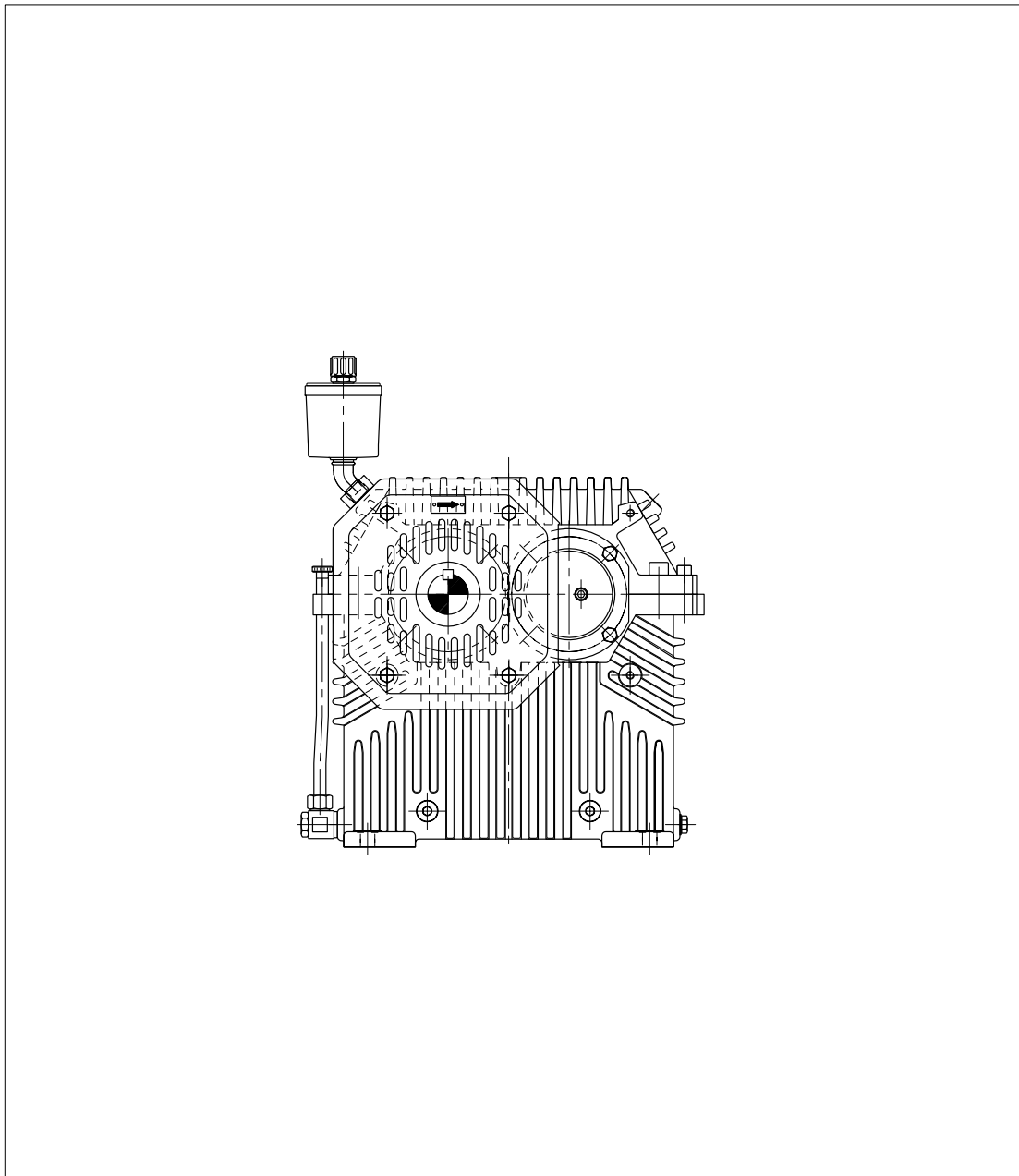


Operating Instructions

BA 5800 EN 01.02

Gear Unit Types
SENT 150



FLENDER

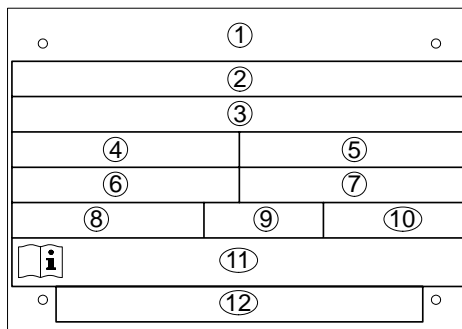
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1. Technical data

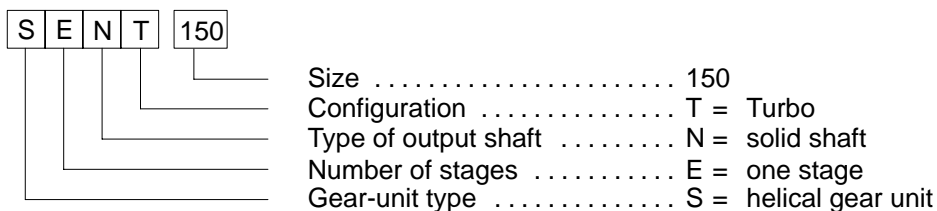
1.1 General technical data

The most important technical data are shown on the rating plate. These data together with the contractual agreements on the gear unit determine the limits of its proper use.



- | | |
|---|---|
| ① Company logo and production location | ⑦ Speed n_2 |
| ② Special information | ⑧ Type of oil |
| ③ Order no. - item - serial no. | ⑨ Viscosity of oil in VG class |
| ④ Type / Size *) | ⑩ Quantity of oil in litres for main gear housing |
| ⑤ Power rating P_2 in kW or T_2 in Nm | ⑪ Operating instructions number |
| ⑥ Speed n_1 | ⑫ Special information |

e.g. *)



Data on weights and measuring surface sound levels of the various gear types are given in items 1.1.1 and 1.1.2.

For further technical data, refer to the drawings in the gear-unit documentation.

1.1.1 Weights

The gear unit in the current size weighs approx. 105 kg.

Note: All weights are for gear unit without oil charge or attachments.

1.1.2 Measuring-surface sound-pressure level

The gear unit has a measuring-surface sound-pressure level at a distance of 1 m which will be found on the rating plate.

The measurement is carried out to DIN 45635 Parts 1 and 23, 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 metre in the vicinity of which persons may be present.

The sound-pressure level applies to the warmed up gear unit at input speed n_1 and input power P_1 stated on the rating plate. If several figures are given, the highest speed and power values apply.

The measuring-surface sound-pressure level includes attached lubrication units (if applicable). With outgoing and incoming pipes, the interfaces are the flanges.

If repeat measurements on site do not produce conclusive results with regard to measuring technology, the measurement obtained on the FLENDER test bench will apply.

The sound levels stated in the table were obtained by statistical calculation by our Quality Control Dept. The gear unit can be statistically expected to comply with these sound levels.

i_N	n_1 1/min	L_{pA} dB(A)	
		G	GL
1 ... 2	3550	92	95
	2950	91	94
	1750	89	91
	1450	88	90

Table 1.2: Measuring-surface sound-pressure level
G = gear unit without fan
GL = gear unit with fan

2. General instructions

2.1 Introduction

These Operating Instructions (BA) are an integral part of the gear unit supplied and must be kept in its vicinity for reference at all times.

Caution!

All persons involved in the installation, operation, maintenance and repair of the gear unit must have read and understood these Operating Instructions and must comply with them. We accept no responsibility for damage or disruption caused by disregard of these Instructions.

The "FLENDER gear unit" described in these Instructions has been developed for driving hydraulic pumps.

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

The gear unit described in these Instructions reflects 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 Operating Instructions is held by **FLENDER GMBH**.

These Operating 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

A. FRIEDR. FLENDER GMBH

D-46393 Bocholt

Tel.: 02871/92-0

Fax: 02871/92-2596

or to one of our customer-service addresses. A list of our customer-service addresses is given in section 11. "Spare parts, customer-service addresses".

3. Safety instructions

3.1 Proper use

- The gear unit has been manufactured in accordance with the state of the art and is delivered in a condition for safe and reliable use. Changes made by the user which affect the safe and reliable operation of the gear unit are not permitted. This applies equally to safety features designed to prevent accidental contact.
- The gear unit should be used and operated only in accordance with the conditions laid down in the service and supply contract.

3.2 Obligations of the user

- The user must ensure that all persons involved in the installation, operation, maintenance and repair of the gear unit have read and understood these Operating Instructions and comply with them at all times in order to:

- avoid injury or damage to the user and third parties,
- ensure the safety and reliability of the unit,

and

- avoid disruptions and environmental damage through incorrect use.
- During transport, assembly, installation, disassembly, operation and maintenance of the unit the relevant safety and environmental regulations must be complied with.
- The gear unit should be operated, maintained or repaired only by authorised, trained and qualified personnel.
- The gear unit must not be cleaned with high-pressure cleaning equipment.
- All work on the coupling must be carried out with great care and with due regard to safety.
- All work on the gear unit must be carried out only when it is not in operation.
The drive unit must be secured against being switched on accidentally (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.
- No welding work should be done on the gear unit.
The gear unit must not be used as an earthing point for welding operations. Toothed parts and bearings may be irreparably damaged by welding.
- If any changes (e.g. overheating or unusual noises) are noticed on the gear unit during operation, the drive unit must be switched off immediately.
- Rotating drive components such as couplings, gearwheels, belt drives, etc. must be protected with appropriate safeguards against accidental contact.
- If the gear unit is intended for installation in plant or machinery, the manufacturer of such plant or machinery must ensure that the contents of these Operating Instructions are incorporated in his own instructions.
- Notices attached to the gear unit, e.g. rating plate, direction arrows, etc., must always be observed. They must be kept free from dirt and paint at all times. Missing plates must be replaced.
- All spare parts must be obtained from FLENDER.

3.3 Environmental protection

- When changing oil, the used oil must be collected in suitable containers. Any oil spillage must be removed immediately.
- 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.

3.4 Special dangers

- Depending on operating conditions, the surface of the gear unit may heat up considerably.
Danger of burns!
- When changing oil, take care to prevent scalding by hot oil.

3.5 Warnings and symbols used in these Operating Instructions (BA)



This symbol indicates safety measures which must be observed to avoid **personal injury**.

Caution!

This symbol indicates safety measures which must be observed to avoid **damage to the gear unit**.

Note: This symbol indicates general operating instructions which are of particular importance.

4. Transport, handling and storage

Note: Observe the "Safety instructions" in section 3.

4.1 Scope of supply

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

4.2 Transport and handling

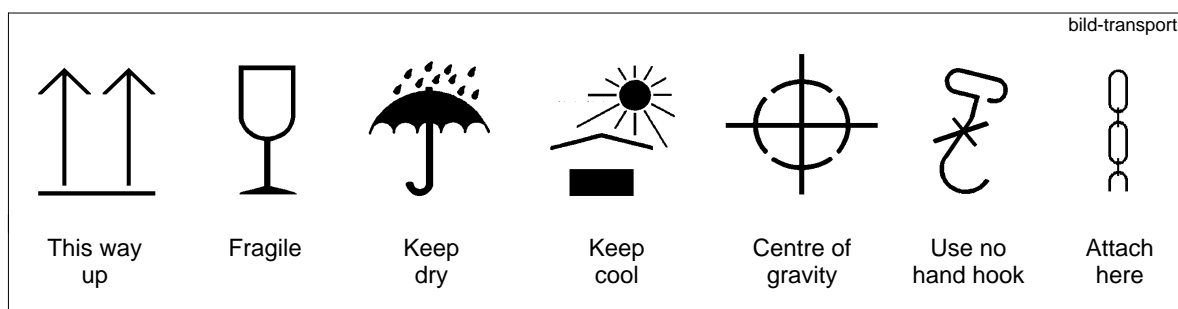


When handling FLENDER products, use only lifting and handling equipment of sufficient load-bearing capacity!

The gear unit is delivered in the fully assembled condition. Additional items (e.g. oil cooler, pipes and fittings) can be delivered separately packaged.

Different forms of packaging may be used, depending on the size of the unit and method of transport. Unless otherwise agreed, 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:



Caution!

The gear unit must always be transported with due care to avoid danger to persons and the gear unit.

If, for example, the free shaft ends are knocked, this may damage the gear unit.

Note:

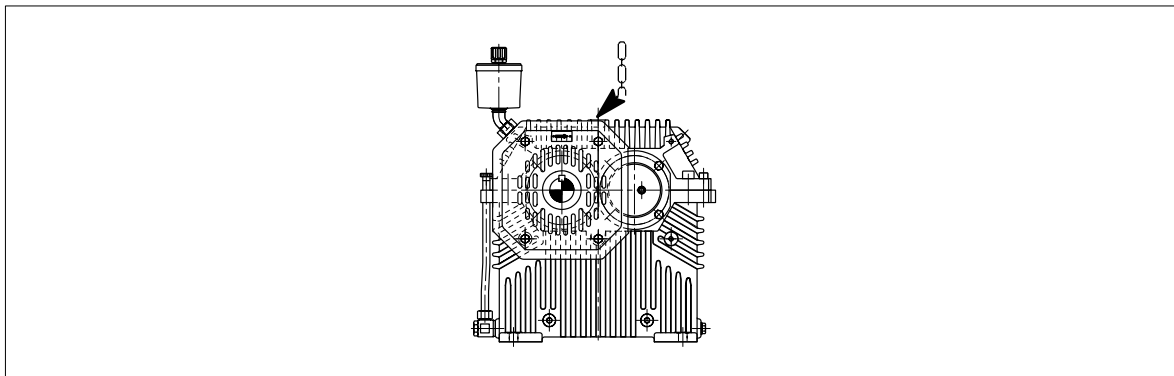
The gear units must be transported with suitable equipment only.

Never transport the gear unit with an oil filling.

Caution!

The gear unit must be handled and transported only with the aid of an eyebolt (M10) on the gear-unit housing. Attach slings with shackles or rope coils to eye bolt.

Do not use the front threads at the shaft ends to attach eye bolts for transport.



For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

4.2.1 Storing the gear units

The gear unit must be stored in the position of use in a sheltered place. It must be placed on a vibration-free wooden base and covered over.



Do not stack gear units on top of one another.

Caution!

If the gear unit is being stored out of doors, it must be particularly carefully covered, and care must be taken that neither moisture nor foreign material can collect on the unit.

Note:

Provision for special environmental conditions during transport (e.g. transport by ship) and storage (climate, termites, etc.) must be contractually agreed.

4.3 Standard preservation

The gear unit is provided with an internal preservative agent. The free shaft ends are painted for protection.

The properties of the outer paint coat are as follows: Resistant to acids, weak alkalis, solvents, atmospheric action, temperatures up to 120 °C (temporarily up to 140 °C) and to tropical conditions.

Note:

Ensure that the paint is not damaged!

Mechanical damage (scratches), chemical damage (acids, alkalis) and thermal damage (sparks, welding beads, heat) cause corrosion which may cause failure of the external protective coating.

For longer periods of storage (> 6 months) we advise regular checking and, if necessary, renewal of the internal and external preservation (see section 7 "Start-up").

5. Technical description

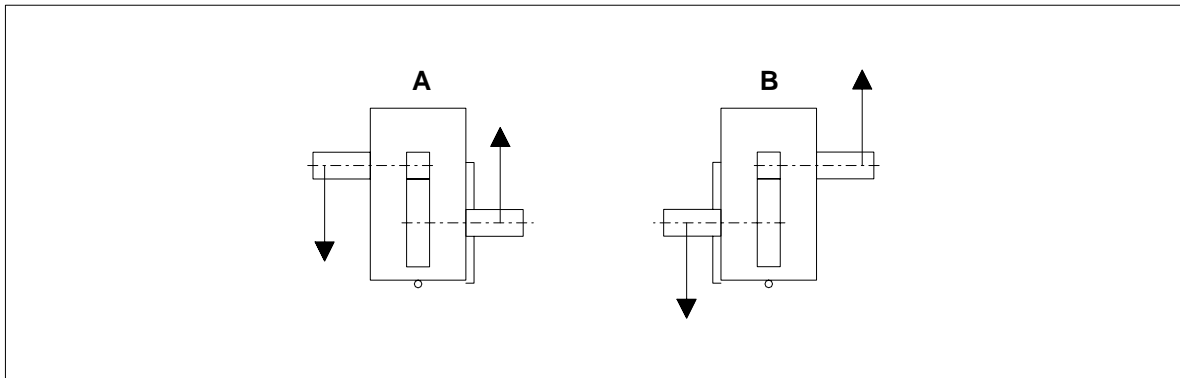
Note: Observe the "Safety instructions" in section 3.

5.1 General description

The gear unit is delivered as a single-stage helical gear unit. It is designed for installation in the horizontal position.

A number of shaft configurations (types and rotation directions) as shown schematically in the following table are possible:

Configuration:



The gear units are characterised by a low noise level, which is achieved by helical gears with a high contact ratio and a special 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: Unless otherwise agreed by contract, the gear units must not be exposed to harmful environmental factors such as chemical products, high air pollution and ambient temperatures outside the range 0 to +20 °C.

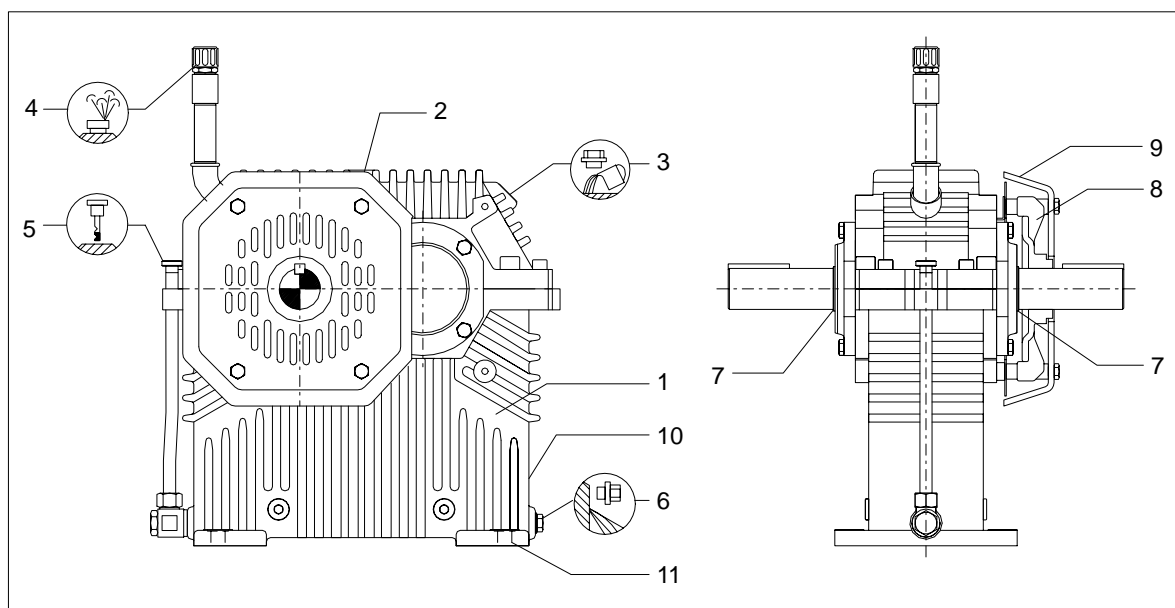
5.2 Housing

The gear-unit housing is made of cast iron and in two parts. The housing is rigid in design and due to its form has excellent noise and temperature characteristics.

It is also fitted with a dipstick for checking the oil level, a drain plug for oil change and a venting screw.

Colour coding of vent, oil inlet, oil level and oil drain and symbol:

Breather:	yellow	
Oil inlet:	yellow	
Oil level:	red	
Oil drain:	white	



1	Housing	5	Oil dipstick	9	Fan cowl
2	Transport thread (M10)	6	Oil drain plug	10	Rating plate
3	Oil inlet	7	Shaft seal	11	Gear-unit fastening
4	Housing ventilation	8	Fan		

For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

5.3 Shaft

For the connection geometry of the shaft ends, refer to the gear-unit documentation.

The shafts have been balanced at the factory with a half-section, round-ended parallel key. With shaft speeds > 5000 1/min we recommend that the parallel keys be adjusted in form and height by the customer to avoid imbalance.

5.4 Toothed components

The toothed components of the gear unit are case-hardened. Helical-gear teeth are ground. The high quality of the teeth leads to a significant noise reduction and ensures safe and reliable running.

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

5.5 Lubrication

Unless otherwise stated in the order documentation, the teeth and bearings are adequately splash-lubricated with oil by the gearwheels. This means that the gear units require very little maintenance.

5.6 Shaft bearings

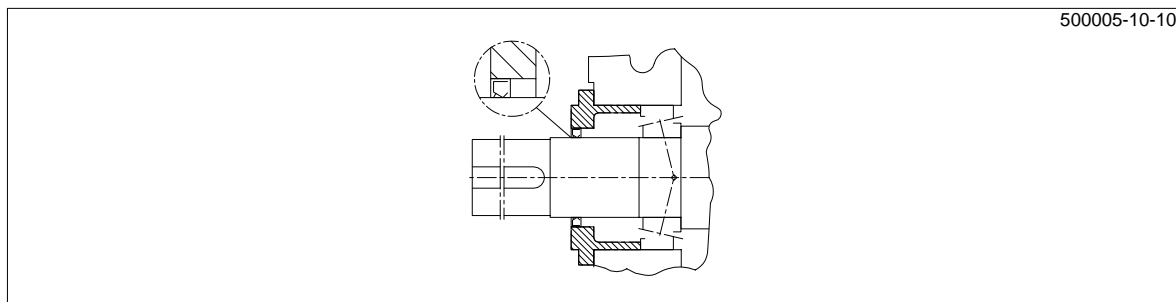
All shafts are mounted on rolling bearings.

5.7 Shaft seals

Labyrinth seals and radial shaft seal rings at the shaft outlets prevent oil from escaping from the housing and dirt from entering the housing.

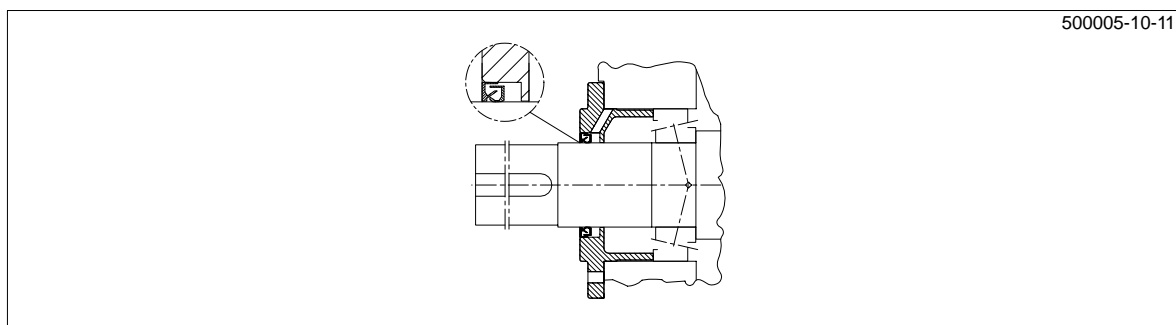
5.7.1 Radial shaft sealing rings

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



5.7.2 Labyrinth seals

Labyrinth seals are non-contacting and avoid wear to the shaft. They therefore require no maintenance and ensure favourable temperature characteristics.



Caution!

For reliable operation, this type of seal requires horizontal positioning in a splash-free and relatively dust-free environment.

5.8 Cooling

The gear unit is normally fitted with a fan for cooling.

5.8.1 Fan

The fan is mounted on the driven shaft of the gear unit and is protected from unintentional contact by a cowl. The fan draws in air through the holes in the cowl and blows it over the gear-unit housing. It thereby removes a certain amount of heat from the housing.

Caution!

For gear units fitted with a fan, sufficient space must be allowed for air intake when mounting the safety guards for the coupling or other components. The correct distance is given in the dimensioned drawing in the gear-unit documentation.

Note:

The cooling effect is considerably reduced if the fan or the gear housing are dirty (see section 10 "Maintenance and repair").

5.9 Vibration monitoring system

The gear unit has been provided at the factory with mounting holes for the attachment of shock pulse sensors. We recommend continuous vibration monitoring of the gear units supplied by us.

5.10 Couplings

If rigid couplings or other input or output elements which generate additional radial or axial forces (e.g. gear wheels, belt pulleys, disk flywheels, hydraulic couplings) are used, these must be agreed by contract.

Caution!

Couplings with peripheral velocities on the outer diameter of up to 30 m/s must be statically balanced. Couplings with peripheral velocities over 30 m/s must be dynamically balanced.

For maintenance and operation of the couplings, refer to the specific operating instructions for the coupling.

Caution!

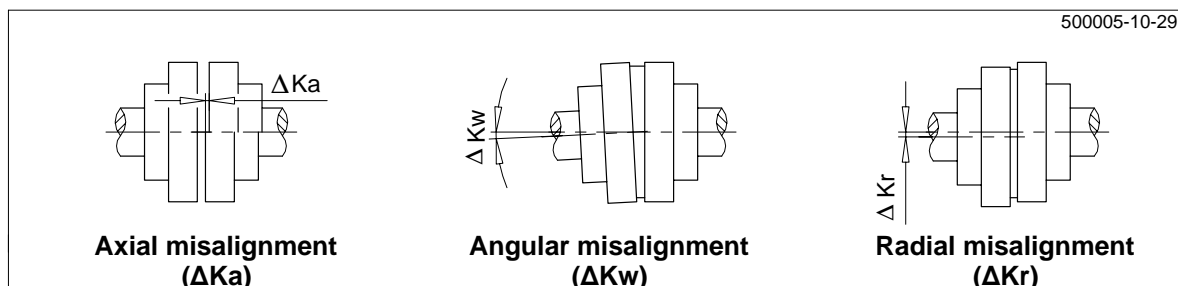
When installing the drives, make absolutely certain that the individual components are accurately aligned in relation to each other. Inadmissibly excessive misalignments of the shaft ends to be connected due to angular and axial misalignments result in premature wear and material damage.

Note:

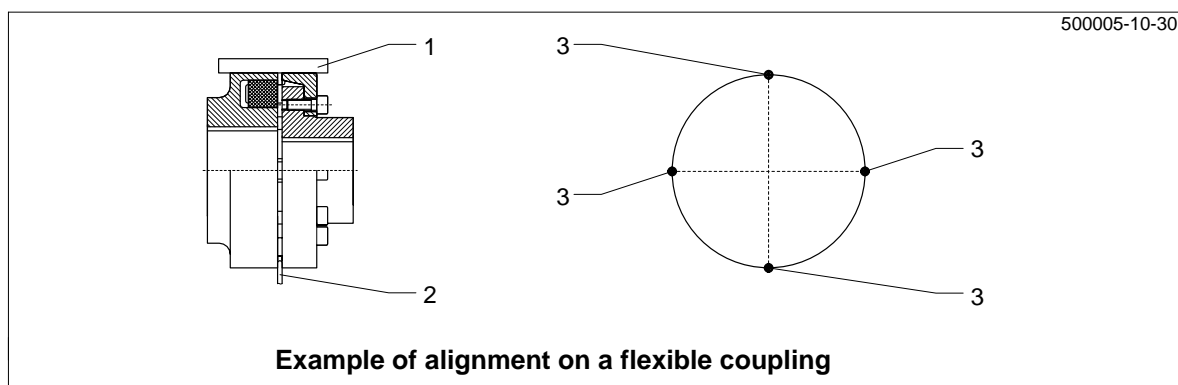
The smaller the radial and angular misalignment between coupling parts on the shaft ends to be connected, the longer the service life and the higher the reliability of the equipment and the quieter the operation.

Misalignments of the coupling parts in relation to each other can be caused by inaccurate alignment during assembly, but also by actual operation of the equipment (expansion due to heat, shaft deflection, insufficiently rigid machine frames, etc.).

Possible misalignments



Alignment has to be effected in two axial planes arranged in vertical relation 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, optically, by using a laser.



1 Ruler

2 Feeler gauge

3 Measuring points

Caution!

The maximum permissible misalignments must under no circumstances be exceeded during operation.

For the exact values please see operating instructions for the coupling.

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.

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. Assembly

Note: Observe the "Safety instructions" in section 3.

6.1 General information on assembly and installation

Assembly and installation work must be done with great care by trained and qualified personnel. The manufacturer cannot be held liable for damage caused by incorrect assembly and installation.

During the planning phase sufficient space must be allowed around the gear unit for later care and maintenance work.

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

Caution!

Exposure to direct sunlight may cause overheating. Protective features such as covers, roofing, etc. must be provided as required.

Adequate lifting equipment must be available before beginning the installation and assembly work.

Caution!

No welding work must be done on the drive. The drives must not be used as an earthing point for welding operations. Toothed parts and bearings may be irreparably damaged by welding.

Caution!

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

To ensure proper lubrication, the installation position specified in the order must always be observed.

6.2 Installation of gear unit on housing base

6.2.1 Foundation

The foundation must be horizontal and level.

It must 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 mounted must be rigid. It must be designed according to the weight and torque, taking into account the forces acting on the gear unit.

When fastening the gear unit to concrete foundations by means of foundation blocks, suitable recesses should be made in the foundation.

Fastening bolts or nuts must be tightened to the prescribed torque. For the correct torque, refer to item 10.2.5. Bolts of the minimum strength class 8.8 must be used.

Note: For dimensions, space requirement, arrangement of supply connections (e.g. with separate oil-cooling units), refer to the drawings in the gear-unit documentation.

6.2.2 Description of installation work

- Remove the anti-corrosion paint on the shafts with benzine.

Caution!

Do not allow the benzine to contact the shaft sealing rings.



**Ensure adequate ventilation. Do not smoke!
Danger of explosion.**

- Mount and, if necessary, secure input and output drive elements (e.g. coupling components) on the shafts.
If these are to be heated before mounting, refer to the dimensioned drawings in the coupling documentation for the correct joining temperatures.

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



Take precautions to avoid burns from hot components!

Caution!

Protect shaft sealing rings from damage and heating to over +100 °C (use heat-protective screens to protect against radiant heat.)

Caution!

**The coupling components must be fitted with the aid of suitable equipment to avoid damaging the shaft bearings through axial joining forces.
Always use suitable lifting equipment.
When fitting the components, care must be taken that the shaft sealing rings and shaft running surface are not damaged.**

The components must be pushed smartly onto the shaft up to the position specified in the order-specific dimensioned drawing.

Caution!

Fit the coupling with the aid of suitable fitting equipment. Never use force or knock the couplings into position, as this may damage the gearwheels, rolling bearings, locking rings, etc.

Note:

Gear units whose weight requires the use of lifting gear must be attached as shown in section 4 "Transport, handling and storage". When add-on components are mounted on the gear unit, appropriate additional attachment points must be provided in accordance with the order-specific dimensioned drawing.

6.2.2.1 Alignment

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

- laser measuring instruments (preferably)
- rulers
- spirit level
- dial gauge
- feeler gauge, etc.

The gear unit can now be fixed in position.

Note:

The accuracy of shaft axis alignment is an important factor in determining the life span of shafts, bearings and couplings. Temperature-dependent length and size changes must be taken into consideration. If possible, the deviation should be zero. For e.g. the special requirements for the couplings, refer to the specific operating instructions.

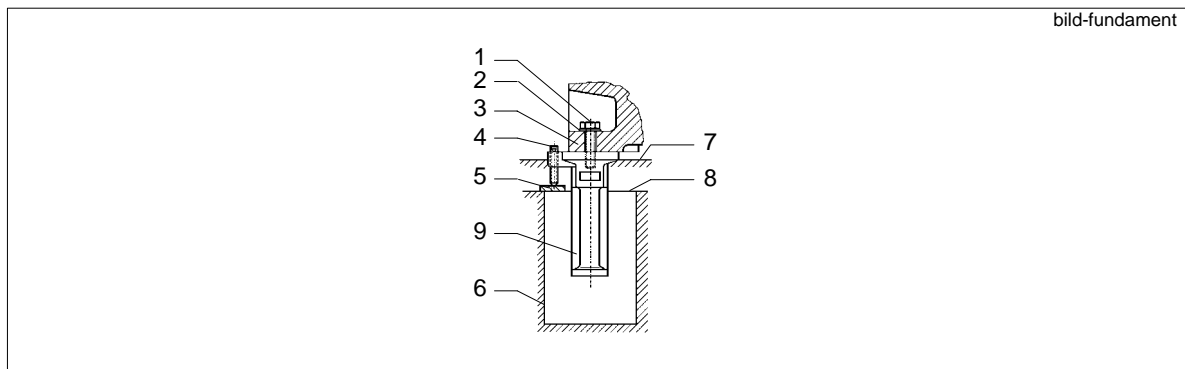
6.2.2.2 Mounting on a foundation frame

- Clean the undersurface of the gear-unit base.
- Using suitable lifting gear, place the gear unit on the foundation frame.
- Using suitable measuring equipment, align gear unit horizontally with the in- and output shafts
- Tighten the foundation bolts to the specified torque (see item 10.2.5). If necessary, use stops to prevent shifting.

Caution! The gear unit must not be twisted when tensioning the fastening bolts.

6.2.2.3 Mounting on a concrete foundation

- Clean the undersurface of the gear-unit base.
- Hook the foundation blocks with washers and fastening bolts into the foundation fastening points on the housing and tighten the fastening bolts (see diagram below).



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

- Using suitable lifting gear, place the gear unit on the concrete foundation.
- Align the gear unit horizontally by the input and output shafts, using foundation blocks (and set screws, if applicable).
- Pour concrete into the recesses for the foundation blocks.

Note: Before pouring the concrete foundation, fill up the openings in the foundation blocks with polystyrene.
When the concrete has set, tighten the fastening bolts of the foundation blocks to the **specified torque** (see item 10.2.5).

Caution! The gear unit must not be twisted when tensioning the fastening bolts.

7. Start-up

Note: Observe the "Safety instructions" in section 3.

7.1 Procedure before start-up

Caution!

If an additional plastic coating (varnish paint) is applied, the shaft seals must be protected against contact with the coating material.

7.1.1 Removal of preservative agent

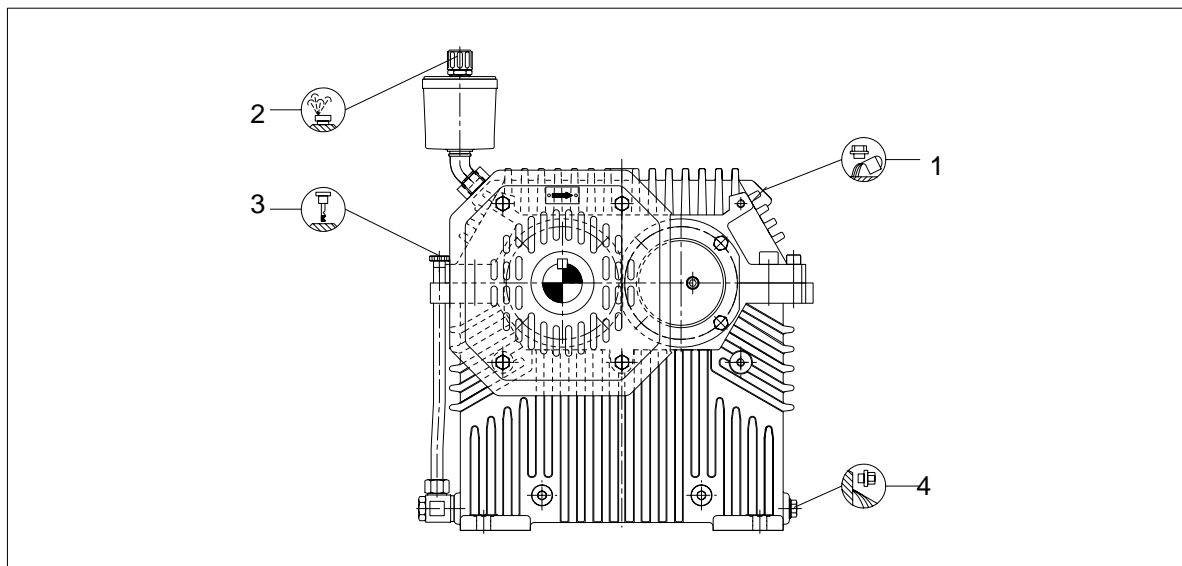
- Unscrew oil drain plug and drain off the remaining preservative or running-in oil from the housing into a suitable receptacle and dispose of it in accordance with regulations
- Replace the oil drain plug.



Remove any oil spillage immediately with an oil-binding agent.

Caution!

Before start-up, replace the yellow plastic plug with a breather screw with cap (see also notice on gear unit).



1 Oil inlet
2 Housing ventilation

3 Oil dipstick
4 Oil drain

For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

7.1.2 Filling with lubricant

- Unscrew screw plug of the oil filling hole on the gear unit
- Remove oil dipstick

Caution!

Using a filter, fill the gear unit with fresh oil (max. mesh 25 µm) up to the MAX mark on the oil dipstick.

Because of the design of the gear unit the precise oil level on the oil dipstick will take a while to settle down.

The oil level must be checked again approx. 10 minutes after any change in oil level. Under no circumstances must the oil level rise above or fall below the MIN/MAX mark when the oil is cold. If necessary, oil must be drained off or topped up.

Note:

The oil to be used is indicated in section 10 "Maintenance and Repair".

Data, such as oil grade, oil viscosity and oil quantity required will be found on the rating plate (see Section 1. "Technical Data").

The quantity of oil indicated on the rating plate is an approximation only. The marks on the oil dipstick must always be observed.

- Check oil level on the oil dipstick

Note:

The oil level must be at the upper mark on the oil dipstick.

Caution!

Remove any oil spillage immediately with an oil-binding agent.

- Close oil filling hole with screw plug

7.2 Start-up

- Check the oil level in the gear housing with the oil dipstick

Note:

When the oil is cool, the level should be at the upper mark on the oil dipstick. Under no circumstances must the oil level rise above or fall below the MIN/MAX mark. If necessary, oil must be drained off or topped up.

- Replace oil dipstick

7.3 Shutting down

- To shut down the gear unit, first switch off the drive unit.



Secure the drive unit to prevent it from being started up unintentionally. Attach a warning notice to the start switch.

Note:

During longer periods of disuse, start the unit up briefly at intervals of 3 weeks. If the gear unit is to remain out of service for longer than six months, it must be treated with preservative (see item 7.3.1).

7.3.1 Internal preservation during longer periods out of service

Depending on the type of lubrication or shaft sealing, the following types of internal corrosion protection can be used:

7.3.1.1 Internal preservation with gear oil

Gear units with dip lubrication systems and contacting shaft seals can be filled with the correct type of oil up to a point just below the breather screw.

7.3.1.2 Internal protection with preservative agent

Before longer periods of storage, gear units with pressure lubrication systems or non-contacting shaft seals should be filled with preservative agent and run without load.

We recommend the preservative agents listed in the table below for preservation of the gear unit:

Duration of protection	Preservative agent	Special measures
up to 6 months	Castrol Alpha SP 220 S	none
For storage periods longer than 6 months renew the preservative agent.		

Table 7.1: Preservation procedure when using PAO-based synthetic oil

7.3.1.3 Internal preservation procedure

- Switch the gear unit off and drain the oil as described in section 10 "Maintenance and repair".
- Pour in the preservative agent indicated in Table 7.1 through the oil filler plug until it reaches the upper mark on the oil dipstick.
- Close oil filling hole with screw plug
- Start the gear unit and allow it to run for a short time without load.
- Unscrew the oil drain plug and allow the preservative to drain into a suitable container and dispose of it according to regulation.



There is a risk of scalding from the hot preservative agent draining from the gear unit. Wear protective gloves.

- Replace the oil drain plug.
- Close gear unit and replace breather screw or air filter with a screw plug

Caution!

**Before re-starting the gear unit replace the screw plug with the breather screw or air filter.
See also item 7.1.1.**

7.3.2 External preservation

Duration of protection	Preservative agent	Layer thickness	Remarks
up to 12 months	Tectyl 846 K19	approx. 50 µm	Long-term wax-based preservative agent, resistant to sea water and tropical conditions (soluble with CH compounds)

Table 7.2: External protection of shaft ends and other bright machined surfaces

7.3.2.1 External preservation procedure

- Clean the surfaces
- To separate the sealing lip of the shaft sealing ring and the preservative agent, the shaft should be brushed with grease in the area of the sealing lip
- Apply preservative agent

8. Operation

Note: Observe the "Safety instructions" in section 3.

8.1 General operating data

During operation the unit must be monitored for:

- excessive operating temperature (If synthetic oil (PAO) is used, the gear unit is suitable for a temperature of 100 °C in continuous operation. Operating temperatures of 120 °C are permitted for short periods (see also section 10 "Maintenance and repair").
- changes in gear noise
- possible oil leakage at the housing and shaft seals

and

- correct oil level (see section 7 "Start-up")

Note: To check the oil level, stop operation of gear unit. When the oil is cool, the level should be at the upper mark on the oil dipstick. Under no circumstances must the oil level rise above or fall below the MIN/MAX mark. If necessary, oil must be drained off or topped up.

Caution!

If any irregularities are noticed during operation, switch the drive assembly off at once. Determine the cause of the fault, using the table in section 9.

This table contains a list of possible faults, their causes and suggested remedies.

If the cause cannot be identified or the unit repaired with the facilities available, you are advised to contact one of our customer-service offices for specialist assistance (see section 11.).

9. Faults, causes and remedy

Note: Observe the "Safety instructions" in section 3.

9.1 General information on faults and malfunctions

Note: Faults and malfunctions occurring during the guarantee period and requiring repair work on the gear unit must be carried out only by FLENDER Customer Service. In the case of faults and malfunctions occurring after the guarantee period and whose cause cannot be precisely identified we advise our customers to contact our customer service.

Caution!

FLENDER 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 FLENDER's agreement or use of spare parts not supplied by FLENDER.



To remedy faults and malfunctions, the gear unit must always be taken out of service.

Secure the drive unit to prevent it from being started up unintentionally. Attach a warning notice to the start switch.

9.2 Possible faults

Malfunctions	Causes	Remedy
Changes in gear noise	Damage to gear teeth	Contact Customer Service. Check all toothed components and replace any damaged parts.
	Excessive bearing play	Contact Customer Service. Adjust bearing play.
	Bearing defective	Contact Customer Service. Replace defective bearings.
Increased temperature at bearing points	Oil level in housing too low	Check oil level at room temperature and, if necessary, top up oil
	Oil too old	Check date of last oil change and, if necessary, change oil. See section 10.
	Bearing defective	Contact Customer Service. Check and, if necessary, replace bearings.
Gear unit is oiled up	Inadequate sealing of housing covers or joints	Seal joints
	Labyrinth seals oiled up	Check oil filling if necessary, clean labyrinth seals Transport bracket defective
Oil leakage from gear unit	Inadequate sealing of housing covers or joints	Check and, if necessary, replace seals. Seal joints
	Radial shaft sealing rings defective	Check radial shaft sealing rings and, if necessary, replace
Water in oil	Oil foams in sump	Check state of oil by the test-tube method for water contamination. Have oil analysed by laboratory.
	Defective oil cooler or cooling coil	Repair or, if necessary, replace oil cooler or cooling coil. Fill with oil, look for and repair any leaks.
	Gear unit exposed to cold air from machine-room ventilator: water condensing	Protect gear unit with suitable heat insulation. Close air outlet or alter its direction by structural measures.
Operating temperature too high	Oil level in housing too high	Check the oil level at room temperature and, if necessary, adjust oil level
	Oil too old	Check date of last oil change and, if necessary, change oil. See section 10.
	Oil badly contaminated	Change oil. See section 10.
	On gear units with oil-cooling system: Coolant flow too low	Fully open valves in inflow and outflow pipes. Check for free flow through water oil-cooler.
	Coolant temperature too high	Check temperature and, if necessary, adjust
	Oil flow through water oil-cooler too low through: badly clogged oil filter	Clean oil filter. See section 10.
	Gear unit with fan: Suction opening in cowl and/or housing clogged by dirt	Clean fan cowl and housing
	Gear unit with cooling coil Deposits in cooling coil	Clean or replace cooling coil. See section 10.
Loud noises in area of gear-unit fastening	Fastening has worked loose	Tighten bolts / nuts to prescribed torque. Replace damaged bolts / nuts.

Table 9.1: Faults, causes and remedies

10. Maintenance and repair

Note: Observe the "Safety instructions" in section 3.

10.1 General notes on maintenance

Note: Maintenance and repair work must be done with care by trained and qualified personnel only.

Caution!

The periods indicated in table 10.1 depend on the conditions under which the gear unit is operated. Only average periods can therefore be indicated here. These refer to:

a daily operating time of	24 hours
a duty factor of	100%
an input-drive speed of	3500 1/min
a maximum oil temperature of	100 °C (synthetic oil only)

Note: Under different operating conditions the periods indicated below must be adjusted accordingly.

Measures	Periods	Remarks
Check oil temperature	daily	
Check for unusual gear unit noise	daily	
Check oil level	monthly	
Check gear unit for leaks	monthly	
Test oil for water content	after approx. 400 service hours once per year at least	see item 10.2.1
First oil change after start-up	after approx. 400 service hours	see item 10.2.2
subsequent oil changes	every 18 months or 5000 service hours	see item 10.2.2
Cleaning the breather screw	every 3 months	see item 10.2.3
Clean fan, fan cowl and gear-unit housing	simultaneously with oil change	see item 10.2.4
Checking tightness of fastening bolts	after first oil change, thereafter after every second oil change	see item 10.2.5
Carry out complete inspection of gear unit	after 20 000 operating hours simultaneously with due oil change	see item 10.2.6

Table 10.1: Maintenance and repair work

10.2 Description of maintenance and repair work

10.2.1 Test oil for water-content

For detailed information on testing the oil for water-content apply to the lubricant manufacturer.

10.2.2 Changing the oil

Caution!

When changing the oil, always re-fill the gear unit with the same type of oil. Never mix different types of oil or oils made by different manufacturers. Never mix synthetic oils with mineral-based oils or with other synthetic oils.

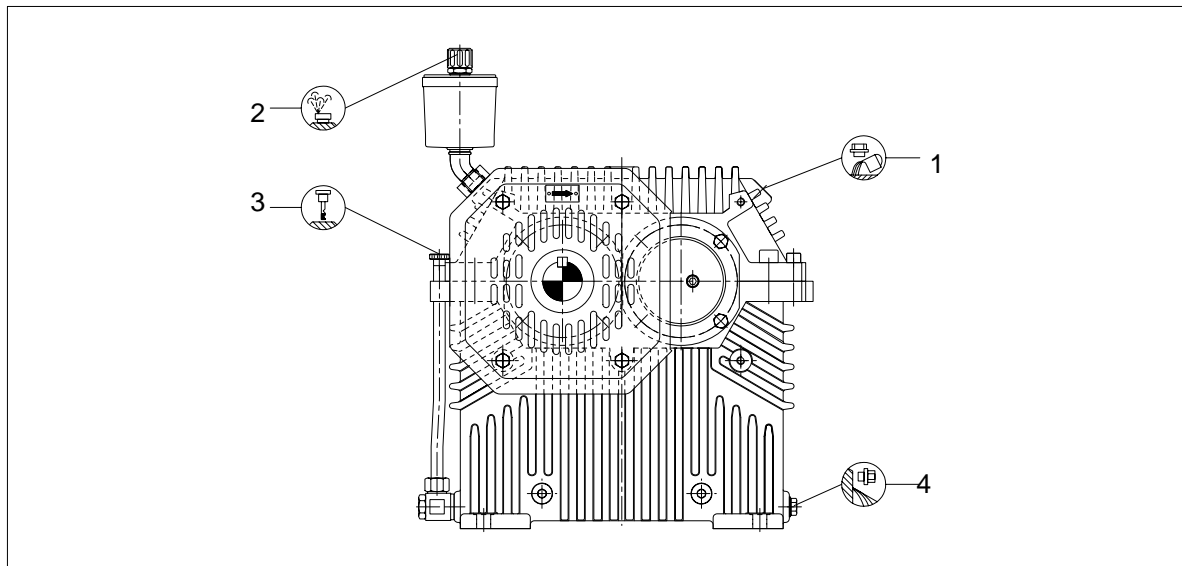
When changing the oil, the housing must be flushed with oil to remove sludge, metal particles and oil residue. Use the same type of oil as is used for normal operation. High-viscosity oils must be heated beforehand. Ensure that all residues have been removed before filling with fresh oil.

Note: Drain the oil while it is still warm, i.e. immediately after shutting down the machinery.

- Shut down the gear unit by switching off the drive unit



Secure the drive unit to prevent it from being started up unintentionally. Attach a warning notice to the start switch.



1 Oil inlet
2 Housing ventilation

3 Oil dipstick
4 Oil drain

For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

- Place a suitable container under the oil drain plug
- Unscrew the breather screw on the top of the housing
- Unscrew the oil drain plug and allow the oil to drain into the container



There is a danger of scalding from the hot oil emerging from the housing. Wear protective gloves. Remove any oil spillage immediately with an oil-binding agent.

- Clean the permanent magnet of the oil drain plug thoroughly

- Replace the oil drain plug

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.

- Unscrew screw plugs of oil filling hole on the gear unit
- Remove oil dipstick

Caution!

Using a filter, fill the gear unit with fresh oil (max. mesh 25 µm) up to the MAX mark on the oil dipstick.

Because of the design of the gear unit the precise oil level on the oil dipstick will take a while to settle down.

The oil level must be checked again approx. 10 minutes after any change in oil level. Under no circumstances must the oil level rise above or fall below the MIN/MAX mark when the oil is cold. If necessary, oil must be drained off or topped up.

Note: The oil to be used is indicated in section 10 "Maintenance and Repair". Data, such as oil grade, oil viscosity and oil quantity required will be found on the rating plate (see Section 1. "Technical Data"). The quantity of oil indicated on the rating plate is an approximation only. The marks on the oil dipstick must always be observed.

- Check the oil level in the gear housing with the oil dipstick

Note: When the oil is cool, the level should be at the upper mark on the oil dipstick. Under no circumstances must the oil level rise above or fall below the MIN/MAX mark. If necessary, oil must be drained off or topped up.

Caution!

Remove any oil spillage immediately with an oil-binding agent.

- Close oil filling hole with screw plug
- Replace oil dipstick

10.2.3 Cleaning the breather screw

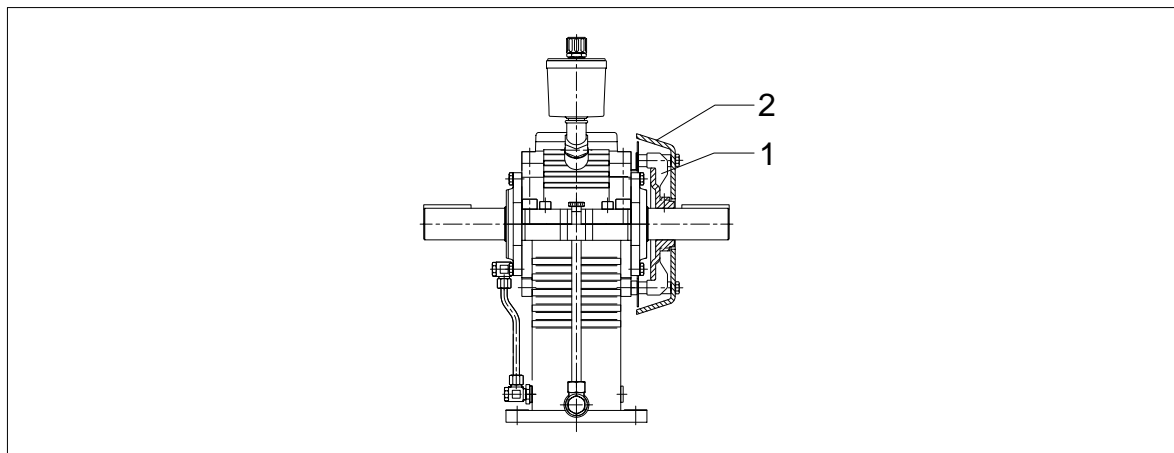
Remove any dust which has collected on the breather screw. It must be cleaned at least every 3 months. To do this, the breather screw must be unscrewed, cleaned with benzine or similar agent and dried. It can also be cleaned by blowing out with compressed air.

10.2.4 Cleaning the fan and gear unit

- Shut down the gear unit by switching off the drive unit



Secure the drive unit to prevent it from being started up unintentionally. Attach a warning notice to the start switch.



1 Fan

2 Fan cowl

For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

- Remove the fan cowl
- Using a stiff brush, remove any dirt adhering to the fan wheel, cowl or safety grid.
- Remove any corrosion.
- Screw safety grid back onto the fan cowl with fastening bolts

Caution!

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

10.2.5 Check tightness of fastening bolts

- Shut down the gear unit by switching off the drive unit



Secure the drive unit to prevent it from being started up unintentionally. Attach a warning notice to the start switch.

- Check tightness of all fastening bolts with a torque wrench

Thread size	Strength class	Tightening torque (with $\mu = 0.14$)
M 6	8.8	10 Nm
M 8	8.8	25 Nm
M 10	8.8	49 Nm
M 12	8.8	86 Nm
M 16	8.8	210 Nm
M 20	8.8	410 Nm
M 24	8.8	710 Nm

Table 10.2: Tightening torques

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

10.2.6 General inspection of gear unit

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

10.3 Lubricants

10.3.1 Lubricating oils for helical-gear unit

10.3.2 Required quality

The oils listed in table 10.3 are a selection of those recommended by FLENDER for helical-gear units. These oils meet FLENDER's essential requirements.

For its gear units, FLENDER approves only CLP oils which contain ingredients to DIN 51517-3 for improvement of corrosion protection, resistance to ageing, and which reduce wear in mixed-friction areas. The scuffing resistance as determined by the FZG test A/8,3/90 must be at least 12.

In addition, the gear oils must meet the following quality requirements demanded by FLENDER:

- High resistance to grey staining with criteria stage 10 or above 10 as determined by the grey staining test FVA 54
- Low degree of foaming with less than 15% foam formation in the FLENDER foam test
- Compatibility with residues of corrosion-protection agent and run-in oils used by FLENDER
- Compatibility with the paints used by FLENDER in its gear-unit interiors
- Compatibility with the elastomer seals of the shaft-sealing rings
- Compatibility with liquid seals between bolted-joint surfaces.

According to manufacturer's information, the following gear oils are manufactured and supplied worldwide in the above-mentioned quality as required by FLENDER.

Note: The use of gear oils which do not comply with the above quality requirements, may invalidate our product guarantee. Every oil manufacturer or supplier of oil is responsible for the quality of his product.

Always select the gear oil in accordance with the viscosity class indicated on the rating plate on the gear unit. If a different viscosity is selected, or oil of a type other than those recommended in these instructions, the operator assumes the responsibility for its technical suitability. In order to minimise the technical risk in such a case, we advise the use of a CLP oil of the above quality which should be accompanied by a statement of suitability by the oil manufacturer.

Caution!

Always comply with the information given on the rating plates and the written instructions for the gear units.

10.3.3 Oil types

In table 10.3 only synthetic oils (poly- α olefins) are listed.

Poly- α olefins may be used over a temperature range of between around -20 °C and 100 °C (for a short time +120 °C).

Note: The upper and lower temperatures (flash point, pour point) for using certain gear oils may deviate widely from the figures indicated. For these and other data and properties of the gear oils, refer to the technical-data sheets published by the oil manufacturers.

A minimum period of 4 years or 20 000 operating hours at a mean temperature of 80 °C without any significant change in the oil quality is specified by the oil manufacturers for synthetic oils (poly- α -olefins).

The actual utilisation periods may be higher or lower (for temperatures over 80 °C). The general rule is that an increase in temperature of 10 °C will halve the utilisation period.

10.3.4 Oil change

The degree of purity of the oil affects the operating reliability and life span of the oil and the gear unit. It should therefore be ensured that the oil in the gear unit is clean. Follow the gear-unit instructions regarding the first oil change after start-up as well as for subsequent oil changes. In the case of larger oil quantities, an analysis should be carried out before cleaning or changing the oil.

When changing oil, the quantity of oil remaining in the gear unit should be kept as low as possible. Generally speaking, a small residual quantity will cause no particular problems. Gear oils of different types and manufacturers must not be mixed. If necessary, the manufacturer should confirm that the new oil is compatible with residues of the old oil. Residues of old oil must be completely removed from the gear unit.

Caution!

Gear oils must never be mixed with other substances. Flushing with paraffin or other solvents is not permitted, as traces of these substances always remain inside the unit.




Table A	Viscosity ISO-VG DIN 51519 at 40 °C (mm ² /s)	Lubricating oils for FLENDER helical-gear units				
Lubricant			Mobil		Tribol <small>A BURMAH CASTROL COMPANY</small>	
Synthetic oils oly- α -olefin	VG 1000					
	VG 680					
	VG 460					
	VG 320					
	VG 220	Intor HCLP 220	Mobil SHC 630 Mobilgear SHC XMP 220	Shell Omala Oil HD 220	Tribol 1510 / 220 Tribol 1710 / 220	Synigo FL-220
	VG 150					
	VG 100					

Table 10.3: Lubricant

11. Spare parts, customer-service addresses

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 indicated in the list.

We guarantee only the original spare parts supplied by us.

Caution!

Please note that spare parts and accessories not supplied by us have not been tested or approved by us. The installation and/or use of such products may therefore impair essential characteristics of the gear unit, thereby posing an active or passive risk to safety. FLENDER will assume no liability or guarantee for damage caused by spare parts and accessories not supplied by FLENDER.

Please note that certain components often have special production and supply specifications and that we supply 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. / Item	Type / Size	Part no.	Quantity
------------------	-------------	----------	----------

11.2 Spare-part and customer-service addresses

When ordering spare parts or the services of our specialist engineers, apply first to FLENDER GMBH.

FLENDER Germany

A. FRIEDR. FLENDER GMBH

D- 46393 Bocholt - Tel.: (0 28 71) 92-0 - Fax: (0 28 71) 92 25 96
E-mail: contact@flender.com • <http://www.flender.com>
Shipping address: Alfred - Flender - Strasse 77, D- 46395 Bocholt

A. FRIEDR. FLENDER GMBH - Kupplungswerk Mussum

Industriepark Bocholt - Schlavenhorst 100 - D- 46395 Bocholt - Tel.: (0 28 71) 92 28 68 - Fax: (0 28 71) 92 25 79
E-mail: anja.blits@flender.com • <http://www.flender.com>

A. FRIEDR. FLENDER GMBH - Werk Friedrichsfeld

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A. FRIEDR. FLENDER GMBH - Getriebewerk Penig

Thierbacher Strasse 24 - D- 09322 Penig - Tel.: (03 73 81) 60 - Fax: (03 73 81) 8 02 86
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D- 72007 Tübingen - Tel.: (0 70 71) 7 07-0 - Fax: (0 70 71) 70 74 00
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D- 94095 Ruhstorf - Tel.: (0 85 31) 3 90 - Fax: (0 85 31) 3 94 37
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12. Declaration by the manufacturer

Declaration by the manufacturer

in accordance with EEC Engineering Guideline 98/37/EG, Appendix II B

We hereby declare that the

Gear Unit Types **SENT 150**

described in these Operating Instructions are intended for incorporation in a machine, and that it is prohibited to put them into service before verifying that the machine into which they are incorporated complies with the EEC Guidelines (original edition 98/37/EG including any subsequent amendments thereto).

This Manufacturer's Declaration takes into account all the unified standards (inasmuch as they apply to our products) published by the European Commission in the Official Journal of the European Community.



Bocholt, 2002-01-04

Signature (person responsible for products)