free of mechanical stress.
NOTICE

Poor stability
Damage to the gear unit is possible if it is not mounted on a stable foundation.
The foundation frame must be horizontal and level.
It is particularly important that the surface on which the gear unit is mounted is level because
this determines the contact pattern of the teeth and the load on the bearings, and so has an
influence on the service life of the gear unit.
All points on the gear unit mounting surface must lie between two imaginary parallel planes
that are 0.1 mm per 1 m apart.

Procedure
To install the gear unit on a foundation frame, proceed as follows:
1. Clean the underside of the gear unit feet.
2. Use suitable hoisting gear to set the gear unit down on the foundation frame.
3. Tighten the foundation bolts to the specified tightening torque (Page 76). If necessary, install
   stops to prevent displacement.
4. Align the gear unit precisely with the input and output equipment (Page 63).
5. Record the alignment dimensions.
6. Keep the report in a safe place together with these operating instructions.

NOTICE
Damage caused by unevenly tightening the fastening bolts
The gear unit can be damaged by unevenly tightening the fastening bolts.
Evenly tighten the fastening bolts. When tightening the fastening bolts, make sure that the
gear unit is free of mechanical stress.

Mounting on a concrete foundation using foundation blocks

Requirement
The lower side of the gear unit mounting feet must be clean.
5.3 Gear unit assembly

Gear unit with foundation blocks

The following diagram shows a foundation block:

![Foundation block diagram]

1. Fastening bolt
2. Washer
3. Gear unit foot
4. Height of the completed foundation
5. Height of the prepared foundation
6. Foundation
7. Foundation block
8. Flat steel plate
9. Set screw

Figure 5-1 Foundation block

Procedure

Proceed as follows to mount the gear unit using foundation blocks:

1. Attach the foundation blocks with washers and fastening bolts in the foundation mounting points in the gear unit housing.

2. Using a suitable crane or lifting gear, place the gear unit down on the concrete foundation.

3. Align the gear unit so that the input and output shafts are horizontal using the set screws (if available) (Page 63).

4. For higher external forces, if necessary, use lateral stops to prevent the gear unit shifting.

5. Before casting the foundation, close the openings in the foundation blocks using a suitable material (e.g. using polystyrene).

6. Pour concrete into the recesses in the concrete foundation for the stone bolts or foundation blocks.

7. After the concrete has set, tighten the hexagon nuts of the stone bolts or fastening bolts of the foundation blocks with the specified tightening torque (Page 78).

NOTICE

**Damage caused by unevenly tightening the fastening bolts**

The gear unit can be damaged by unevenly tightening the hexagon nuts or fastening bolts. Evenly tighten the hexagon nuts or fastening bolts. Ensure that the gear unit is not deformed or distorted when tightening the fastening bolts.
Mounting on a concrete foundation using anchor bolts

Requirement

The lower side of the gear unit mounting feet must be clean.

Inserting the anchor bolt

The following diagram shows the inserted anchor bolt:

![Diagram of inserted anchor bolt]

1. Baseplate
2. Support
3. Fine-grout concrete
4. Raw foundation
5. Anchor bolt
6. Pressure plate
7. Wood
8. Hexagon nut

Figure 5-2 Inserted anchor bolt

Proceed as follows to insert the anchor bolt:

1. Place the support on the baseplate embedded in the fine-grout concrete.
2. Insert the anchor bolt.
3. Attach the pressure plate and tighten the nuts.
4. Place a piece of wood under the anchor bolt so that it is approximately 10 mm from the upper edge of the support.
5. Place the gear unit down.

NOTICE

Use of incorrect attachment points

Use of incorrect attachment points may result in damage to the gear unit. When transporting the gear unit, only attach it at the lifting eyes provided for the purpose.

The threads in the end faces of the shaft ends may not be used for attaching lifting equipment. Lifting equipment must be adequately designed to accommodate the weight of the gear unit.
Mounting the gear unit using anchor bolts

The following diagram shows a tightened anchor bolt:

![Diagram of anchor bolt components]

1. Hexagon nut
2. Washer
3. Housing foot
4. Fine-grout concrete
5. Raw foundation
6. Anchor bolt
7. Baseplate
8. Support

Figure 5-3  Tightened anchor bolt

Proceed as follows to mount the gear unit using anchor bolts:

1. Pull the anchor bolt upwards; to do this you can use a screw or threaded bar that you screw into the thread provided on the face side.
2. Attach the washer.
3. Screw on the hexagon nut by hand a few turns.
4. Align the gear unit with the supports (Page 63).
   - Observe the values on the alignment strips.
   - Maintain the alignment tolerances to the units connected at the input and output according to the permissible angular and axial displacements of the couplings.
5. Document the alignment dimensions in the form of a report, and archive this together with these instructions.
6. Keep the anchor bolts in their position by tightening the nuts by hand.
7. Locate the protective sleeve.
8. Attach the hydraulic clamping device.
9. Tighten the screws alternating, taking into account the preload forces (Page 78).
10. Tighten the hexagon nuts to their end stops using a suitable tool.
11. Document the tensioning pressures and preload forces, and archive this report together with these operating instructions.
5.3 Gear unit assembly

5.3.2 Mounting

5.3.2.1 Mounting on a housing foot

Description of assembly work

Measures to be taken prior to assembly

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect use of the preload tool</td>
</tr>
<tr>
<td>Incorrectly using the preload tool can result in injury.</td>
</tr>
<tr>
<td>To ensure correct handling and adjustment of the preload tool, you must carefully comply with the instructions provided in the manufacturers operating instructions for the preload tool.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate concrete hardness and strength</td>
</tr>
<tr>
<td>Damage caused by inadequate stability of the gear unit as a result of inadequate concrete hardness and strength is possible.</td>
</tr>
<tr>
<td>The fine-grout concrete must be allowed to harden for at least 28 days before tensioning the anchor bolts.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of chemical burns due to chemical substances</td>
</tr>
<tr>
<td>There is a risk of chemical burns when handling aggressive cleaning agents.</td>
</tr>
<tr>
<td>Please observe the manufacturer's guidelines on how to handle cleaning agents and solvents.</td>
</tr>
<tr>
<td>Wear suitable protective equipment (gloves, safety goggles). Please use binding agents to immediately clear up any spilled solvent.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of burns</td>
</tr>
<tr>
<td>There is a risk of serious burn injury from hot surfaces (&gt; 55 °C).</td>
</tr>
<tr>
<td>Wear suitable protective gloves and protective clothing.</td>
</tr>
</tbody>
</table>
Improper use can damage the gear unit. Be sure to take the following precautions:

- Use a suitable cleaning agent to remove the corrosion protection from the shafts.
- Do not allow the cleaning agent to come into contact with the shaft-sealing rings.
- Mount the input elements (e.g. coupling parts) on the shafts and lock them securely.
- If these input elements must be fitted hot, the joining temperatures required are listed in the dimension drawings in the coupling operating instructions.
- Unless otherwise specified, heat the coupling parts by an induction heater, with a torch or in an oven.
- The elements must be quickly pulled onto the shaft as far as stated in the dimension drawing prepared in accordance with order specifications.

### NOTICE

**Risk of damage to shaft sealing rings due to heat**

Shaft sealing rings can be damaged if they are heated up to over 100 °C. Use the appropriate heat shields to protect against radiant heat.

### NOTICE

**Damage as a result of blows or impact**

Damage in the gear unit as a result of blows or impact as possible. Pull on the coupling using the appropriate pulling equipment. Avoid damaging the shaft sealing rings and the shaft running surfaces when fitting coupling parts.

### NOTICE

**Poor alignment**

The gear unit or individual components can be damaged as a result of poor alignment. When installing and mounting the drive ensure that the individual components are precisely aligned with one another. Inadmissibly high alignment errors of the shaft ends to be connected as a result of angular or axial offset result in premature wear and material damage. Base frames or substructures that are too soft can cause the coupling parts to become radially and/or axially displaced during operation. This displacement is not measurable when the drive is at a standstill.

### Further information

Further information about removing the corrosion protection can be found in the operating instructions BA 7300 in the complete documentation for the gear unit.
Additional information on how gear units should be attached which, as a result of their weight, require a crane or lifting gear, is provided in chapter Application planning (Page 51).

If the gear unit is transported with mounted parts and components, then it may be necessary to use additional attachment points. The position of these attachment points can be found in the order-specific dimension drawing in the complete documentation for the gear unit.

Alignment

Depending on the order specification, the top of the housing has machined surfaces (alignment surfaces) to assist with provisional alignment of the gear unit in the horizontal direction.

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of fatal injury from flying fragments</td>
</tr>
</tbody>
</table>
Failure to align the unit with the required degree of accuracy can cause the shaft to rupture. A ruptured shaft can result in serious or even fatal injuries.
Align the gear unit exactly so that it conforms to the specified alignment values.
Damage to the gear unit or its components or mounted parts is possible.
The accuracy of the alignment between the shaft axes largely determines the service life of the shafts, bearings and couplings. Please therefore always endeavour to achieve zero deviation in the alignment of the shaft axes (does not apply to ZAPEX couplings). In this context, please also refer to the relevant operating instructions for further information about, for example, the requirements of couplings.

Procedure

The gear unit can be equipped with alignment threads in the housing feet to make it simpler to align.

![Alignment surface](image)

To align the gear unit by its alignment surface, proceed as follows:

1. For the precise position of the alignment surfaces, refer to the dimension drawings in the complete documentation.
2. Note the values inscribed in the alignment surfaces.
3. Use these surfaces as a guide for aligning the gear unit horizontally to ensure that it will run smoothly.
The following diagram shows the alignment surfaces and alignment thread at the gear units:

![Diagram of gear unit showing alignment surfaces and thread]

1. Alignment surfaces
2. Alignment thread

Figure 5-5  Alignment surfaces and alignment thread at the gear unit

Further information

Further information and the precise position of the alignment thread are provided in the dimension drawing in the overall gear unit documentation.

Tools

The following tools are needed to perform the final fine alignment (Page 71) work on the shaft axes of the gear unit and the equipment installed on the input and output sides.

- Rulers
- Spirit level
- Dial gauge
- Feeler gauge etc.

Once the gear unit is finely aligned, tighten the foundation bolts and check the settings again. Record the alignment dimensions and keep the report in a safe place together with these operating instructions.
5.3.3 Mounting the torque arm for the gear unit housing

5.3.3.1 Mounting the torque arm

**NOTICE**

Damage to the gear unit due to incorrect mounting of the motor and torque arm

Damage to the gear unit due to incorrect mounting of the motor and torque arm is possible. The motor and torque arm may only be mounted after prior consultation with Siemens. Mount the torque arm to the machine side without causing any distortion or deformation.

The following diagram shows the torque arm for the gear unit housing:

![Torque arm diagram](image)

1. Machine side
2. Elastic pedestal

Figure 5-6 Torque arm for the gear unit housing

**Further information**

Further information about constructing the foundation for gear units with a torque arm can be found in chapter Foundation (Page 57).

5.4 Shaft-mounted gear unit with hollow shaft and shrink disk

**Introduction**

The shaft end of the driven machine shaft (material C60+N or higher strength) should have a hole centred in its end face as defined by DIN 332, form DS (with thread).

**Further information**

Further information about the connection dimensions of the driven machine shaft can be found in the dimension drawing in the complete documentation for the gear unit.
5.4.1 Assembly

Measures to be taken prior to assembly

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk of injury due to chemical substances</strong></td>
</tr>
<tr>
<td>Observe the manufacturer's guidelines on how to handle lubricants and solvents.</td>
</tr>
<tr>
<td>Wear suitable protective clothing.</td>
</tr>
</tbody>
</table>

Improper use can damage the gear unit. Be sure to take the following precautions:

- Use a suitable cleaning agent to remove the corrosion protection from the hollow shaft and the machine shaft.
- Inspect the hollow shaft and machine shaft for damaged seats and edges.
- If necessary, rework the components with an appropriate tool and then clean them again.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk of damage to shaft sealing rings</strong></td>
</tr>
<tr>
<td>Aggressive chemical cleaning agents may cause damage to shaft sealing rings.</td>
</tr>
<tr>
<td>Do not allow the cleaning agent to come into contact with the shaft-sealing rings.</td>
</tr>
</tbody>
</table>

Note

The bore of the hollow shaft and the machine shaft must be free of any grease

Make sure that the hollow shaft bore and the machine shaft are completely free of grease in the area around the shrink disk seat. The reliability with which torque is transmitted depends to a large extent on this.

Do not use any contaminated solvents or soiled cleaning cloths, nor any cleaning agents that contain oil (such as petroleum or turpentine) to degrease the surfaces.
5.4.1.1 Pulling on with integrated DU bushing

Procedure

**NOTICE**

**Damage to the gear unit**

The gear unit can become damaged if it skews during assembly.

The hollow shaft must be flush with the machine shaft during assembly of the gear unit on the machine shaft. The gear unit must be prevented from skewing.

**NOTICE**

**Damage to the rolling-contact bearings**

The rolling-contact bearings can become damaged if the gear unit skews during mounting.

The hollow shaft may be mounted on a machine shaft shoulder only if the gear unit features one of the following:

- Torque arm
- Elastic pedestal
- Supported by gear unit swing base

Proceed as follows to mount the gear unit with hollow shaft and shrink disk onto the driven machine shaft with integrated DU bushing:

1. Use suitable hoisting gear to lift the gear unit.

2. Mount the gear unit using the nut and screw spindle.
   
   The gear unit is supported by the end plate in the hollow shaft.

3. Pull on the gear unit with hollow shaft up to the seat below the shrink disk on the machine shaft.

   The machine shaft centres itself in the seat below the shrink disk and in the DU bushing.

4. Mount the hollow shaft against the machine shaft collar:

**Special aspects of shaft-mounted gear units with hollow shaft and shrink disk**

Pull on the gear unit with hollow shaft up to the seat below the shrink disk on the machine shaft. The machine shaft centres itself in the seat below the shrink disk and in the DU bushing.
The following diagram shows the preparation for gear units with hollow shaft and shrink disk:

- Screw spindle
- Jacking screw
- Nut
- Locking ring
- End plate
- Machine shaft
- Hollow shaft
- DU bushing

Figure 5-7 Preparation for gear units with hollow shaft and shrink disk

Parts 1, 2 and 3 are not included in the scope of delivery.

5.4.1.2 Axial locking

Tightening the shrink disk as per specification ensures that the gear unit is properly axially locked. It is not necessary to install any further axial locking elements.

5.4.2 Dismantling the shaft-mounted gear unit

Procedure

1. Dismantle the shrink disk.
2. Lift the gear unit off the machine shaft using jacking screws until the seats under the shrink disk and the DU bushing are exposed.
3. Use suitable hoisting gear to lift the gear unit off the machine shaft.
**NOTICE**

**Use of incorrect attachment points**

Use of incorrect attachment points may result in damage to the gear unit.

- Only attach the gear unit at the lifting eyes provided for this purpose.
- Do not use the pipework to move the gear unit. The pipework must not be damaged.
- Do not use the threads in the end faces of the shaft ends for attaching lifting equipment to transport the gear unit.
- Lifting equipment must be adequately designed to accommodate the weight of the gear unit.

---

**5.5 Couplings**

**Introduction**

The coupling parts might become misaligned as a result of:

- Failure to accurately align the parts during assembly
- During operation of the system:
  - Due to thermal expansion
  - Due to shaft deflection
  - Due to machine frames that are too soft

**NOTICE**

**Damage or destruction of the coupling through incorrect alignment**

Refer to the coupling operating instructions for the maximum permissible displacements. Under no circumstances may these values be exceeded in operation.

Angular and radial displacement might occur simultaneously. Make sure that the total value of both displacements does not exceed the maximum permissible angular or radial displacement value.

If couplings from other manufacturers are to be used, then, specifying the radial loads that occur, ask the manufacturer which alignment errors are permissible.

The following diagram shows the possible displacements:
Alignment

Alignment must be carried out in two axis planes that are vertical with respect to one another. This is possible using rulers (radial offset) and feeler gauges (angular offset) as shown in the diagram. You will achieve a greater degree of alignment accuracy by using a dial gauge or laser alignment system.

The diagram below shows the alignment process based on the example of a flexible coupling:

![Alignment diagram](image)

1. Ruler
2. Feelers gauge
3. Measuring points

---

**Note**

It is advisable to insert shims or metal sheets under the mounting feet in order to align the drive components in the vertical direction. It is helpful to use support paws with adjusting screws on the foundation to adjust the drive components laterally.

**Note**

**Gear unit with motor bell housing**

Couplings do not have to be aligned if the gear unit and motor are connected through a motor bell housing.
Further information

You can find additional information about the permissible alignment errors for Siemens couplings in the complete documentation for the gear unit.

If couplings from other manufacturers are to be used, then, specifying the radial loads that occur, ask the manufacturer which alignment errors are permissible.

Hollow output shaft and output flange shaft

There is no need to install the output-side coupling for gear units with a hollow output shaft or flanged output shaft.

5.6 Connecting components

5.6.1 Gear units with mounted components

Depending on the order specification, the gear unit can be equipped with various components.

Connect the closed-loop control and open-loop control electrical devices corresponding to the specifications of the device supplier.

Further information

You can find additional information on operation and maintenance in the associated operating instructions, provided in the complete gear unit documentation.

You can find the technical data of the mounted components in the contract-list of equipment provided in the complete gear unit documentation.

5.6.2 Connecting the cooling coil

Procedure

To connect the cooling coil to the gear unit, proceed as follows:

1. Before connecting the cooling coil, remove the sealing plugs from the connection sleeves.
2. Flush through the cooling coil to remove any dirt or dust.
3. Connect up the cooling water inlet and drain lines. Refer to the dimension drawing for the position of the connections.
Further information

Further information about the cooling coil can be found in the complete documentation for the gear unit.

Note

Observe the information provided in chapter Cooling coils (Page 37).

5.6.3 Installing a separate oil supply system

Procedure

To connect the oil supply system to the gear unit, proceed as follows:

1. Remove the dummy flange from the suction and delivery line before connecting the system.
2. Mount the system on the gear unit in accordance with the dimension drawings in the complete documentation, or install it as a separate system.
3. Avoid distorting the piping when installing.

Further information

Further information about the oil supply system can be found in the oil supply system operating instructions in the complete documentation for the gear unit.

5.6.4 Connecting the pressure monitor

For gear units with mounted oil supply system or separate oil supply system, you must connect the pressure monitor so that it functions correctly.

Further information

You can find additional information on pressure monitoring in the pressure monitor operating instructions, provided in the complete gear unit documentation.

5.6.5 Connecting the heating element

Procedure

To connect heating elements to the gear unit, proceed as follows:

1. Check that the heating element connection is not damaged.
2. Install the electrical wiring for the heating elements.
Further information
Further information about the heating can be found in the heating operating instructions in the complete documentation for the gear unit.

5.6.6 Connecting the oil-level monitoring system

Procedure
To connect the oil-level monitoring system to the gear unit, proceed as follows:
1. Ensure that the filling level limit switch connection is not damaged.
2. Electrically connect the filling level limit switch.
3. Connect the signal so that for the "oil level too low" signal, the drive motor cannot start and an alarm is output. Bypass this signal in operation.

Further information
Additional information about the oil-level monitoring system can be found in the operating instructions for the oil-level monitoring system components provided in the complete gear unit documentation.
You can find technical data in the separate data sheet and in the equipment list in the complete gear unit documentation.

5.6.7 Connecting a speed encoder

Procedure
To connect the air-oil cooler to the gear unit, proceed as follows:
1. Ensure that the speed encoder connection is not damaged.
2. Electrically connect the speed encoder.

Further information
You can find additional information on the speed encoder in the speed encoder operating instructions, provided in the complete gear unit documentation.
5.6.8 Electrical connections

Procedure

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric shock</td>
</tr>
<tr>
<td>Live parts can cause electric shock.</td>
</tr>
<tr>
<td>Ensure that the entire plant is de-energised before starting electrical installation work. Carefully observe the five safety rules (Page 13).</td>
</tr>
</tbody>
</table>

To connect the motors and monitoring devices, proceed as follows:

1. Ensure that the connections of the motors and monitoring devices are not damaged.
2. Connect the motors and monitoring devices according to the terminal diagram.

Further information

You can find additional information about the electrical connections in the terminal diagrams and equipment lists provided in the complete gear unit documentation.

5.7 Tightening procedure

5.7.1 Introduction

Bolts

The bolts must have the following properties:

- Made of steel
- Black-annealed or phosphatised
- Lightly oiled (do not add additional oil)

Note

Replacing bolts

Replace any bolts that are no longer fit for use by bolts of the same type and strength class.
Mating threads

The mating threads must have the following properties:

- Made of steel or cast iron
- Dry, cut threads

Note

Using a lubricant

As a rule, lubricants may not be used, because this can result in the bolt connection becoming overloaded.

5.7.2 Bolt connection classes

In order to affix fastening bolts, note the information in the following table:

<table>
<thead>
<tr>
<th>Mounting</th>
<th>Bolt connection class</th>
<th>Scatter of the torque emitted on the tool</th>
<th>Tightening procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gear unit</td>
<td>C</td>
<td>± 5 % to ± 10 %</td>
<td>• Hydraulic tightening with mechanical screwdriver</td>
</tr>
<tr>
<td>Motor</td>
<td></td>
<td></td>
<td>• Torque-controlled tightening with a torque wrench or a signal-emitting torque wrench</td>
</tr>
<tr>
<td>Brake</td>
<td></td>
<td></td>
<td>• Tightening with a precision mechanical screwdriver with dynamic torque measurement</td>
</tr>
<tr>
<td>Torque arm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection cover</td>
<td>D</td>
<td>± 10 % to ± 20 %</td>
<td>• Torque-controlled tightening with mechanical screwdriver</td>
</tr>
<tr>
<td>Sun shield</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Further information

You can find additional information about tightening torques when mounting motor and brake in the operating instructions from the particular manufacturer.
5.7.3 Tightening torques and preload forces

The specified bolted connections must be tightened to the torques stated in the table below:

The tightening torques apply to friction values of $\mu_{\text{total}} = 0.14$.

The following table lists the preload forces and tightening torques for bolt connections, strength classes 8.8; 10.9; 12.9:

Table 5-2 Preload forces and tightening torques

<table>
<thead>
<tr>
<th>Nominal thread diameter</th>
<th>Bolt strength class</th>
<th>Preload force for bolt connection classes from the table in chapter Bolt connection classes (Page 77)</th>
<th>Tightening torque for bolt connection classes from the table in chapter Bolt connection classes (Page 77)</th>
</tr>
</thead>
<tbody>
<tr>
<td>d mm</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>$F_{\text{Mmin.}}$ N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M10</td>
<td>8.8</td>
<td>18 000</td>
<td>11 500</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>26 400</td>
<td>16 900</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>30 900</td>
<td>19 800</td>
</tr>
<tr>
<td>M12</td>
<td>8.8</td>
<td>26 300</td>
<td>16 800</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>38 600</td>
<td>24 700</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>45 100</td>
<td>28 900</td>
</tr>
<tr>
<td>M16</td>
<td>8.8</td>
<td>49 300</td>
<td>31 600</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>72 500</td>
<td>46 400</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>85 000</td>
<td>54 400</td>
</tr>
<tr>
<td>M20</td>
<td>8.8</td>
<td>77 000</td>
<td>49 200</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>110 000</td>
<td>70 400</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>129 000</td>
<td>82 400</td>
</tr>
<tr>
<td>M24</td>
<td>8.8</td>
<td>109 000</td>
<td>69 600</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>155 000</td>
<td>99 200</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>181 000</td>
<td>116 000</td>
</tr>
<tr>
<td>M30</td>
<td>8.8</td>
<td>170 000</td>
<td>109 000</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>243 000</td>
<td>155 000</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>284 000</td>
<td>182 000</td>
</tr>
<tr>
<td>M36</td>
<td>8.8</td>
<td>246 000</td>
<td>157 000</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>350 000</td>
<td>224 000</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>409 000</td>
<td>262 000</td>
</tr>
<tr>
<td>M42</td>
<td>8.8</td>
<td>331 000</td>
<td>212 000</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>471 000</td>
<td>301 000</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>551 000</td>
<td>352 000</td>
</tr>
<tr>
<td>M48</td>
<td>8.8</td>
<td>421 000</td>
<td>269 000</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>599 000</td>
<td>383 000</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>700 000</td>
<td>448 000</td>
</tr>
<tr>
<td>M56</td>
<td>8.8</td>
<td>568 000</td>
<td>363 000</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>806 000</td>
<td>516 000</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>944 000</td>
<td>604 000</td>
</tr>
</tbody>
</table>
### 5.8 Final work

#### Measures

Once all the components have been assembled or connected, perform the following final work:

- Check whether all devices dismantled for transportation have been reassembled.
- Check all bolt connections for tightness after installation of the gear unit has been completed.
- Check the alignment after tightening the fastening elements. The alignment must not have changed in any way.
- Lock the oil drain valves against accidental opening.
- Protect the gear unit against falling objects.
- Check that the guards over rotating parts are securely fastened.
  Contact (accidental or deliberate) with rotating parts is not permitted.
- Perform potential equalisation in accordance with the applicable regulations and guidelines. If no threaded holes are available on the gear unit for an earth connection, please take suitable alternative measures. This work must always be done by specialist electricians.
- Protect the cable entries against penetrating moisture.

#### Table: Preload Force and Tightening Torque for Bolt Connection Classes

<table>
<thead>
<tr>
<th>Nominal thread diameter</th>
<th>Bolt strength class</th>
<th>Preload force for bolt connection classes from the table in chapter Bolt connection classes (Page 77).</th>
<th>Tightening torque for bolt connection classes from the table in chapter Bolt connection classes (Page 77).</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>Fmin</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>M64</td>
<td>8.8</td>
<td>744 000</td>
<td>476 000</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>1 060 000</td>
<td>676 000</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>1 240 000</td>
<td>792 000</td>
</tr>
<tr>
<td>M72x6</td>
<td>8.8</td>
<td>944 000</td>
<td>604 000</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>1 340 000</td>
<td>856 000</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>1 570 000</td>
<td>1 000 000</td>
</tr>
<tr>
<td>M80x6</td>
<td>8.8</td>
<td>1 190 000</td>
<td>760 000</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>1 690 000</td>
<td>1 100 000</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>1 980 000</td>
<td>1 360 000</td>
</tr>
<tr>
<td>M90x6</td>
<td>8.8</td>
<td>1 510 000</td>
<td>968 000</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>2 150 000</td>
<td>1 380 000</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>2 520 000</td>
<td>1 600 000</td>
</tr>
<tr>
<td>M100x6</td>
<td>8.8</td>
<td>1 880 000</td>
<td>1 200 000</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>2 670 000</td>
<td>1 710 000</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>3 130 000</td>
<td>2 000 000</td>
</tr>
</tbody>
</table>
Further information

Further information about the gear unit and all assembled elements can be found in the operating instructions for assembled elements in the complete documentation for the gear unit. You can find additional technical specifications in the separate data sheet in the complete gear unit documentation.
Commissioning

6.1 Measures prior to commissioning

Take the following measures before commissioning the gear unit:

- Read and observe the operating instructions.
- Replace the screw plug with the air filter or the wet-air filter. Read operating instructions BA 7300 for further information.
- Gear units with backstop: Observe the appropriate measures prior to commissioning gear units equipped with backstop.
- Gear unit with auxiliary drive: Observe the appropriate measures prior to commissioning gear units equipped with auxiliary drive.
- Fill the gear unit with oil.
- Gear unit with oil supply system: Check that the oil supply system is working properly.
- Check the oil level.
- Check the gear unit for leaks.
- Gear unit with oil supply system: Observe the appropriate measures prior to commissioning gear units equipped with oil supply system.
- Ensure that all pipes and components are filled with oil.

Further information

Further information about oil and replacement of air filters can be found in the operating instructions BA 7300 in the complete documentation for the gear unit.

Further information about individual components can be found in the operating instructions for the components in the complete documentation for the gear unit.

6.1.1 Gear unit with backstop

Take the following measures before commissioning the gear unit with backstop:

- Fill the backstop with oil (Page 91).
- Check that the backstop can be easily rotated in the free-wheeling direction without having to exert excessive force. When doing this, observe the direction of rotation arrows at the gear unit.
- Before connecting the motor, identify the phase sequence of the three-phase mains. Connect the motor corresponding to the defined direction of rotation.
6.1 Measures prior to commissioning

### 6.1.2 Gear units with cooling coil

Implement the following measures before commissioning the gear unit with cooling coil:

- Make sure that the pressure in the cooling coil does not exceed the maximum permissible pressure.
- Make sure that the temperature of the cooling coil does not exceed the maximum permissible temperature.

**Further information**

Further information about the cooling coil can be found in the separate data sheet and the list of equipment in the complete documentation for the gear unit.

### 6.1.3 Gear unit with reversing mechanism

Take the following measures before commissioning a gear unit with a reversing mechanism:

- Make sure that the operating lever of the reversing mechanism is in the "Off" position.
- Make sure that the locking knob engages.
- Make sure that the locking bolt is tight.

**Further information**

Refer to the separate operating instructions for the auxiliary gear unit with motor and the clutch for more information about operating the reversing mechanism.
6.1.4 Gear units with oil supply system

Implement the following measures before commissioning the gear unit with oil supply system:

- Ensure that the maximum permissible pressure in the oil supply system components is not exceeded.
- Ensure that the maximum permissible temperature of the oil supply system components is not exceeded.
- Using the oil supply system, lubricate the gear unit for 2 minutes using a pre-lubrication phase. During this time, the rolling-contact bearings and gearing are supplied with sufficient oil for starting. Carefully ensure that the pre-lubrication phase is not longer than 5 minutes as the oil can foam up at low temperatures. For oil temperatures below 10 °C, heat up the oil using suitable measures and contact Siemens in this regard.

Further information

You can find additional information on the oil cooling system in the separate data sheet, and in the equipment list in the complete gear unit documentation.

6.2 Measures during commissioning

Please observe the following measures to commission the gear unit and document these:

- For gear units with oil supply system: Check that the oil supply system is working properly.
- Check the oil level.
- Measure the oil sump temperature (Page 90) after the gear unit has run in.
- Check that the shaft seal on the gear unit does not leak.
- Check that no contact with rotating parts is possible.
- Check whether the shutoff valves are open.
  - Check that all of the oil drain valves are closed.
  - Ensure that all of the other shutoff valves are open.
- Check all the connection lines are securely tightened and leak-free.
- For gear units with bearing monitoring by measuring the vibration: Measure the vibration levels of the rolling-contact bearings (Page 93) to create initial and comparison values.
- When commissioning, the pressure monitor signal should be bypassed for approximately 20 seconds. This is necessary as the pressure in the gear unit must first stabilise.

Further information

You can find additional information on the topic of oil in the operating instructions BA 7300, provided in the complete gear unit documentation.

Further information about the oil supply system can be found in the oil supply system operating instructions in the complete documentation for the gear unit.
6.2.1 Heating

Please observe the following measures to commission the gear unit with heating:

- Ensure that the heating elements are not exposed.
- Check the switching points of the temperature monitor.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>The oil sump can catch fire</td>
</tr>
</tbody>
</table>

The oil sump can catch fire if exposed heating elements are switched on. Never switch on the heating elements until you have checked that they are completely immersed in the oil bath.

Further information

Further information about heating elements can be found in the heating element operating instructions in the complete documentation for the gear unit.
7.1 Operating data

Introduction

To ensure correct, trouble-free operation of the system, observe the operating data of the gear unit. The valid operating data can be found in the annex Technical data.

The following operating data apply to the oil:

<table>
<thead>
<tr>
<th>Table 7-1</th>
<th>Operating data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average operating temperature</td>
<td>90 °C is applicable for mineral oil, API groups I or II and saturated synthetic ester</td>
</tr>
<tr>
<td>Maximum operating temperature</td>
<td>100 °C is applicable for semi-synthetic oils, API group III, PAO and PG oils</td>
</tr>
<tr>
<td>Oil pressure of the oil supply system</td>
<td>&gt; 0.5 bar</td>
</tr>
</tbody>
</table>

Further information

You can find additional technical data of the gear unit in the separate data sheet and in the equipment list in the complete gear unit documentation.

7.2 Irregularities in operation

Introduction

Switch off the drive assembly immediately if it exhibits irregular behaviour during operation. A few irregularities are listed below as examples:

- Oil temperature exceeds the maximum permissible value
- Alarm tripped by the pressure monitor in the oil cooling system or oil supply system
- Unusual operating noise

NOTICE

Faults can cause damage to the gear unit

The gear unit might sustain damage if it is not shut down when a fault occurs.

Switch off the drive assembly immediately if any fault condition develops.
Rectifying irregularities in operation

Proceed as follows to rectify any irregularities in operation:

1. Switch off the drive assembly if it exhibits irregular behaviour during operation.
2. Refer to the Fault information (Page 95) to find the cause of the fault.
3. If you still cannot determine the fault cause, contact Siemens Customer Services.

7.3 Taking the unit out of service

If you take the unit out of service for a prolonged period, you must take the following measures depending on the length of time that the gear unit will remain out of service:

- Switch off the drive assembly.
- For gear units with a cooling coil or a water-oil cooler:
  - Drain the water out of the cooling coil or the water-oil cooler if there is a risk of frost.
  - Close the shutoff valves for the cooling water inlet and drain lines.
- For gear units with an oil supply system, perform the following steps before you preserve the gear unit:
  - Detach the connection between the oil supply system and the gear unit.
  - Seal the openings in the gear unit and oil supply system so that they are air-tight.
- Take measures to preserve the gear unit if it is to be out of service for a prolonged period. Follow the procedure described in operating instructions BA 7300.
Servicing

8.1 General maintenance information

The operator must ensure compliance with the stipulated time limits. This also applies if the maintenance activities are included in the operator’s internal maintenance schedules.

The gear unit could be damaged if the stipulated time limits for maintenance and servicing are not observed.

The time limits stipulated in the maintenance schedule are largely dependent on the conditions of use of the gear unit. For this reason, it is only possible to state average time limits here. These refer to the following conditions of use:

- Daily operating time 24 h
- Duty cycle "ED" 100%
- Gear unit input speed 1500 rpm
- Permissible average oil temperature (Page 85)

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger to life due to live system</td>
</tr>
<tr>
<td>Working on a gear unit while it is in operation is hazardous and can result in potentially fatal injuries.</td>
</tr>
<tr>
<td>Always shut down the gear unit and any oil supply system (whether separate or mounted on the gear unit) before you carry out any work. Take measures to prevent the accidental restarting of the drive assembly. Display a warning notice that clearly states that work is being carried out on the gear unit.</td>
</tr>
</tbody>
</table>
### 8.2 Maintenance schedule

**Maintenance and servicing work**

The following table provides an overview of all maintenance and servicing work which you are required to perform continuously or at regular intervals.

<table>
<thead>
<tr>
<th>Intervals and time limits</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>As required</td>
<td>Replace the wet-air filter</td>
</tr>
<tr>
<td></td>
<td>Clean the air filter</td>
</tr>
<tr>
<td></td>
<td>Clean the fan and gear unit</td>
</tr>
<tr>
<td>Plate on the gear unit, gear unit dimension drawing</td>
<td>Replace the backstop</td>
</tr>
<tr>
<td>Daily</td>
<td>Check the oil temperature</td>
</tr>
<tr>
<td></td>
<td>Check the oil pressure (if pressure lubrication is fitted)</td>
</tr>
<tr>
<td></td>
<td>Check for changes in the gear unit noise</td>
</tr>
<tr>
<td>Monthly and prior to every start-up</td>
<td>Check for leaks</td>
</tr>
<tr>
<td></td>
<td>Check the oil level</td>
</tr>
<tr>
<td>400 operating hours after commissioning</td>
<td>Check the water content of the oil</td>
</tr>
<tr>
<td></td>
<td>Change the oil (or depending on results of the oil sample test)</td>
</tr>
<tr>
<td></td>
<td>Check that all of the fastening bolts are tight</td>
</tr>
<tr>
<td>Every 3 months</td>
<td>Check the speed monitoring of the auxiliary drive</td>
</tr>
<tr>
<td></td>
<td>Check the auxiliary drive</td>
</tr>
<tr>
<td></td>
<td>Clean the oil filter</td>
</tr>
<tr>
<td></td>
<td>Clean the air filter</td>
</tr>
<tr>
<td>Every 3 000 operating hours</td>
<td>Measure the vibration levels of the rolling-contact bearings</td>
</tr>
<tr>
<td>Every 3 000 operating hours, at least every 6 months</td>
<td>Regrease taconite seals</td>
</tr>
<tr>
<td></td>
<td>Regrease Tacolab seals</td>
</tr>
<tr>
<td>Every 5 000 operating hours, at least every 10 months</td>
<td>Replenish grease in the oil retaining pipe</td>
</tr>
<tr>
<td>Every 12 months</td>
<td>Check the friction linings of the torque-limiting backstop</td>
</tr>
<tr>
<td></td>
<td>Inspect the hose lines</td>
</tr>
<tr>
<td></td>
<td>Inspect the shrink disk</td>
</tr>
<tr>
<td></td>
<td>Check the water content of the oil</td>
</tr>
<tr>
<td>Every 10 000 operating hours, at least every 2 years</td>
<td>Change the oil if using mineral oil of API Group I or II or saturated</td>
</tr>
<tr>
<td></td>
<td>synthetic esters (or depending on the result of the oil sample test)</td>
</tr>
<tr>
<td></td>
<td>Check the air-oil cooler (the same time as you change the oil)</td>
</tr>
<tr>
<td></td>
<td>Check the water-oil cooler (the same time as you change the oil)</td>
</tr>
</tbody>
</table>
### Intervals and time limits

<table>
<thead>
<tr>
<th>Intervals and time limits</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 2 years</td>
<td>Carry out a general inspection of the gear unit</td>
</tr>
<tr>
<td></td>
<td>Check the cooling coil</td>
</tr>
<tr>
<td></td>
<td>Check that all of the fastening bolts are tight</td>
</tr>
<tr>
<td></td>
<td>Clean the fan and gear unit</td>
</tr>
<tr>
<td>Every 20,000 operating hours, at least every 4 years</td>
<td>Change the oil if using semi-synthetic oil of API Group III, PAO or PG oil (or depending on the result of the oil sample test)</td>
</tr>
<tr>
<td>6 years after the specified date of manufacture</td>
<td>Change the hoses</td>
</tr>
</tbody>
</table>

### Further information

Further information about additional maintenance and servicing work can be found in the separate data sheet in the complete documentation for the gear unit.

Further information about installed components can be found in the operating instructions for the components in the complete documentation for the gear unit.

### 8.3 Maintenance and servicing work

#### Introduction

You can find maintenance and servicing measures relating to gear unit lubrication and preservation, which are not provided in this chapter, in BA 7300 in the complete gear unit documentation.

#### 8.3.1 Cleaning the venting screw

#### Cleaning interval

For dust deposits, you must clean the venting screw before the minimum interval of 3 months expires.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressed air can cause injuries</td>
</tr>
<tr>
<td>There is a risk of eye injury when using compressed air.</td>
</tr>
<tr>
<td>Wear suitable safety goggles.</td>
</tr>
</tbody>
</table>
Procedures

Proceed as follows to clean the venting screw:
1. Remove the venting screw.
2. Do not allow foreign matter to enter the gear unit.
3. Wash the venting screw with cleaning solvent or a similar cleaning agent.
4. Dry the venting screw and blow it out using compressed air.

8.3.2 Checking the oil temperature

Damage to the gear unit due to excessively high oil sump temperatures.
The gear unit can sustain damage due to inadequate lubrication if you allow it to operate at oil sump temperatures above the maximum permissible temperature.
Do not operate the gear unit above the maximum permissible oil sump temperature.

Procedure

Proceed as follows to check the oil temperature:
1. Allow the gear unit to reach its normal operating temperature.
2. Operate the gear unit with the maximum driven machine power.
3. Measure the temperature of the oil in the oil sump.
4. Compare the measured value with the maximum permissible oil temperature (Page 85).
5. Immediately stop the gear unit if the maximum permissible oil temperature is exceeded.
   Contact Siemens Customer Services.

8.3.3 Replacing the backstop

Introduction

If you operate the gear unit at speeds below the disengagement speed of the backstop, then you must regularly replace the backstop.
The replacement intervals are provided in the dimension drawing and on a plate attached to the gear unit. This plate is attached to the gear unit housing close to the backstop.

Procedure

Proceed as follows to replace the backstop:
1. Replace the backstop.
2. Fill the new backstop with oil (Page 91).
8.3.4 Filling the backstop with oil

Oil type and filling filter

When filling the backstop with oil, observe the following points:

- Use the same oil type and oil viscosity as for the gear unit itself.
- Use a filling filter with the same filter gauge as for the gear unit itself.

Procedure

Proceed as follows to fill the backstop with oil:

1. Clean the oil filling point of the backstop.
2. Open the oil filling screw of the backstop.
3. Fill the amount of oil that is specified on the backstop plate.
4. Screw in the oil filling screw.

8.3.5 Checking the friction linings of the torque-limiting backstop

Introduction

The friction linings of the torque-limiting backstop can wear, especially for frequent slippage.

---

Note

Loss of warranty

The warranty becomes null and void if you remove or damage the locking wire at the guide screws of the springs.

Do not change the slip torque setting. The sliding torque was set to the correct value in the factory.
The following diagram shows the torque-limiting backstop:

![Torque-limiting backstop diagram]

1. Outer ring
2. Guide screw with spring
3. Locking wire
4. Shaft (intermediate flange)
5. Inner ring
6. Cage with sprags
7. Friction lining

Figure 8-1 Torque limiting backstop

**Procedure**

Proceed as follows to check the friction linings of the torque-limiting backstop:

1. Clean the measurement location at the backstop.
2. Measure dimension "x".
3. If dimension "x" falls below limit value "$x_{\min}$" stamped on the backstop type plate, then you must replace the torque-limiting backstop. It is not permissible that the gear unit continues to operate.

**Further information**

Additional information about the torque-limiting backstop can be found in the torque-limiting backstop operating instructions provided in the complete gear unit documentation.
8.3.6 Measuring the vibration levels of the rolling-contact bearings

Procedure

Proceed as follows to measure the vibration levels of the rolling-contact bearings:

1. Document the measurement results.
2. Compare the measured values with the comparison values that were documented when commissioning the gear unit.
3. Replace defective rolling-contact bearings.
4. Archive the report together with these instructions.

Further information

You can find additional information on measuring the vibration levels at rolling-contact bearings in the operating instructions of the measurement sensor provided in the complete gear unit documentation.

8.3.7 Cleaning the fan and gear unit

Introduction

The gear unit can sustain damage due to inadequate cooling if you operate it with a damaged or soiled fan. Depending on the conditions at the site of installation, it may therefore be necessary to clean the fan and gear unit more frequently than stipulated in the maintenance schedule.

Procedure

Proceed as follows to clean the fan and gear unit:

1. Remove the air guide cover.
2. Use a hard brush to remove any stubborn dirt from the impeller, air guide cover and protective grille. Never use a high-pressure cleaning device.
3. Treat any areas of corrosion.
4. Reinstall the air guide cover.
5. Make sure that the air guide cover is correctly fastened.
   Make sure that there is no contact between the fan and the air guide cover.
8.3.8 Checking the cooling coil

Introduction
A soiled cooling coil can cause damage to the gear unit. It is therefore important to check the cooling coil regularly.

Procedure
To check the cooling coil, proceed as follows:
1. Shut off the cooling water supply.
2. Disconnect the cooling water inlet and drain lines from the cooling coil.
3. Inspect the inner surface of the cooling coil for deposits.
4. If you discover that there are heavy deposits inside the cooling coil, arrange for the cooling water or the deposits to be analysed. Analysis services of this kind are offered by specialist chemical cleaning companies. These companies also sell special cleaning agents for removing deposits. Before you use a cleaning agent, check whether it is suitable for use on the cooling coil materials. You must consult Siemens Customer Services. Carefully read the instructions for use supplied by the manufacturer before using different kinds of cleaning agent.
5. If the cooling coil is severely soiled, it must be replaced by a new one. Please consult Siemens Customer Services for further advice.
6. Reconnect the cooling water inlet and drain lines to the cooling coil.

8.3.9 Inspecting the shrink disk

Introduction
The shrink disk inspection is limited to a visual assessment of its condition.

Aspects of the inspection
Observe the following points when inspecting the shrink disk:
- Loose bolts
- Damage due to use of force
- Inner ring resting flush against the outer ring

Further information
Further information about the shrink disk can be found in the shrink disk operating instructions in the complete documentation for the gear unit.
8.3.10 Check that all of the fastening bolts are tight

Procedure

Proceed as follows to check that the fastening bolts are tight:

1. Observe the data regarding connection classes (Page 77), preload forces and tightening torques (Page 78).
2. Replace any bolts that are no longer fit for use by bolts of the same strength class and type.

8.3.11 General inspection of the gear unit

General inspection of the gear unit by Customer Services

Arrange for Siemens Customer Services to perform a general inspection on the gear unit. Thanks to their experience, these engineers are best placed to assess which gear unit components need to be replaced.

8.3.12 Final work

After you have finished all the work listed in the maintenance schedule, replace any bolts that are no longer fit for use by bolts of the same strength class and type.

8.4 Possible faults

The faults listed below are only intended as a troubleshooting guide.

If any faults occur while the unit is still under warranty, do not allow anyone except Siemens Customer Services to attempt a repair.

Even after the warranty period has expired, you should still arrange for faults to be rectified by Siemens Customer Services.

Note

Loss of warranty

You will invalidate the warranty for the gear unit if you modify it in any way without seeking the approval of Siemens beforehand, or if you do not use original spare parts.

Only use original spare parts from Siemens. Always arrange for Siemens Customer Services to repair any faults that develop while the unit is still under warranty.
### Possible faults and their rectification

The following table provides you with an overview of possible faults and indicates how they can be rectified.

#### Table 8-2 Possible faults and their rectification

<table>
<thead>
<tr>
<th>Possible faults</th>
<th>Causes</th>
<th>Possible remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure monitor triggers an alarm</td>
<td>Oil pressure &lt; 0.5 bar</td>
<td>• Check the oil level at room temperature&lt;br&gt;• Top up with oil if necessary&lt;br&gt;• Check the oil pump&lt;br&gt;• If required, replace the oil pump&lt;br&gt;• Check the oil filter and coarse filter&lt;br&gt;• If required, replace the oil filter or clean the coarse filter</td>
</tr>
<tr>
<td>Grease escaping at the output shaft</td>
<td>Defective rotary shaft sealing rings</td>
<td>• Inspect the rotary shaft seals and replace if necessary</td>
</tr>
<tr>
<td>Noise</td>
<td>Damage to gearing</td>
<td>• Contact Customer Services&lt;br&gt;• Inspect toothed components&lt;br&gt;• Replace damaged components if necessary</td>
</tr>
<tr>
<td></td>
<td>The bearing play is excessive.</td>
<td>• Contact Customer Services&lt;br&gt;• Adjust bearing play</td>
</tr>
<tr>
<td></td>
<td>Defective bearing</td>
<td>• Contact Customer Services&lt;br&gt;• Replace defective bearing</td>
</tr>
<tr>
<td></td>
<td>Gear unit fastening has worked loose</td>
<td>• Tighten bolts and nuts to the specified tightening torque&lt;br&gt;• Replace damaged bolts and nuts</td>
</tr>
<tr>
<td>Outer surface of gear unit soiled with oil</td>
<td>Inadequate sealing of the housing cover or joints</td>
<td>• Seal housing cover or joints</td>
</tr>
<tr>
<td></td>
<td>Labyrinth seals soiled with oil, incorrect transport position</td>
<td>• Check oil filling&lt;br&gt;• Clean the labyrinths</td>
</tr>
<tr>
<td>Main drive motor does not start</td>
<td>Motor direction of rotation incorrect</td>
<td>• Change polarity of motor</td>
</tr>
<tr>
<td></td>
<td>Backstop cage with sprags incorrectly installed or defective</td>
<td>• Contact Customer Services&lt;br&gt;• Install the backstop cage, rotated through 180° - or replace</td>
</tr>
<tr>
<td></td>
<td>Overrunning clutch blocked</td>
<td>• Contact Customer Services&lt;br&gt;• Replace the overrunning clutch</td>
</tr>
<tr>
<td></td>
<td>Overrunning clutch cage with sprags incorrectly installed and/or defective</td>
<td>• Contact Customer Services&lt;br&gt;• Install the overrunning clutch cage, rotated through 180° - or replace</td>
</tr>
<tr>
<td>Main drive motor can start while the auxiliary drive is operational</td>
<td>Defective electrical interlocking between the main and auxiliary motor</td>
<td>• Check the connections&lt;br&gt;• If necessary, replace defective devices</td>
</tr>
<tr>
<td></td>
<td>Defective speed monitoring</td>
<td>• Check the connections&lt;br&gt;• If necessary, replace defective devices</td>
</tr>
<tr>
<td>Possible faults</td>
<td>Causes</td>
<td>Possible remedies</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Auxiliary drive motor does not start</td>
<td>Overload at the output</td>
<td>• Reduce the load at the output</td>
</tr>
<tr>
<td></td>
<td>Defective auxiliary drive motor</td>
<td>• Repair the motor or replace</td>
</tr>
<tr>
<td></td>
<td>Motor brake not released</td>
<td>• Correct the electrical connection of the motor brake</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If required, replace the motor brake</td>
</tr>
<tr>
<td>The auxiliary drive motor starts, the main gear unit output shaft does not turn</td>
<td>Motor direction of rotation incorrect</td>
<td>• Change polarity of motor</td>
</tr>
<tr>
<td></td>
<td>Overrunning clutch cage with sprags incorrectly installed</td>
<td>• Contact Customer Services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Install the overrunning clutch cage, rotated through 180° - or replace</td>
</tr>
<tr>
<td></td>
<td>Defective overrunning clutch</td>
<td>• Contact Customer Services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Replace the overrunning clutch</td>
</tr>
<tr>
<td>Leaks</td>
<td>Inadequate sealing of the housing cover or joints</td>
<td>• Seal housing cover or joints</td>
</tr>
<tr>
<td></td>
<td>Labyrinth seals oiled up or transport position incorrect</td>
<td>• Check oil filling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Clean the labyrinths</td>
</tr>
<tr>
<td></td>
<td>Inadequate sealing of the housing cover or joints</td>
<td>• Check the seals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Replace, if necessary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Seal housing cover or joints</td>
</tr>
<tr>
<td></td>
<td>Defective rotary shaft sealing rings</td>
<td>• Check the rotary shaft sealing rings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Replace, if necessary</td>
</tr>
<tr>
<td>Oil is foaming in the gear unit</td>
<td>Preservation agent not completely drained off</td>
<td>• Change the oil</td>
</tr>
<tr>
<td></td>
<td>Oil supply system left in operation for too long at low temperatures</td>
<td>• Switch off the oil supply system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Degas the oil</td>
</tr>
<tr>
<td></td>
<td>Gear unit too cold in operation</td>
<td>• Switch off the gear unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Degas the oil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Start up without cooling water during cold restart</td>
</tr>
<tr>
<td></td>
<td>Water in the oil</td>
<td>• Take test tube sample to examine oil condition for water penetration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Have the oil examined by a chemical lab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Change the oil if necessary</td>
</tr>
<tr>
<td></td>
<td>Oil defoamer has run out</td>
<td>• Examine the oil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Change the oil if necessary</td>
</tr>
<tr>
<td></td>
<td>Unsuitable mixture of oils</td>
<td>• Examine the oil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Change the oil if necessary</td>
</tr>
<tr>
<td>Oil escaping from the gear unit</td>
<td>Inadequate sealing of the housing cover or joints</td>
<td>• Check the seals and replace if necessary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Seal housing cover or joints</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the compression seals and retighten screws if necessary</td>
</tr>
<tr>
<td></td>
<td>Leaking pipes</td>
<td>• Check the pipes, and replace or seal if necessary</td>
</tr>
<tr>
<td>Oil supply system malfunction</td>
<td>-</td>
<td>• Read the operating instructions for the oil supply system</td>
</tr>
</tbody>
</table>
### 8.4 Possible faults

<table>
<thead>
<tr>
<th>Possible faults</th>
<th>Causes</th>
<th>Possible remedies</th>
</tr>
</thead>
</table>
| Elevated temperature during operation | Oil level in the gear unit housing too high | • Check the oil level  
• If required, correct the oil level |
| | Oil is too old | • Check when the last oil change was done  
• Change the oil if necessary |
| | Oil is severely contaminated | • Change the oil |
| | Oil supply system or cooling coil defective | • Check the oil supply system or cooling coil  
• Replace defective components if necessary  
• Read the operating instructions for the oil supply system |
| | Gear unit with oil cooling system: Cooling liquid flow rate too low or too high | • Fully open the valves in the intake and outlet pipes  
• Check that water and oil can freely flow through the water-oil cooler |
| | Gear unit with oil cooling system: The oil flow through the water-oil cooler is too low. | • Check the filter and coarse filter  
• If required, replace the oil filter or clean the coarse filter |
| | Gear units with cooling coil: Deposits in the cooling coil | • Clean, or if necessary, replace the cooling coil |
| | For gear units with fan: Air intake opening in air guide cover or gear unit housing is soiled | • Clean the air guide cover and gear unit housing |
| | Coolant temperature too high | • Check the temperature  
• Correct the temperature if necessary |
| | Defective oil pump | • Check the oil pump function  
• If required, repair or replace the oil pump |
| Elevated temperature at bearing points | Oil level in the gear unit housing too low or too high | • Check the oil level at room temperature  
• Top up with oil if necessary |
| | Oil is too old | • Check when the last oil change was done  
• Change the oil if necessary |
| | Oil supply system defective | • Inspect the oil supply system  
• Replace defective components if necessary  
• Read the operating instructions for the oil supply system |
| | Defective bearing | • Contact Customer Services  
• Check the bearings and if required, replace |
| Increased backstop temperature with failure of the blocking function | Damaged backstop | • Contact Customer Services  
• Check the backstop  
• Replace, if necessary |
| Elevated vibration amplitude at bearing points | Defective bearing | • Contact Customer Services  
• Check the bearings and if required, replace |
| | Gear wheels defective | • Contact Customer Services  
• Inspect the gear wheels and replace if necessary |
| Contamination indicator of the double change-over filter triggers an alarm | Double change-over filter clogged | • Changeover the double change-over filter corresponding to the separate operating instructions  
• Clean the filter element |
### 8.4 Possible faults

<table>
<thead>
<tr>
<th>Possible faults</th>
<th>Causes</th>
<th>Possible remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water in the oil</td>
<td>Oil supply system or cooling coil defective</td>
<td>• Check the oil supply system or cooling coil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Replace defective components if necessary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Read the operating instructions for the oil supply system</td>
</tr>
<tr>
<td>Engine room fan is blowing cold air onto gear unit: Water condenses</td>
<td></td>
<td>• Install suitable thermal insulation to protect gear unit housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Close the air outlet or change the direction of the air outlet using structural measures.</td>
</tr>
<tr>
<td>Climatic conditions</td>
<td></td>
<td>• Contact Customer Services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use wet-air filter if necessary</td>
</tr>
<tr>
<td>Oil foams in the oil sump</td>
<td></td>
<td>• Take test tube sample to examine oil condition for water penetration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Have the oil examined by a chemical lab</td>
</tr>
</tbody>
</table>

### 8.4.1 Clearing blockages (reversing mechanism)

#### 8.4.1.1 Activating the reversing mechanism

**Requirements**

Make sure that the following conditions are fulfilled before you clear blockages:

- Switch off the motor of the main drive.
- Never attempt to activate the reversing mechanism unless the drive is at a standstill.

**Procedure**

Proceed as follows to activate the reversing mechanism:

1. Undo the locking bolt.
2. Pull the locking knob.
3. Move the operating lever to the "On" position.
4. Allow the locking pin to engage.
5. Tighten the locking bolt.
6. Start up the motor of the reversing mechanism (Page 48).

**Further information**

Refer to the separate operating instructions for the auxiliary gear unit with motor and the clutch for more information about operating the reversing mechanism.
Servicing

8.4 Possible faults

8.4.1.2 Deactivating the reversing mechanism

Procedure

Proceed as follows to deactivate the reversing mechanism:

1. Undo the locking bolt.
2. Pull the locking knob.
3. Move the operating lever to the "Off" position.
   You have now disconnected the clutch in the bell housing from the reversing mechanism.
4. Allow the locking pin to engage.
5. Tighten the locking bolt.

Further information

Refer to the separate operating instructions for the auxiliary gear unit with motor and the clutch for more information about operating the reversing mechanism.
Contact

When ordering spare parts, requesting a customer service technician or in the case of technical queries, please contact our factory or one of our customer service addresses:

Siemens AG
Am Industriepark 2
46562 Voerde
Germany
Tel.: +49 (0)2871 / 92-0
Fax: +49 (0)2871 / 92-1544
Disposal

Disposal of the gear unit

When disposing of the gear unit after its useful life, please observe the following measures:

- Remove operating oil, preservative agents and coolant from the gear unit and dispose of it according to regulations.
- Dispose of the gear unit parts according to applicable national regulations or recycle them.

Environmental protection

Observe the following environmental protection measures for disposal:

- Dispose of or recycle packaging material according to applicable national regulations.
- When changing the oil, collect the used oil in suitable containers. Use oil-binding agents to clean up any oil spillages immediately.
- Store preservative agents separately from used oil.
- Dispose of used oil, preservative agents, oil binding agents and oil-soaked cloths according to the applicable environmental protection regulations.
By stocking the most important spare parts at the installation site you can ensure that the gear unit is ready for use at any time.

**Note**

**Damage to the gear unit due to use of unsuitable spare parts**

Only use original spare parts from Siemens. Siemens shall not accept any warranty claims for spare parts that are not supplied by Siemens.

Other spare parts are not tested and approved by Siemens. Non-approved spare parts may possibly change the design characteristics of the gear unit and thus impair its active or passive safety.

Siemens will accept no liability or warranty whatsoever for damage occurring as a result of the use of non-approved spare parts. The same applies to any accessories which were not supplied by Siemens.

The contact address of Siemens Customer Services can be found under Service & Support.

**Information required when ordering spare parts**

To order spare parts, refer to the spare-parts list. Only use spare parts that are supplied by Siemens.

When ordering spare parts, please provide the following information:

- Order number with item
- Type and size
- Part number
- Quantity
Quality documents

A.1 Declaration of Incorporation
Declaration of incorporation

Company name and full address of the manufacturer:
Siemens Aktiengesellschaft
Am Industriepark 2
46562 Voerde
Deutschland – Germany

Name and address of the person, authorised to compile the relevant technical documentation:
Mark Zundel
Siemens Aktiengesellschaft
Am Industriepark 2
46562 Voerde
Deutschland – Germany

Description and identification of the partly completed machinery:
Gear unit
H.SH, H.HH, H.DH, H.KH,
H.HM, H.DM, H.KM,
B.SH, B.HH, B.DH, B.KH,
B.HM, B.DM, B.KM
Sizes 23 to 28
for driving machines

The following "Essential health and safety requirements" are applied and are met:
1.1, 1.1.2, 1.1.3, 1.1.5; 1.2.4.4, 1.2.6; 1.3.1 - 1.3.4, 1.3.6 - 1.3.8.1; 1.4.1, 1.4.2.1;
1.5.1, 1.5.2, 1.5.4 - 1.5.11, 1.5.13, 1.5.15; 1.6.1, 1.6.2; 1.7.1, 1.7.1.1, 1.7.2, 1.7.4 - 1.7.4.3

The special technical documents described in Annex VII part B have been prepared.
The manufacturer undertakes, in response to a reasoned request by national authorities, to
transmit in electronic form relevant information about the partly completed machinery.
The partly completed machinery must not be put into service until it has been established that
the machinery into which the partly completed machinery is to be incorporated has been
declared to be in conformity with the provisions of Directive 2006/42/EC, as appropriate.

Siemens Aktiengesellschaft

Voerde, 2016-03-23 i.V.
Mark Zundel, Head of PD MD AP VOE

Voerde, 2016-03-23 i.V.
Björn Podewski, Head of PD MD AP VOE BA

Translation of the original declaration of incorporation
### B.1 General technical data

#### Rating plate

The gear unit rating plate contains the most important technical data.

1. Company logo
2. Serial no.: production plant code/order no. item ser. no./year of manufacture
3. Total weight in kg
4. For special information
5. Type, size
6. Power rating $P_2$ in kW or torque $T_2$ in Nm
7. Speed $n_1$
8. Speed $n_2$
9. Oil data: Oil type, oil viscosity, oil quantity
10. Numbers of operating instructions
11. For special information
12. Manufacturer and place of manufacture
13. Country of origin

Figure B-1  Rating plate

The limits of the intended use of the gear unit are defined on the basis of these data and the contractual agreements concerning the gear unit concluded between Siemens and the customer.

#### Further information

Further information about these technical data can be found in the separate data sheet and the dimension drawings in the complete documentation for the gear unit.

Further information about all major accessories including their technical data can be found in the order-specific list of equipment in the complete documentation for the gear unit.
**Technical data**

**B.3 Types**

---

**Example code**

The following is an example of the code printed in line 5 of the rating plate and explains the meaning of the individual letters and numbers.

![Example code diagram]

- **Size:** 23 ... 28
- **Mounting:**
  - H = horizontal
  - M = horizontal version without feet
- **Output shaft version:**
  - S = solid shaft
  - D = hollow shaft for shrink disk
- **No. of stages:** 3 or 4
- **Gear unit type:**
  - H = helical gear unit
  - B = bevel helical gear unit (only number of stages 3 or 4)

---

**Further information**

You can find additional information on the weights and the enveloping surface sound pressure levels in chapters Weights (Page 111) and Enveloping surface sound pressure level (Page 111).

Further information about these technical data can be found in the separate data sheet and the dimension drawings in the complete documentation for the gear unit.

---

**B.2 Ambient temperature**

Unless otherwise contractually agreed, the gear unit must not be exposed to any harmful atmospheres or substances such as aggressive chemical products. By applying various suitable measures, the gear unit can be used in the ambient temperature range extending from -40 °C up to 60 °C. However, this must always be authorised by Siemens and specified in the order text.

---

**B.3 Types**

The gear unit is available in the following types.

![Types diagram]
B.4 Weights

The precise weights are specified in the dimension drawings in the complete documentation or on the rating plate.

All weight specifications refer to units without oil filling or mounted components.

B.5 Enveloping surface sound pressure level

The gear unit has an enveloping surface sound pressure level at a distance of 1 m away, which can be taken from the following table.

The measurement is performed using the sound-intensity method according to DIN EN ISO 9614 Part 2.

The workplace of operating personnel is defined as the area on the measuring surface at a distance of 1 m around the gear unit and in the vicinity where persons may be present.

The sound pressure level applies to a gear unit in the warm condition at a drive speed $n_1$ and output power $P_2$ according to the rating plate, for measurements carried out on a Siemens test bench. If several values are given, then the highest speed and power values apply.

The enveloping surface sound pressure level includes any mounted lubrication units. With outgoing and incoming pipes, the flange is considered to be the interface.

The sound pressure levels listed in the table were obtained based on statistical evaluations carried out by our Quality Control department. With statistical certainty, it can be assumed that the gear unit complies with these sound pressure levels.
Refer to the following table for the enveloping surface sound pressure level $L_{pa}$ in dB(A) for bevel helical gear units with fan.

<table>
<thead>
<tr>
<th>Type</th>
<th>$i_n$</th>
<th>$n_i$ in rpm</th>
<th>Gear unit size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>B3</td>
<td>20 - 31.5</td>
<td>1000</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>35.5 - 56</td>
<td>1000</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>63 - 80</td>
<td>1000</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750</td>
<td>78</td>
</tr>
</tbody>
</table>

You can obtain information about the enveloping surface sound pressure levels for gear unit sizes 27 and 28 on request.

Refer to the following table for the enveloping surface sound pressure level $L_{pa}$ in dB(A) for bevel helical gear units without fan.

<table>
<thead>
<tr>
<th>Type</th>
<th>$i_n$</th>
<th>$n_i$ in rpm</th>
<th>Gear unit size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>B3</td>
<td>20 - 31.5</td>
<td>1000</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>35.5 - 56</td>
<td>1000</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750</td>
<td>78</td>
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<tr>
<td></td>
<td>63 - 80</td>
<td>1000</td>
<td>81</td>
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<tr>
<td></td>
<td></td>
<td>750</td>
<td>74</td>
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<tr>
<td>B4</td>
<td>80 - 125</td>
<td>1500</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>140 - 224</td>
<td>1500</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>250 - 355</td>
<td>1500</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750</td>
<td>67</td>
</tr>
</tbody>
</table>

You can obtain information about the enveloping surface sound pressure levels for gear unit sizes 27 and 28 on request.
Refer to the following table for the enveloping surface sound pressure level $L_{pa}$ in dB(A) for helical gear units with fan.

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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>H2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.3 - 10</td>
<td>750</td>
<td>86</td>
</tr>
<tr>
<td>11.2 - 16</td>
<td>1000</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>83</td>
</tr>
<tr>
<td>18 - 22.4</td>
<td>1000</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>750</td>
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</tr>
</tbody>
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You can obtain information about the enveloping surface sound pressure levels for gear unit sizes 27 and 28 on request.

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<td>750</td>
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<td>11.2 - 16</td>
<td>1000</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>79</td>
</tr>
<tr>
<td>18 - 22.4</td>
<td>1000</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>77</td>
</tr>
<tr>
<td>H3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.4 - 31.5</td>
<td>1000</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>78</td>
</tr>
<tr>
<td>35.5 - 63</td>
<td>1500</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>76</td>
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<tr>
<td>71 - 100</td>
<td>1500</td>
<td>81</td>
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<tr>
<td></td>
<td>1000</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>73</td>
</tr>
<tr>
<td>H4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 - 140</td>
<td>1500</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>71</td>
</tr>
<tr>
<td>160 - 250</td>
<td>1500</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>68</td>
</tr>
<tr>
<td>280 - 400</td>
<td>1500</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>65</td>
</tr>
</tbody>
</table>
You can obtain information about the enveloping surface sound pressure levels for gear unit sizes 27 and 28 on request.
## Glossary

**CAVEX**
CAVEX is an assembly and sales company for worm gear sets, worm gear units and drive solutions.

**CSFW**
Type of CAVEX helical worm unit, where the flange is defined as the output.

**DU bushing**
Designation for a type of plain bearing.

**ED**
Duty cycle

**HPG**
High Precision Gears

**MIL-spec connector**
An MIL-spec connector is a circular connector used for military, aeronautic and industrial applications.

**PAO**
Poly-alpha-olefin is a synthetic paraffin and naphthenic base oil.

**PG/PAG**
Polyglycol is a synthetic, common water soluble polymer-based base oil.

**ZAPEX coupling**
A ZAPEX coupling is a torsionally rigid gear coupling manufactured by Siemens AG.
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