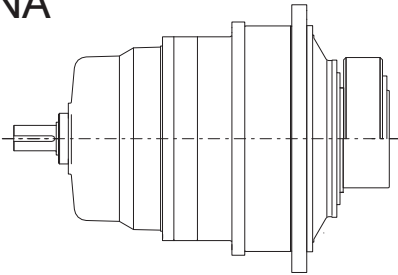


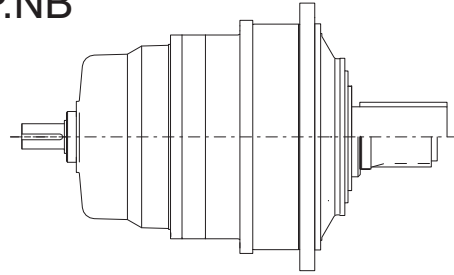
Operating Instructions

Planetary Gear Units Types
P.NA, P.SA, P.KA, P.LA
P.NB, P.SB, P.KB, P.LB
Sizes 9 to 36

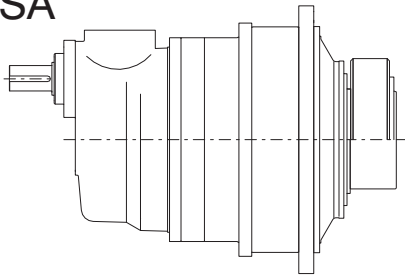
P.NA



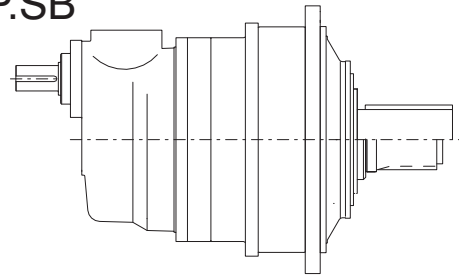
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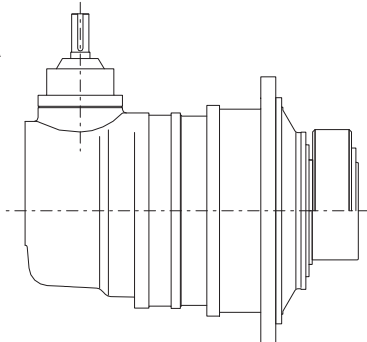
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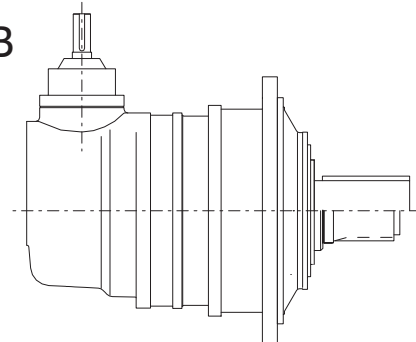
P.SB



P..A



P..B



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1. Technical data

1.1 General technical data

The most important technical data are shown on the rating plate. For further data please refer to the drawings, these Operating Instructions and a Technical Data Sheet, if any.

○ ① ○		
②		
③		
④	⑤	
⑥	⑦	
⑧	⑨	⑩
i ⑪		
○ ⑫ ○		

- | | |
|---|---|
| ① Company logo and place of manufacture
② Special information
③ Order no. - item - seq. no.
④ Type / Size *)
⑤ Power rating P in kW or T ₂ in Nm
⑥ Speed n ₁ | ⑦ Speed n ₂
⑧ Type of oil
⑨ Viscosity of oil in VG class
⑩ Quantity of oil in litres for main gear housing
⑪ Operating instructions number(s)
⑫ Special information |
|---|---|

Example *)

P	2	N	A	13	
					Size 9 ... 36
					Type of output shaft A = Hollow shaft for shrink disk or with with toothed hub profile acc. to DIN 5480 B = Solid shaft with parallel keyway or with toothed shaft profile acc. to DIN 5480
					Gear-unit identification N = Coaxial type of construction S = Helical gear stage K = Bevel-helical gear stage L = Bevel gear stage
					Number of planetary stages . 1, 2 or 3
					Gear-unit type P = Planetary gear unit

Data on weights and measuring-surface sound-pressure 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

Type	Approx. weight (kg) for sizes (including shrink disc)													
	9	10	11	12	13	14	16	17	18	19	20	21	22	23
P..A, P..B	180	250	350	530	650	1000	1270	1750	2100	2600	2800	3150	3350	4150

Type	Approx. weight (kg) for sizes (including shrink disc)													
	24	25	26	27	28	29	30	31	32	33	34	35	36	
P..A, P..B	4500	5450	5900	7500	8000	9250	9800	11300	12200	14000	14800	18500	19500	

Table 1.1: Weights (approx. values for 3-stage gear unit)

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

1.1.2 Measuring-surface sound-pressure level

The measuring-surface sound-pressure level for the gear unit at a distance of 1 metre can be found in the table 1.2.

The measurement is carried out to DIN 45 635 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 sound-pressure 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-pressure levels.

Type	i _N	Gear-unit size																																			
		9	10	11	12	13	14	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36									
P2N.	25 ... 40	83	83	84	84	84	85	85	85	86	86	86	87	87	87	87	87	87	87	87	87	88	88	88	88	88	88	88	88								
P3N.	140 ... 280	80	80	80	80	81	81	81	81	82	82	82	83	83	83	83	84	84	84	84	84	84	85	85	85	85	85	85	85								
P2S.	45 ... 56	83	84	85	87	88	90	92	93	94	95	95	97	97	98	98	99	99	100	100	101	101	102	102	103	103	104	104									
	63 ... 80	81	82	83	85	86	88	90	91	92	93	93	95	95	96	96	97	97	98	98	99	99	100	100	101	101	102	102									
	90 ... 125	79	81	82	84	85	86	89	89	90	91	91	93	93	94	94	95	95	96	96	97	97	98	98	99	99	100	100									
P3S.	280 ... 355	74	75	76	78	79	81	82	83	84	85	86	87	87	88	88	89	89	90	90	91	91	92	92	93	93	94	94									
	400 ... 560	72	73	74	76	78	79	80	81	82	83	84	85	85	86	86	87	87	88	88	89	89	90	90	91	91	92	92									
	630 ... 900	70	71	72	74	76	77	78	79	80	81	82	83	83	84	84	85	85	86	86	87	87	88	88	89	89	90	90									
P2K.	112 ... 160	79	81	83	85	87	89	91	92	94	95	96	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—									
	180 ... 250	76	78	80	82	84	86	88	89	91	92	93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—									
	280 ... 560	73	75	77	79	81	83	85	86	88	89	90	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—									
P3K.	560 ... 900	70	70	72	74	76	78	80	81	82	84	85	86	87	88	88	90	90	91	91	92	92	—	—	—	—	—	—									
	1000 ... 1600	68	68	69	71	73	75	76	77	78	80	81	82	83	84	84	86	86	87	87	88	88	—	—	—	—	—	—									
	1800 ... 4000	65	65	66	68	70	72	73	74	75	77	78	79	80	81	81	82	82	83	84	85	85	—	—	—	—	—	—									

Table 1.2: Measuring-surface sound-pressure level L_{pA} in dB(A)

Note: The measuring-surface sound-pressure levels shown apply with a tolerance of + 3 dB(A) for $n_1 = 1\,500\,1/\text{min}$.
In the case of gear units with flanged foot, the values will be approx. 2 dB(A) higher.
At $n_1 = 750\,1/\text{min}$, the values will be appr. 2 to 3 dB(A) lower.

2. General notes

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 (BA) and must comply with them. We accept no responsibility for damage or disruption caused by disregard of these Instructions.

The **"TORK planetary gear unit"** described in these Instructions has been developed for stationary use in general engineering applications. Possible areas of use for gear units of this type are (e.g.) sewage treatment, excavators, chemical industry, iron and steel industry, conveyor systems, crane systems, foodstuffs industry, paper machinery, cableways, cement industry, etc.

The gear unit is designed only for the application described in section 1, "Technical data".

The gear unit described in these Operating 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 (BA) is held by **TORK** .

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

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. Any changes on the part of the user which may affect safety and reliability are prohibited. This applies equally to safety features designed to prevent accidental contact.
- The gear unit should be used and operated only within the context of the conditions laid down in the contract governing performance and supply.

3.2 Obligations of the user

- The operator must ensure that all persons involved in installation, operation, maintenance and repair have read and understood these Operating Instructions (BA) and comply with them at all times in order to:

- avoid injury or damage,
- ensure the safety and reliability of the unit,

and

- avoid disruptions and environmental damage through incorrect use.
- During transport, assembly, installation, dismantling, operation and maintenance of the unit, the relevant safety and environmental regulations must be complied with at all times.
- The gear unit should be operated, maintained or repaired by authorised, trained and qualified personnel.
- The gear unit must not be cleaned using high-pressure cleaning equipment.
- All work 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 must 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 are noticed during operation (e.g. overheating or unusual noises), the drive assembly must be switched off immediately.
- Rotating drive components such as couplings, gearwheels, belt drives etc. must be protected 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 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.
- Screws which have been damaged during assembly or disassembly work must be replaced with new ones of the same strength class and type.

3.3 Environmental protection

- When changing oil, the used oil must be collected in suitable containers. Any spillage of oil must be removed immediately.
- Preservative agent should be stored separately from used oil.
- Used oil, preservative agent, 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.
- Small foreign matter such as sand, dust, etc. can get into the cover plates of the rotating parts and be thrown back by these. Eye protection must therefore be worn while the gear unit is operating.

3.5 Warnings and symbols used in these Operating Instructions



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. Handling and storage

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 to TORK.

Caution!

If damage has occurred, the gear unit must not be put into operation.

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

If the unit is fitted with a shrink disk, this will be shipped as a loose component.

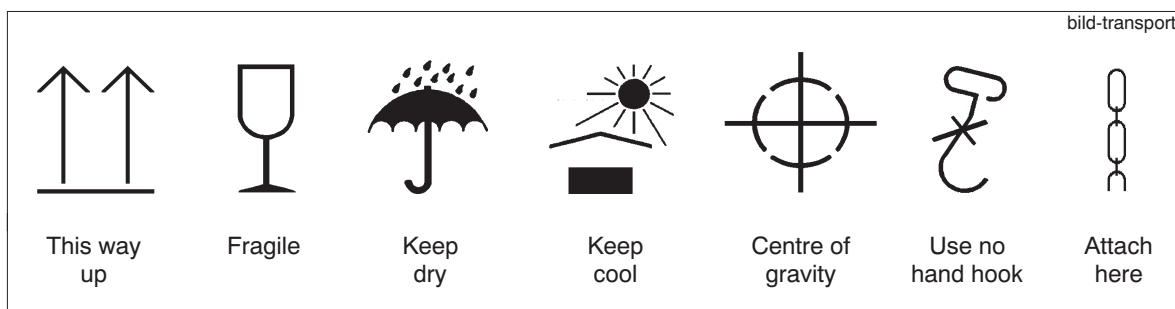
4.2 Handling



**When handling TORK products, use only lifting and handling equipment of sufficient load-bearing capacity!
Wedges or rails must be used to prevent rolling.**

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:

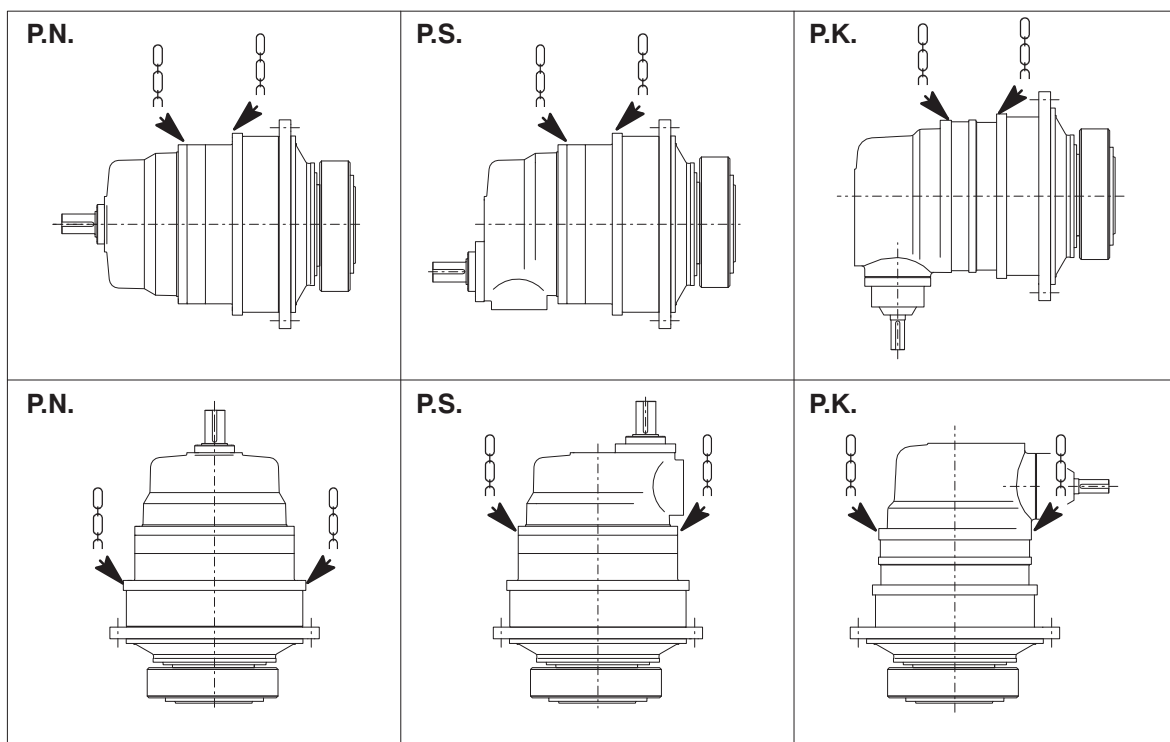
The gear units must be transported with suitable equipment only.
Never transport the gear unit with an oil filling.

Caution!

**The gear unit may be transported and handled only with the existing brackets, eye bolts or lifting eyes.
Do not use the front threads at the shaft ends to attach eye bolts for transport.**

Caution!

If fitted with a shrink disk, the shrink disk must be secured axially before handling.



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

4.3 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: Unless otherwise agreed by contract, the gear units must not be exposed to harmful environmental factors such as chemically aggressive products.

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

4.4 Standard corrosion protection

The gear unit is provided with an interior 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 (short term 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.

Unless otherwise contractually agreed, the interior preservation and the preservation of the free shaft ends are guaranteed for 24 months, provided that storage is in dry, frostfree sheds and that the gear unit is duly sealed. The period of validity of the guarantee starts on the date of delivery of the gear unit.

For longer periods of storage (> 24 months) we advise regular checking and, if necessary, renewal of the interior preservation (see section 7, "Start-up"). The output shaft must be rotated at least one turn to change the position of the rolling element in the bearings. The input shaft must not come to a standstill in the same position as before rotation. This procedure must be repeated and documented every 24 months until start-up.

5. Technical description

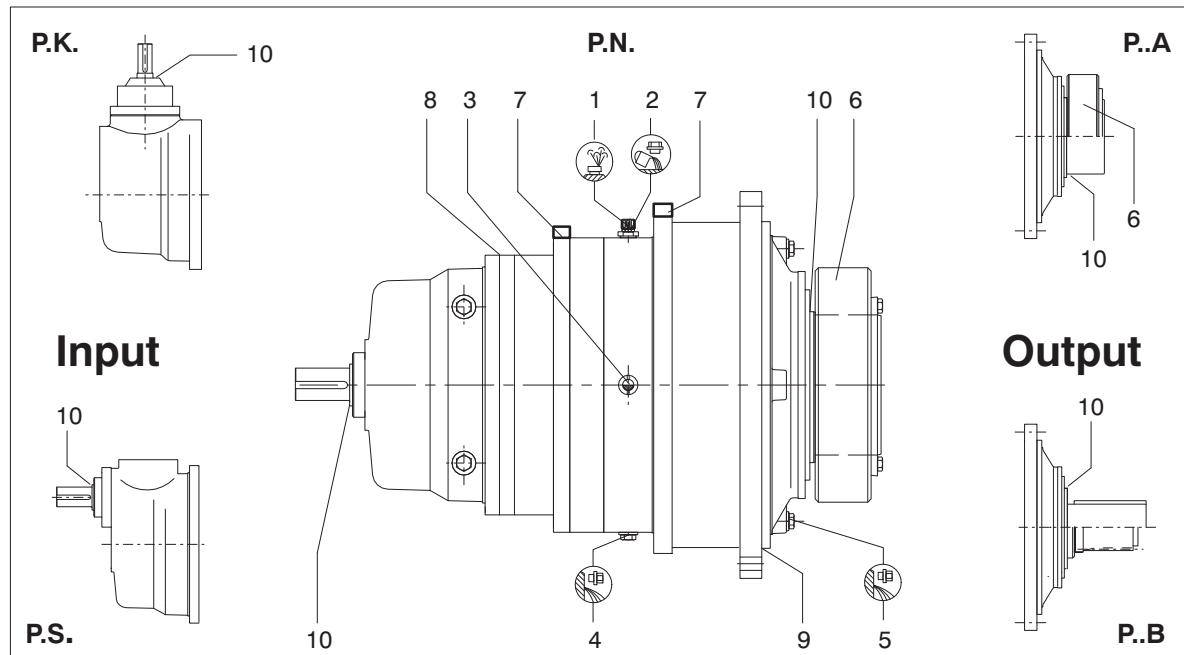
Observe the "Safety instructions" in section 3!

5.1 General description

The gear unit is supplied as a single-, two- or three-stage planetary gear unit. It is designed for a horizontal and vertical mounting position. If necessary, it can also be designed for installation in a different position.

It can be operated in both directions of rotation.

Depending on type and size, the gear units of the standard range can be fitted with mounting flange, oil cooler, angular oil level indicator, temperature sensor, backstop etc.

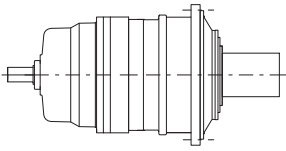
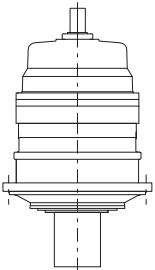
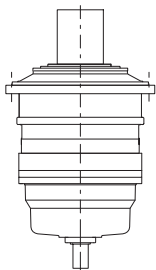
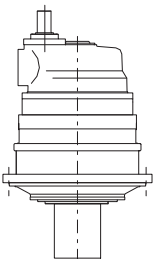
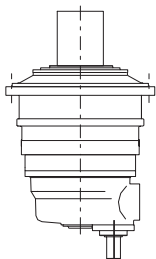
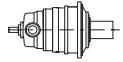
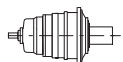
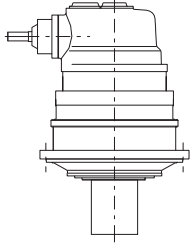
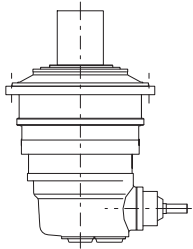
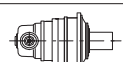
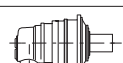
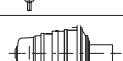
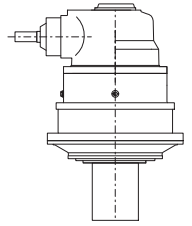
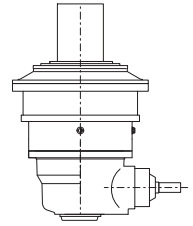
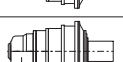
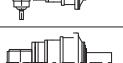
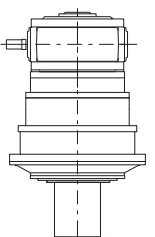
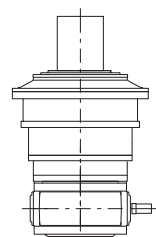
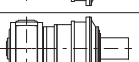


- | | |
|-------------------------------|------------------------------------|
| 1 Housing ventilation | 6 Shrink disk |
| 2 Oil inlet | 7 Lifting eyes |
| 3 Oil sight glass / oil level | 8 Rating plate |
| 4 Oil drain | 9 Mounting position for torque arm |
| 5 Residual-oil drain | 10 Shaft seal |

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

5.2 Identification of gear unit mounting position

It is possible to mount the gear unit in different positions; these positions are shown diagrammatically below and have been given an identification number:

		Horizontal gear unit mounting position	Vertical gear unit mounting position 1)	
		5..	9..	6..
Coaxial planetary gear units P.N. and P.M.	0			
		500	900	600
Planetary helical gear units P.S. and P.G.	1			
				
				
				
		511 512 513 514		
Planetary bevel-helical gear units P.K. and P.G.	2			
				
				
				
		521 522 523 524		
Planetary bevel gear units P.L..	3			
				
				
				
		531 532 533 534		
Planetary worm gear units P.C.	4			
				
				
				
		541 542 543 544		
Torque arm	5			
		551	552	553
				554

1) Identification Number when looking at shaft d_1 .
The lubricant supply must be checked. An enquiry is necessary.

5.3 Housing

The gear unit housing is made of cast iron; the housing flange is made of nodular cast iron. If necessary, the housing may also be made of grey cast iron or steel.

Colour codes for ventilating, oil inlet, oil level and oil drainage:

Ventilating:	yellow	
Oil inlet:	yellow	
Oil level:	red	
Lubrication points:	red	
Oil drain:	white	

5.4 Toothed components

Externally toothed spur gears are made of case-hardening steel 18CrNiMo7. The tooth flanks are case-hardened and ground.

Depending on size, the internal gear teeth are made of heat-treatable steel or bainitic nodular cast iron. The teeth are shaped, milled or ground (depending on size).

5.5 Lubrication

The teeth and rolling bearings of the gear units are adequately supplied with oil by splash lubrication. For special mounting positions and/or gear units requiring additional cooling it may be necessary to provide pressure-feed or oil circuit lubrication.

Note: For safety reasons, the gear unit is supplied without oil filling for transport.

Depending on the mounting position, it is possible that the bearings are not lubricated by the gear unit oil. In such cases, these bearings are lubricated with lithium-base grease.

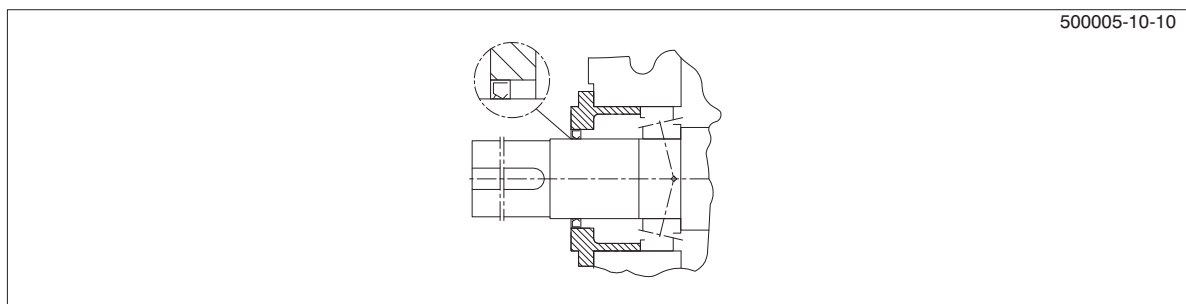
Note: Do not mix greases of different soap bases when relubricating.

5.6 Shaft bearings

All shafts are mounted in rolling bearings.

5.7 Shaft seals, static seals

As a rule radial shaft sealing rings are used as standard seals. They are fitted preferably with an additional dust lip to protect the actual sealing lip from external contamination.



Alternatively, and depending on the order, it is also possible to provide the gear units with regreasable labyrinth seals to prevent the ingress of dust (Taconite seal).

The individual housing components are sealed statically with Loctite 640 to prevent leakages.

5.8 Cooling

If required, planetary gear units are fitted either with water oil- coolers or air oil-coolers.

5.8.1 Water oil-cooler

The water oil-cooler is an essential part of the oil cooling system and dissipates a certain heat quantity of the warm gear unit oil.

The required water connection must be provided by the user.

Caution!

To ensure optimum cooling performance, the specified direction of flow in the water oil-cooler must be observed. The cooling-water inlet and outlet must not be reversed.

The pressure of the cooling water must not exceed 8 bars.

If the gear unit is being withdrawn from service for a longer period and if there is a danger of freezing, the cooling water must be drained off. Remove any remaining water with compressed air.

Note:

For operation and maintenance, always observe the operating instructions indicated in the order-specific appendix.

For technical data, refer to the order-specific list of equipment.

Alternatively, it is possible to use air oil-coolers.

5.9 Couplings

As a rule, flexible couplings must be provided for the input and output drive sides of the gear unit.

If rigid couplings or other input or output elements which generate additional radial and/or axial forces (e.g. gear wheels, belt pulleys, disk flywheels, hydraulic couplings) are to be used, this 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.

Note:

When installing the drives, the individual components must be very precisely aligned with one another in order to minimise restoring forces caused by angle and shaft offset and avoid premature wear to flexible coupling components.

In the case of gear units with hollow output shafts or flange output shafts, the coupling on the output side is not required. Gear units with hollow output shafts must be mounted on the shafts of the customer's machinery. Gear units with flanged output shafts must be mounted on the customer's shaft via a counterflange.

5.10 Shrink disk

In the case of a shaft mounting gear unit, a shrink disk should be used as a frictional clamping connection between the gear unit hollow shaft and machine.

5.11 Attachment of IEC Motors

When attaching IEC motors, the Operating Instructions for the motor are to be observed.

Caution!

Do not use a motor with a motor speed exceeding the specified speeds of the gear unit shown on the rating plate, as otherwise the gear unit may be damaged.

5.12 Attachment of torque arms or flanges on the output side

Before fitting, the screw-on faces of these parts must be degreased and smeared with Loctite 640. This Loctite medium increases the friction coefficient of the torque-carrying faces and protects against corrosion at the same time.

6. Fitting

Observe the "Safety instructions" in section 3!

6.1 General information on fitting

Fitting 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.

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

Caution!

Exposure to direct sunlight may cause overheating. Protective features such as covers, roofing, etc. must be provided as required! The operator should ensure that no foreign bodies affect the proper function of the gear unit (e.g. falling objects or heaping over).

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

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

6.2 Foundation

The foundation must be horizontal and level.

It must be designed in such a way that no resonance vibrations are set up 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.

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.

6.3 Description of installation work

- Remove corrosion protection coat from the solid shaft, the hollow shaft and the machined add-on surfaces with a suitable cleaning medium.



Adequate ventilation must be ensured, when using cleaners containing solvent additives.

No open flames! Danger of explosion!

Observe current regulations.

Caution!

The cleaner must not be allowed to come in contact with the shaft sealing rings.

- Mount and 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 parts are mounted on the gear unit, appropriate additional attachment points must be provided in accordance with the order-specific dimensioned drawing.

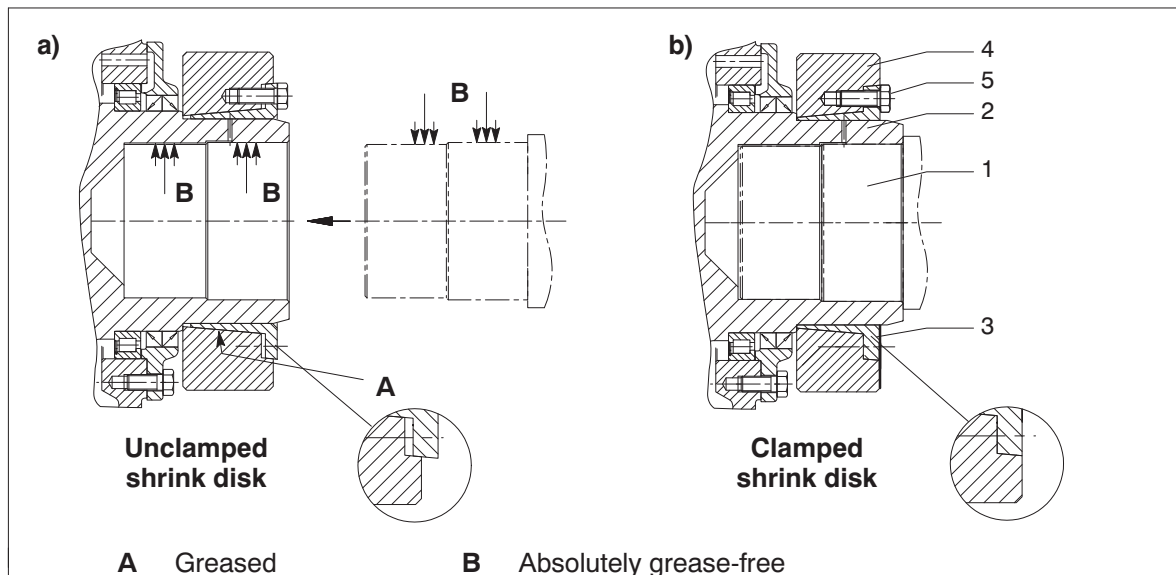
6.4 Shrink disk, type HSD

6.4.1 Fitting the shrink disk

The shrink disk is delivered ready for installation.

Caution! It must not be dismantled before clamping for the first time.

Caution! The bore of the hollow shaft and the machine shaft must be absolutely free of grease in the area of the shrink disk seat. This is essential for safe and reliable torque transmission. Do not use contaminated solvents or dirty cloths for removing grease.



1 Machine shaft
2 Hollow shaft

3 Inner ring
4 Outer ring

5 Tensioning bolt

- Mounting the shaft or fitting the hub onto the shaft.



If the gear unit is fitted in a vertical position with the output shaft down, the fitted shrink disk must be protected from dropping.

Note: The outer surface of the hollow shaft may be greased in the area of the shrink disk seat.

Caution! Do not tighten the tensioning bolts until the machine shaft is installed.

Tighten all the tensioning bolts gradually one after the other, working round several times.

Caution! Do not tighten diametrically opposite bolts one after the other.

Tighten the tensioning bolts until the front surfaces of the inner and outer rings are aligned (see fig. b).

Note: This allows the clamping condition to be checked visually.

Caution! To avoid overloading the individual bolts, the maximum tensioning torque (see table 6.1) must never be exceeded. The alignment of the front surfaces has priority. If alignment cannot be achieved by clamping, consult TORK.

Tensioning-bolt thread	Max. tensioning torque per bolt (with $\mu = 0.1$) Strength class		Tensioning-bolt thread	Max. tensioning torque per bolt (with $\mu = 0.1$) Strength class	
	10.9 Nm	12.9 Nm		10.9 Nm	12.9 Nm
M 6	12	14.5	M 20	470	570
M 8	29	35	M 24	820	980
M 10	58	70	M 27	1210	1450
M 12	100	121	M 30	1640	1970
M 14	160	193	M 33	2210	2650
M 16	240	295	M 36	2850	3420

Table 6.1: Maximum torques for tensioning bolts



For safety reasons, a protective cover should be mounted above the shrink disk.

6.4.2 Demounting and remounting the shrink disk

Disassemble the protective cover.

The releasing process is similar to that of clamping.

To enable the stored energy of the outer ring during disassembly to be lowered slowly via the bolts to be loosened, the bolts must be loosened evenly and in sequence, initially only by a quarter turn.

Caution!

Under no circumstances must the bolts be unscrewed one after the other.

If after loosening all the bolts approx. one turn the outer ring does not come free of the inner ring of its own accord, the outer ring can be detensioned with the forcing threads by screwing some of the adjacent fastening bolts into them. The now loosening outer ring is braced against the remaining bolts. This operation must be carried out until the outer ring releases of its own accord.

Releasing is possible without difficulty.

Pull the shrink disk off the hollow shaft.

Caution!

The hollow shaft of the gear unit can be provided with an additional oil hole for injecting oil for demounting the hollow shaft from the machine shaft. When using this hole, observe the maximum permissible pressures shown in the drawings of the gear-unit documentation.

6.4.2.1 Cleaning and greasing the shrink disk

Released shrink disks do not have to be dismantled and re-greased before being re-clamped.

The shrink disk should only be dismantled and cleaned if it is dirty.

Caution!

Following cleaning, only the inner sliding surfaces of the shrink disk should be re-greased.

Use a solid lubricant with a high MoS₂-based molybdenum disulphide content and with a coefficient of friction of $\mu = 0.04$ according to the following table.

Lubricant	Form	Manufacturer
Molykote 321 R (lubricating paint)	Spray	DOW Corning
Molykote Spray (powder spray)	Spray	DOW Corning
Molykote G Rapid	Spray or paste	DOW Corning
Aemasol MO 19 P	Spray or paste	A. C. Matthes
Molykombin UMFT 1	Spray	Klüber Lubrication
Unimoly P 5	Powder	Klüber Lubrication

Table 6.2: Lubricants for shrink disk after cleaning

6.5 Shrink disk type HYD (HYD = hydraulic)

6.5.1 Fitting the shrink disk

The shrink disk is delivered ready for installation.

Caution!

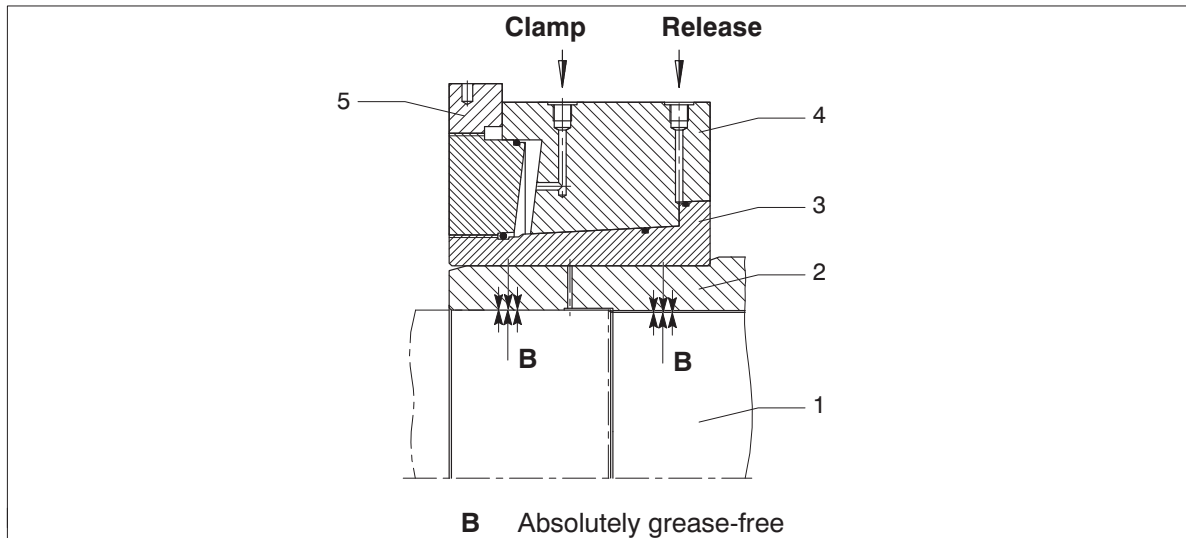
It must not be dismantled before clamping for the first time.

Caution!

The bore of the hollow shaft and the machine shaft must be absolutely free of grease in the area of the shrink disk seat.

This is essential for safe and reliable torque transmission.

Do not use contaminated solvents or dirty cloths for removing grease.



1 Machine shaft
2 Hollow shaft

3 Inner ring
4 Outer ring

5 Lock nut

- Mounting the shaft or slipping the shrink disk on the shaft



If the gear unit is fitted in a vertical position with the output shaft down, the fitted shrink disk must be protected from dropping.

Note:

The outer surface of the hollow shaft may be greased in the area of the shrink disk seat.

Caution!

Never clamp the shrink disk until the machine shaft has been mounted.

- Remove screw plugs from the "Clamp" and "Release" connections.



Catch any hydraulic fluid that may run out!

Caution!

Connect the pressure line to the connection marked "Clamp".

Caution!

Clamping of the shrink disk.

The correct clamping condition has been reached as soon as the faces of the outer and inner rings are flush.

The maximum permissible clamping pressure is 450 bar!

Note:

This allows the clamping condition to be checked visually.

Caution!

If alignment cannot be achieved by clamping, consult TORK.

- Turn lock nut finger-tight against the outer ring.
- Relieve oil pressure. This will cause the outer ring to be forced firmly against the lock nut by the previously stored energy.
- Screw screw plugs back into the "**Clamp**" and "**Release**" connections. Leave the hydraulic fluid in the shrink disk.



For safety reasons, a protective cover should be mounted above the shrink disk.

6.5.2 Disassembly of the HYD shrink disk

- Disassemble the protective cover.
- Remove screw plugs from the "**Clamp**" and "**Release**" connections.



Catch any hydraulic fluid that may run out!

- Connect the oil pressure pump to the connection marked "**Clamp**".
- Increase the oil pressure (**max. 450 bar**) until the lock nut can be loosened by hand.
- Relieve pressure and attach pump to connection marked "**Release**".
- While the oil pressure is increasing, the outer ring will slip off the cone of the inner ring. The connection is disengaged again.
- Leave hydraulic fluid in the released shrink disk and firmly reseal the "**Clamp**" and "**Release**" connections with the screw plugs.
- Remove shaft or slip hub off the shaft. Rust deposits which may have formed on the shaft must be removed before performing this operation.
- Pull the shrink disk off the hollow shaft.

6.5.2.1 Cleaning and greasing the shrink disk

Released shrink disks do not have to be dismantled and re-greased before being re-clamped.

The shrink disk should only be dismantled and cleaned if it is dirty.

Caution!

Following cleaning, only the inner sliding surfaces of the shrink disk should be re-greased.

Use a solid lubricant with a high MoS₂-based molybdenum disulphide content and with a coefficient of friction of $\mu = 0.04$ according to the following table.

Lubricant	Form	Manufacturer
Molykote 321 R (lubricating paint)	Spray	DOW Corning
Molykote Spray (powder spray)	Spray	DOW Corning
Molykote G Rapid	Spray or paste	DOW Corning
Aemasol MO 19 P	Spray or paste	A. C. Matthes
Molykombin UMFT 1	Spray	Klüber Lubrication
Unimoly P 5	Powder	Klüber Lubrication

Table 6.3: Lubricants for shrink disk after cleaning

6.6 Installation of the torque arm

Note:

For all shaft mounting gear units, the reaction torque corresponding to the torque of the machine and acting in an opposite direction on the housing must be absorbed.

6.6.1 One-sided torque arm

In the case of a one-sided torque arm, a ball and socket joint (see figure 1) or a flexible bush should be provided.

Caution!

The screw-on surface of the torque arm on the gear unit housing must be degreased and smeared with Loctite 640. This increases the reliability of the torque transmission and protects against corrosion.

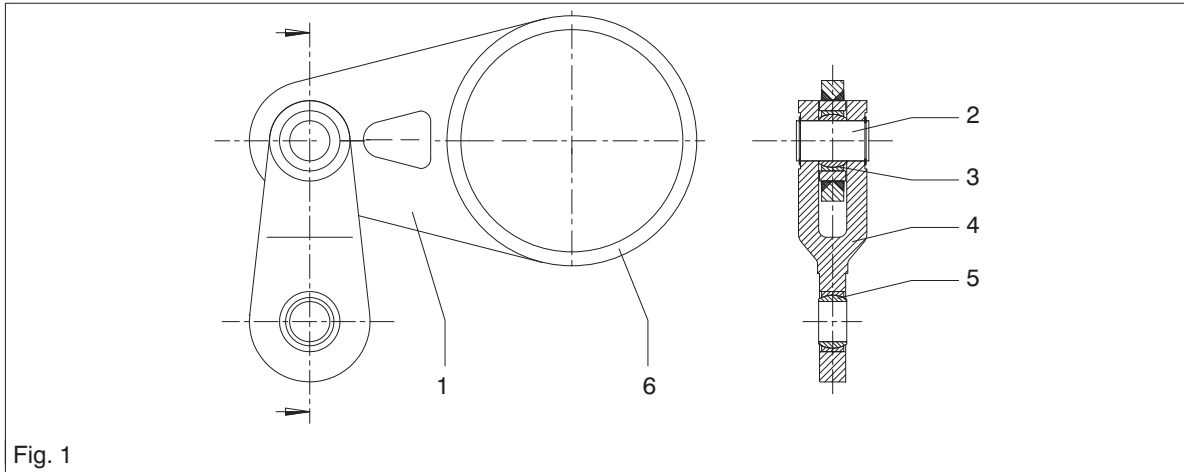


Fig. 1

- | | | |
|------------------------|-------------------------|-------------------------|
| 1 One-sided torque arm | 3 Ball and socket joint | 5 Ball and socket joint |
| 2 Axle | 4 Lever | 6 Gear unit connection |

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

6.6.2 Double-sided torque arm

In the case of a double-sided torque arm, if any, the torque is supported by bars and joints on a torsion shaft. The screw-on surface of the torque arm on the gear unit should be treated as described under 6.6.1.

This type of construction ensures that the machine bearings are freed from any shearing forces, except for the weights. Figure 2 shows a possible variant.

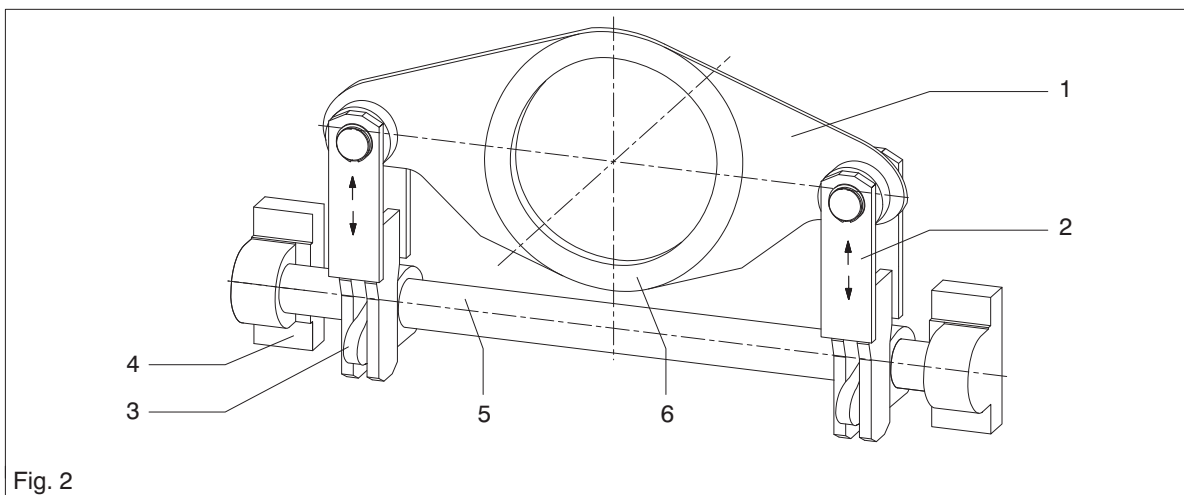


Fig. 2

- | | | |
|---------------------------|--------------------|------------------------|
| 1 Double-sided torque arm | 3 Joint component | 5 Torsion shaft |
| 2 Bar | 4 Bearing pedestal | 6 Gear unit connection |

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

The bearing pedestals may be mounted both to a vertical wall (as illustrated) and on a horizontal foundation.

6.7 Gear unit with oil cooling system

The operating instructions for the oil cooling system must be observed.

6.8 Final work

Caution!

After installation of the gear unit check all screw connections for tight fit.

In addition, after tightening the fixings a check must be made to see that the alignment has not changed.

Check by means of the list of equipment as well as the associated drawings whether all units which may have been removed for transport have been refitted.

Oil drain cocks, if any, must be secured against accidental opening.

The gear unit must be protected against falling objects.

Protective devices for rotating parts must be checked for correct seating. Contact with rotating parts is not permitted.

7. Start-up

Observe the "Safety instructions" in section 3!

7.1 Procedure before start-up

7.1.1 Removal of preservative agent

- Unscrew and open oil drain plug and drain remaining preservative agent or running-in oil from the housing into a suitable container and dispose of in accordance with regulations. Any residual-oil drain plugs should also be opened. The location of the oil draining point is marked by an appropriate symbol in the dimensioned drawing in the gear-unit documentation.



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

- Screw in the oil drain plug.

Caution!

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



The oil must not come into contact with the skin (e.g. the operator's hands). The safety notes on the data sheets for the oil used must be observed here!

7.2 Filling with lubricant

- Open oil filler plug.

Caution!

Fill the gear unit with fresh oil of the grade specified on the rating plate, using a filter (max. mesh 25 µm).

Note:

The quality of the oil used must meet the requirements of the separately enclosed operating instructions, otherwise the guarantee given by TORK will lapse. We urgently recommend using one of the oils listed in BA 7300 EN, because they have been tested and meet the requirements. Information on the type, quantity and viscosity of the oil is given on the rating plate on the gear unit.

The quantity of oil indicated on the rating plate is an approximation only. The actual oil quantity to be put in is shown by the marks on the oil sight glass, on the right-angle oil level indicator or on the oil dipstick.

Note:

In the case of gear units with an oil cooling system, the oil circuit should also be filled up. To do so, the gear unit should be started and then run briefly, as described in Section 8.

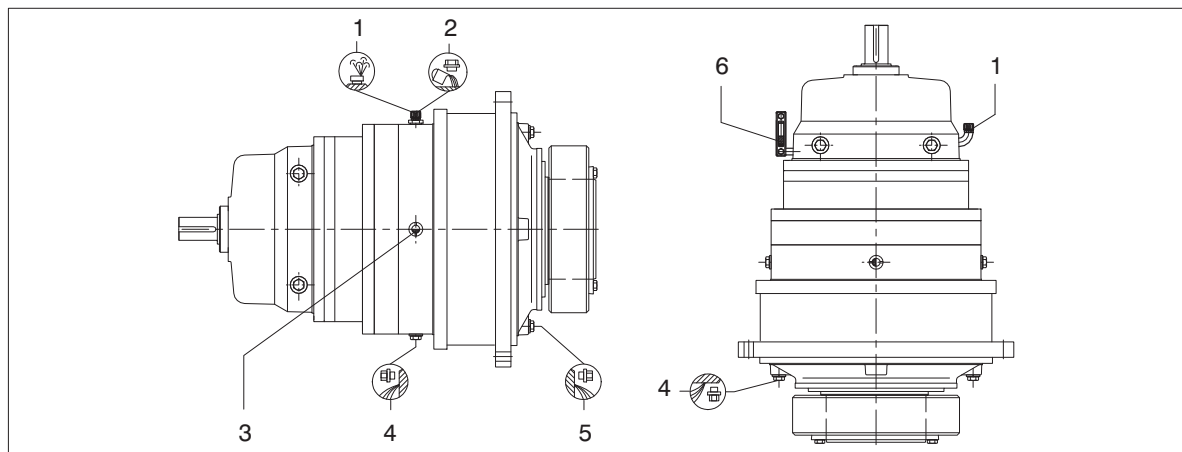
- Check oil level on the oil sight glass, right angle oil level indicator or oil level dipstick.

Note:

The oil level should be up to the middle of the oil sight glass or at the upper mark on the oil level dipstick.



Remove any oil spillage immediately with an oil-binding agent. The oil must not come into contact with the skin (e.g. the operator's hands). The safety notes on the data sheets for the oil used must be observed here!



- 1 Housing ventilation
- 2 Oil filler plug

- 3 Oil-sight glass
- 4 Oil drain

- 5 Residual-oil drain
- 6 Right angle oil level indicator/oil level dipstick

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

- Screw in oil filler plug.

7.3 Start-up

- Check the oil level in the gear unit.

Note: When the oil has cooled down, the oil level should be up to the middle of the oil sight glass or the middle of the marks on the right angle oil level indicator or at the upper mark on the oil level dipstick. If the oil is hot, the marks may be slightly exceeded. It must not be allowed to fall below the mark. If necessary, top oil up to the correct level.

Gear unit with water oil-cooling systems:

- Fully open the stop valves in the coolant in- and outflow pipes.

Note: For technical data, refer to the order-specific list of equipment.

7.4 Removal from service

- To take the gear unit out of service, 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.**

- With gear units fitted with water oil-coolers, close the stop valves on the water in- and outflow pipes. To prevent freezing, drain the water from the cooling coil or the water oil-cooler.
- During longer periods of disuse, start the unit up briefly at intervals of approx. 3 weeks. If the gear unit is to remain out of service for longer than six months, it must be treated with preservative agent (see item 7.4.1).

7.4.1 Interior preservation during longer disuse

Depending on the type of lubrication or shaft sealing, the following types of interior preservative agent can be used.

7.4.1.1 Interior preservation with gear oil

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

7.4.1.2 Interior preservation with preservative agent

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

Interior preservation procedure:

- Switch the gear unit off and drain the oil as described in section 10, "Maintenance and repair".
- Fill conservation agent in accordance with table 7.1 or 7.2, as appropriate, up to the middle of the oil sight glass or up to the mark on the right angle oil level indicator.
- Start the gear unit and allow it to idle briefly.
- Unscrew the oil drain plug and allow the preservative agent to drain into a suitable container and dispose of it according to regulations.



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

- Screw in the oil drain plug.

Caution!

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

Duration of protection	Preservative agent	Special measures
up to 6 months	Castrol Alpha SP 220 S	none
up to 24 months		Close gear unit, replace breather screw or air filter with a yellow plug screw (replace the original parts before start-up). Storage in enclosed dry rooms.
For storage periods longer than 24 months, renew the preservative agent. For storage periods longer than 36 months.		

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

Duration of protection	Preservative agent	Special measures
up to 6 months	Special anti-corrosion oil TRIBOL 1390 1)	none
up to 36 months		Close gear unit, replace breather screw or air filter with a yellow plug screw (replace the original parts before start-up). Storage in enclosed dry rooms.
For storage periods longer than 36 months,.		

Table 7.2: Preservation procedure when using PG-based synthetic oil

- 1) Resistant to tropical conditions and sea water; max. ambient temperature 50 °C

7.4.2 Exterior preservation

Exterior preservation procedure:

- Clean the surfaces.
- For separation between the sealing lip of the shaft sealing ring and the preservative agent, the shaft should be brushed with grease in way of the sealing lip.
- Apply preservative agent.

Duration of protection	Preservative agent	Layer thickness	Remarks
up to 36 months	Tectyl 846 K19	approx. 50 µm	Long-term wax-based preservative agent, resistant to sea water and tropical conditions (soluble with CH compounds) Storage in enclosed dry rooms.

Table 7.3: Exterior preservation of shaft ends and other bright machined surfaces

8. Operation

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

- During operation the unit must be monitored for:
 - Oil temperature (The gear unit is designed for a temperature of 90 °C with mineral oil in continuous operation. For higher temperatures, synthetic oils must be used. The maximum short-term operating temperature is 100 °C. See also section 10.)
 - Changes in gear noise
 - Possible oil leakage at the housing and shaft seals
 - Correct oil level (see section 7, "Start-up").

Note: To check the oil level, stop operation of gear unit.
When the oil has cooled down, the oil level should be up to the middle of the oil sight glass or the middle of the marks on the right angle oil level indicator or at the upper mark on the oil level dipstick. If the oil is hot, the marks may be slightly exceeded. It must not be allowed to fall below the mark. If necessary, top oil up to the correct level.

Caution!

If any irregularities are noticed during operation or if the pressure monitor in the oil-cooling system (if installed) triggers the alarm, switch the drive unit off at once. Determine the cause of the fault, using the table in section 9.

The trouble-shooting 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

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

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 DOFINE 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!

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



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

Faults	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.
	Grind labyrinth rings.	Readjust labyrinth rings.
Loud noises in area of gear-unit fastening.	Fastening has worked loose.	Tighten bolts / nuts to specified torque. Replace damaged bolts / nuts.
Increased temperature at the 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.
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.

Faults	Causes	Remedy
Oil foams.	Water in oil. Oil too old (defoaming agent used up). Unsuitable oils mixed up.	Test the oil, change oil if necessary. Test the oil, change oil if necessary. Test the oil, change oil if necessary.
Water in oil.	Oil foams in sump. Defective oil cooler. Gear unit exposed to cold air from machine-room ventilator: water condensing.	Check state of oil by the test-tube method for water contamination. Have oil analysed by laboratory. Repair or replace oil cooler. Fill with oil, look for and repair any leaks. 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. Oil too old. Oil badly contaminated. On gear units with oil-cooling system: Coolant flow too low. Coolant temperature too high. Oil flow through water oil-cooler too low due to: Badly clogged oil filter.	Check oil level and, if necessary, adjust. Check date of last oil change and, if necessary, change oil. See section 10. Change oil. See section 10. Fully open valves in in- and outflow pipes. Check for free flow through water oil-cooler. Check temperature and, if necessary, adjust. Clean oil filter. See section 10.
Fault in oil-supply system.		Consult operating instructions for oil-supply system.

Table 9.1: Faults, causes and remedies

10. Maintenance and repair

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

10.1 General notes on maintenance

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

The following applies to all work in item 10.2:



Switch gear unit and add-on components off.

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

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 stated here. These refer to:

a daily operating time of	24 h
a duty factor of	100 %
a maximum oil temperature of	90 °C (mineral oil only)
	100 °C (synthetic oil only)

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

Measures	Periods	Remarks
Checking oil temperature	Daily	
Checking for unusual gear-unit noise	Daily	
Checking oil level	Monthly	Oil level up to the middle of the oil sight glass or up to the middle of the mark on the right angle oil level indicator
Checking gear unit for leaks	Monthly	
Testing oil for water content	After approx. 400 operating hours, once per year at least	See Item 10.2.1
First oil change after start-up	After approx. 400 operating hours	See Item 10.2.2
Subsequent oil changes	Every 18 months or 5 000 operating hours ¹⁾	See Item 10.2.2
Cleaning the breather screw	Every 3 months	See Item 10.2.3
Refilling Taconite seals with grease	Every 3000 operating hours or every 6 months at least	See Item 10.2.4
Cleaning gear-unit housing	Simultaneously with oil change	See Item 10.2.5
Checking condition of water oil-cooler	Simultaneously with oil change	See Item 10.2.6
Checking tightness of fastening bolts	After first oil change, then after every second oil change	See Item 10.2.6

Measures	Periods	Remarks
Checking the preservation of the free shaft ends	Every 3 years	See Item 7.4.2
Carrying out complete inspection of gear unit	Approx. every 2 years simultaneously with due oil change	See Item 10.3.1

Table 10.1: Maintenance and repair work

1) When using synthetic oils, the periods can be tripled.

10.2 Description of maintenance and repair work

10.2.1 Testing water content of oil

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

10.2.2 Changing the oil

- The instructions in item 7.1 must be observed!
- Close the stop valves in the coolant in- and outflow pipes (for gear units with water oil-cooling system)
- Drain the oil while it is still warm, i.e. immediately after shutting down the machinery.

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. If nevertheless a different type of oil is changed to, the gear unit must be flushed through with the new type of oil.

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.

- Place a suitable container under the oil drain plug of the gear-unit housing.
- 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 to avoid scalding. Remove any oil spillage immediately with an oil-binding agent.

- Clean the permanent magnet of the oil drain plug thoroughly.
- Screw in 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.

- Open oil filler 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.

- Fill with lubricant according to item 7.2.

10.2.3 Cleaning the breather screw

If a layer of dust has built up, the breather screw must be cleaned, whether or not the minimum period of 3 months has expired. 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 Refilling Taconite seals with grease

- Inject approx. 30 g lithium-based bearing grease into each of the lubrication points of the Taconite seal. The lubrication points are fitted with flat grease nipples type AM10x1 to DIN 3404.



Remove and dispose of any old grease escaping.

10.2.5 Cleaning the gear unit

- Remove any dirt adhering to the housing with a hard brush.
- Remove any corrosion.

Caution!

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

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

10.2.6 Check oil cooling system

- Close the stop valves in the coolant in- and outflow pipes.
- Inspect cooler for leaks in the piping.
- Check the condition of screw connections and, if necessary, replace.

Note: For operation and maintenance, always observe the operating instructions indicated in the order-specific appendix.
For technical data, refer to the order-specific list of equipment.

10.2.7 Topping up oil

- The instructions in item 7.2 must be observed!
- Always top up with the same type of oil as already used in the gear unit (see also item 10.2.2).

10.2.8 Checking tightness of fastening bolts

- The instructions in item 10.1 must be observed!
- Check tightness of all fastening bolts with a torque wrench.

Thread size	Tightening torque	Initial tensioning force
M 42	4070 Nm	526000 N
M 48	6140 Nm	693000 N
M 56	9840 Nm	959000 N
M 64	14300 Nm	1268000 N
M 72 x 6	20800 Nm	1600000 N
M 80 x 6	28900 Nm	1950000 N
M 90 x 6	41650 Nm	2550000 N
M 100 x 6	57800 Nm	3200000 N

Table 10.2: Tightening torques and initial tensioning forces of the foundation bolts

All other bolts on the gear unit should be checked for tightening torques according to the following table:

Thread size	Tightening torque (with $\mu = 0.14$) Strength class		Thread size	Tightening torque (with $\mu = 0.14$) Strength class	
	8.8	10.9		8.8	10.9
M 10	49 Nm	69 Nm	M 36	2530 Nm	3560 Nm
M 12	86 Nm	120 Nm	M 42	4070 Nm	5720 Nm
M 16	210 Nm	295 Nm	M 48	6140 Nm	8640 Nm
M 20	410 Nm	580 Nm	M 56	9840 Nm	13850 Nm
M 24	710 Nm	1000 Nm	M 64	14300 Nm	21000 Nm
M 30	1450 Nm	2000 Nm			

Table 10.3: Tightening torques



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

10.3 Final work

The final work is to be done in accordance with the instructions in item 6.8.

10.3.1 General inspection of gear unit

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

10.4 Lubricants

The quality of the oil used must meet the requirements of the separately enclosed BA 7300 EN operating instructions, otherwise the guarantee given by TORK will lapse. We urgently recommend using one of the oils listed in BA 7300 EN, because they have been tested and meet the requirements.

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

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

The quantity of oil indicated on the rating plate is an approximation only. The marks on the dipstick or oil sight glass are decisive for the amount of oil to be filled in.

The use instructions for lubricants currently recommended by TORK are also available on the Internet at "<http://www.torkdrive.com>".

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

We recommend regularly checking whether the selected lubricating oil is still recommended by TORK. If it is not, the brand of oil must be changed.

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 stated 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. TORK will assume no liability or guarantee for damage caused by spare parts and accessories not supplied by TORK.

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
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11.2 Spare parts and customer-service addresses

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