

# Bevel-helical gear unit

**B4SV**

**Sizes 306, 309 and 311**

Assembly and operating instructions

BA 5054 en 06/2015

**FLENDER gear units**

**SIEMENS**

## Bevel-helical gear unit

**B4SV**  
Sizes 306, 309 and 311

### Assembly and operating instructions

Translation of the original assembly and operating instructions


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## Legal notes

### Warning note concept

This manual comprises notes which must be observed for your personal safety and for preventing material damage. Notes for your personal safety are marked with a warning triangle, those only for preventing material damage appear without a warning triangle. Depending on the level of hazard, the warning notes are shown in reverse order of seriousness, as follows.

 <b>DANGER</b>
means, that death or serious injury <b>will</b> result, if the appropriate preventive action is not taken.

 <b>WARNING</b>
means that death or serious injury <b>may</b> result, if the appropriate preventive action is not taken.

 <b>CAUTION</b>
means that a slight injury may result, if the appropriate preventive action is not taken.

<b>NOTICE</b>
means that material damage may result, if the appropriate preventive action is not taken.


Where there is more than one hazard level, the warning note for whichever hazard is the most serious is always used. If in a warning note a warning triangle is used to warn of possible personal injury, a warning of material damage may be added to the same warning note.

### Qualified personnel

The product or system to which this documentation relates may be handled only by **persons qualified** for the work concerned and in accordance with the documentation relating to the work concerned, particularly the safety and warning notes contained in those documents. Qualified personnel must be specially trained and have the experience necessary to recognise risks associated with these products and to avoid possible hazards.

### Proper use of Siemens products

Observe also the following:

 <b>WARNING</b>
Siemens products must be used only for the applications provided for in the catalogue and the relevant technical documentation. If products and components of other makes are used, they must be recommended or approved by Siemens. The faultfree, safe operation of the products calls for proper transport, proper storage, erection, assembly, installation, start-up, operation and maintenance. The permissible ambient conditions must be adhered to. Notes in the relevant documentations must be observed.

### Trademarks

All designations to which the registered industrial property mark ® is appended are registered trademarks of Siemens AG. Other designations used in this document may be trademarks the use of which by third parties for their own purposes may infringe holders' rights.

### Exclusion of liability

We have checked the content of the document for compliance with the hard- and software described. Nevertheless, variances may occur, and so we can offer no warranty for complete agreement. The information given in this document is regularly checked, and any necessary corrections are included in subsequent editions.

# Foreword

The term "Assembly and operating instructions" will in the following also be shortened to "instructions" or "manual".

## Symbols in these assembly and operating instructions

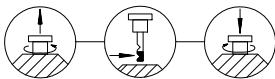


This symbol additionally indicates an imminent risk of explosion in the meaning of Directive 94/9/EC.

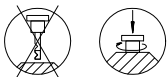


This symbol additionally indicates an imminent risk of burns due to hot surfaces in the meaning of standard "DIN EN ISO 13732-1".

Earth-connection point			Air-relief point		yellow
Oil-filling point		yellow	Oil-draining point		white
Oil level		red	Oil level		red
Oil level		red	Connection for vibration-monitoring device		
Lubricating point		red	Apply grease		
Lifting eye			Eye bolt		
Do not unscrew					
Alignment surface, horizontal			Alignment surface, vertical		



These symbols indicate the oil-level checking procedure using the oil dipstick.



These symbols indicate that the oil dipstick must always be firmly screwed in.

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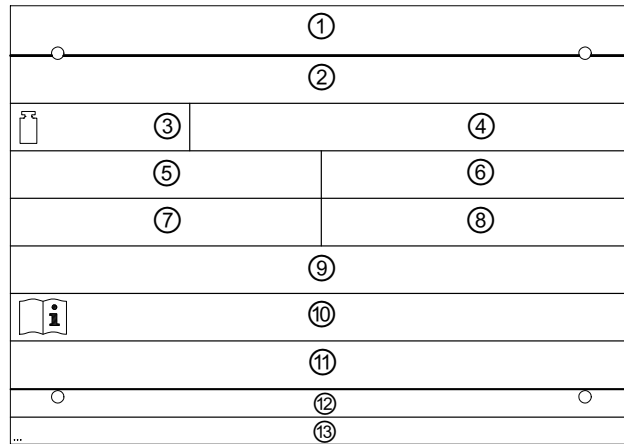
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# 1. Technical data

## 1.1 General technical data

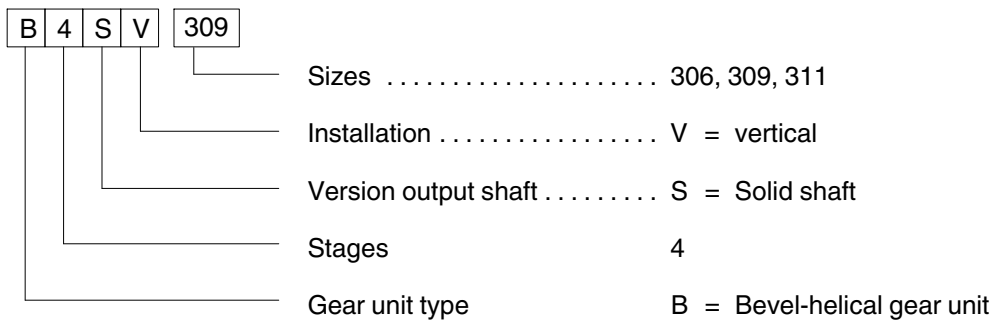
The most important technical data are shown on the rating plate. These data and the contractual agreements between Siemens and the customer for the gear unit determine the limits of its correct use.



**Fig. 1:** Rating plate on gear unit

- |   |   |   |  |
|---|---|---|--|
| ① | Company logo                                    | ⑦ | Speed $n_1$                                      |
| ② | Order number, item, sequence number, year built | ⑧ | Speed $n_2$                                      |
| ③ | Total weight in kg                              | ⑨ | Oil data (oil type, oil viscosity, oil quantity) |
| ④ | Special information                             | ⑩ | Number of the instruction manual                 |
| ⑤ | Type, size *)                                   | ⑪ | Special information                              |
| ⑥ | Power rating $P_2$ in kW or torque $T_2$ in Nm  | ⑫ | Manufacturer and place of manufacture            |
|   |   | ⑬ | Country of origin                                |

\*) Example



Data on weights and measuring-surface sound-pressure levels of the various gear unit types are given in items 1.2 and 1.3.

For further technical data, please refer to the drawings in the gear unit documentation and the order-specific data sheet.

### 1.1.1 Ambient temperature

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#### Note

The gear unit may only be used in the settings as defined and approved in the supply agreement concluded between Siemens and the buyer.

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1.2 Measuring-surface sound-pressure level

The gear unit has a measuring-surface sound-pressure level at a distance of 1 m, which is indicated in table 1.

The measurement is carried out to standard "DIN EN ISO 9614" Part 2, using the sound-intensity method.

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

The sound-pressure level applies to the warmed-up gear unit as well as the input speed  $n_1$  and output power  $P_2$  stated on the rating plate, as measurement obtained on the Siemens test bench.

The measuring-surface sound-pressure level includes add-on lubrication units if present. With outgoing and incoming pipes, the flanges are considered the intersection.

The sound-pressure levels stated in the table were obtained by statistical evaluation by our Quality Control Dept. It can be assumed with statistical certainty that the gear unit complies with these noise levels.

**Table 1:** Measuring-surface sound-pressure level

<b>Measuring-surface sound-pressure level <math>L_{pA}</math> in dB(A)</b>			
Type	Gear unit size	Gear unit size	
	<b>306</b>	<b>309</b>	<b>311</b>
<b>B4SV</b>	76	70	75

1.3 Weights

**Table 2:** Weights (approximate values)

<b>Approximate weight (kg)</b>			
Type	Gear unit size	Gear unit size	
	<b>306</b>	<b>309</b>	<b>311</b>
<b>B4SV</b>	480	1300	2000

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**Note**

All weights are indicated for units without oil filling and without add-on parts. For the exact weights, refer to the drawings in the gear unit documentation.

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1.4 List of equipment

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**Note**

All important accessory components are specified in the order-specific equipment list including your technical data.

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## 2. General notes

### 2.1 Introduction

These instructions are an integral part of the gear unit supplied and must be kept at hand for reference at all times.

#### **NOTICE**

##### **Property damage**

Damage to the gear unit or occurrence of operating failures is possible.

All persons carrying out work on the gear unit must have read and understood the instructions and must adhere to them.

Siemens accepts no responsibility for damage or disruption caused by disregard of these instructions.

The "**FLENDER bevel-helical gear unit**" described in these instructions was designed for driving a pre-heater in a power plant.

The gear unit is designed only for the application specified in the section 1. "Technical data". Other operating conditions must be agreed by contract.

The gear unit is manufactured in accordance with the state of the art and is delivered in a condition ready for safe and reliable use.

The gear unit must be used and operated strictly in accordance with the conditions laid down in the contract governing performance and supply agreed by Siemens and the customer.

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

In the interest of technical progress we reserve the right to make changes to the individual assemblies and accessories which we regard as necessary to preserve their essential characteristics and improve their efficiency and safety.

### 2.2 Copyright

The copyright to these instructions is held by **Siemens AG**.


These instructions must not be wholly or partly reproduced for competitive purposes, used in any unauthorised way or made available to third parties without our agreement.

Technical enquiries should be addressed to the following works or to one of our customer service centres:

Siemens AG  
Am Industriepark 2  
46562 Voerde


Tel.: +49 (0)2871 / 92-0  
Fax: +49 (0)2871 / 92-1544

### 3. Safety instructions

 <b>WARNING</b>
<b>Risk of falling</b> Serious injury from falling is possible. The gear unit and its add-on parts must not be accessed.

#### 3.1 Obligations of the user

- The operator must ensure that everyone carrying out work on the gear unit has read and understood these instructions and is adhering to them in every point in order to:
  - avoid injury or damage to the user and third parties,
  - ensure the safety and reliability of the unit,
  - avoid loss of use and environmental damage caused by incorrect use.
- During transport, assembly, installation, demounting, operation and maintenance of the unit, the relevant safety and environmental regulations must be complied with at all times.
- The gear unit may only be operated, maintained and/or repaired by persons qualified for the work concerned (see "Qualified personnel" on page 3 of this manual).
- The outside of the gear unit must not be cleaned with high-pressure cleaning equipment.
- All work must be carried out with great care and with due regard for safety.

 <b>DANGER</b>
<b>Danger to life from switched on system</b> When carrying out work on the gear unit, the gear unit and any fitted oil-supply system must generally be shut down. The drive unit must be secured against accidental start-up (e. g. by locking the key switch or removing the fuses from the power supply). A notice should be attached to the start switch stating clearly that work is in progress. At the same time, there must not be any load on the entire system so that no hazard is created during demounting operations.

- No welding work may be done at all on the drive.  
The drive systems must not be used as an earthing point for electrical welding works. Toothed parts and bearings can be irreparably damaged by welding.
- A potential equalisation in accordance with the applicable regulations and/or directives must be carried out!  
If no threaded holes for earth connection are available on the gear unit, other appropriate measures must be taken. This work must always be done by **specialist electricians**.

<b>NOTICE</b>
<b>Property damage</b> Damage to the gear unit is possible. Immediately stop the gear unit by turning off the drive unit when inexplicable changes are noticed during the operation, such as a significantly increased operating temperature or changed sounds of the gear unit.



## **DANGER**

### **Danger to life by rotating and/or moving parts**

Risk of being gripped or drawn in by rotating and/or moving parts.

Rotating and/or movable drive parts must be fitted with suitable safeguards to prevent contact.

### **Note**

When the gear unit is incorporated in plant or machinery, the manufacturer of such plant or machinery must ensure that the prescriptions, notes and descriptions contained in these instructions are incorporated in his own instructions.

- Removed safeguards must be refitted prior to starting up.
- Notices attached to the gear unit, such as rating plate and direction arrow, must always be observed. They must be kept free from dirt and paint at all times. Missing plates must be replaced.
- Screws which have been damaged during assembly or disassembly work must be replaced with new ones of the same strength class and type.
- Spare parts must be obtained from Siemens (see section 11. "Spare parts, customer service").

## 3.2

### Environmental protection

- Dispose of any packaging material in accordance with regulations or separate it for recycling.
- When changing oil, the used oil must be collected in suitable containers. Remove any pools of oil immediately using an oil binding agent.
- Preservative agents should be stored separately from used oil.
- Used oil, preservative agents, oil binding agents and oil-soaked cloths must be disposed of in accordance with environmental legislation.
- Disposal of the gear unit after its service life:
  - Drain all the operating oil, preservative agent and/or cooling agent from the gear unit and dispose of in accordance with regulations.
  - Depending on national regulations, gear unit components and/or add-on parts may have to be disposed of or given to recycling separately.

### 3.3 Special dangers and personal protective equipment

Depending on operating conditions, the surface of the gear unit may heat up or cool down to extreme temperatures.



#### **WARNING**

##### **Risk of burns**

Serious injury caused by burns on hot surfaces ( $> 55\text{ °C}$ ) is possible.  
Wear suitable protection gloves and protection clothing.

#### **WARNING**

##### **Risk of low temperatures**

Serious injury from cold damage (pain, numbness, frostbites) on cold surfaces ( $< 0\text{ °C}$ ) is possible.  
Wear suitable protection gloves and protection clothing.

#### **WARNING**

##### **Risk of scalding**

Serious injury from discharging hot operating media is possible when these are changed.  
Wear suitable protection gloves, protection glasses and protection clothing.

#### **WARNING**

##### **Risk of eye injury**

Small foreign matter such as sand or dust can get into the cover plates of the rotating parts and might be thrown back by these.  
Wear suitable protective glasses.

#### **Note**

In addition to any generally prescribed personal protection equipment (protection shoes, protection clothing, helmet, etc.) handling the gear unit requires wearing **suitable safety gloves** and **suitable safety glasses**.

#### **DANGER**

##### **Explosion hazard**


Danger to life from ignition of a present explosive atmosphere is possible in the operation of the gear unit.  
The gear unit does **not** comply with the requirements of Directive 94/9/EC and must therefore, in the area of applicability of this directive, **not** be used in areas with explosion hazard.

## 4. Transport and storage


Observe the instructions in section 3. "Safety instructions"!

### 4.1 Scope of supply

The products supplied are listed in the dispatch papers. Check immediately on receipt to ensure that all the items listed have actually been delivered. Parts damaged and/or missing parts must be immediately reported in writing to Siemens.

 <b>WARNING</b>
<b>Serious physical injury from defective product</b>
If there is any visible damage, the gear unit must not be put into operation.

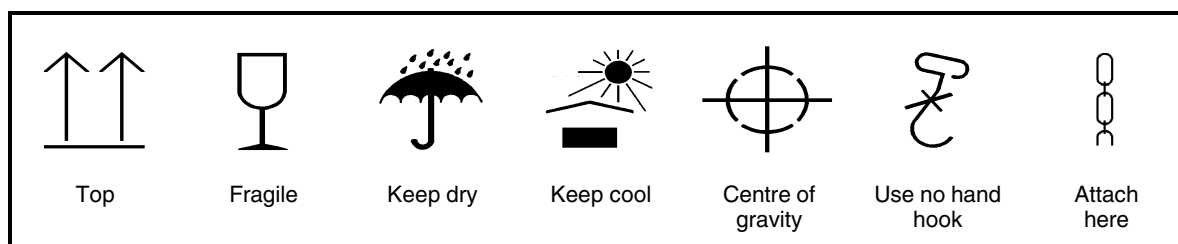
### 4.2 Transport

 <b>WARNING</b>
<b>Risk of crushing</b>
Risk of being crushed by a transported component when the used lifting gear and load-bearing equipment is not suitable and the component comes loose. When handling these products, use only lifting and handling equipment of sufficient load-bearing capacity. Observe the notes on the packaging regarding the load distribution. The gear unit must be transported in such a way that personal injury and damage to the gear unit is avoided. For example, impact on free shaft ends might lead to damage on the gear unit.

The gear unit is delivered in a fully assembled condition. Additional items are delivered separately packaged, if applicable.

Different forms of packaging may be used, depending on the size of the unit and method of transport. Unless agreed otherwise by contract, the packaging complies with the **HPE Packaging Guidelines**.

The symbols marked on the packaging must be observed at all times. These have the following meanings:



**Fig. 2:** Transport symbols

## Note

The gear unit may only be transported by means of the appropriate transport equipment. During transport the gear unit should be left without oil filling and on the transport packaging. In case of gear units with auxiliary drive, the auxiliary gear unit will be delivered ex works with oil filling. The instructions for the add-on auxiliary drive unit must be observed.

## NOTICE

### Property damage

Damage to the gear unit is possible when using the wrong attachment points. Use only the eye bolts provided to attach lifting equipment to the unit.

Transporting of the gear unit by attaching it to the pipework is not permitted.

The pipework must not be damaged.

Do not use the threads in the front sides of the shaft ends to attach slinging and lifting gear for transport.

Slinging and lifting gear must be adequate for the weight of the gear unit.

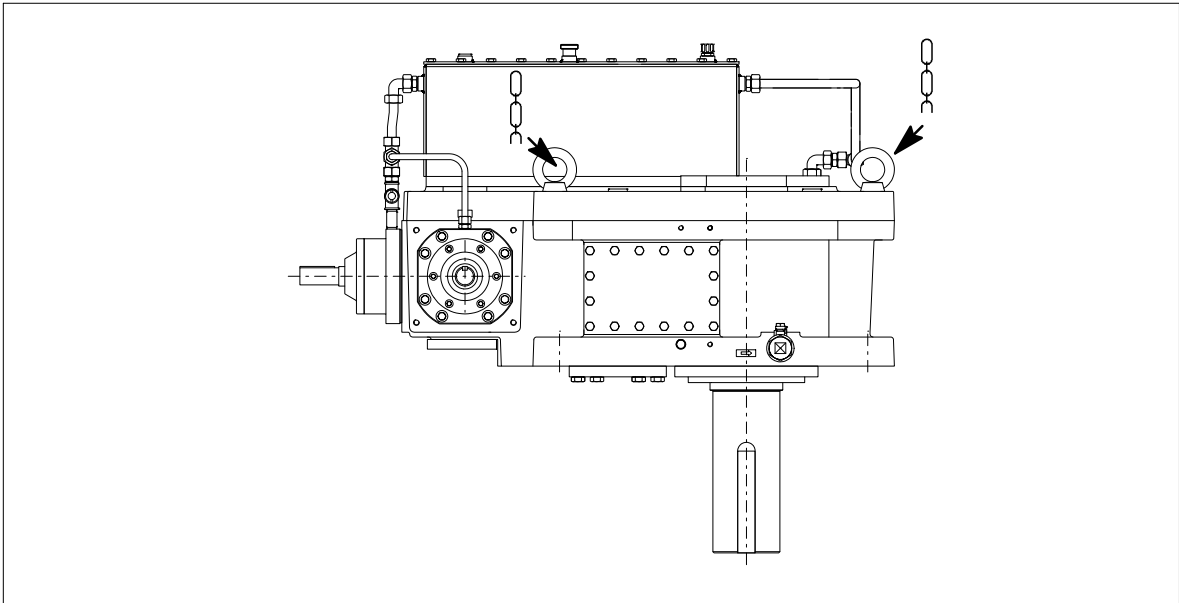


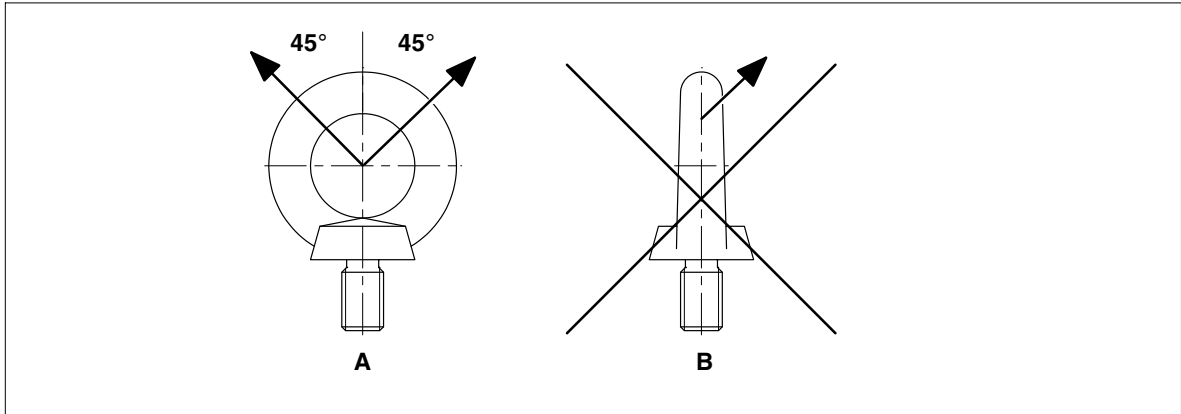
Fig. 3: Attachment points

## NOTICE

### Property damage

Damage to the eye bolts is possible.

When slinging to eye bolts, no lateral pull may be created counter to the direction of the ring level, in order to avoid breakage of the eye bolts.



**Fig. 4:** Tilted and lateral pull with eye bolts

**A** Permitted tilting in the direction of the ring level (angle maximally 45°)

**B** Not permitted lateral pull counter to the direction of the ring level

For a detailed illustration of the gear unit and the position of the attachment points, please refer to the drawings in the order-specific gear unit documentation.

#### 4.3 Storing the gear unit

The gear unit must be stored in a sheltered place in the position of the original packaging or in the position of use, placed on a vibration-free dry base, and covered over.

#### NOTICE

##### Property damage

Any damage to the coating may cause failure of the exterior protective coating and corrosion. When temporarily storing the gear unit and any components supplied with it, the corrosion protection applied to them has to be preserved. Ensure that the coat is not damaged.



#### DANGER

##### Danger to life from gear units toppling or dropping

Risk of being crushed or struck by a gear unit toppling or falling down. Do not stack gear units on top of one another.

#### NOTICE

##### Property damage

Damage to the gear unit by deposit of foreign matter or moisture. If the gear unit is stored outdoors, it must be particularly carefully covered, and it must be ensured that neither moisture nor foreign material can collect on the unit. Waterlogging must be avoided.

#### NOTICE

##### Property damage

Damage to the gear unit from external effects. Unless agreed otherwise by contract, the gear unit must not be exposed to harmful effects, such as chemically aggressive products. Provision for special environmental conditions during transport (e. g. transport by ship) and storage (climate, termites, etc.) must be contractually agreed.



#### 4.4 Standard coating and preservation

The gear unit is provided with an interior preservation; protective preservation is applied to the free shaft ends.

The characteristics of the external coat depend on the ambient conditions defined for the method of transport and the region of use.

<b>NOTICE</b>
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<b>Property damage</b>
------------------------

Damage to the gear unit from corrosion is possible. The gear unit is normally delivered completely ready with a priming and a finishing coat. Where gear units are delivered with a priming coat only, it is necessary to apply a finishing coat in accordance with directives relevant to the specific application. The priming coat alone is not suitable to provide sufficient long-term corrosion protection.
--

<b>NOTICE</b>
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<b>Property damage</b>
------------------------

Any damage to the coating may cause failure of the exterior protective coating and corrosion. Ensure that the coat is not damaged.
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**Note**

Unless agreed otherwise by contract, the durability periods of the interior gear unit preservation specified in table 3 or 4 apply, provided the related requirements are adhered to. The durability period for the exterior preservation and the related requirements can be found in table 5.

The guarantee period starts on the date of delivery or that of the notice that the item is ready for shipment.

---

If a storage period is different to what is indicated in table 3 or 4 and table 5, the interior preservation and exterior preservation must be checked and, if necessary, repeated (see items 7.3.1 and 7.3.2). Each prolongation of the interior preservation and any renewal of the exterior preservation must be logged.

---

**Note**

The record must be kept with these instructions.

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4.4.1 Interior preservation with preservative agent

**Table 3:** Durability period and measures for interior preservation when using mineral oil or PAO-based synthetic oil

Duration of protection	Preservative agent	Special measures
up to 6 months	Castrol Alpha SP 220 S	None
up to 24 months		<ul style="list-style-type: none"> <li>– Close all openings on the gear unit.</li> <li>– Replace the air or wet air filter with a screw plug. (Replace the screw plug with the air filter or wet air filter before start-up.)</li> </ul>
For storage periods longer than 24 months, the preservation of the gear unit must be renewed (see item 4.4.1.1).		

**Table 4:** Durability period and measures for interior preservation when using PG-based synthetic oil

Duration of protection	Preservative agent	Special measures
up to 6 months	Special anti-corrosion oil TRIBOL 1390 <sup>1)</sup>	None
up to 36 months		<ul style="list-style-type: none"> <li>– Close all openings on the gear unit.</li> <li>– Replace the air or wet air filter with a screw plug. (Replace the screw plug with the air filter or wet air filter before start-up.)</li> </ul>
For storage periods longer than 36 months, the preservation of the gear unit must be renewed (see item 4.4.1.1).		

1) Resistant to tropical conditions and sea water; maximum ambient temperature 50 °C

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**Note**

The implementation of the interior preservation is described in section 7. (see item 7.3.1).

---

#### 4.4.1.1 Re-preserving the interior of the gear unit in case of longer periods of storage



### CAUTION

#### Risk of injury

Risk of injury to eyes or hands from chemically aggressive operating substances.  
Wear suitable protection glasses and protection gloves.  
Remove any spilled oil immediately using an oil binding agent.

For storage periods longer than 24 months (see table 3) or 36 months (see table 4), the interior preservation of the gear unit must be renewed. The following procedure is recommended:

- Undo and remove oil filler plug.
- Place a suitable container under the oil draining point of the gear unit housing.
- Unscrew the oil drain plug and/or open the oil drain cock and drain the used preservation oil into a suitable container.
- Dispose of the residual preservative oil in accordance with regulations.
- Close the oil drain cock and/or screw in the oil drain plug.
- Fill gear unit with "Castrol Alpha SP 220 S".  
Establish the filling quantity in accordance with the gear unit dimensions:  
Length x width x height x 0.05

### NOTICE

#### Property damage

Corrosion is possible when using the wrong preservative.  
Use the special "Castrol Alpha SP 220 S" oil with extra corrosion protection (addition "S").

### NOTICE

#### Property damage

Corrosion is possible when the gear unit is opened for too long.  
Close the gear unit airtight again at the latest one hour after opening.  
Before restarting the gear unit carry out the following action:  
- Replace the screw plug with the air filter or wet air filter.

- Screw in oil filler plug.

The gear unit is now preserved for a further period of 24 months.

### NOTICE

#### Property damage

Damage to the gear unit possible from inadequate lubrication due to mixing of preservative and operating oil.  
If the gear unit is to be filled with a PG-based synthetic operating oil after preservation, the gear unit must be thoroughly flushed out with operating oil after draining the preservative oil and before the start-up (for this see item 10.2.2).  
The flushing oil must not be used for operation of the unit.

#### 4.4.2 Exterior preservation

**Table 5:** Durability period for exterior preservation of shaft ends and other bright machined surfaces

Durability of protection	Preservative agent	Layer thickness	Remarks
with indoor storage up to <b>36</b> months <sup>1)</sup>	Tectyl 846 K19	approx. 50 µm	Long-term wax-based preservative agent: – resistant to sea water – resistant to tropical conditions – soluble with CH compounds
with outdoor storage up to <b>12</b> months <sup>2)</sup>			

1) The gear unit must be stored in the position of use in a sheltered place; it must be placed on a vibration-free, dry base and covered over.

2) If the gear unit is stored outdoors, it must be particularly carefully covered, and it must be ensured that neither moisture nor foreign material can collect on the unit. Waterlogging must be avoided.

---

#### Note

The implementation of the exterior preservation is described in section 7. (see item 7.3.2).

---

#### 4.4.2.1 Re-preservation of the metallic bright exterior surfaces of the gear unit

In case of storage periods exceeding the periods specified in table 5 the exterior of the gear unit must be re-preserved using the preservative agent shown in table 5.

## 5. Technical description

Observe the instructions in section 3. "Safety instructions"!

### 5.1 General description

The gear unit described is a "**FLENDER bevel-helical gear unit**" designed for driving a pre-heater in a power plant.

#### NOTICE

##### Property damage

Destruction of the gear unit or gear unit parts from wrong rotation direction is possible.  
The gear unit may only be operated in one direction of rotation.

The gear units are characterised by a low noise level, which is achieved by helical gears with a high contact ratio and a sound-damping housing.

The good temperature characteristics of the gear unit are achieved by its high degree of efficiency, large housing surface and performance-related cooling system.

#### Note

For fitting an auxiliary drive is fitted, the attribution of the rotational direction is defined in the dimensioned drawing.







### 5.2 Housing

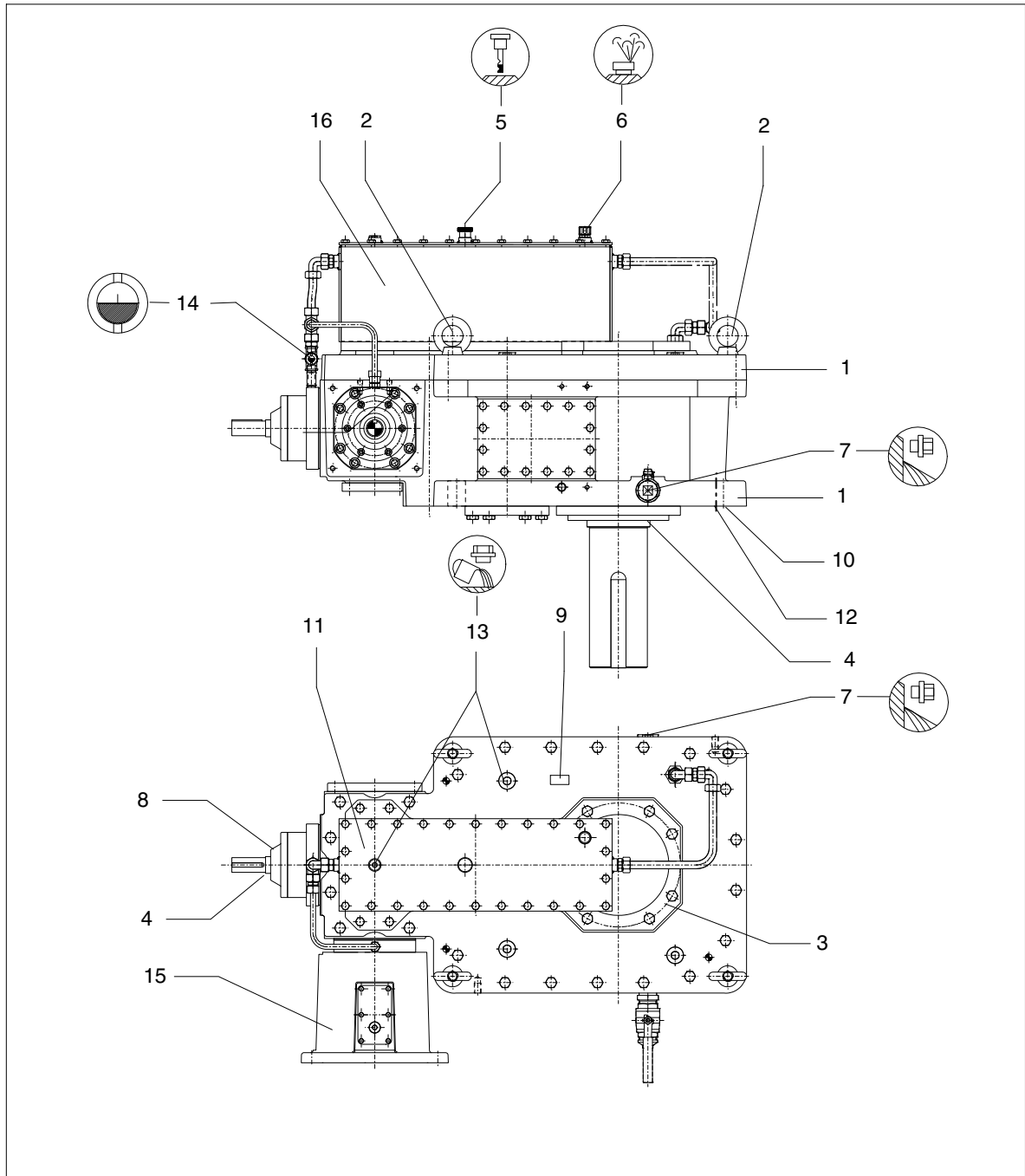
The housing consists of two parts and is made of cast iron. It is of torsionally rigid design and due to its shape imparts very favourable noise and temperature characteristics.

The gear unit housing comes with the following equipment:

- Eye bolts (adequately dimensioned for transport)
- Inspection and/or assembly cover (for inspection)
- Oil sight glass and/or oil dipstick with MIN and MAX marking (for oil level check)
- Oil drain plug and/or oil drain cock (to drain the oil).
- Air filter or wet air filter (for supply and exhaust ventilation)

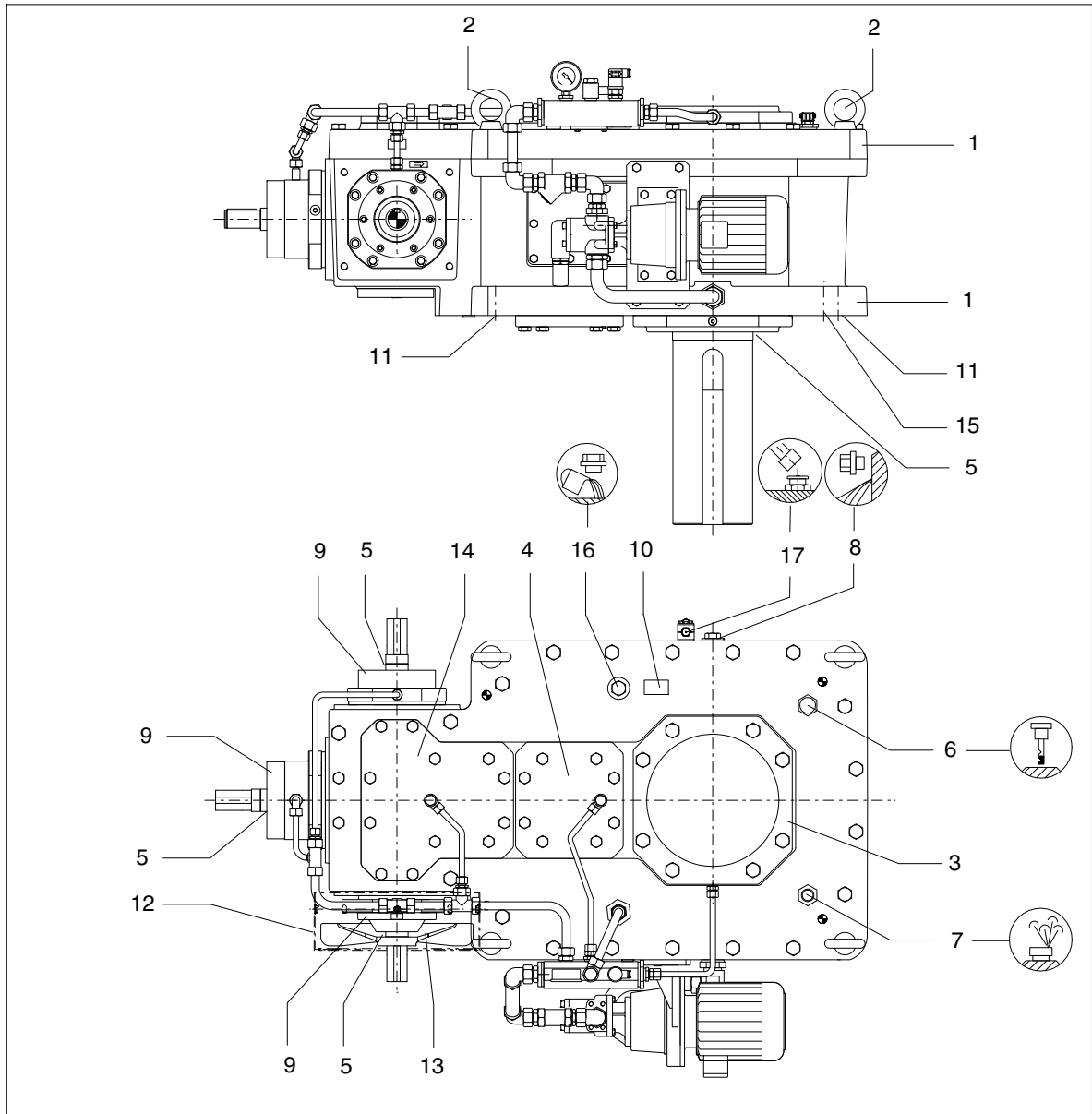
Colour codes for venting, oil filling point, oil level and oil drainage:

Air relief point		yellow	Oil drain point		white
Oil filling point		yellow	Lubricating point		red
Oil level: Oil sight glass		red	Oil level: Oil dipstick		red



**Fig. 5:** Housing equipment on gear units with splash lubrication

- |   |  |    |                                  |
|---|--|----|----------------------------------|
| 1 | Housing                                | 9  | Rating plate                     |
| 2 | Eye bolt                               | 10 | Gear unit fastening              |
| 3 | Cover                                  | 11 | Inspection and/or assembly cover |
| 4 | Shaft seal                             | 12 | Alignment thread                 |
| 5 | Oil dipstick                           | 13 | Oil filling point                |
| 6 | Housing supply and exhaust ventilation | 14 | Oil sight glass                  |
| 7 | Oil drain plug and/or oil drain cock   | 15 | Overrunning clutch               |
| 8 | Cover and/or bearing journal           | 19 | Oil compensation container       |



**Fig. 6:** Housing equipment on gear units with forced lubrication

- |   |  |    |                                  |
|---|--|----|----------------------------------|
| 1 | Housing                                | 10 | Rating plate                     |
| 2 | Eye bolt                               | 11 | Gear unit fastening              |
| 3 | Cover                                  | 12 | Air-guide cover                  |
| 4 | Cover                                  | 13 | Fan                              |
| 5 | Shaft seal                             | 14 | Inspection and/or assembly cover |
| 6 | Oil dipstick                           | 15 | Alignment thread                 |
| 7 | Housing supply and exhaust ventilation | 16 | Oil filling point                |
| 8 | Oil drain plug                         | 17 | Grease lubrication point         |
| 9 | Cover and/or bearing journal           |    |                                  |

For a detailed illustration of the gear unit and the position of the add-on parts, please refer to the drawings in the gear unit documentation.

### 5.3 Toothed components

The externally toothed components of the gear unit are case-hardened. The helical gear teeth are ground. The high quality of the teeth leads to a significant noise reduction. Safe running is ensured.

The gear wheels are joined to the shafts by interference fits and parallel keys. These types of joints transmit the torques generated with adequate reliability.

### 5.4 Lubrication

#### 5.4.1 Splash lubrication

Unless agreed otherwise by contract, the teeth and bearings are supplied adequately through splash lubrication. The gear unit thus requires very little maintenance.

#### 5.4.2 Forced lubrication

With high input speeds or high peripheral speeds at the toothed systems, the splash lubrication can, depending on the order, be supplemented by or replaced with a forced lubrication.

The following configuration is available:

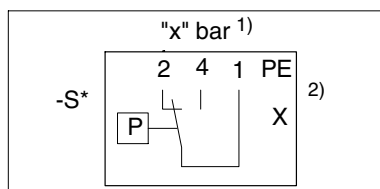
- Add-on oil-supply system (fixed to the gear unit, see item 5.7.2)

---

#### Note

For gear units with a combined splash and forced lubrication, it is necessary to connect the pressure monitor as an opening contact or closing contact prior to start-up.

---



1) Pressure according to the information in the order-specific documentation.

2) To be connected as an opening or closing contact as required.

---

#### Note

When operating and servicing the components of the oil supply system, observe the operating instructions of the components.

For technical data, refer to the data sheet and/or the list of equipment.

For a detailed illustration of the gear unit and oil-supply system, refer to the drawings in the gear unit documentation.

---



## 5.5 Shaft bearings

All shafts are fitted in rolling bearings.

## 5.6 Shaft seal

Radial shaft sealing rings or special seals on the shaft outlets prevent oil from escaping the gear unit or dirt from penetrating the gear unit.

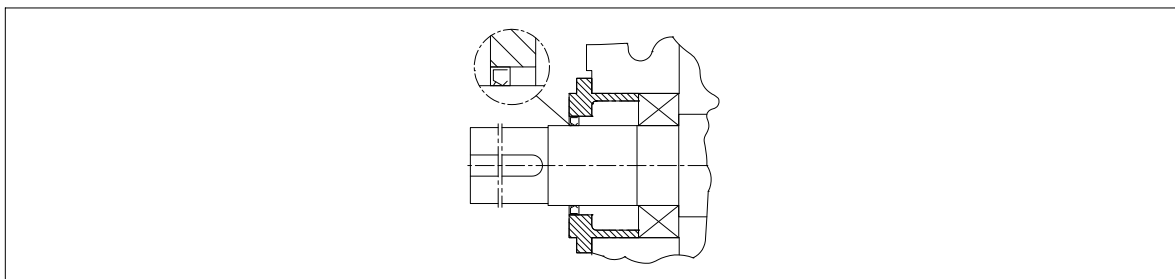
### 5.6.1 Radial shaft seal

Radial shaft seals are the standard type of seal. They are preferably fitted with an additional dust lip to protect the actual sealing lip from external contamination.

#### **NOTICE**

##### **Property damage**

Destruction of the radial shaft sealing ring caused by high dust concentrations is possible.  
Radial shaft sealing ring is not to be used in high concentrations of dust.



**Fig. 7:** Radial shaft seal

## 5.6.2 Oil retaining pipe

By sealing the input shaft that is pointing downward with a contact-free and wear-free shaft seal (a so-called "oil retaining pipe"), the shaft outlet is kept absolutely tight so to prevent oil from escaping. This system is used only for forced lubrication.

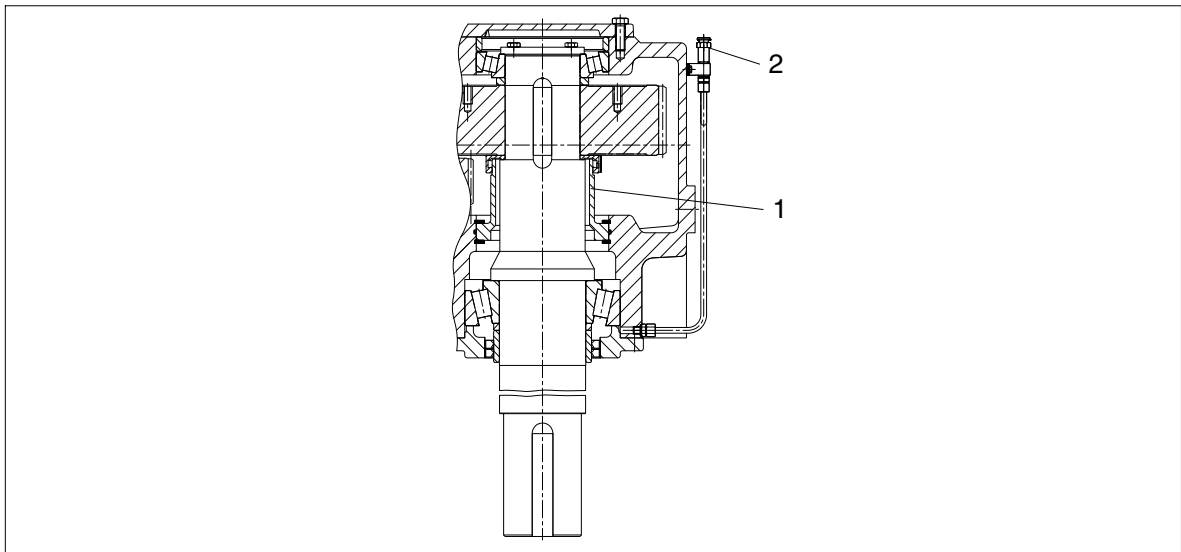
The lower anti-friction bearing of the output shaft is separated from the gear unit interior by the oil retaining pipe and is lubricated with grease. Grease is prevented from escaping by the use of a radial shaft sealing ring.

### NOTICE

#### Property damage

Damage to the bottom bearing is possible from inadequate lubrication.

For refilling grease in the lower bearing, the specified frequencies must be observed (see section 7 "Start-up" and table 12 in section 10 "Maintenance and repair").



**Fig. 8:** Oil retaining pipe

1 Oil retaining pipe

2 Lubrication point

## 5.7 Cooling

The gear unit is fitted with a fan.

---

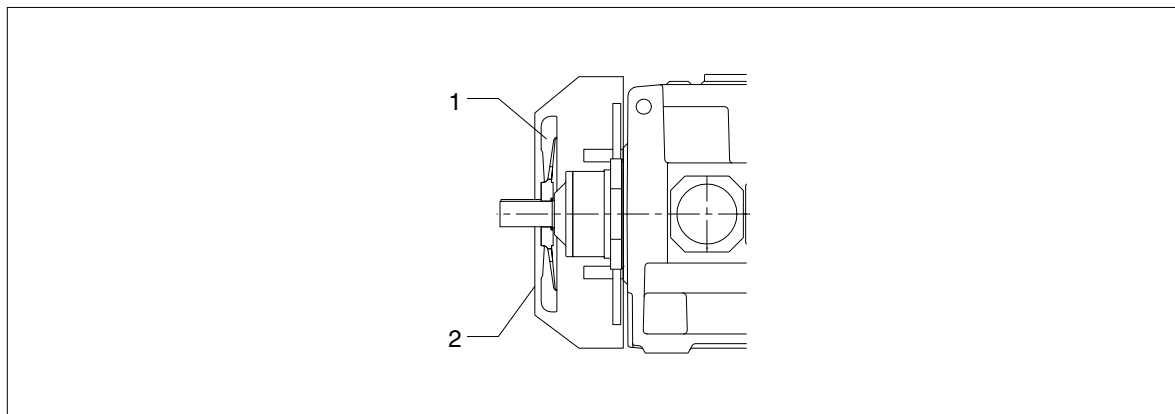
### Note

When installing the gear unit, free convection must be ensured on the housing surface, in order to definitely avoid overheating the gear unit.

---

### 5.7.1 Fan

The fan is fitted on the high-speed shaft of the gear unit and is protected from accidental contact by an air guide cover. The fan sucks air through the grid of the air-guide cover and blows it along the air ducts on the side of the gear unit housing. It thereby dissipates a certain amount of heat from the housing.



**Fig. 9:** Fan

1 Fan

2 Air-guide cover

For a detailed illustration of the gear unit and the position of the add-on parts, please refer to the drawings in the gear unit documentation.

### NOTICE

#### Property damage

Overheating of the drive unit is possible by inadequate air supply.

If gear units are fitted with a fan, sufficient space must be allowed as suction opening for cooling air intake when mounting the safeguards for the coupling or similar.

The correct distance is given in the dimensioned drawing in the gear unit documentation.

It must be ensured that the air-guide cover is correctly fastened. The air-guide cover must be protected against damage from outside. The fan must not come into contact with the air-guide cover.

### NOTICE

#### Property damage

Overheating of the gear unit by a dirt layer with insulating effect on the gear unit or by soiled fan is possible.

The cooling effect is considerably reduced if the the fan or the housing surface is soiled.

Observe the information on cleaning contained in section 10. "Maintenance and repair".

## 5.7.2 Add-on oil-supply system

Components:

- Pump
- Pipework
- Filter
- Monitoring equipment

---

### Note

The flow direction of the pump used is **not dependent on the direction of rotation**, unless it is specified otherwise in the documentation.  
When connecting the fittings, the actual flow direction must be observed however.

---

---

### Note

When operating and servicing the components of the oil supply system, observe the operating instructions of these components.  
For technical data, refer to the data sheet and/or the list of equipment.

---

For a detailed illustration of the gear unit and oil-supply system, refer to the drawings in the gear unit documentation.

### 5.7.2.1 Pump

The used pump is suitable for the supply of lubricating oil. The flow medium must not contain abrasive components and must not chemically affect the materials of the pump. A precondition of a proper functioning, high reliability and long service life of the pump is in particular a clean and lubricating delivery medium.

### 5.7.2.2 Filter

The filter protects downstream aggregates, measuring and control devices from contamination. The filter comprises a housing with connections and a sieve. The medium flows through the filter housing whereby the dirt particles flowing through the pipe are retained.  
Dirty filter elements must be cleaned or replaced.

## 5.8 Couplings

As a rule, flexible couplings or safety couplings are used for driving the gear unit.

If rigid couplings or other in- and/or output elements, which create additional radial and/or axial forces, (e. g. gear wheels, belt pulleys, disk flywheels, hydraulic couplings) are to be used, this must be agreed by contract.

## 5.9 Indication of oil level

The gear unit is fitted with an oil level indicator (oil sight glass or oil dipstick with MIN and MAX marking) for visual check of the oil level at standstill. The oil level can be checked on the oil sight glass or the oil dipstick when the oil has cooled down.

For a detailed illustration of the gear unit and the position of the add-on parts, please refer to the drawings in the gear unit documentation.

## 5.10 Oil temperature monitoring (optional)

The gear unit can be fitted with a temperature monitor for measuring the oil temperature in the oil sump. In order to measure the temperatures and/or temperature differences, the temperature monitor should be connected to an evaluating device by the customer.

For a detailed illustration of the gear unit and the position of the add-on parts, please refer to the drawings in the gear unit documentation.

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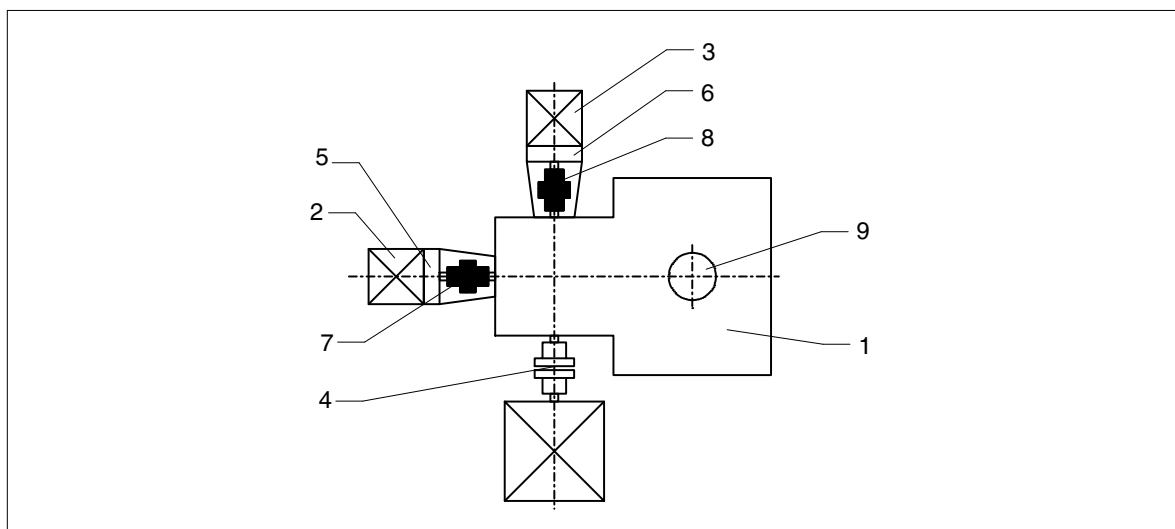
### Note

For operation and maintenance, the operating manuals in the order-specific annex must be observed. For technical data and control information, refer to the list of equipment prepared specifically for the order.

---

## 5.11 Auxiliary drive unit

The gear unit is optionally equipped with one or two auxiliary drives. The auxiliary drives allow for the main gear unit to be operated at a lower output speed in the same direction of rotation. The auxiliary drive is provided either by Siemens or the customer. The auxiliary drive is coupled with the main gear unit through an overrunning clutch and is positioned in a connecting flange that is fitted on the main gear unit. The overrunning clutch is supplied with oil from the main gear unit. An example of a basic drive configuration is shown in figure 10.



**Fig. 10:** Basic design of the gear unit with main and auxiliary drives

- |   |                              |   |                                    |
|---|------------------------------|---|------------------------------------|
| 1 | Main gear unit               | 6 | Auxiliary drive 2 (optional)       |
| 2 | Auxiliary motor 1            | 7 | Overrunning clutch 1               |
| 3 | Auxiliary motor 2 (optional) | 8 | Overrunning clutch 2 (optional)    |
| 4 | Coupling                     | 9 | Output shaft of the main gear unit |
| 5 | Auxiliary drive 1            |   |                                    |

For a detailed illustration of the gear unit and the number of the auxiliary drives, please refer to the drawings in the gear unit documentation.

For the exact designation of the geared motor as well as the mounting position please refer to the drawings (see section 1. "Technical data"). The auxiliary gear unit has its own oil circulation system which is separated from that of the main gear unit.

Before connecting the motor, determine the direction of rotation of the three-phase current supply using a phase-sequence indicator, and connect the motor in accordance with the pre-determined direction of rotation.

Observe the notice pasted onto the gear unit.

---

### Note

The special operating instructions should be observed for operation of the auxiliary gear unit.

---

### 5.11.1 Overrunning clutch

If the gear unit is fitted with an auxiliary drive unit in addition to the main drive, coupling is realized by an overrunning clutch. This allows, when driving by the auxiliary drive, a torque transmission in one direction of rotation, while there is "**free-wheeling operation**" when driven by the main drive.

The output shaft of the main drive will rotate in the same direction of rotation both if the drive is effected via the main motor and via the auxiliary drive.

The overrunning clutch is positioned on one of the two or three input shafts and is integrated in the oil circulation of the gear unit. Maintenance and oil change take place simultaneously with maintenance and oil change of the main drive.

The overrunning clutch is provided with centrifugally operated grippers. If the main gear unit is rotating in the specified direction of rotation, the inner ring will rotate together with the grippers, while the outer ring remains stationary. From a certain speed of rotation, the grippers will lift off and the overrunning clutch will operate without wear. If the drive is effected by the motor of the auxiliary drive via the outer ring, the overrunning clutch will be in "**carrier operation**", i.e. the main gear unit is turned over slowly in the chosen direction of rotation. At the same time, the input shaft of the main gear unit and, if an elastic coupling is used between the main motor and gear unit, possibly the main motor will rotate slowly along with it.

---

#### Note

The main motor and the motor of the auxiliary drive unit have to be interlocked electrically in such a manner that only one of the two motors can be switched on.

---

#### Note

When the gear unit is driven by the auxiliary drive unit, the input shaft of the main gear unit slowly rotates along with it at the same time. This rotary motion **must not** be impeded. A brake arranged on the drive side on the main drive must be released if the drive is opened through the auxiliary drive.

---

### 5.12 Oil compensating tank

The oil compensating tank ensures the appropriate volumetric compensation, when the volume of oil increases with rising temperature.

## 6. Fitting

Observe the instructions in section 3. "Safety instructions"!

### 6.1 General assembly information

When transporting the gear unit observe the notes in section 4 "Transport and storage".

Fitting work must be done with great care by authorised, trained and qualified personnel. Damage caused by incorrect assembly and installation lead to a preclusion of liability.

As early as during the planning phase sufficient space must be allowed around the gear unit for later care and maintenance work.

---

#### Note

Free convection through the surface of the housing must be ensured by suitable measures.

---

If the gear unit is fitted with a fan, there sufficient space for air intake should be ensured.

Adequate lifting gear must be available before beginning the fitting work.

#### NOTICE

##### Property damage

Heating up due to exposure to external influences, such as direct irradiation from the sun or other heat sources, is not acceptable and must be prevented by suitable measures.  
A heat concentration must be avoided.

This can be ensured as follows:

- fitting a sunshade roof

or

- fitting an additional cooling unit

or

- by a temperature monitoring device in the oil sump with a shut-off function.

---

#### Note

Any heat concentration must be prevented when using a sunshade roof.

When using a temperature monitoring device, a warning signal must be emitted when the maximum permitted oil sump temperature is reached. If the maximum permitted oil sump temperature is exceeded, the drive must be shut off.

Such shutting off may cause the operator's plant to stop.

---

#### NOTICE

##### Property damage

Damage to the gear unit from dropping objects, heaping over, welding work or inadequate fastening. The operator must ensure the following:

- The gear unit must be protected against dropping objects and heaping over.

- No welding work must be done at all on the drive.

- The gear unit must not be used as an earthing point for electrical welding work.

- All fastening points provided by the design of the unit must be used.

- The screws having become useless in the context of assembly and disassembly works must be replaced by new screws of the same tightness class and model.

---

#### Note

To ensure proper lubrication during operation, the mounting position specified on the drawings must always be observed.

---

## 6.2 Unpacking

### NOTICE

#### Property damage

Damage to the gear unit from corrosion is possible.  
The packaging must not be opened or damaged beforehand if this is part of the preservation method.

The products supplied are listed in the dispatch papers. Check immediately on receipt to ensure that all the products listed have actually been delivered. Parts damaged and/or missing parts must be reported to Siemens in writing immediately.

- Remove packaging material and transporting equipment and dispose of in accordance with regulations.
- Perform a visual check for any damage and contamination.



### WARNING

#### Serious physical injury from defective product

If there is any visible damage, the gear unit must not be put into operation.  
The instructions in section 4. "Transport and storage", must be observed.

## 6.3 Assembly of the gear unit

### 6.3.1 Fitting the gear unit on a housing base

#### 6.3.1.1 Foundation

### NOTICE

#### Property damage

Damage from absent stability of the gear unit is possible.  
The foundation must be horizontal and level. The gear unit must not be stressed excessively when tensioning the fastening bolts.

The foundation should be designed in such a way that no resonance vibrations are created and that no vibrations are transmitted from adjacent foundations. The structure on which the unit is to be fitted must be rigid. It must be designed according to the weight and torque, taking into account the forces acting on the gear unit.

Careful alignment with the units on the in- and output sides must be ensured. Any elastic deformation through operating forces must be taken into consideration.

### NOTICE

#### Property damage

Damage from absent stability of the gear unit is possible.  
Fastening bolts and fastening nuts must be tightened to the prescribed tightening torque.  
For the correct tightening torque refer to item 6.7. Bolts of the minimum strength class 8.8 must be used.


If external forces are acting upon the gear unit, it is advisable to prevent the unit from displacement by means of lateral stops.

### Note


For dimensions, space requirement and arrangement of supply connections, refer to the drawings in the gear unit documentation.



6.3.2 Description of assembly work

 <b>WARNING</b>
<b>Serious physical injury</b> Risk of physical injury from inflammation caused by solvent steams during cleaning work. Observe the following: - Ensure adequate ventilation. - Do not smoke.

- Remove the corrosion protection on the shafts using a suitable cleaning agent.


 <b>CAUTION</b>
<b>Risk of injury from chemical substances</b> Observe manufacturer's instructions for handling lubricants and solvents. Wear suitable protective clothing.

<b>NOTICE</b>
<b>Property damage</b> Damage to the shaft seals from chemically aggressive cleaning agents is possible. Any contact of the cleaning agent with the shaft seals must be avoided.

- Fit and secure input drive elements (e. g. coupling parts) on shafts.  
If these are to be fitted in heated condition, refer to the dimensioned drawings in the coupling documentation for the correct joining temperatures.

Unless specified otherwise, the components may be heated inductively, with a burner, or in a furnace.



 <b>WARNING</b>
<b>Risk of burns</b> Serious injury caused by burns on hot surfaces (> 55 °C) is possible. Wear suitable protection gloves and protection clothing.

<b>NOTICE</b>
<b>Property damage</b> Damage to the shaft seals from heating above 100 °C is possible. Use heat shields to protect against radiant heat.

The elements must be pulled smartly onto the shaft as far as stated in the dimensioned drawing prepared in accordance with the order.

<b>NOTICE</b>
<b>Property damage</b> Damage in the gear unit from blows or impact is possible. Fit the coupling with the aid of suitable fitting equipment. The shaft seals and running surfaces of the shaft must not be damaged when pulling in the coupling parts.

## NOTICE

### Property damage

Damage to the gear unit or individual components is possible from inadequate alignment. When installing the drives, make absolutely certain that the individual components are accurately aligned to one other. Unacceptable large errors in the alignment of the shaft ends to be connected due to angular and/or axial misalignments result in premature wear and material damage. Insufficiently rigid base frames or sub-structures can also cause a radial and/or axial misalignment during operation, which cannot be measured when the unit is at a standstill.

### Note

Gear units with a weight that requires the use of lifting gear must be attached at the points shown in section 4. "Transport and storage". If the gear unit is to be transported with add-on parts, additional attachment points may be required. The position of these attachment points is shown on the order-related dimensioned drawing.

#### 6.3.2.1 Alignment

The final alignment with the assemblies on the in- and output side must be carried out accurately by the shaft axes, using:

- rulers
- spirit level
- dial gauge
- feeler gauge, etc.

Only then should the gear unit be fastened and then the alignment should be checked once again.

- Record alignment dimensions.

### Note

The record must be kept with these instructions.



## DANGER

### Danger to life from air-borne fracture pieces

Disregard for the precision of alignment can cause shaft rupture, resulting in serious injury and danger to life and limb.

Align gear unit precisely (observe specified values).

Damage to the gear unit or its components or add-on parts is possible.

The accuracy of the alignment of the shaft axes to each other is decisive for the lifespan of shafts, bearings and couplings. If possible, the deviation should be zero (exception: ZAPEX couplings). For this purpose, e. g. also the special requirements for the couplings can be found in the related operating instructions.

### 6.3.2.2 Fitting on a foundation frame

- Clean the bottom side of the gear unit base.
- Using suitable lifting gear, set the gear unit down on the foundation frame.
- Tighten the foundation bolts to the specified torque (see item 6.7); if necessary, use stops to prevent displacement if required.

#### **NOTICE**

##### **Property damage**

Damage to the gear unit from uneven tensioning of the fastening screws is possible. Tighten the fastening screws evenly. The gear unit must not be stressed excessively when tensioning the fastening bolts.

- Align the gear unit exactly with the input and output units (see item 6.3.2.1).
- Record alignment dimensions.

#### **Note**

The record must be kept with these instructions.

### 6.3.2.3 Fitting on a concrete foundation with stone bolts or foundation blocks

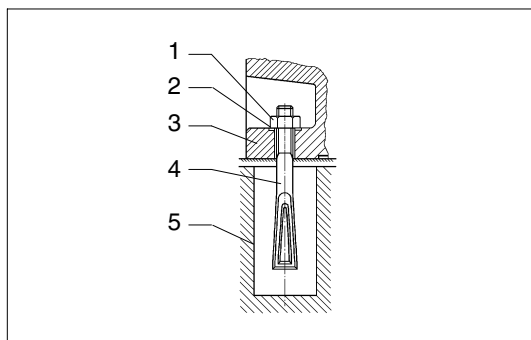
- Clean the bottom side of the gear unit base.

#### **If using stone bolts:**

- Hook stone bolts with washers and hexagon nuts into the foundation fastening points on the gear unit housing (see figure 11).

#### **Note**

The hexagon nuts must only be tightened when the concrete has set.



- 1 Hexagon nut
- 2 Washer
- 3 Gear unit base
- 4 Stone bolt
- 5 Foundation

**Fig. 11:** Stone bolt

### If using foundation blocks:

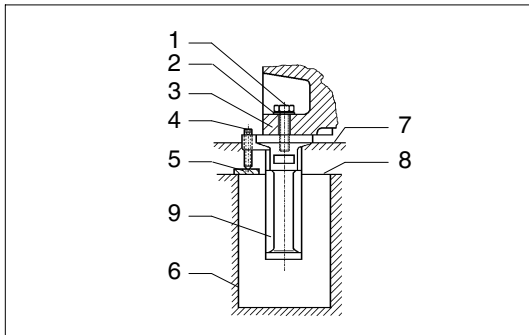
- Hook the foundation blocks with washers and fastening bolts into the foundation fastening points on the gear unit housing (see figure 12).

---

#### Note

The fastening bolts must only be tightened when the concrete has set.

---



- 1 Fastening bolt
- 2 Washer
- 3 Gear unit base
- 4 Set screw
- 5 Flat steel plate
- 6 Foundation
- 7 Final foundation height
- 8 Prepared foundation height
- 9 Foundation block

**Fig. 12:** Foundation block

- Using suitable lifting gear, place the gear unit on the concrete foundation.
- Align gear unit horizontally by in- and output shafts:
  - when using stone bolts: with shims,
  - when using foundation blocks, with the aid of the set screws (if available).
- If necessary with more powerful forces, use stops to prevent the unit from displacement.
- Before pouring the concrete foundation, fill up the openings in the foundation blocks with adequate material (e. g. polystyrene).
- Pour concrete into the recesses for the stone bolts or foundation blocks.
- When the concrete has set, tighten the hexagon nuts of the stone bolts or fastening bolts of the foundation blocks to the specified torque (see item 6.7).

#### NOTICE

##### Property damage

Damage to the gear unit from uneven tensioning of the hexagon nuts or fastening screws is possible. Tighten the hexagon nuts or fastening screws evenly. The gear unit must not be stressed excessively during the fastening process.

## 6.4 Couplings

As a rule, flexible couplings or safety slip clutches are used for driving the gear unit.

If rigid couplings or other in- and/or output elements, which create additional radial and/or axial forces, (e. g. gear wheels, belt pulleys, disk flywheels, hydraulic couplings) are to be used, this must be agreed by contract.

### Note

Couplings must be balanced in accordance with the specifications in the pertinent instructions manual. When operating and servicing the couplings, observe the operating instructions relating to the couplings.

Increased system service life and reliability and reduced running noise can be achieved through the least possible radial and angular misalignment.

### NOTICE

#### Property damage

Damage to the gear unit or individual components is possible from inadequate alignment. When installing the drives, make absolutely certain that the individual components are accurately aligned to one other. Unacceptable large errors in the alignment of the shaft ends to be connected due to angular and/or axial misalignments result in premature wear and material damage. Insufficiently rigid base frames or sub-structures can also cause a radial and/or axial misalignment during operation, which cannot be measured when the unit is at a standstill.

### Note

For permissible alignment errors in couplings supplied by Siemens, refer to the instructions manuals for the couplings.

When using couplings manufactured by other manufacturers, ask these manufacturers which alignment errors are permissible, stating the radial loads occurring.

The coupling parts may get out of alignment:

- by imprecise alignment during assembly or installation,
- during operation of the system due to:
  - due to heat expansion,
  - due to shaft flexure,
  - due to too weak machine frames, etc.

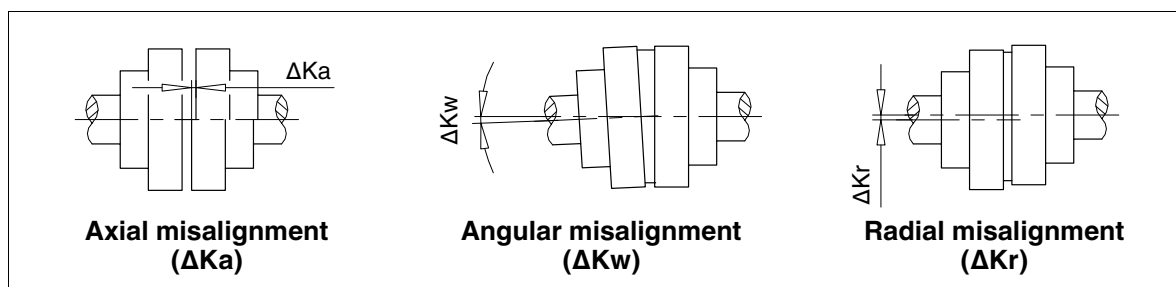
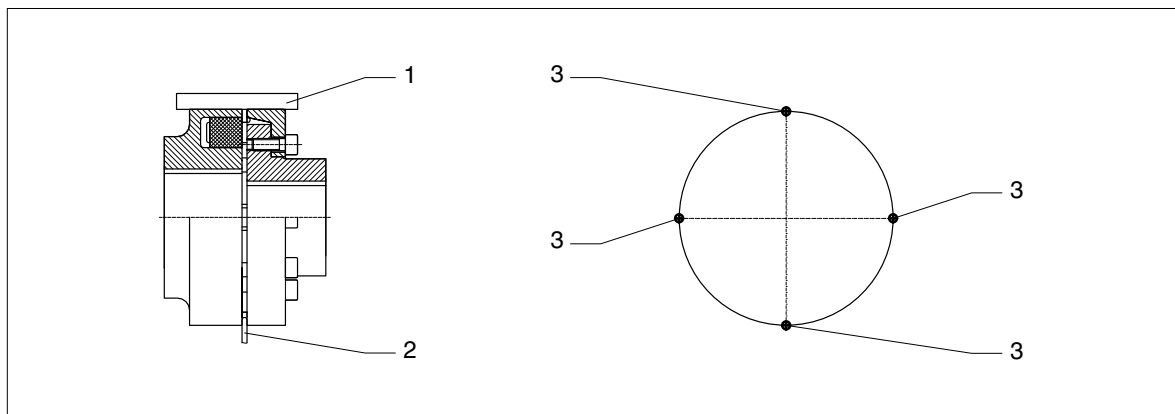


Fig. 13: Possible misalignments

Alignment has to be done in two axial planes arranged perpendicularly to each other. This can be done by means of a ruler (radial misalignment) and feeler gauge (angular misalignment), as shown in the illustration. The aligning accuracy can be increased by using a dial gauge or a laser alignment system.



**Fig. 14:** Example of alignment on a flexible coupling

1 Ruler

2 Feeler gauge

3 Measuring points

## NOTICE

### Property damage

Damage or destruction of the coupling from wrong alignment is possible.

The maximum permissible misalignment values are specified in the operating instructions for the coupling; they must under no circumstances be exceeded during operation.

Angular and radial misalignments may occur at the same time. The sum of both misalignments must not exceed the maximum permissible value of the angular or radial misalignment.

If you use couplings manufactured by other manufacturers, ask these manufacturers which alignment errors are permissible, stating the radial loads occurring.

### Note

For alignment of the drive components (vertical direction), it is recommended to use packing or foil plates underneath the mounting feet. The use of claws with set screws on the foundation for lateral adjustment of the drive components is also advantageous.

## 6.5 General notes on add-on components

### Note

For operating and servicing the components described in section 6., the pertinent instruction manuals and the specifications in section 5. must be observed.

For technical data, refer to the data sheet and/or the list of equipment.

6.6 Final work

- After installation of the gear unit check all screw connections for tight fit.
- Check of the alignment after tightening the fastening elements. The alignment must not have changed.
- Check that all the devices which have been demounted for transport reasons have been refitted. For this refer to the details in the data sheet, the list of equipment and the associated drawings.
- Existing oil drain cocks must be secured against accidental opening.
- The gear unit must be protected against dropping objects.
- Protective devices for rotating parts must be checked for correct seating. Contact with rotating parts is not permitted.
- A potential equalisation in accordance with the applicable regulations and/or directives must be carried out!  
If no threaded holes for earth connection are available on the gear unit, other appropriate measures must be taken. This work must always be done by **specialist electricians**.
- Cable entries must be protected against moisture.

6.7 Screw connection classes, tightening torques and initial stressing forces

6.7.1 Screw connection classes

The specified screw connections are to be fastened applying the tightening torques specified observing the table below.

**Table 6:** Screw connection classes

Fastening of	Screw connection class	Tightening procedure
Gear unit Motor* Brake*	C	<ul style="list-style-type: none"> <li>- Hydraulic tightening with mechanical screwdriver</li> <li>- Torque-controlled tightening with torque wrench or signal generating torque wrench</li> <li>- Tightening with precision mechanical screwdriver with dynamic torque measurement</li> </ul>
	D	- Torque-controlled tightening with mechanical screwdriver.
Protective hood Canopy	E	<ul style="list-style-type: none"> <li>- Tightening with pulse screwdriver or impact wrench without adjustment checking device</li> <li>- Tightening by hand, using a spanner without torque measurement</li> </ul>

<b>NOTICE</b>
<b>Property damage</b>
Damage to screws and/or counter threads from wrong tensioning is possible. Foundation bolts, hub bolts and bearing cover bolts must always be tightened generally according to screw connection class "C".

\*) The tightening torques applying to these add-on parts can be found in the instructions supplied by the manufacturers of the parts.

6.7.2 Tightening torques and initial initial stressing forces

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

The friction coefficient  $\mu_{total} = 0.14$  applies here to lightly oiled steel bolts, black-annealed or phosphatised and dry, cut counter threads in steel or cast iron. Lubricants which alter the friction coefficient are not permitted and might overload the screw connection.

**Table 7:** Initial stressing forces and tightening torques for screw connections of strength classes **8.8; 10.9; 12.9** with a common friction coefficient of  $\mu_{total} = 0.14$

Nominal thread diameter  d mm	Strength class of the bolt	Initial-tensioning force for screw-connection classes from table 6			Tightening torque for screw-connection classes from table 6		
		C	D	E	C	D	E
			$F_{M\ min.}$ N			$M_A$ Nm	
M10	8.8	18000	11500	7200	44.6	38.4	34.3
	10.9	26400	16900	10600	65.4	56.4	50.4
	12.9	30900	19800	12400	76.5	66.0	58.9
M12	8.8	26300	16800	10500	76.7	66.1	59.0
	10.9	38600	24700	15400	113	97.1	86.6
	12.9	45100	28900	18100	132	114	101
M16	8.8	49300	31600	19800	186	160	143
	10.9	72500	46400	29000	273	235	210
	12.9	85000	54400	34000	320	276	246
M20	8.8	77000	49200	30800	364	313	280
	10.9	110000	70400	44000	520	450	400
	12.9	129000	82400	51500	609	525	468
M24	8.8	109000	69600	43500	614	530	470
	10.9	155000	99200	62000	875	755	675
	12.9	181000	116000	72500	1020	880	790
M30	8.8	170000	109000	68000	1210	1040	930
	10.9	243000	155000	97000	1720	1480	1330
	12.9	284000	182000	114000	2010	1740	1550
M36	8.8	246000	157000	98300	2080	1790	1600
	10.9	350000	224000	140000	2960	2550	2280
	12.9	409000	262000	164000	3460	2980	2670
M42	8.8	331000	212000	132000	3260	2810	2510
	10.9	471000	301000	188000	4640	4000	3750
	12.9	551000	352000	220000	5430	4680	4180
M48	8.8	421000	269000	168000	4750	4090	3650
	10.9	599000	383000	240000	6760	5820	5200
	12.9	700000	448000	280000	7900	6810	6080
M56	8.8	568000	363000	227000	7430	6400	5710
	10.9	806000	516000	323000	10500	9090	8120
	12.9	944000	604000	378000	12300	10600	9500
M64	8.8	744000	476000	298000	11000	9480	8460
	10.9	1060000	676000	423000	15600	13500	12000
	12.9	1240000	792000	495000	18300	15800	14100
M72x6	8.8	944000	604000	378000	15500	13400	11900
	10.9	1340000	856000	535000	22000	18900	16900
	12.9	1570000	1000000	628000	25800	22200	19800



Nominal thread diameter  d mm	Strength class of the bolt	Initial-tensioning force for screw-connection classes from table 6			Tightening torque for screw-connection classes from table 6		
		C	D	E	C	D	E
		$F_{M.min.}$ N			$M_A$ Nm		
M80x6	8.8	1190000	760000	475000	21500	18500	16500
	10.9	1690000	1100000	675000	30500	26400	23400
	12.9	1980000	1360000	790000	35700	31400	27400
M90x6	8.8	1510000	968000	605000	30600	26300	23500
	10.9	2150000	1380000	860000	43500	37500	33400
	12.9	2520000	1600000	1010000	51000	43800	39200
M100x6	8.8	1880000	1200000	750000	42100	36200	32300
	10.9	2670000	1710000	1070000	60000	51600	46100
	12.9	3130000	2000000	1250000	70000	60400	53900

---

**Note**

Damaged bolts must be replaced with new bolts of the same type and strength class.

---


## 7. Start-up

Observe the instructions in section 3. "Safety instructions"!

### 7.1 Procedure before start-up

#### 7.1.1 Removal of preservative agent from exterior

- The preserved shaft ends in the area of the couplings to be fitted must be depreserved, using suitable media (special solvent etc.).  
The depreservation also applies to bright surfaces of the gear unit, onto which components are to be fitted.

 <b>CAUTION</b>
<b>Risk of injury from chemical substances</b>
The solvent must not come into contact with the skin (e. g. the operator's hands). The safety notes on the data sheets for the solvent used must be observed. Immediately remove any spilled oil immediately using an oil binding agent. Observe manufacturer's instructions for handling lubricants and solvents. Wear suitable protective clothing.

#### 7.1.2 Removal of preservative agent from interior


<b>NOTICE</b>
<b>Property damage</b>
Damage to the gear unit due to absent or inadequate ventilation is possible. Replace the screw plug with the air filter or the wet air filter before start-up.

The location of the oil draining points is marked by a symbol in the dimensioned drawing in the gear unit documentation.

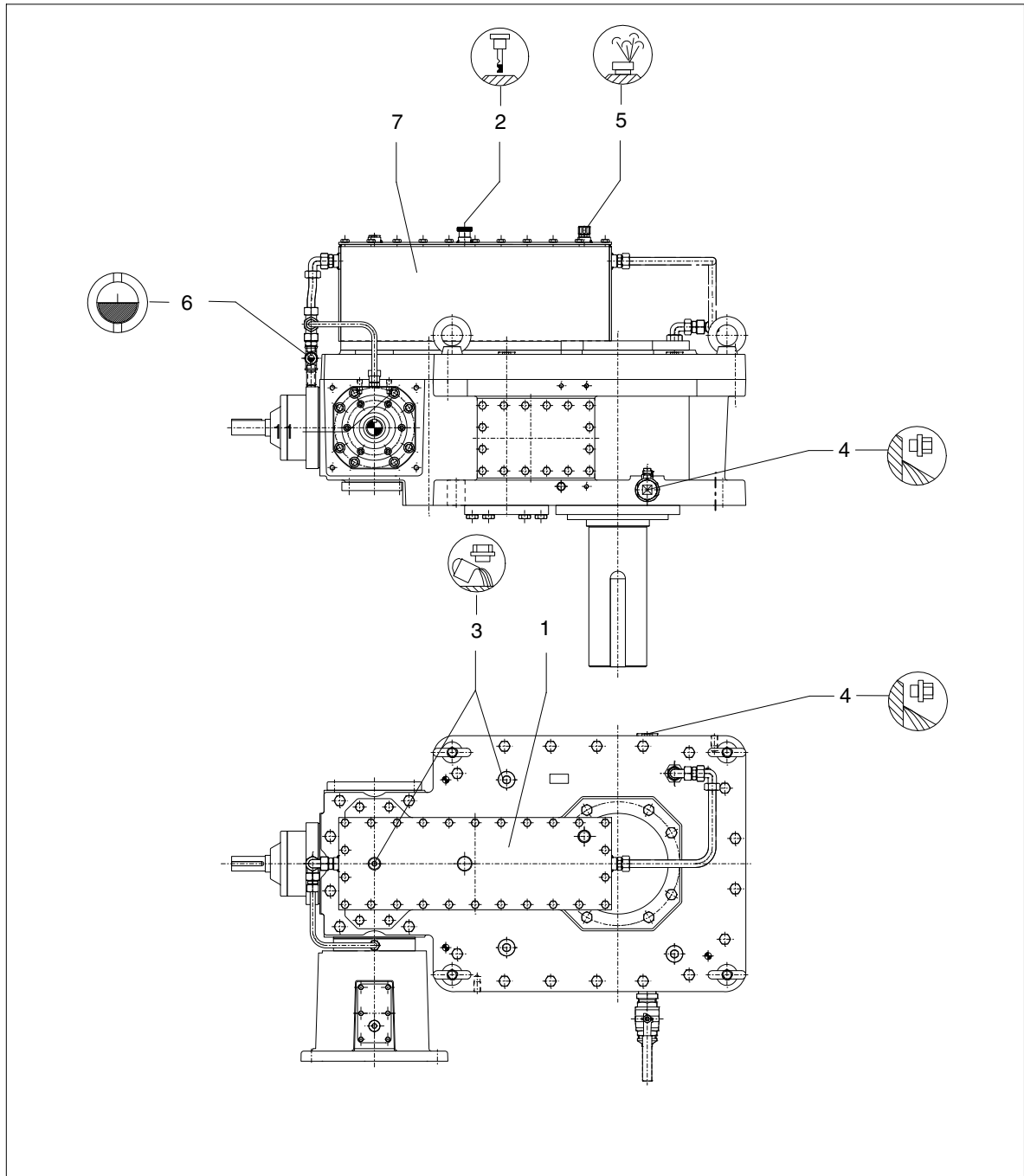
Oil drain point:



- Place suitable containers under the oil drain points.
- Unscrew the oil drain plug and/or open the oil drain cock.
- Remove remaining preservative agent and/or running-in oil from the housing using a suitable container; to do so, unscrew any existing residual oil drain plugs.
- Dispose of remaining preservative agent and/or running-in oil in accordance with regulations.

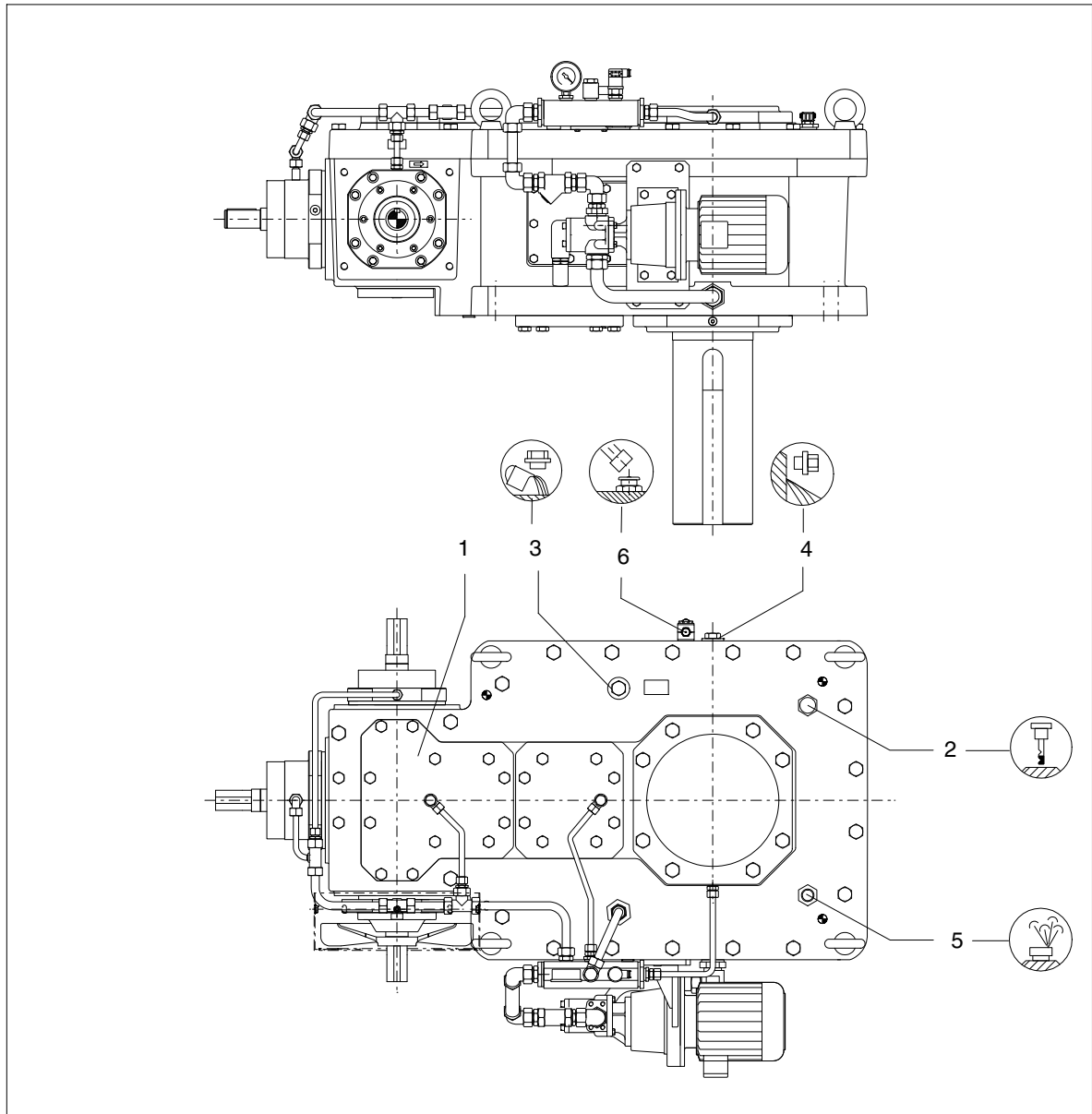
 <b>CAUTION</b>
<b>Risk of injury from chemical substances</b>
The oil must not come into contact with the skin (e. g. the operator's hands). The safety notes on the data sheets for the oil used must be observed here. Remove any spilled oil immediately using an oil binding agent. Observe the manufacturer's instructions for handling lubricants and binding agents. Wear suitable protective clothing.

- Screw the oil drain plug back in and/or close oil drain cock again.
- Screw in any removed plugs for the residual oil back in.



**Fig. 15:** Oil filling and oil draining points on gear units with splash lubrication

- |   |                                      |   |  |
|---|--------------------------------------|---|--|
| 1 | Inspection and/or assembly cover     | 5 | Housing supply and exhaust ventilation |
| 2 | Oil dipstick                         | 6 | Oil sight glass                        |
| 3 | Oil filling point                    | 7 | Oil compensation container             |
| 4 | Oil drain plug and/or oil drain cock |   |  |



**Fig. 16:** Oil filling and oil draining points on gear units with forced lubrication

- |   |                                  |   |  |
|---|----------------------------------|---|--|
| 1 | Inspection and/or assembly cover | 4 | Oil drain plug                         |
| 2 | Oil dipstick                     | 5 | Housing supply and exhaust ventilation |
| 3 | Oil filling point                | 6 | Lubrication point                      |

For a detailed illustration of the gear unit and the position of the add-on parts, please refer to the drawings in the gear unit documentation.

### 7.1.3 Filling with lubricant

- Undo and remove oil filler plug.
- Unscrew the air filter including the reducing screw or the wet air filter.
- Fill fresh oil into the gear unit using a filter (filter mesh approx. 10 µm), until the oil rises up to the bottom in the oil sight glass or until the oil is at the bottom marking on the oil dipstick. Do not put in any further oil. The viscosity of the oil in cold condition will cause the oil level to continue rising slowly. Continue filling in oil only after the oil level has steadied if necessary, up to the middle of the oil sight glass or up to the middle between the MIN and MAX marking on the oil dipstick.

---

#### Note

The quality of the oil used must meet the requirements of the separately supplied BA 7300 instructions manual, otherwise the guarantee given by Siemens will lapse. We urgently recommend using one of the oils listed in table "T 7300" (for a link to the Internet, see back cover), as they have been tested and meet the requirements.

Information on the type, quantity and viscosity of the oil is given on the rating plate on the gear unit. The oil quantity shown on the rating plate is to be understood as an approximate quantity. Decisive for the oil quantity to be filled in is the middle on the oil sight glass or the MIN and MAX marking on the oil dipstick.

---

#### Note

In case of gear units with forced lubrication the oil circuit must also be filled. To do this, briefly start up the gear unit with added pump. The information in section 8. "Operation" must be observed.

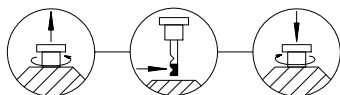
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- Check the oil level in the gear unit housing.
- 

#### Note

The oil must be in the range of the middle on the oil sight glass or between the MIN and MAX marking on the oil dipstick.

---



### CAUTION

#### Risk of injury from chemical substances

The oil must not come into contact with the skin (e. g. the operator's hands).  
The safety notes on the data sheets for the oil used must be observed here.  
Remove any spilled oil immediately using an oil binding agent.  
Observe the manufacturer's instructions for handling lubricants.  
Wear suitable protective clothing.

- Screw in oil filler plug.
- Screw the air filter with the reducing screw or wet air filter back in.

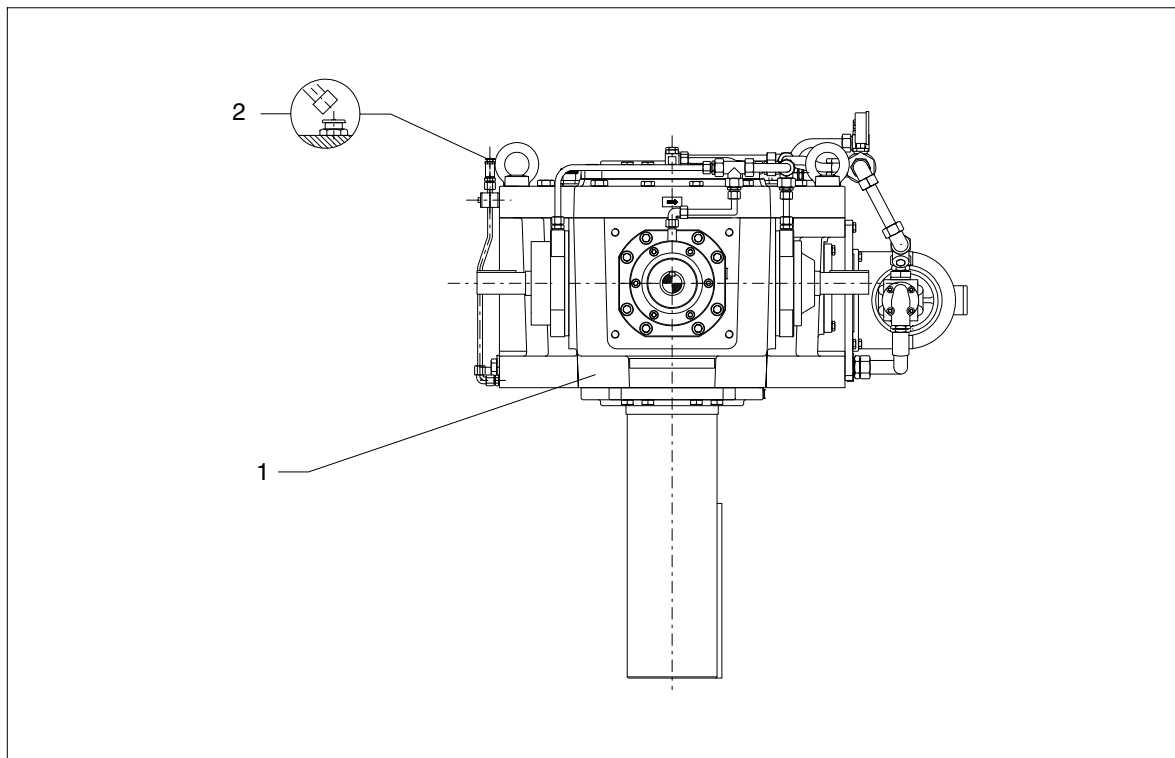
### NOTICE

#### Property damage

Damage to the wet air filter is possible.  
Prior to taking the wet air filter into operation, 2 of the 8 sealed drill holes on the bottom side must be opened.

### 7.1.3.1 Grease-lubricated rolling bearing

The gear unit is delivered ex-factory with a grease charge on the lower output shaft bearing.



**Fig. 17:** Lubricating point for lower output-shaft bearing

1 Lower output shaft bearing

2 Lubrication point

A detailed view of the gear unit can be obtained from the drawings in the gear unit documentation.

For longer periods of storage (> 6 months) in a position differing from the installation position, a corresponding quantity of grease according to table 8 in item 7.1.3.1 must be repacked. The grease type can be found in table "T 7300" (for a link to the internet, see back cover).

**Table 8:** Grease quantities for the lower output shaft bearing for shut-down period > 6 months

Type	Grease quantity (Standard value in kg) for gear-unit size		
	306 *)	309	311
<b>B4SV</b>	-	0.5	0.7

\*) Design without oil retaining tube

If the gear unit has not been in use for more than 36 months or if the lower bearing of the output shaft has been inspected or renewed, the bearing space must be filled with the amount of rolling bearing grease specified in table 9.

**Table 9:** Grease quantities for the lower bearing of the output shaft for shut-down period > 36 months

Type	Grease quantity (Standard value in kg) for gear-unit size		
	306 *)	309	311
<b>B4SV</b>	-	0.8	1.1

\*) Design without oil retaining tube

The lubricating points are identified with the following identification plate.

○	Lubricating point	○
□	g lithium-based grease	
○	after	□ Operating hours
045		

## 7.2 Start-up

### NOTICE

#### Property damage

Damage to the gear unit due to absent or inadequate ventilation is possible.  
Replace the screw plug with the air filter or the wet air filter before start-up.

### NOTICE

#### Property damage

Damage to the wet air filter is possible.  
Prior to taking the wet air filter into operation, 2 of the 8 sealed drill holes on the bottom side must be opened.

- Check the oil level of the gear unit (see item 7.2.1).

### 7.2.1 Oil level

Depending on equipment, the following oil levels are correct:

- Middle of the oil sight glass.
- The middle between the MIN and MAX marking on the oil dipstick.

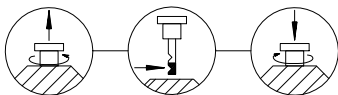
#### Note

The cooled down oil should be visible below the middle of the oil sight glass or in the middle between the MIN and MAX marking on the oil dipstick.  
Hot oil may rise slightly above the middle on the oil sight glass or the MAX marking on the oil dipstick.

### NOTICE

#### Property damage

Deficient lubrication by oil level too low is possible.  
Notice the oil level.  
In no case may the visible bottom edge on the oil sight glass or the MIN marking on the oil dipstick be fallen short of. Fill up oil if necessary.



## 7.2.2 Gear unit with oil supply system

### 7.2.2.1 Pre-lubrication phase

- Prior to start-up, the gear unit should be prelubricated for a maximum of 5 minutes by means of the oil-supply system.  
During this time, rolling bearings and gear teeth are adequately supplied with oil for start-up.

---

#### Note

The pre-lubrication phase must not take longer than 5 minutes since there will be heavy foaming of the oil at low temperatures. If the oil temperature is below 10 °C, the oil should be pre-heated by suitable measures, or Siemens should be consulted.

Be sure to observe the operating instructions of the oil supply system for operation and maintenance.

---

### 7.2.2.2 Initial operation

- Observe all necessary instructions.
- Start the gear unit.

Operation of the gear unit without load must be limited to a minimum. During the no-load running, the following points have to be observed:

– **Oil level**

After the first run the oil level will drop. As the gear unit continues to heat up, the oil level will rise to the level of the mark showing the operating oil level.

– **Oil leak**

Screw joints should be checked for oil leakages and, if necessary, resealed!

### 7.2.3 Gear unit with auxiliary drive unit

<b>NOTICE</b>
<b>Property damage</b> Damage to the gear unit is possible. Before start-up, check whether the overrunning clutch can be turned manually in the free-wheeling direction without exerting undue force. Observe the arrows on the housing for the direction of rotation.

---

#### Note

The **overrunning clutch** is in free-wheeling operation if the motor shaft of the auxiliary drive is rotated in operating direction of rotation.

When rotating in the operating direction of rotation, the blocking action of the overrunning clutch (carrier operation) becomes effective. Coupling and, thus, rotation of the output shaft of the main gear unit in operating direction of rotation takes place.

It is required for auxiliary drives, which are designed for load operation, to first vent the brake on the auxiliary motor in order to check for proper functioning of the overrunning clutch.

---



Before connecting the motor, determine the direction of rotation of the three-phase current supply using a phase-sequence indicator, and connect the motor in accordance with the determined direction of rotation.

---

**Note**

The main motor and the motor of the auxiliary drive have to be interlocked electrically in such a manner that only one of the two motors can be switched on.

---

**Note**

The start-up can follow after the oil quantity specified on the instruction plate has been filled in through the oil filling plug on the gear unit and/or the oil compensation container (see figure 15 or figure 16). Always use oil of the same type and viscosity as for the gear unit.

---

**Note**

For details regarding the auxiliary gear unit please see the Special operating instructions.

---

#### 7.2.4 Temperature measurement

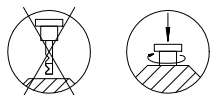
During the first start-up and after maintenance work, the oil sump temperature must be measured during correct use (maximum machine performance) after running in.

**NOTICE****Property damage**

Damage to the gear unit from inadequate lubrication because of excessively high oil temperature is possible.  
The maximum permissible oil sump temperature is **100 °C** (applies to synthetic oil).  
At higher temperatures the gear unit must be shut down immediately and Siemens customer service consulted.

#### 7.2.5 Checking procedure

The following visual checks must be conducted and recorded when starting up:



- Oil level
- Leak tightness of the oil cooling or oil supply lines
- Opening condition of the shut-off valves
- Effectiveness of the shaft seals
- Freedom of the rotating parts from contact

The tension pressures or initial stressing forces in accordance with item 6.3.2.2 and 6.3.2.3 must also be recorded in this document.

---


**Note**

The report must be kept with these instructions.

---

### 7.3 Removal from service

- Switch off the drive unit.

 <b>DANGER</b>
<b>Danger to life from switched on system</b> For carrying out work on the gear unit, the gear unit and any fitted oil-supply system must generally be shut down. The drive unit must be secured against accidental start-up (e. g. by locking the key switch or removing the fuses from the power supply). A notice should be attached to the start switch stating clearly that work is in progress.

- Treat the gear unit with preservative, see items 7.3.1 and 7.3.2 (before a shut-down period exceeding 6 months).

#### 7.3.1 Interior preservation for longer disuse

Depending on the type of lubrication and/or shaft sealing, the following types of interior preservation can be applied.

##### 7.3.1.1 Interior preservation with gear oil

Gear units with splash lubrication systems and contacting shaft seals can be filled with the service oil that was used previously, up to a point just below the air filter or the wet air filter.

The duration of this preservation depends on the age of the shaft seals and the oil.

---

**Note**

In the case of a preservation period exceeding 36 months, the radial shaft-sealing rings must be replaced before start-up.

---

<b>NOTICE</b>
<b>Property damage</b> Damage from inadequate lubrication due to unnoticed leaks is possible. The leak tightness of the gear unit must be checked regularly every 4 weeks.

- Undo and remove oil filler plug.
- Unscrew the air filter including the reducing screw or the wet air filter.
- Fill up gear unit oil through the opening to just below the air filter or wet air filter.

---

**Note**

For gear unit oil, see table "T 7300" (for a link to the internet, see back cover).

---

 <b>CAUTION</b>
<b>Risk of injury from chemical substances</b> The oil must not come into contact with the skin (e. g. the operator's hands). The safety notes on the data sheets for the oil used must be observed here. Remove any spilled oil immediately using an oil binding agent. Wear suitable protective clothing.

- Screw in oil filler plug.
- Replace the air filter with reducing screw, or the wet air filter with a screw plug.

### 7.3.1.2 Interior preservation with preservative agent

Drive units with forced lubrication should be run idle with preservative agent prior to longer periods out of operation.



#### **WARNING**

##### **Risk of scalding**

Serious injury from discharging operating media when these are changed is possible. Wear suitable protection gloves, protection glasses and protection clothing.

- Place a suitable container under the oil draining point of the gear unit housing.
- Unscrew the oil drain plug and/or open the oil drain cock.
- Drain the oil into a suitable container (see section 10. "Maintenance and repair").
- Undo and remove oil filler plug.
- Unscrew the air filter including the reducing screw or the wet air filter.
- Fill in preservative through the opening up to the middle of the oil sight glass or up to the middle between the MIN and MAX marking on the oil dipstick.

##### **Note**

Preservative agent, see table 3 or 4 in item 4.4.1.

- Screw in oil filler plug.
- Screw the air filter with the reducing screw or wet air filter back in.

#### **NOTICE**

##### **Property damage**

Damage to the wet air filter is possible. Prior to taking the wet air filter into operation, 2 of the 8 sealed drill holes on the bottom side must be opened.

- Start the gear unit and allow it to idle briefly.
- Open the oil drain cock and/or unscrew the oil drain plug.
- Drain the preservative agent into a suitable container.
- Dispose of the preservative agent in accordance with the regulations.
- Close the oil drain cock again and/or screw the oil drain plug back in.
- Replace the air or wet air filter with a screw plug.

#### **NOTICE**

##### **Property damage**

Damage to the gear unit due to absent or inadequate ventilation is possible. Replace the screw plug with the air filter or the wet air filter before start-up.

### 7.3.1.3 Interior preservation with the preservative "Castrol Alpha SP 220 S"

- Place a suitable container under the oil draining point of the gear unit housing.
- Unscrew the oil drain plug and/or open the oil drain cock.
- Drain the oil into a suitable container (see section 10. "Maintenance and repair").



#### **WARNING**

##### **Risk of scalding**

Serious injury from discharging operating media when these are changed is possible.  
Wear suitable protection gloves, protection glasses and protection clothing.



#### **CAUTION**

##### **Risk of injury from chemical substances**

The oil must not come into contact with the skin (e. g. the operator's hands).  
The safety notes on the data sheets for the oil used must be observed here.  
Remove any spilled oil immediately using an oil binding agent.  
Wear suitable protective clothing.

#### **Note**

Check the condition of the sealing ring; the sealing ring is vulcanised onto the oil drain plug. If necessary, use a new oil drain plug.

- Close the oil drain cock again and/or screw the oil drain plug back in.
- Unscrew the air filter or wet air filter on the top of the housing.
- Replace the air or wet air filter with a screw plug.

#### **Note**

Carefully clean the air filter (see item 10.2.5) and keep it in a safe place (it will be required when starting up again) or use a new wet air filter when starting up.

- Undo and remove oil filler plug.
- Fill the gear unit with "Castrol Alpha SP 220 S".  
Establish the filling quantity by means of the gear unit dimensions: Length x width x height x 0.1.

#### **NOTICE**

##### **Property damage**

Corrosion is possible when using the wrong preservative.  
Use the special "Castrol Alpha SP 220 S" oil with extra corrosion protection (addition "S").

- Screw in oil filler plug.

#### **NOTICE**

##### **Property damage**

Corrosion is possible when the gear unit is opened for too long.  
Close the gear unit airtight again at the latest one hour after opening.  
Before restarting the gear unit carry out the following action:  
- Replace the screw plug with the air filter or wet air filter.

### 7.3.2 Exterior preservation

#### 7.3.2.1 Exterior-preservation procedure

- Clean the surfaces.

<b>NOTICE</b>
---------------

<b>Property damage</b>
------------------------

Damage to the shaft seal from contact with chemically aggressive preservative agent. For separation between the sealing lip of the radial shaft seal and the preservative agent, the shaft should be brushed with grease in the area of the sealing lip.
---

- Apply preservative agent.

---

**Note**

Preservative agent, see table 5 in item 4.4.2.

---

## 8. Operation

Observe the instructions in section 3. "Safety instructions", in section 9. "Faults, causes and remedy" and in section 10. "Maintenance and repair"!

### 8.1 General

To achieve a satisfactory operation of the equipment without failures, be certain to observe the operating values specified in section 1. "Technical Data", as well as the information given in the operating instructions of the oil-supply system.

During operation the gear unit must be monitored for the following:

- |  |  |
|--|--|
| <input type="checkbox"/> Operating temperature                               | The gear unit is designed for an operating temperature in continuous operation of:<br><br><b>90 °C</b> (applies to synthetic oil)<br><br>The maximum permitted temperature is:<br><b>100 °C</b> (applies to synthetic oil) |
| <input type="checkbox"/> Oil pressure of the oil-supply system               | min. 0.5 bar   |
| <input type="checkbox"/> Changes in gear noise                               |  |
| <input type="checkbox"/> Possible oil leakage at the housing and shaft seals |  |

### 8.2 Oil level

---

#### Note

For checking the oil level, the gear unit must be shut down.  
Depending on the equipment of the gear unit housing, the following oil levels are correct when the oil has cooled down:

- middle of the oil sight glass
- middle between the MIN and MAX marking on the oil dipstick

The cooled down oil should be visible below the middle of the oil sight glass or in the middle between the MIN and MAX marking on the oil dipstick. Hot oil may rise slightly above the middle on the oil sight glass or the MAX marking on the oil dipstick.

---

#### NOTICE

##### Property damage

Deficient lubrication by oil level too low is possible.  
Notice the oil level.  
In no case may the visible bottom edge on the oil sight glass or the MIN marking on the oil dipstick be fallen short of. Fill up oil if necessary.

---

#### Note

The oil level in the oil supply system must be checked.  
For this purpose, the operating instructions of the oil supply system must be observed.

---

### 8.3 Irregularities

<b>NOTICE</b>
<b>Property damage</b>
Damage to the gear unit from error states is possible. Turn off the drive unit immediately in the cases stated below.

- If irregularities are found during the operation.
- If the pressure monitor in the oil-supply system triggers alarm.

---

**Note**

Determine the cause of the fault, using table 10 "Faults, causes and remedy" (see item 9.2).

Table 10 "Faults, causes and remedy", contains a list of possible faults, their causes and suggested remedies.

If the cause cannot be found, a specialist from one of the Siemens customer-service centres should be called in (see section 2. "General notes").

---

## 9. Faults, causes and remedy


Observe the instructions in section 3. "Safety instructions" and in section 10. "Maintenance and repair"!

### 9.1 General information on faults and malfunctions

Faults and malfunctions occurring during the guarantee period and requiring repair work on the gear unit must be carried out only by Siemens customer service.

If faults and malfunctions occur after the guarantee period, the cause of which cannot be precisely identified, we advise our customers to contact our customer service.

<b>NOTICE</b>
<b>Property damage</b>
Damage to the gear unit from improper use is possible. Siemens will not be bound by the terms of the guarantee or otherwise be responsible in cases of improper use of the gear unit, modifications carried out without the approval by Siemens or use of spare parts not originally supplied by Siemens.

 <b>DANGER</b>
<b>Danger to life from switched on system</b>
For carrying out work on the gear unit, the gear unit must generally be set in standstill. The drive unit must be secured against unintentional start-up. A notice should be attached to the start switch stating clearly that work is in progress.

### 9.2 Possible faults

**Table 10:** Faults, causes and remedy

<b>Faults</b>	<b>Causes</b>	<b>Remedy</b>
Changed gear unit noises.	Damage to gear teeth.	Contact Customer Service. Check toothed components. If necessary exchange damaged components.
	Excessive bearing play.	Contact Customer Service. Adjust bearing backlash.
	Bearing is defective.	Contact Customer Service. Replace defective bearings.
Loud noises in the area of the gear unit fastening.	Gear unit fastening has worked loose.	Tighten bolts or nuts to the specified tightening torque. Replace damaged bolts and nuts.



Faults	Causes	Remedy
Increased temperature at the bearing points.	<p>Oil level in gear unit housing too low or too high.</p> <p>Oil too old.</p> <p>Oil pump defective.</p> <p>Bearing is defective.</p>	<p>Check oil level at room temperature. Refill oil if necessary.</p> <p>Check when the last oil change was done. Change oil if necessary. See section 10.</p> <p>Check that oil pump is working correctly. If necessary, repair or replace oil pump.</p> <p>Contact Customer Service. Check and, if necessary, replace bearings.</p>
Exterior of gear unit is oiled up.	Inadequate sealing of housing covers and/or joints.	Seal housing cover and/or joints.
Oil leakage from gear unit.	<p>Inadequate sealing of housing covers and/or joints.</p> <p>Radial sealing-shaft rings defective.</p>	<p>Check and, if necessary, replace seals. Seal housing cover and/or joints.</p> <p>Check and, if necessary, replace radial shaft sealing rings.</p>
Oil foaming in the gear unit.	<p>Preservative agent not completely drained.</p> <p>Gear unit too cold in operation.</p> <p>Water in oil.</p> <p>Oil too old (defoaming agent used up).</p> <p>Unsuitable oils mixed up.</p>	<p>Change oil.</p> <p>Shut down gear unit and have oil degassed.</p> <p>Check state of oil by the test-tube method for water contamination. Have oil analysed by a chemical laboratory. Change oil if necessary.</p> <p>Test the oil; change the oil, if necessary.</p> <p>Test the oil; change the oil, if necessary.</p>
Water in oil.	<p>Gear unit exposed to cold air from machine-room ventilator: Water condensing.</p> <p>Climatic conditions.</p>	<p>Protect gear unit with suitable heat insulation. Close air outlet or alter its direction by structural measures.</p> <p>Contact Customer Service. If necessary, use wet air filter.</p>

Faults	Causes	Remedy
Increased operating temperature.	<p>Oil level in gear unit housing too high.</p> <p>Oil too old.</p> <p>Oil badly contaminated.</p> <p>Oil pump defective.</p>	<p>Check the oil level. Adjust oil level if necessary.</p> <p>Check when the last oil change was done. If necessary, change oil, see section 10.</p> <p>Change oil, see section 10.</p> <p>Check that oil pump is working correctly. If necessary, repair or replace oil pump.</p>
Pressure monitor triggers alarm. (for gear units with forced lubrication)	Oil pressure < 0.5 bar.	<p>Check oil level at room temperature. Fill up oil if necessary. Check oil pump. If necessary, replace oil pump. Check oil filter / coarse filter. If necessary, replace oil filter or clean coarse filter, see section 10.</p>
Contamination indicator on double change-over filter triggers alarm.	Double change-over filter clogged.	Change double change-over filter over as instructed in separate operating instructions, clean clogged filter element.
Main drive motor does not start.	<p>Incorrect direction of rotation of the motor.</p> <p>Overrunning clutch blocked.</p> <p>Cage with sprags on the Overrunning clutch incorrectly installed and/or defective.</p>	<p>Change polarity of motor.</p> <p>Contact Customer Service. Fitting a new overrunning clutch.</p> <p>Contact Customer Service. Install the cage of the overrunning clutch turned by 180° and/or replace it.</p>
Auxiliary drive motor does not start.	<p>Overload on output.</p> <p>Motor of auxiliary drive unit defective.</p> <p>Motor brake is not vented.</p>	<p>Load reduction.</p> <p>Repair and/or replace the motor.</p> <p>Correct electrical connection of motor brake; replace motor brake if necessary.</p>
Auxiliary drive motor does not start, but the output shaft of the main gear unit does not rotate.	<p>Wrong direction of rotation of the motor.</p> <p>Incorrect installation and/or defect of cage with grippers of overrunning clutch.</p> <p>Overrunning clutch defective.</p>	<p>Change polarity of motor.</p> <p>Contact Customer Service. Install the cage of the overrunning clutch turned by 180° and/or replace it.</p> <p>Contact Customer Service. Fitting a new overrunning clutch.</p>

## 9.2.1 Leakage and leak tightness

In standard "DIN 3761" information is given on the subject of leakage on gear units. Based on this and building on the extensive experience gained at Siemens\* and other FVA<sup>1)</sup> member companies, brief descriptions, required measures and notes on this subject are included in the following overview.

**Table 11:** Notes on the leak tightness of radial shaft seals (RWDR<sup>2)</sup>)

Condition	Description	Measures	Notes
Leaktight, dry	No moisture to be seen on radial shaft seal.	None	
Leaktight, damp	Film of moisture formed functionally in the area of the sealing edge but not extending beyond the bottom side of the radial shaft seal.	Only if dirt adheres, clean below the sealing lip with a clean rag.  The sealing lip must not be soiled.  Monitor.	The radial shaft seal often dries by itself in further operation.  <b>No reason for complaint.</b>
Leaktight, wet	Moisture film extending beyond the bottom side of the radial shaft seal but not dripping.	Clean below the sealing lip with a clean rag.  The sealing lip must not be soiled.  Monitor.	The radial shaft seal often dries by itself in further operation.  <b>No reason for complaint.</b>
Measurable leak	Small trickle to be seen on the bottom side of the radial shaft seal, dripping.	Replace radial shaft seal if necessary; identify possible cause of radial shaft seal failure and rectify.	May be a reason for complaint; one drop of oil a day is acceptable.
Short-term leak	Short-term failure of the sealing system.	Clean below the sealing lip with a clean rag.  The sealing lip must not be soiled.  Monitor.	E. g. through small particles on the seal edge, which are removed again in further operation.  <b>No reason for complaint.</b>
Apparent leak	Temporary leak.	Clean below the sealing lip with a clean rag.  The sealing lip must not be soiled.	Mostly due to excessive grease filling between seal and dust lip or oil secretions from the grease filling of labyrinth seals  <b>No reason for complaint.</b>

\*) Siemens AG, Business Unit Mechanical Drives "MD"

1) FVA = Forschungsvereinigung Antriebstechnik e. V.

2) RWDR = radial shaft seal

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### Note

Oil mist escaping from an air relief valve or a labyrinth seal is functional and therefore **not a reason for complaint.**

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## 10. Maintenance and repair

Observe the instructions in section 3. "Safety instructions" and in section 9. "Faults, causes and remedy"!

### 10.1 General notes on maintenance

All maintenance and repair work must be carried out carefully and by qualified personnel only (see section "Qualified Personnel" on page 3 of these instructions).

The following applies to all work in item 10.2:

 <b>DANGER</b>
<b>Danger to life from switched on system</b> For carrying out maintenance and/or repair work on the gear unit, the gear unit and any fitted oil-supply system must generally be shut down. The drive unit must be secured against unintentional start-up. A notice should be attached to the start switch stating clearly that work is in progress.

The periods indicated in table 12 largely depend on the conditions under which the gear unit is operated. Only average periods can therefore be stated here. These refer to the following values:

<b>a daily operating time of</b>	<b>24 h</b>
<b>a duty factor "ED" of</b>	<b>100 %</b>
<b>input speed of max.</b>	<b>1500 1/min</b>
<b>an operating temperature of</b>	<b>90 °C (applies for synthetic oil)</b>
<b>operating temperature of max.</b>	<b>100 °C (applies for synthetic oil)</b>

<b>NOTICE</b>
<b>Property damage</b> Damage to the gear unit possible from non-compliance with the specified periods for maintenance and repair works is possible. The operator must ensure that the intervals stated in table 12 are adhered to. This also applies if the maintenance work is included in the operator's internal maintenance schedules.

**Table 12:** Maintenance and repair work

Measures	Periods	Remarks
Check the oil temperature	daily	
Check for unusual gear unit noise	daily	
Check the oil level	monthly	<ul style="list-style-type: none"> <li>- middle of the oil sight glass</li> <li>- top marking on the dipstick</li> </ul>
Check the gear unit for leaks	monthly	
Test the water content of the oil	after approx. 400 operating hours, at least once per year	See item 10.2.1.
Perform the first oil change	approx. 400 operating hours after start-up	See item 10.2.2.

Measures	Periods	Remarks
Perform subsequent oil changes	every 24 months or 10 000 operating hours	See item 10.2.2.
Clean coarse filter	every 3 months	See item 10.2.3
Change the wet air filter	as required	See item 10.2.4.
Clean the air filter	every 3 months	See item 10.2.5.
Clean the gear unit	as required, at least every 2 years	See item 10.2.6.
Clean fan and gear unit	as required, at least every 2 years	See item 10.2.7.
Type with oil retaining pipe: recharge with grease	every 5000 operating hours or at least every 10 months	See item 10.2.8.
Check hose lines	annually	See item 10.2.9.
Change the hose lines	6 years after the stamped date of manufacture	See item 10.2.9.
Check tightness of fastening bolts	after the first oil change, then every 2 years	See item 6.7.
Check the auxiliary drive unit	every 3 months	See item 5.11
Inspection of the gear unit	every 2 years	See item 10.4.

#### 10.1.1 General service lives of oils

According to the oil manufacturers, the following are the expected periods during which the oils can be used without undergoing any significant change in quality. They are calculated on the basis of an average oil temperature of 80 °C:

- for mineral oils, bio-degradable oils and physiologically safe oils (synthetic esters): 2 years or 10 000 operating hours. Does not apply to natural esters like rape seed oils.
- for poly- $\alpha$ -olefins and polyglycols, 4 years or 20 000 operating hours.

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#### Note

The actual service lives may differ. The general rule is that an increase in temperature of 10 K will halve the service life and a temperature decrease of 10 K will approximately double the service life.

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## 10.2 Description of maintenance and repair works

### 10.2.1 Examine water content of oil, conduct oil analyses

More information about examining the oil for water content or conducting oil analyses can be obtained from your lubricant manufacturer or the Siemens customer service.

- For reference purposes, a fresh sample of the operating lubricating oil used must be sent with the used-oil sample to the analysing institute for analysis.
- The oil sample must be taken downstream from the filter of the oil-supply system while the gear unit is running. A suitable connection point is normally located upstream of the gear unit input (e. g. oil drain cock in the pressure line).
- A special sample container should be filled with the specified quantity of oil.  
If there is no such sample container available, at least one litre of oil must be filled into a **clean**, sealable vessel that is safe for transport.

## 10.2.2 Change oil

As an alternative to the oil-change intervals indicated in table 12 (see item 10.1), it is possible to have an oil sample tested at regular intervals by the technical service of the relevant oil company and to have it cleared for further use.

If further usability has been confirmed, no oil change will be necessary.

---

### Note

Observe the separately attached operating instructions BA7300 and the information in item 7.1.

---

- Drain the oil while the gear unit is still warm, i.e. immediately after stopping the machinery.

<b>NOTICE</b>
---------------

<b>Property damage</b>
------------------------

Damage to the gear unit possible from inadequate lubrication because of mixed oils.
---

When changing the oil, always re-fill the gear unit with the same type of oil.
--

Never mix different types of oil and/or oils made by different manufacturers. Never mix synthetic oils with mineral-based oils or with other synthetic oils.
--

When changing to any different oil type, the gear unit must be flushed thoroughly using the new oil type.
---

---

### Note

When changing the oil, the housing and the oil-supply system, if available, must be flushed with oil to remove sludge, metal particles and oil residue. Use the same type of oil as is used for normal operation. High-viscosity oils must be heated beforehand using suitable means. Ensure that all residues have been removed before filling with fresh oil.

---

- Place a suitable container under the oil draining point of the gear unit housing.
- Undo and remove oil filler plug.
- Unscrew the air filter with the reducing screw or wet air filter from the housing top.
- Unscrew the oil drain plug and/or the open the oil drain cock and drain the oil into the collecting container.
- Drain the oil from the oil-supply system (see operating instructions to the oil-supply system).

 <b>CAUTION</b>
--

<b>Risk of scalding</b>
-------------------------

Risk of injury from escaping hot oil.
---------------------------------------

Wear suitable protection gloves, protection glasses and protection clothing.
--

Remove any spilled oil immediately using an oil binding agent.
--

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### Note

Check the condition of the sealing ring (the sealing ring is vulcanised onto the oil drain plug); if necessary, use a new oil drain plug.

---

- Screw in the oil drain plug and/or close the oil drain cock.
- Clean the oil filter in the oil cooling system (see operating instructions to the oil-supply system).
- Clean the coarse filter in the oil-cooling system (see item 10.2.3).

- Clean the air filter (see item 10.2.5) or change the wet air filter (see item 10.2.4).
- Fill fresh oil into the gear unit (see item 7.1.3).
- Screw in oil filler plug.
- Screw the air filter with the reducing screw or wet air filter back in.

<b>NOTICE</b>
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<b>Property damage</b>
------------------------

<p>Damage to the wet air filter is possible. Prior to taking the wet air filter into operation, 2 of the 8 sealed drill holes on the bottom side must be opened.</p>
--

#### 10.2.3 Clean coarse filter

- Check coarse filter.
- Loosen drain plug.
- Pull out sieve and remove dirt particles.
- Replace defective sieves and seal rings.

---

**Note**

Observe the operating instructions for the coarse filter for operation and maintenance of the coarse filter.  
For technical data, refer to the data sheet and/or the list of equipment.

---

#### 10.2.4 Replace the wet air filter

The wet air filter has a container filled with silica gel. The air humidity absorbed by the silica gel changes the colour of the gel from "blue" to "pink" (visible through the transparent container). Changing the wet air filter is only necessary when the silica gel has turned completely pink.

- Unscrew the wet air filter and replace it with a new one.

<b>NOTICE</b>
---------------

<b>Property damage</b>
------------------------

<p>Damage to the wet air filter is possible. Prior to taking the wet air filter into operation, 2 of the 8 sealed drill holes on the bottom side must be opened.</p>
--

### 10.2.5 Clean the air filter

**Note**

A period of 3 months applies to the cleaning of the air filter.  
If a layer of dust has built up, the air filter must already be cleaned, whether or not before the 3-month period has expired.

- Unscrew the air filter including the reducing screw.
- Clean the air filter using a suitable cleaning agent.
- Dry the air filter and/or blow with compressed air.

 **WARNING****Risk of injury to the eyes from pressurised air**

Residual water and/or dirt particles can injure the eyes.  
Wear suitable protective glasses.

**NOTICE****Property damage**

Damage to the gear unit due to penetration of foreign bodies is possible.  
The penetration of foreign bodies into the gear unit must be prevented.

### 10.2.6 Clean the gear unit

**NOTICE****Property damage**

Damage to the gear unit from overheating.  
Dust deposits can affect the heat discharge through the housing surface and lead to overheating.  
To prevent the build-up of dust on the gear unit, cleaning must be done in accordance with the local operating conditions.

- Remove any dirt adhering to the gear unit, using a hard brush.
- Remove any corrosion.

**NOTICE****Property damage**

Damage to the gear unit due to penetration of moisture is possible.  
The gear unit must not be cleaned with high-pressure cleaning equipment.



### 10.2.7 Clean fan and gear unit

- Observe the instructions in item 5.7.1!
- Demount the air-guide cover.
- Using a stiff brush, remove any dirt adhering to the fan wheel, air-guide cover and safety grid.
- Remove any corrosion.
- Screw safety grid with fastening screws back onto the air guide cover.

#### **NOTICE**

##### **Property damage**

Damage to the gear unit from absent cooling due to a soiled or damaged fan and/or damage to the gear unit by penetrating moisture.

It must be ensured that the air-guide cover is correctly fastened. The fan must not come into contact with the air-guide cover.

To prevent the build-up of dust on the gear unit, cleaning must be done in accordance with the local operating conditions.

The gear unit must not be cleaned with high-pressure cleaning equipment.

### 10.2.8 Refill the oil retaining pipe with grease.

For longer periods of storage (> 6 months) in a situation differing from the mounting position, a corresponding quantity of grease according to table 8 in item 7.1.3.1 should be repacked. The grease type can be found in table "T 7300" (for a link to the internet, see back cover).

- Stop the gear unit by deactivating the drive unit, and secure electrically and mechanically against turning.
- Lithium saponified grease must be repacked at the lubricating point of the oil-dam pipe, as specified in table 13 below.
- The lubricating point has been provided with a grease nipple.



#### **CAUTION**

##### **Risk of slipping**

Risk of slipping on leaked grease.

Remove and dispose of any old grease escaping.

**Table 13:** Grease repacking quantities for the oil retaining tube

Type	Grease quantity (approx. value in g) for gear-unit size		
	306 *)	309	311
<b>B4SV</b>	-	75	75

\*) Design without oil retaining tube

### 10.2.9 Check hose lines

Even when adequately stored and subjected to permissible loads, hoses and hose lines are subject to a natural ageing process. This limits their period of use.

<b>NOTICE</b>
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<b>Property damage</b>
------------------------

Damage to the hose lines from ageing or external influences. The period of use of the hose lines must not exceed 6 years. For control purposes, the manufacturing date is printed on the hose lines. If during inspections a fault is found, this must be rectified immediately.
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The period of use can be determined using available test results and empirical values, taking into account the conditions of use.

---

**Note**

The operator of the system must ensure that hose lines are replaced at suitable intervals, even if no defects can be detected that might affect their safe operation.

Hose lines must be inspected for safe working condition by an expert before the plant is first put into operation and thereafter at least once a year.

---

### 10.2.10 Top up oil

- Observe the instructions in item 7.1!
- Always only use the same oil type as before (see also item 10.2.2).

### 10.2.11 Check tightness of fastening bolts

- Observe the instructions in item 10.1!
- Check tightness of all fastening bolts.

---

**Note**

Damaged bolts must be replaced with new bolts of the same type and strength class.

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## 10.3 Final work

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**Note**

For operating and servicing all components, the relevant instructions manuals and the specifications in sections 5. "Technical description" and 7. "Start-up" must be observed.  
For technical data, refer to the data sheet and/or the list of equipment.

The instructions in item 6.6 must be observed.

Damaged bolts must be replaced with new bolts of the same type and strength class.

---

#### 10.4 General inspection of the gear unit

The general inspection of the gear unit should be carried out by the Siemens Customer Service, as our engineers have the experience and training necessary to identify any components requiring replacement.

#### 10.5 Lubricants

The quality of the oil used must meet the requirements of the separately supplied BA 7300 instructions manual, otherwise the guarantee given by Siemens will lapse. We urgently recommend using one of the oils listed in the table "T 7300" (for a link to the internet, see back cover), as they have been tested and meet the requirements.

---

#### **Note**

To avoid misunderstandings, we should like to point out that this recommendation is in no way intended as a guarantee for the quality of the lubricant supplied. Each lubricant manufacturer is responsible for the quality of his own product.

---

Information on the type, viscosity and required quantity of the oil is given on the rating plate on the gear unit and/or in the supplied documentation.

The oil quantity shown on the rating plate is to be understood as an approximate quantity. Decisive for the oil quantity to be filled in is the middle of the oil sight glass or the middle between the MIN and MAX marking on the oil dipstick.

The BA 7300 manual relating to the gear unit lubrication and table "T 7300" containing the current lubricant recommendations of Siemens can also be consulted on the internet (see back cover).

The oils listed there are subjected to continuous tests. Under certain circumstances the oils recommended there may therefore later be removed from the range or replaced with further developed oils.

We recommend checking before any oil change whether the chosen lubricant is still approved by Siemens.

## 11. Spare parts, customer service

### 11.1 Stocking spare parts

By stocking the most important spare and wearing parts on site you can ensure that the gear unit is ready for use at any time.

To order spare parts, refer to the spare-parts list.

For further information refer to the spare-parts drawing stated in the spare parts list.

#### **NOTICE**

##### **Property damage**

Damage to the gear unit from improper use.

Siemens guarantee only the original spare parts supplied by Siemens.

Non-original spare parts have not been tested or approved by Siemens. Non-original spare parts may alter technical characteristics of the gear unit, thereby posing an active or passive risk to safety.

Siemens will assume no liability or guarantee for damage caused by spare parts not supplied by Siemens. The same applies to any accessories not supplied by Siemens.

Please note that certain components often have special production and supply specifications and that Siemens supplies you with spare parts which comply fully with the current state of technical development as well as current legislation.

When ordering spare parts, always state the following:

Order no., position	Type, size	Part no.	Quantity
---------------------	------------	----------	----------

### 11.2 Addresses for ordering spare parts and customer service

When ordering spare parts or requesting a service specialist, please contact Siemens first.

Siemens AG  
Am Industriepark 2  
46562 Voerde

Tel.: +49 (0)2871 / 92-0  
Fax: +49 (0)2871 / 92-1544

## 12. Declarations

### 12.1 Declaration of incorporation

#### Declaration of incorporation

in accordance with Directive 2006/42/EC, Annex II 1 B

The manufacturer, Siemens AG, 46395 Bocholt, Germany, declares with regard to the partly completed machinery

#### **Bevel-helical gear unit B4SV Sizes 306, 309 and 311**

for driving a pre-heater in power plants:

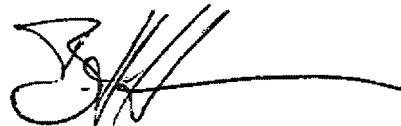
- The special technical documents described in Annex VII B have been prepared.
- The following basic health and safety requirements set out in Directive 2006/42/EC, Annex I, are applied and fulfilled:  
1.1, 1.1.2, 1.1.3, 1.1.5; 1.2.4.4, 1.2.6; 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.6, 1.3.7, 1.3.8, 1.3.8.1; 1.4.1, 1.4.2.1; 1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.6, 1.5.8, 1.5.9, 1.5.10, 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, 1.7.4.1, 1.7.4.2, 1.7.4.3
- 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.
- The manufacturer undertakes, in response to a reasoned request by the national authorities, to transmit in electronic form relevant information about the partly completed machinery.
- The person authorised to compile the relevant technical documentation is:  
Mark Zundel (PD MD AP EMEA VOE OE)

Voerde, 2015-06-26



Mark Zundel  
(PD MD AP EMEA VOE OE)

Voerde, 2015-06-26



Dr. Bernhard Hoffmann  
(PD MD AP)

## Further Information:

"FLENDER gear units" on the Internet

[www.siemens.com/gearunits](http://www.siemens.com/gearunits)

"FLENDER couplings" on the Internet

[www.siemens.com/couplings](http://www.siemens.com/couplings)

Service & Support:

<http://support.automation.siemens.com/WW/view/en/10803928/133300>

Lubricants:

<http://support.automation.siemens.com/WW/view/en/42961591/133000>

Siemens AG  
Industry Sector  
Mechanical Drives  
Alfred-Flender-Straße 77  
46395 Bocholt  
GERMANY

Subject to modifications

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