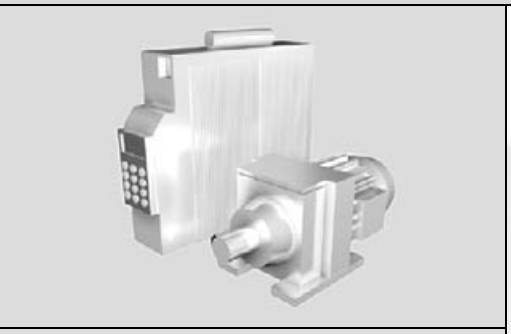
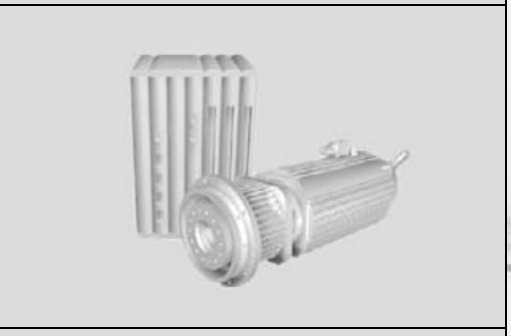
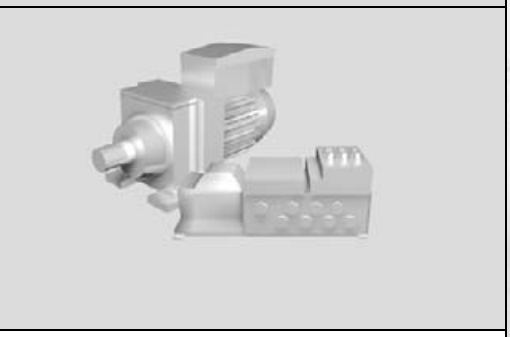
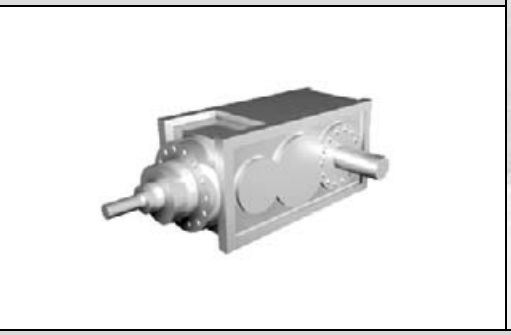
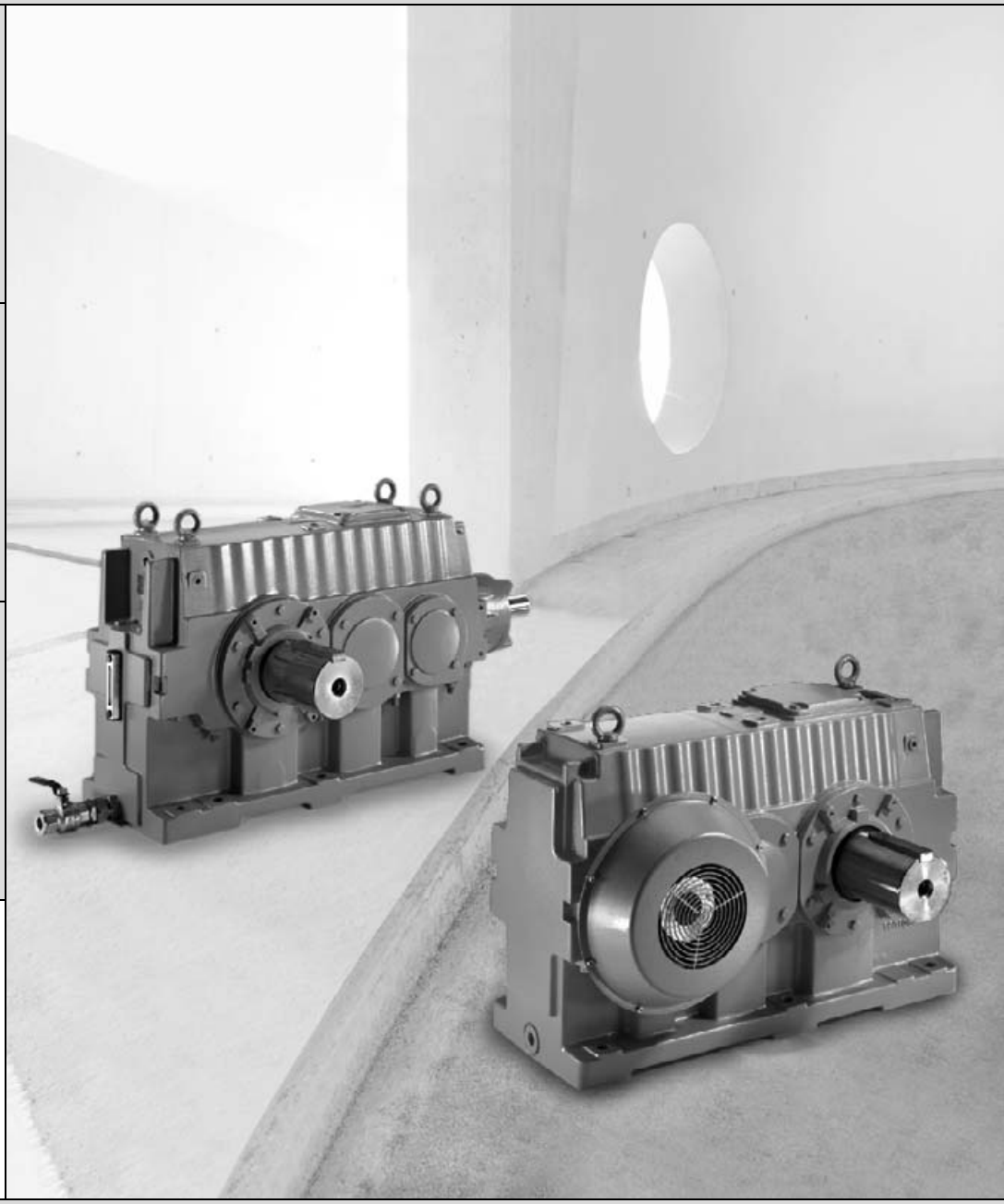
SEW EURODRIVE











Industrial Gear Units of the M.. Series
M.P../M.R.. Horizontal Gear Units

D6.C00

Edition 07/2004

11279028 / EN

Operating Instructions

SEW EURODRIVE

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 SEW-EURODRIVE regarding a subsequent change of mounting position!**
- **The industrial gear units of the M.. series 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 of the M series. If **gear units** of the R, F, K, S series or motors of the DR/DT/DV series 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 SEW-EURODRIVE 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 [1] 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.

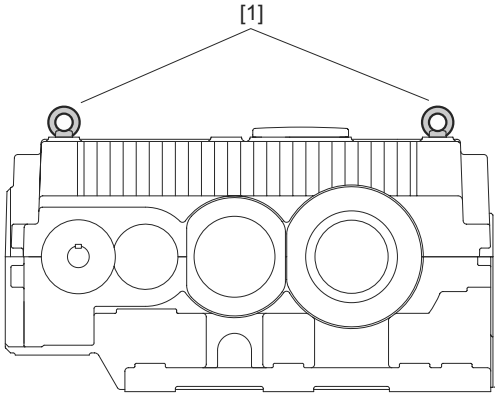


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Figure 1: Positions of transport eyebolts

- **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 (→ following figures)!**

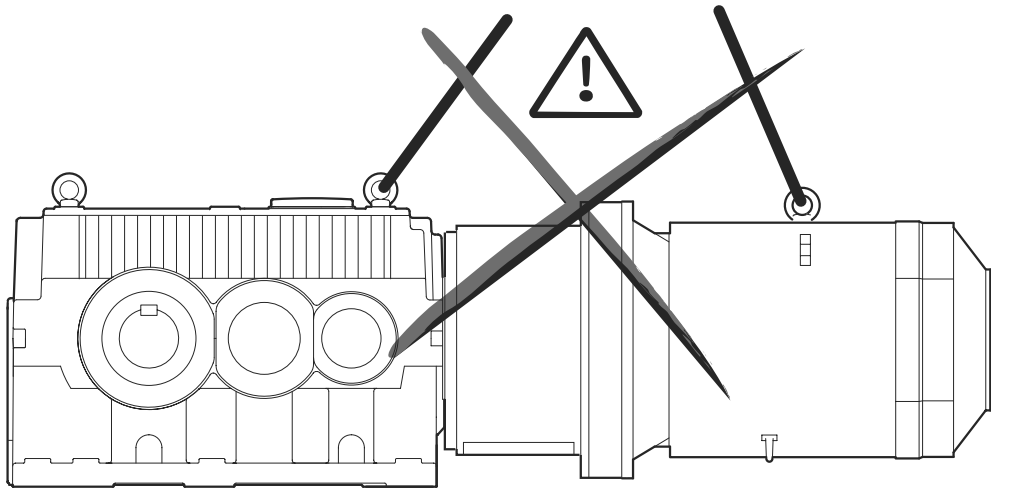

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Figure 2: Do not use eyebolts on the motor for transport

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

Transport of M.. industrial gear units with motor adapter

Industrial gear units of the **M.P.. / M.R..** series **with motor adapter** (→ following figure) must **only** be transported using **lifting ropes/chains [2] or lifting belts [1]** at an **angle of 90° (vertically) to 70°**.

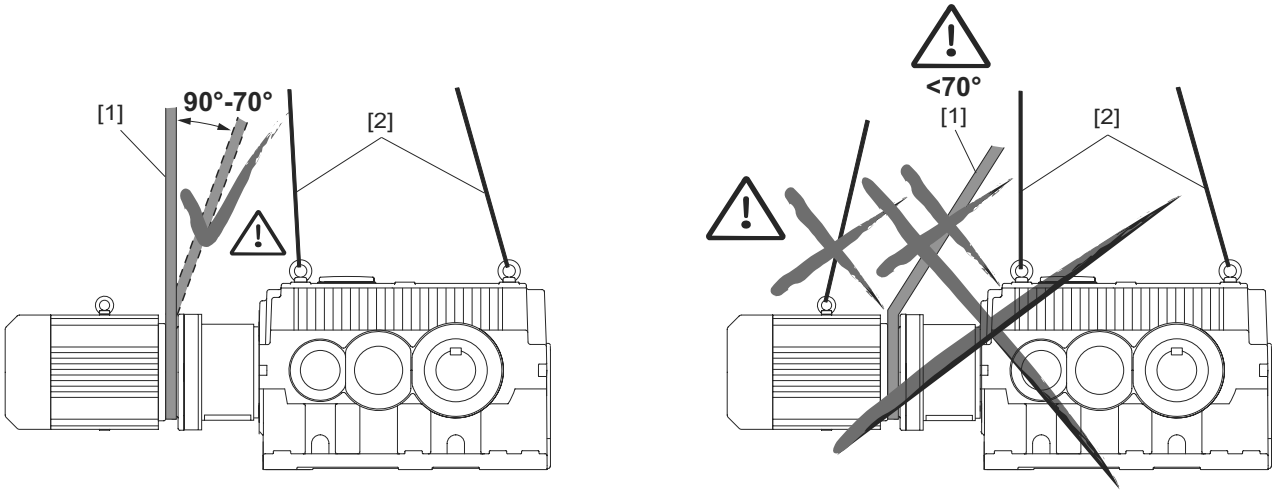

Figure 3: Transport of industrial gear unit with motor adapter – Do not use eyebolts on the motor for transport

Transport of M.. industrial gear units on a base plate

Industrial gear units of the **M** series **on a base plate** (→ following figure) must **only** be transported with the **lifting ropes** [1] or chains (angle 90°) **vertically** to the base plate:

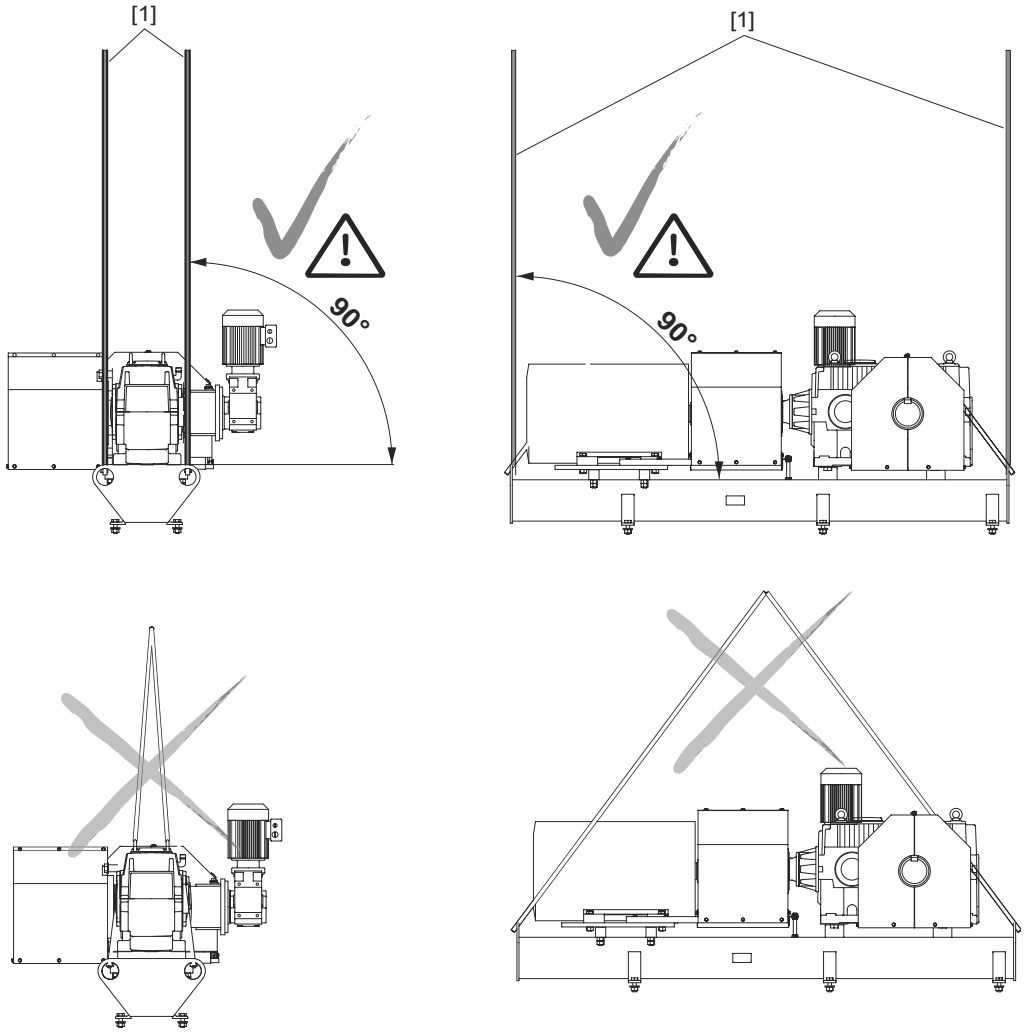

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Figure 4: Transport of M.. industrial gears unit on a base plate

Transport of M.. industrial gear units on a swing base

Industrial gear units of the **M series on a swing base** (→ following figures) must **only** be transported using **lifting belts [1]** and **lifting ropes [2]** at an **angle of 90° (vertically) to 70°**.

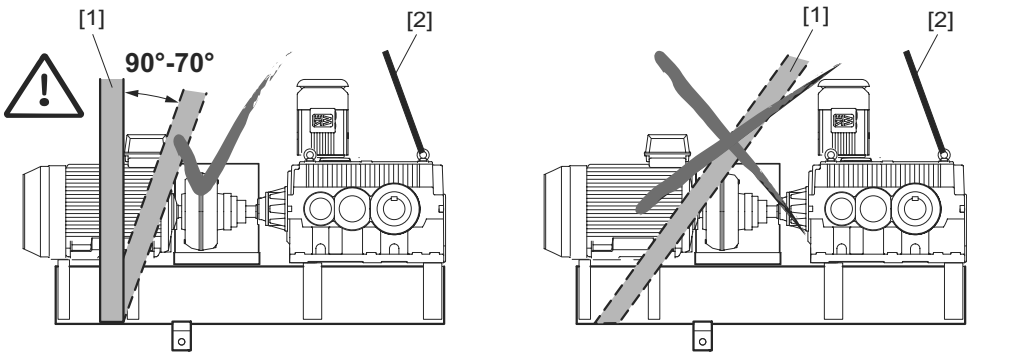

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Figure 5: Transport of M.. industrial gear unit on a swing base

Transport of M.. industrial gear units with V-belt drive

Industrial gear units of the **M series with V-belt drive** (with motors up to IEC size 200) must **only** be transported using **lifting ropes [2]**. The eyebolts on the motor must **not** be used for transport.

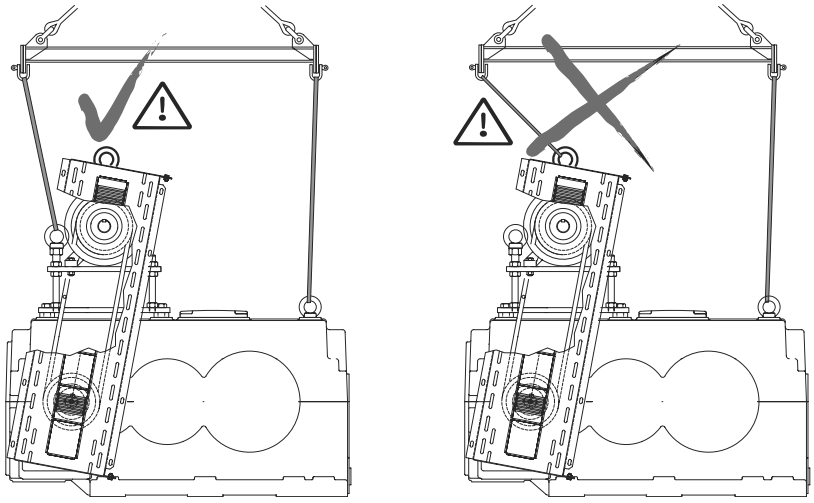

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Figure 6: Transport of M.. with V-belt drive (with motors up to IEC size 200)

Industrial gear units of the **M series with V-belt drive** (with motors of IEC sizes 225 to 315) must **only** be transported using **lifting belts [1] and lifting ropes [2]** at an **angle of 90° (vertically)**. The eyebolts on the motor must **not** be used for transport.

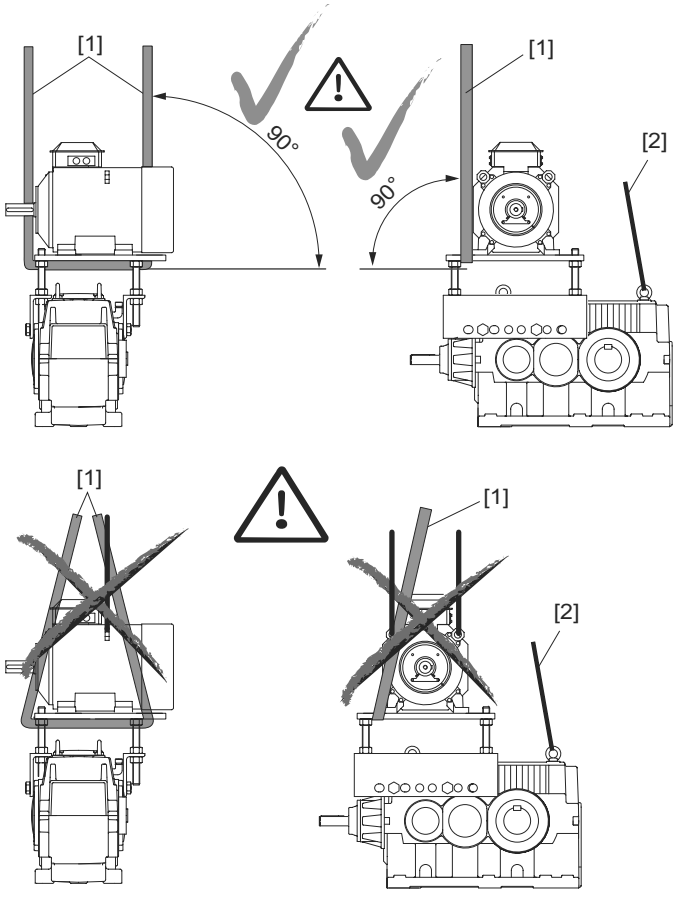

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Figure 7: Transport of M.. with V-belt drive (with motors of IEC sizes 225 to 315)

2.2 Corrosion protection and storage conditions

Overview

Industrial gear units of the M.. series 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, under roof	Indoors (dry, warm air, heated if required)
6 months	Standard protection	Standard protection
12 months	Consult with SEW-EURODRIVE	Standard protection
24 months	Long-term protection	Long-term protection
36 months	Consult with SEW-EURODRIVE	Long-term protection
Sea transport, storage in areas close to the sea	Consult with SEW-EURODRIVE	Long-term protection

Standard protection

- The gear unit is delivered on a pallet without cover.
- Protection of the inside of the gear unit: Gear units of the M series undergo a test run with protection oil.
- Oil seals and seal surfaces are protected through bearing grease.
- SEW-EURODRIVE 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 (VCI corrosion protection bag).
- 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 delivered in a separate bag and has to be mounted before start-up.

Long-term protection

- The gear unit is packaged in a seaworthy plywood box and is delivered on a pallet. This way, the gear unit is protected from humidity and shock. SEW-EURODRIVE 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 (VPI = Vapor Phase Inhibitor) is sprayed through the oil filling hole (recommended value: 0.5 liters in a 10 % solvent per m^3). 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.**
- SEW-EURODRIVE 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 (VCI corrosion protection bag).
- Threaded holes and blind holes are covered by plastic plugs.

3 Gear Unit Design

The following illustrations serve to explain the general design. Their only purpose is to facilitate the assignment of components to the spare parts lists. Discrepancies are possible depending on gear unit size and version!

3.1 Basic design of the M..P.. series

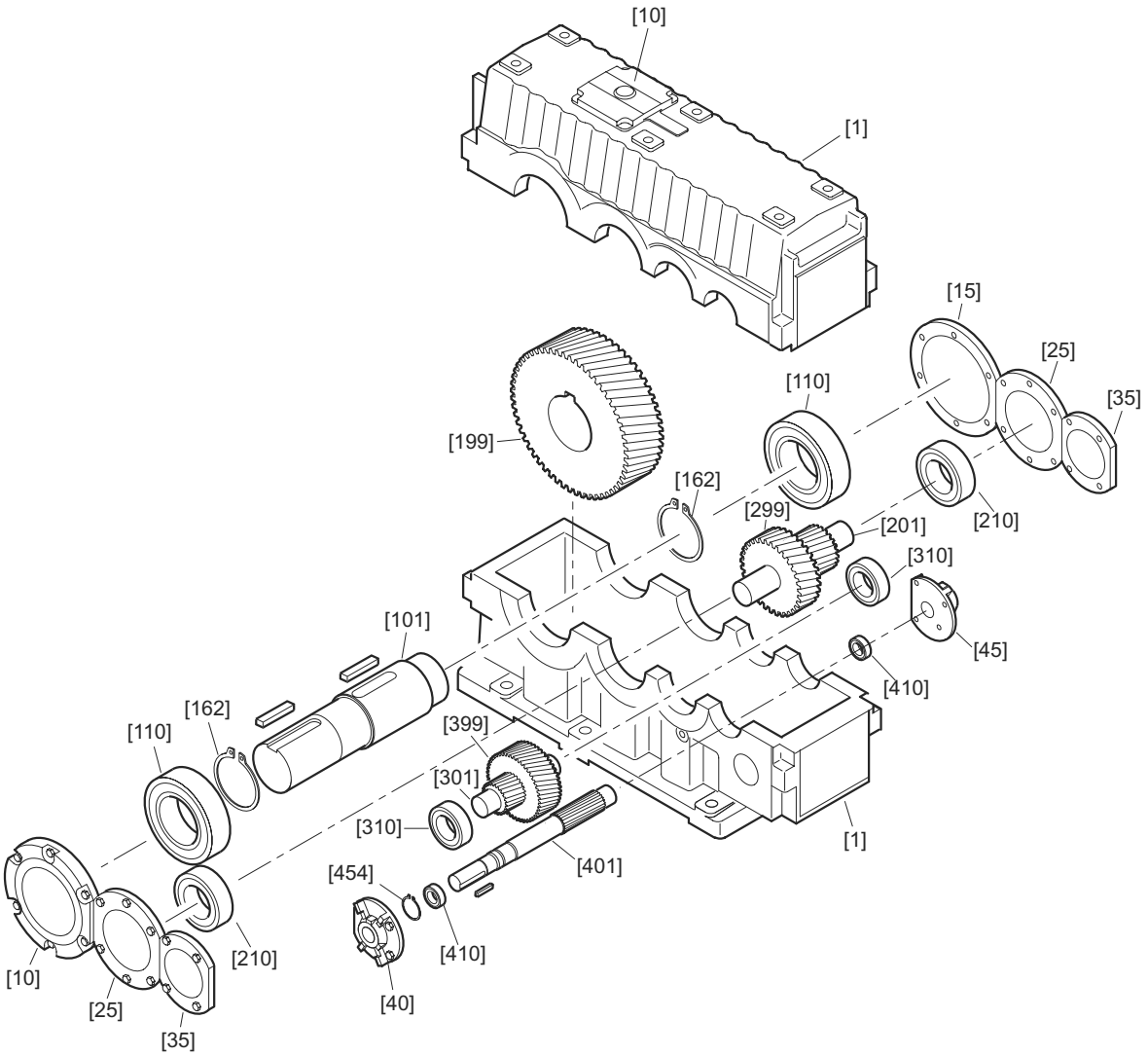

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Figure 8: Basic design of the M..P.. series

[1]	Housing	[45]	Cover	[199]	Gear wheel	[310]	Bearing
[10]	Cover	[70]	Inspection cover	[201]	Pinion	[399]	Gear wheel
[15]	Cover	[100]	LSS shaft	[210]	Bearing	[401]	Pinion shaft
[25]	Cover	[110]	Bearing	[299]	Gear wheel	[410]	Bearing
[35]	Cover	[162]	Retaining ring	[301]	Pinion	[454]	Retaining ring
[40]	Cover						

3.2 Basic design of the M..R.. series

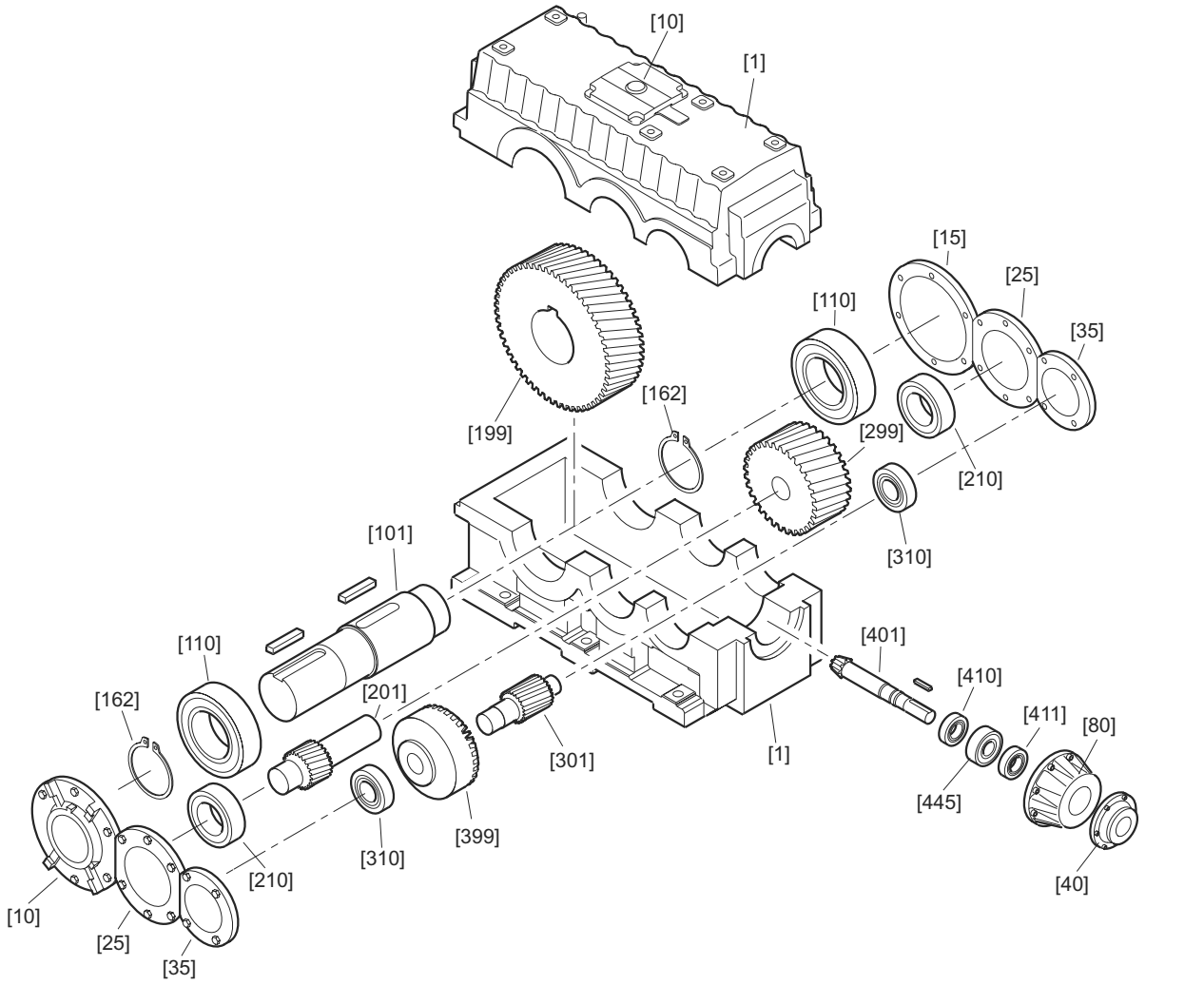
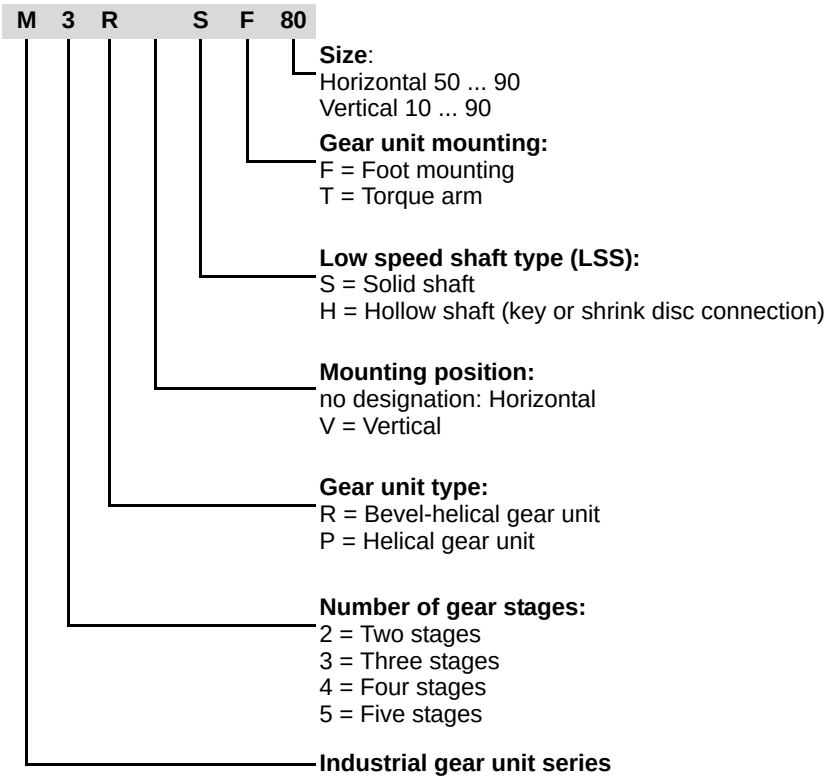


Figure 9: Basic design of the M..R.. series

[1]	Housing	[40]	Cover	[199]	Gear wheel	[399]	Bevel wheel
[10]	Cover	[70]	Inspection cover	[201]	Pinion	[401]	Bevel pinion
[15]	Cover	[100]	LSS shaft	[210]	Bearing	[410]	Bearing
[25]	Cover	[110]	Bearing	[299]	Gear wheel	[411]	Bearing
[35]	Cover	[162]	Retaining ring	[301]	Pinion	[449]	Bushing

3.3 Unit designation / nameplates

Sample unit designation



Example: Nameplate of the M series industrial gear unit, SEW-EURODRIVE

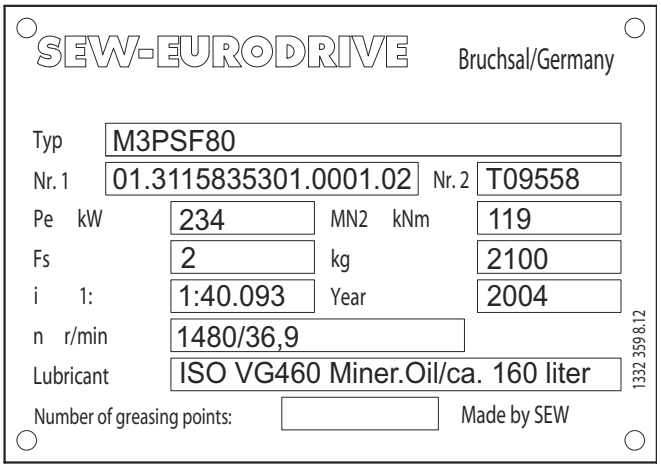


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Figure 10: Nameplate

Type		Unit designation
Nr. 1		Serial number 1
Nr. 2		Serial number 2
P_e	[kW]	Absorbed power on the output shaft
M_{N2}	[kNm]	Rated torque of the gear unit
F_S		Service factor
i		Exact gear unit reduction ratio
n	[r/min]	Input/output speed
kg	[kg]	Weight
Lubricant		Oil grade and viscosity class / oil volume
Year		Year of manufacture
Number of greasing points	[pcs]	Number of points that require regreasing

3.4 Mounting positions, shaft positions and directions of rotation

The shaft positions (0, 1, 2, 3, 4) and directions of rotation shown in the following figures apply to output shafts (LSS) of the types **solid shaft and hollow shaft**. For other shaft positions or gear units with backstop, contact SEW-EURODRIVE.

The following mounting positions (for a detailed overview, see → Sec. "Mounting Positions") and shaft positions (0, 1, 2, 3, 4) are possible:

Mounting position, shaft positions M.P..

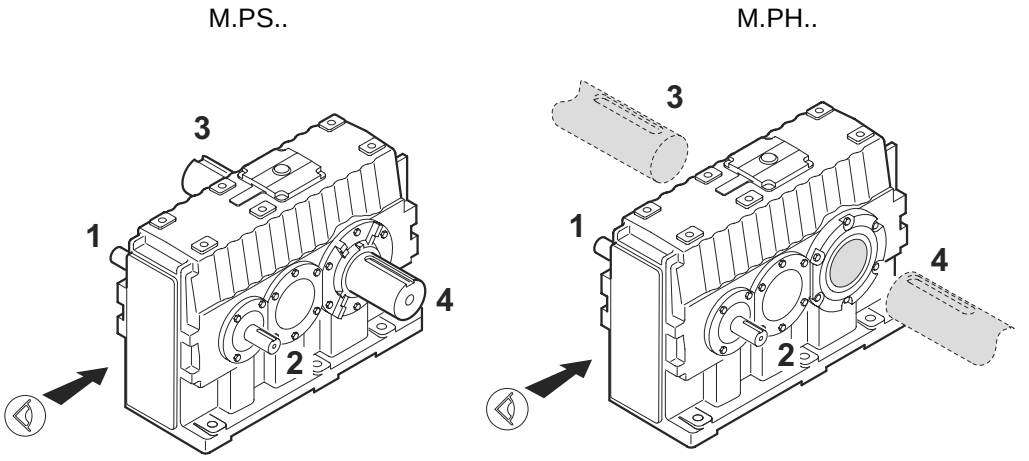


Figure 11: Mounting positions and shaft positions M.P..

Mounting position, shaft positions M.R..

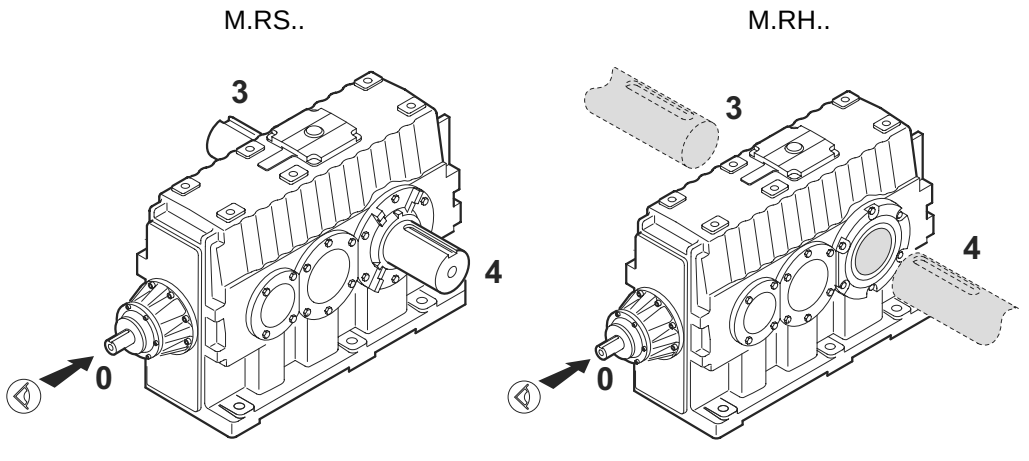
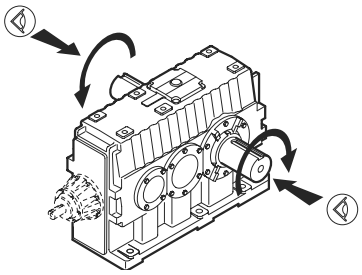
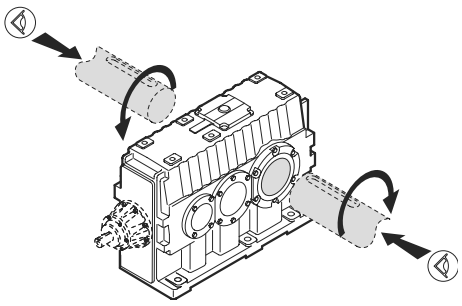
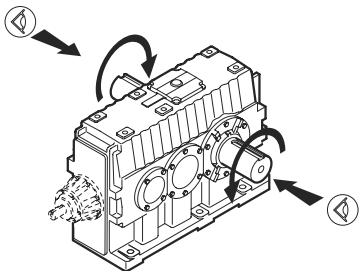
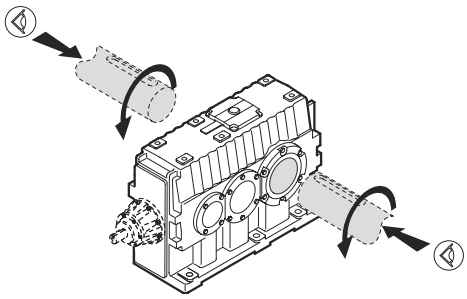


Figure 12: Mounting positions and shaft positions M.R..

Directions of rotation

The directions of rotation of the outputs shaft (LSS) are defined as follows:

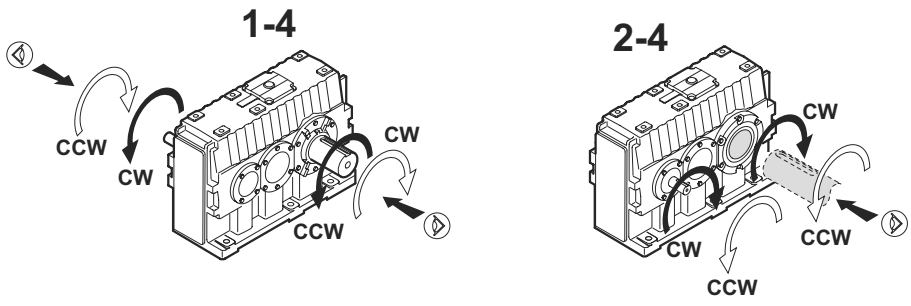
Direction of rotation	Gear unit version	
	M.PS.. M.RS..	**M.PH.. M.RH..**
Clockwise (CW)	 53219AXX	 53260AXX

Direction of rotation	Gear unit version	
	M.PS.. M.RS..	**M.PH.. M.RH..**
Counterclock-wise (CCW)	 53265AXX	 53266AXX

Shaft positions and corresponding directions of rotation of M2P.. industrial gear units

The following figures show shaft positions and corresponding directions of rotation for industrial gear units of the M2P.. series.

Two stages



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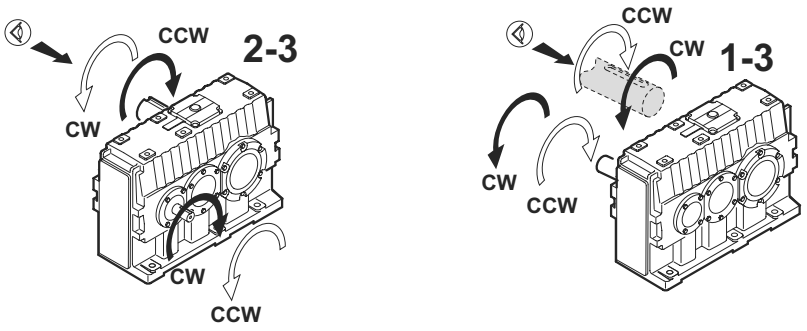

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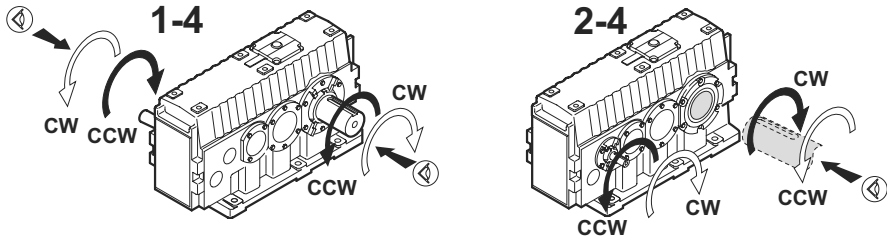
Shaft positions and corresponding directions of rotation of M3P.. industrial gear units

The following figures show shaft positions and corresponding directions of rotation for industrial gear units of the M3P.. series.

Three stages



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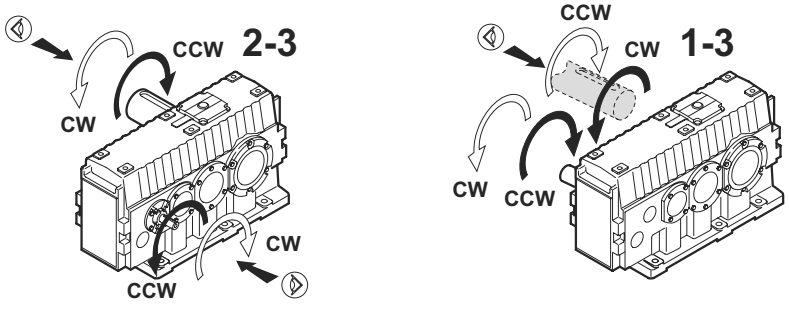

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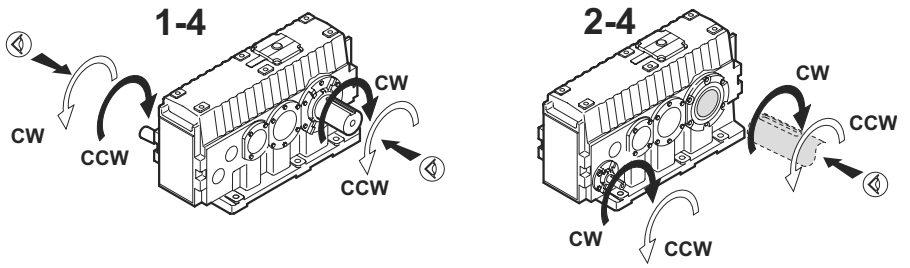
Shaft positions and corresponding directions of rotation of M4P.. industrial gear units

The following figures show shaft positions and corresponding directions of rotation for industrial gear units of the M4P.. series.

Four stages



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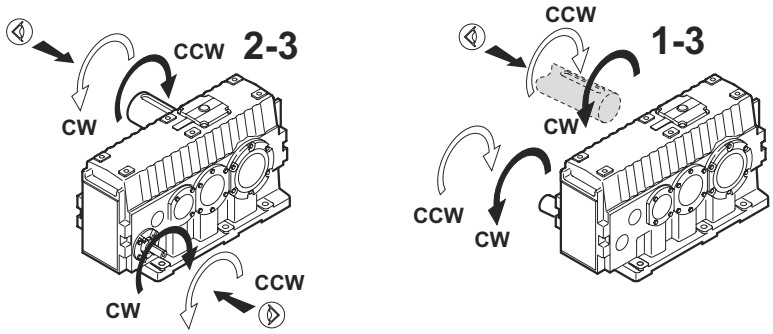

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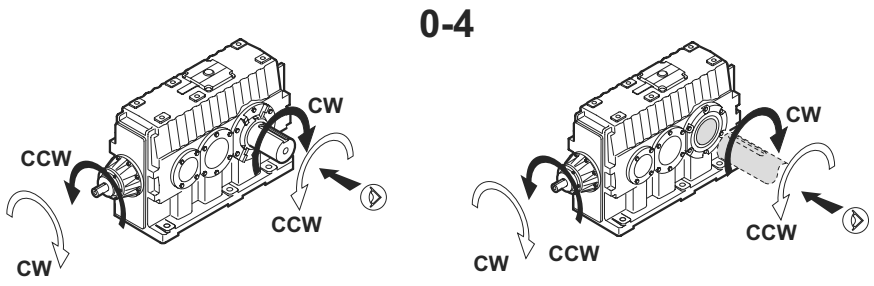
Shaft positions and corresponding directions of rotation of M3R.. industrial gear units

The following figures show shaft positions and corresponding directions of rotation for industrial gear units of the M3R.. three stage series.

Three stages



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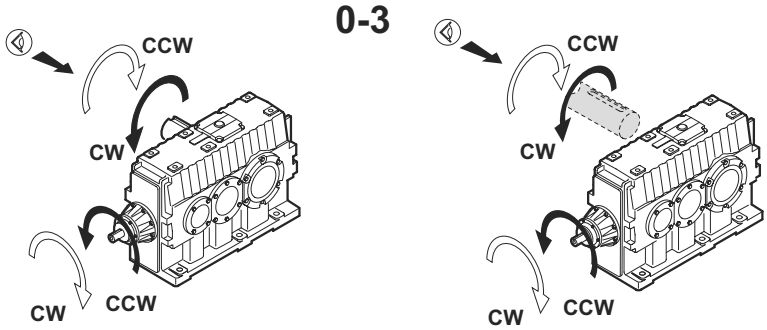

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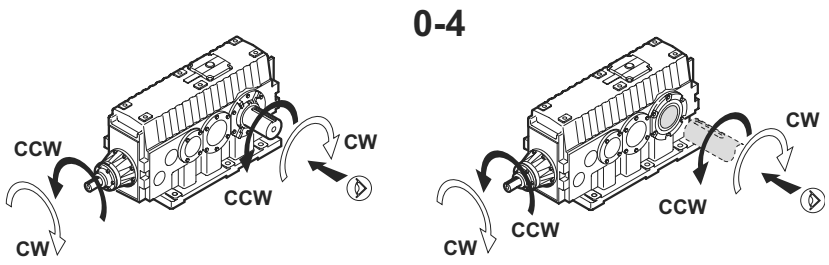
Other directions of rotation are possible. Please refer to the order-specific drawing.

Shaft positions and corresponding directions of rotation of M4R.. industrial gear units

The following figures show shaft positions and corresponding directions of rotation for industrial gear units of the M4R.. four stage series.

Four stages



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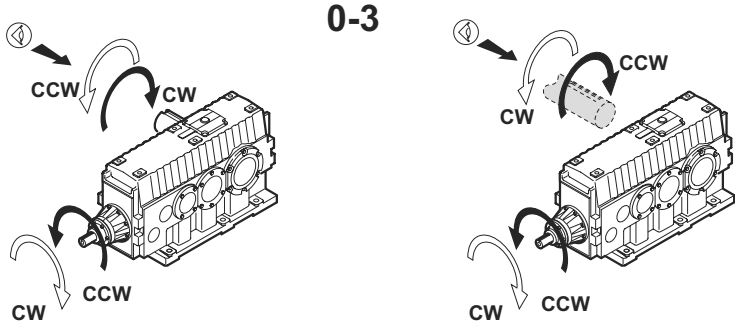

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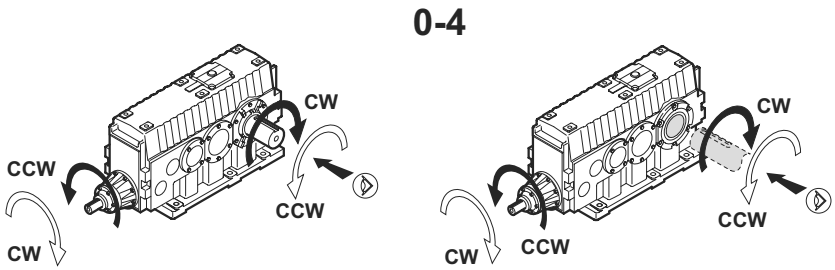
Shaft positions and corresponding directions of rotation of M5R.. industrial gear units

The following figures show shaft positions and corresponding directions of rotation for industrial gear units of the M5R.. five stage series.

Five stages



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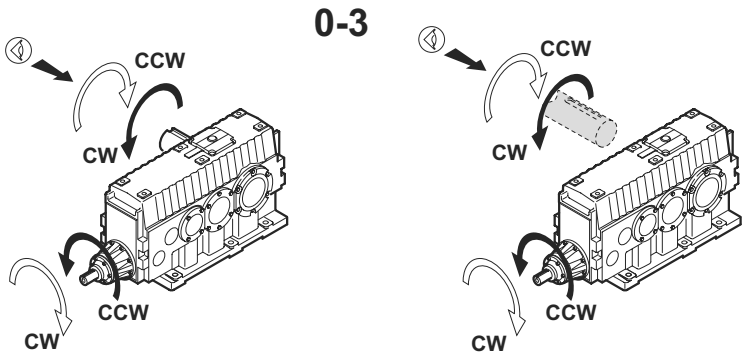

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Other directions of rotation are possible. Please refer to the order-specific drawing.

3.5 Lubrication of industrial gear units

For M... gear units in horizontal design, the lubrication types "splash lubrication" or "pressure lubrication" are normally used.

Splash lubrication

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

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 (→ Sec. "Shaft end pump"), or, through a motor pump (⟶ Sec. "Motor pump").

The lubrication method "pressure lubrication" is used when

- oil bath lubrication is not desired for vertical mounting positions
- input speeds are very high
- the gear unit must be cooled by an external oil/water (→ Sec. "Oil/water cooling system") or oil/air cooling system (→ Sec. "Oil/air cooling system")
- the pitch line velocity is too high for splash or bath lubrication.

Oil bath lubrication

Oil bath lubrication is normally only used for industrial gear units of the M.. series in vertical design (unit designation M..**V**.. ⟶ separate manual). With oil bath lubrication, the oil level is so high that the bearings and gearing components are completely submerged in the lubricant.

Oil expansion tanks are normally used with bath lubrication. **Oil expansion tanks allow the lubricant to expand when the gear unit heats up during operation.**

⟶ See separate instruction "industrial Gear Unit of the M.. Series - Vertical Gear Units M.PV../M.RV.."

Disregarding design and mounting position, a steel oil expansion tank is used when the unit is installed outdoors and when the ambient conditions are very humid. This tank can be used both for the version with solid shaft and hollow shaft. A membrane in the oil expansion tank separates the oil in the gear unit from the humid ambient air. This way, no humidity can build up in the gear unit.

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 (e.g. NOCO® fluid from SEW-EURODRIVE)
- For hollow shaft gear units (→ Sec. "Mounting/removal of hollow shaft gear units with keyed connection): Threaded rod, nut (DIN 934), retaining screw, ejector screw, end-plate
- Securing components according to Sec. "Gear unit foundation"

Installation tolerances

Shaft end	Flanges
Diametric tolerance in accordance with DIN 748 • 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 • Center hole in accordance with DIN 332, shape DS..	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" (see standard), no oil, acid, gas, vapors, radiation, etc.
  - **with special versions:**
    drive configured in accordance with the ambient conditions (→ order documents)

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.

SEW-EURODRIVE recommends foundation methods shown in the following figures. A customer's own foundation method must be equally adequate.

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.

Example 1

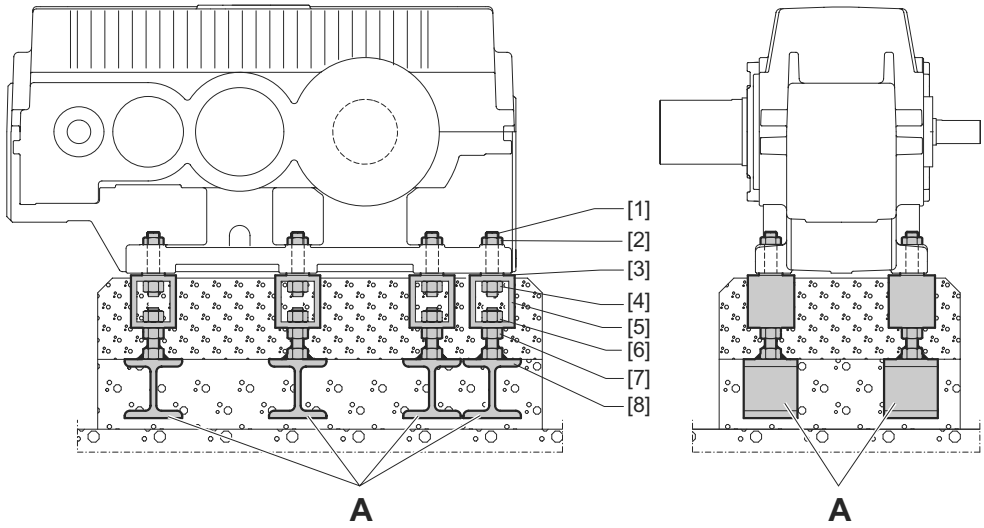

Figure 13: Reinforced concrete foundation for M...F..

[1] Hex head screw or stud
[2] Hex nut if [1] is a stud or an upside-down screw
[3] Shims (about 3 mm space for shims)
[4] Hex nut
[5] Foundation bracket
[6] Hex nut
[7] Hex nut and foundation screw
[8] Supporting girder

Pos. "A" → Sec. "Concrete base" Figure 14

Concrete base

The concrete base for the gear unit must be reinforced and interlocked with the concrete using steel clamps, steel rods or steel elements. Only the supporting girders are embedded in the concrete (Pos. "A" → following figure).

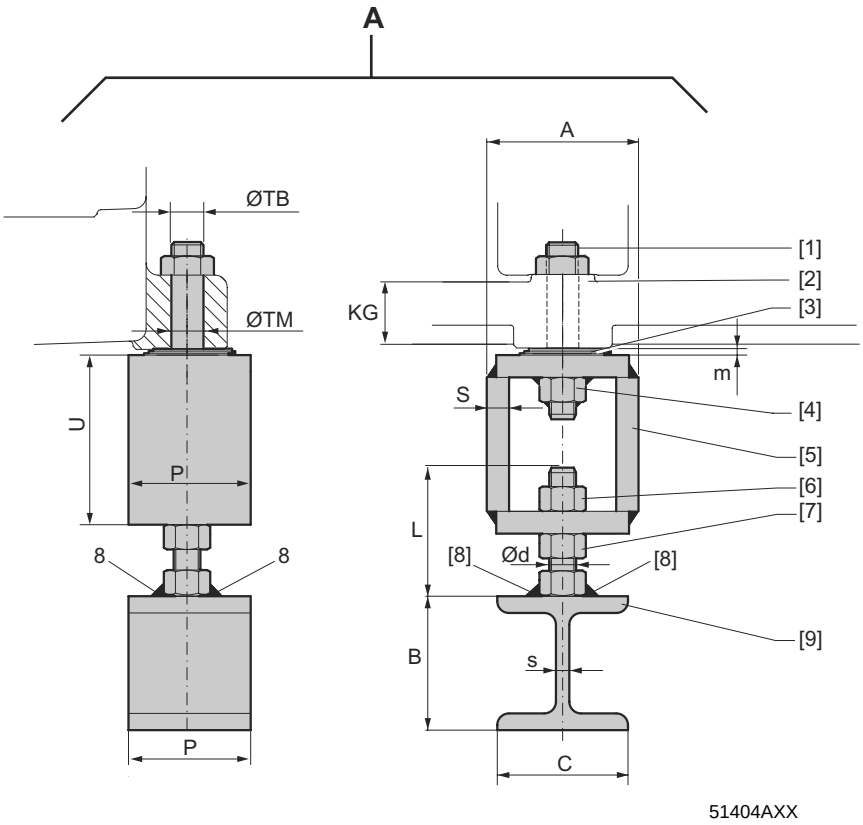

Figure 14: Reinforcing the concrete base (Pos. "A")

[1] Hex head screw or stud
[2] Hex nut if [1] is a stud or an upside-down screw
[3] Shims (about 3 mm space for shims)
[4] Hex nut
[5] Foundation bracket
[6] Hex nut
[7] Hex nut and foundation screw
[8] Weld seam
[9] Supporting girder

Dimensions

Gear unit size	Stud			Foundation frame					Foundation screws		Supporting girders				
horizontal M...	∅TB	∅TM	KG	m	P	U	A	S	∅d	L	P	B	C	s	t
								[mm]							
50	M24	28	65	3	120	140	120	20	M24	120	120	100		6	10
60	M30	35	73					30	M30	140		140		7	12
70	M30		82												
80	M36	42	90						M36	150					
90	M36		97												

The minimum tensile strength of the supporting girders and foundation screws must be at least 350 N/mm^2.

Grouting

The density of the grout must be equal to that of the base concrete. The grout is connected with the concrete base using concrete reinforcement steel.

Before welding the weld seams [8], ensure that

- the concrete base around the supporting girder has dried
- the gear unit with all mount-on components has been aligned to its final position

Tightening torques

Gear unit size M.. horizontal	Screw / nut	Tightening torque screw / nut [Nm]
50	M24	540
60	M30	1090
70	M30	
80	M36	1900
90	M36	

4.5 Mounting of solid shaft gear units

Before mounting the gear unit, check the foundation dimensions with those in the corresponding drawings in Sec. "Gear unit foundation."

Mount the gear unit in the following order:

1. Mount the components according to Sec. "Gear unit foundation". The shims [1] (→ Figure 15) 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

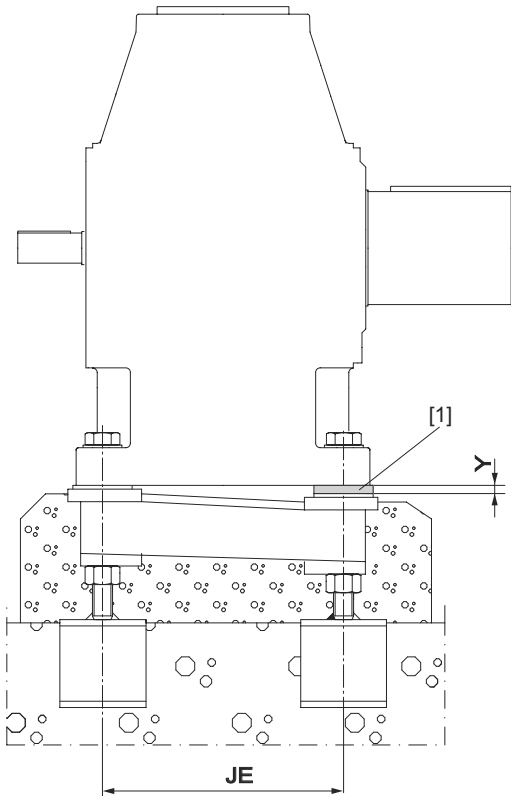

Figure 15: Mounting accuracy when aligning

When aligning the gear unit, make sure that the mounting tolerances for the evenness of the foundation are not exceeded (values y_{max} in below table). If necessary, use shims [1] to align the gear unit on the foundation plate.

JE [mm]	y_{max} [mm]
< 400	0.035
400 ... 799	0.06
800 ... 1200	0.09
1200 ... 1600	0.125
1600 ... 2000	0.15

4.6 Mounting / removing hollow shaft gear units with keyed connection

- Not included in the scope of delivery (→ Figure 16, Figure 17, Figure 18)
  - Threaded rod [2], nut [5], retaining screw [6], ejector screw [8]
- Included in the scope of delivery
  - Circlips [3], end plate [4]

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

Thread sizes

SEW-EURODRIVE recommends the following thread sizes:

Gear unit size horizontal M...	Quantity	Thread size for • threaded rod [2] • nut (DIN 934) [5] • retaining screw [6] (→ Figure 16, Figure 17)
50	1	M30
60		M30
70	2	M20
80		M20
90		M24

The thread size of the ejector screw depends on the end plate [4]:

Gear unit size horizontal M...	Quantity	Thread size for • ejector screw [8] (→ Figure 18)
50	1	M36
60		M36
70	2	M24
80		M24
90		M30

Mounting the hollow shaft gear unit onto the customer's shaft

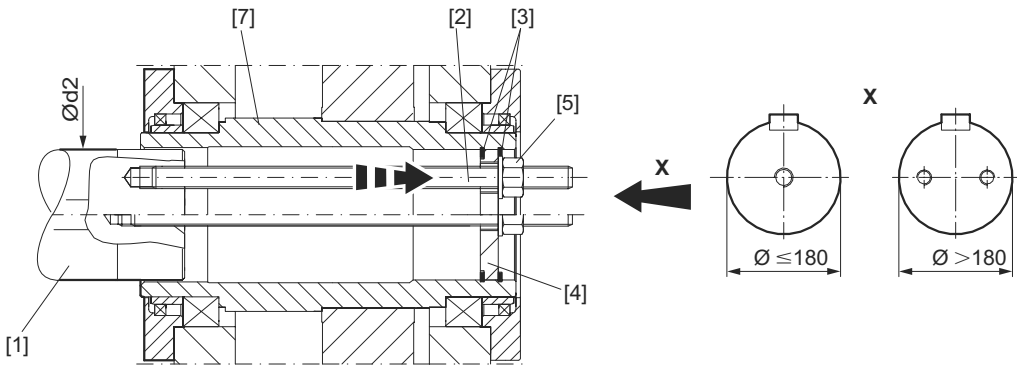

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Figure 16: Mounting of horizontal gear unit with keyed connection

[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 NOCO® 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].

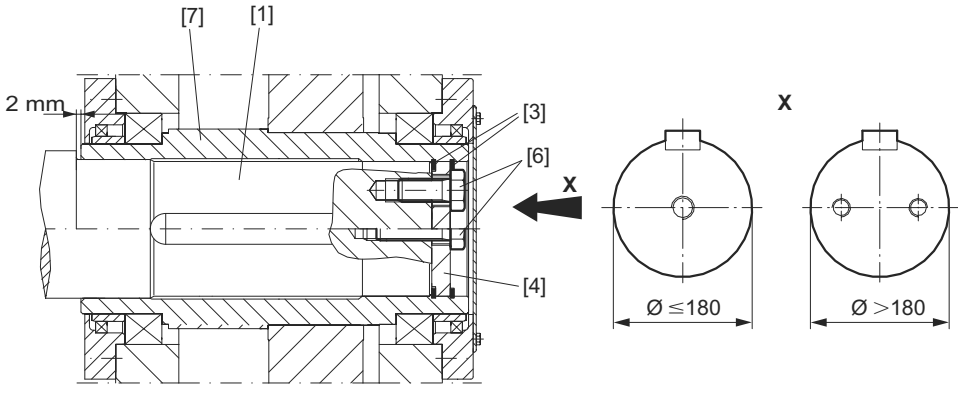

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Figure 17: Mounted horizontal gear unit with keyed connection

[1] Customer's shaft
[3] Circlips
[4] End plate
[6] Retaining screw
[7] Hollow shaft

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

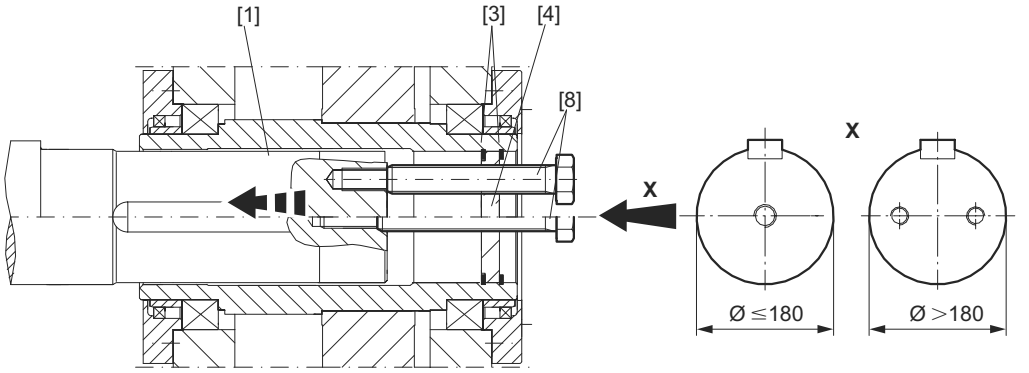

Figure 18: Removing of horizontal gear unit with keyed connection

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

- Remove the retaining screw [Figure 17, Pos. 6].
- 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 (unit designation: 3171 or RLK608), refer to the order documents.

- Included in the scope of delivery (→ Figure 22):
  - [12] protection cover; optional: shrink disc with locking srews [10]
- Not included in the scope of delivery (→ Figure 20, Figure 21, Figure 22, Figure 23)
  - Threaded rod [2], nut [5], ejector screw [8], end plate screws [3], end plate [4]

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.

Thread sizes

SEW-EURODRIVE recommends the following thread sizes:

Gear unit size horizontal M...	Quantity • threaded rod [2] • nut (DIN 934) [5]	Thread size for
50	1	M30
60		M30
70	2	M20
80		M20
90		M24

Gear unit size horizontal M...	Quantity • ejector screw [8]	Thread size for
50	1	M36
60		M36
70	2	M24
80		M24
90		M30

Gear unit size horizontal M...	Quantity and distribution • end plate screw [3]	Recommended screw
50	6 x 60°	M10 x 35
60		
70		M12 x 42
80		M12 x 49
90		

Recommended dimension of end plate [4]

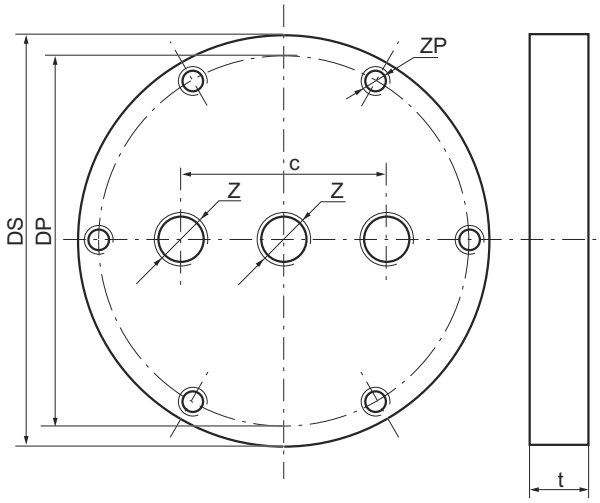

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Figure 19: End plate design

Gear unit size horizontal M...	DS	t	DP	ZP 6 x 60°	Z	c
	[mm]					[mm]
50	190	15	172	M10	1 x M30	-
60	220	15	200		1 x M30	-
70	240	18	215	M12	2 x M20	114
80	260	25	235		2 x M20	126
90	300	25	275		2 x M24	144

Mounting the hollow shaft gear unit onto the customer's shaft

Shrink disc opposite to customer's side of machine shaft#

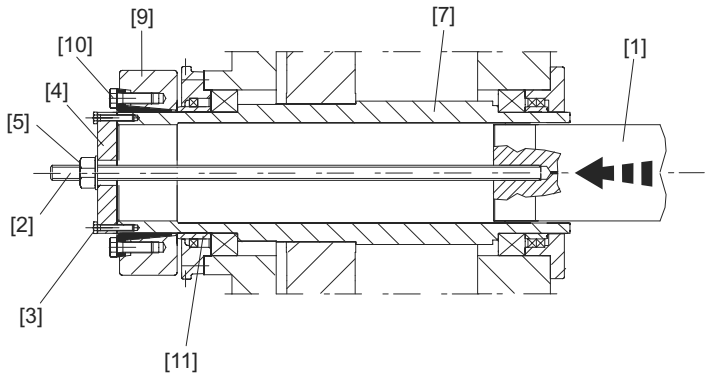

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Figure 20: Mounting of horizontal gear unit with shrink disc connection

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

Shrink disc on customer's side of machine shaft

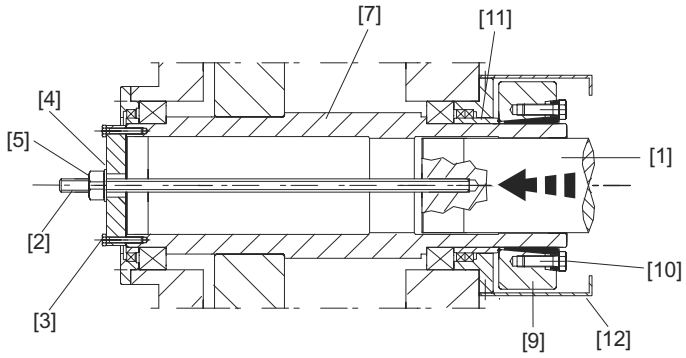

Figure 21: Mounting of horizontal gear unit with shrink disc connection

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

- **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 end plate [4] with the end plate screws [3] on the hollow shaft [7].
- 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].

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 NOCO® fluid to the area where the shrink disc [9] is seated on the hollow shaft.
- Slide the shrink disc [9] with untightened locking screws [10] onto the hub of the hollow shaft bore until the shrink disc touches the bushing [11]. Position the customer's shaft [1] in the hollow shaft bore.

Tightening torques

Tighten all locking screws [10] of the shrink disc [9] evenly in several stages one after other in clockwise direction (not diametrically). Repeat the process until all locking screws [10] have the correct thightening torque.

Gear unit size M...	Screw size (class 10.9)	Shrink disc type 3171 Tightening torque [Nm]	Shrink disc type RLK608 Tightening torque [Nm]
50	M16	250	The required tightening torque is reached when the faces of outer and inner ring are in line.
60, 70, 80	M20	490	
90	M24	840	

Mounted hollow shaft gear unit

Shrink disc opposite to customer's side of machine shaft

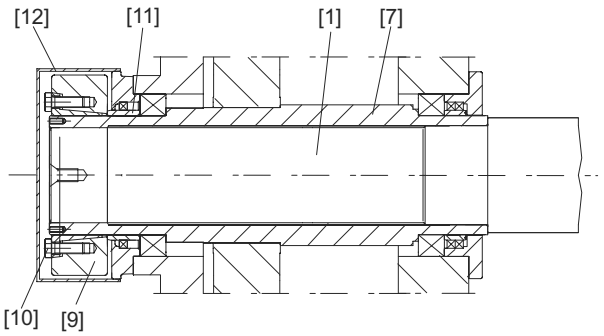

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Figure 22: Mounted horizontal gear unit with shrink-disc connection

[1] Customer's shaft
[7] Hollow shaft
[9] Shrink disc
[10] Locking screws
[11] Bushing
[12] Protection cover

Shrink disc on customer's side of machine shaft

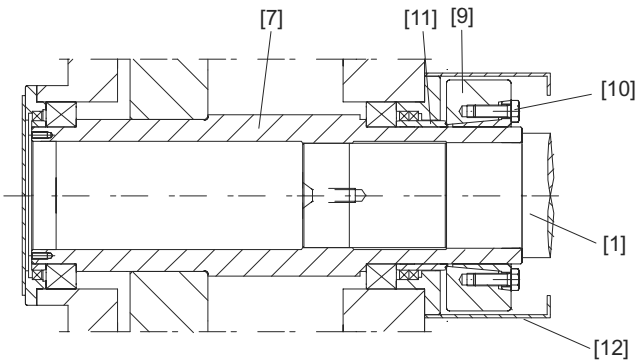

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Figure 23: Mounted horizontal gear unit with shrink-disc connection

[1] Customer's shaft
[7] Hollow shaft
[9] Shrink disc
[10] Locking screws
[11] Bushing
[12] Protection cover

Removing the shrink disc

Shrink disc opposite to customer's side of machine shaft

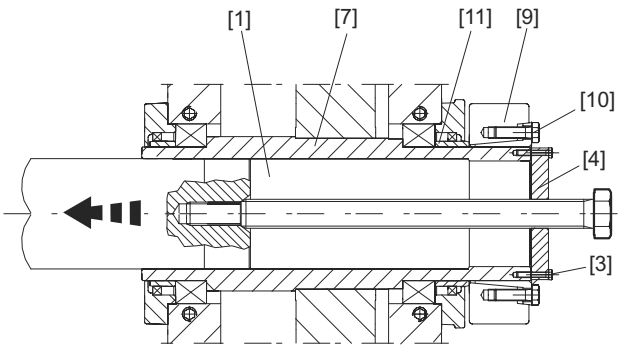

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Figure 24: Removing of horizontal gear unit with shrink disc connection

[1] Customer's shaft
[4] End plate
[3] End plate screws
[9] Shrink disc
[7] Hollow shaft
[10] Locking screws
[11] Bushing

Shrink disc on customer's side of machine shaft

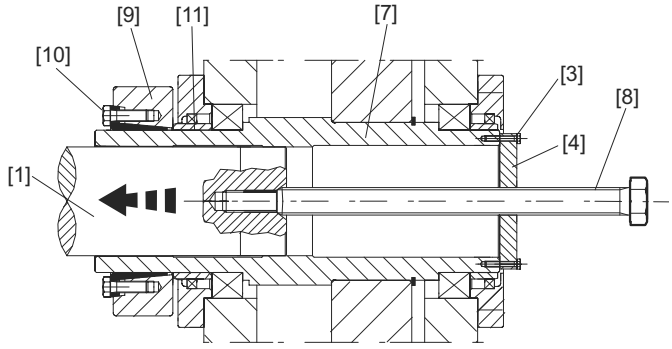

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Figure 25: Removing of horizontal gear unit with shrink disc connection

[1] Customer's shaft
[4] End plate
[2] Threaded rod
[3] End plate screws
[7] Hollow shaft
[8] Ejector screw
[9] Shrink disc
[10] Locking screws
[11] Bushing

- 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 of shrink discs are used.

4.8 Mounting a motor with motor adapter

Motor adapters [1] are available for mounting IEC motors of sizes 132 to 355 to industrial gear units of the M series.

For assembly clearance between motor shaft end and shaft end of the gear unit, please refer to chapter "5.2 coupling" or to a separate coupling manual.
The clearance can be checked by opening the inspection cover of the motor adapter.

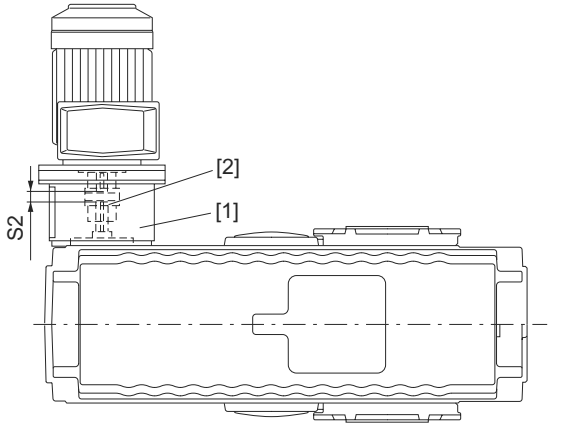

Figure 26: Mounting a motor with motor adapter

[1] Adapter
[2] Coupling

For mounting couplings [2], refer to the notes in Sec. "Mounting of couplings."

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 °C - 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

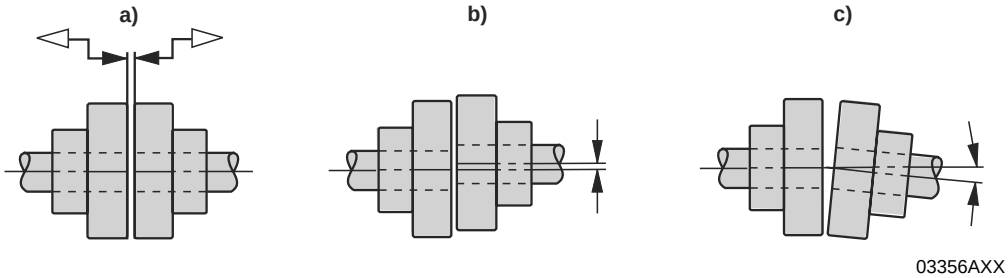

Figure 27: Clearance and misalignment when mounting the coupling

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

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 ($a_1 - a_2$).

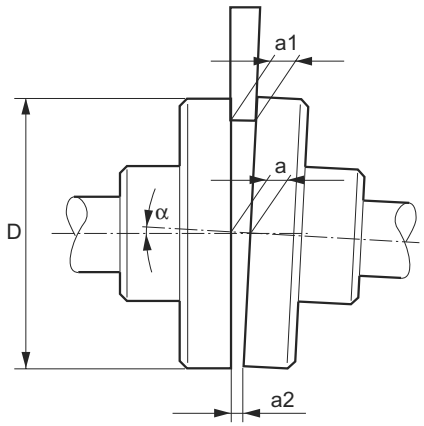

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Figure 28: Measuring angular misalignment using a feeler gauge

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.

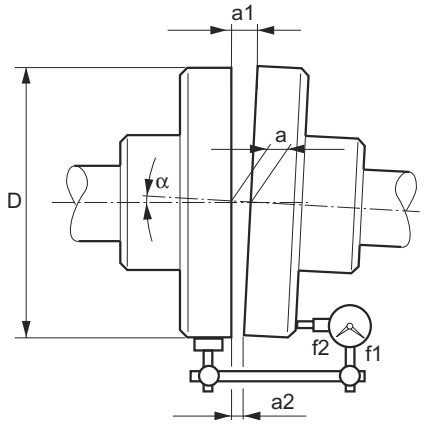

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Figure 29: Measuring angular misalignment using a micrometer dial

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 straight-edge. 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.

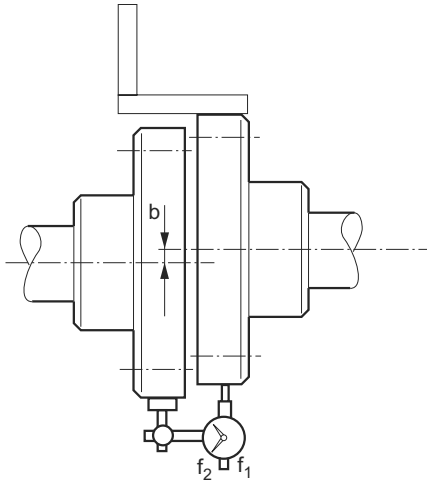

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Figure 30: Measuring offset misalignment using straight-edge and micrometer dial

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").

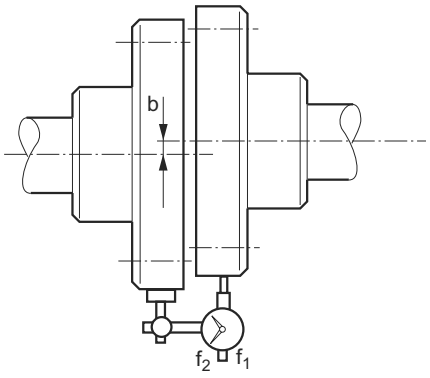

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Figure 31: Measuring offset misalignment using a micrometer dial

5.2 Mounting of couplings

ROTEX coupling

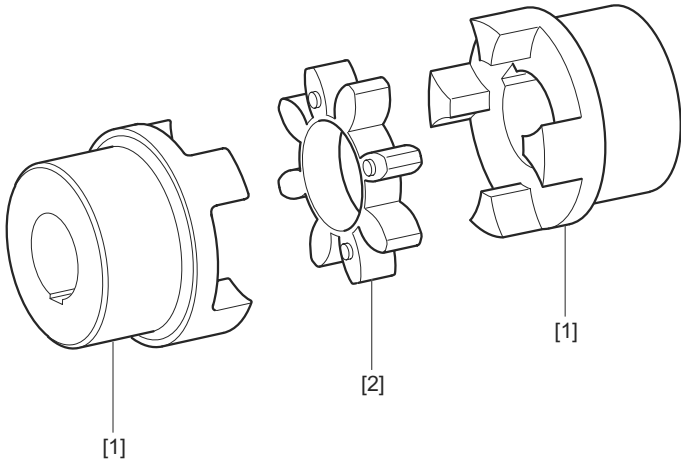

Figure 32: Design of the ROTEX coupling

[1] Coupling hub
[2] Ring gear

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

Mounting the coupling halves onto the shaft

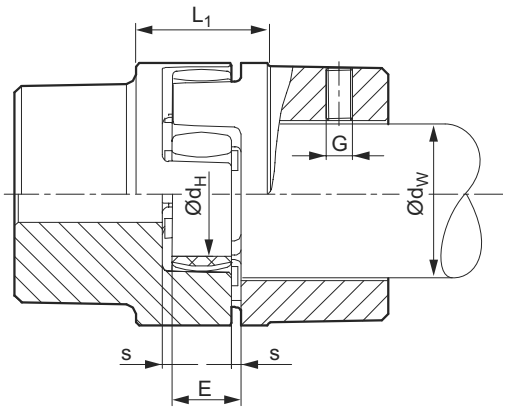

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Figure 33: Mounting dimensions of the ROTEX coupling

Coupling size	Mounting dimensions						Locking screw	
	E [mm]	s [mm]	d_H [mm]	d_W [mm]	L_1 (Alu/GG/GGG) [mm]	L_1 (steel) [mm]	G	Tightening torque [Nm]
14	**13**	1.5	10	7	-	-	M4	2.4
19	**16**	2	18	12	26	-	M5	4.8
24	**18**	2	27	20	30	-	M5	4.8
28	**20**	2.5	30	22	34	-	M6	8.3
38	**24**	3	38	28	40	60	M8	20
42	**26**	3	46	36	46	70	M8	20
48	**28**	3.5	51	40	50	76	M8	20
55	**30**	4	60	48	56	86	M10	40
65	**35**	4.5	68	55	63	91	M10	40
75	**40**	5	80	65	72	104	M10	40
90	**45**	5.5	100	80	83	121	M12	69
100	**50**	6	113	95	92	-	M12	69
110	**55**	6.5	127	100	103	-	M16	195
125	**60**	7	147	120	116	-	M16	195
140	**65**	7.5	165	135	127	-	M20	201
160	**75**	9	190	160	145	-	M20	201
180	**85**	10.5	220	185	163	-	M20	201

STOP

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

Nor-Mex coupling, types G and E

The low-maintenance Nor-Mex couplings types G and E are torsionally flexible couplings capable of compensating axial, angular, and radial shaft misalignments. Torque is transmitted via an elastic element with high damping properties, which is also oil and heat resistant. The couplings can be used for either direction of rotation and can be mounted in any position. The design of the Nor-Mex coupling type G allows to replace the elastic element [5] without movement of the shafts.

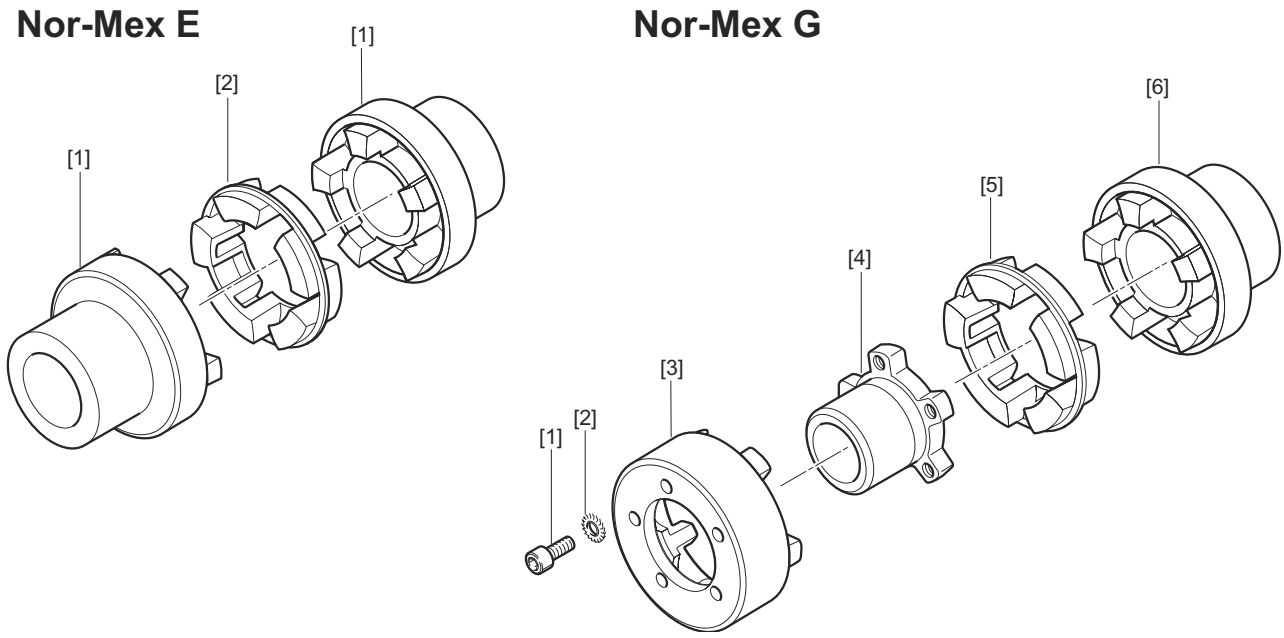

Figure 34: Design of the Nor-Mex E / Nor-Mex G coupling

[1] Coupling hub
[2] Elastic element

[1] Socket head screw
[2] Washer
[3] Claw ring
[4] Flange hub
[5] Elastic element
[6] Coupling hub

Mounting instructions, mounting dimensions for Nor-Mex G couplings

After having mounted the coupling halves, ensure that the recommended play (dimension S_2 for type G, dimension S_1 for type E) and the overall length (dimension L_G for type G and dimension L_E for type E) corresponds with the dimensions given in the following tables. Accurate alignment of the coupling (→ Sec. 'Mounting tolerances') ensures long service life.

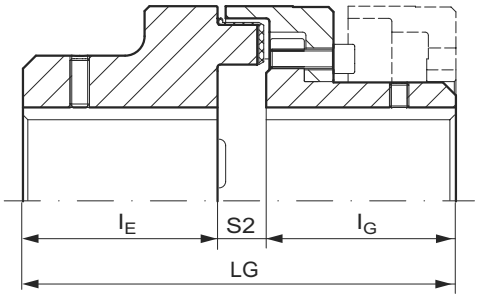

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Figure 35: Mounting dimensions of the Nor-Mex G coupling

Nor-Mex G Coupling size	Mounting dimensions				Weight [kg]
	I_E [mm]	I_G [mm]	L_G [mm]	Permitted tolerance S_2 [mm]	
82	40	40	92	12±1	1.85
97	50	49	113	14±1	3.8
112	60	58	133	15±1	5
128	70	68	154	16±1	7.9
148	80	78	176	18±1	12.3
168	90	87	198	21±1.5	18.3
194	100	97	221	24±1.5	26.7
214	110	107	243	26±2	35.5
240	120	117	267	30±2	45.6
265	140	137	310	33±2.5	65.7
295	150	147	334	37±2.5	83.9
330	160	156	356	40±2.5	125.5
370	180	176	399	43±2.5	177.2
415	200	196	441	45±2.5	249.2
480	220	220	485	45±2.5	352.9
575	240	240	525	45±2.5	517.2

Mounting dimensions of the Nor-Mex E coupling

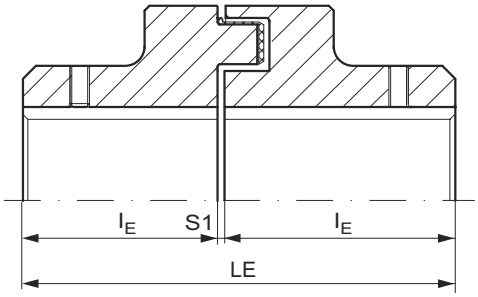

Figure 36: Mounting dimensions of the Nor-Mex E coupling

Nor-Mex E Coupling size	Mounting dimensions			
	l_E [mm]	L_E [mm]	Permitted tolerance S_1 [mm]	Weight [kg]
67	30	62.5	2.5± 0.5	0.93
82	40	83	3± 1	1.76
97	50	103	3± 1	3.46
112	60	123.5	3.5± 1	5
128	70	143.5	3.5± 1	7.9
148	80	163.5	3.5± 1.5	12.3
168	90	183.5	3.5± 1.5	18.4
194	100	203.5	3.5± 1.5	26.3
214	110	224	4± 2	35.7
240	120	244	4± 2	46.7
265	140	285.5	5.5± 2.5	66.3
295	150	308	8± 2.5	84.8
330	160	328	8± 2.5	121.3
370	180	368	8± 2.5	169.5
415	200	408	8± 2.5	237
480	220	448	8± 2.5	320
575	240	488	8± 2.5	457

Mounting tolerances

Offset misalignment **Angular misalignment**

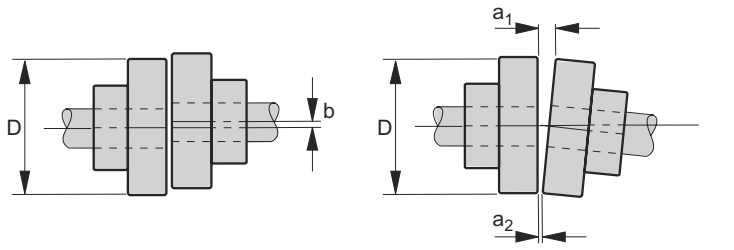

Figure 37: Mounting tolerances

The mounting tolerances specified in the following table apply to elastic Nor-Mex and ROTEX couplings.

Outside diameter D [mm]	Mounting tolerances [mm]					
	$n < 500\ min^{-1}$		$n: 500 - 1500\ min^{-1}$		$n > 1500\ min^{-1}$	
	$a_1 - a_2$	b	$a_1 - a_2$	b	$a_1 - a_2$	b
≤ **100**	0.05	0.05	0.04	0.04	0.03	0.03
100 < D ≤ 200	0.06	0.06	0.05	0.05	0.04	0.04
200 < D ≤ 400	0.12	0.10	0.10	0.08	0.08	0.06
400 < D ≤ 800	0.20	0.16	0.16	0.12	0.12	0.10

$a_1 - a_2$ = max. angular misalignment

b = max. offset misalignment

Mounting of torsionally rigid GM, GMD, and GMX couplings

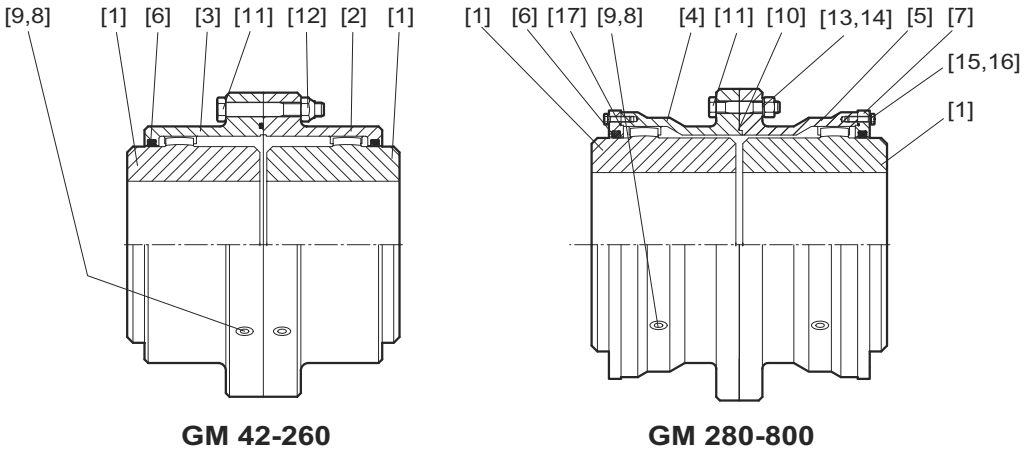

Figure 38: Design of the GM coupling

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

- 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 (dimension "a" → Sec. "Shaft distance, tightening torque").
- Align both axes and check the permitted values using a dial indicator. The mounting tolerances (→ Sec. "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 (→ Sec. "Shaft distance, 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

Offset misalignment **Angular misalignment**

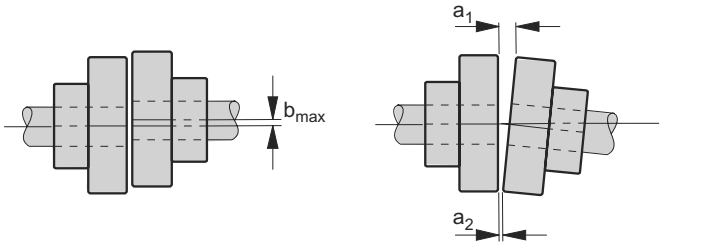

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Figure 39: Mounting tolerances of the GM coupling

Coupling type	Mounting tolerances [mm]									
	n < 250 min^{-1}		n: 250 -500 min^{-1}		n: 500-1000min^{-1}		n: 1000-2000min^{-1}		n: 2000-4000min^{-1}	
	$a_1 - a_2$	b_{max}	$a_1 - a_2$	b_{max}	$a_1 - a_2$	b_{max}	$a_1 - a_2$	b_{max}	$a_1 - a_2$	b_{max}
GM42 ... 90	0.25	0.25	0.25	0.25	0.25	0.25	0.2	0.15	0.1	0.08
GM100 ... 185	0.6	0.5	0.6	0.5	0.35	0.25	0.2	0.15	0.1	0.08
GM205 ... 345	1	0.9	0.75	0.5	0.35	0.25	0.2	0.15	-	-
GM370 ... 460	2	1.5	1.1	0.8	0.5	0.4	0.25	0.2	-	-
GM500 ... 550	2.2	1.5	1.1	0.8	0.5	0.4	0.25	0.2	-	-

$a_1 - a_2$ = max. angular misalignment

b_{max} = max. offset misalignment

Shaft distance, tightening torque

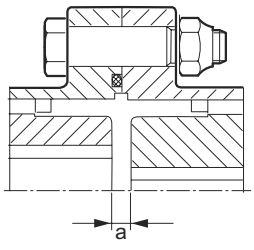

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Figure 40: Shaft distance "a"

Coupling type	42	55	70	90	100	125	145	165	185	205	230	260	280
Shaft distance a [mm]	61	61	62	82	82	82	102	103	103	123	123	123	163
Tightening torque screw [Nm]	8	20	68	108	108	230	230	230	325	325	325	375	375

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 SEW-EURODRIVE if you want to alter the blocking direction!**

The maintenance-free type backstop is a centrifugally operated backstop with sprags that lift off. Once the lift-off speed is reached, the sprags completely lift off from the contact surface of the outer ring. The backstop is lubricated with gear oil. An arrow on the gear unit housing indicates the permitted direction of rotation [1] (→ following figure).

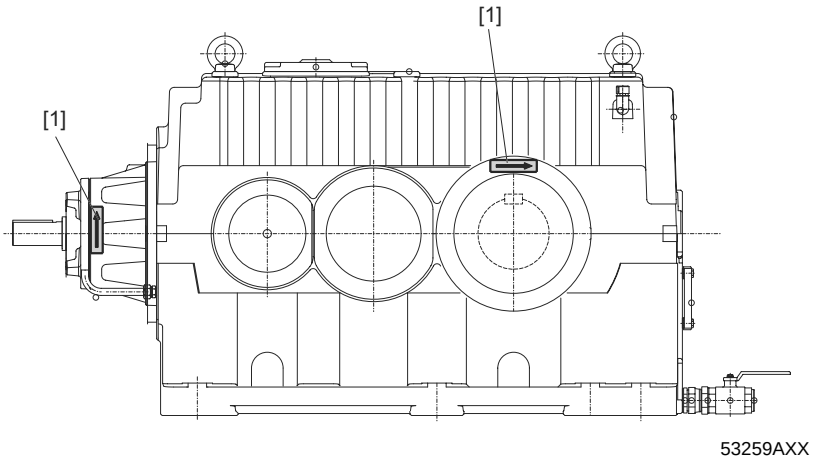

Figure 41: Rotation direction with backstop

5.4 Installation with steel frame

For industrial gear units of the M series in horizontal mounting position (M2P.., M3P.., M4P.., M3R.., M4R.., M5R..), SEW-EURODRIVE supplies preassembled drive packages on a steel frame (swing base or base frame).

Swing base

A swing base is a steel frame [1] that accommodates gear unit, (fluid) coupling and motor (and brake, if required) such as

- hollow shaft gear unit or
- solid shaft gear unit with flange coupling on the output shaft

The swing base [1] is supported by a torque arm [2] (→ Sec. "Torque arm").

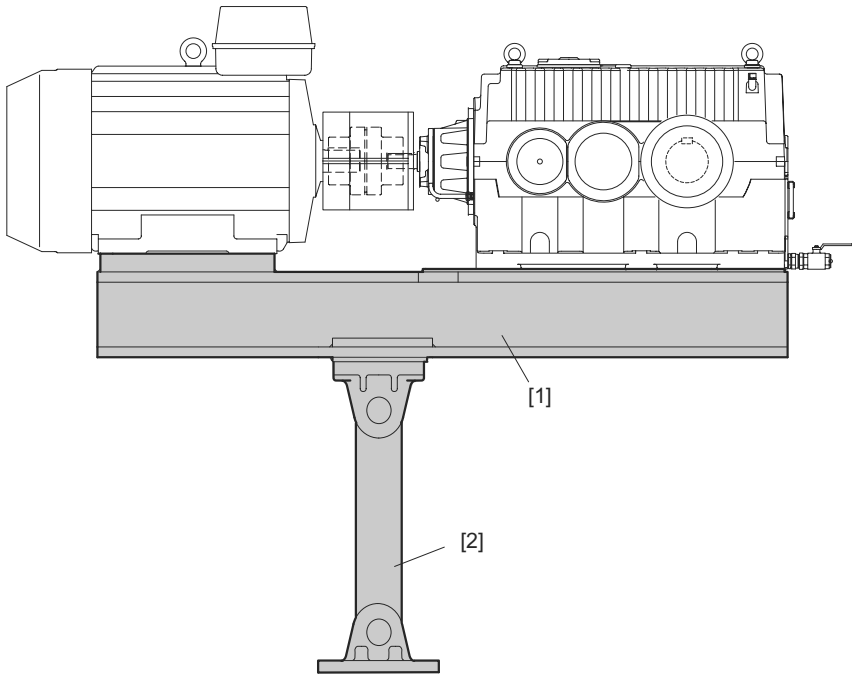

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Figure 42: Industrial gear unit of the M.. series on swing base with torque arm

[1] Swing base
[2] Torque arm

It is essential that

- **the system is dimensioned in such a way that the torque of the torque arm can be absorbed (→ Sec. "Gear unit foundation")**
- **that the swing base is not deformed during installation (hazard of damage to gear unit and coupling)**

Base frame

A base frame is a steel frame [1] that accommodates gear unit, (fluid) coupling and motor (and brake, if required). The steel frame is supported by several foot mountings [2]. Such a frame is usually used for solid shaft gear units with elastic coupling on the output shaft.

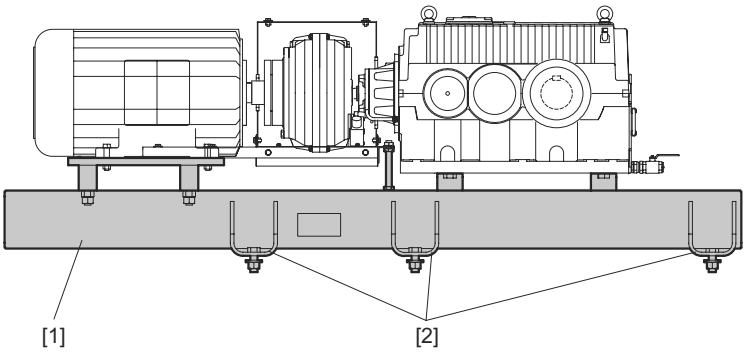

Figure 43: M.. industrial gear units on base frame with foot mounting

[1] Base frame
[2] Foot mounting

It is essential that

- **the support structure of the foot mounting is adequately dimensioned and rigid (→ Sec. "Gear unit foundation")**
- **that the base frame is not deformed through incorrect alignment (hazard of damage to gear unit and coupling)**.

5.5 Torque arm

Mounting options

A torque arm is available as option to be mounted directly to the gear unit or to the swing base.

Basic elements

The torque arm consists of 3 main parts (→ Figure 44/45)

[5409] Gear unit anchor plate

[5410] Anchoring rod

[5413] Foundation anchor plate

Directly mounted to the gear unit

The torque arm can be directly mounted to the gear unit both in the case of tensile strain and compressive stress. Additional strain or stress to the gear unit can be caused by

- eccentricity during operation
- expansion of the driven machine due to heat.

To avoid such strain, the anchoring rod [5410] is equipped with double connection elements that allow sufficient lateral and radial play [1].

M2P../M3R..

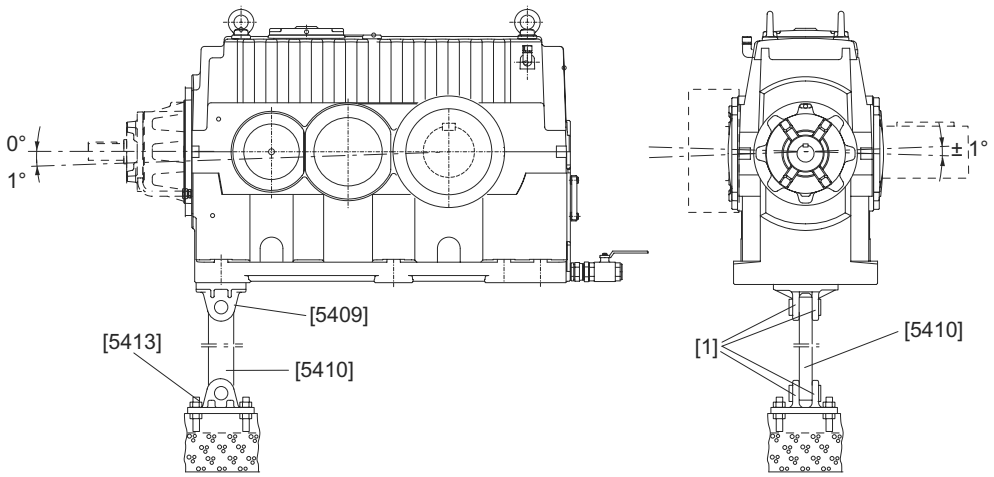

Figure 44: Torque arm directly mounted to the gear unit

[1] Sufficient play
[5409] Anchor plate
[5410] Anchoring rod
[5413] Anchor plate

M3P../M4P../M4R../ M5R..

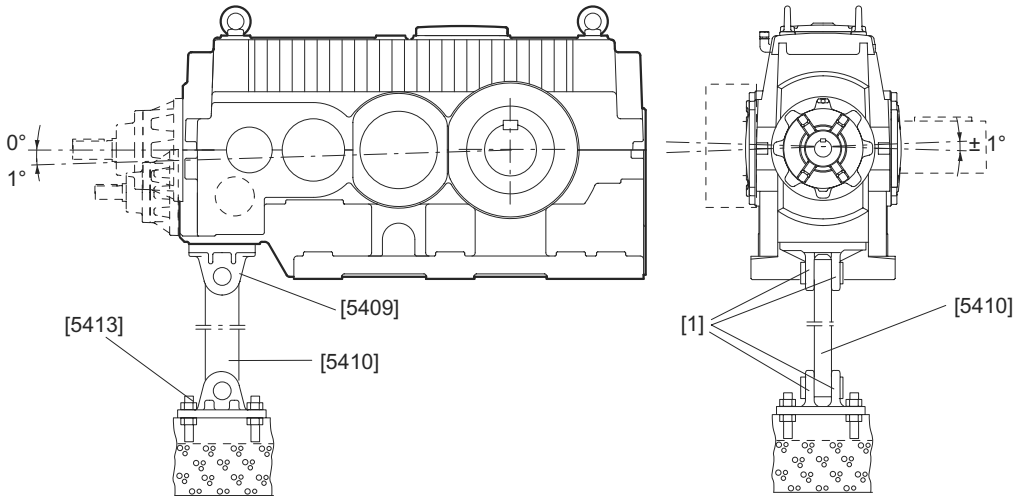

Figure 45: Torque arm directly mounted to the gear unit

[1] Sufficient play
[5409] Anchor plate
[5410] Anchoring rod
[5413] Anchor plate

It is essential that there is sufficient play [1] between anchoring rod [5410] and gear unit anchor plate [5409] and between anchoring rod [5410] and foundation anchor plate [5413]. This way, no bending force can act on the torque arm and the bearings of the output shaft are not subjected to additional stress.

Foundation for the torque arm

To build the foundation for the torque arm directly mounted to the gear unit or mounted to the swing base of the motor, do the following:

- Place the supporting girders horizontally in their fixed locations. Embody the supporting girders in the base concrete (A).
- Reinforce the concrete base (A) and interlock using steel rods. The base concrete (A) must withstand the same load as the weld joints of the foundation screws.
- After having mounted the torque arm, carry out the grouting and bond it to the base concrete with steel rods.

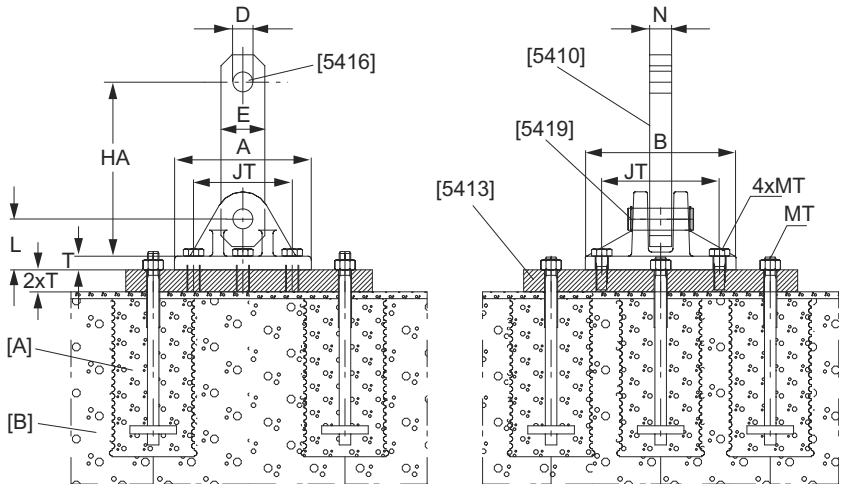

Figure 46: Foundation for the torque arm

[A] Concrete base
[B] Grouting
[5410] Anchoring rod
[5413] Foundation anchor plate
[5416] Locking ring
[5419] Anchoring bolt

All parts except A and B are included in the scope of delivery.

When ordening the torque arm, the dimension HA (→ table below) can be selected between HA_{min} and HA_{max}. If HA has to be longer than HA_{max}, the torque arm will be of special design.

Gear unit size	A	B	T	JT	∅ D H8	MT	E	N	L	HA_{min}	HA_{max}
50	172	172	15	125	32	M20	75	32	50	125	950
60 - 90	240	240	20	180	45	M24	90	45	70	175	1070

5.6 Mounting of V-belt drive

A V-belt drive is used when the overall gear ratio needs to be adjusted. The standard scope of delivery includes motor bracket, belt pulleys, V-belts and belt guard.

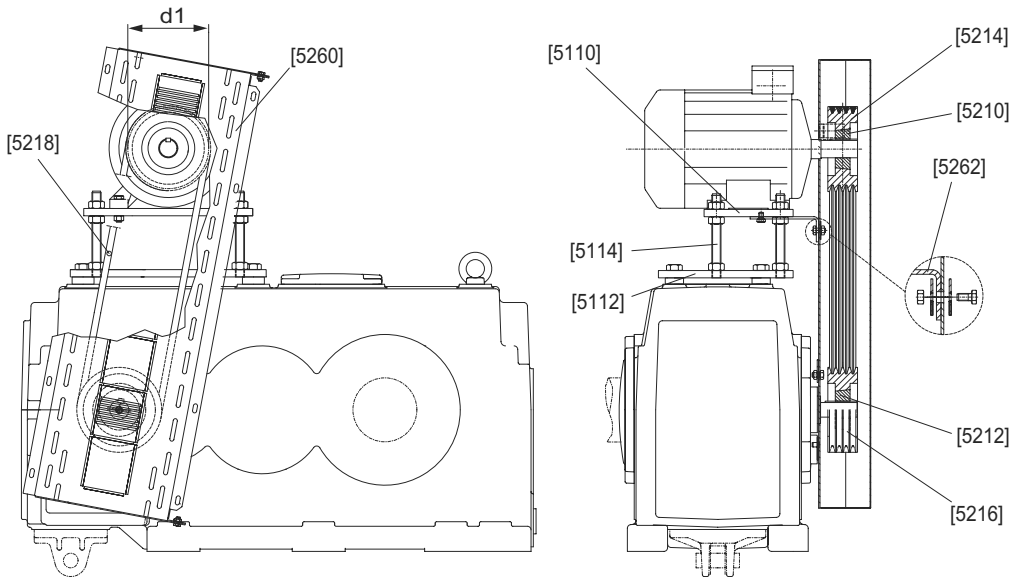

Figure 47: Complete V-belt drive

[5110, 5112] Motor bracket
[5114] Angle bracket
[5210, 5212] Taper bushing
[5214, 5216] Belt pulleys
[5218] V-belt
[5260] Belt guard cover

Installation

- Mount the motor on the motor bracket (retaining screws not included in the scope of delivery).
- Attach the back plate of the belt guard cover [5260] to the motor bracket [5112, 5114] of the gear unit using screws. Take into account the desired direction of the opening of the belt guard cover [5260]. To adjust the tension of the V-belt, loosen the upper screw [5262] of the backplate of the belt guard cover.
- **Installing the taper bushings [5210, 5212]:**
  - Mount the belt pulleys [5214, 5216] onto motor and gear shaft as closely as possible to the shaft shoulder.
  - Degrease taper bushings [5210, 5212] and belt pulleys [5214, 5216]. Place the taper bushings into the belt pulleys [5214, 5216]. Make sure that the boreholes are aligned.
  - Grease the retaining screws and screw them into the thread of the belt pulley hub.
  - Clean motor and gear shaft and insert the complete belt pulleys [5214, 5216].
  - Tighten the screws. Tap slightly against the sleeve and retighten the screws. Repeat this procedure several times.

– Make sure that the belt pulleys [5214, 5216] are aligned accurately. Check correct alignment using a steel ruler making contact at four points (→ following figure).

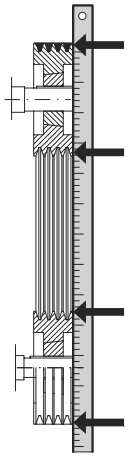

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Figure 48: Alignment check of belt pulleys

– Fill the holes with grease to exclude dirt.

- Draw V-belts [5218] over the pulleys [5214, 5216] and tighten the belts using the adjustment screws in the motor bracket (→ Sec. V-belt tightening).
- The maximum permissible error is 1 mm per 1000 mm span of the V-belt. This way, maximum power transmission is ensured and excessive loads on the gear and motor shafts can be prevented.
- **Check belt tension using a V-belt tension meter:**
  – Measure the length of the V-belt span (= free V-belt length)
  – Measure the perpendicular force causing a 16 mm sag per 1000 mm of the belt. Compare the measured values with those listed in Sec. "V-belt tightening."
- Tighten the lock screws for the motor rack and the belt guard rear plate.
- Mount the belt guard cover using the hinge pins. Secure the hinge pins.

V-belt tightening

V-belt profile	∅ d_1 [mm]	Force required to offset the V-belt by 16 mm per 1000 mm span length [N]
SPZ	56 - 95 100 - 140	13 - 20 20 - 25
SPA	80 - 132 140 - 200	25 - 35 35 - 45
SPB	112 - 224 236 - 315	45 - 65 65 - 85
SPC	224 - 355 375 - 560	85 - 115 115 - 150

Limitations

The following limitations for the use of V-belt drives shall apply:

1. V-belt speed:

   The V-belt speed determined by the manufacturer of cast-iron V-belt pulleys is:

   v_{max} = 35 m/s
2. Usually, a V-belt drive does not require extra inspection if the ambient temperature does not exceed 70 °C. V-belt drives used at temperatures exceeding 70 °C should be checked regularly at least every 1500 hours.

5.7 Oil heater

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

Purpose and basic design

The oil heater consists of 3 basic parts (→ Figure 49)

1. Resistor element in the oil bath ("Oil heater") with terminal box
2. Temperature sensor
3. Thermostat

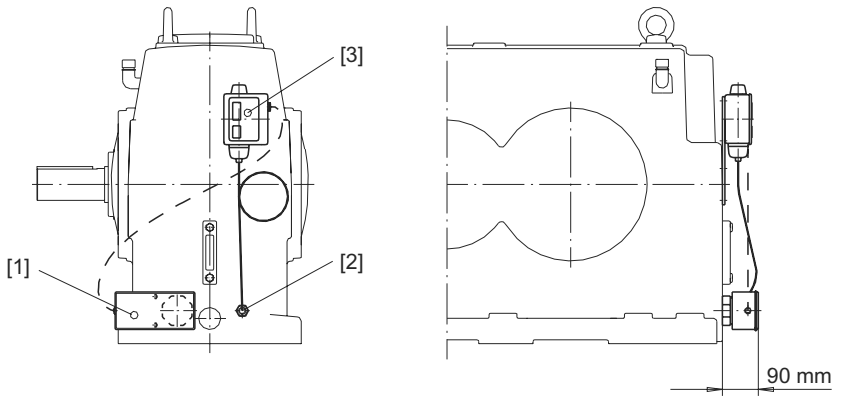


Figure 49: Oil heater M.. horizontal gear units

[1] Oil heater
[2] Temperature sensor
[3] Thermostat

Activation / deactivation behaviour

The oil heater

- Is activated when the factory set temperature is reached. This temperature setpoint depends on the following:
  - for splash/bath lubricated units: on the pour point of the used oil
  - for pressure lubricated units: on the temperature at which the oil viscosity is maximal 2000 cSt

	Setpoint for splash/bath lubrication [°C]					
ISO VG	**680**	**460**	**320**	**220**	**150**	**100**
Mineral oil	-7	-10	-15	-20	-25	-28
Synthetic oil		-30	-35	-40	-40	-45

	Setpoint for pressure lubrication [°C]					
ISO VG	**680**	**460**	**320**	**220**	**150**	**100**
Mineral oil	+25	+20	+15	+10	+5	
Synthetic oil		+15	+10	+5	0	-5

- Is deactivated when the set temperature is exceeded by 8 to 10 degrees C.

The thermostat and the oil heater are normally installed to the gear unit and are ready to operate but without electrical connections. Therefore, the following has to be done before startup:

1. Connect the resistor element ("Oil heater") with the power supply
2. Connect the thermostat with the power supply

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

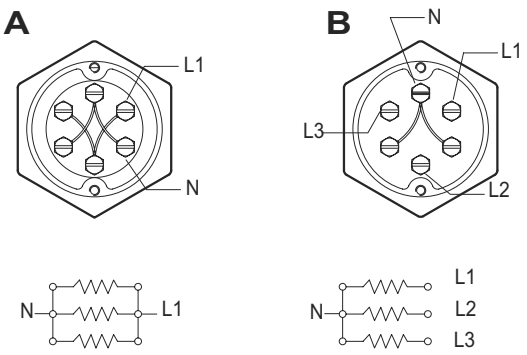
- **Check for correct electrical connection according to the ambient conditions (→ Sec. "Electrical connection")**
- **Check for correct oil grade and oil volume of the gear unit (→Nameplate)**

There is a potential danger of explosion if the oil heater is not connected correctly or is operated above the oil surface!

Technical data resistor element

Gear unit size	M2P .., M3R Power [W]	M3P Power [W]	M4P.., M4R.., M5R.. Power [W]	Voltage [V]
50	1000	1000	1500	230/400
60	1500	1000	1500	230/400
70	1500	2000	2000	230/400
80	2000	1500 + 1500 (2 heating rods)	2330	230/400
90	2330	1500 + 1500 (2 heating rods)	2330	230/400

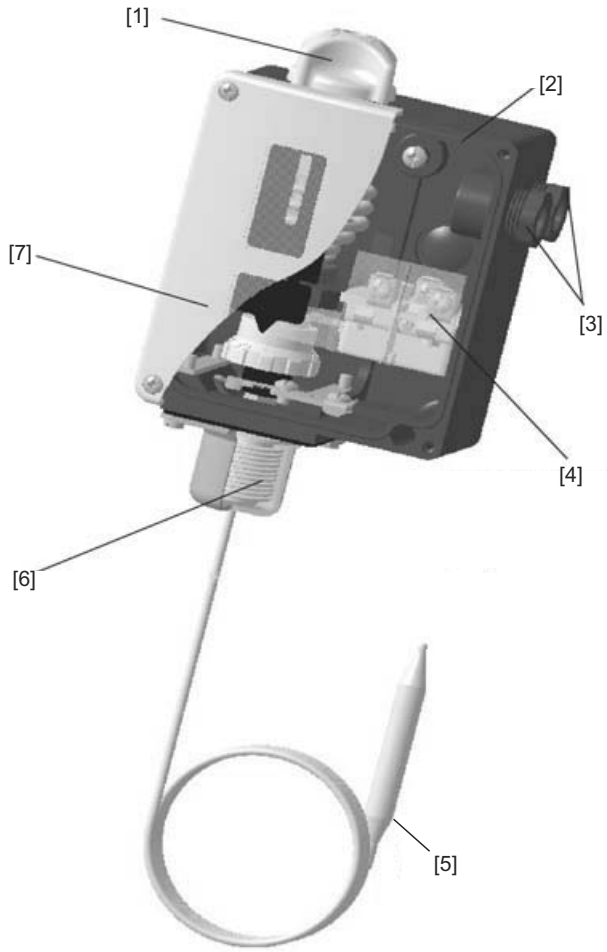
Electrical connection resistor element



51693AXX

Figure 50: Electrical connection options for the oil heater (A: single-phase / B: three-phase)

Basic design thermostat

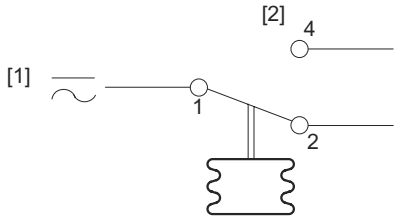
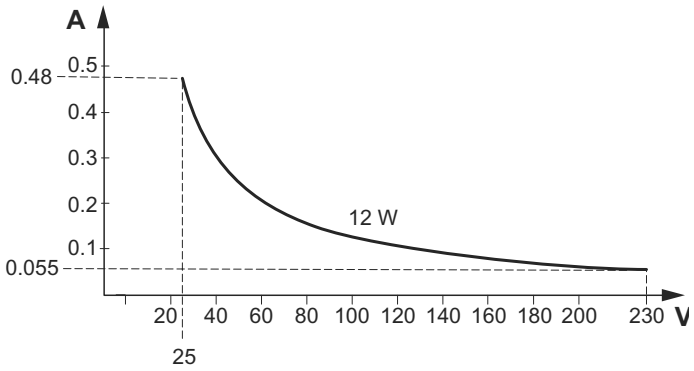


53993AXX

Figure 51: Basic design thermostat

[1] Setting range knob
[2] IP66 enclosure (units with external reset IP54)
[3] 2 x PG 13.5 cable diameter 6 mm → 14 mm
[4] SPDT contact system. Exchangeable
[5] Capillary tube length up to 10 m
[6] Stainless steel bellows
[7] Polyamide cover

Basic design thermostat

	RT thermostats
Ambient temperature	-50 °C to 70 °C
Contact system	 [1] Line [2] SPDT
Contact load **Contact material:** **AgCdO**	**Alternating current:** AC-1: 10 A, 400 V AC-3: 4 A, 400 V AC-15: 3A, 400 V **Direct current:** DC-13: 12 W, 230 V 
Cable entry	2 PG 13.5 for 6 -14 mm diameter cable
Enclosure	IP66 acc. to IEC 529 and EN 60529. Units with external reset IP54. Thermostat housing is made of bakelite acc. to DIN 53470, the cover is made of polyamid.

In the following cases, a contactor must be used:

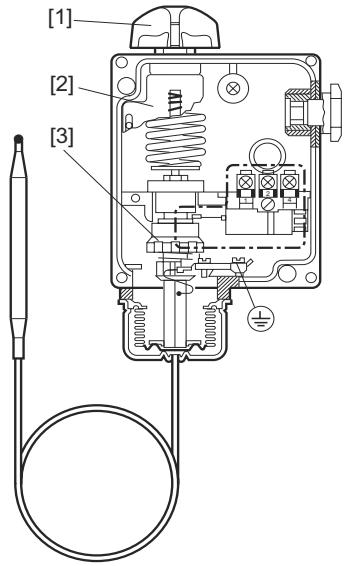
- a 3-phase voltage supply is used
- 2 heating rods are used (e.g. M3P…80)
- current ratings exceed nominal values of the thermostat

Adjusting the setpoint

The setpoint is normally set at the factory. For adjustments, the following process has to be followed:

The range is set by using the setting knob [1] while at the same time reading the main scale [2]. Tools must be used to set thermostats equipped with a seal cap. The differential is set by the differential disc [3]

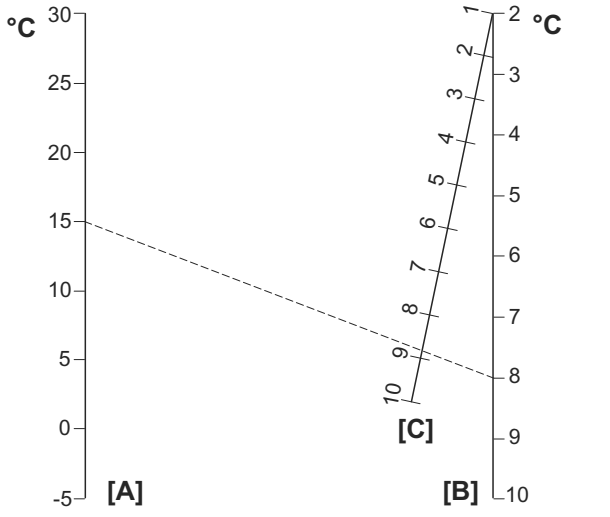
The size of the obtained differential can be established by comparing the set main scale value and the scale value on the differential disc with the help of the nomogram for the thermostat concerned.



53994AXX

Figure 52: design thermostat

[1] Setting knob
[2] Main scale
[3] Differential setting disc



53992AXX

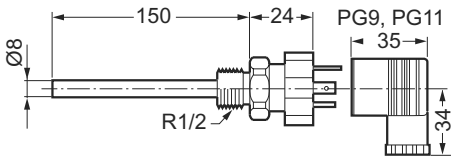
Figure 53: Nomogrcem for obtained differential

[A] Range setting
[B] Obtained differential
[C] Differential setting

5.8 Temperature sensor PT100

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

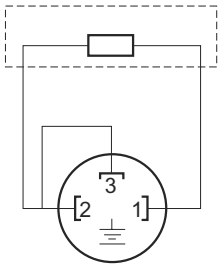
Dimensions



50533AXX

Figure 54: Temperature sensor PT100

Electrical connection



50534AXX

Figure 55: Electrical connection temperature sensor PT100

Technical data

- Sensor tolerance ± (0.3 + 0.005 × t), (corresponds to DIN IEC 751 class B), t = oil temperature
- Plug connector DIN 43650 PG9 (IP65)
- The tightening torque for the retaining screw in the back of the plug connector for electrical connection is 25 Nm.

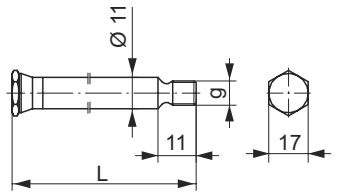
5.9 SPM adapter

SPM adapters are available for measuring the shock pulses of the gear unit bearings. Shock pulses are measured using shock pulse sensors attached to the SPM adapter.

Nipple 32000 and cover 81025

g = M8

L = 24, 113, 202, 291



53871AXX

Figure 56: SPM adapter

Sensor to be wired 40000 and fitting 13008

g = M8

L = 17, 106, 195, 284

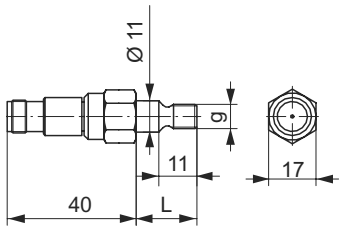


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Figure 57: SPM adapter

Mounting position of SPM - adapter

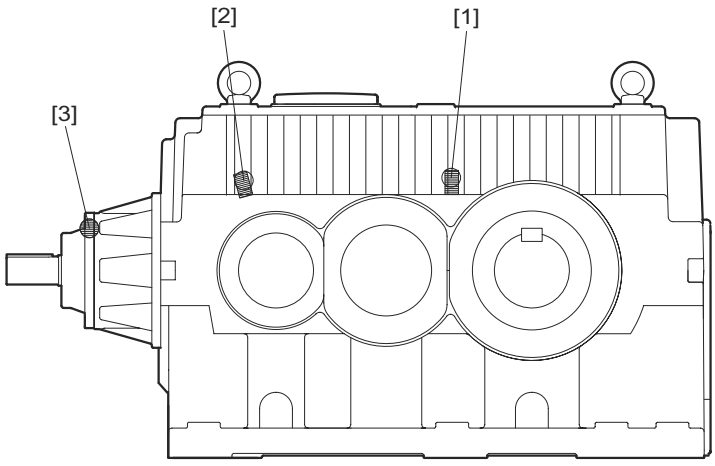

Figure 58: M2P.../M3R... Position SPM - adapter

M2P../M3R..

Nipples [1] and [2] are on both sides of the gear unit.

Nipple [3] only for bevel-helical gear units (M.R..)

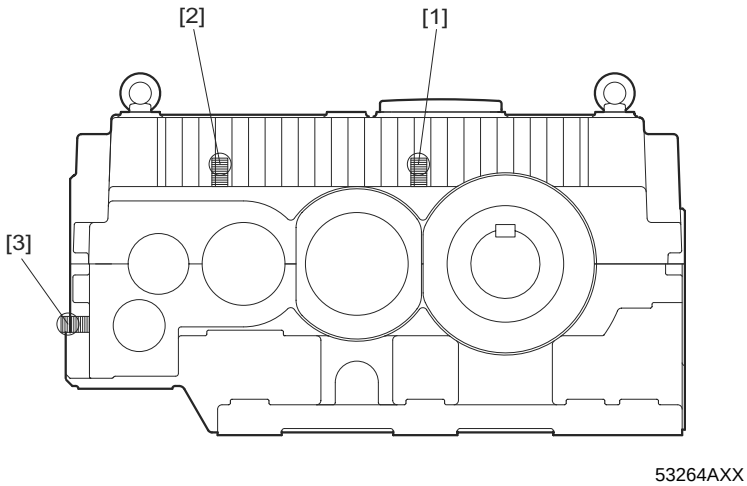

Figure 59: M3P.../M4P ..Position SPM - adapter

M3P../M4P..

Nipples [1] and [2] are on both sides of the gear unit.

Nipple [3] only for M4P.. gear units on both sides

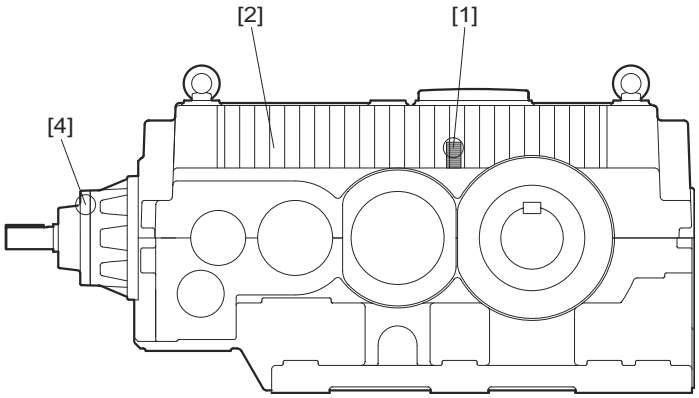

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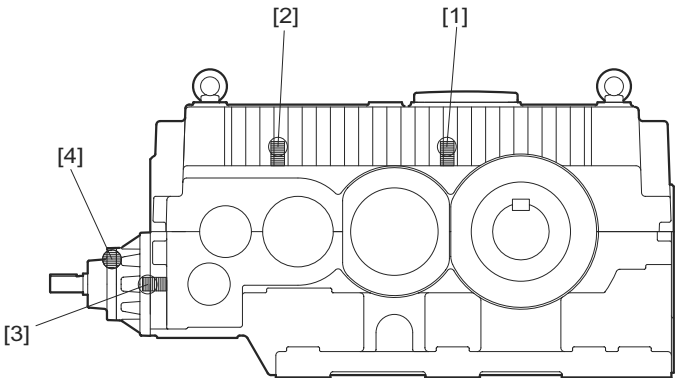
Figure 60: M4R.. Position SPM - adapter

M4R..

Nipples [1] and [2] are on both sides of the gear unit.



53269AXX

Figure 61: M5R.. Position SPM - adapter

M5R..

Nipples [1], [2] and [3] are on both sides of the gear unit.

Mounting of shock pulse sensor

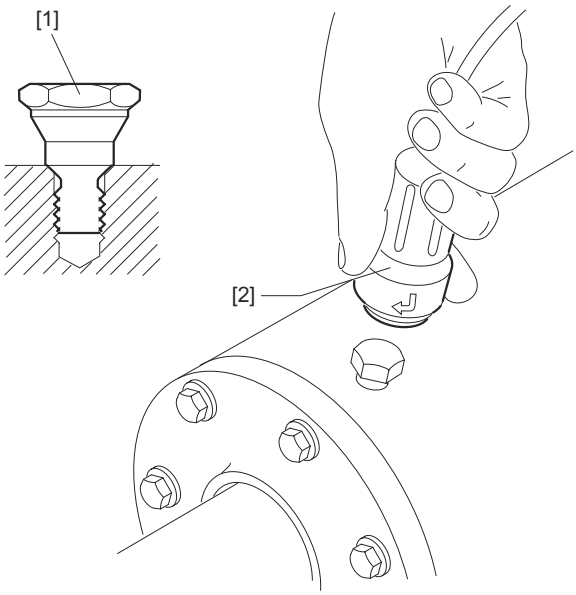


Figure 62: Mounting the shock pulse sensor onto the SPM adapter

[1] SPM adapter
[2] Pulse sensor

- Remove the protection cap of the SPM adapter [1]. Ensure that the SPM adapter [1] is tightened correctly and securely (tightening torque: 15 Nm).
- Mount the shock pulse sensor [2] onto the SPM adapter [1].

5.10 Fan

A fan can be mounted if the projected thermal power of the gear unit is exceeded. The direction of rotation of the gear unit does not influence the operation of the fan.

M2P.., M3P..

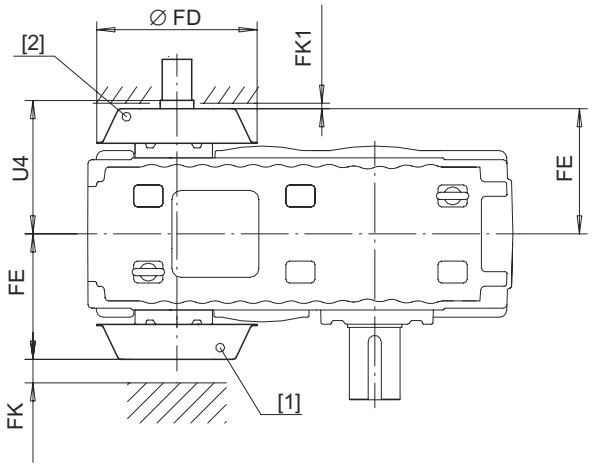


Figure 63: Fan

[1] Fan on the opposite side as the motor
[2] Fan on the HSS

Gear Unit	Fan[1]	$n1_{max}$	U4	∅ FD [mm]	FE	FK_{min}	$FK1_{min}$
M2P50	∅ 315	3000	355	443	326	55	20
M2P60	∅ 315	3000	372	443	343	55	20
M2P70	∅ 400	2350	423	547	394	65	20
M2P80	∅ 400	2350	443	547	414	65	20
M2P90	∅ 400	2350	466	547	437	65	20

1 Outer diameter of the fan

Gear Unit	Fan[1]	$n1_{max}$	U4	∅ FD [mm]	FE	FK_{min}	$FK1_{min}$
M3P50	∅ 315	3000	343	443	314	55	20
M3P60	∅ 315	3000	367	443	338	55	20
M3P70	∅ 400	2350	417	547	388	65	20
M3P80	∅ 400	2350	435	547	406	65	20
M3P90	∅ 400	2350	457	547	428	65	20

1 Outer diameter of the fan

M3R..

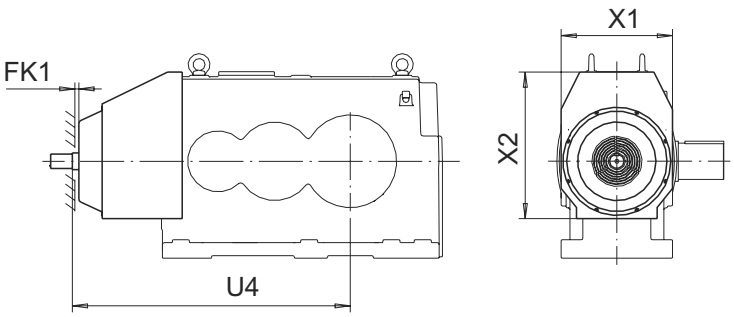


Figure 64: Fan

Gear Unit	Fan[1]	$n1_{max}$	U4	X1	X2	$FK1_{min}$
	[mm]					
M3R50	∅ 315	3000	998	406	537	20
M3R60	∅ 315	3000	1129	460	582	20
M3R70	∅ 400	2350	1278	518	689	20
M3R80	∅ 400	2350	1328	554	729	20
M3R90	∅ 400	2350	1499	598	769	20

1 Outer diameter of the fan

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

5.11 Cooling coil

The cooling coil increases the thermal power of the gear unit by cooling the oil bath.

The cooling coil is a helical pipe with water flowing through it. The cooling coil is located in the oil bath inside the gear unit. The customer must ensure a minimum flow volume as specified in the order documents.

A cooling coil is generally used with splash lubrication:

- in conjunction with a fan if the thermal power of the fan alone is not sufficient
- instead of the fan if a fan cannot be used due to the ambient conditions.

Data required for project planning:

- Cooling water input temperature
- Permitted temperature increase of the cooling water

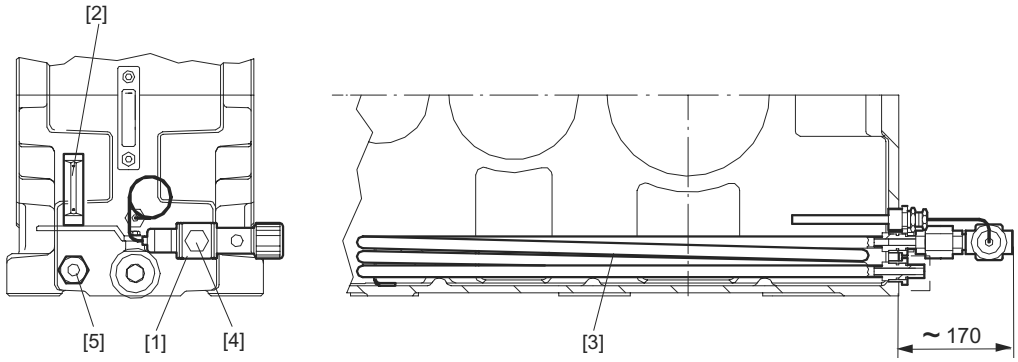


Figure 65: Cooling coil

[1] Thermostatic valve for controlling the flow of water
[2] Thermometer, temperature display range 0 °C ...100 °C
[3] Cooling coil, stainless steel AISI 316
[4] Return water R1/2 (male thread)
[5] Water supply R1/2 (female thread)

6 Pressure Lubrication

For gear units equipped with a separate lubrication system (sometimes in connection with a cooling system) refer also to the separate manual.

6.1 Shaft end pump

The maintenance-free shaft end pump RHP [1] is suited for operation in both directions of rotation..

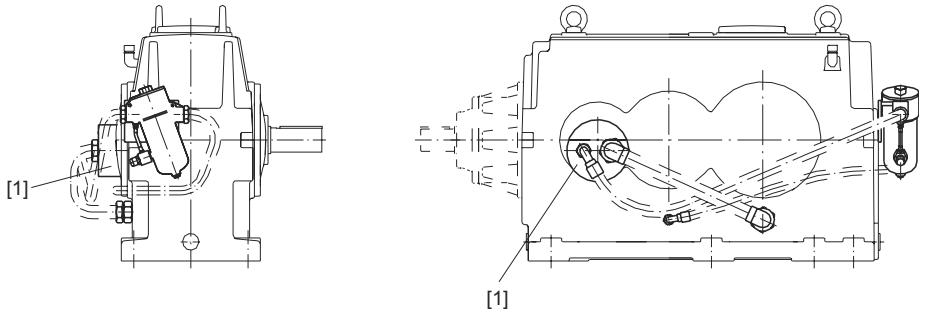


Figure 66: Shaft end pump - Horizontal gear units

For operation with variable input speed, it is essential to consult SEW-EURODRIVE.

The standard scope of delivery includes

- RHP (horizontal) shaft end pump [1]
- instrumentation version "IP" comprising
  - visual pressure gauge (0...10 bars)
  - pressure switch
- piping and tube connections

For a detailed description, please refer to the separate manual.

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:

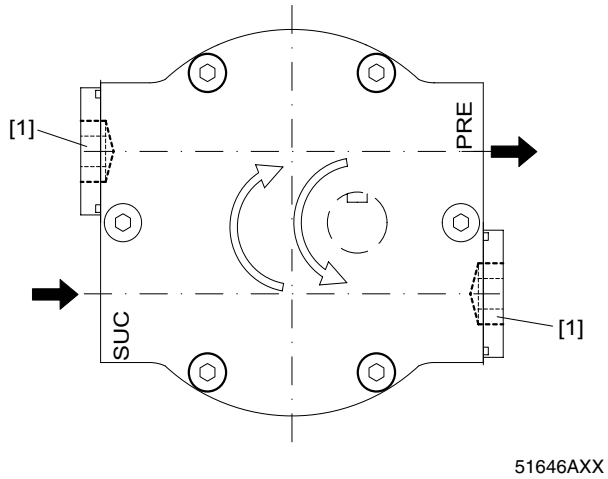


Figure 67: Shaft end pump

[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]!**

6.2 Motor pump

The MHP motor pump [1] is suited for operation in both directions of rotation.

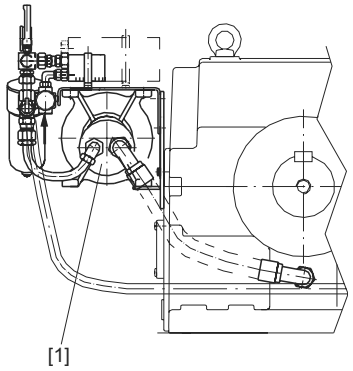


Figure 68: Motor pump

The standard scope of delivery includes

- MHP motor pump comprising
  - AC motor
  - coupling between AC motor and gear wheel pump
  - gear wheel pump
- instrumentation version "IP" comprising
  - visual pressure gauge (0...10 bars)
  - pressure switch
- piping and tube connections
- bracket installed on the gear unit to accommodate the motor pump.

AC motor:

Supply voltage: 220-240 V / 380-420 V, 50 Hz

Instrumentation IP

See shaft end pump

Consult SEW-EURODRIVE in case of deviating supply voltages and/or 60 Hz operation.

For a detailed description, please refer to the separate manual.

Other optional instruments (flow monitor, temperature monitor, ...) and optional equipment (oil filter, ...) are also available. Consult SEW-EURODRIVE.

6.3 External cooling system

For gear units supplied with an oil/water or oil/air cooling system, please refer to the separate manual.

6.4 Customer supplied external cooling and lubrication systems

Genaral

If the customer orders a gear unit for which SEW-EURODRIVE recommends a pressure lubrication or/and an additional cooling system, this chapter provides some guidelines for selecting the components.

First, define

- the required oil volume Q_P the motor pump has to provide
- the required cooling capacity P_L of the oil/water or oil/air cooler

If the gear unit is ordered for a customer-supplied pressure lubrication system, the gear unit must not be taken into operation without the pressure lubrication system.

Selecting the required oil flow for the oil pump Q_P

The minimum required oil flow Q_L can be selected from the following table:

Gear unit size	M2P...	M3P... M3R..	M4P... M4R...	M5R...
	Oil flow in ltr/min			
50	11.0	13.2	15.3	16.7
60	12.8	15.2	17.7	19.3
70	14.5	17.3	20.2	21.9
80	15.9	19.0	22.1	24.1
90	17.5	20.9	24.3	26.4

If a cooling system has to be used, the required oil flow can be calculated with the following formula:

$Q_R = 2{,}3 \times P_L$

with P_L: Power losses to be cooled (→ "Selecting the cooling capacity of the cooler")

Q_L determines the minimum required oil flow for pressure lubrication with or without cooler. If $Q_R < Q_L$, then Q_L has to be used as the required value for the oil flow Q_P.

Selecting the cooling capacity

$$P_L = \left(P_{K1} - \frac{P_T}{2}\right) \times (1 - \eta)$$

P_L	[kW]	= power loss to be cooled
P_{K1}	[kW]	= gear unit running load
P_T	[kW]	= gear unit thermal rating (from catalog)
η		= gear unit efficiency
	M2P	η = 0.97
	M3P, M3R	η = 0.955
	M4P, M4R	η = 0.94
	M5R	η = 0.93

$$Q_R = 2{,}3 \times P_L$$

$$Q_P \geq Q_R$$

Q_R	[ltr/min]	= oil flow needed for cooling the gear unit
Q_P	[ltr/min]	= oil pump output

Choosing the cooling capacity of the oil cooler:

F_L = 1.1 (clean) ... 1.2 (dirty cooling media)

$$P_C \geq F_L \times P_L$$

P_C	[kW]	= cooling rating (see tables 1.2 and 3)
F_L		= safety factor for cooling capacity

We recommend to use the following additional components and instrumentation:

- Oil filter with a minimum filtration degree of 25 µm
- Control switch to check operation of the motor pump, for example using a **pressure switch**
- If cooler is used: Control of oil temperature in the return line of the cooler, for example using a **thermo switch** or a **visual thermometer**

Typical setup pressure lubrication

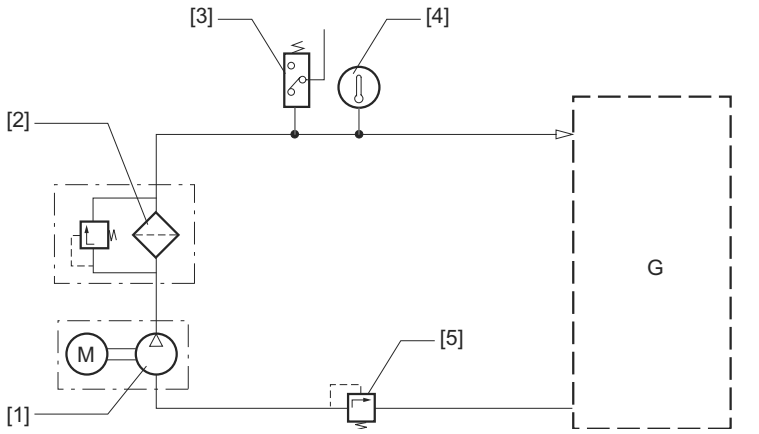


Figure 69: Pressure lubrication

[1] Motor pump
[2] Filter
[3] Pressure switch
[4] Visual thermometer
[5] Pressure relief valve
[G] Gear unit

Typical setup pressure lubrication with oil/water cooler

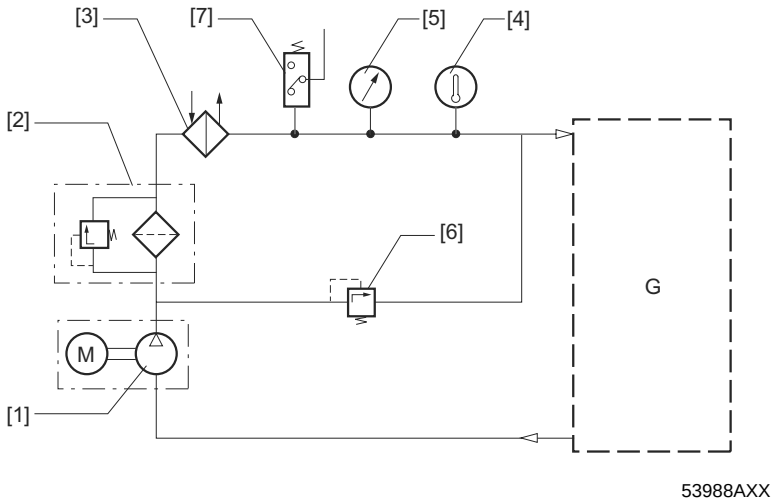


Figure 70: Pressure lubrication with oil/water cooler

[1] Motor pump
[2] Filter
[3] Oil/water cooler
[4] Thermometer
[5] Pressure gauge
[6] Pressure relief valve
[7] Pressure switch
[G] Gear unit

Typical setup pressure lubrication with oil/water cooler

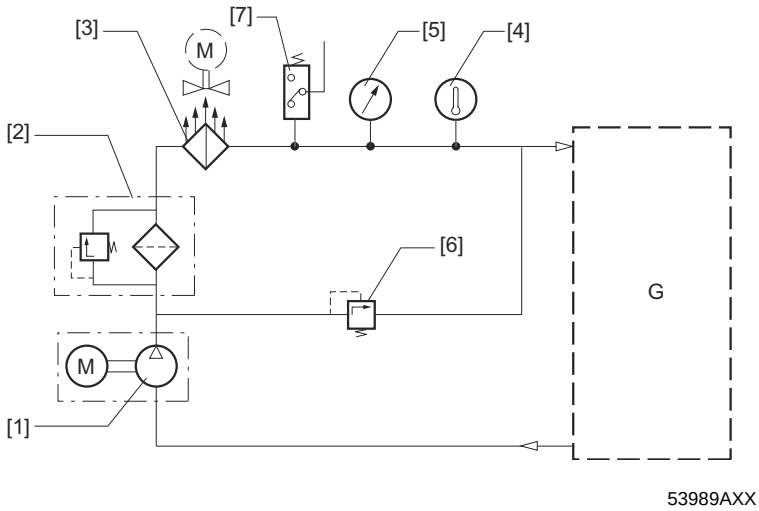


Figure 71: Setup of pressure lubrication with oil/water cooler

[1] Pump
[2] Filter
[3] Oil cooler
[4] Thermo switch 50 °C
[5] Thermometer
[6] Pressure gauge
[7] Pressure switch
[G] Gear unit

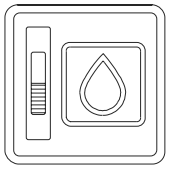
7 Startup

7.1 Startup of M 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. "Lubricants."**
- **For gear units with long-term protection: Replace the screw plug on the location indicated by the breather plug (Position → Sec. "Mounting Positions").**

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 (Position → Sec. "Mounting Positions"). Use a funnel to fill the oil (filter mesh max. 25 µm). Fill the gear unit with the correct oil grade and volume (→ Sec. "Nameplate"). Guidelines for selecting the correct oil type (→ Sec. "11 Lubricants"). Decisive is the oil type mentioned on the nameplate. The oil volume specified on the nameplate of the gear unit is a reference value. The oil level glass is the decisive indicator of the correct oil level. 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 (→ Sec. "Fan").

Running-in period

SEW-EURODRIVE recommends running-in the gear unit as first startup phase. Increase load and revolutions in two to three steps up to maximum level. The running-in 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."

7.2 Startup of M gear units with backstop

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

7.3 Taking M 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 SEW-EURODRIVE 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 → Sec. "Startup."

8 Inspection and Maintenance

8.1 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 (→ Sec. "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 0.03 % (300 ppm). • Regrease labyrinth seals. Option for gear unit. Standard gear unit supplied without grease nipple. 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")

8.2 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 (according to DIN 51502) shown in the following figure corresponds to the PAO oils.

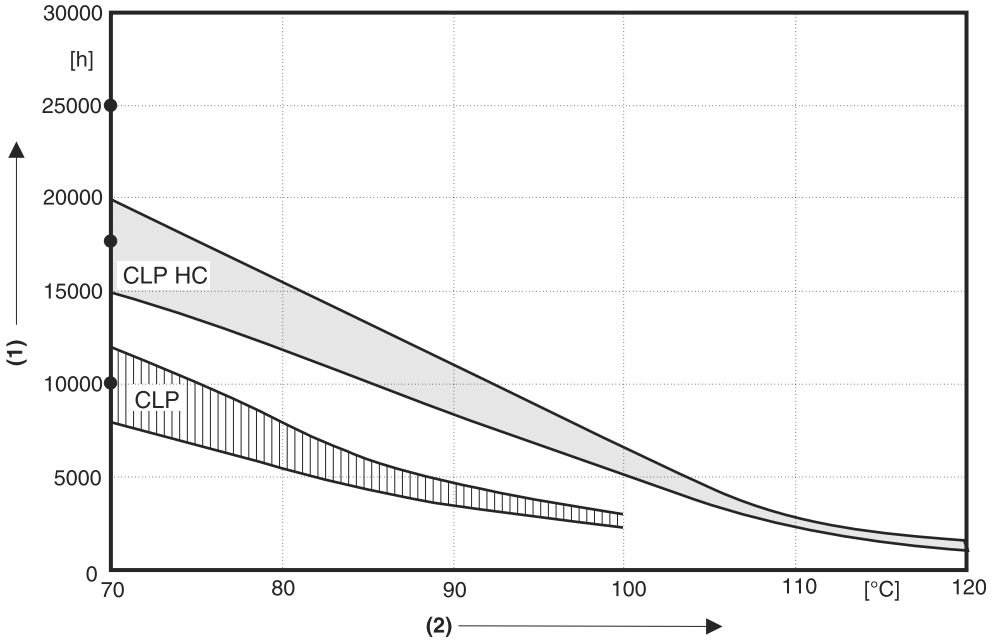


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Figure 72: Lubricant change intervals for M gear units under normal ambient conditions

(1) Hours of operation
(2) Sustained oil bath temperature
• Average value per oil type at 70 °C

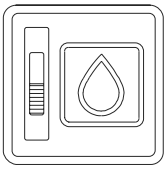
8.3 Inspection and maintenance of the gear unit

- **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, refer to Sec. "Mounting Positions."**

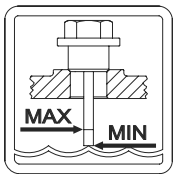
Checking the oil level

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 level glass: Visually check correct oil level (= middle of oil sight glass)



3. For gear units with oil dipstick (option):
   - 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)

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."

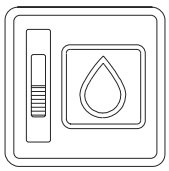
Changing the oil

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 (filter mesh max. 25 µm). 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 level glass (option: 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/air or 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 SEW-EURODRIVE 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

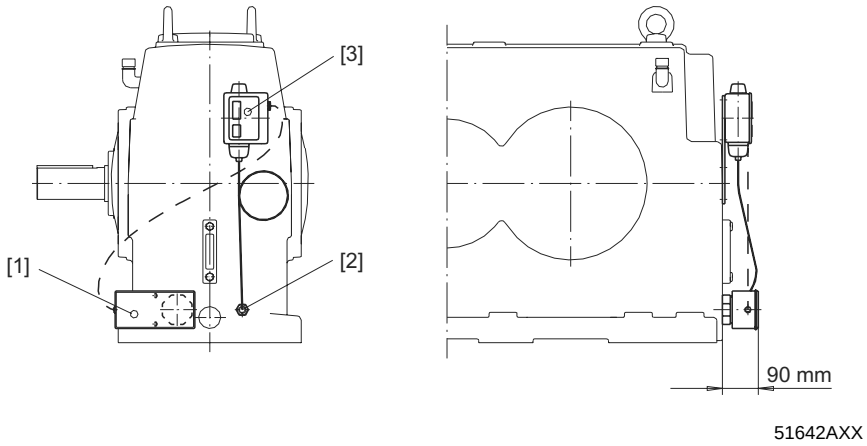


Figure 73: Oil heater M.. horizontal gear units

[1] Oil heater
[2] Temperature sensor
[3] Thermostat

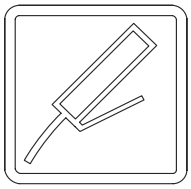
- Remove the oil heater [1] and the gasket on the gear unit.
- Remove the base of the terminal box.
- Clean the tubular heating elements with solvent.

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 of NLGI2 consistency to grease the regreasable dust protection covers or labyrinth seals ("Taconite") attached to input and output shafts as option (→ Sec. "Lubricants", "Sealing grease").

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.

9 Malfunctions

9.1 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 (→ Sec. "Inspection and Maintenance"), replace bearings B Contact customer service
Unusual, irregular running noise	Foreign particles in the oil	• Check the oil (→ 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 (→ Sec. "Inspection and Maintenance") B Check when the oil was changed last time; change oil if necessary (→ Sec. "Inspection and Maintenance") C Change the oil (→ 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 or too much oil B Oil too old C Shaft end pump defective D Bearing damaged	A Check the oil level, correct if necessary (→ Sec. "Inspection and Maintenance") B Check when the oil was changed last time; change oil if necessary (→ 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 / 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 (→ Sec. "Mounting Positions") Observe the gear unit. Oil still leaking: contact customer service C Contact customer service
Oil leaking • from oil drain plug/valve • 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 (→ Sec. "Inspection and Maintenance") B Mount the breather plug correctly (→ Sec. "Mounting Positions") and correct the oil level (→ 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, see also DIN 3761).

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

10 Symbols and Mounting Positions

10.1 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 filling plug
	Oil drain plug/oil drain valve
	Oil level glass

The positions of the elements are exemplary and cover most of the cases. For exact positions, please refer to the corresponding dimension drawing.

10.2 Symbols and Mounting Positions of M.P.. gear units

Mounting position M.P.

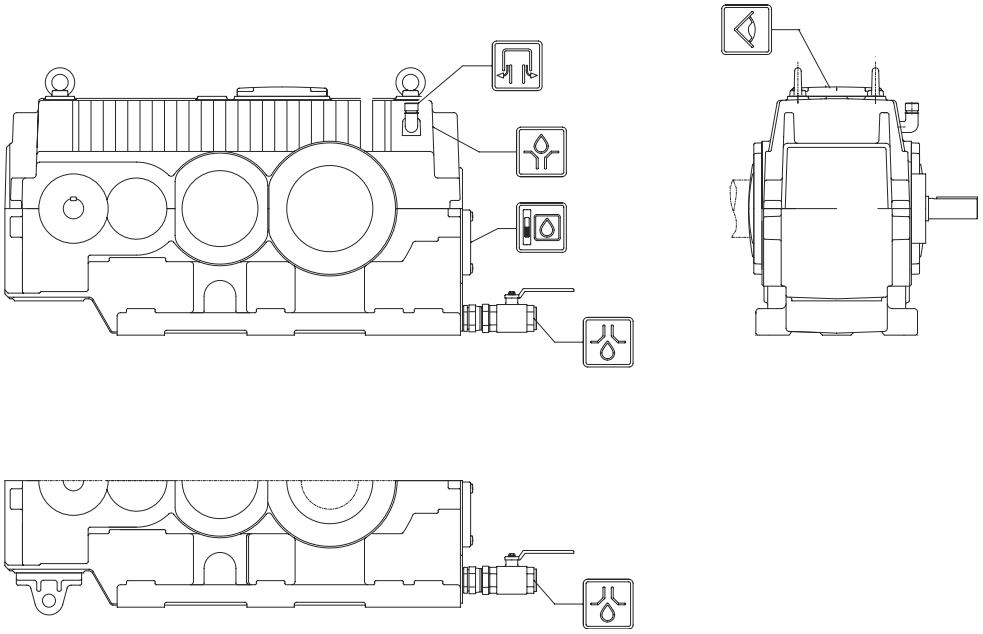


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Figure 74: Mounting positions of M.P.. gear units

10.3 Symbols and mounting positions of M.R.. gear units

Mounting position M.R..

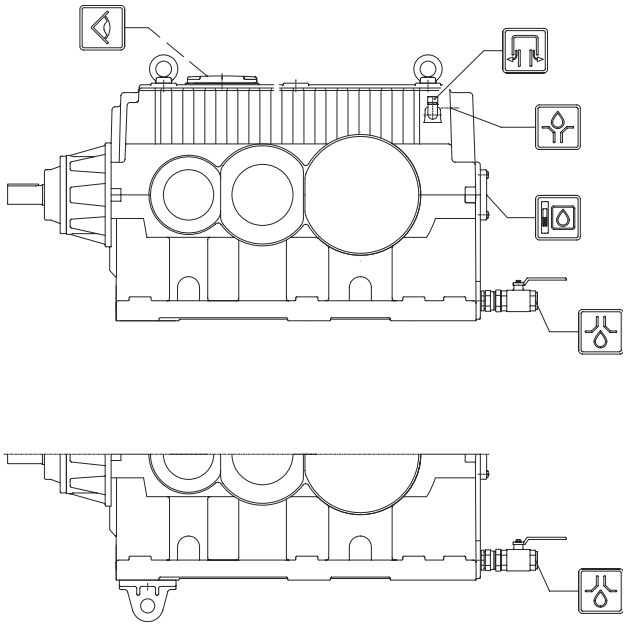

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Figure 75: Mounting positions of M.R.. gear units

11 Lubricants

11.1 Guideline for oil and grease selection

Lubricating oils

This instruction applies to the following conditions:

- Ambient temperature in the range of -30 °C…+40 °C
- Actual max. pitch line velocity less than 35 m/s
- All lubricating methods with oil: splash, bath and pressure lubrication

In addition to the required viscosity class ISO VG, the oil must contain anti-wear, anti-rust, anti-oxidant and antifoam additives. The FZG stage should be at least 12 according to DIN 51354.

The oil must also contain EP additivies. If synthetic oils are selected due to operating temperatures or oil change intervals, SEW-EURODRIVE recommends polyalfaolefin based (PAO) oil.

Mineral oils

Lubricating oil standards

Lubricating oils are grouped in ISO VG viscosity classes according to standards ISO 3448 and DIN 51519.

ISO VG class	ISO 6743-6 designation	DIN 51517-3 designation	AGMA 9005-D94 designation
150	ISO-L-CKC 150	DIN 51517 CLP 150	AGMA 4 EP
220	ISO-L-CKC 220	DIN 51517 CLP 220	AGMA 5 EP
320	ISO-L-CKC 320	DIN 51517 CLP 320	AGMA 6 EP
460	ISO-L-CKC 460	DIN 51517 CLP 460	AGMA 7 EP
680	ISO-L-CKC 680	DIN 51517 CLP 680	AGMA 8 EP

Containing EP additives

Selection of viscosity class ISO VG (40 °C)

The maximum operating temperature of mineral oil is 80 °C. Table 1 indicates the required ISO VG class of the oil and the max. lubricating temperature T_L of the oil.

Selection of the lubricating oil

Mineral oil (→ Tabel in sec. "Overview of lubricants for M.. industrial gear units/Mineral lubricants")

When the gear unit is located outdoors, use an oil heater in the following cases:

- With splash or bath lubrication when the starting temperature is less than the pour point of the oil
- With pressure lubrication when the starting oil viscosity is greater than 2000 cSt.

Synthetic oils (PAO)

Lubricating oil standards

Lubricating oils are grouped in ISO VG viscosity classes according to standards ISO 3448 and DIN 51519.

ISO VG class	ISO 6743-6 designation
150	ISO-L-CKT 150
220	ISO-L-CKT 220
320	ISO-L-CKT 320
460	ISO-L-CKT 460

Containing EP additives

Selection of viscosity class ISO VG (40 °C)

The maximum operating temperature of synthetic oil is 90 °C. (→ Table in sec. 11.2 "Overview of lubrications for M.. industrial gear units") indicates the required ISO VG class of the oil and the max. lubricating temperature T_L of the oil.

Selection of the lubricating oil

Synthetic PAO oils (→ Table in sec. "Synthetic polyalphaolefin (PAO) based lubricant"). When the gear unit is located outdoors, use an oil heater in the following cases:

- With splash or bath lubrication when the starting temperature is less than the pour point of the oil.
- With pressure lubrication when the starting oil viscosity is greater than 2000 cSt.

Lubricating greases for bearings

Lubricating grease standards

If lubricating grease for bearings is used, this will be indicated on the gear unit and in the technical specification. Contains EP additives. Only to be used for greasing of bearings. Hardness class NLGI 2.

ISO 6743-9 designation	ISO 51502 designation
ISO-L-XCCFB 2	**DIN 51502 K2K-30**

Lithium soap based greases are recommended.

Selection of lubricating grease

The greases shown in table 4 are used for roller bearings. A plate with grease recommendations is attached if the gear unit requires grease lubrication.

Slow speed gear units

When the pitch line velocity of the slowest stage is under 1 m/s (n_2 < 15 1/min), the gear unit operates in boundary lubrication area.

It is recommended to use:

- mineral oils with EP- and anti-wear additives
- running viscosity should be ≥ 100 cSt
- the cleanliness of the oil and the oil sump must be ensured.

Oil selection, ISO VG (40 °C) class

Number of stages in the gear unit	Splash or bath lubrication[1] ISO VG (40 °C)/T_L	Pres. lubrication NO ext. cooler[1] ISO VG (40 °C)/T_L	Pres. lubrication ext. cooler, spray dose, splash or bath lubrication[2] ISO VG (40 °C)/T_L	Pres. lubrication ext. cooler, oil led to gearmeshes and bearings[3] ISO VG (40 °C)/T_L	Note
2	320/90	320/90	220/70	220/60	Synthetic oil
2	320/80	320/80	220/70	220/60	Mineral oil
3	460/80	460/80	320/70	320/60	Mineral oil Synthetic oil
4	460/70	460/70	460/70	320/60	ONLY mineral oil
5	460/70	460/70	460/70	320/60	ONLY mineral oil

1 The oil temperature T_L is measured from the oil surface)

2 The oil temperature going into the gear unit is different that lubricates the gearmeshes and bearings. NO direct piping to the gearmeshes and bearings is made. The oil temperature when going into the gear unit is set in the range of 45 °C …55 °C

3 The oil is led directly to the gearmeshes and bearings via direct piping. The oil temperature when going into the gear unit is set in the range of 45 °C … 55 °C

T_L = Max. lubricating temperature of the oil which lubricates the gearmeshes and bearings (Celcius)

Mineral oils

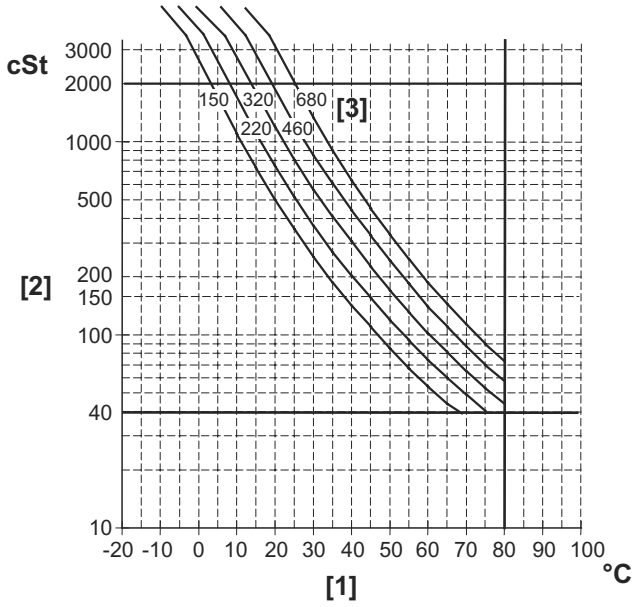

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Figure 76: Mineral oils

[1] Oil temperature
[2] Operating oil viscosity
[3] Oil ISO VG viscosity class

Synthetic PAO oils

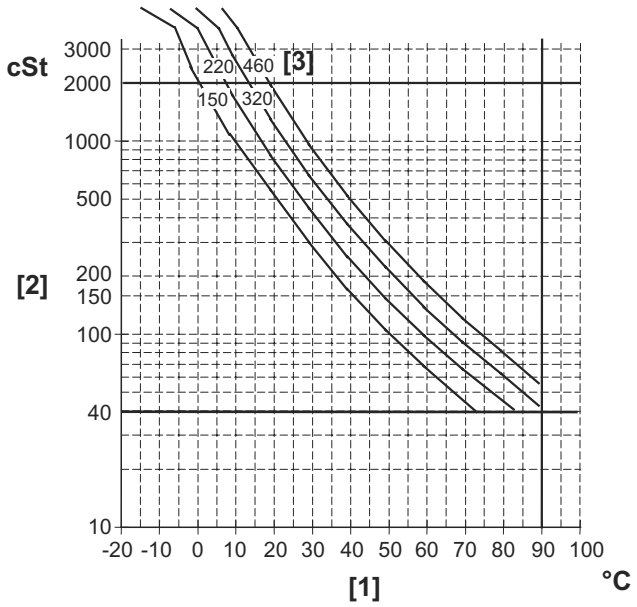

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Figure 77: Synthetic PAO oils

[1] Oil temperature
[2] Operating oil viscosity
[3] Oil ISO VG viscosity class

11.2 Overview of lubricants for M.. industrial gear units

Mineral lubricants

ISO VG class	AGMA number	Company	Oil	Viscosity cSt / 40 °C	Pour point °C
150	4EP	Aral	Degol BG150	150	–24
		BP	Energol GR-XP150	140	–27
		Castrol	Alpha SP150	150	–21
		Castrol	Alphamax 150	150	–24
		Chevron	Industrial Oil EP150	150	–15
		Dea	Falcon CLP150	150	–21
		Esso	Spartan EP150	152	–27
		Exxon	Spartan EP150	152	–27
		Fuchs	Renolin CLP150 Plus	148	–21
		Gulf	Gulf EP Lubricant HD150	146	–27
		Klüber	Klüberoil GEM 1-150	150	–15
		Kuwait	Q8 Goya 150	150	–27
		Mobil	Mobilgear 629	143	–24
		Mobil	Mobilgear XMP 150	150	–27
		Molub-Alloy	MA-814 / 150	140	–23
		Neste	Vaihteisto 150 EP	145	–27
		Nynäs	Nynäs GL 150	150	–24
		Optimol	Optigera BM150	150	–18
		Petro Canada	Ultima EP150	152	–27
		Shell	Omala Oil F150	150	–21
		Texaco	Meropa 150	142	–30
		Total	Carter EP150	150	–18
		Tribol	Tribol 1100 / 150	151	–28

ISO VG class	AGMA number	Company	Oil	Viscosity cSt / 40 °C	Pour point °C
220	5EP	Aral	Degol BG220	220	–21
		BP	Energol GR-XP220	210	–27
		Castrol	Alpha SP220	220	–21
		Castrol	Alphamax 220	220	–24
		Chevron	Industrial Oil EP220	220	–12
		Dea	Falcon CLP220	220	–18
		Esso	Spartan EP220	226	–30
		Exxon	Spartan EP220	226	–30
		Fuchs	Renolin CLP220 Plus	223	–23
		Gulf	Gulf EP Lubricant HD220	219	–19
		Klüber	Klüberoil GEM 1-220	220	–15
		Kuwait	Q8 Goya 220	220	–21
		Mobil	Mobilgear 630	207	–18
		Mobil	Mobilgear XMP 220	220	–24
		Molub-Alloy	MA-90 / 220	220	–18
		Neste	Vaihteisto 220 EP	210	–27
		Nynäs	Nynäs GL 220	220	–18
		Optimol	Optigear BM220	233	–15
		Petro Canada	Ultima EP220	223	–30
		Shell	Omala Oil F220	220	–21
		Texaco	Meropa 220	209	–21
		Total	Carter EP220	220	–12
		Tribol	Tribol 1100 / 220	222	–25

ISO VG class	AGMA number	Company	Oil	Viscosity cSt / 40 °C	Pour point °C
320	6EP	Aral	Degol BG320	320	–18
		BP	Energol GR-XP320	305	–24
		Castrol	Alpha SP320	320	–21
		Castrol	Alphamax 320	320	–18
		Chevron	Industrial Oil EP320	320	–9
		Dea	Falcon CLP320	320	–18
		Esso	Spartan EP320	332	–27
		Exxon	Spartan EP320	332	–27
		Fuchs	Renolin CLP320 Plus	323	–21
		Gulf	Gulf EP Lubricant HD320	300	–12
		Klüber	Klüberoil GEM 1-320	320	–15
		Kuwait	Q8 Goya 320	320	–18
		Mobil	Mobilgear 632	304	–18
		Mobil	Mobilgear XMP 320	320	–18
		Molub-Alloy	MA-90 / 320	320	–15
		Neste	Vaihteisto 320 EP	305	–24
		Nynäs	Nynäs GL 320	320	–12
		Optimol	Optigear BM320	338	–15
		Petro Canada	Ultima EP320	320	–21
		Shell	Omala Oil F320	320	–18
		Texaco	Meropa 320	304	–18
		Total	Carter EP320	320	–12
		Tribol	Tribol 1100 / 320	317	–23
460	7EP	Aral	Degol BG460	460	–18
		BP	Energol GR-XP460	450	–15
		Castrol	Alpha SP460	460	–6
		Castrol	Alphamax 460	460	–15
		Chevron	Industrial Oil EP460	460	–15
		Dea	Falcon CLP460	460	–15
		Esso	Spartan EP460	459	–18
		Exxon	Spartan EP460	459	–18
		Fuchs	Renolin CLP460 Plus	458	–12
		Gulf	Gulf EP Lubricant HD460	480	–15
		Klüber	Klüberoil GEM 1-460	480	–15
		Kuwait	Q8 Goya 460	460	–15
		Mobil	Mobilgear 634	437	–6
		Mobil	Mobilgear XMP 460	460	–12
		Molub-Alloy	MA-140 / 460	460	–15
		Neste	Vaihteisto 460 EP	450	–15
		Optimol	Optigear BM460	490	–12
		Petro Canada	Ultima EP460	452	–15
		Shell	Omala Oil F460	460	–15
		Texaco	Meropa 460	437	–15
		Total	Carter EP460	460	–12
		Tribol	Tribol 1100 / 460	464	–21

ISO VG class	AGMA number	Company	Oil	Viscosity cSt / 40 °C	Pour point °C
680	8EP	Aral	Degol BG680	680	–12
		BP	Energol GR-XP680	630	–9
		Castrol	Alpha SP680	680	–6
		Dea	Falcon CLP680	680	–12
		Esso	Spartan EP680	677	–15
		Exxon	Spartan EP680	677	–15
		Fuchs	Renolin CLP680 Plus	671	–15
		Gulf	Gulf EP Lubricant HD680	680	–12
		Klüber	Klüberoil GEM 1-680	680	–12
		Kuwait	Q8 Goya 680	680	–9
		Mobil	Mobilgear 636	636	–6
		Mobil	Mobilgear XMP 680	680	–9
		Molub-Alloy	MA-170W / 680	680	–12
		Neste	Vaihteisto 680 EP	630	–9
		Optimol	Optigear BM680	680	–9
		Petro Canada	Ultima EP680	680	–9
		Statoil	Loadway EP 680	645	–9
		Texaco	Meropa 680	690	–12
		Total	Carter EP680	680	–9
		Tribol	Tribol 1100 / 680	673	–21

Synthetic polyalphaolefin (PAO) based lubricant

The synthetic polyalphaolefin-based lubricants correspond to the CLP HC oils (according to DIN 51502).

ISO VG class	AGMA number	Company	Oil	Viscosity cSt		Pour point °C
				40 °C	100 °C	
150	4EP	Dea	Intor HCLP150	150	19.8	–36
		Fuchs	Renolin Unisyn CLP150	151	19.4	–39
		Klüber	Klübersynth EG 4-150	150	19	–45
		Mobil	Mobilgear SHC XMP150	150	21.2	–48
		Shell	Omala Oil HD150	150	22.3	–45
		Texaco	Pinacle EP150	150	19.8	–50
		Total	Carter EP / HT150	150	19	–42
		Tribol	Tribol 1510 / 150	155	18.9	–45
220	5EP	Dea	Intor HCLP 220	220	25.1	–36
		Esso	Spartan Synthetic EP220	232	26.5	–39
		Exxon	Spartan Synthtic EP220	232	26.5	–39
		Fuchs	Renolin Unisyn CLP220	221	25.8	–42
		Klüber	Klübersynth EG 4-220	220	26	–40
		Mobil	Mobilgear SHC XMP220	220	28.3	–45
		Mobil	Mobilgear SHC220	213	26	–51
		Optimol	Optigear Synthic A220	210	23.5	–36
		Shell	Omala Oil HD220	220	25.5	–48
		Texaco	Pinnacle EP220	220	25.8	–48
		Total	Carter EP / HT220	220	25	–39
		Tribol	Tribol 1510 / 220	220	24.6	–42
		Tribol	Tribol 1710 / 220	220	-	–33
320	6EP	Dea	Intor HCLP 320	320	33.9	–33
		Esso	Spartan Synthetic EP320	328	34.3	–36
		Exxon	Spartan Synthtic EP320	328	34.3	–36
		Fuchs	Renolin Unisyn CLP320	315	33.3	–39
		Klüber	Klübersynth EG 4-320	320	38	–40
		Mobil	Mobilgear SHC XMP320	320	37.4	–39
		Mobil	Mobilgear SHC320	295	34	–48
		Optimol	Optigear Synthic A320	290	30	–36
		Shell	Omala Oil HD320	320	33.1	–42
		Texaco	Pinnacle EP320	320	35.2	–39
		Total	Carter EP / HT320	320	33	–36
		Tribol	Tribol 1510 / 320	330	33.2	–39
		Tribol	Tribol 1710 / 320	320	-	–30

ISO VG class	AGMA number	Company	Oil	Viscosity cSt		Pour point °C
				40 °C	100 °C	
460	7EP	Dea	Intor HCLP 460	460	45	–33
		Esso	Spartan Synthetic EP460	460	44.9	–33
		Exxon	Spartan Synthtic EP460	460	44.9	–33
		Fuchs	Renolin Unisyn CLP460	479	45	–33
		Klüber	Klübersynth EG 4-460	460	48	–35
		Mobil	Mobilgear SHC XMP460	460	48.5	–36
		Mobil	Mobilgear SHC460	445	46	–45
		Optimol	Optigear Synthic A460	463	44.5	–30
		Shell	Omala Oil HD460	460	45.6	–39
		Texaco	Pinnacle EP460	460	47.2	–39
		Total	Carter EP / HT460	460	44	–33
		Tribol	Tribol 1510 / 460	460	43.7	–33
		Tribol	Tribol 1710 / 460	460	-	–30

11.3 Sealing grease

SEW-EURODRIVE recommends the grease types listed in below table for operating temperatures from – 30 °C to +100 °C.

Company	Oil	Penetration	NLGI 2 (EP) Drop point °C
Aral	Aralub HLP2	265/295	180
BP	Energrease LS-EPS	265/295	190
Castrol	Spheerol EPL2	265/295	175
Chevron	Dura-Lith EP2	265/295	185
Elf	Epexa EP2	265/295	180
Esso	Beacon EP2	270/280	185
Exxon	Beacon EP2	270/280	185
Gulf	Gulf crown Grease 2	279/290	193
Klüber	Centoplex EP2	265/295	190
Kuwait	Q8 Rembrandt EP2	265/295	180
Mobil	Mobilux EP2	265/295	177
Molub	Alloy BRB-572	240/270	188
Optimol	Olista Longtime 2	265/295	180
Shell	Alvania EP2	265/295	180
Texaco	Multifak EP2	265/295	186
Total	Multis EP2	265/295	190
Tribol	Tribol 3030-2	265/295	182

11.4 Lubricant fill quantities

The specified fill quantities are guide values. The precise values vary depending on the gear ratio.

M.P..

Gear unit size M.P..	Lubrication type	Oil volume [l]		
		Two stages M2P..	Three stages M3P..	Four stages M4P..
50	Splash Pressure	44 38	57 32	57 57
60	Splash Pressure	48 41	83 50	83 83
70	Splash Pressure	74 64	125 73	125 125
80	Splash Pressure	89 79	160 97	160 160
90	Splash Pressure	118 105	208 123	208 208

M.R..

Gear unit size M.R..	Lubrication type	Oil volume [l]		
		Three stages M3R..	Four stages M4R..	Five stages M5R..
50	Splash Pressure	62 38	58 36	57 35
60	Splash Pressure	92 41	85 38	83 37
70	Splash Pressure	144 64	128 57	125 56
80	Splash Pressure	185 79	164 70	160 68
90	Splash Pressure	227 105	213 99	208 96

When using pressure lubrication, it is essential to observe the specifications on the nameplate and in the order-specific documentation!