FLK DRIVE INDUSTRIAL GEAR UNITS MAINTENANCE INSTRUCTIONS

1 Important Notes

Safety and warning instructions

Always follow the safety and warning instructions in this publication!

Electrical hazard
Possible consequences: Severe or fatal injuries.

Hazard
Possible consequences: Severe or fatal injuries.

Hazardous situation
Possible consequences: Slight or minor injuries.

Harmful situation
Possible consequences: Damage to the drive and the environment.

Important information about explosion protection.

Tips and useful information.

A requirement of fault-free operation and fulfillment of any rights to claim under guarantee is that you adhere to the information in the operating instructions. Consequently, read the operating instructions before you start working with the gear unit!

The operating instructions contain important information about servicing; as a result, they should be kept in the vicinity of the gear unit.

. It is essential to contact FLK DRIVE regarding a subsequent change of mounting position!

. The industrial gear units of the are delivered without oil fill. Refer to the information on the nameplate!

. Refer to the instructions in the sections "Mechanical Installation" and "Startup"!

Waste disposal

Follow the current instructions:

. Housing parts, gears, shafts and anti-friction bearings of the gear units must be disposed of as steel scrap. The same applies to gray cast iron castings unless there are separate collection arrangements.

. Collect waste oil and dispose of it correctly.

2 Safety Notes

Preliminary remarks

The following safety notes are concerned with the use of industrial gear units . If the others gear units or motors are used, also refer to the safety notes for motors and gear units in the corresponding operating instructions.

Also take account of the supplementary safety notes in the individual sections of these operating instructions.

General information

During and after operation, industrial gear units and motors have live and moving parts and their surfaces may be hot.

All work related to transport, storage, setting up/mounting, connection, startup, maintenance and repair may only be performed by trained personnel observing

. the corresponding detailed operating instruction(s) and wiring diagrams,

. the warning and safety signs on the industrial gear unit,

. the specific regulations and requirements for the system and

. national/regional regulations governing safety and the prevention of accidents.

Severe injuries and damage to property may result from

. incorrect use,

. incorrect installation or operation,

. removal of required protective covers or the housing when this is not permitted.

Designated use

Industrial gear units are intended for industrial systems. They correspond

to the applicable standards and regulations. The technical data and the information about permitted conditions are provided on the nameplate and in the documentation.

It is essential to observe all specified information!

Transport

Inspect the delivery for any damage in transit as soon as you receive the delivery.

Inform the transport company immediately. It may be necessary to preclude startup.

Startup/operation

Check that the direction of rotation is correct in decoupled status (also listen for unusual grinding noises as the shaft rotates).

Secure the shaft keys for test mode without drive components. Do not render monitoring and protection equipment inoperative even for test mode.

Switch off the main motor if in doubt whenever changes occur in relation to normal operation (e.g. increased temperature, noise, vibration). Determine the cause; contact F L K if necessary.

Inspection / maintenance

Refer to the instructions in Sec. "Inspection and Maintenance."

2.1 Transport of industrial gear units

Transport eyebolts

Tighten screwed in transport eyebolts firmly. They are only designed for the weight of the industrial gear unit including the motor connected via motor adapter; do not attach any additional loads.

. The main gear unit must only be lifted using lifting ropes or chains on the two screwed in transport eyebolts on the main gear unit. The weight of the gear unit is indicated on the nameplate or the dimension sheet. The loads and regulations specified on the nameplate must always be observed.

. The length of the lifting chains or ropes must be dimensioned in such a way that the angle between the chains or ropes does not exceed 45°.

. Eyebolts on the motor, auxiliary gear unit or primary gear unit must not be used for transport!

. Use suitable, sufficiently rated handling equipment if necessary. Before startup, remove securing devices used for transport.

2.2 Corrosion protection and storage conditions

Overview

Industrial gear units are delivered without oil fill. Observe the corrosion protection required for the various storage periods listed in the following table:

Storage period	Storage conditions	
	Outdoors, roofed	Indoors (dry, warm air, heated if required)
6 months	Standard protection	Standard protection
12 months	Consult with FLK	Standard protection
24 months	Long-term protection	Consult with FLK
36 months	Consult with FLK	Long-term protection
Sea transport, storage in areas close to the sea	Consult with FLK	Long-term protection

Standard protection

. The gear unit is delivered on a palette without cover.

. Protection of the inside of the gear unit: Gear units undergo a test run with protection oil.

. Oil seals and seal surfaces are protected through bearing grease.

. DONLY applies a protective coating to unpainted surfaces, including spare parts. Before assembly or before other equipment is mounted to such surfaces, the protective coating must be removed. To do so, clean the surface with solvent.

. Small spare parts and loose pieces, such as screws, nuts, etc., are supplied in corrosion protected plastic bags.

. Threaded holes and blind holes are covered by plastic plugs.

. The corrosion protection is not intended for long-term storage or for humid conditions. The operator is responsible for keeping the gear unit in corrosion-free condition.

. The breather plug (Position → Sec. "Mounting Positions") is already installed at the factory.

Long-term protection

. The gear unit is packaged in a seaworthy plywood box and is delivered on a palette. This way, the gear unit is protected from humidity and shock. FLK recommends a seaworthy package if the gear unit will be stored for an extended period of time or if protection against salty air is required.

. Protection of the inside of the gear unit apart from standard protection: A solvent in the form of a vapor phase inhibitor is sprayed through the oil filling hole. Inhibitors are volatile, fixed substances that saturate the ambient air with their vapor in closed rooms. If the inside of the gear unit is subjected to such an atmosphere, then an invisible VPI film forms on the components inside the gear unit. This film serves as corrosion protection. After this protection treatment, the solvent vapors (methanol, ethanol) should have evaporated before closing the gear unit. The breather plug (Position → Sec. "Mounting Positions") is replaced with a screw plug. The screw plug must be screwed into the gear unit again before startup. Repeat the long-term protection treatment after 24 or 36 months (→ Overview of corrosion protection conditions).

. Never open the gear unit near open flames, sparks and hot objects because the solvent vapors might be ignited.

. Take preventive measures to protect people from solvent vapors. It is absolutely crucial that open flames are avoided when the solvent is applied and when the solvent evaporates.

. FLK applies a protective coating to unpainted surfaces, including spare parts. Before assembly or before other equipment is mounted to such surfaces, the protective coating must be removed. To do so, clean the surface with solvent.

. Small spare parts and loose pieces, such as screws and nuts are supplied in corrosion protected plastic bags.

. Threaded holes and blind holes are covered by plastic plugs.

3 Lubrication of industrial gear units

Depending on the mounting position, the lubrication types "splash lubrication" or "bath lubrication" are used for industrial gear units.

Splash lubrication

Splash lubrication is used for industrial gear units in horizontal mounting position. With splash lubrication, the oil level is low. With this lubrication method, oil is splashed onto the bearings and gearing components.

Oil bath lubrication

Oil bath lubrication is used for industrial gear units in vertical mounting position and upright mounting position With oil bath lubrication, the oil level is so high that the bearings and gearing components are completely submerged in the lubricant.

Symbols used

The following table shows which symbols are used in the subsequent figures and what they mean.

Symbol	Meaning
	Breather plug
	Inspection opening
	Oil dipstick
	Oil drain plug
	Oil filling plug
	Oil sight glass
	Air outlet screw

Pressure lubrication

If requested, pressure lubrication is possible as lubrication method disregarding the mounting position.

With pressure lubrication, the oil level is low. The gearing components and bearings not submerged in the oil bath are lubricated through a shaft end pump or a motor pump.

The lubrication method "pressure lubrication" is used when

. oil bath lubrication is not desired for upright or vertical mounting positions

. input speeds are very high

. the gear unit must be cooled by an external oil/water

4 Mechanical Installation

4.1 Required tools / resources

Not included in the scope of delivery:

. Wrench set

. Torque wrench (for shrink discs)

. Mounting device

. Shims and spacing rings if necessary

. Fasteners for input and output elements

. Lubricant

. For hollow shaft gear units

.Threaded rod, nut , retaining screw, ejector screw

. Securing components

Installation tolerances

Shaft end	Flanges
Diametric tolerance in accordance with ISO . ISO k6 for solid shafts with . ≤ 50 mm . ISO m6 for solid shafts with . > 50 mm . ISO H7 for hollow shafts for shrink disc . ISO H8 for hollow shafts with keyway	Centering shoulder tolerance: . ISO js7 / H8

4.2 Before you begin

The drive may only be installed if

. the data on the nameplate of the motor match the supply voltage

. the drive is not damaged (no damage resulting from transport or storage) and

. the following requirements have been properly met:

- with standard gear units:

ambient temperature according to the lubricant table in Sec. "Lubricants", no oil, acid, gas, vapors, radiation, etc.

- with special versions:

drive configured in accordance with the ambient conditions

4.3 Preliminary work

Output shafts and flange surfaces must be completely free of anti-corrosion agents, contamination or other impurities (use a commercially available solvent). Do not let the solvent get in contact with the sealing lips of the oil seals:danger of damage to the material!

4.4 Gear unit foundation

Foundation for foot-mounted gear units

To ensure quick and successful mounting, the type of foundation should be correctly selected and the mounting carefully planned in advance. Foundation drawings with all necessary construction and dimension details should be available.

When mounting a gear unit onto steel framework, special attention should be paid to the rigidity of this framework to prevent destructive vibrations and oscillations. The foundation must be dimensioned according to weight and torque of the gear unit by taking into account the forces acting on the gear unit.

Tightening torques

Screw / nut	Tightening torque screw / nut [Nm]
M20	315
M24	540
M30	1090
M36	1900

4.5 Mounting of solid shaft gear units

Mount the gear unit in the following order:

1. Mount the components according to Sec. "Gear unit foundation". The shims facilitate later adjustment and, if necessary, to mount a replacement gear unit.

2. Secure the gear unit at the selected positions on the supporting girders using three foundation screws. Position the foundation screws at maximum possible distance (two screws on one side of the gear unit and one on the other side). Align the gear unit as follows:

- vertically by lifting, lowering or tilting the unit using the nuts of the foundation screws
- horizontally by tapping the foundation screws slightly into the required direction

3. After having aligned the gear unit, tighten the three nuts of the foundation screws used for alignment. Carefully insert the fourth foundation screw into the supporting girder and tighten it securely. When doing so, make sure that the position of the gear unit does not change. If necessary, realign the gear unit.

4. Tack-weld the ends of the foundation screws to the supporting girders (at least three welding spots per foundation screw). Tack-weld the foundation screws alternately in both directions (starting from the middle) on each side of the center line of the gear unit. This way, misalignment caused by the welding process is avoided. After having tack-welded all screws, they must be welded all the way round in the above mentioned order. Adjust the nuts on the foundation screws to ensure that the welded foundation screws do not twist the gear unit housing.

5. After having tack-welded the nuts of the retaining screws of the gear unit, check the mounting and carry out grouting.

6. When the grouting concrete has set, check the mounting a last time and adjust, if necessary.

Mounting accuracy when aligning

When aligning the gear unit, make sure that the mounting tolerances for the evenness of the foundation are not exceeded (values ymax in below table). If necessary, use shims to align the gear unit on the foundation plate.

JE [mm]	y_{max} [mm]
< 400	0.035
400 ... 799	0.060
800 ... 1200	0.090
1200 ... 1600	0.125

4.6 Mounting / removing hollow shaft gear units with keyed connection

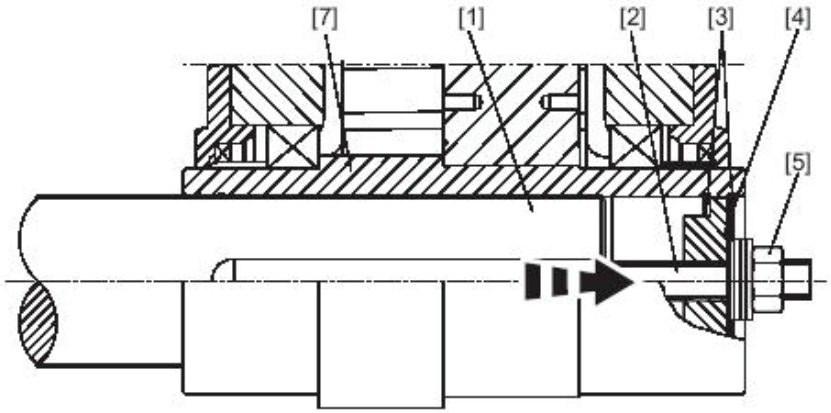
. Included in the scope of delivery (→Figure):

- Circlips [3], end plate [4]

. Not included in the scope of delivery (→ Figure):

- Threaded rod [2], nut [5], retaining screw [6], ejector screw [8]

Selecting the adequate thread and length of the threaded rod as well as the retaining screw depends on the design of the customer's machine.



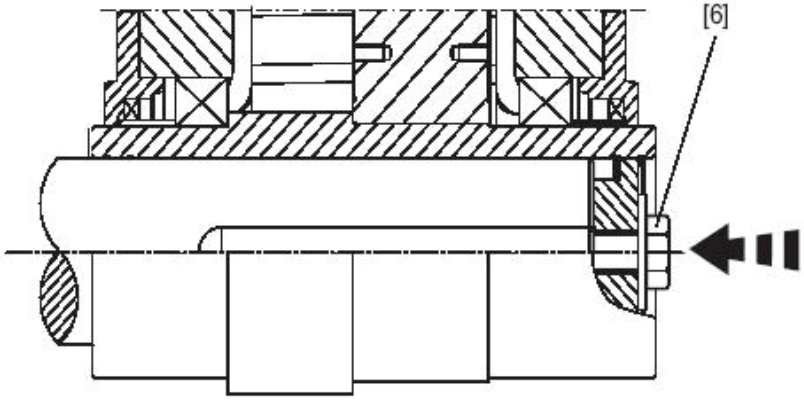
[1] Customer's shaft
[2] Threaded rod
[3] Circlips
[4] End plate
[5] Nut
[7] Hollow shaft

. To mount and secure the gear unit, attach the circlips [3] and the end plate [4] on the hollow shaft bore.

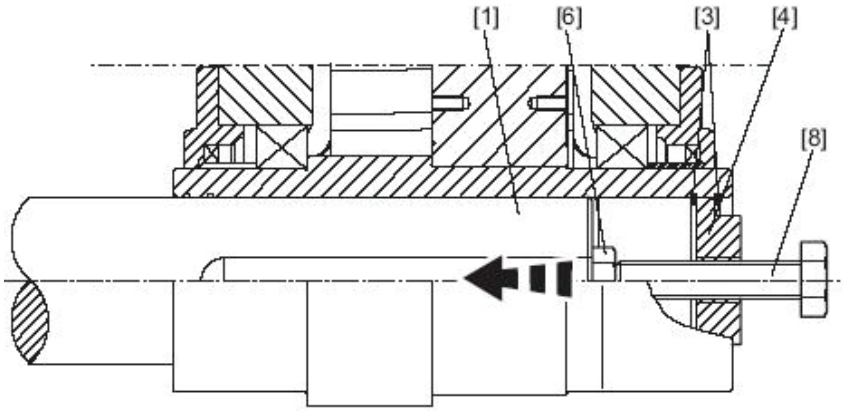
. Apply fluid to the hollow shaft [7] and the shaft end of the customer's shaft [1].

. Push the gear unit onto the customer's shaft [1]. Thread the threaded rod [2] into the customer's shaft [1]. Tighten the customer's shaft [1] with the nut [5] until the shaft end of the customer's shaft [1] and the end plate [4] meet.

. Loosen the nut [5] and unscrew the threaded rod [2]. After having mounted the gear unit, secure the customer's shaft [1] using the retaining screw [6].



Removing the hollow shaft gear unit from the customer's shaft



[1] Customer's shaft
[3] Circlips
[4] End plate
[6] Retaining screw
[8] Ejector screw

. Remove the retaining screw [6].
. Remove the outer circlip [3] and the end plate [4].
. Thread the retaining screw [6] into the customer's shaft [1].
. Flip the end plate [4] and remount the end plate and the outer circlip [3].
. Thread the ejector screw [8] into the end plate [4] to remove the gear unit from the customer's shaft [1].

4.7 Mounting / removing hollow shaft gear units with shrink disc

A shrink disc serves as connecting element between the hollow shaft of the gear unit and the customer's shaft. For the shrink disc type used, refer to the order documents.

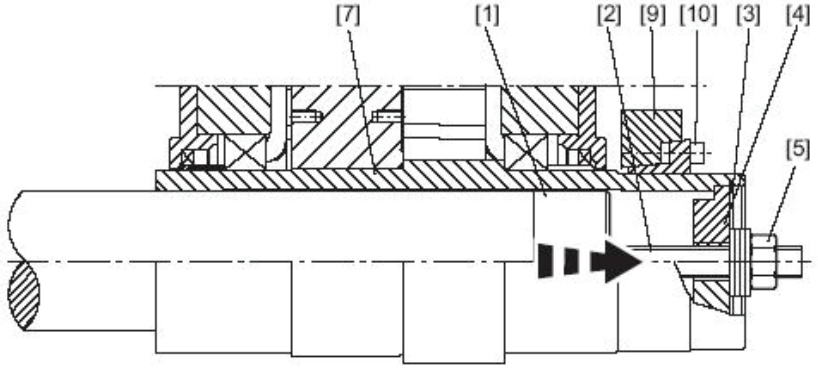
. Included in the scope of delivery (→Figure):

- Circlip [3], end plate [4]

. Not included in the scope of delivery (→ Figure):

- Threaded rod [2], nut [5], retaining screw [6], ejector screw [8]

Selecting the appropriate thread and length of the threaded rod as well as the retaining screw depends on the design of the customer's machine.



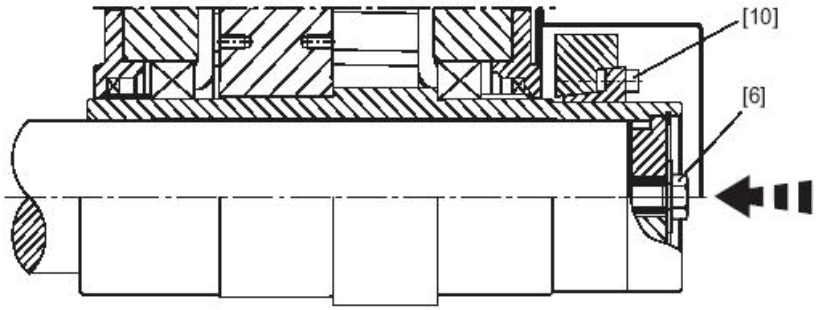
[1] Customer's shaft [2] Threaded rod
[3] Circlip [4] End plate
[5] Nut [7] Hollow shaft
[9] Shrink disc [10] Locking screws

. Before mounting the gear unit, degrease the hollow shaft bore and the customer's shaft [1].

. To mount and secure the gear unit, attach the circlips [3] and the end plate [4] on the hollow shaft bore.

. Push the gear unit onto the customer's shaft [1]. Thread the threaded rod [2] into the customer's shaft [1]. Tighten the customer's shaft [1] with the nut [5] until the shaft end of the customer's shaft [1] and the end plate [4] meet.

. Loosen the nut [5] and unscrew the threaded rod [2]. After having mounted the gear unit, secure the customer's shaft [1] using the retaining screw [6].

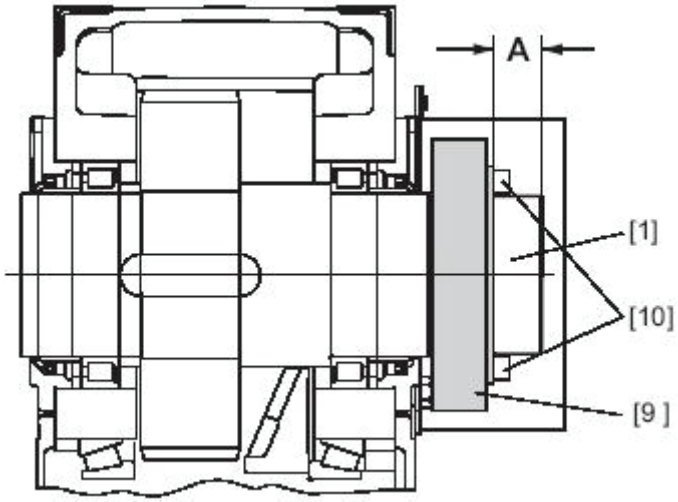


Mounting the shrink disc

. Do not tighten the locking screws [10] before the customer's shaft [1] has been mounted, else the hollow shaft could be deformed!

. Apply a small amount of fluid to the area where the shrink disc [9] is seated on the hollow shaft.

. Slide the shrink disc [9] with untightened screws onto the hub of the hollow shaft bore. Position the customer's shaft [1] in the hollow shaft bore. Next move the shrink disc [9] by dimension A from the shaft end of the hollow shaft:



[1] Customer's shaft

[9] Shrink disc

[10] Locking screws

Removing the shrink disc

. Loosen the locking screws evenly one after the other in several stages in clockwise direction, to avoid tilting the shrink disc. Do not remove the locking screws entirely because the shrink disc might spring off.

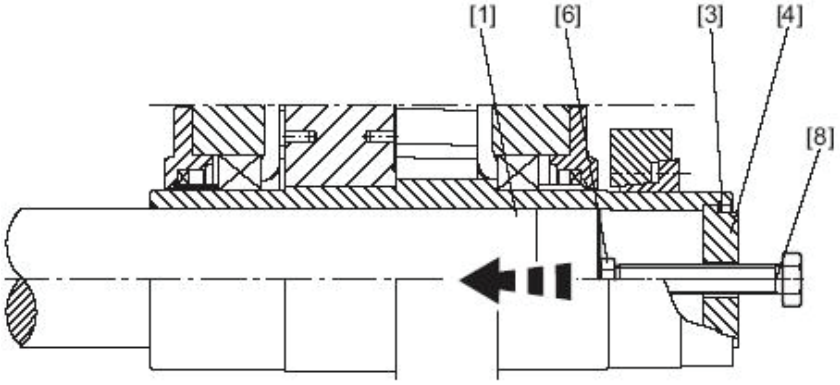
. If the rings do not loosen, remove as many screws as forcing-off threads exist and turn the screws into the forcing-off threads until the taper bushing comes off from the taper ring.

. Remove the shrink disc from the hollow shaft.

Refer to the separate documentation for mounting / removing hollow shaft gear units if other types are used.

Removing the hollow shaft gear unit from the

customer's shaft



[1] Customer's shaft
[3] Circlip
[4] End plate
[6] Retaining screw
[8] Ejector screw

. Remove the retaining screw [6].
. Remove the outer circlip [3] and the end plate [4].
. Thread the retaining screw [6] into the customer's shaft [1].
. Flip the end plate [4] and remount the end plate and the outer circlip [3].
. Thread the ejector screw [8] into the end plate [4] to remove the gear unit from the customer's shaft [1].

5 Mechanical Installation Options

5.1 Important installation instructions

Disconnect the motor from the power supply before starting work and secure it against unintentional restart!

Important installation notes

. Only use a mounting device for installing input and output elements. Use the center bore and the thread on the shaft end for positioning purposes.
. Never mount couplings, pinions, etc. onto the shaft end by hitting them with a hammer (damage to bearings, housing and the shaft!).

. Observe correct tension of the belt for belt pulleys (in accordance with manufacturer's specifications).
. Power transmission elements should be balanced after insertion and must not give rise to any impermissible radial or axial forces.

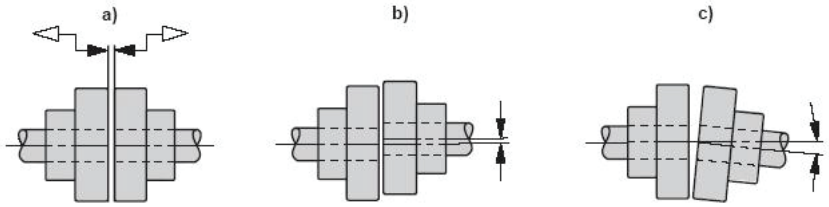
Note:
Installation is easier if you first apply lubricant to the output element or heat it up briefly (to 80-100 °C).

Adjust the following misalignments when mounting couplings:

a) Axial misalignment (maximum and minimum clearance)

b) Offset misalignment (concentric running fault)

c) Angular misalignment



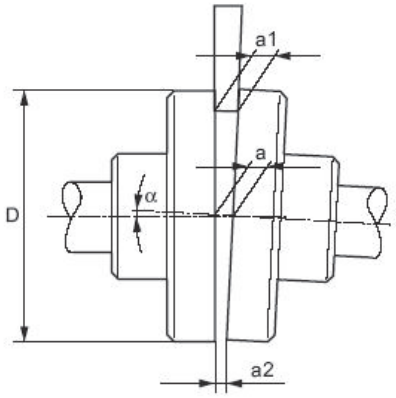
Input and output elements such as couplings must be equipped with a protection cover!

Note:

The following methods for measuring angular and axial misalignment are important for complying with the mounting tolerances specified in Sec. "Mounting of couplings"!

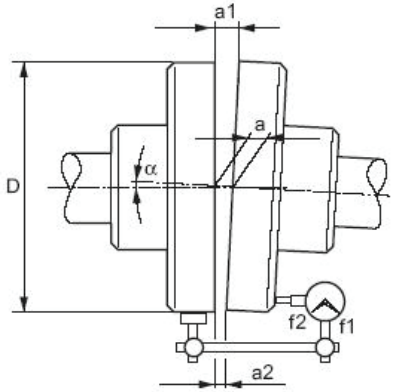
Measuring of angular misalignment with a feeler gauge

The following figure shows the measurement for angular misalignment (α) using a feeler gauge. When using this method, an accurate result is only achieved when the deviation of the coupling faces is eliminated by turning both coupling halves by 180° and the average value is then calculated from the difference (a1– a2).



Measuring of angular misalignment using a micrometer dial

The following figure shows the measurement for angular misalignment using a micrometer dial. This measuring method provides the same result as described under "Measuring angular offset with a feeler gauge" if the coupling halves are rotated together, for instance with one coupling pin, so that the needle of the micrometer dial does not move noticeably on the measuring surface.

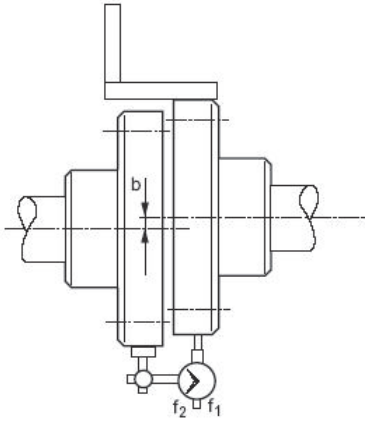


A prerequisite for this measuring method is that there is no axial play in

the shaft bearings when the shafts rotate. If this condition is not fulfilled, the axial play between the faces of the coupling halves must be eliminated. As an alternative, you can use two micrometer dials positioned on the opposite sides of the coupling (to calculate the difference of the two micrometer dials when rotating the coupling).

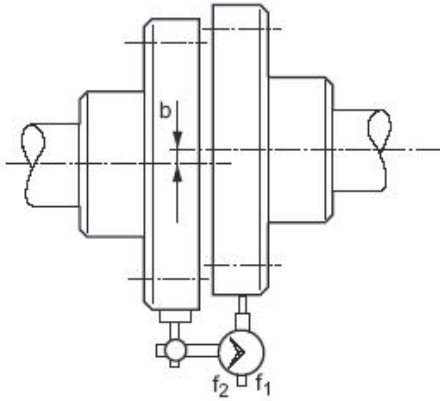
Measuring of offset misalignment using straight-edge and micrometer dial

The following figure shows the measurement for offset misalignment using a straightedge. Permissible values for eccentricity are usually so small that the best measurement results can be achieved with a micrometer dial. If you rotate one coupling half together with the micrometer dial and divide the deviation by two, the micrometer dial will indicate the deviation and as a result the misalignment (dimension "b"), which includes the offset misalignment of the other coupling half.



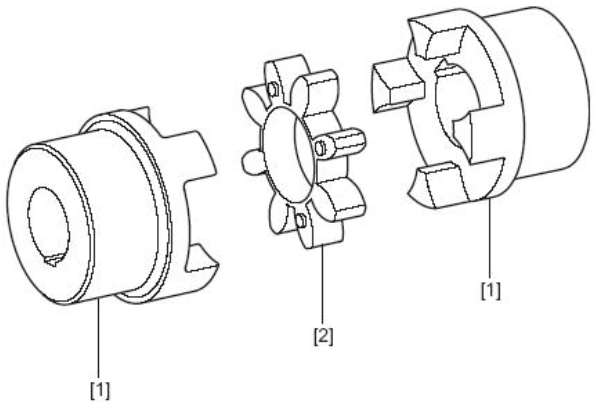
Measuring of offset misalignment using a micrometer dial

The following figure shows the measurement for offset misalignment using a more accurate measuring method. The coupling halves are rotated together without the tip of the micrometer dial moving on the measuring surface. The offset misalignment is obtained by dividing the deviation indicated on the micrometer dial (dimension "b").



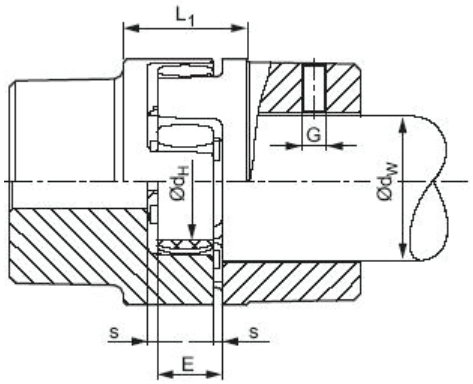
5.2 Mounting of couplings

Quincunx coupling



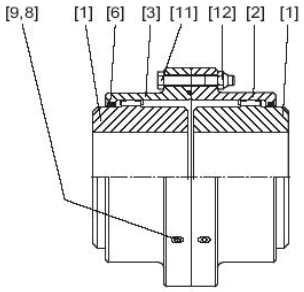
[1] Coupling hub [2] Ring gear

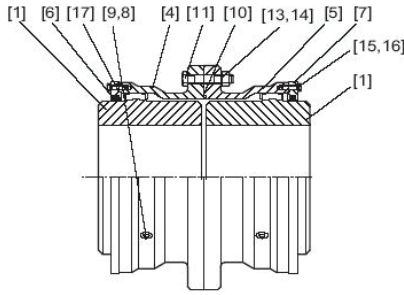
The low-maintenance, Quincunx coupling is capable of compensating radial and angular misalignment. Careful and exact alignment of the shaft ensures long service life of the coupling.



The shaft distance must be strictly observed (dimension E) to ensure axial play of the coupling.

Dentate couplings





[1] Coupling hub
[2] Sleeve
[3] Sleeve
[4] Sleeve (male)
[5] Sleeve (female)
[6] Seal or O-ring
[7] Cover
[8] Grease nipple
[9] Grease nipple
[10] Gasket
[11] Bolt
[12] Self-locking nut
[13] Washer
[14] Nut
[15] Bolts
[16] Washer
[17] O-ring

. Before mounting the coupling, thoroughly clean the individual parts of the coupling, in particular the toothing.

. Grease the O-rings [6] slightly and place them into the corresponding grooves in the sleeve [2, 3].

. Grease the toothing of the sleeves [2,3] and push the sleeves onto the shaft ends without damaging the O-rings [6].

. Slide the coupling hubs [1] onto the shaft. Move hubs to be flush with the shaft end.

. Align the machine to be coupled and check the shaft distance.

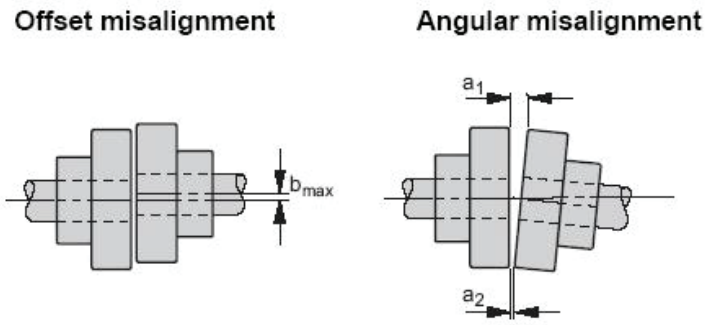
. Align both axes and check the permitted values using a dial indicator. The mounting tolerances depend on the coupling torque.

. Before you screw on the sleeves [2, 3], have the coupling hugs [1] cool off and grease the toothing.

. Insert the gasket [10] and tighten the sleeve halves to the specified tightening torque. Grease the gasket slightly to facilitate mounting.

. It is important that the grease nipples [9] on the two sleeve halves [4, 5] are positioned at an angle of 90° towards each other after having tightened the sleeves.

Mounting tolerances



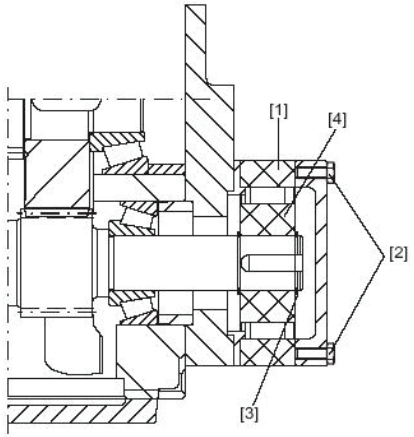
5.3 Backstop

The purpose of a backstop is to prevent undesirable reverse rotation. During operation, the backstop permits rotation in one specified direction of rotation only.

. Do not start up the motor in blocking direction. Ensure correct connection of power supply with motor to achieve the desired direction of rotation! Running the motor in blocking direction might destroy the backstop! . Contact FLK if you want to alter the blocking direction!

Changing the direction of rotation

To change the direction of rotation, turn the inner ring with the sprags by 180°. Pull out the inner ring with the sprags using a pulling-off device (not included in the scope of delivery) and replace turned by 180°.



[1] Outer ring [2] Retaining screws

[3] Circlip [4] Inner ring with cage and sprags

. Loosen the retaining screws [2] of the backstop.

. Remove the outer ring [1]. To facilitate dismounting, slightly turn the outer ring [2] in freewheeling direction.

. Remove circlip [3], and inner ring with cage and sprags [4].

. Turn the inner ring [4] with the sprags by 180° and replace the parts in reverse order. When mounting the backstop, do not apply pressure to the cage with the sprags but to the inner ring [4] only. Use the threaded holes on the inner ring [4] for mounting.

. Lock the inner ring [4] with the circlip [3] in axial direction. Mount the outer ring [1] using the retaining screws [2]. Observe the tightening torques specified in the table below:

Screw size	Tightening torque [Nm]
M5	6
M6	10
M8	25
M10	48
M12	84
M16	206
M20	402
M24	696
M30	1420

. Alter the direction arrow on the gear unit housing .

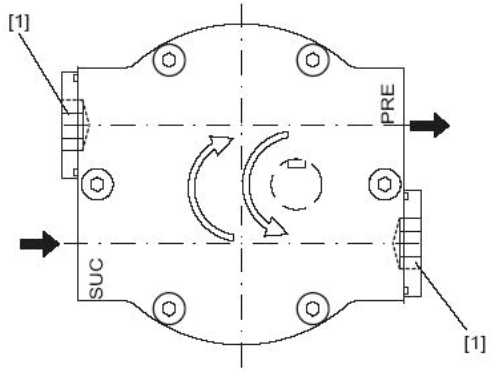
. After mounting, check that the backstop runs smoothly.

5.4 Shaft end pump

Shaft end pump can be used to lubricate gear unit that are not submerged in the oil bath. The shaft end pump can be operated in both directions of rotation.

Pump suction

The intake and delivery pipe or tube is connected disregarding the direction of rotation of the output shaft and must not be altered. If the shaft end pump does not build up pressure within 10 seconds after the gear unit has been started (→ Flow monitoring via oil sight glass on the gear unit), do the following:



[1] Plug connector

[SUC] Suction line

[PRE] Pressure line

. Loosen the plug-in connection [1] next to the intake pipe / intake tube on the valve housing. Fill the suction line [SUC] and the pump with oil.

. Turn the pump so that the gear pump is lubricated with oil.

. Make sure that the pump can create a vacuum in the suction line [SUC] so the oil flow can start.

. It is essential that the gear unit is sufficiently lubricated from the very beginning!

. Do not change the diameter of the tube / pipe

connection!

. Do not open the pressure line [PRE]!

5.5 Oil heater

Activation / deactivation behaviour

Oil heating is required to ensure lubrication at startup when the ambient temperature is low (e.g. cold start of the gear unit).

The oil heater

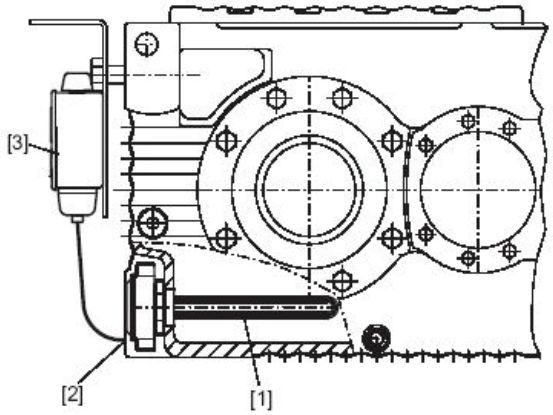
. is activated when the temperature set at the factory is reached

. is deactivated when the set temperature is exceeded by 8°C to 10°C

It is essential that you check the following points before activating the oil heater:

. Check for correct electrical connection according to the ambient conditions

. Check for correct oil grade and oil volume of the gear unit (→ Nameplate) There is a potential danger of explosion if the oil heater is not connected correctly or is operated above the oil surface!



[1] Oil heater

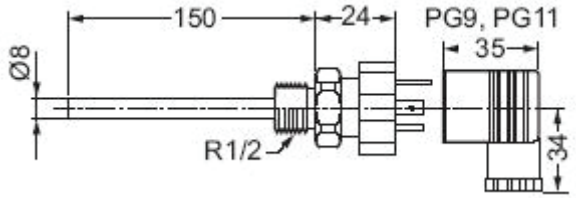
[2] Temperature sensor

[3] Thermostat

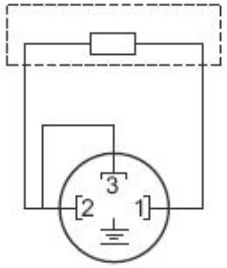
5.6 Temperature sensor PT100

The temperature sensor PT100 can be used to measure the temperature of the oil in the gear unit.

Dimensions

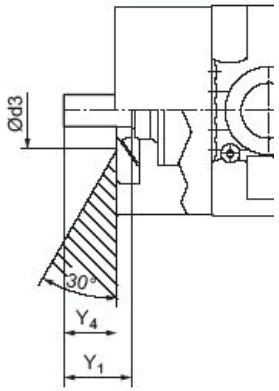


Electrical connection



5.7 Fan

A fan can be mounted if the projected thermal power of the gear unit is exceeded. A fan can be retrofitted if the ambient conditions change after having installed the gear unit. The direction of rotation of the gear unit does not influence the operation of the fan.



Make sure that air intake vents are not blocked or covered!

5.8 Connecting the oil/water cooling system

Follow the instructions in the separate manufacturer's documentation when connecting the oil/air cooling system.

5.9 Connecting the motor pump

Follow the instructions in the separate manufacturer's documentation when connecting the motor pump.

6 Startup

6.1 Startup of gear units

. It is essential to adhere to the safety notes in Sec. "Safety Notes."

. It is absolutely necessary to avoid open flames or sparking when working with the gear unit!

. Take preventive measures to protect people from the solvent vapors generated by the vapor phase inhibitor!

. Before startup, check for correct oil level! For lubricant fill quantities, refer to Sec. "nameplate."

. For gear units with long-term protection: Replace the screw plug on the location indicated by the breather plug .

Before startup

. For gear units with long-term protection: Remove the gear unit from the seaworthy protection box.

. Remove the corrosion protection agent from the gear unit parts. Make sure gaskets, sealing surfaces and sealing lips are not damaged by mechanical abrasion, etc.

. Before filling the gear unit with the correct oil grade and volume, drain the remaining amount of protection oil. To do so, unscrew the oil drain

plug and drain the remaining protection oil. Thread the oil drain plug back in place.

. Remove the oil filling plug. Use a funnel to fill the oil. Fill the gear unit with the correct oil grade and volume (→ Sec. "Nameplate"). The oil volume specified on the nameplate of the gear unit is a reference value. The mark on the dipstick is the decisive indicator of the correct oil level. Check for correct oil level (= below the "max" mark on the dipstick) using the oil dipstick. After having filled the oil, replace the oil filling plug.

. Make sure that rotating shafts as well as couplings are equipped with suitable protective covers.

. If the gear unit has a motor pump, check for proper functioning of the pressure lubricating system. Make sure that monitoring devices are connected properly.

. After an extended period of storage (max. two years), have the gear unit operate without load with the correct oil fill (→ Sec. "Nameplate"). This way, the correct functioning of the lubricating system and particularly the oil pump is ensured.

. If the gear unit is equipped with a fan on the input shaft, check for free air intake within the specified angle.

Running-in period

FLK recommends running-in the gear unit as first startup phase. Increase load and revolutions in two to three steps up to maximum level. The runningin phase takes about 10 hours.

Check the following points during the running-in phase:

. Verify the power values specified on the nameplate because their frequency may be a decisive factor for the service life of the gear unit.

. Does the gear unit run smoothly?

. Are there vibrations or unusual running noise?

. Are there signs of oil leakages on the gear unit?

For further information and troubleshooting, refer to Sec. "Malfunctions."

6.2 Startup gear units with backstop

For gear units with backstop, make sure the direction of rotation of the motor is correct!

6.3 Taking gear units out of operation

Disconnect the drive from voltage supply and secure it to prevent unintentional restart!

If the gear unit is not operated for a longer period of time, you must activate it at regular intervals every two to three (2 to 3) weeks.

If the gear unit is not operated for a period longer than six (6) months, additional corrosion protection is required:

. Corrosion protection for the inside of gear units with splash lubrication or bath lubrication:

Fill the gear unit up to the breather plug with the oil grade specified on the nameplate.

. Corrosion protection for the inside of gear units with oil pressure lubrication:

Contact FLK in this case!

. Surface corrosion protection:

Apply a wax-based protective coating onto shaft ends and unpainted surfaces as corrosion protection. Grease the sealing lips of the oil seal to protect them from preservative agents.

For taking the gear unit back into operation, refer to Sec. "Startup."

7 Inspection and Maintenance

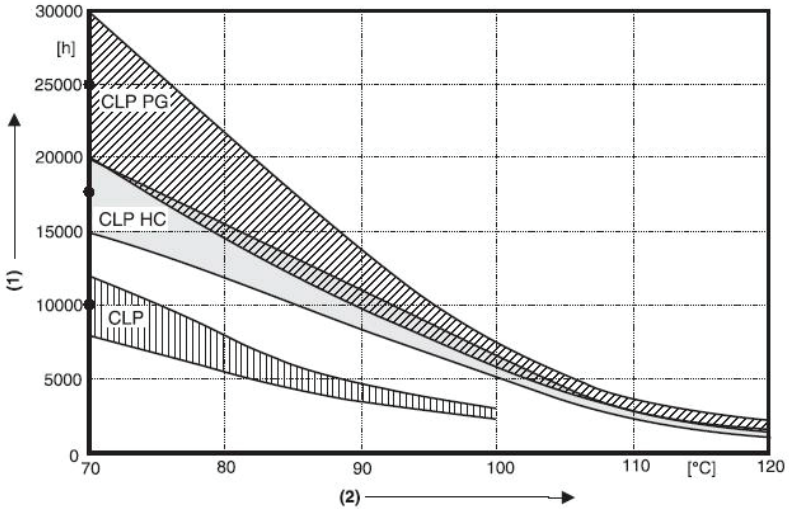
7.1 Inspection and maintenance intervals

Interval	What to do?
• Daily	• Check the housing temperature: – with mineral oil: max 90 °C – with synthetic oil: max. 100 °C • Check gear unit noise • Check the gear unit for signs of leakage
• After 500 - 800 hours of operation	• First oil change after initial startup
• After 500 hours of operation	• Check the oil level, refill oil (→ Nameplate) if necessary
• Every 3000 hours of operation, at least every 6 months	• Check the oil: If the gear unit is operated outdoors or in humid conditions, check the water content of the oil. The water content must not exceed 0.05 % (500 ppm). • Fill labyrinth seals with grease. Use about 30 g grease per grease nipple. • Clean the breather plug
• Depending on the operating conditions, at the latest every 12 months	• Change the mineral oil (→ Sec. "Inspection and maintenance of the gear unit") • Check whether retaining screws are tightly secured • Check contamination and condition of the oil/air cooling system • Check the condition of the oil/water cooling system • Clean oil filter, replace filter element if necessary
• Depending on the operating conditions, at the latest every 3 years	• Change synthetic oil (→ Sec. "Inspection and maintenance of the gear unit")
• Varying (depending on external factors)	• Repair or renew the surface/anticorrosion coating • Clean the gearcase surface and fan • Check the oil heater: • Are all connection cables and terminals tightened securely and free from corrosion? • Clean incrusted elements (such as the heating element) and replace, if required (→ Sec. "Inspection and maintenance of the gear unit")

7.2 Lubricant change intervals

Change the oil more frequently when operating the industrial gear unit under more severe/aggressive environmental conditions!

Mineral CLP lubricants and synthetic polyalphaolefin-based (PAO) lubricants are used for lubrication. The synthetic lubricant CLP HC shown in the following figure corresponds to the PAO oils.



Lubricant change intervals for gear units under normal ambient conditions

(1) Hours of operation

(2) Sustained oil bath temperature

. Average value per oil type at 70°C

7.3 Inspection and maintenance of the gear unit

. Do not mix different synthetic lubricants and do not mix synthetic with mineral lubricants!

. For positions of the oil level plug, the drain plug, the breather plug and the oil sight glass.

Checking the oil level

1. Disconnect the motor from voltage supply and secure it to prevent unintentional restart!

Wait until the gear unit has cooled off – Danger of burns!

2. For gear units with oil dipstick:

. Unscrew the oil dipstick and remove it. Clean the dipstick and re-insert it into the gear unit (do not screw in tightly!).

. Remove dipstick again and check oil level. Correct if necessary: the oil level is correct when it is between the oil level mark (= maximum oil level) and the end of the dipstick (= minimum oil level)

3. For gear units with oil sight glass (option): Visually check correct oil level (= middle of oil sight glass)

Checking the oil

1. Disconnect the motor from voltage supply and secure it to prevent unintentional restart!

Wait until the gear unit has cooled off – Danger of burns!

2. Remove some oil from the oil drain plug

3. Check the oil consistency

- Viscosity
- If you can see that the oil is heavily contaminated, we recommend to change the oil disregarding the service intervals specified in Sec. "Service and maintenance intervals."

Changing the oil

When changing the oil, clean the gearcase thoroughly to remove oil residues and abrasion. Use the same oil grade as for the operation of the gear unit.

1. Disconnect the motor from voltage supply and secure it to prevent unintentional restart! Wait until the gear unit has cooled off – Danger of burns! If your gear unit is equipped with an oil expansion tank, let the gear unit cool off until it reaches ambient temperature. The reason is that there might still be oil in the oil expansion tank which might leak through the oil filling hole!

Note: The gear unit must still be warm because the high viscosity of cold oil will make it more difficult to drain the oil correctly.

2. Place a container under the oil drain plug.

3. Remove oil filling plug, breather plug and oil drain plugs. When using a steel oil expansion tank, also remove the air outlet screw on the air expansion tank. To drain the oil completely, blow air through the breather into the oil expansion tank. As a result, the rubber membrane lowers and forces the remaining oil out. The lowering membrane compensates the pressure, which facilitates filling the new oil.

4. Drain the oil completely.

5. Reinstall the oil drain plugs.

6. Use a funnel to fill the oil. Fill new oil of the same type as the old oil via the oil filling plug (if you want to change the oil type, contact our customer service first).

- Fill the oil according to the volume specified on the nameplate (→ Sec. "Nameplate").

The oil volume specified on the nameplate is an approximate value. The

marks on the oil dipstick are decisive for the oil level.

- Check whether the oil level is correct using the oil dipstick.

7. Reinstall the oil filling plug. If your gear unit is equipped with a steel oil expansion tank, also screw in the air outlet screw.

8. Mount the breather plug.

9. Clean the oil filter, replace the filter element if necessary (when using an external oil/water cooling system).

If you remove the housing cover, you must apply new sealing compound to the sealing surface. Else, the tightness of the gear unit is not guaranteed! Contact DONLY in this case!

Cleaning the oil heater

Incrustation on the oil heater caused by oil must be removed. Remove the oil heater for this purpose.

The oil heater must be deactivated before draining the oil. The reason is that the hot oil heater might ignite the evaporating oil.

Removing the oil heater

. Remove the oil heater [1] and the gasket on the gear unit.

. Remove the base of the terminal box.

. Clean the tubular heating elements with solvent.

Be careful not to damage the heating elements through scratching or scraping!

Mounting the oil heater

. Reinstall the oil heater [1] and the gasket on the gear unit. The tubular heating elements must always be immersed in liquid.

. Mount the base of the terminal box onto the heating rod using a mounting ring.

. Make sure that the gasket is placed correctly between terminal box and upper end of the heating element.

. Insert the temperature sensor [2] into the oil sump of the gear unit. Set the required temperature on the thermostat [3].

Refilling grease

You can use grease consistency to grease the regreasable dust protection covers or labyrinth seals attached to input and output shafts as option .

For the locations of regreasing points, refer to the order-specific dimension sheet. Use about 30 g grease per grease nipple disregarding the position of regreasing points and gear unit size.

8 Malfunctions

8.1 Gear unit malfunctions

Problem	Possible cause	Solution
Unusual, regular running noise	A Meshing/grinding noise: bearing damage B Knocking noise: irregularity in the gearing	A Check the oil (see →Sec. "Inspection and Maintenance), replace bearings B Contact customer service
Unusual, irregular running noise	Foreign particles in the oil	• Check the oil (see Sec. "Inspection and Maintenance") • Stop the drive, contact customer service
Unusual noise in the area of the gear unit mounting	Gear unit mounting has loosened	• Tighten the retaining screws and nuts to the specified torque • Replace the damaged / defective retaining screws or nuts
Operating temperature too high	A Too much oil B Oil too old C Oil contaminated D Gear units with fan: air intake opening / gearcase contaminated E Shaft end pump defective F Malfunctions of oil/air or oil/water cooling system	A Check the oil level, correct if necessary (see Sec. "Inspection and Maintenance") B Check when the oil was changed last time; change oil if necessary (see Sec. "Inspection and Maintenance") C Change the oil (see Sec. "Inspection and Maintenance") D Check the air intake opening and clean if necessary, clean gear unit housing E Check the shaft end pump; replace if necessary F Observe the separate operating instructions of the oil/water and oil/air cooling system!
Bearing point temperatures too high	A Oil not enough B Oil too old C Shaft end pump defective D Bearing damaged	A Check the oil level, correct if necessary (see Sec. "Inspection and Maintenance") B Check when the oil was changed last time; change oil if necessary (see Sec. "Inspection and Maintenance") C Check the shaft end pump; replace if necessary D Check bearing and replace if necessary, contact customer service
Oil leaking[1] • from cover plate • from gearcase cover • from bearing cover • from mounting flange • from output/input end oil seal	A Gasket on cover plate (MC2P.) / gearcase cover / bearing cover / mounting flange leaking B Sealing lip of oil seal upside down C Oil seal damaged / worn	A Tighten the bolts on the respective cover plate and observe the gear unit. Oil still leaking: contact customer service B Vent the gear unit (see →Sec. "Mounting Positions") Observe the gear unit. Oil still leaking: contact customer service C Contact customer service
Oil leaking • from oil drain plug • from breather plug	A Too much oil B Drive operated in incorrect mounting position C Frequent cold starts (oil foams) and/or high oil level	A Correct the oil level (see Sec. "Inspection and Maintenance) B Mount the breather plug correctly (see Sec. "Mounting Positions") and correct the oil level (see Sec. "Lubricants")
Malfunctions of the oil/air or oil/water cooling system		Observe separate operating instructions of the oil/water and oil/air cooling system!
Operating temperature at backstop too high	Damaged / defective backstop	• Check the backstop; replace if necessary • Contact customer service

1 It is normal for small amounts of oil/grease to emerge from the oil seal during the running-in phase (24 hour running time).

Customer service

Please have the following information available when contacting our customer service:
- Complete nameplate data
- Nature and extent of the fault
- Time of occurrence and accompanying circumstances of the fault
- Presumed cause

Remark: