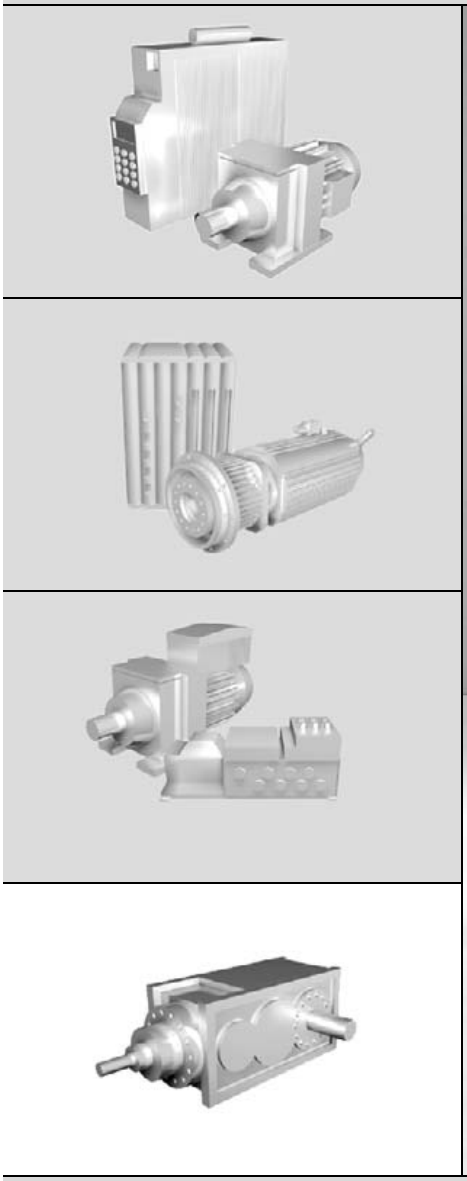
SEW EURODRIVE



Industrial Gear Units of the M.. Series
M.PV../M.RV.. Vertical Gear Units

D6.C00

Edition 08/2004

11280816 / 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.V.. 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.

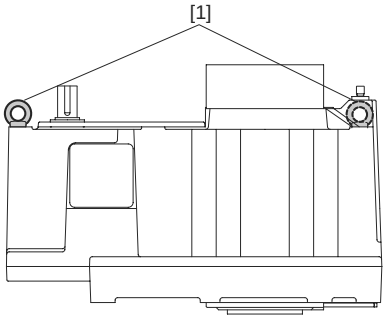


Figure 1: Positions of transport eyebolts

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

Transport with motor adapter

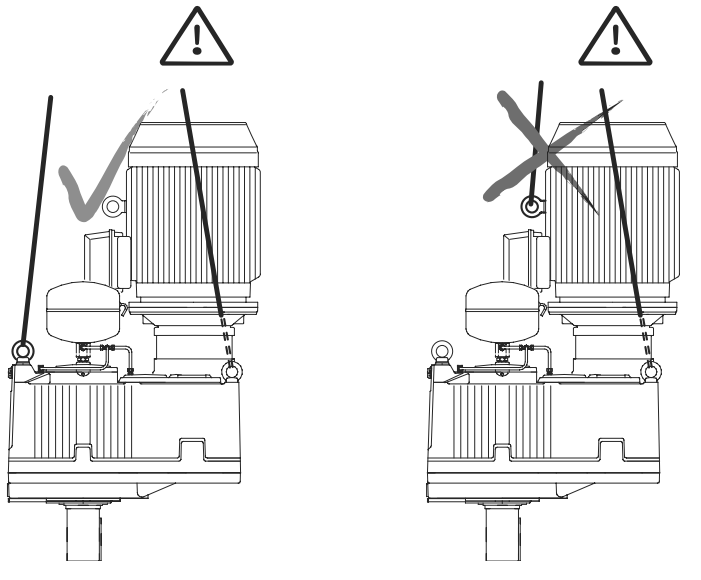


Figure 2: Do not use eyebolts on the motor for transport

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	Consult with SEW-EURODRIVE
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 palette. 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 breather 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.PV.. series

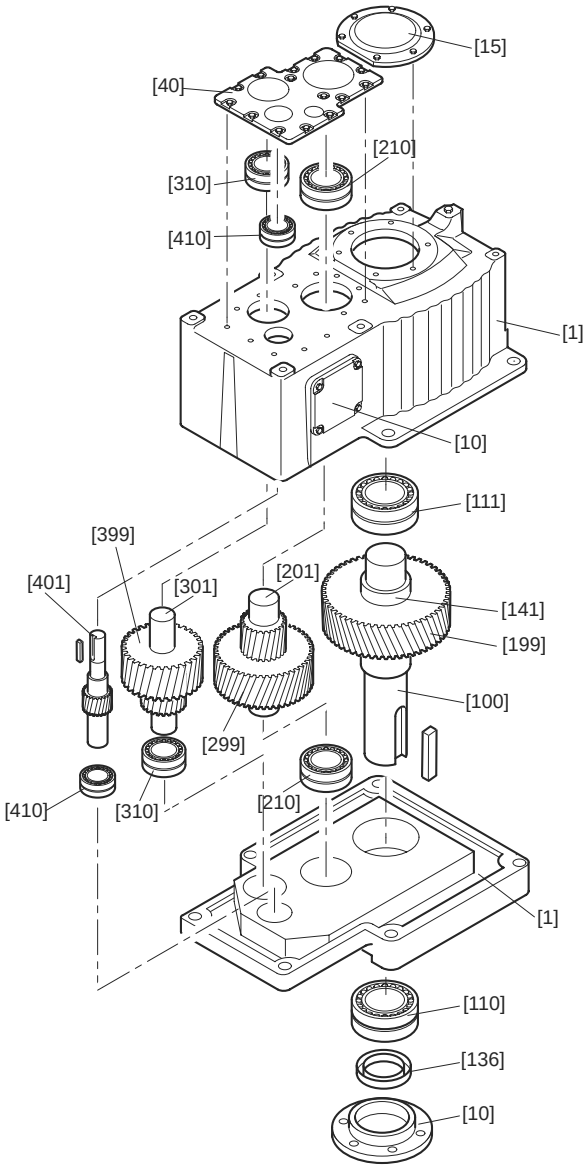


Figure 3: Basic design of the M.PV.. series

[1]	Housing	[100]	LSS shaft	[199]	Gear wheel	[310]	Bearing
[10]	Cover	[110]	Bearing	[201]	Pinion	[399]	Gear wheel
[15]	Cover	[111]	Bearing	[210]	Bearing	[401]	Pinion
[40]	Cover	[136]	Seal bushing	[299]	Gear wheel	[410]	Bearing
[70]	Inspection cover	[136]	Distance ring	[301]	Pinion		

3.2 Basic design of the M.RV.. series

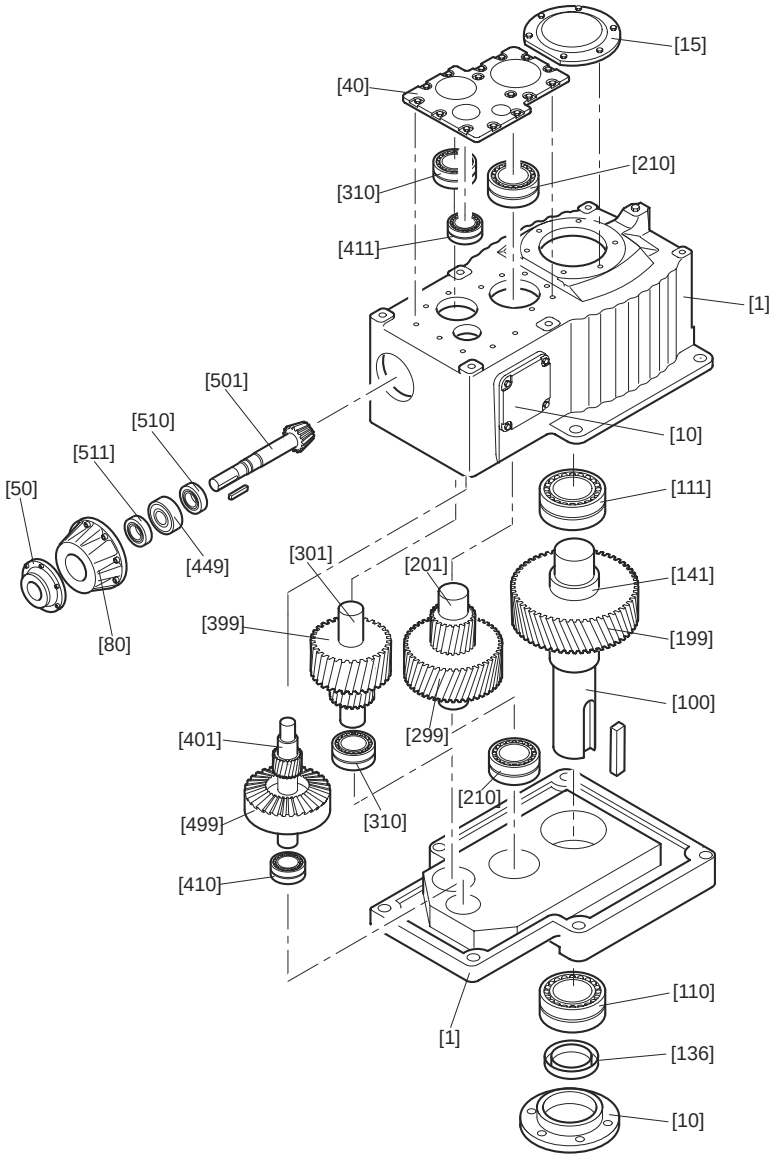


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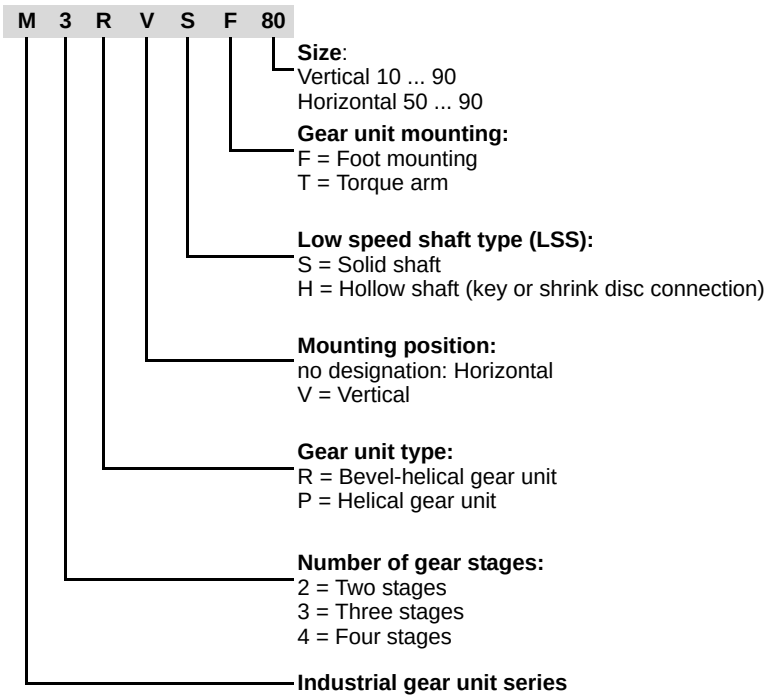
Figure 4: Basic design of the M.RV.. series

[1]	Housing	[100]	LSS shaft	[201]	Pinion	[401]	Pinion
[10]	Cover	[110]	Bearing	[210]	Bearing	[410]	Bearing
[15]	Cover	[111]	Bearing	[299]	Gear wheel	[449]	Bushing
[40]	Cover	[136]	Seal bushing	[301]	Pinion	[499]	Bevel wheel
[50]	Cover	[141]	Distance ring	[310]	Bearing	[501]	Bevel pinion
[70]	Inspection cover	[199]	Gear wheel	[399]	Gear wheel	[510]	Bearing
						[511]	Bearing

3.3 Unit designation / nameplates

Sample unit designation



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

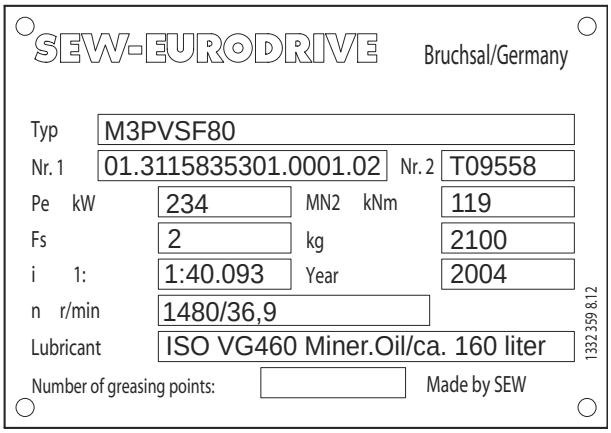


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Figure 5: Nameplate

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

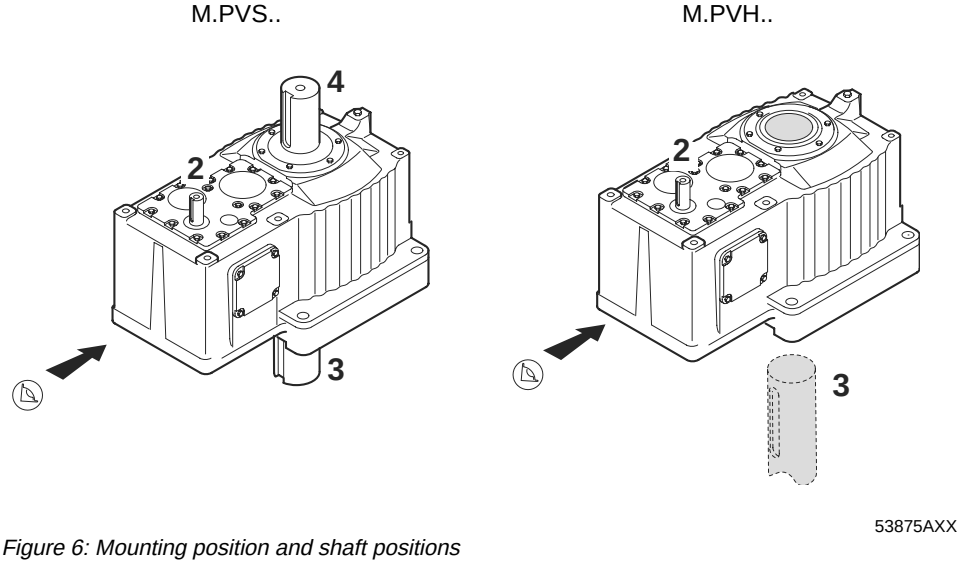


Figure 6: Mounting position and shaft positions

Mounting positions, shaft positions M.RV..

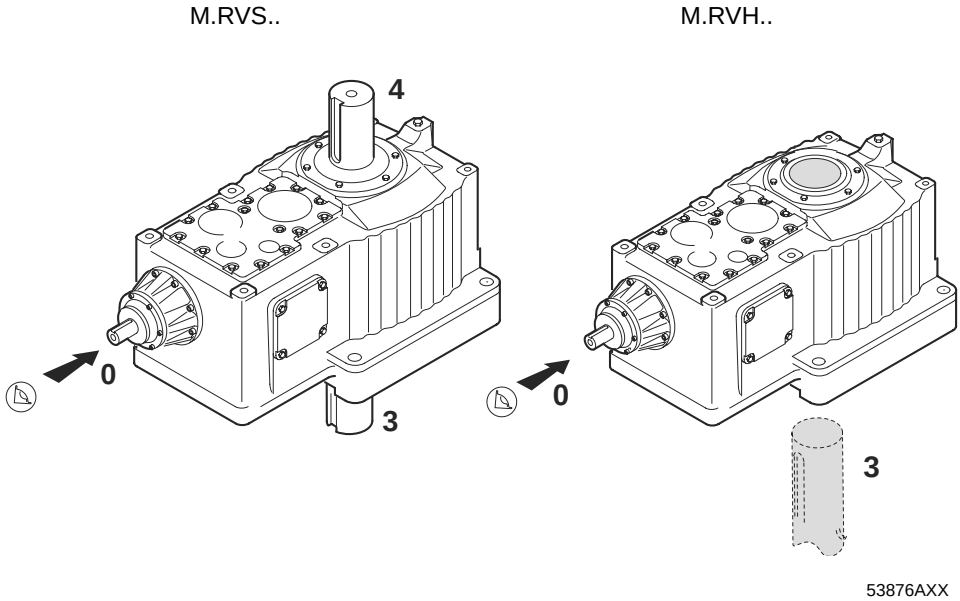
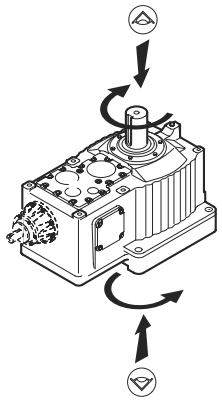
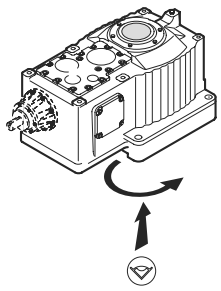
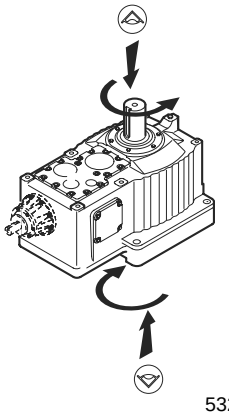
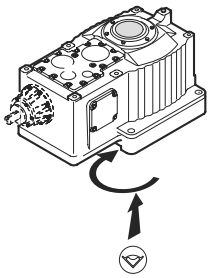


Figure 7: Mounting position and shaft positions M.RV...

Directions of rotation

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

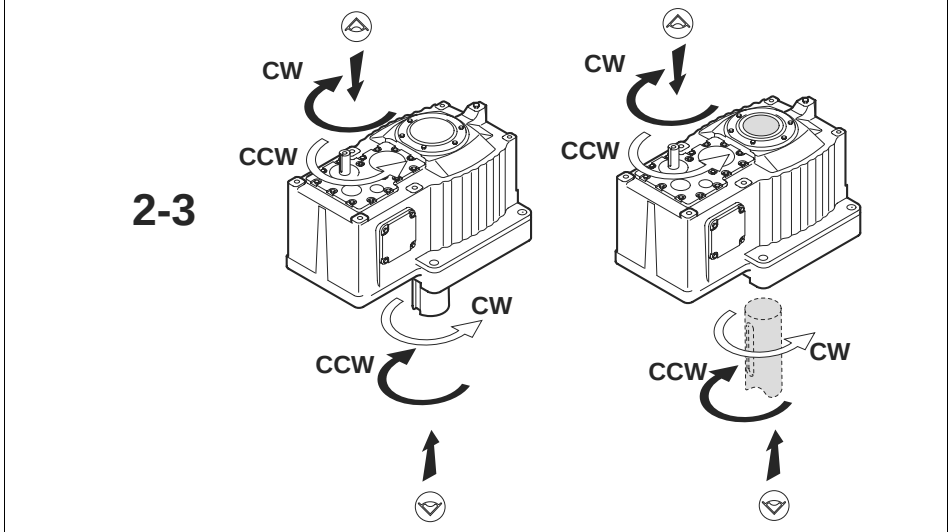
Direction of rotation	Gear unit version	
	M.PVS.. M.RVS..	**M.PVH.. M.RVH..**
Clockwise (CW)	 53221AXX	 53261AXX

Direction of rotation	Gear unit version	
	M.PVS.. M.RVS..	**M.PVH.. M.RVH..**
Counterclock-wise (CCW)	 53268AXX	 53270AXX

Shaft positions and corresponding directions of rotation of M2PV.. industrial gear units

The following figures show shaft positions and corresponding directions of rotation for industrial gear units of the M2PV.. two stage series.

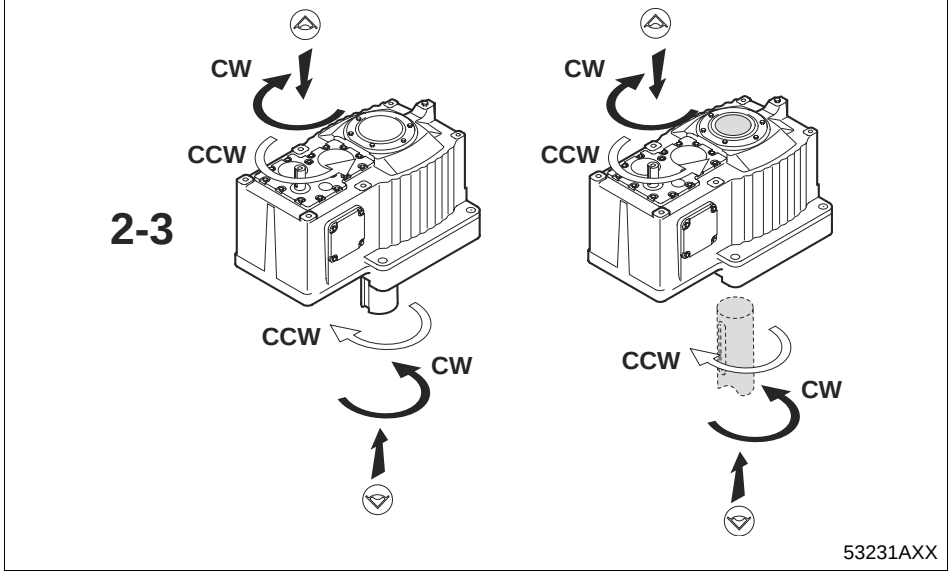
Two stages



Shaft positions and corresponding directions of rotation of M3PV.. industrial gear units

The following figures show shaft positions and corresponding directions of rotation for industrial gear units of the M3PV.. three stage series.

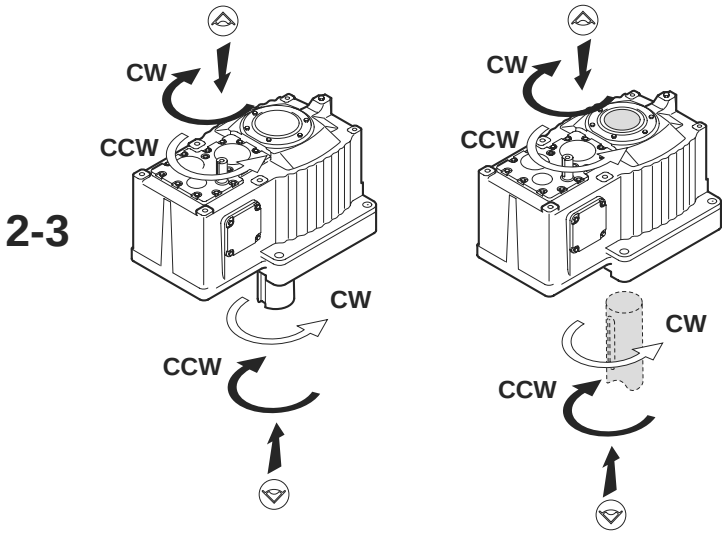
Three stages



Shaft positions and corresponding directions of rotation of M4PV.. industrial gear units

The following figures show shaft positions and corresponding directions of rotation for industrial gear units of the M4PV.. four stage series.

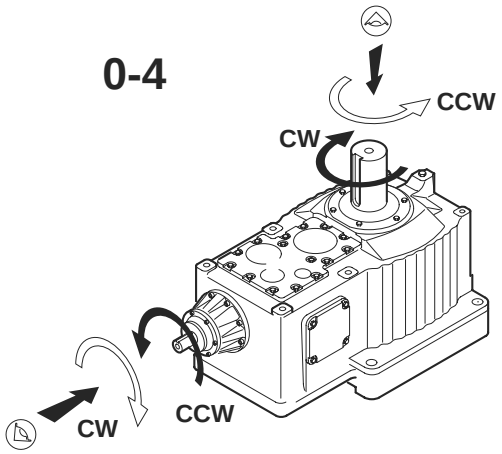
Four stages



Shaft positions and corresponding directions of rotation of M3RV.. industrial gear units

The following figures show shaft positions and corresponding directions of rotation for industrial gear units of the M3RV.. three stage series.

Three stages



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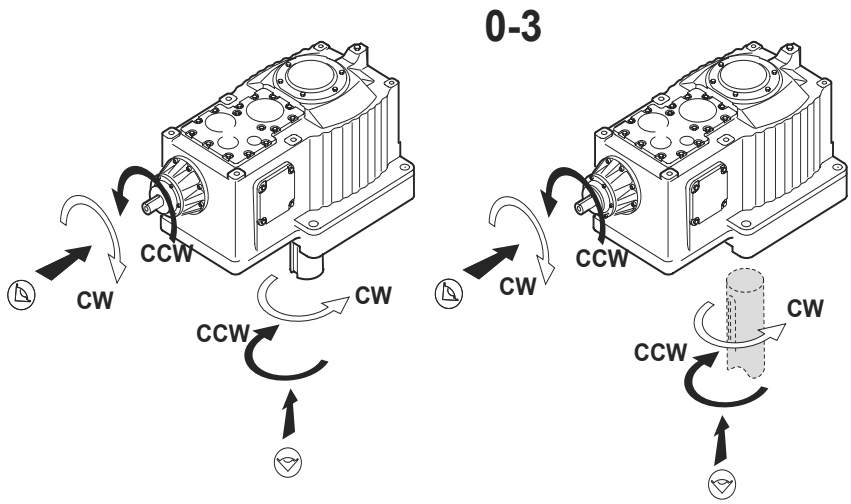

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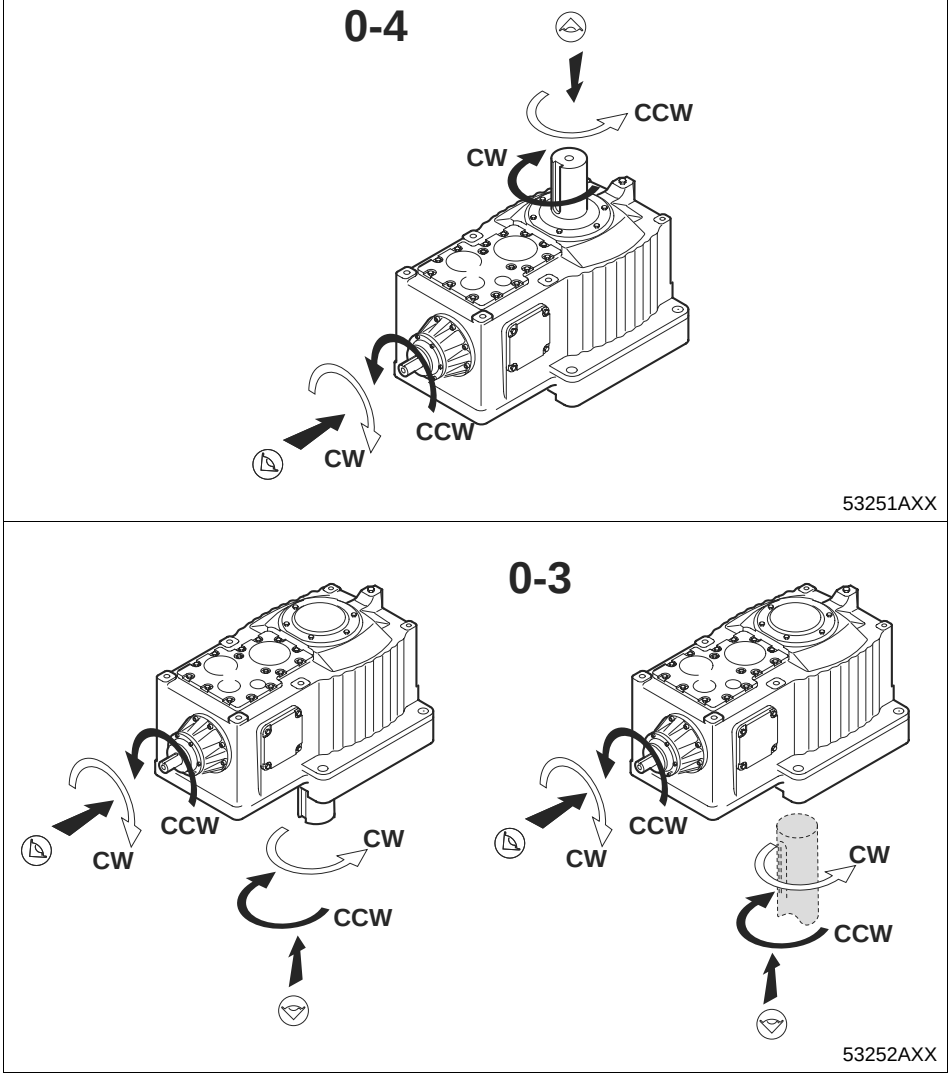
Based on the position of the bevel wheel, other corresponding directions of rotation can be possible. Please refer to or specific drawing.

Shaft positions and corresponding directions of rotation of M4RV.. industrial gear units

The following figures show shaft positions and corresponding directions of rotation for industrial gear units of the M4RV.. four stage series.

Four stages



Based on the position of the bevel wheel, other corresponding directions of rotation can be possible. Please refer to or specific drawing.

3.5 Lubrication of industrial gear units

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

Oil bath lubrication

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 **always** used for industrial gear units of the M.PV.., M.RV.. series with **oil bath lubrication. Oil expansion tanks allow the lubricant to expand when the gear unit heats up during operation.**

Disregarding the 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.

Symbols used

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

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

Oil bath lubrication vertical mounting position

The steel oil expansion tank [1] for industrial gear units of the **M series in vertical mounting position** (unit designation **M.PV.. / M.RV..**) is located on the upper side of the gear unit housing.

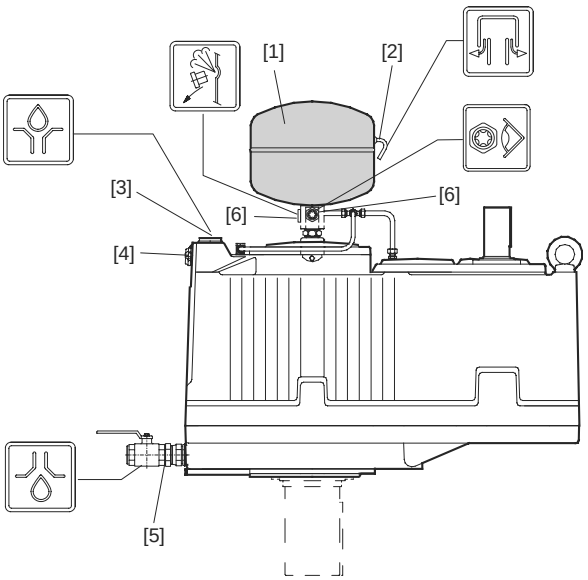


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Figure 8: M.PVSF../M.RVSF.. industrial gear unit with steel oil expansion tank

[1] Steel oil expansion tank
[2] Breather
[3] Oil filling plug
[4] Oil sight glass
[5] Oil drain plug
[6] Air outlet screw

In **dry environmental conditions**, a **cast iron oil expansion tank** [1] is used. This oil expansion tank is only used for the vertical mounting position with the **solid output shaft pointing downwards** (unit designation M.P**VSF**.. or M.R**VSF**..).

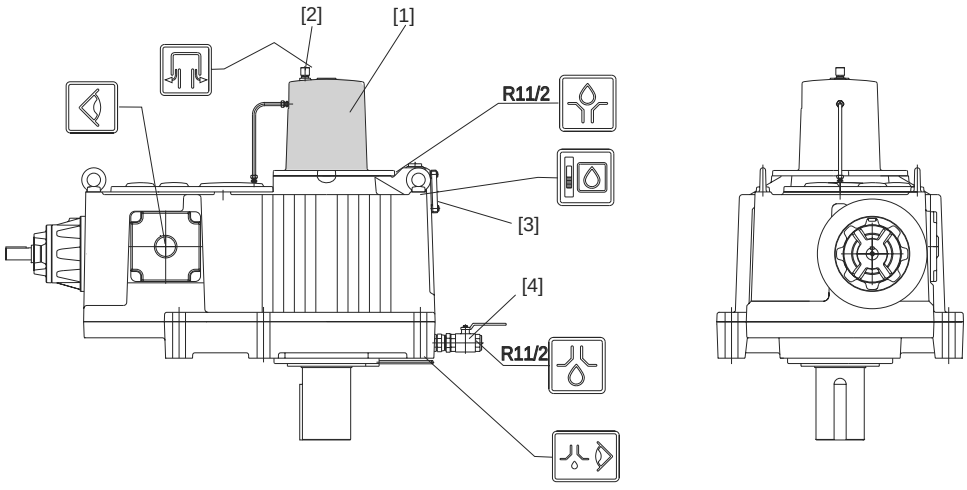

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Figure 9: M.PVSF../M.RVSF.. industrial gear unit with cast iron oil expansion tank

[1] Cast iron oil expansion tank
[2] Breather plug
[3] Oil level glass
[4] Oil drain valve

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
- a drywell sealing system is used on the LSS

For more details on oil expansion tanks, refer to Sec. "Mounting Positions".

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

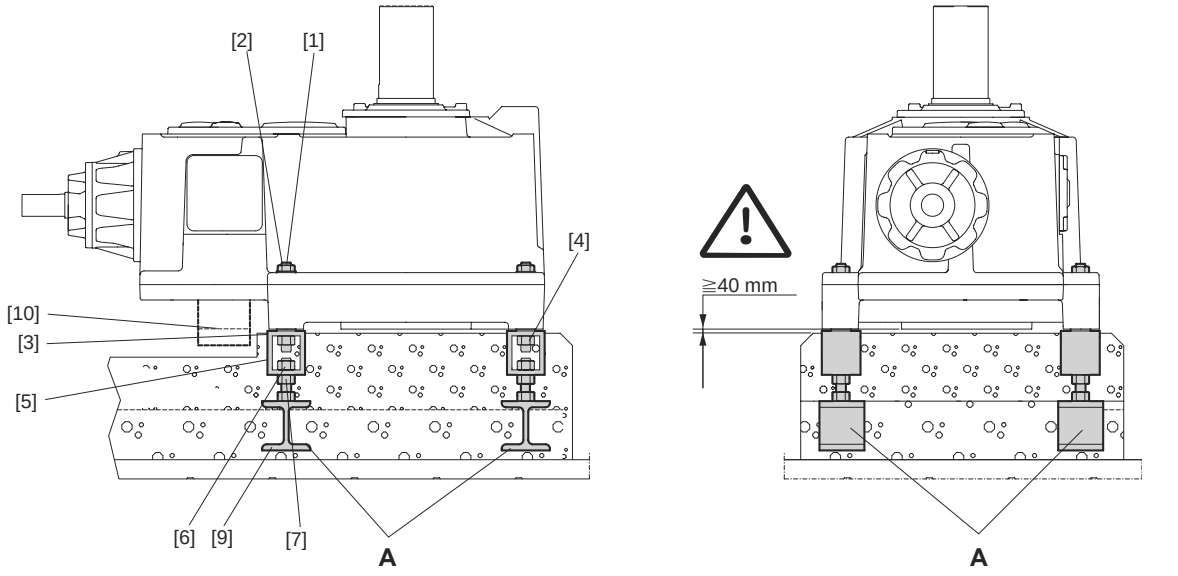

Figure 10: Reinforced concrete foundation for M..V.F..

page Pos. "A" → Sec. "Concrete base" page 24 and page 25

[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
[9] Supporting girder
[10] Shaft end pump (optional)

Important for M.PV.. / M.RV.. gear unit types:

- **The mounting clearance between bearing cover and gear unit foundation must be at least 40 mm.**
- **The mounting clearance must be dimensioned adequately if the gear unit is equipped with a shaft end pump [10] (→ Sec. "Shaft end pump")**

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).

M.V.. 10...50

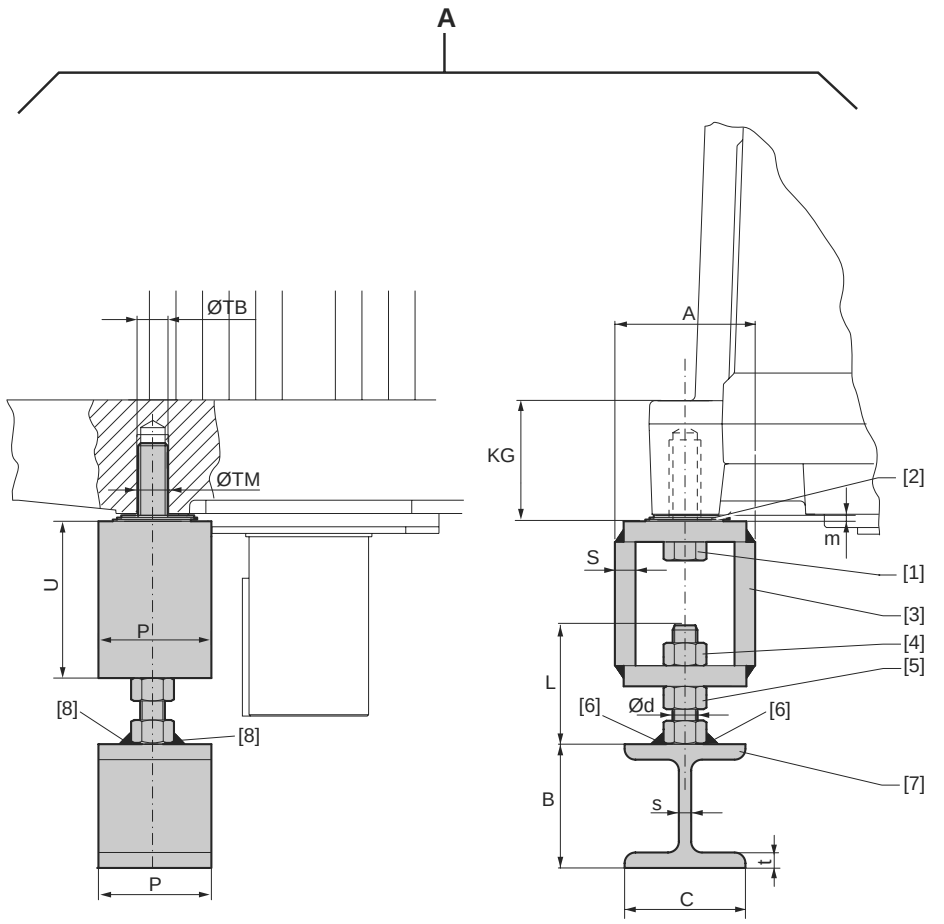

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Figure 11: Reinforcing the concrete base (Pos. "A") M.V.. 10...50

[1] Hex head screw or stud
[2] Shims (about 3 mm space for shims)
[3] Foundation bracket
[4] Hex nut
[5] Hex nut and foundation screw
[6] Weld seam
[7] Supporting girder

Gear unit size	Stud			Foundation frame					Foundation screws		Supporting girders				
vertical M.V..	ØTB	ØTM	KG	m	P	U	A	S	Ød	L	P	B	C	s	t
	[mm]														
10	M20	M20x35	-	3	120	140	120	20	M20	120	120	100	140	7	12
20	M24	M24x42	-						M24						
30	M30	M30x53	-					30	M30	140					
40	M30	M30x53	-												
50	M36	M36x63	-						M36	150					

M.V.. 60...90

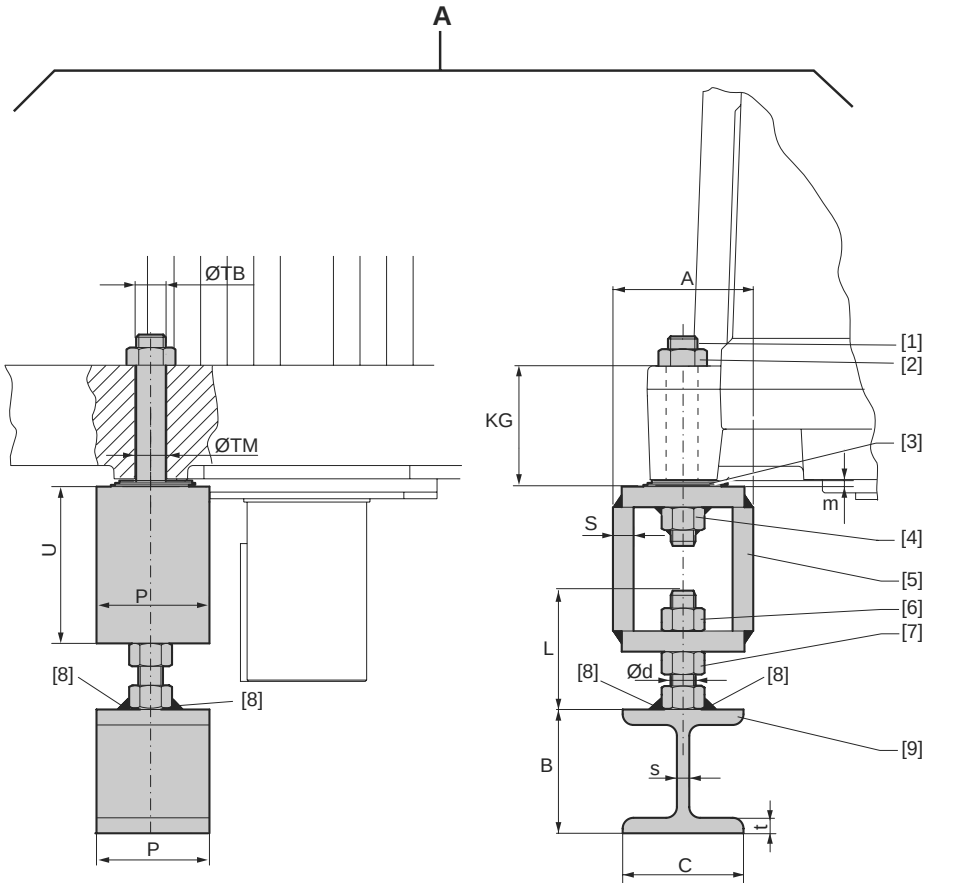

Figure 12: Reinforcing the concrete base (Pos. "A") M.V.. 60...90

[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

Gear unit size	Stud			Foundation frame					Foundation screws		Supporting girders				
vertical M.V..	∅TB	∅TM	KG	m	P	U	A	S	∅d	L	P	B	C	s	t
	[mm]														
60	M42	48	165	3	150	180	200	36	M42	185	150	180		8,5	14
70			171												
80			182												
90			188												

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.V.. vertical	Screw	Tightening torque screw / nut [Nm]
10	M20	315
20	M24	540
30	M30	1090
40	M30	1090
50	M36	1900

Gear unit size M.V.. vertical	Screw / nut	Tightening torque screw / nut [Nm]
60	M42	3045
70		
80		
90		

Counterflange for flange mounted gear units

Gear units M..PV10..50 / M..RV10…50 with LSS in downwards direction (Solid or hollow shaft) can be supplied with a mounting flange on the LSS:

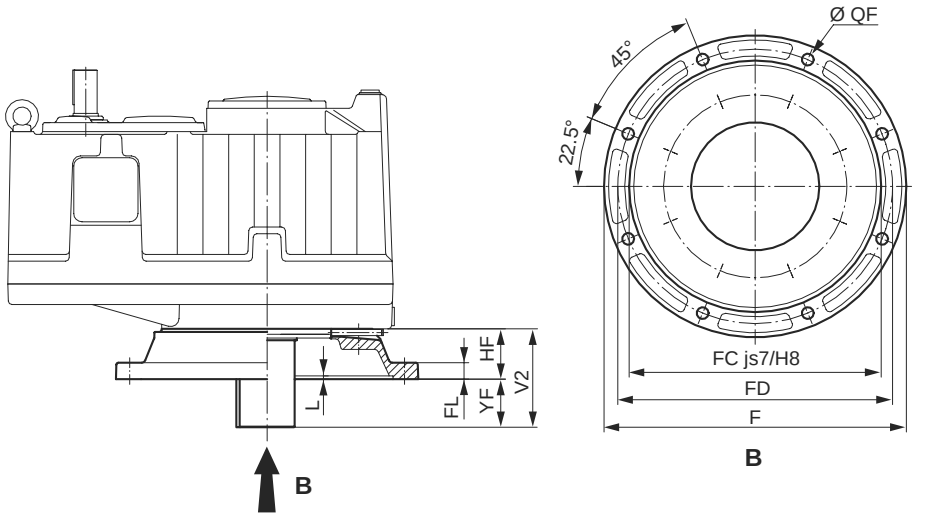

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Figure 13: Mounting flange for flange mounted gear units

Mounting flange dimensions

Gear unit size vertical M.V..	F	FD	FC js 7/H8	∅QF	L	FL	YF	HF	V2
	[mm]								
10	450	400	350	18	6	24	65	110	175
20	480	430	380	22	6	25	65	110	175
30	560	500	450	26	6	30	105	110	215
40	660	600	550	26	7	36	105	110	215
50	820	740	680	33	7	45	140	110	250

The counterflange must have the following characteristics:

- Stiff and torsionally rigid, taking into consideration
  - gear unit weight
  - motor weight
  - the torque that has to be transmitted
  - additional forces acting on the gear unit from the customer machine (e.g. axial forces from and towards gear unit from a mixing process)
- Horizontal
- Plain
- Vibration isolating, that means no vibrations are to be transmitted from close-by machines and elements
- Not creating resonance vibration
- A centering shoulder ∅ FC with js7-fitting according to picture (→ Figure 13)

The mounting surface of mounting flange and counter flange must be absolutely free of grease or oil and from other contamination (e.g. small textile particles, dust, ….).

The alignment of the gear unit LSS in relation to the counterflange has to be as accurately as possible. Correct alignment has an effect on the lifetime of bearing, shafts and coupling.

For permitted misalignments for the coupling on the LSS, please refer to Sec. 5.2 or to a separate coupling manual.

Following bolts of the 8.8-class should be used (Tensile strength 640 N/mm^2):

Gear unit size MP.V.. / MR.V..	Bolt size
10	M16
20	M20
30	M24
40	M24
50	M30

4.5 Mounting of solid shaft gear units

Foot mounted 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 16) 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.

Flange mounted gear units

Before mounting the gear unit, check if the counterflange fullfils the requirements mentioned in Sec. "4.4 Gear unit foundation - Counterflange for flange mounted gear units"

Mount the gear unit in the following order:

1. Lower the gear unit on the counterflange using suitable lifting means. Observe the guidelines mentioned in Sec. 2.1.
2. Secure the gear unit at the correct position on the counterflange using the flange bolts and tighten them crosswise to full tightening torque (see Sec. 4.4).

Mounting accuracy when aligning

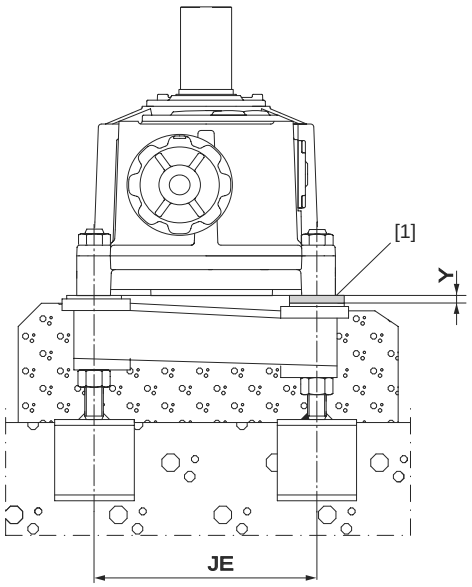

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Figure 14: Mounting accuracy when aligning

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 15, Figure 16, Figure 17)
  - 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 vertical M.V..	Quantity	Thread size for • threaded rod [2] • nut (DIN 934) [5] • retaining screw [6] (Figure 15, Figure 16)
10	1	M20
20		M24
30		M24
40		M24
50		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 vertical M.V..	Quantity	Thread size for • ejector screw [8] (Figure 17)
10	1	M24
20		M30
30		M30
40		M30
50		M36
60		M36
70	2	M24
80		M24
90		M30

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

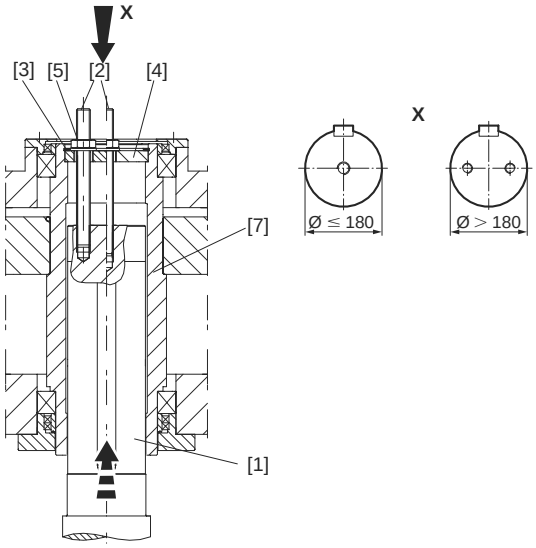

Figure 15: Mounting of vertical gear unit with keyed connection

[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].

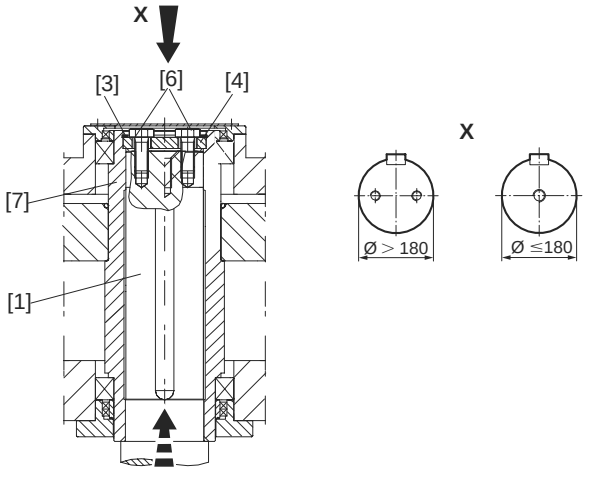

Figure 16: Mounted vertical gear unit with keyed connection

[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

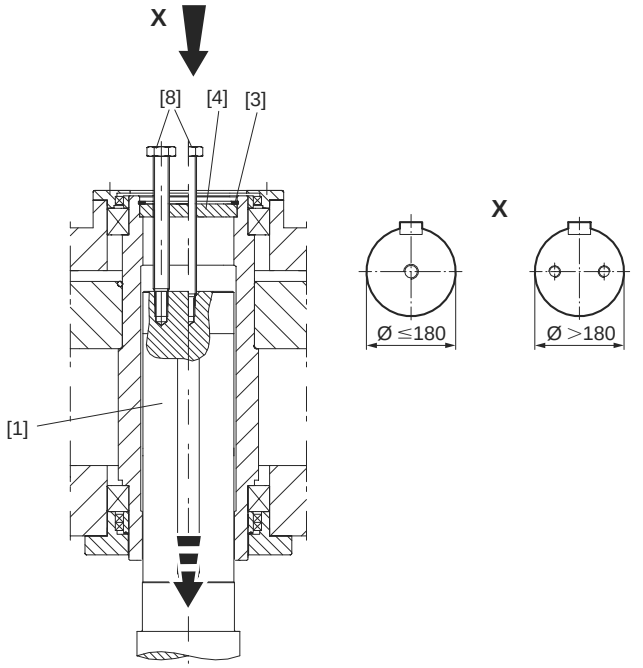

Figure 17: Removing of vertical gear unit with keyed connection

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

- Remove the retaining screw (→ Figure 16, 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 RLK 608), refer to the order documents.

- Figure Included in the scope of delivery (→ Figure 19, Figure 20, Figure 21)
  - [12] protection cover; optional: shrink disc with locking srews [10]
- Not included in the scope of delivery (→ Figure 19, Figure 20, Figure 21)
  - Threaded rod [2], nut [5], ejector screw [8], end plate screws [3], endplate [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:

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

Gear unit size vertical M.V..	Quantity	Thread size for • threaded rod [2] • nut (DIN 934) [5] (→ Figure 19)
10	1	M20
20		M24
30		M24
40		M24
50		M30
60		M30
70	2	M20
80		M20
90		M24

Gear unit size vertical M.V..	Quantity	Thread size for • ejector screw [8] (→ Figure 21)
10	1	M24
20		M30
30		M30
40		M30
50		M36
60		M36
70	2	M24
80		M24
90		M30

Gear unit size vertical M.V..	Quantity of • end plate screws [3] (→ Figure 19)	Recommended screw
10	6 x 60°	M6 x 22
20		
30		
40		M8 x 28
50		M10 x 35
60		
70		M12 x 50
80		
90		

Recommended dimension of end plate [4] → Figure 19

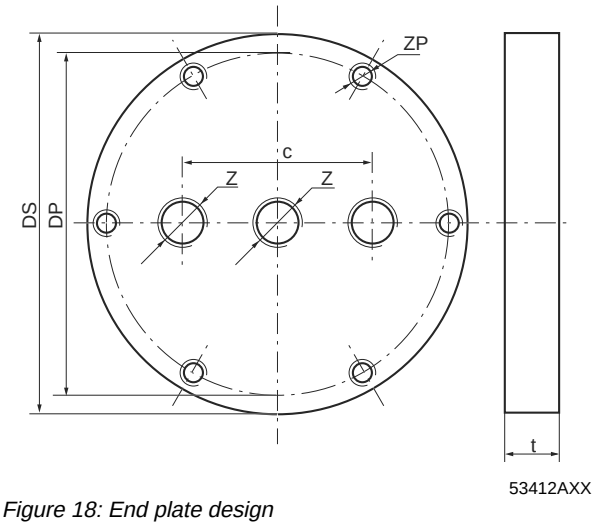

Figure 18: End plate design

Gear unit size vertical M.V..	DS	t [mm]	DP	ZP 6 x 60°	Z	c [mm]
10	110	10	97	M6	1 x M20	-
20	120	10	107		1 x M24	-
30	150	12	135		1 x M24	-
40	160	12	145	M8	1 x M24	-
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:

Shrink disc on customer's side of machine shaft:

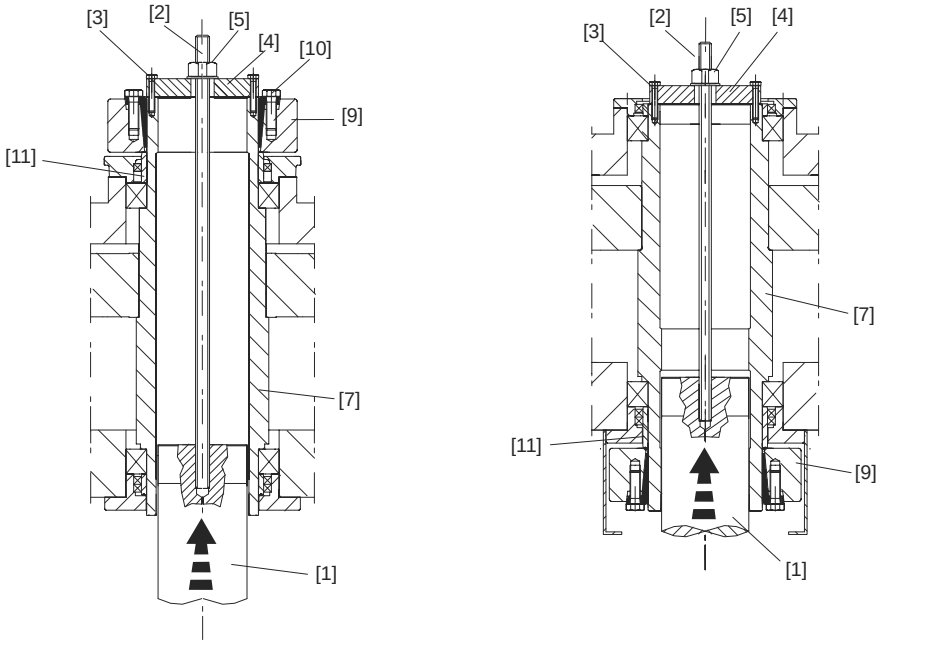

Figure 19: Mounting of vertical gear unit with shrink disc connection

[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

- 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 reached the required 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]
10, 20	M12	100	The required tightening torque is reached when the faces of outer and inner ring are in line.
30, 40	M14	160	
50	M16	250	
60, 70, 80	M20	490	
90	M24	840	

Mounted hollow shaft gear unit

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

Shrink disc on customer's side of machine shaft:

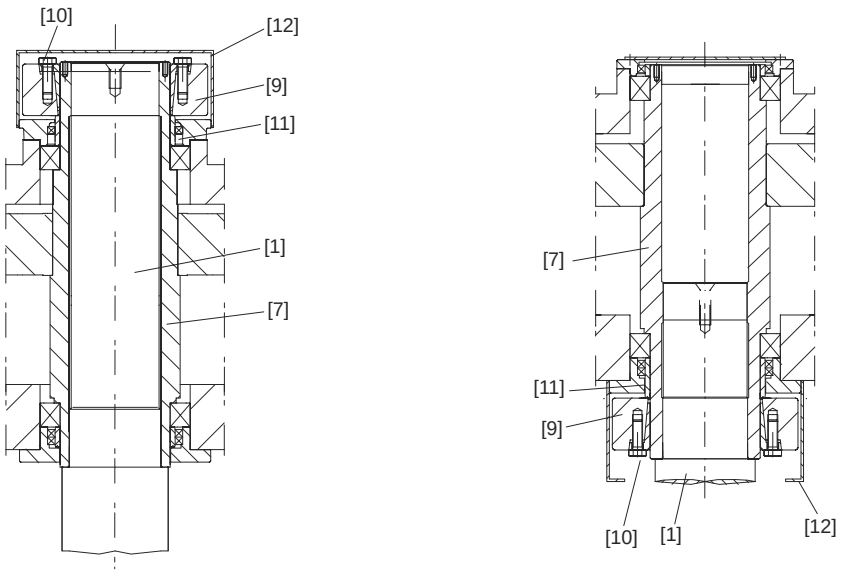

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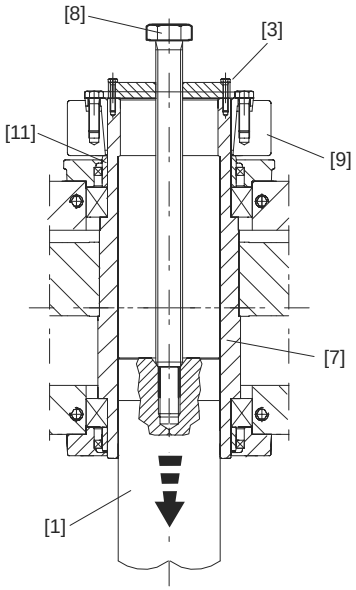
Figure 20: Mounted vertical gear unit with shrink disc connection

[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:



Shrink disc on customer's side of machine shaft:

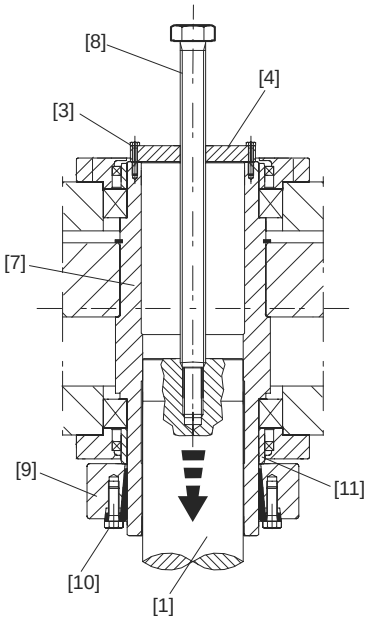


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Figure 21: Removing of vertical gear unit with shrink disc connection

[1] Customer's shaft
[3] End plate screws
[4] End plate
[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 the assembly clearance between the motor shaft end and the shaft end of the gear unit, please refer to Sec. "5.2 coupling" or to a separate coupling manual. The clearance can be checked by opening the inspection cover of the motor adapter.

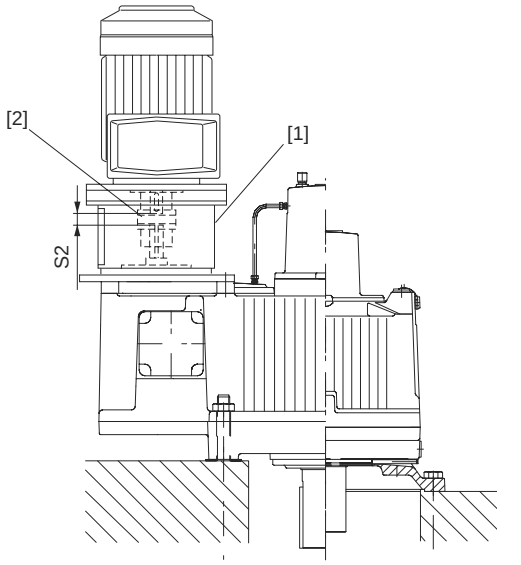

Figure 22: Mounting a motor with motor adapter

[1] Motor 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

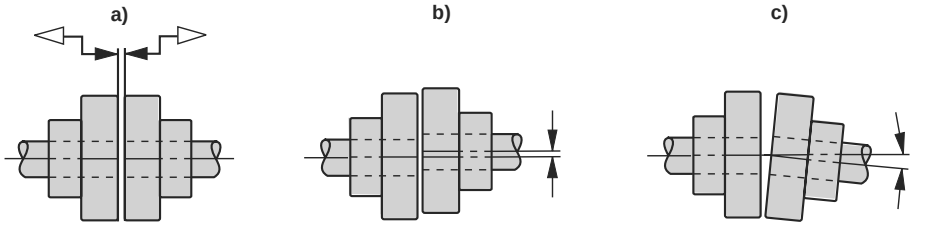

Figure 23: Clearance and misalignment when mounting the coupling

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 ($a_1 - a_2$).

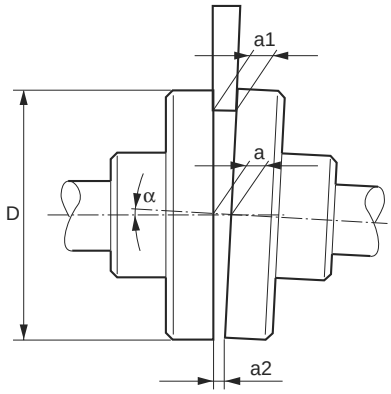

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Figure 24: Measuring angular misalignment using a feeler gauge

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.

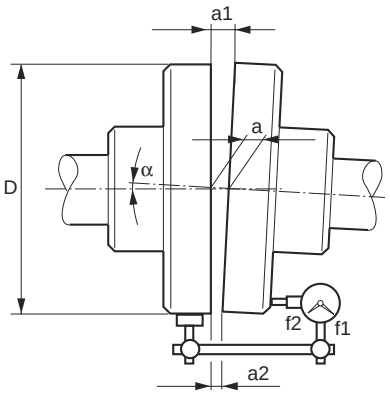

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Figure 25: Measuring angular misalignment using a micrometer dial

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.

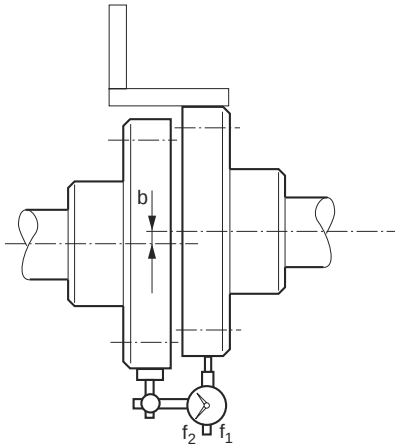

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Figure 26: Measuring offset misalignment using straight-edge and micrometer dial

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").

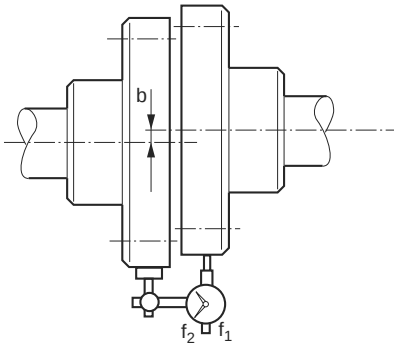

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Figure 27: Measuring offset misalignment using a micrometer dial

5.2 Mounting of couplings

ROTEX coupling

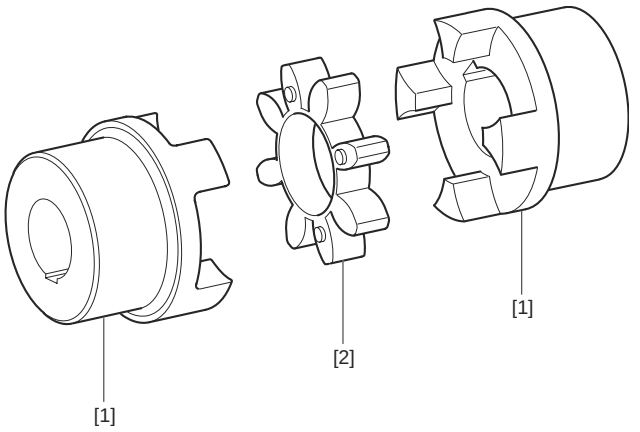

Figure 28: Design of the ROTEX coupling

[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

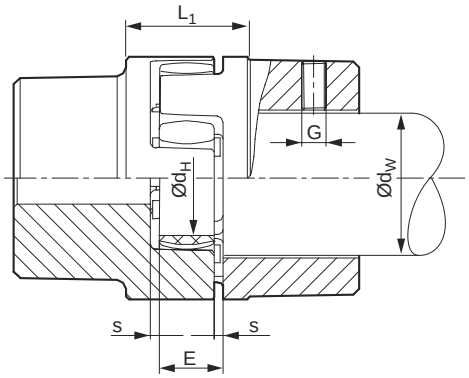

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Figure 29: Mounting dimensions of the ROTEX coupling

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

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.

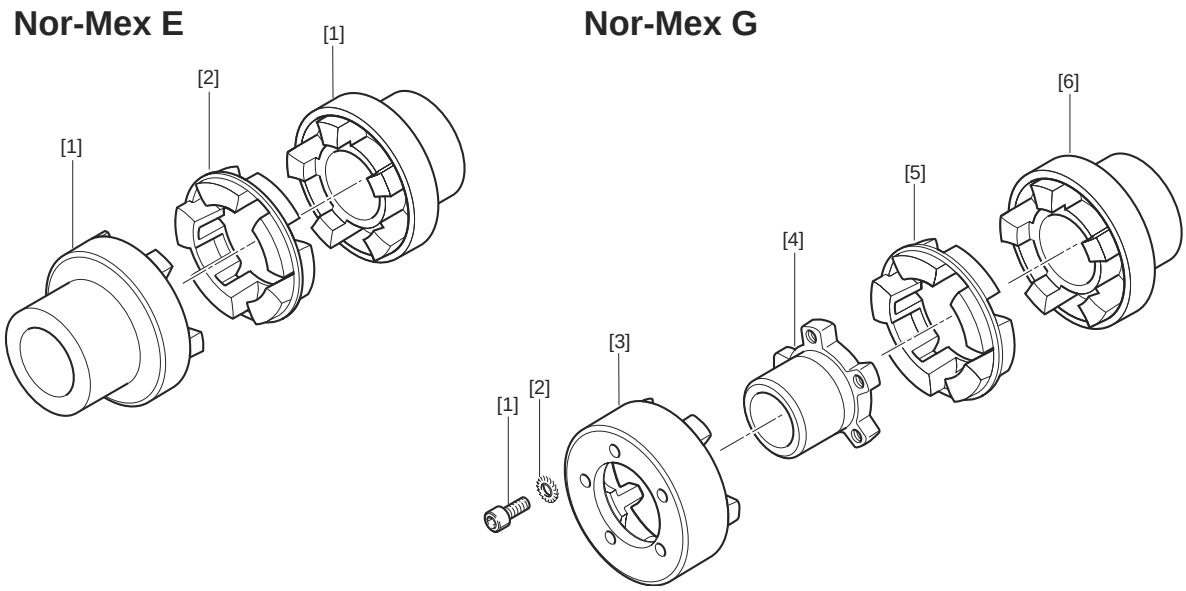

Figure 30: Design of the Nor-Mex E / Nor-Mex G coupling

[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.

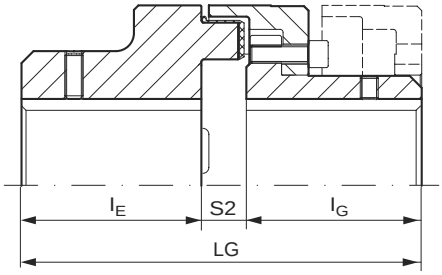

Figure 31: Mounting dimensions of the Nor-Mex G coupling

Nor-Mex G Coupling size	Mounting dimensions				Weight [kg]
	l_E [mm]	l_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

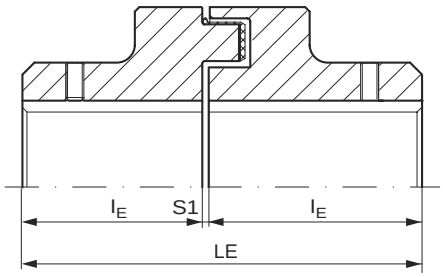

Figure 32: Mounting dimensions of the Nor-Mex E coupling

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**

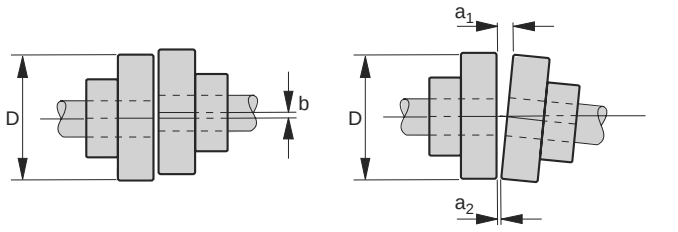

Figure 33: Mounting tolerances

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

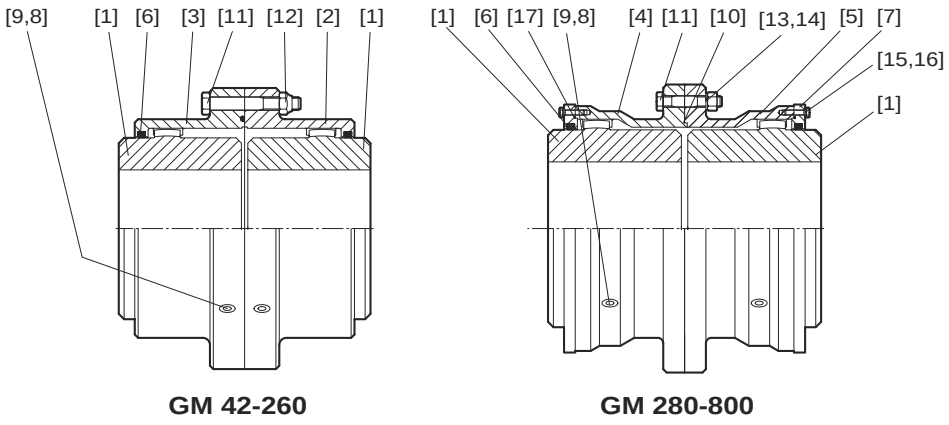

Figure 34: Design of the GM coupling

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

- Before mounting the coupling, thoroughly clean the individual parts of the coupling, in particular the toothing.
- Grease the O-rings [6] slightly and place them into the corresponding grooves in the sleeve [2, 3].
- Grease the toothing of the sleeves [2,3] and push the sleeves onto the shaft ends without damaging the O-rings [6].
- Slide the coupling hubs [1] onto the shaft. Move hubs to be flush with the shaft end.
- Align the machine to be coupled and check the shaft distance (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 hubs [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**

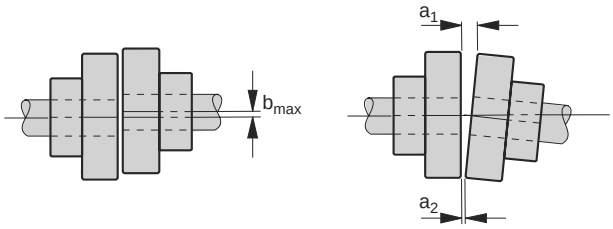

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Figure 35: Mounting tolerances of the GM coupling

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

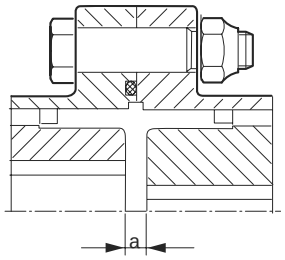

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Figure 36: Shaft distance "a"

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 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 37)

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

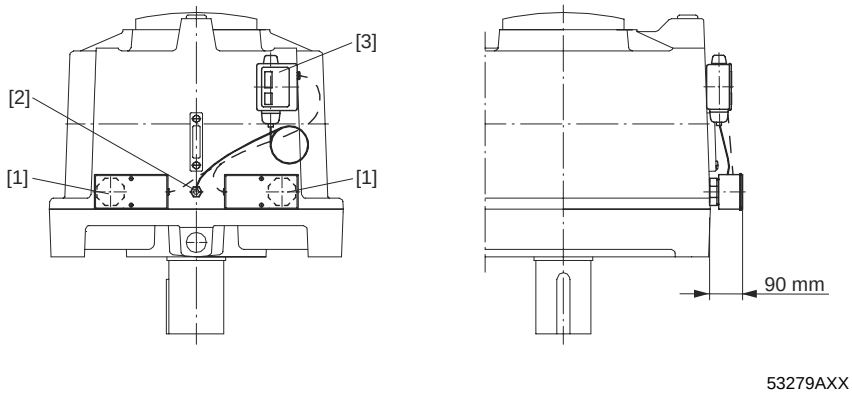

Figure 37: Oil heater M.V.. vertical gear units

[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 °C to 10 °C.

The thermostat and the oil heater are usually 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	Power [W]	Voltage [V]
50	1000 + 1500	200/400
60	1500 + 2500	230/400
70	1500 + 2500	230/400
80	2000 + 3000	230/400
90	2000 + 3000	230/400

Electrical connection resistor element

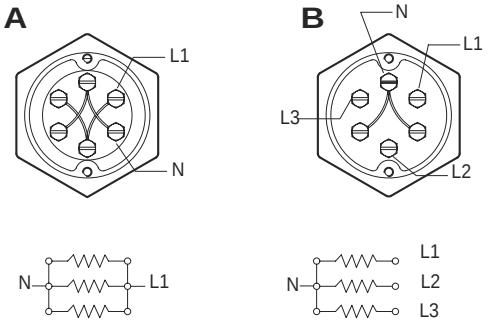

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Figure 38: Electrical connection options for the oil heater (A: single-phase / B: three-phase)

Basic design thermostat

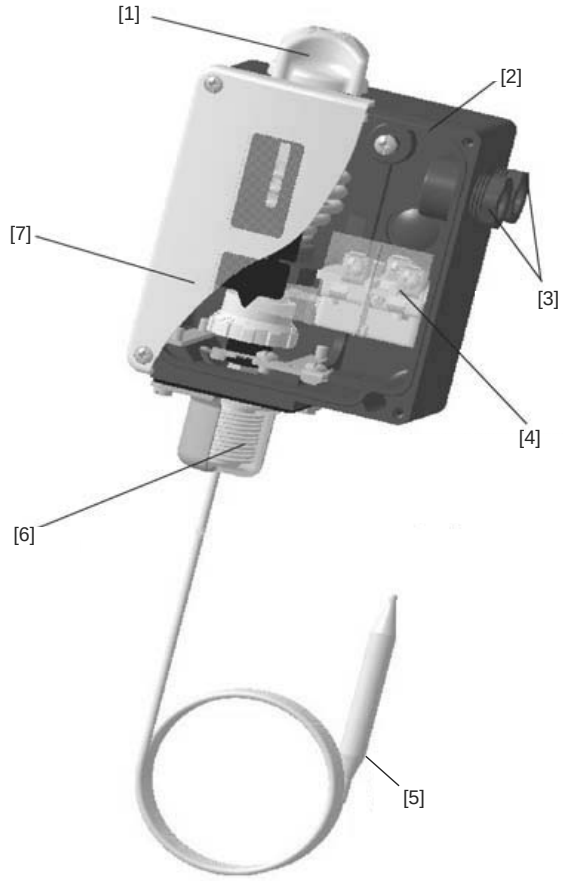
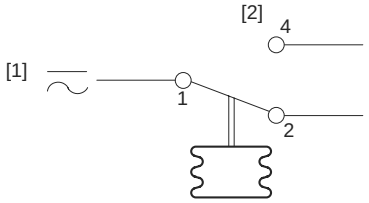
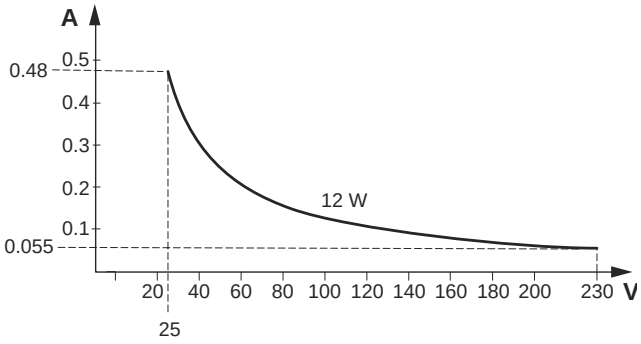


Figure 39: Basic design of a thermostat

[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	**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 
Contact material: **AgCdO**	
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.

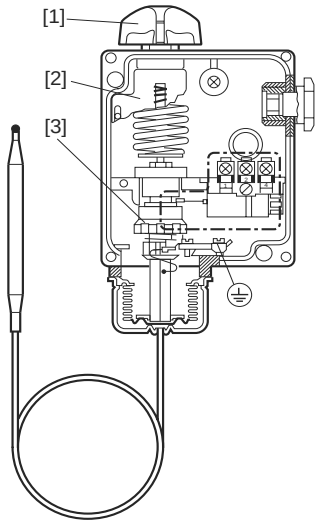


Figure 40: Design of the thermostat

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

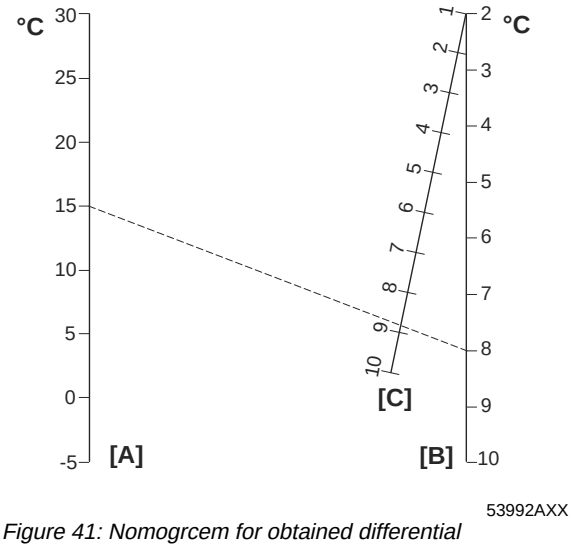


Figure 41: Nomogrcem for obtained differential

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

5.4 Temperature sensor PT100

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

Dimensions

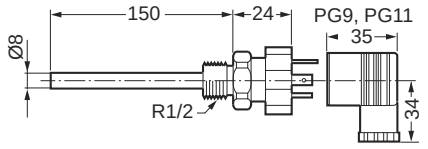


Figure 42: Dimensions

Electrical connection

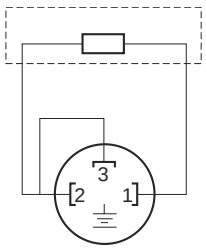


Figure 43: Electrical connection

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.

5.5 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

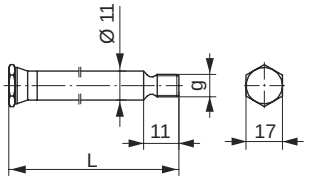


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Figure 44: SPM adapter

Sensor to be wired 40000 and fitting 13008

g = M8

L = 17, 106, 195, 284

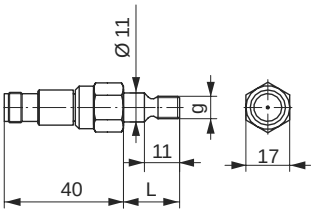

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Figure 45: SPM adapter

Mounting position of SPM - adapter

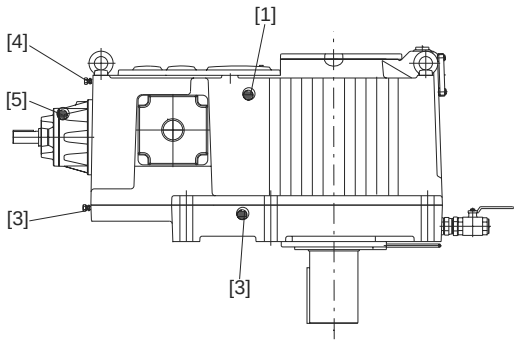

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Figure 46: M2P.../M3R... Position SPM - adapter

M.PV../M.RV..

Nipples [1], [2], [3] and [4] are on one side of the gear unit.

Nipple [5] only for M.RV.. gear units

Mounting of shock pulse sensor

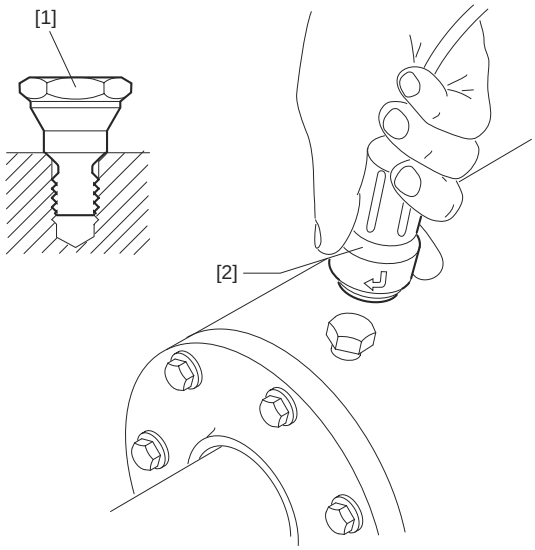

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Figure 47: Mounting the shock pulse sensor onto the SPM adapter

[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].

5.6 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.

Typ M3RV..

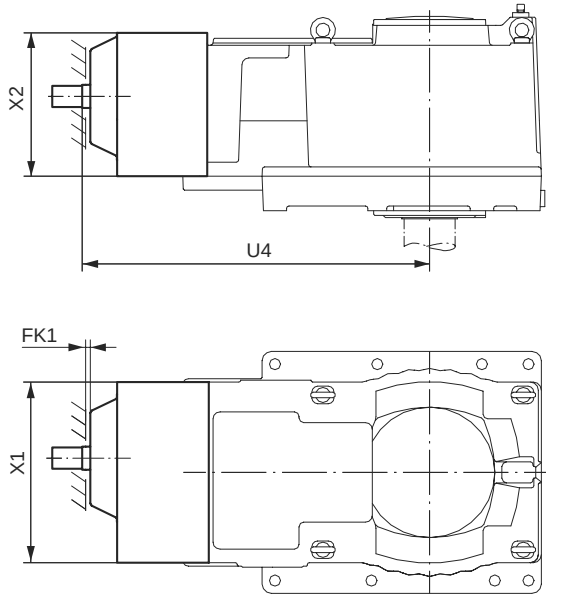


Figure 48: Fan

Gear Unit	Fan[1]	$n1_{max}$	U4	X1	X2	$FK1_{min}$
M3RV30	∅ 200	3000	758	450	371	15
M3RV40	∅ 250	3000	821	504	423	15
M3RV50	∅ 315	3000	995	590	491	20
M3RV60	∅ 315	3000	1114	640	519	20
M3RV70	∅ 400	2350	1269	740	607	20
M3RV80	∅ 400	2350	1320	800	625	20
M3RV90	∅ 400	2350	1493	846	652	20

1 Outer diameter of the fan

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

6 Pressure Lubrication

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

6.1 Shaft end pump

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

M.V.. 10...50

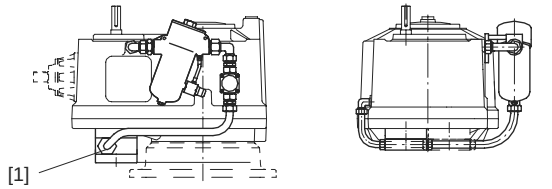


Figure 49: Shaft end pump

M.V.. 60...90

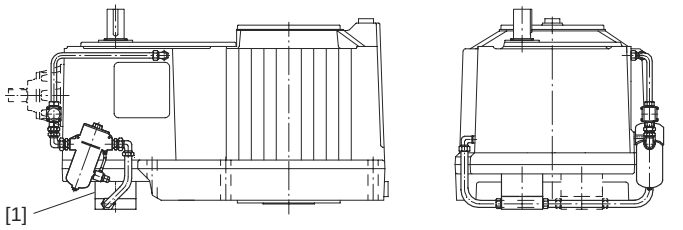


Figure 50: Shaft end pump

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

The standard scope of delivery includes

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

For a detailed description, 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:

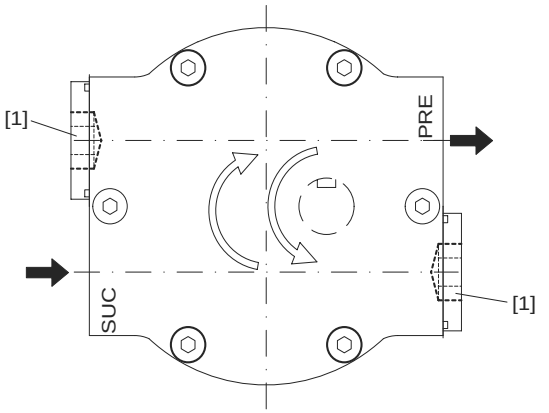


Figure 51: Shaft end pump

[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.

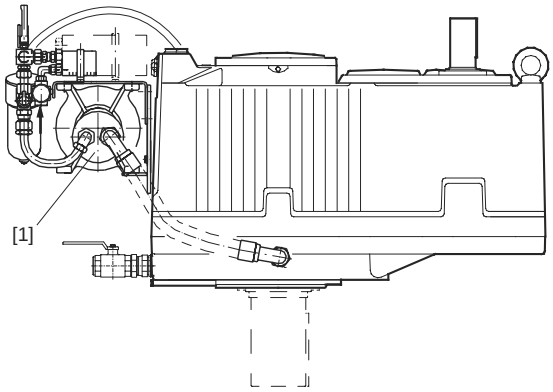


Figure 52: Motor pump

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 V - 240 V / 380 V - 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_P can be selected from the following table:

Gear unit size	Required oil flow in ltr./min		
	M2PV ...	M3PV... M3RV...	M4PV... M4RV...
10	6.3	7.5	
20	6.9	8.3	
30	8.4	10.0	
40	9.6	11.5	
50	11.0	13.2	15.3
60	12.8	15.2	17.7
70	14.5	17.3	20.2
80	15.9	19.0	22.1
90	17.5	20.9	24.3

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 $\eta = 0.97$
M3P, M3R $\eta = 0.955$
M4P, M4R $\eta = 0.94$

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

$$Q_P \geq Q_R$$

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 20 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 ther cooler, for example using a **thermo switch** or a **visual thermometer**

Typical setup pressure lubrication

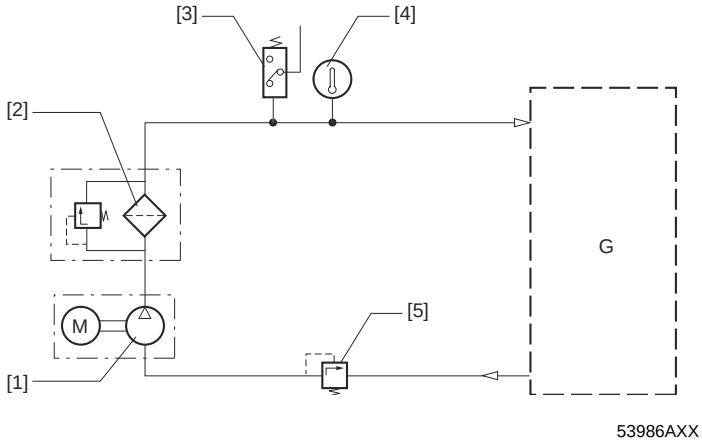


Figure 53: Pressure lubrication

[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

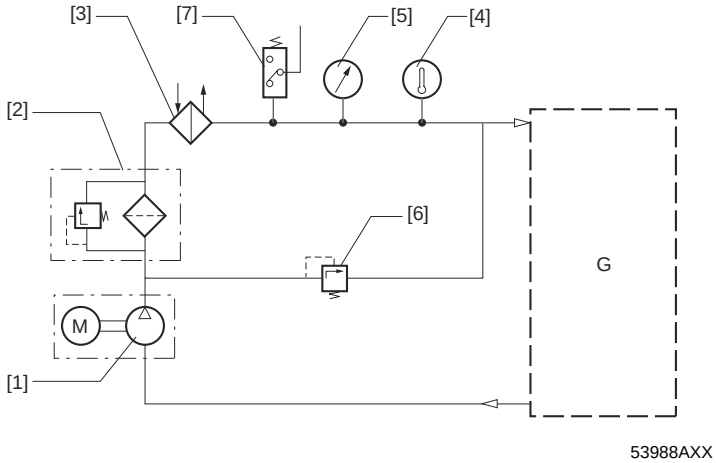


Figure 54: Pressure lubrication with oil/water cooler

[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

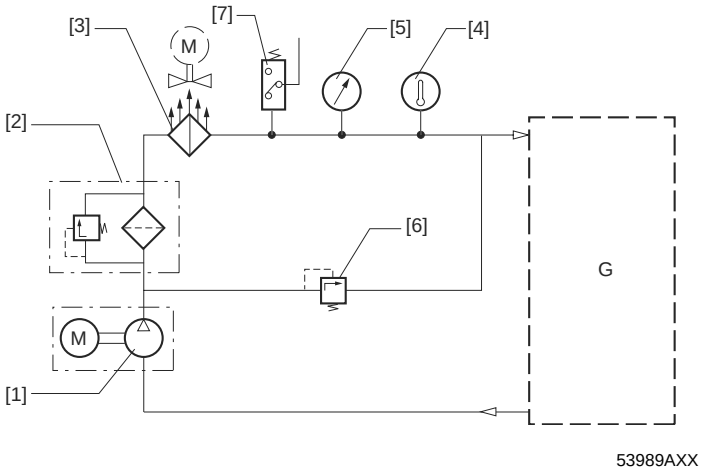


Figure 55: Setup of pressure lubrication with oil/water cooler

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

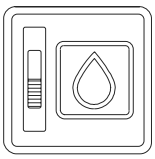
7 Startup

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. 20 µm). Fill the gear unit with the correct oil grade and volume (→ Sec. "Nameplate"). Guidelines for selecting the correct oil type (→ Sec. "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 Startup of M gear units with steel oil expansion tanks

Oil filling must be carried out with care to avoid that any air is left in the gear unit. Before filling the gear unit with oil, the membrane in the steel expansion tank must be in down position. During operation of the gear unit, the membrane moves up and down due to the thermal expansion of the oil.

Position of the membrane before startup:

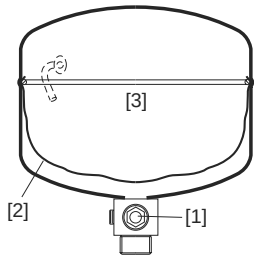


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Figure 56: Position of the membrane before startup

[1] Oil level

[2] Membrane in down position

[3] Air

If air gets under the membrane in the steel oil expansion tank, it can move the membrane upward thus causing pressure in the gear unit and possibly oil leakage.

The oil must have ambient temperature when filling the gear unit and the gear unit must be installed in its final mounting position. If the gear unit is filled before installation, the gear unit must not be tilted during installation to avoid that oil pushes the membrane upward.

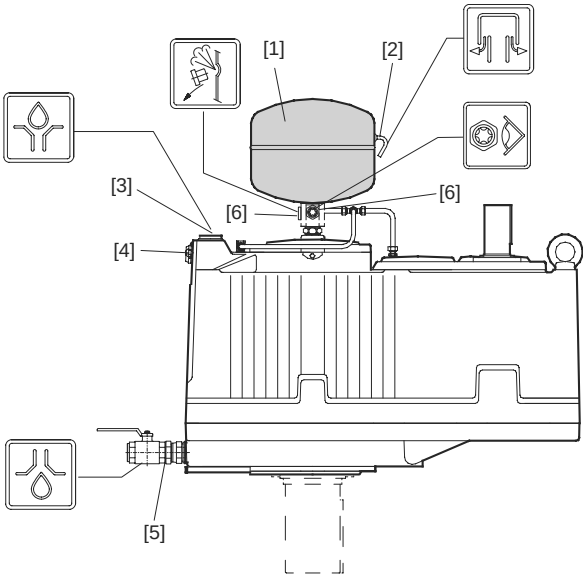

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Figure 57: M.PVSF../M.RVSF.. industrial gear unit with steel oil expansion tank

[1] Steel oil expansion	[4] Oil sight glass
[2] Breather	[5] Oil drain plug
[3] Oil filling plug	[6] Air outlet screw

1. Open the air outlet screw [6].
2. Open ALL upper screw plugs (usually two to three screw plugs) of the gear unit, such as breather plug, oil filling plug and oil dipstick (optional).
3. Blow compressed air into the oil expansion tank through the breather plug [2]. The membrane goes down (sometimes audibly).
4. Fill oil through the filling plug.
5. When the oil reaches the screw plug openings, re-install the screw plugs on the housing.
6. Fill the gear unit until oil comes out from the air outlet screw [6]. Close the air outlet screw.
7. Fill oil level to the oil sight glass [4].
8. Check the oil level via oil sight glass to ensure that the oil level keeps stable. The marks on the oil sight glass are decisive for the oil level. Fill more oil if required.
9. Screw in the oil dipstick (optional).
10. Carry out a test run to ensure that the oil level does not fall below the oil sight glass.
11. Check the oil level only when the gear unit has cooled off to ambient temperature.

7.4 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. 80 °C – with synthetic oil: max. 90 °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 0.05 % (500 ppm). • Fill labyrinth seals with grease. Use about 30 g grease per grease nipple. • Clean the breather plug
• Depending on the operating conditions, at the latest every 12 months	• Change the mineral oil (→ Sec. "Inspection and maintenance of the gear unit") • Check whether retaining screws are tightly secured • Check contamination and condition of the oil/air cooling system • Check the condition of the oil/water cooling system • Clean oil filter, replace filter element if necessary
• Depending on the operating conditions, at the latest every 3 years	• Change synthetic oil (→ Sec. "Inspection and maintenance of the gear unit")

• Varying (depending on external factors)	• Repair or renew the surface/anticorrosion coating
	• Clean the gearcase surface and fan
	• Check the oil heater:
	  • Are all connection cables and terminals tightened securely and free from corrosion?
	  • Clean incrusted elements (such as the heating element) and replace, if required (→ Sec. "Inspection and maintenance of the gear unit")

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.

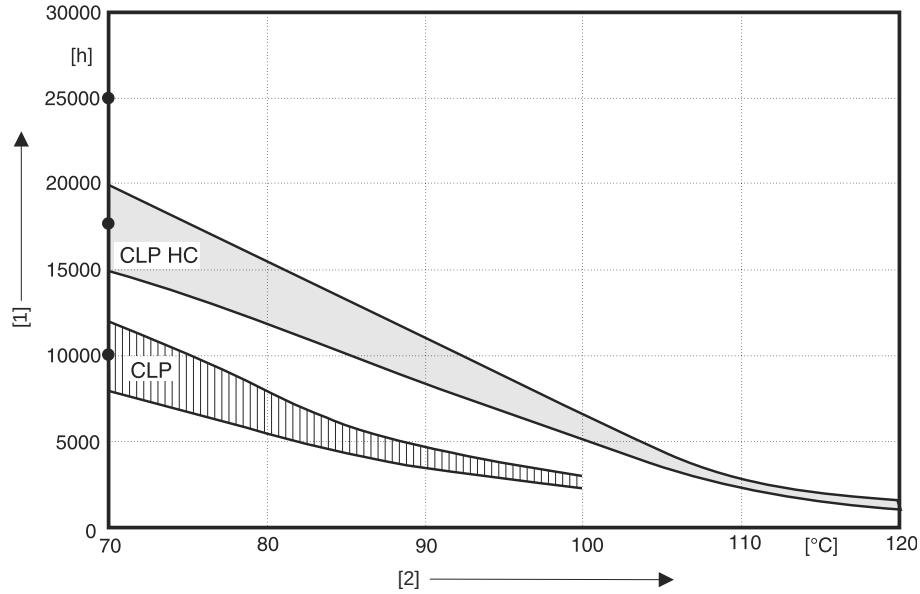


Figure 58: Lubricant change intervals for M gear units under normal ambient conditions

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

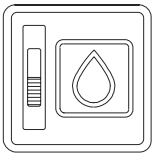
8.3 Inspection and maintenance of the gear unit

- **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."**

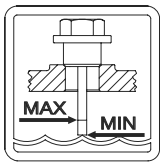
Checking the oil level

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".

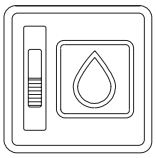
Changing the oil

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. 20 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

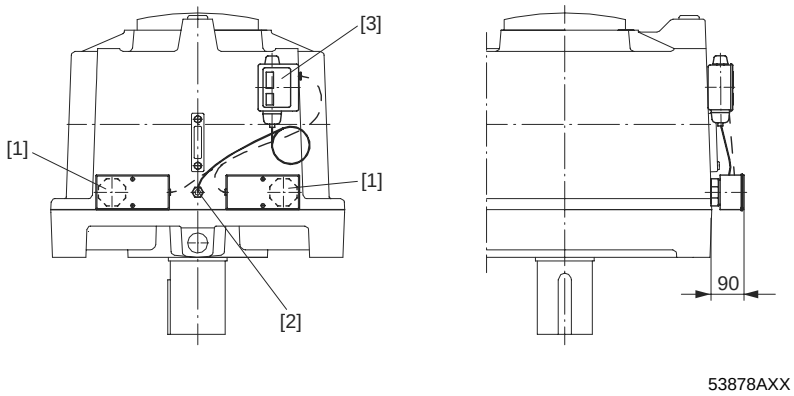


Figure 59: Oil heater M.V.. vertical gear units

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

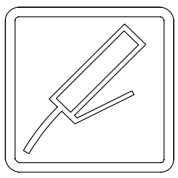
- Remove the oil heater [1] and the gasket on the gear unit.
- Remove the base of the terminal box.
- Clean the tubular heating elements with solvent.

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.

8.4 Vertical gear units with drywell sealing system on the Low Speed Shaft

The recommended grades of grease as well as greases recommended as alternative are given on the plate attached to the gear unit.

Amounts of grease

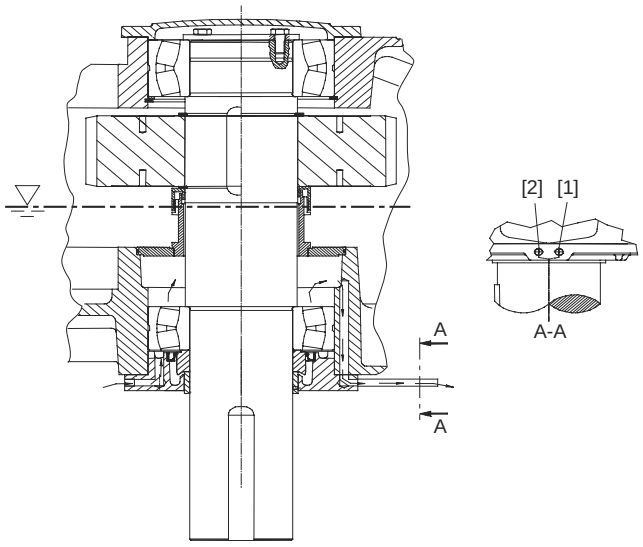


Figure 60: Drywell sealing system on the Low Speed Shaft

[1] Grease filling
[2] Outlet for excessive grease, remove plug

Amounts of grease for standard and re-inforced design.

Size M..V..	Regreasing [g]	First filling [g]
10	20	40
20	30	60
30	45	90
40	55	105
50	65	130
60	90	180
70	105	210
80	135	270
90	175	350

Regreasing is recommended when the gear unit is warm

The LSS should be slowly rotated during regreasing.

Greasing intervals

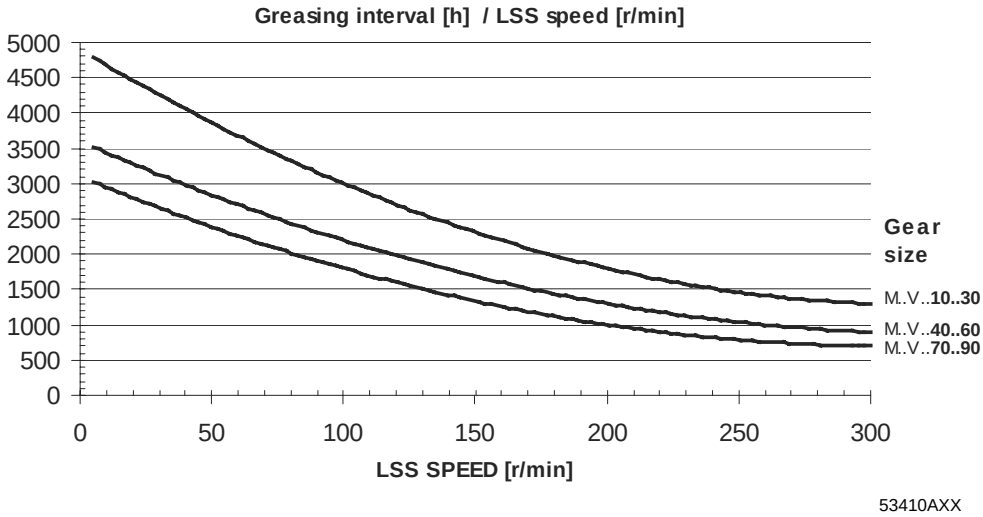


Figure 61: Greasing intervals for drywell system

Grease labels

The label indicates the correct grease type. The number of grease nipples is marked in the technical specification and on the nameplate, or on a separate plate.

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
	Air outlet screw
	Inspection opening
	Oil filling plug
	Oil drain plug
	Oil dipstick (optional)
	Oil sight glass
	Oil level glass
	Oil indication in case of leakage

10.2 Mounting positions of M.PV.. gear units

M.PV..
Bath lubrication

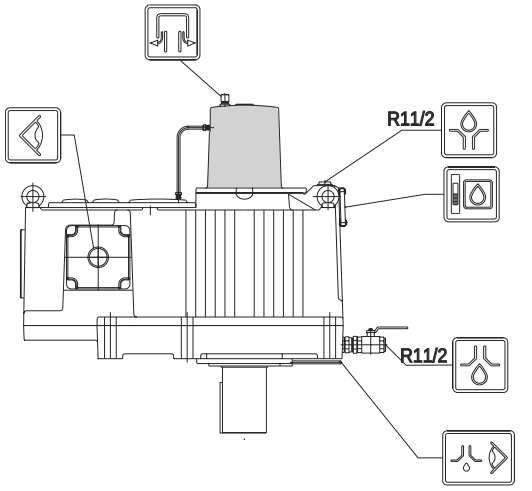


Figure 62: M.PV.. Bath lubrication

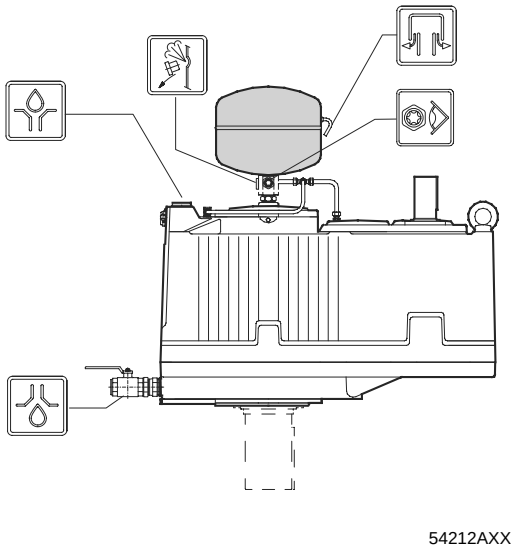


Figure 63: M.PV.. Bath lubrication

M.PV.. Pressure lubrication

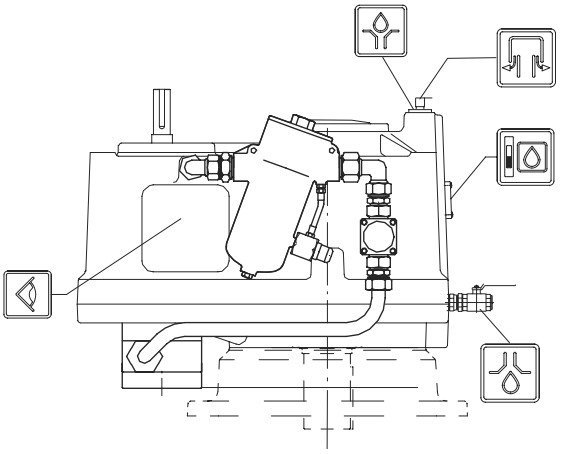


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Figure 64: M.PV.. Pressure lubrication

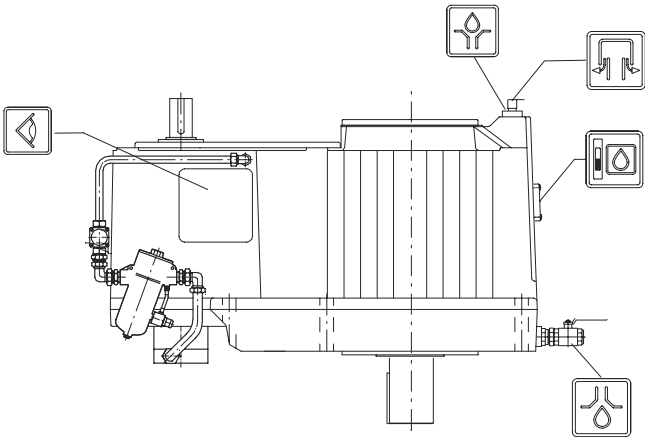

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Figure 65: M.PV.. Pressure lubrication

M.RV..
Bath lubrication

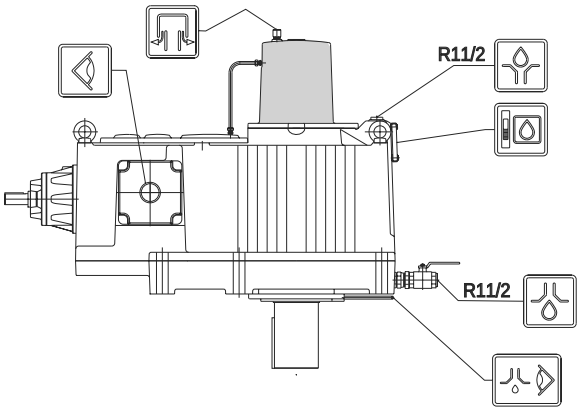

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Figure 66: M.RV.. Bath lubrication

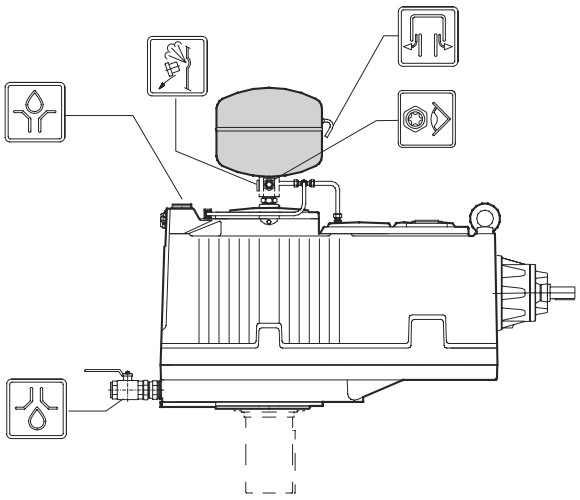

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Figure 67: M.RV.. Bath lubrication

M.RV.. Pressure lubrication

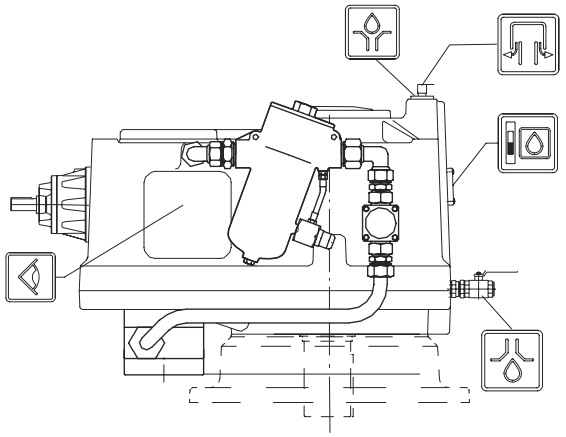

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Figure 68: M.RV.. Pressure lubrication

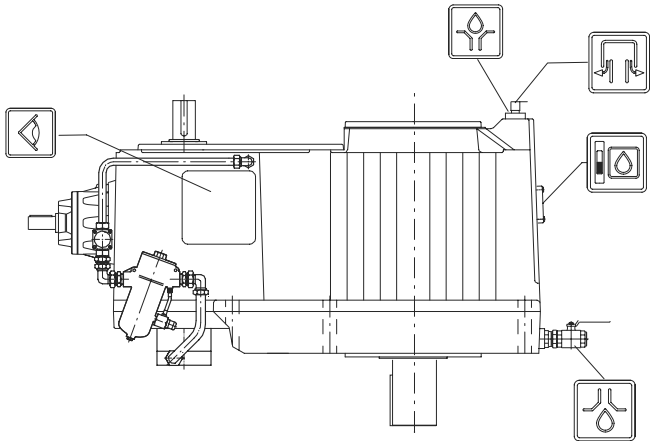

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Figure 69: M.RV.. Pressure lubrication

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]		Pres. lubrication NO ext. cooler[1]		Pres. lubrication ext. cooler, spray dose, splash or bath lubrication[2]		Pres. lubrication ext. cooler, oil led to gearmeshes and bearings[3]		Note
	ISO VG (40 °C)	T_L [°C]	ISO VG (40 °C)	T_L [°C]	ISO VG (40 °C)	T_L [°C]	ISO VG (40 °C)	T_L [°C]	
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

Mineral oils

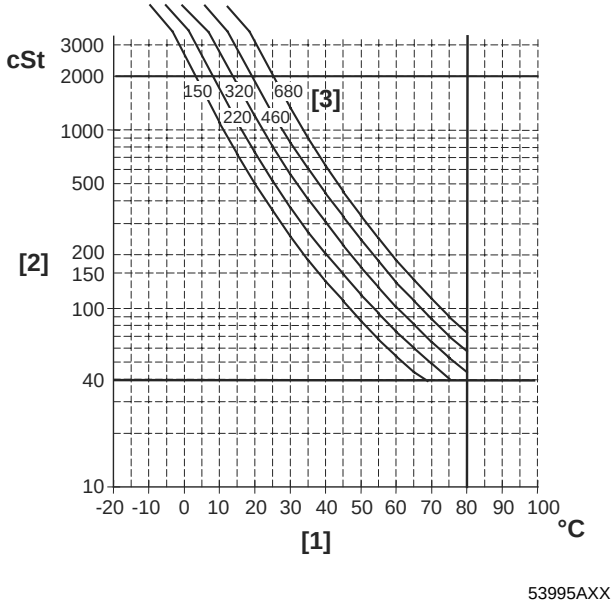

Figure 70: Mineral oils

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

Synthetic PAO oils

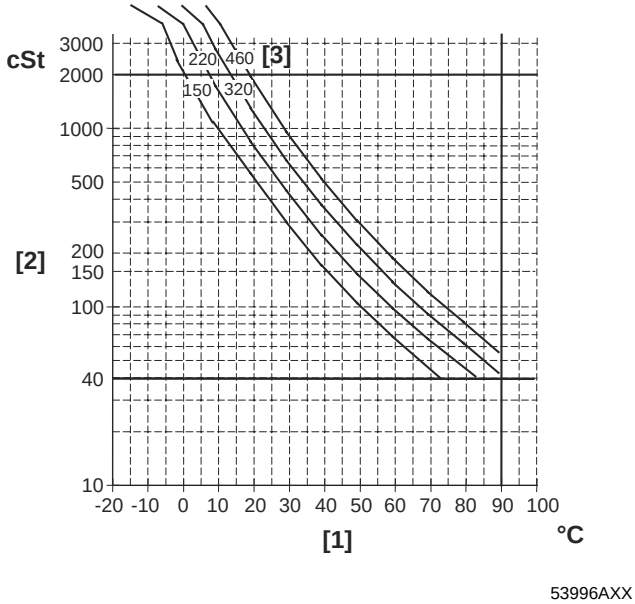

Figure 71: Synthetic PAO oils

[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.PV..

Gear unit size M.PV..	Lubrication type	Oil volume [l]		
		Two stages M2PV..	Three stages M3PV..	Four stages M4PV..
10	Bath Pressure	34 14	33 13	
20	Bath Pressure	39 16	38 15	
30	Bath Pressure	68 25	66 24	
40	Bath Pressure	94 34	92 33	
50	Bath Pressure	152 51	150 50	148 49
60	Bath Pressure	183 61	180 60	177 59
70	Bath Pressure	263 86	260 85	257 84
80	Bath Pressure	353 122	350 120	347 118
90	Bath Pressure		450 150	446 148

M.RV..

Gear unit size M.RV..	Lubrication type	Oil volume [l]	
		Three stages M3RV..	Four stages M4RV..
30	Bath Pressure	66 24	
40	Bath Pressure	92 33	
50	Bath Pressure	150 50	148 49
60	Bath Pressure	180 60	177 59
70	Bath Pressure	260 85	257 84
80	Bath Pressure	350 120	347 118
90	Bath Pressure	450 150	446 148

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

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