2 Product Description and Overview of Types

2.1 Design features

- Independent industrial gear unit platform
- Helical and bevel-helical gear units
- Monoblock and split gear unit housing
- Distinctive modular technology
- Customer-specific adaptations
- Universal mounting positions
- Large number of variants due to predefined accessory equipment and options

2.2 Advantages at a glance

The X series was completely newly designed. Advantages are:

- Extremely robust gear unit housing
- Reduced costs and weight due to high power density and finely stepped sizes
- Effective cooling systems
- Mounting option on both sides due to axially symmetric housing design
- Efficient project planning tools including 2D and 3D dimension drawing generators
- Short delivery times for standard designs
- Worldwide service

2.3 Application areas

The X series can be used in the following application areas:

- In conveyor systems such as those used in the building materials, mining, chemical, food and feed industries
- In the timber and paper industry
- In the environmental industry
- In agitators and mixers
- As travel and hoist drives for assembly hall cranes, handling and container cranes
- For shredders and crushers
- For bucket elevators in bulk-handling technology
- And many other more areas
2.4 General information

Note the following points:

- The illustrations in the catalog are examples and are not binding.
- The specified fill quantities are non-binding guidelines. The marks on the oil dipstick or oil level glass are determinative for the oil level.
- Read and follow the operating instructions carefully before startup.
- The gear units are ready for operation when delivered, but are not filled with oil.
- Oil viscosity and grade must comply with those specified on the nameplate.
- The weights shown are non-binding average values.
- The buyer must provide protection against unintentional contact with moving parts. The applicable safety regulations of the country in which the unit will be used should be followed.

2.4.1 Nominal power, torques and drive speeds

The nominal power and torque values given in this catalog depend on the drive speed and are valid for a service factor of $F_S = 1.0$ and constant, unidirectional load. If the direction of rotation changes once per minute under full load, then only 70% of these values may be applied.

The overview shows nominal power and torques for drive speeds of 1800 1/min and 15001/min. The nominal torques are also applicable for drive speeds 3% less than the synchronous speed. For input speeds > 1800 1/min, please contact SEW-EURODRIVE.

2.4.2 Mounting position

This catalog describes horizontal gear units (mounting position "M1"). Vertical ("M5") and upright ("M4") mounting positions will be included in separate publications (available end of 2007). For inclined or changing mounting positions ("pivoting mounting positions"), such as may occur with drives in booms, please consult SEW-EURODRIVE.

The gear unit housings are symmetric to the central axis, so that an "overhead mount" (mounting position M3) is, in principle, possible. If this is required, consult SEW-EURODRIVE.

2.4.3 Housings

The gear unit housings are made of sturdy gray cast iron, in either monoblock design or as split housings with horizontal parting lines.

2.4.4 Gearing and shafts

The gearing is with edge corrections of high-quality, tempered and ground case hardened steels. The output shafts are made of hardy quenched and tempered steel.

2.4.5 Shaft bearings

Self-aligning, cylindrical and tapered roller bearings from well-known manufacturers are used.
2.4.6 Torque support / gear unit mounting
As an alternative to foot mounting, the gear units can be mounted with a torque arm (see section 6.1) or a mounting flange (consult SEW-EURODRIVE) on the output shaft.

2.4.7 Lubrication
The horizontal gear units described in this catalog are normally operated using "splash lubrication".

Pressure or bath lubrication may optionally be used with these gear units. When using bath lubrication, an oil expansion tank may be required. When using pressure lubrication, the gear unit is lubricated using an integrated shaft end pump or an attached motor pump.

To provide a visual check on the oil level, an oil level glass is normally used. An oil dipstick may also optionally be used.

Instead of the oil drain plug, an oil drain valve may be provided. This ball valve allows for a drain line to be easily attached when changing the gear unit oil.

Under certain conditions (e.g. extremely cold start temperatures), an oil heater may be required. The oil heater ensures that the oil is sufficiently fluid when starting up the gear unit in cold environments. SEW-EURODRIVE provides the oil heater with a pre-set thermostat that is attached to the gear unit.

2.4.8 Thermal rating
The thermal rating needs to be checked for every gear unit. The relevant values are listed in the selection tables.

2.4.9 Sealing system
Industrial gear units can be supplied with different sealing systems for the drive and output shafts (→ section 2.9).

• Lip seal (standard)
• Lip seal with dust protection cover (non-regreasable)
• Lip seal with dust protection cover (regreasable)
• Radial labyrinth seal (regreasable)

2.4.10 Cooling
If the thermal rating of the gear unit is not sufficient without additional cooling measures, the following may used:

• Fan (independent of direction of rotation) on the input shaft for 2- and 3- stage gear units (→ section 5.3.1). For gear units with fans on the input shaft, make sure that there is enough space in the axial and radial directions to allow for sufficient supply of cooling air.

• Integrated water cooling cover for 2-stage gear units, integrated water cooling cartridge for 3- and 4- stage gear units. The water cooling cover may be combined with all types of lubrication (→ section 5.3.2).

• A combination of a fan and a water cooling cover or cooling cartridge.

• An oil supply system with an oil-water or oil-air heat exchanger.
2.4.11 Motor connection

SEW-EURODRIVE can supply the following variants with the gear unit:

- **Motor adapter** with an elastic coupling for attaching IEC (B5) / NEMA ("C" face) motors (→ section 6.3). The motor adapter may optionally be equipped with a fan.
- **Steel frame** consisting of a swing base or a base frame (→ section 6.4): Includes gear unit + steel frame, as well as the necessary components such as input and output coupling, drum or disk brake, AC motor and protection guards.
- **Motor bracket** with V-belt drive: Includes motor bracket, pulleys, V-belt and belt guard.
- **Motor scoop**, including AC motor, coupling and protection guards.

2.4.12 Backstop (→ section 6.2)

Gear unit with integrated, oil-lubricated backstop to prevent inadvertent reverse rotation.

2.4.13 Condition monitoring

A variety of optional equipment is available for condition monitoring:

- **PT100 temperature sensor** (→ section 7.1):
  For measuring the oil bath temperature
- **SEW DUO diagnostics system** (see section 7.3 or refer to separate publication):
  For monitoring the condition of the oil in the gear unit
- **SEW DUV diagnostics system** (→ section 7.4):
  For monitoring vibration of bearings and gears

2.4.14 Very low output speeds

The gear units described in this catalog cover a nominal gear ratio range of up to 400:1. With an attached 4-pole motor, this means that output speeds of approx. 4 min⁻¹ can be obtained.

Lower output speeds (ratios above 400:1) can be achieved by combining the gear unit with a 6- or 8-pole motor or with an SEW-EURODRIVE primary gear unit or gearmotor of type R, F, K or S.

It may be necessary to limit the motor power to match the maximum permitted output torque of the gear unit.
2.4.15 **Auxiliary drives**

SEW-EURODRIVE can supply gear units with an auxiliary drive. This is the standard configuration for 3-stage bevel-helical gear units in the gear ratio range from 28:1 to 63:1, and is chiefly used for bucket elevators.

2.4.16 **Drive packages**

Predefined drive packages for conveyor drives are described in section 6.4.

2.4.17 **Surface and corrosion protection**

If required, all gear units can also be supplied with special surface protection for applications in extremely damp or chemically aggressive environments.

2.4.18 **Coating**

The gear units are painted with "blue-gray" machine paint RAL 7031 as per DIN 1843 as standard. Special coatings are available on request. The SEW protection guards included in the delivery are coated in "signal yellow" / RAL 1003.

2.4.19 **Noise level**

Normally, the gear unit’s sound-power levels, according to ISO 8579-1, are below the 50% line given in the standard.

2.4.20 **Weight data / oil volume**

Please note that all weights shown for the gear units in this catalog do not include the lubricant. Recommended oil volumes, depending on gear unit version, are found in the dimension drawings. The exact gear unit weight is given in the order-specific dimension drawing.

2.4.21 **International markets**

SEW-EURODRIVE is a member of the AGMA (American Gear Manufacturers Association), and as such, all its gear units conform to AGMA specifications.


2.5 **Basic gear unit versions**

2.5.1 **Gear unit versions**

- Helical gear units (X.F..) with parallel shafts and
- Bevel-helical gear units (X.K..) with right-angle shaft arrangement

![Helical and Bevel-Helical Gear Units](image)

2.5.2 **Mounting position**

The SEW X gear units described in this catalog are available with horizontally aligned housings and horizontal output shafts (mounting positions "M1 and M3", see section 3.1).

2.5.3 **Housing fixation**

The basic variants are:

- Foot mounting (X/B)
- Flange mounting (X.../F)
- Torque arm (X.../T)

2.5.4 **Basic output shaft (LSS) variants**

- Solid shaft with keyway (X..S.), with one- or two-sided shaft end
- Hollow shaft with keyway (X..A.)
- Hollow shaft for shrink disc connection (X..H.)

Other variants, such as

- Splined hollow shaft according to DIN 5480 (X..V.)
- Shortened solid shaft without keyway for shrink-fitted flange coupling hub (X..R.)

are available on request.
### 2.6 Overview of technical data

#### 2.6.1 Helical gear unit (X.F..)

<table>
<thead>
<tr>
<th>Gear unit size</th>
<th>Nominal torque [kNm] – class</th>
<th>Nominal gear ratio range</th>
</tr>
</thead>
<tbody>
<tr>
<td>X.F.180</td>
<td>58</td>
<td>6.3 ... 355</td>
</tr>
<tr>
<td>X.F.190</td>
<td>65</td>
<td>7.1 ... 400</td>
</tr>
<tr>
<td>X.F.200</td>
<td>79</td>
<td>6.3 ... 355</td>
</tr>
<tr>
<td>X.F.210</td>
<td>90</td>
<td>7.1 ... 400</td>
</tr>
<tr>
<td>X.F.220</td>
<td>112</td>
<td>6.3 ... 355</td>
</tr>
<tr>
<td>X.F.230</td>
<td>131</td>
<td>7.1 ... 400</td>
</tr>
<tr>
<td>X.F.240</td>
<td>156</td>
<td>6.3 ... 355</td>
</tr>
<tr>
<td>X.F.250</td>
<td>175</td>
<td>7.1 ... 400</td>
</tr>
</tbody>
</table>

#### 2.6.2 Bevel-helical gear unit (X.K..)

<table>
<thead>
<tr>
<th>Gear unit size</th>
<th>Nominal torque [kNm] – class</th>
<th>Nominal gear ratio range</th>
</tr>
</thead>
<tbody>
<tr>
<td>X.K.180</td>
<td>58</td>
<td>12.5 ... 355</td>
</tr>
<tr>
<td>X.K.190</td>
<td>65</td>
<td>14 ... 400</td>
</tr>
<tr>
<td>X.K.200</td>
<td>79</td>
<td>12.5 ... 355</td>
</tr>
<tr>
<td>X.K.210</td>
<td>90</td>
<td>14 ... 400</td>
</tr>
<tr>
<td>X.K.220</td>
<td>112</td>
<td>12.5 ... 355</td>
</tr>
<tr>
<td>X.K.230</td>
<td>131</td>
<td>14 ... 400</td>
</tr>
<tr>
<td>X.K.240</td>
<td>156</td>
<td>12.5 ... 355</td>
</tr>
<tr>
<td>X.K.250</td>
<td>175</td>
<td>14 ... 400</td>
</tr>
</tbody>
</table>
## Overview of options for motor connection, output shaft, and housing fixation

### Motor connection
- Motor adapter
- Base frame or swing base
- Motor scoop
- Motor bracket with V-belt drive

### Output shaft
- Solid shaft with keyway
- Hollow shaft with keyway
- Hollow shaft with shrink disc

### Housing fixation
- Foot mounting
- Flange mounting
- Shaft mounted with torque arm
### Overview of options for motor connection, output shaft, and housing fixation

#### Motor connection
- Motor adapter
- Base frame or swing base
- Motor scoop
- Motor bracket with V-belt drive

#### Output shaft
- Solid shaft with keyway
- Hollow shaft with keyway
- Hollow shaft with shrink disc

#### Housing fixation
- Foot mounting
- Flange mounting
- Shaft mounted with torque arm
2.8 **Input and output shaft**

Two types of shafts are differentiated in the catalog:
- High-speed shaft (HSS), normally an input shaft
- Low-speed shaft (LSS), normally an output shaft

### 2.8.1 Input shaft

The input shaft is provided with a closed keyway (according to DIN 6885/T1) and center bore (according to DIN 332). The key that fits (according to DIN 6885/T1 - form A) is included in the scope of delivery.

### 2.8.2 Output shaft as a solid shaft with key

The output shaft is provided with a closed keyway (according to DIN 6885/T1) and center bore (according to DIN 332). A key (according to DIN 6885/T1 - form B) is included in the scope of delivery. In order to simplify the mounting of output elements, such as a coupling hub, the shaft has an insertion area with a reduced diameter.
2.8.3 Output shaft as a hollow shaft with keyway
The hollow shaft is equipped with a keyway according to DIN 6885/T1.

Included in the scope of delivery:
End plate with bolts [1], protection guard [2]

The hollow shaft is equipped with a keyway according to DIN 6885/T1.
Included in the scope of delivery:
End plate with bolts [1], protection guard [2]

The protection guard is dust-proof. The standard sealing system is, therefore, normally used on the protection guard side.
Detailed guidelines regarding the geometry of the machine shaft are found in the data sheets in section 12.

2.8.4 Output shaft as hollow shaft with shrink disc
The shrink disc is positioned on the side opposite to the machine shaft.

Included in the scope of delivery:
End plate with bolts [1], shrink disc [2], protection guard [3]

The shrink disc is positioned on the side opposite to the machine shaft.
Included in the scope of delivery:
End plate with bolts [1], shrink disc [2], protection guard [3]

The protection guard is dust-proof. The standard sealing system is, therefore, normally used on the protection guard side.
Detailed guidelines regarding the geometry of the machine shaft are found in the data sheets in section 12.
2.9 **Sealing systems**

### 2.9.1 Input shaft

<table>
<thead>
<tr>
<th>Standard</th>
<th>Dust-proof</th>
<th>Dust-proof Regreasable</th>
<th>Radial labyrinth seal (Taconite)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single lip seal with dust protection lip</td>
<td>Single lip seal with dust protection cover (not regreasable)</td>
<td>Double lip seal with dust protection cover (regreasable)</td>
<td>Single lip seal with radial labyrinth seal</td>
</tr>
<tr>
<td>• Normal environment</td>
<td>• <strong>Medium</strong> dust load with abrasive particles</td>
<td>• <strong>High</strong> dust load with abrasive particles</td>
<td>• <strong>Very high</strong> dust load with abrasive particles</td>
</tr>
</tbody>
</table>

### 2.9.2 Output shaft

<table>
<thead>
<tr>
<th>Standard</th>
<th>Dust-proof</th>
<th>Dust-proof Regreasable</th>
<th>Radial labyrinth seal (Taconite)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single lip seal with dust protection lip</td>
<td>Single lip seal with dust protection cover (not regreasable)</td>
<td>Double lip seal with dust protection cover (regreasable)</td>
<td>Single lip seal with radial labyrinth seal</td>
</tr>
<tr>
<td>• Normal environment</td>
<td>• <strong>Medium</strong> dust load with abrasive particles</td>
<td>• <strong>High</strong> dust load with abrasive particles</td>
<td>• <strong>Very high</strong> dust load with abrasive particles</td>
</tr>
</tbody>
</table>

---

![Diagram of Sealing Systems](#)

---

![Diagram of Sealing Systems](#)
Regreasing should be carried out while the gear unit shafts are turning.

2.9.3 Greasing nipple on gear unit cover (standard)

Taper greasing nipples (according to DIN 71412 A R1/8) are normally used on the gear unit cover in regreasable sealing systems.

Regreasing should be carried out at regular intervals. The lube points are located near the drive and output shafts.

Example

![Image of gear unit with greasing nipple](60700AXX)

2.9.4 Grease nipple on the top side of the gear unit (option)

When installed in a restricted space, the lube points can be relocated to the top side of the gear unit.

When this is done, flat grease nipples (according to DIN 3404 A G1/8) are used. Regreasing should be carried out at regular intervals.

Note the following points:

• This option is normally used on drives with fans and/or motor adapters
• The option applies to both input and output shaft(s)

Example

![Image of gear unit with greasing nipple on top](60703AXX)
2.10 Unit designation

2.10.1 Example

<table>
<thead>
<tr>
<th>X</th>
<th>3</th>
<th>K</th>
<th>S</th>
<th>220</th>
<th>/T</th>
</tr>
</thead>
</table>

**Housing fixation:**
/ B = Foot mounting
/ T = Torque arm
/ F = Flange

**Gear unit size:**
180...250

**Type of output shaft:**
S = Solid shaft with key
R = Solid shaft without key
L = Splined solid shaft
A = Hollow shaft with keyway
H = Hollow shaft with shrink disc
V = Splined hollow shaft

**Gear unit design:**
F = Helical gear unit
K = Bevel-helical gear unit

**Number of gear stages:**
2 = 2-stage
3 = 3-stage
4 = 4-stage

**Industrial gear unit series**

1) Upon request to SEW-EURODRIVE
## 2.11 Nameplate

### 2.11.1 Example

<table>
<thead>
<tr>
<th>Type</th>
<th>Unit designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nr. 1</td>
<td>Serial number</td>
</tr>
<tr>
<td>( P_{K1} )</td>
<td>[kW] Operating power on HSS</td>
</tr>
<tr>
<td>( M_{K2} )</td>
<td>[Nm] Gear unit output torque</td>
</tr>
<tr>
<td>( n_1 )</td>
<td>[1/min ( = rpm)] Input speed (HSS)</td>
</tr>
<tr>
<td>( n_2 )</td>
<td>[1/min ( = rpm)] Output speed (LSS)</td>
</tr>
<tr>
<td>( n_{\text{norm.}} )</td>
<td>Standard operating point</td>
</tr>
<tr>
<td>( n_{\text{min.}} )</td>
<td>Operating point at minimum speed</td>
</tr>
<tr>
<td>( n_{\text{max.}} )</td>
<td>Operating point at maximum speed</td>
</tr>
<tr>
<td>i</td>
<td>Exact gear unit reduction ratio</td>
</tr>
<tr>
<td>( F_S )</td>
<td>Service factor</td>
</tr>
<tr>
<td>( F_{R1} )</td>
<td>[N] Actual overhung load acting on the input shaft</td>
</tr>
<tr>
<td>( F_{R2} )</td>
<td>[N] Actual overhung load acting on the output shaft</td>
</tr>
<tr>
<td>( F_{A1} )</td>
<td>[N] Actual axial load acting on the input shaft</td>
</tr>
<tr>
<td>( F_{A2} )</td>
<td>[N] Actual axial load acting on the output shaft</td>
</tr>
<tr>
<td>Mass</td>
<td>[kg] Weight of the gear unit</td>
</tr>
<tr>
<td>Qty of greasing points</td>
<td>Number of points for regreasing</td>
</tr>
<tr>
<td>Fans</td>
<td>Number of installed fans</td>
</tr>
<tr>
<td>Oil grade and viscosity class / oil quantity</td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Year of construction</td>
</tr>
<tr>
<td>IM</td>
<td>Mounting position and mounting surface</td>
</tr>
</tbody>
</table>

**Table:**

<table>
<thead>
<tr>
<th>Type</th>
<th>Unit designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>X3FS190/B</td>
<td></td>
</tr>
</tbody>
</table>

**Nameplate Example:**

<table>
<thead>
<tr>
<th>Type</th>
<th>Unit designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nr. 1</td>
<td>Serial number</td>
</tr>
<tr>
<td>( P_{K1} )</td>
<td>[kW] Operating power on HSS</td>
</tr>
<tr>
<td>( M_{K2} )</td>
<td>[Nm] Gear unit output torque</td>
</tr>
<tr>
<td>( n_1 )</td>
<td>[1/min ( = rpm)] Input speed (HSS)</td>
</tr>
<tr>
<td>( n_2 )</td>
<td>[1/min ( = rpm)] Output speed (LSS)</td>
</tr>
<tr>
<td>( n_{\text{norm.}} )</td>
<td>Standard operating point</td>
</tr>
<tr>
<td>( n_{\text{min.}} )</td>
<td>Operating point at minimum speed</td>
</tr>
<tr>
<td>( n_{\text{max.}} )</td>
<td>Operating point at maximum speed</td>
</tr>
<tr>
<td>i</td>
<td>Exact gear unit reduction ratio</td>
</tr>
<tr>
<td>( F_S )</td>
<td>Service factor</td>
</tr>
<tr>
<td>( F_{R1} )</td>
<td>[N] Actual overhung load acting on the input shaft</td>
</tr>
<tr>
<td>( F_{R2} )</td>
<td>[N] Actual overhung load acting on the output shaft</td>
</tr>
<tr>
<td>( F_{A1} )</td>
<td>[N] Actual axial load acting on the input shaft</td>
</tr>
<tr>
<td>( F_{A2} )</td>
<td>[N] Actual axial load acting on the output shaft</td>
</tr>
<tr>
<td>Mass</td>
<td>[kg] Weight of the gear unit</td>
</tr>
<tr>
<td>Qty of greasing points</td>
<td>Number of points for regreasing</td>
</tr>
<tr>
<td>Fans</td>
<td>Number of installed fans</td>
</tr>
<tr>
<td>Oil grade and viscosity class / oil quantity</td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Year of construction</td>
</tr>
<tr>
<td>IM</td>
<td>Mounting position and mounting surface</td>
</tr>
</tbody>
</table>

**Nameplate Details:**

- **Type:** X3FS190/B
- **Nr. 1:** 01.1101687801.0001.06 / 66.1234567812
- **Operation instruction have to be observed:**
- **Made in Germany**
- **Mass:** [kg] 1340
- **Qty of greasing points:** 2
- **Fans:** 0
- **CLP HC460 - Synthetic Oil - 90 ltr.**
- **Year:** 2007

**Operation Instruction:**

- Made in Germany

**Specification:**

- Type: X3FS190/B
- Serial number: 01.1101687801.0001.06 / 66.1234567812
- Operation instruction have to be observed!
- Made in Germany
- Mass: 1340 kg
- Qty of greasing points: 2
- Fans: 0
- CLP HC460 - Synthetic Oil - 90 ltr.
- Year: 2007
### 2.12 Coating and surface protection systems

<table>
<thead>
<tr>
<th>SEW version</th>
<th>OS 1 Low environmental impact</th>
<th>OS 2 Medium environmental impact</th>
<th>OS 3 High environmental impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use as surface protection with typical ambient conditions Corrosion categories DIN EN ISO 12944-2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condensation test ISO 6270</td>
<td>120 h</td>
<td>120 h</td>
<td>240 h</td>
</tr>
<tr>
<td>Salt spray test ISO 7253</td>
<td></td>
<td>240 h</td>
<td>480 h</td>
</tr>
<tr>
<td>Condensation test ISO 6270</td>
<td>150 m</td>
<td>210 m</td>
<td>270 m</td>
</tr>
<tr>
<td>Color top coat(1))</td>
<td>RAL 7031</td>
<td>RAL 7031</td>
<td>RAL 7031</td>
</tr>
<tr>
<td>Color according to RAL</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Uncoated parts: shaft end/flange</td>
<td>Coat with hand perspiration and water repellent anticorrosion agent for external preservation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) NDFT (nominal dry film thickness) = standard layer thickness; minimum layer thickness = 80% NDFT; maximum layer thickness = 3x NDFT (DIN EN ISO 12944-5)

2) Standard color

### 2.13 Storage and transport conditions

#### 2.13.1 Interior corrosion protection

**Standard protection**

After the test run, the test oil fill is drained out of the gear unit. The oil film that remains protects the gear unit against corrosion for a certain period of time.

**Long-term protection**

After the test run, the test oil fill is drained out of the gear unit and the interior space is filled with a vapor phase inhibitor. The ventilation filter is replaced by a screw plug and enclosed with the gear unit.
2.13.2 Exterior corrosion protection:

- Bare, uncoated parts are coated with an anti-rust agent. Remove it only using an appropriate solvent which is not harmful to the oil seal.
- Sealing surfaces on radial oil seals are protected by an appropriate anti-corrosion agent.
- When the gear unit is filled with vapor phase inhibitor, the ventilation filter is replaced by a screw plug and enclosed with the gear unit. The enclosed ventilation filter must be installed on the gear unit again before startup.
- Small spare parts and loose pieces, such as bolts, nuts, etc., are packed in corrosion protection plastic bags (VCI corrosion protection bags).
- Threaded holes and blind holes are covered by plastic plugs.
- If the gear unit is stored longer than 6 months, we recommend that you regularly check the protective coating of unpainted areas as well as the paint coating. Areas where the protective coating or paint has been damaged may have to be recoated, as applicable.
- The output shaft must be rotated at least one full rotation so that the position of the roller elements in the bearings of the drive and output shafts changes. This procedure must be repeated every 6 months until startup.

2.13.3 Packaging

**Standard packaging**

The gear unit is delivered on a palette without cover.

**Application**: Land transport

**Long-term packaging**

The gear unit is delivered on a pallet. The gear unit is wrapped in a film and equipped with appropriate corrosion protection material in the film packaging.

**Application**: Land transport and for long-term storage

**Seaworthy packaging**

The gear unit is packaged in a seaworthy wooden box and is delivered on a pallet that is appropriate for sea transport. The gear unit is wrapped in a film and equipped with appropriate corrosion protection material in the film packaging.

**Application**: Sea transport and for long-term storage
2.13.4 Storage conditions

During storage, up to startup, the gear unit must be stored in a shock-free manner in order to prevent damage to the anti-friction bearing races.

The gear units are delivered without an oil fill; different protection systems are required depending on storage period and storage conditions.

<table>
<thead>
<tr>
<th>Climate zone</th>
<th>Packaging and corrosion protection</th>
<th>Storage location</th>
<th>Storage duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperate (Europe, USA, Canada, China and Russia, excluding tropical zones)</td>
<td>Long-term packaging + Long-term corrosion protection:</td>
<td>Roofed, protected against rain and snow, no shock loads.</td>
<td>Up to three years with regular checks of the packaging and moisture indicator (rel. humidity &lt; 50 %).</td>
</tr>
<tr>
<td></td>
<td>Standard packaging + Standard corrosion protection</td>
<td>Roofed and enclosed at constant temperature and atmospheric humidity ($5°C &lt; \theta &lt; 60°C, &lt; 50%$ relative humidity). Protected against sudden temperature fluctuations and with controlled ventilation with filter (free from dust and dirt). Protected against aggressive vapors and shocks.</td>
<td>One year or more with regular inspections. Check for cleanliness and mechanical damage during inspection. Check corrosion protection.</td>
</tr>
<tr>
<td>Tropical (Asia, Africa, Central and South America, Australia, New Zealand excluding temperate zones)</td>
<td>Long-term packaging + Long-term corrosion protection:</td>
<td>Roofed, protected against rain and shocks.</td>
<td>Up to three years with regular checks of the packaging and moisture indicator (rel. humidity &lt; 50 %).</td>
</tr>
<tr>
<td></td>
<td>Protected against insect damage and mildew by chemical treatment.</td>
<td>Roofed and enclosed at constant temperature and atmospheric humidity ($5°C &lt; \theta &lt; 60°C, &lt; 50%$ relative humidity). Protected against sudden temperature fluctuations and with controlled ventilation with filter (free from dust and dirt). Protected against aggressive vapors and shocks. Protected against insect damage.</td>
<td>One year or more with regular inspections. Check for cleanliness and mechanical damage during inspection. Check corrosion protection.</td>
</tr>
</tbody>
</table>