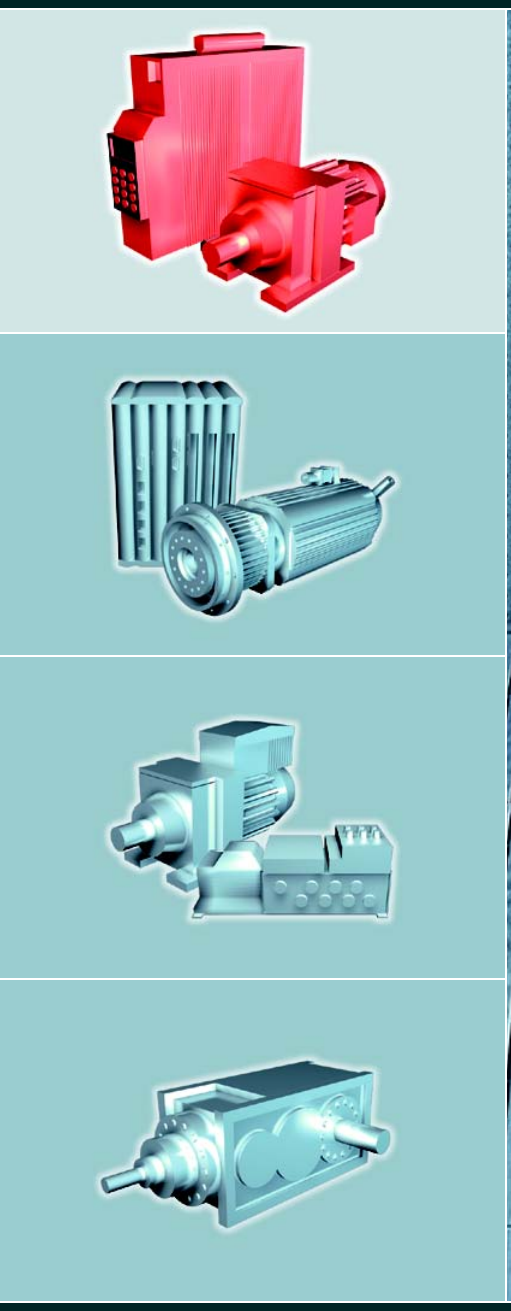
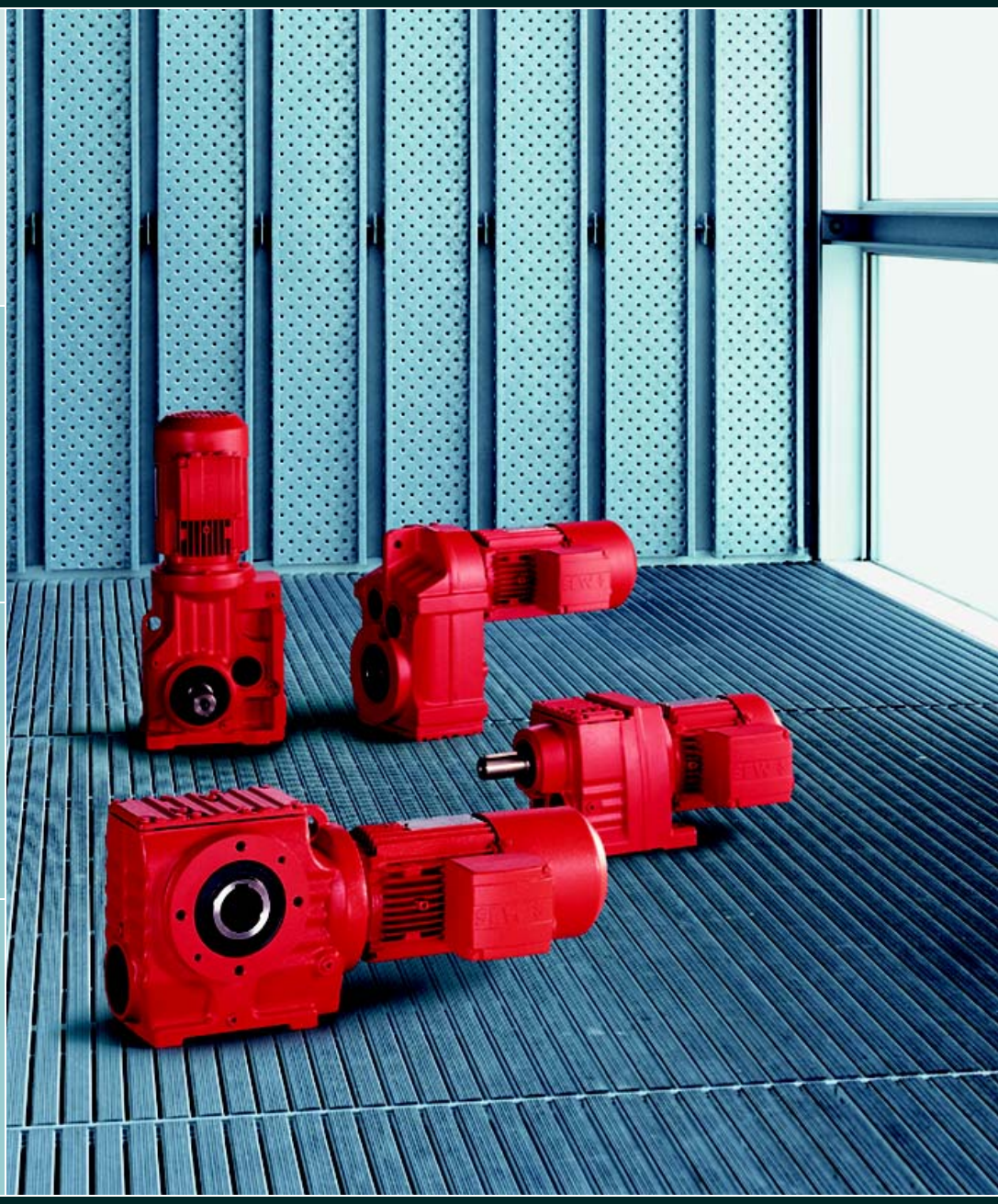
SEW EURODRIVE





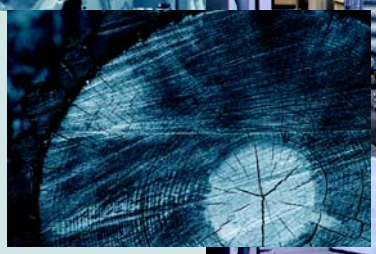
Gear Units and Gearmotors

FA100000/US09

11509031 / US

Revision 1

Manual



SEW
EURODRIVE

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1 Introduction

1.1 The SEW-EURODRIVE Group of Companies

Global presence

Since it introduced the world's first gearmotor 75 years ago, SEW-EURODRIVE has grown to become the global leader in electromechanical and electronic solutions for power transmission and motion control. SEW-EURODRIVE does business in more than 144 countries, providing the most advanced and reliable drive solutions to hundreds of industries: automotive, food and beverage processing, packaging, building materials, water and wastewater treatment, logistics and transportation, entertainment and many more. Whether it involves moving people, raw materials or finished goods, SEW-EURODRIVE solutions drive the world.

Always the right drive

The modular concept behind our global approach to product design enables SEW-EURODRIVE to offer customers literally millions of ways to combine our components to create truly custom solutions. That means each SEW-EURODRIVE solution can be finely tuned for the speed and torque range, available space and ambient conditions of each customer's unique application. This ability to customize solutions makes SEW-EURODRIVE an ideal partner for OEMs trying to increase the performance of their machines to meet customer demand for increased quality and throughput.

Our global product line assures that components are the same no matter where in the world our drive solutions are assembled or used. This is an important benefit for industrial customers with global operations, allowing them to standardize on the best in drive technology at their facilities anywhere in the world. With 11 manufacturing plants and 58 assembly plants in 44 countries, SEW-EURODRIVE products and technical support are immediately available to customers worldwide.

SEW-EURODRIVE gearmotors are electronically powered by MOVITRAC® frequency inverters, MOVIDRIVE® drives and MOVIAXIS® multi-axis servo drives, a combination that blends perfectly with existing SEW-EURODRIVE systems. As with SEW-EURODRIVE mechanical systems, our drive electronics assure a complete SEW-EURODRIVE solution to deliver the maximum in functionality and flexibility.

Servo drive system products, such as low backlash servo gear units, compact servomotors or MOVIAXIS® multi-axis servo drives deliver exacting precision and dynamics. From a simple single-axis application to complex synchronized process sequences, you can be confident SEW-EURODRIVE will deliver the optimum solution.

For economical, decentralized systems, SEW-EURODRIVE offers MOVIMOT®, the gearmotor with an integrated frequency inverter, or MOVI-SWITCH®, with its integrated switching and protective functions. SEW-EURODRIVE hybrid cables assure cost-effective installation no matter the size of the system. And in the latest product advances, we have introduced MOVITRANS®, a contactless energy transfer system, MOVIPRO® decentralized drive control and MOVIFIT® decentralized intelligence.

SEW-EURODRIVE also sets the global standard for power, quality and reliability with its industrial gear units for large loads. These large gear units are based on the same modular design concept to provide optimum adaptability for a wide range of applications.

Your ideal partner

With its global presence, broad product range and expert technical services, SEW-EURODRIVE is the ideal partner for your next equipment design project, no matter your industry or application.

1.2 Products and systems from SEW-EURODRIVE

The products and systems from SEW-EURODRIVE are divided into four product groups. These four product groups are:

1. Gearmotors and frequency inverters
2. Servo drive systems
3. Decentralized drive systems
4. Industrial gear units

Products and systems used in several group applications are listed in a separate group "Products and systems covering several product groups." Consult the following tables to locate the products and systems included in the respective product group:

1) Gearmotors and frequency inverters		
Gear units / gearmotors	**Motors**	**Frequency inverters**
• Helical gear units/ helical gearmotors • Parallel shaft helical gear units / parallel shaft helical gearmotors • Helical-bevel gear units / helical-bevel gearmotors • Helical-worm gear units/ helical-worm gearmotors • Spiroplan® right-angle gearmotors • Drives for overhead trolley systems • Multi-speed gearmotors • Variable speed gear units / variable speed gearmotors • Aseptic gearmotors	• Asynchronous AC motors / AC brake motors • Multi-speed AC motors / AC brake motors • Energy efficient motors	• MOVITRAC® frequency inverters • MOVIDRIVE® drive inverters • Control, technology and communication options for inverters

2) Servo drive systems		
Servo gear units / servo gearmotors	**Servomotors**	**Servo drive inverters / servo inverters**
• Low backlash servo planetary gear units / planetary gear-motors • Low backlash helical-bevel servo gear units / helical-bevel gearmotors	• Synchronous servomotors / servo brake motors	• MOVIDRIVE® servo drive inverters • MOVIAXIS® multi-axis servo inverter • Control, technology and communication options for servo drive inverters and servo inverters

3) Decentralized drive systems		
Decentralized drives	**Communication and installation**	**Contactless energy transfer system**
• MOVIMOT® gearmotors with integrated frequency inverter • MOVIMOT® motors/brake motors with integrated frequency inverter • MOVI-SWITCH® geamotor with integrated switching and protection function • MOVI-SWITCH® motors/brake motors with integrated switching and protection function	• Fieldbus interfaces • Field distributors for decentralized installation • MOVIFIT® product range – MOVIFIT® MC to control MOVIMOT® drives – MOVIFIT® SC with integrated electronic soft starter – MOVIFIT® FC with integrated frequency inverter	• MOVITRANS® system – Stationary components for energy supply – Mobile components for energy consumption – Line cables and installation material

4) Industrial gear units
• Helical gear units • Helical-bevel gear unit • Planetary gear units

Products and systems for several groups of products
• Operator terminals • MOVI-PLC® drive-based control system

In addition to its products and systems, SEW-EURODRIVE offers a comprehensive range of services. These are:

- Technical application assistance
- Application software
- Seminars and training
- Extensive technical documentation
- International customer service

Visit our home page:

→ **www.seweurodrive.com**

The website offers a lot of information and services.

1.3 Additional documentation

Contents of this publication

This manual "Gear Units and Gearmotors" includes a detailed description of the following SEW-EURODRIVE product groups:

- Helical gear units and helical gearmotors
- Parallel shaft helical gear units and parallel shaft helical gearmotors
- Helical-bevel gear units and helical-bevel gearmotors
- Helical-worm gear units and helical-worm gearmotors
- Gear unit components at the input end
- Spiroplan® gearmotors
- MOVIMOT® gearmotors
- AC motors

This catalog offers the following information:

- Product descriptions
- Type overviews
- Project planning information
- Visual representation of mounting positions
- Explanation on the order information
- Design and operating notes

Additional documentation

In addition to this "Gear Units and Gearmotors" manual, the following product selection catalogs are available from SEW-EURODRIVE:

- Gearmotors (helical, parallel shaft helical, helical-bevel and helical-worm designs as well as Spiroplan®)
- MOVIMOT® gearmotors
- Gear units (helical, parallel shaft helical, helical-bevel and helical-worm designs)

The catalogs offer the following information:

- Important information on tables and dimension sheets
- Visual representation of the different designs
- Overview of all possible combinations
- Selection tables
- Dimension drawings
- Technical data

This manual includes references to let you know which catalog includes the technical data / or dimension drawings associated with the description. Reference is made with the following pictograms and cross references:

	The associated technical data and / or dimension drawings are listed in the catalog "Gearmotors." Also note the cross reference "(→ GM) in the section title and the header.
	The associated technical data and / or dimension drawings are listed in the catalog "MOVIMOT® Gearmotors." Also note the cross reference "(→ MM) in the section title and the header.
	The associated technical data and / or dimension drawings are listed in the catalog "Gear Units." Also note the cross reference "(→ GK) in the section title and the header.

The "Gear Units and Gearmotors" manual and the listed catalog can be ordered separately. The following catalog isavailable:

Gearmotors catalog	Part number US edition:	11508639

Please note that the complete range of technical documentation is available on our home page:

→ **www.seweurodrive.com**

2 Product Description

2.1 General notes on product description

Power and torque

The power and torque ratings listed in the catalogs refer to mounting position M1 and similar mounting positions in which the input stage is not completely submerged in oil. In addition, the gearmotors are assumed to be standard versions with standard lubrication and under normal ambient conditions.

Please note that the motor power shown in the selection tables for gearmotors is subject to selection. However, the output torque for the desired output speed is essential for the application and needs to be checked.

Speeds

The quoted output speeds of the gearmotors are recommended values. You can calculate the rated output speed based on the rated motor speed and the gear unit ratio. Please note that the actual output speed depends on the motor load and the supply system conditions.

Noise levels

The noise levels of all SEW-EURODRIVE gearmotors and motors (brake motors) are well within the maximum permitted noise levels set forth in the VDI guideline 2159 for gear units and IEC/EN 60034 for motors.

Coating

Gear units, motors and gearmotors from SEW-EURODRIVE are painted with "SEW blue" as standard. Special coatings are available on request.

Surface and corrosion protection

If required, all SEW-EURODRIVE gear units, motors and gearmotors can also be supplied with special surface protection for applications in extremely humid and chemically aggressive environments.

Weights

Please note that all weights shown in the catalog exclude the oil fill for the gear units and gearmotors. The weights vary according to gear unit design and gear unit size. The lubricant fill depends on the mounting position selected, which means that in this case no universally applicable information can be given. Please refer to "Lubricants" in the "Design and Operating Notes" section for recommended lubricant fill quantities depending on the mounting position. The exact weight is given in the order confirmation.

Air flow and accessibility

The gearmotors/brake motors must be mounted on the driven machine in such a way that both axially and radially there is enough space left for unimpeded air flow and for the purposes of maintenance of the brake and MOVIMOT® inverter, if necessary. Please also refer to the notes in the motor dimension sheets.

Multi-stage gearmotors

You can achieve particularly low output speeds by using multi-stage gear units or multi-stage gearmotors. This involves mounting a helical gear unit or helical gearmotor on the input end as a second gear unit.

It may be necessary to limit the motor power to match the maximum permitted output torque of the gear unit.

Design with reduced backlash

Helical, parallel shaft helical and helical-bevel gear units with reduced backlash are available from gear unit size 37 and up. The circumferential backlash of these gear units is considerably less than that of the standard versions so that positioning tasks can be performed with great precision. The circumferential backlash is specified in angular minutes [’] in the technical data. The dimension drawings for the standard versions are applicable.

NOCO® fluid for protection against contact corrosion

As standard, all shaft-mounted gear units and gearmotors are supplied with NOCO® Fluid, a paste that prevents contact corrosion. Use this paste in accordance with the instructions in the gear unit operating instructions.

NOCO® fluid is food grade according to NSF certified H1.

RM gear units, RM gearmotors

RM gear units and RM gearmotors are a special type of helical gear unit and helical gearmotor with an extended output bearing hub. They are specifically designed for agitating applications and can be used in applications subject to high overhung and axial loads. The remaining data correspond to the standard helical gear units and helical gearmotors. You can find special project planning notes for RM gearmotors in the "Project Planning for Gear Units/RM gear units" section.

Spiroplan® right-angle gear units/motors

Spiroplan® right-angle gearmotors are robust, single stage right-angle gearmotors with Spiroplan® gearing. The difference to the helical-worm gear units is the material combination of the right-angle gearing, and the aluminum housing. As a result, Spiroplan® right-angle gearmotors are wear-free, quiet-running and lightweight.

After the running-in period, Spiroplan® right-angle gearmotors are below the sound pressure level of 58 dB(A) in 4-pole operation on a 60 Hz supply system. The sound-pressure level may be 3 to 5 dB(A) higher during the initial "run-in" than after hours of regular operation.

The wear-free gearing and the lifetime lubrication make for long periods of maintenance-free operation. The oil fill is independent of the mounting position. Any position possible for Spiroplan® right-angle gearmotors without altering the quantity of oil.

Two different flange diameters are available. On request, Spiroplan® right-angle gearmotors can be equipped with a torque arm.

Brake motors

On request, motors and gearmotors can be supplied with an integrated mechanical brake. The SEW-EURODRIVE brake is an electromagnetic disk brake with a DC coil that releases electrically and brakes using spring force. Due to its operating principle, the brake is applied if the power fails. It meets the basic safety requirements. The brake can also be released mechanically if equipped with a manual brake release. You will receive a manual lever with automatic reset. The brake is controlled by a control module that is either installed in the motor conduit box or the control cabinet.

A significant feature of the brakes is their very short length. The brake bearing end shield is an integral part of both the motor and the brake. The integrated construction of the SEW-EURODRIVE brake motor permits particularly compact and sturdy solutions.

International markets

SEW-EURODRIVE supplies motors with CSA certification meeting the connection requirements to CSA und NEMA guidelines. UL listed motors are available when requested.

We deliver UL listed MOVIMOT® drives with connection requirements according to NEMA guidelines.

For the Japanese market, SEW-EURODRIVE offers motors conforming to JIS standard. Contact your sales representative to assist you in such cases.

Component on the input side

The following components on the input side are available for the gear units from SEW-EURODRIVE:

- **Input covers with input shaft extension, optionally with**
  - Centering shoulder
  - Backstop
  - Motor mounting platform
- **Adapter**
  - for mounting IEC or NEMA motors with the option of a backstop
  - for mounting servomotors with a square flange
  - with torque limiting safety couplings and speed or slip monitor
  - with hydraulic centrifugal coupling, also with disc brake or backstop

Swing base

A swing base is a drive unit consisting of helical-bevel gear unit, optional fluid coupling and electric motor. The complete arrangement is mounted to a rigid mounting rail.

Motor swings are available with the following optional accessories:

- Torque arm
- Mechanical thermal monitoring unit (fluid coupling option)
- Contactless thermal monitoring unit (fluid coupling option)

2.2 Energy efficient motors (→ GM)

DT/DV and DTE/DVE four-pole AC motors comply with the energy efficiency standards and energy efficiency regulations of the following countries:

- USA (EPAct)
- Australia
- New Zealand
- Brazil
- Canada

Europe

CEMEP, the association of European electric motor manufacturers, has reached an agreement with the European Commission's General Directorate for Energy that all 2 and 4-pole low-voltage AC motors from 1 to 100 kW will be classified on the basis of their efficiency, and that this classification will be identified on the nameplate and in catalogs. The classification consists of EFF3, EFF2 and EFF1 classes. EFF3 refers to motors without any particular efficiency requirement. EFF2 indicates improved efficiency motors and EFF1 is for high-efficiency motors.

Type DT/DV four-pole AC motors of motor sizes 90S to 280M meet the requirements of efficiency class EFF 2.

Type DTE/DVE four-pole AC motors of motor sizes 90S to 280M meet the requirements of efficiency class EFF 1. These motors are referred to as energy efficient motors.

2.3 Corrosion and surface protection

General information

SEW-EURODRIVE offers various optional protective measures for operation of motors and gear units in excessive conditions.

- Corrosion protection KS for motors
- Industry option package

Corrosion protection KS

Corrosion protection KS for motors comprises the following measures:

- Stainless steel retaining screws.
- The nameplates are made from stainless steel or equivalent corrosion resistant material.
- Interior motor components are protected with a corrosion resistant coating.
- Additional sealing for brake motors.

Motors with a forced cooling fan and motors with a spreadshaft encoder (ES..) cannot be supplied with corrosion protection KS.

Industry Option Package

SEW-EURODRIVE provides options that provide protecton to the motor and reducer when operating in severe environments.

Contact SEW-EURODRIVE for additional information on available IOP's (Industry Option Packages).

Surface protection OS

Instead of the standard surface protection, the motors and gear units are available with surface protection OS1 to OS4 as an option. The special procedure Z can also be performed in addition. The special procedure Z means that large surface recesses are sprayed with a rubber filling prior to painting.

Surface protection	Suitable for
OSG	Primer only
Standard	Normal ambient conditions
OS1	Low environmental impact
OS2	Medium environmental impact
OS3	High environmental impact
OS4	Very high environmental impact

Special protective measures

Measure	Protection principle	Suitable for
FKM oil seal	High quality material	Drives subject to chemicals
PTFE oil seal	High quality material	Drives subject to chemicals
Stainless steel output shaft	Surface protection through high-quality material	Particularly exacting applications in terms of exterior surface protection

NOCO® fluid

As standard, SEW-EURODRIVE supplies NOCO® fluid corrosion protection and lubricant with every hollow shaft gear unit. Use NOCO® fluid when installing hollow shaft gear units. Using this fluid helps prevent contact corrosion and makes it easier to assemble the drive at a later date.

NOCO® fluid is also suitable for protecting machined metal surfaces that do not have corrosion protection, including parts of shaft ends or flanges. You can also order larger quantities of NOCO® fluid from SEW-EURODRIVE.

NOCO® fluid is food grade according to NSF certified H1.

2.4 Extended storage

Type

You can also order the gear units prepared for "extended storage". SEW-EURODRIVE recommends the "extended storage" type for storage periods longer than 9 months.

In this case, a VCI (volatile corrosion inhibitor) is added to the lubricant in these gear units. Please note that this VCI corrosion inhibitor is only effective in a temperature range of -25 °C...+50 °C. The flange contact surfaces and shaft ends are also treated with an anti-corrosion agent. If not specified otherwise in your order, the gear unit will be supplied with OS1 surface protection. You can order OS2, OS3 or OS4 instead of OS1.

The gear units must remain tightly sealed until taken into operation to prevent the VCI corrosion protection agent from evaporating.

Gear units will be supplied with an oil fill according to the mounting position (M1 ... M6) and are ready for operation. Check the oil level before you start operating the gear unit for the first time!

Storage conditions

For extended storage, observe the storage conditions specified in the following table:

Climate zone	Packaging[1)]	Storage location[2)]	Storage duration
Temperature (Europe, USA, Canada, China and Russia, excluding tropical zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap.	With roof, protected against rain and snow, no shock loads	Up to three years with regular checks to the packaging and moisture indicator (rel. humidity < 50%).
	open	Under roof, enclosed at constant temperature and atmospheric humidity ($5^{\circ}C < \vartheta < 60^{\circ}C$, < 50% relative atmospheric humidity). No sudden temperature fluctuations and controlled ventilation with filter (free of dust and dirt). No aggressive vapors and no shocks.	Two years or more given regular inspections. During inspection, check for cleanliness and mechanical damages. Check corrosion protection.
Tropical (Asia, Africa, Central and South America, Australia, New Zealand excluding temperate zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap. Protected against insect damage and mold through chemical treatment.	Under roof, protected against rain, no shock loads.	Up to three years with regular checks of the packaging and moisture indicator (rel. humidity < 50%).
	open	Under roof, enclosed at constant temperature and atmospheric humidity ($5^{\circ}C < \vartheta < 50^{\circ}C$, < 50% relative atmospheric humidity). No sudden temperature fluctuations and controlled ventilation with filter (free of dust and dirt). No aggressive vapors and no shock loads. Protection against insect damage.	Two years or more given regular inspections. During inspection, check for cleanliness and mechanical damages. Check corrosion protection.

1) Packaging must be performed by an experienced company using the packaging materials that have been expressly specified for the particular application.

2) SEW-EURODRIVE recommends to store the gear units according to the mounting position.

2.5 Drives for applications in hygienic areas

High demands are placed on hygiene both for the production of beverages and food and in the chemical and pharmaceutical industries. Often, regulations stipulate a completely germ-free environment. The drive solutions used in the past made it very hard to clean the production system as thoroughly as required. Standard motors usually have cooling fins and fans. Dirt can collect in these components where it cannot be fully removed due to problems of accessibility. This can lead to a build up of germs!

SEW-EURODRIVE solves this problem by using special gearmotors in hygienic design. Thanks to their smooth surface, the helical, parallel shaft, helical-bevel or helical-worm gearmotors in hygienic design are easy to clean and prevent a build up of germs or bacteria on the surface.

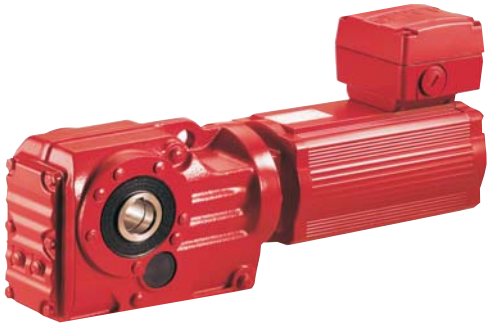

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Figure 1: Gearmotors in hygienic design from SEW-EURODRIVE

The drives for applications in hygienic areas are equipped with special AC motors of the DAS80 ... DAS100 series. These motors have the following characteristics:

- Motors with a smooth surface without cooling fins
- Pure convection cooling (without fan)
- Rated power in S1 mode 0.25 kW ... 1.5 kW
- Motor enclosure IP66 as standard (brake motors IP65)
- Electrical connection via plug connector in enclosure IP66
- Motor to be mounted directly on standard R, F, K and S gear units
- with KS corrosion protection
- Surface protection coating to protect against chemicals and solvents
- All surface recesses sprayed with elastic rubber compound as an option
- Optional with brake for 110 ... 500 V
- Optional with encoder for speed-controlled inverter operation

Gearmotors in hygienic design from SEW-EURODRIVE also create the perfect conditions in your production system for the hygienic production and packaging of food and beverages.

Drive package ASEPTIC^{plus}

The ASEPTIC^{plus} drive package combines the following additional measures and specific components for the gearmotor in hygienic design for the best possible protection for the gearmotor against cleaning agents, chemicals and aggressive environmental conditions.

The ASEPTIC^{plus} drive package includes the following additional measures:

- IP69K enclosure for the DAS motor (brakemotor IP65)
- Epoxy protection coating
- Double oil seals at gear unit output made of FKM
- Stainless steel breather valve
- Cable entry on the IS connector with stainless steel screw plugs
- Gear unit output shaft made of stainless steel as solid shaft for the gear unit types R17-97, F37-97, K37-97 and S37-97
- Gear unit output shaft made of stainless steel as hollow shaft with TorqLOC® for the gear unit types FT27-157, KT37-157 and ST37-97

Contact SEW for availability and delivery.

3 Unit Designations and Versions

3.1 Unit designations for gear units and options

Helical gear units

RX..	Single-stage foot mounted version
RXF..	Single-stage B5 flange-mounted version
R..	Foot-mounted version
R..F	Foot-mounted and B5 flange-mounted version
RF..	B5 flange-mounted version
RZ..	B14 flange-mounted version
RM..	B5 flange-mounted version with extended bearing housing

Parallel shaft helical gear units

F..	Foot-mounted version
FA..B	Foot-mounted version and hollow shaft
FH..B	Foot-mounted and hollow shaft with shrink disc
FV..B	Foot-mounted version and hollow shaft with splined hollow shaft to DIN 5480
FF..	B5 flange-mounted version
FAF..	B5 flange-mounted version and hollow shaft
FHF..	B5 flange-mounted and hollow shaft with shrink disc
FVF..	B5 flange-mounted version and hollow shaft with splined hollow shaft to DIN 5480
FA..	Hollow shaft
FH..	Hollow shaft with shrink disc
FT..	Hollow shaft with TorqLOC® hollow shaft mounting system
FT..B	Foot-mounted hollow shaft with TorqLOC® hollow shaft mounting system
FV..	Hollow shaft with splined hollow shaft to DIN 5480
FAZ..	B14 flange-mounted version and hollow shaft
FHZ..	B14 flange-mounted and hollow shaft with shrink disc
FVZ..	B14 flange-mounted version and hollow shaft with splined hollow shaft to DIN 5480

Helical-bevel gear units

K..	Foot-mounted version
KA..B	Foot-mounted version and hollow shaft
KH..B	Foot-mounted version and hollow shaft with shrink disc
KV..B	Foot-mounted version and hollow shaft with splined hollow shaft to DIN 5480
KF..	B5 flange-mounted version
KAF..	B5 flange-mounted version and hollow shaft
KHF..	B5 flange-mounted and hollow shaft with shrink disc
KVF..	B5 flange-mounted version and hollow shaft with splined hollow shaft to DIN 5480
KA..	Hollow shaft

KH..	Hollow shaft with shrink disc
KT..	Hollow shaft with TorqLOC® hollow shaft mounting system
KT..B	Foot-mounted hollow shaft with TorqLOC® hollow shaft mounting system
KV..	Hollow shaft with splined hollow shaft to DIN 5480
KAZ..	B14 flange-mounted version and hollow shaft
KHZ..	B14 flange-mounted and hollow shaft with shrink disc
KVZ..	B14 flange-mounted version and hollow shaft with splined hollow shaft to DIN 5480

Helical-worm gear units

S..	Foot-mounted version
SF..	B5 flange-mounted version
SAF..	B5 flange-mounted version and hollow shaft
SHF..	B5 flange-mounted and hollow shaft with shrink disc
SA..	Hollow shaft
SH..	Hollow shaft with shrink disc
ST..	Hollow shaft with TorqLOC® hollow shaft mounting system
SAZ..	B14 flange-mounted version and hollow shaft
SHZ..	B14 flange-mounted and hollow shaft with shrink disc

Spiroplan® right-angle gear units

W..	Foot-mounted version
WF..	Flange-mounted version
WA..	Hollow shaft
WAF..	Flange-mounted version and hollow shaft

R, F and K gear unit option

/R	reduced backlash

K, W and S gear unit option

/T	with torque arm

F gear unit option

/G	with rubber buffer

3.2 Unit designations for components on the input side

Adapter

AM..	Adapter for mounting IEC/NEMA motors
	../RS ..and backstop
AQ..	Adapter for mounting servomotors
	AQA with keyway
	AQH with clamping ring hub
AR..	Adapter with torque limiting coupling
	../W ..and speed monitoring
	../WS ..and slip monitoring
AT ..	Adapter with hydraulic centrifugal coupling
	../RS ..and backstop
	../BM(G) ..and disc brake
	../HF ..with manual brake release, lockable
	../HR ..with automatic manual brake disengaging

Input shaft assembly

AD ..	Input shaft assembly
	../P ..with motor mounting platform
	../RS ..with backstop
	../ZR ..with centering shoulder

3.3 Unit designations for the swing base

MK..	Swing base
	../MTS Mechanical thermal monitoring unit
	../BTS Proximity-type thermal monitoring unit
	../T Torque arm

3.4 Example for the unit designation of a gear unit

The unit designation of the gear unit starts from the component on the output end. For example, a helical-bevel multi-stage gear unit with a NEMA C-face adapter has the following unit designation:

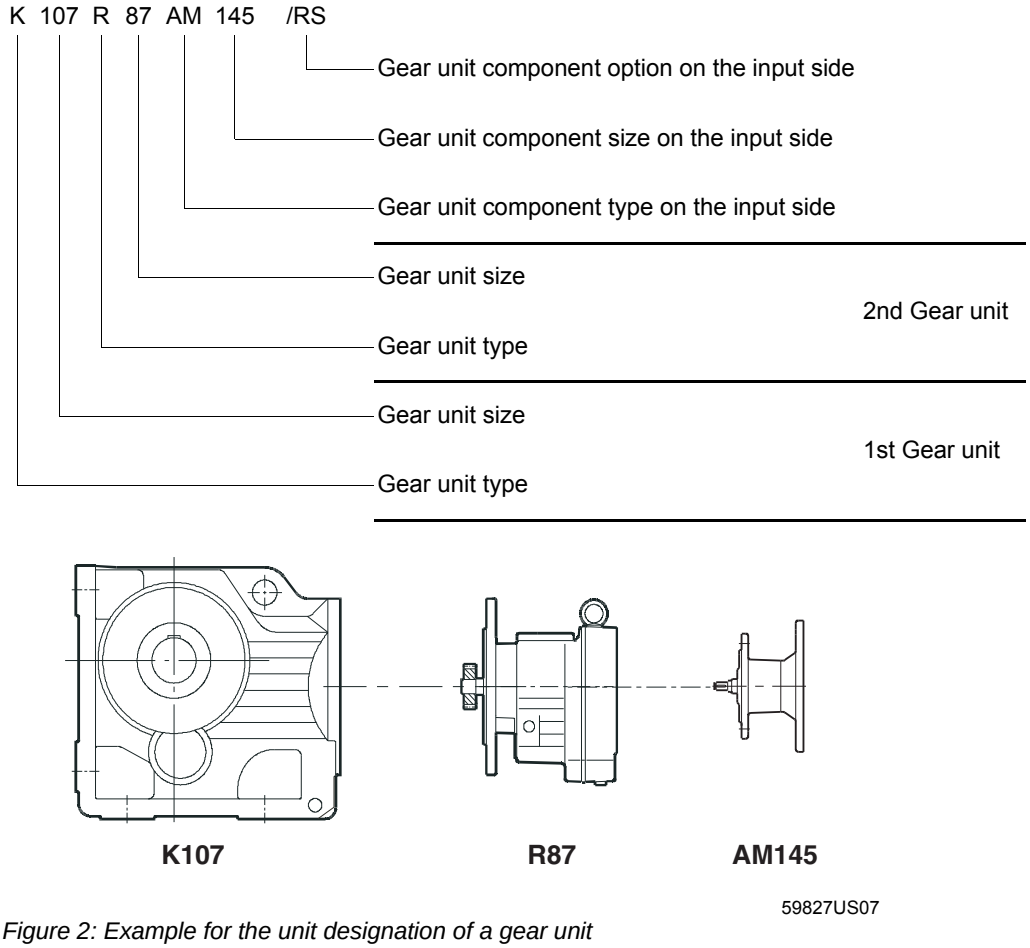


Figure 2: Example for the unit designation of a gear unit

Other examples:

- FH 47 /R /G AQH 100/3
  - Gear unit type: FH parallel shaft helical gear unit with hollow shaft and shrink disc
  - Gear unit size: 47
  - Gear unit option: /R Reduced backlash version
  - Gear unit option: /G Rubber buffer
  - Gear unit component on the input side: AQH 100/3 Adapter for mounting servomotors with size 100/3 clamping ring hub

3.5 Unit designations for AC motors and options

Standard AC motor of the series

DT.., DV..	Foot-mounted version
DR.., ..DT.., ..DV..	Attached motor for gear units
DFR.., DFT.., DFV..	Flange-mounted version
DT..F, DV..F	Foot and flange-mounted version

Multi-speed AC motors with soft start

SDT.., SDV..	Foot-mounted version
SDFT.., SDFV..	Flange-mounted version
SDT..F, SDV..F	Foot and flange-mounted version

Motor options

/BR, /BM(G)	Brake (noise-reduced)
../HF	.. with lock-type manual brake release
../HR	.. with automatic manual brake release
/MM..	MOVIMOT® (integrated frequency inverter)
/MSW..	MOVI-SWITCH® (integrated switching and protection function)
/LN	Low-noise fan guard for motor sizes 71 to 132S
/RS	Backstop
/TF	Thermistor (PTC resistor)
/TH	Thermostat (bimetallic switch)
/U	Non-ventilated
/VR	Forced cooling fan, 1 × DC 24 V
/VR	Forced cooling fan, 1 × 100 ... AC 240 V, 50/60 Hz (with UWU52A)
/VS	Forced cooling fan, 1 × 220 ... AC 266 V, 50 Hz/60 Hz, 1 x 115V
/V	Forced cooling fan, 3 × AC 380 ... 415 V, 50 Hz/60 Hz, 3 x AC, 460V
/Z	Additional flywheel mass (flywheel fan)
/C	Protection canopy for the fan guard

Plug connector on AC motor options

/IS	Integrated plug connector
/AMA..	HAN modular 10B plug connector on terminal box with two-clamp closure
/AMB..	HAN modular 10B plug connector on terminal box with two-clamp closure and EMC housing
/ASA..	HAN modular 10ES plug connector on terminal box with two-clamp closure
/ASB..	HAN modular 10ES plug connector on terminal box with two-clamp closure and EMC housing
/ACA..	HAN modular 10E plug connector on terminal box with two-clamp closure
/ACB	HAN modular 10E plug connector on terminal box with two-clamp closure and EMC housing
/ASE..	HAN modular 10ES plug connector on terminal box with one-clamp closure and EMC housing

Encoder on AC motor options

/AV1Y	Multi-turn absolute encoder with solid shaft, MSI and sin/cos signals
/AV1H	Multi-turn absolute encoder with solid shaft, Hiperface® and sin/cos signals
/AS..H	Multi-turn absolute encoder with spreadshaft, Hiperface® and sin/cos signals
/ES..H	Single-turn absolute encoder with spreadshaft, Hiperface® and sin/cos signals
/ES..T	Encoder with spreadshaft, TTL (RS-422), signals
/ES..S	Encoder with spreadshaft, sin/cos signals
/ES..R	Encoder with spreadshaft, TTL (RS-422), signals
/ES..2	Encoder with spreadshaft, HTL signals, either 1 or 2 pulses per revolution
/ES..6	Encoder with spreadshaft, HTL signals, 6 pulses per revolution
/EV1T	Encoder with solid shaft, TTL (RS-422), signals
/EV1S	Encoder with solid shaft, sin/cos signals
/EV1R	Encoder with solid shaft, TTL (RS-422), signals
/EV1H	Single-turn absolute encoder with solid shaft, Hiperface® and sin/cos signals
/EH1T	Encoder with hollow shaft, TTL (RS-422), signals
/EH1S	Encoder with hollow shaft, sin/cos signals
/EH1R	Encoder with hollow shaft, TTL (RS-422), signals
/NV1..	Proximity sensor with A track
/NV2..	Proximity sensor with A and B tracks

Mounting device for encoders on AC motor options

ES..A	.. with spreadshaft
EV1A	.. with solid shaft

3.6 Example for the unit designation of a gearmotor

The unit designation of the gearmotor starts from the component on the output end. For instance, a multi-staged helical-bevel gearmotor with thermistor sensor in the motor winding has the following unit designation:

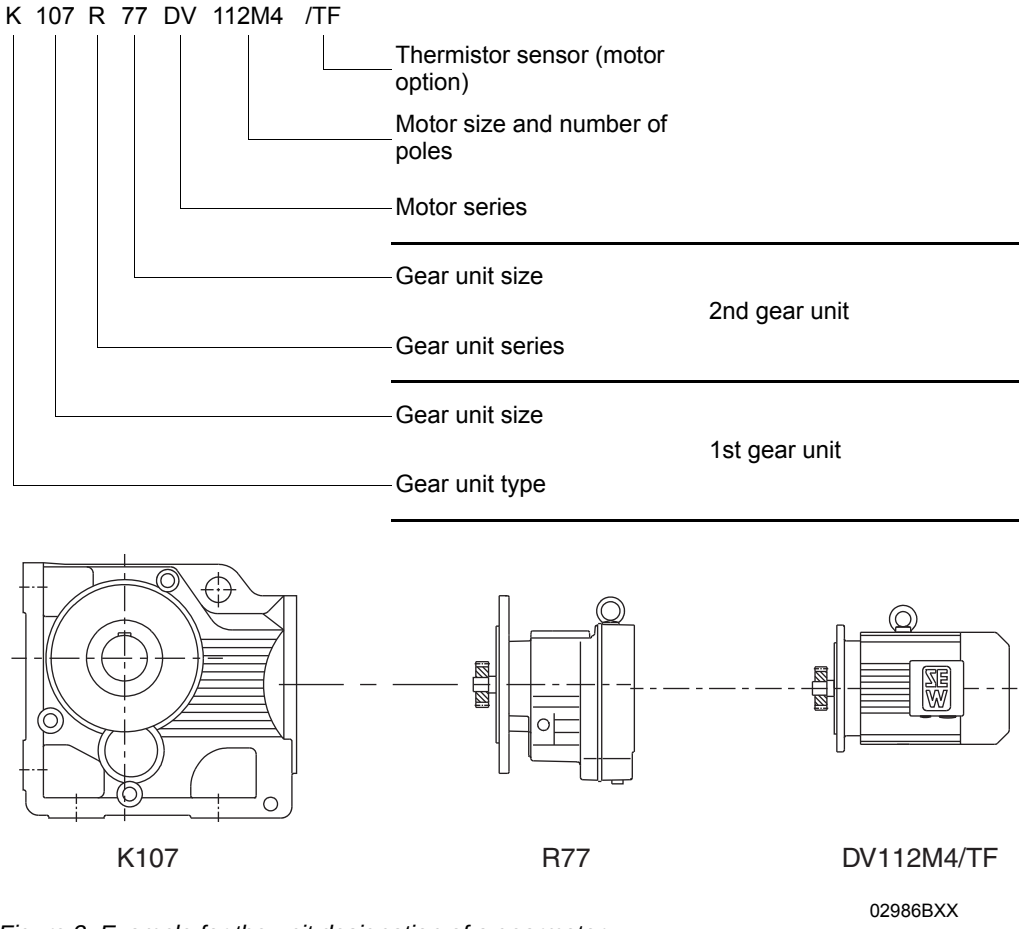
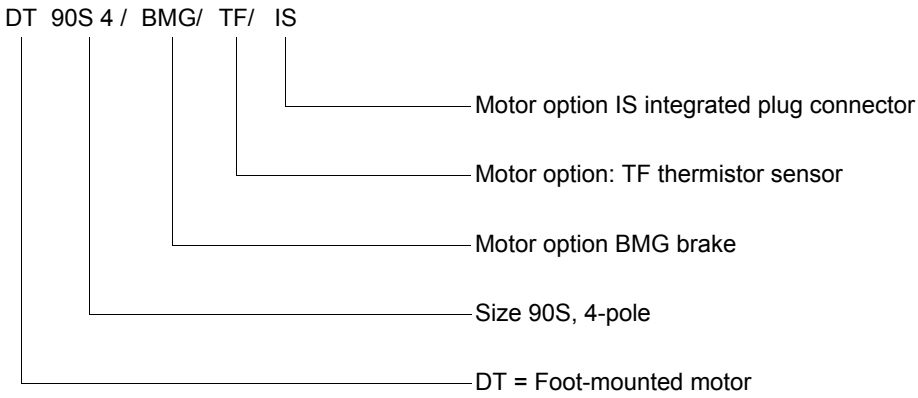


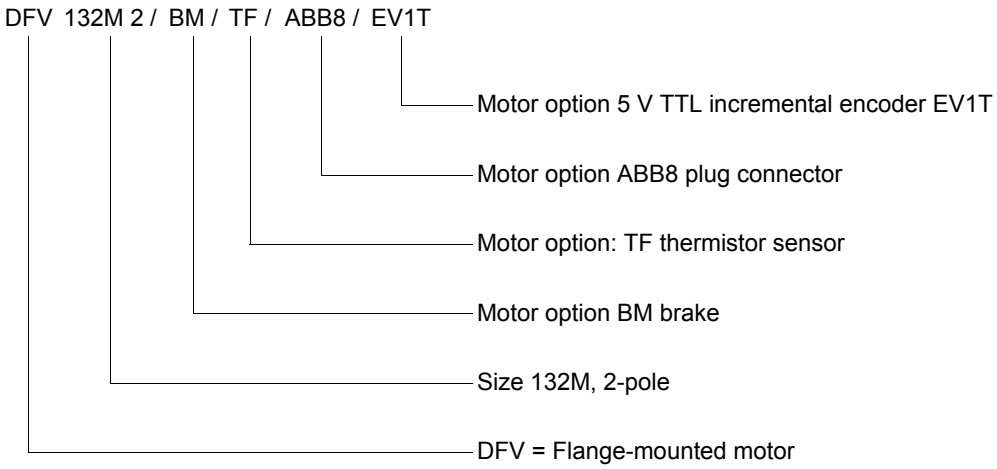
Figure 3: Example for the unit designation of a gearmotor

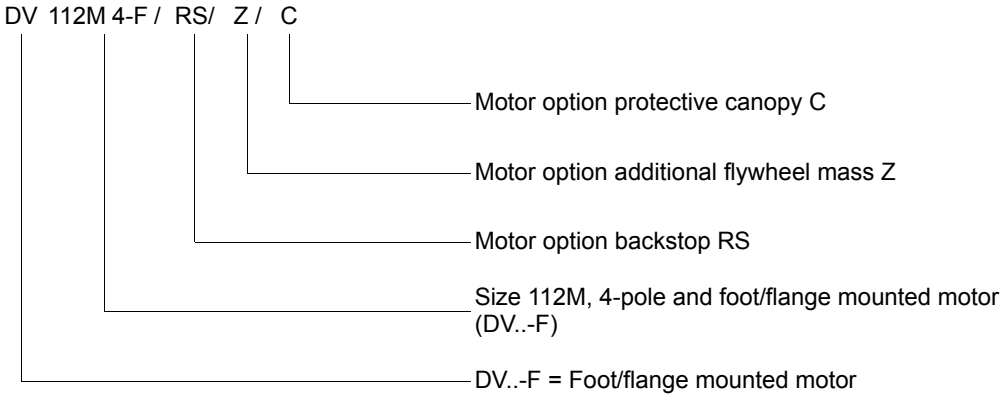
Other examples:

- RF 97 / R DV100M4 / BMG / HR
  - Gear unit type: Reduced backlash (/ R) helical gear unit in flange-mounted version
  - Gear unit size: 97
  - Motor series: DV AC motor
  - Motor size 100M, 4-pole
  - Motor options: Low-noise brake (/ BMG) with automatic manual brake disengagement (/ HR)
- FAF 47 / R DT90L4 / BMG / C
  - Gear unit type: Reduced backlash (/ R) parallel shaft helical gear unit in B5 flange-mounted version with hollow shaft
  - Gear unit size: 47
  - Motor series: DT AC motor
  - Motor size 90L, 4-pole
  - Motor options: Low-noise brake (/ BMG) and protective canopy for the fan guard (/ C)

3.7 Examples for the unit designation of AC (brake) motors







3.8 Unit designations MOVIMOT® standard design

Mechanical versions

DT.. MM.., DV.. MM..	Foot-mounted version
..DT.. MM.., ..DV.. MM..	Attached motor for gear units
DFT.. MM.., DFV.. MM..	Flange-mounted version
DT..F MM.., DV..F MM..	Foot and flange-mounted version

Plug connector

/AVT1	M12 plug connector for RS-485 connection
/RE.A/ASA3	HAN® 10ES plug connector with two-clip closure for power
/RE.A/ASA3/AVT1	HAN® 10ES plug connector with two-clip closure for power and M12-plug connector for RS-485 connection
/RE.A/AMA6	HAN® Modular plug connector with two-clip closure for power and RS-485 connection

Options

/BMG	Brake (noise-reduced)
../HF	.. with lock-type manual brake release
../HR	.. with automatic manual brake release
/RS	Backstop
/LN	Low-noise fan guard
/Z	Additional flywheel mass (flywheel fan)
/C	Protection canopy for the fan guard
/ES..2	Encoder with spreadshaft, HTL signals, either 1 or 2 pulses per revolution
/ES..6	Encoder with spreadshaft, HTL signals, 6 pulses per revolution
/NV1..	Proximity sensor with A track
/NV2..	Proximity sensor with A and B tracks
/R..A/../BGM	Brake control system
/R..A/../BSM	Brake control system
/R..A/../URM	Fast excitation brake
/MLU..A	DC 24 V supply
/MLG..A	Speed control module with DC 24 V supply
/MBG11A	Setpoint generator
/MWA21A	Setpoint converter
/MDG11A	Diagnostic unit
/MF...	Fieldbus interfaces
/MQ...	MQ.. intelligent fieldbus modules

3.9 Unit designations for MOVIMOT® with integrated AS-interface

Mechanical versions

DT.. MM.., DV.. MM..	Foot-mounted version
..DT.. MM.., ..DV.. MM..	Attached motor for gear units
DFT.. MM.., DFV.. MM..	Flange-mounted version
DT..F MM.., DV..F MM..	Foot and flange-mounted version

Plug connector

/AVSK	MOVIMOT® with integrated AS-interface and M12 plug connector for AS-interface
/AZSK	3 x M12 plug connector for AS-interface, AUX PWR and sensor connection
/AND3/AZSK	3 x M12 plug connector for AS-interface, AUX PWR, sensor connection and AND3 plug connector for power connection

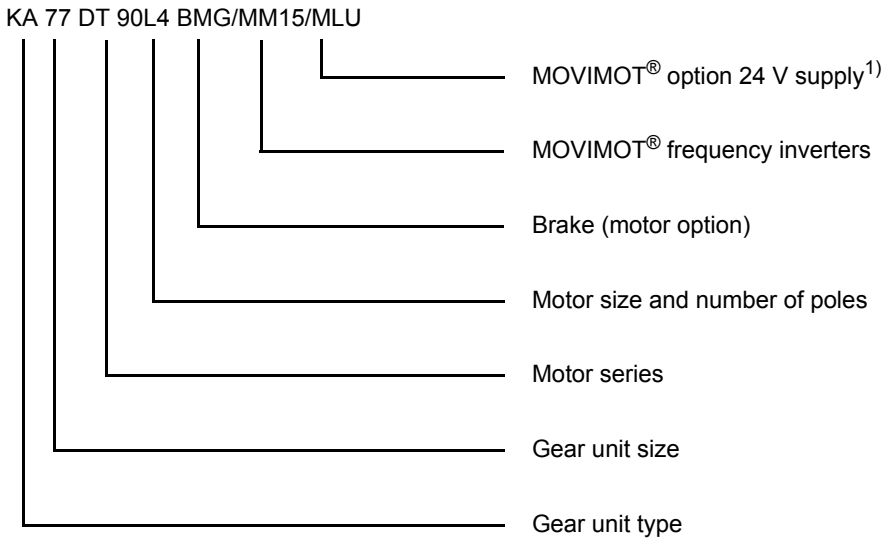
/AND3/AZSK requires longer delivery time from Germany.

Options

/BMG	Brake (noise-reduced)
../HF	.. with lock-type manual brake release
../HR	.. with automatic manual brake release
/RS	Backstop
/LN	Low-noise fan guard
/Z	Additional flywheel mass (flywheel fan)
/C	Protection canopy for the fan guard
/ES..2	Encoder with spreadshaft, HTL signals, either 1 or 2 pulses per revolution
/ES..6	Encoder with spreadshaft, HTL signals, 6 pulses per revolution
/NV1..	Proximity sensor with A track
/NV2..	Proximity sensor with A and B tracks
/R..A/../URM	Fast excitation brake

3.10 Example for the unit designation of a MOVIMOT® gearmotor

The unit designation of the MOVIMOT® gearmotor starts from the component on the output end. For example, a MOVIMOT® helical-bevel gearmotor with brake has the follwing unit designation:



1) Only options installed at the factory are listed on the nameplate.

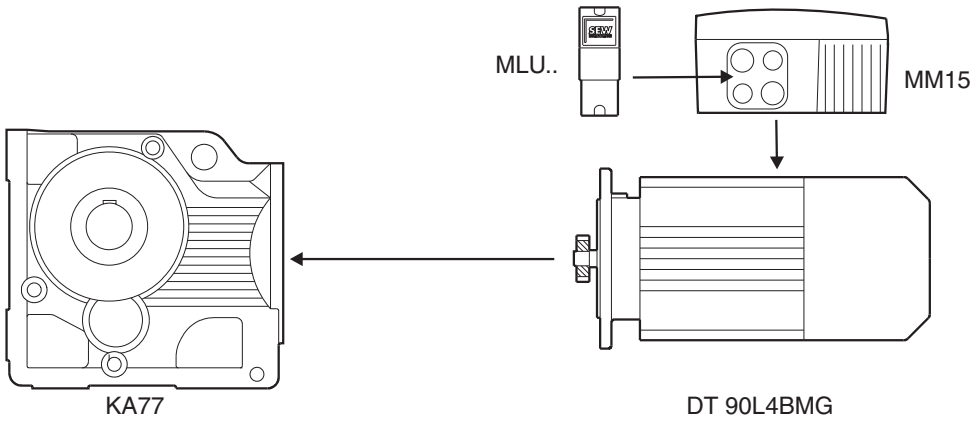


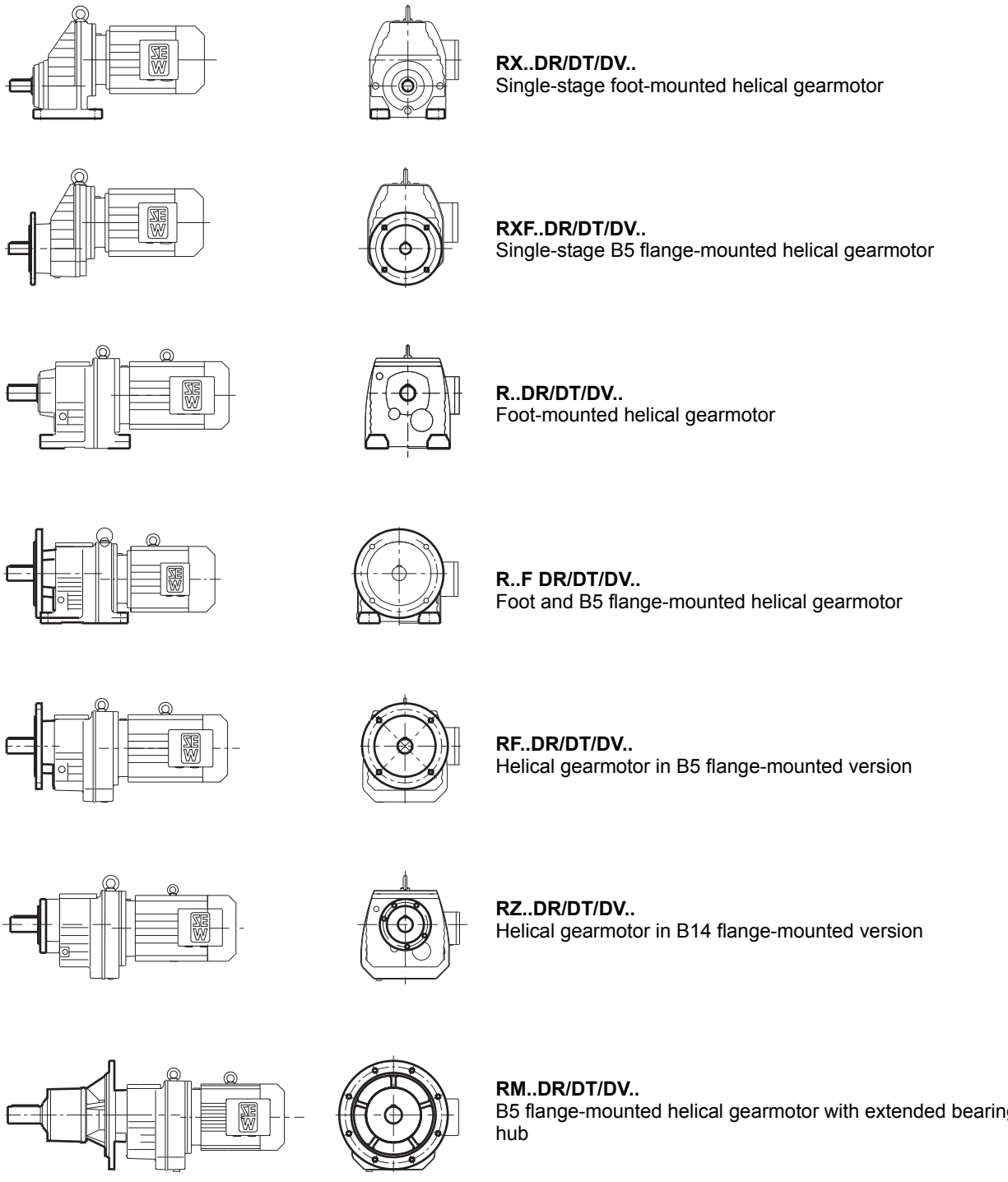
Figure 4: Example for the unit designation of a MOVIMOT® gearmotor

3.11 Gearmotor types

The types described in this section refer to gearmotors from SEW-EURODRIVE. They also apply to gear units without motor (without DR/DT/DV) and for MOVIMOT® gearmotors (../MM..).

Helical gearmotors

The following types of helical gearmotors can be supplied:



RX..DR/DT/DV..
Single-stage foot-mounted helical gearmotor

RXF..DR/DT/DV..
Single-stage B5 flange-mounted helical gearmotor

R..DR/DT/DV..
Foot-mounted helical gearmotor

R..F DR/DT/DV..
Foot and B5 flange-mounted helical gearmotor

RF..DR/DT/DV..
Helical gearmotor in B5 flange-mounted version

RZ..DR/DT/DV..
Helical gearmotor in B14 flange-mounted version

RM..DR/DT/DV..
B5 flange-mounted helical gearmotor with extended bearing hub

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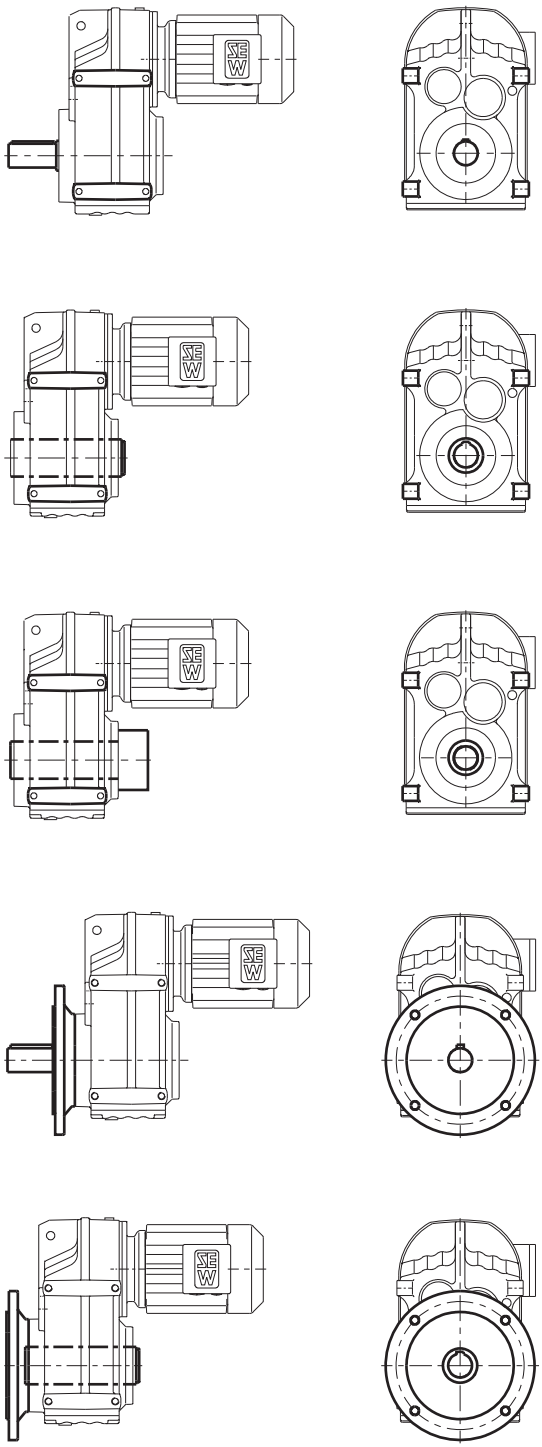
Parallel shaft helical gearmotors

The following types of parallel shaft helical gearmotors can be supplied:



F..DR/DT/DV..
Foot-mounted parallel shaft helical gearmotor

FA..B DR/DT/DV..
Foot-mounted parallel shaft helical gearmotor with hollow shaft

FV..B DR/DT/DV..
Foot-mounted parallel shaft helical gearmotor with hollow shaft and splined hollow shaft to DIN 5480

FH..B DR/DT/DV..
Foot-mounted parallel shaft helical gearmotor with hollow shaft and shrink disc

FF..DR/DT/DV..
B5 flange-mounted parallel shaft helical gearmotor

FAF..DR/DT/DV..
Parallel shaft helical gearmotor in B5 flange-mounted version with hollow shaft

FVF..DR/DT/DV..
Parallel shaft helical gearmotor in B5 flange-mounted version with hollow shaft and splined hollow shaft to DIN 5480

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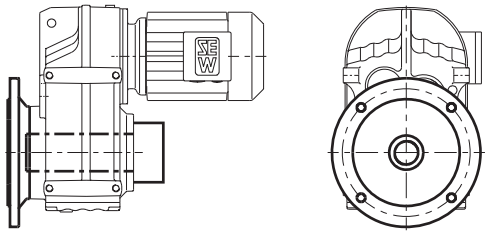
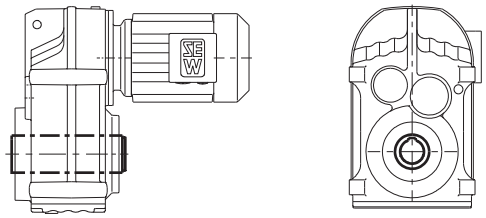
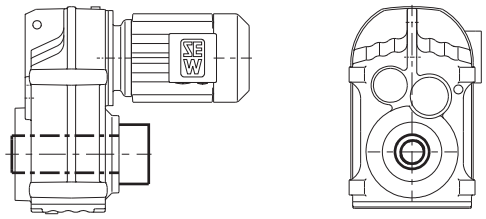


FHF..DR/DT/DV..
Parallel shaft helical gearmotor in B5 flange-mounted version with hollow shaft and shrink disc



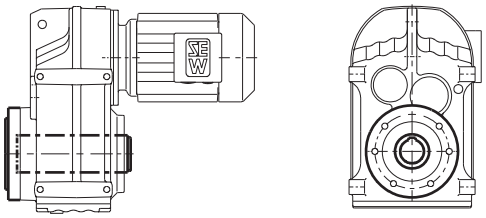
FA..DR/DT/DV..
Parallel shaft helical gearmotor with hollow shaft

FV..DR/DT/DV..
Parallel shaft helical gearmotor with hollow shaft and splined hollow shaft to DIN 5480



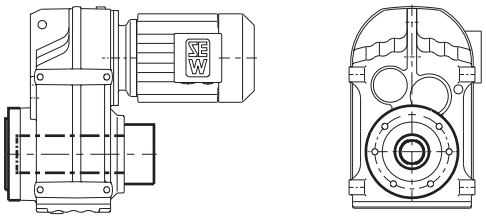
FH..DR/DT/DV..
Parallel shaft helical gearmotor with hollow shaft and shrink disc

FT..DR/DT/DV
Parallel shaft helical gearmotor with hollow shaft and TorqLOC® hollow shaft mounting system



FAZ..DR/DT/DV..
Parallel shaft helical gearmotor in B14 flange-mounted version with hollow shaft

FVZ..DR/DT/DV..
Parallel shaft helical gearmotor in B14 flange-mounted version with hollow shaft and splined hollow shaft to DIN 5480

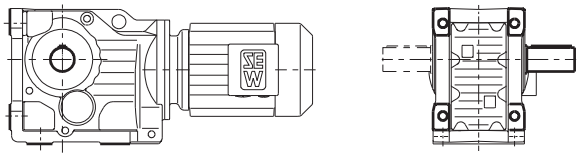


FHZ..DR/DT/DV..
Parallel shaft helical gearmotor in B14 flange-mounted version with hollow shaft and shrink disc

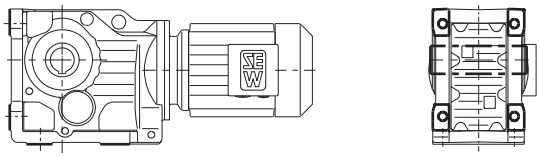
03166AXX

Helical-bevel gearmotors

The following types of helical-bevel gearmotors can be supplied:

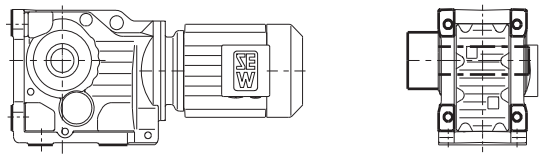


K..DR/DT/DV..
Foot-mounted helical-bevel gearmotor

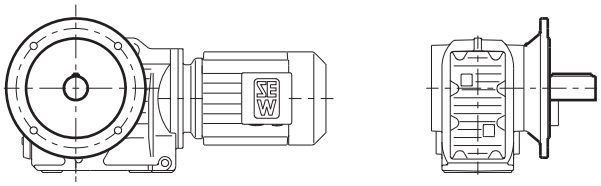


KA..B DR/DT/DV..
Foot-mounted helical-bevel gearmotor with hollow shaft

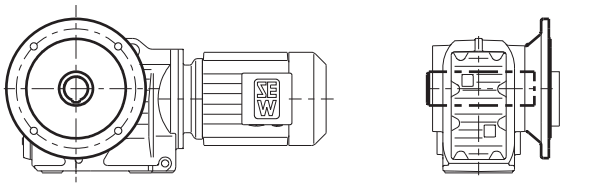
KV..B DR/DT/DV..
Foot-mounted helical-bevel gearmotor with hollow shaft and splined hollow shaft to DIN 5480



KH..B DR/DT/DV..
Foot-mounted helical-bevel gearmotor with hollow shaft and shrink disc



KF..DR/DT/DV..
Helical-bevel gearmotor in B5 flange-mounted version



KAF..DR/DT/DV..
Helical-bevel gearmotor in B5 flange-mounted version with hollow shaft

KVF..DR/DT/DV..
Helical-bevel gearmotor in B5 flange-mounted version with hollow shaft and splined hollow shaft to DIN 5480

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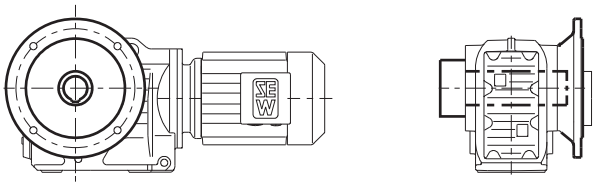
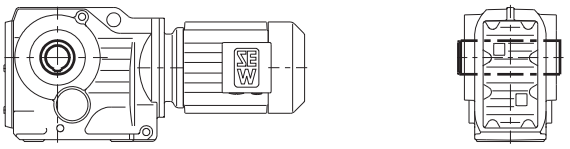
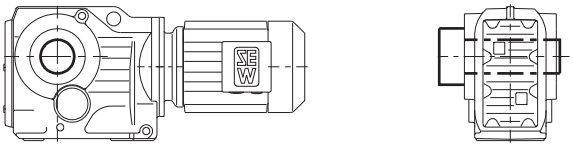


KHF..DR/DT/DV..
Helical-bevel gearmotor in B5 flange-mounted version with hollow shaft and shrink disc



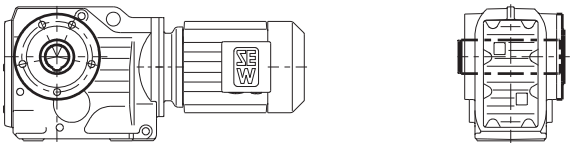
KA..DR/DT/DV..
Helical-bevel gearmotor with hollow shaft

KV..DR/DT/DV..
Helical-bevel gearmotor with hollow shaft and splined hollow shaft to DIN 5480



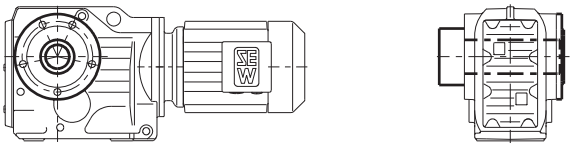
KH..DR/DT/DV..
Helical-bevel gearmotor with hollow shaft and shrink disc

KT..DR/DT/DV..
Helical-bevel gearmotor with hollow shaft and TorqLOC® hollow shaft mounting system



KAZ..DR/DT/DV..
Helical-bevel gearmotor in B14 flange-mounted version with hollow shaft

KVZ..DR/DT/DV..
Helical-bevel gearmotor in B14 flange-mounted version with hollow shaft and splined hollow shaft to DIN 5480



KHZ..DR/DT/DV..
Helical-bevel gearmotor in B14 flange-mounted version with hollow shaft and shrink disc

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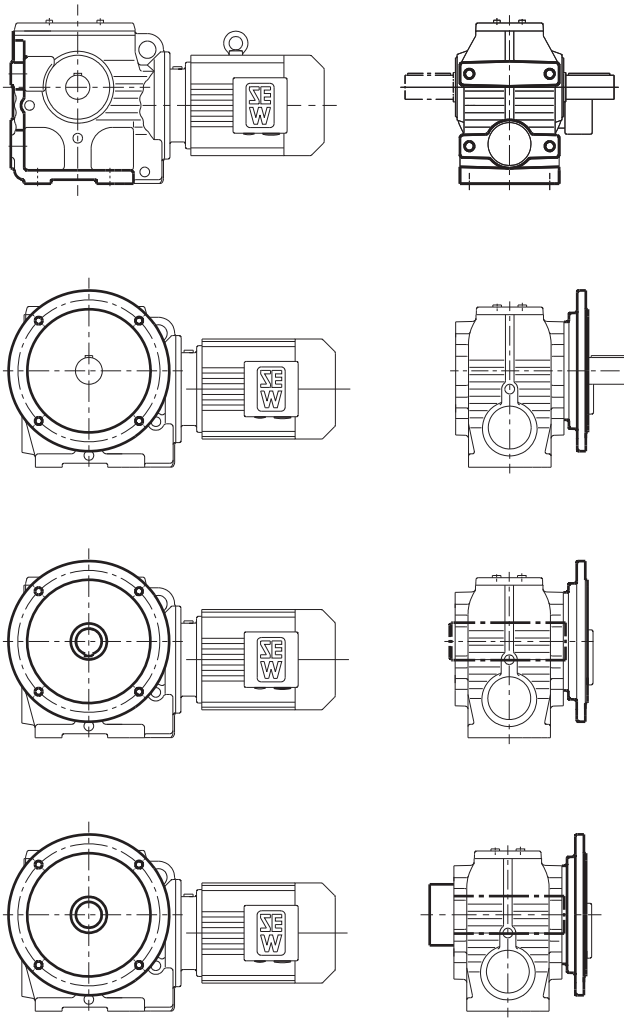
Helical-worm gearmotors

The following types of helical-worm gearmotors can be supplied:



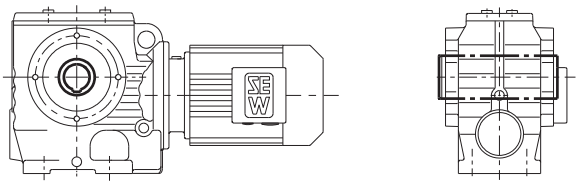
S..DR/DT/DV..
Foot-mounted helical-worm gearmotor

SF..DR/DT/DV..
Helical-worm gearmotor in B5 flange-mounted version

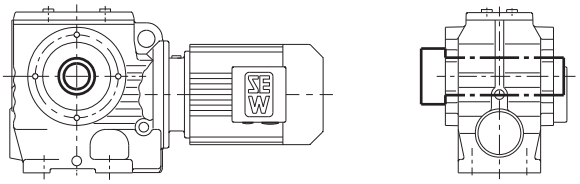
SAF..DR/DT/DV..
Helical-worm gearmotor in B5 flange-mounted version with hollow shaft

SHF..DR/DT/DV..
Helical-worm gearmotor in B5 flange-mounted version with hollow shaft and shrink disc

03180AXX

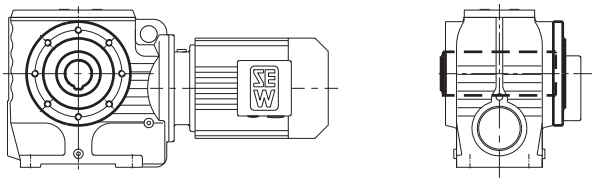


SA..DR/DT/DV..
Helical-worm gearmotor with hollow shaft

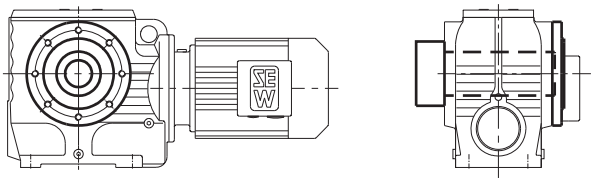


SH..DR/DT/DV..
Helical-worm gearmotor with hollow shaft and shrink disc

ST..DR/DT/DV..
Helical-worm gearmotor with hollow shaft and TorqLOC® hollow shaft mounting system



SAZ..DR/DT/DV..
Helical-worm gearmotor in B14 flange-mounted version with hollow shaft



SHZ..DR/DT/DV..
Helical-worm gearmotor in B14 flange-mounted version with hollow shaft and shrink disc

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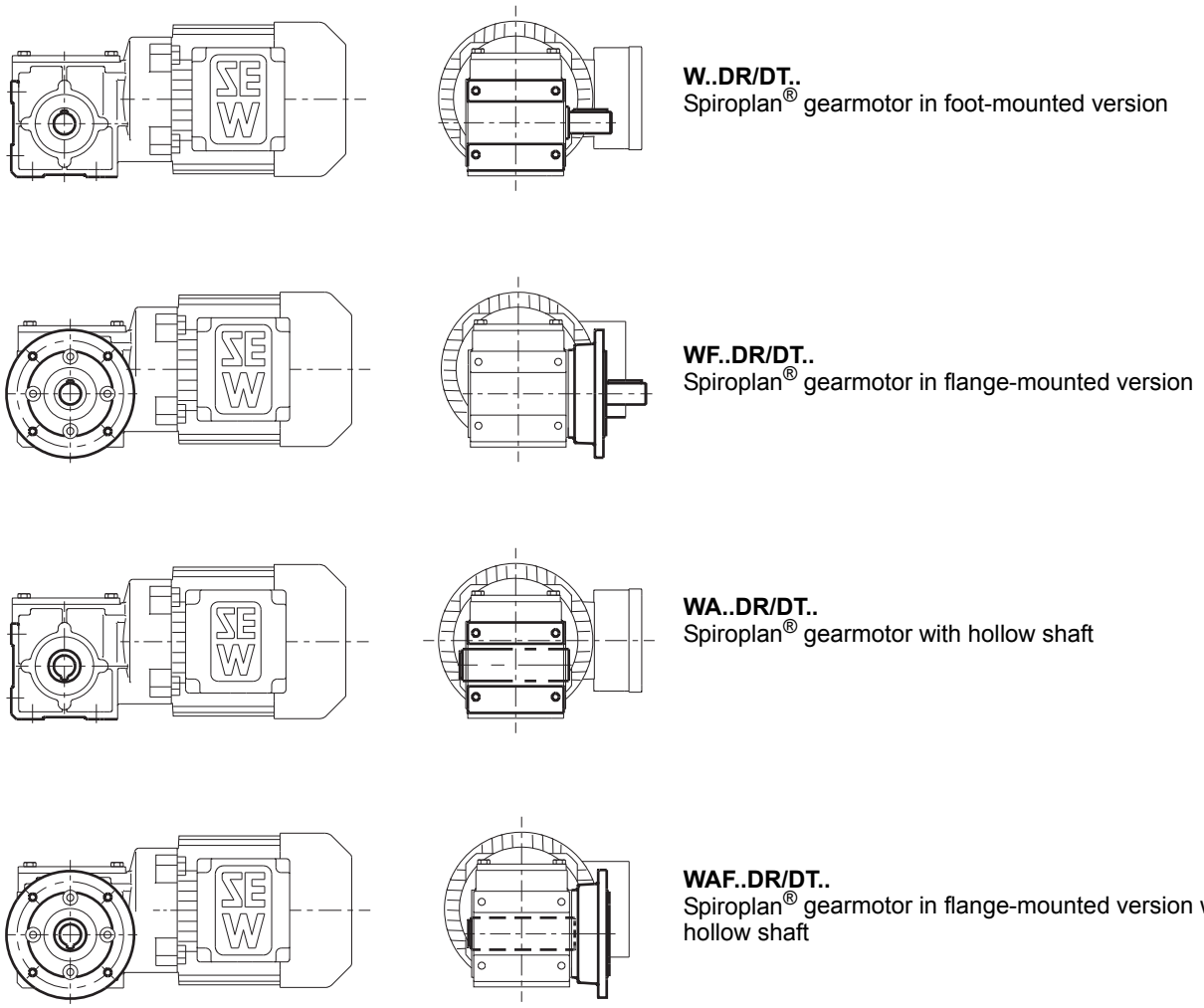
***Spiroplan®* gearmotors**

The following types of Spiroplan® gearmotors can be supplied:



W..DR/DT..
Spiroplan® gearmotor in foot-mounted version

WF..DR/DT..
Spiroplan® gearmotor in flange-mounted version

WA..DR/DT..
Spiroplan® gearmotor with hollow shaft

WAF..DR/DT..
Spiroplan® gearmotor in flange-mounted version with hollow shaft

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3.12 Types of components on the input side

The following figure shows the types of components on the input side:

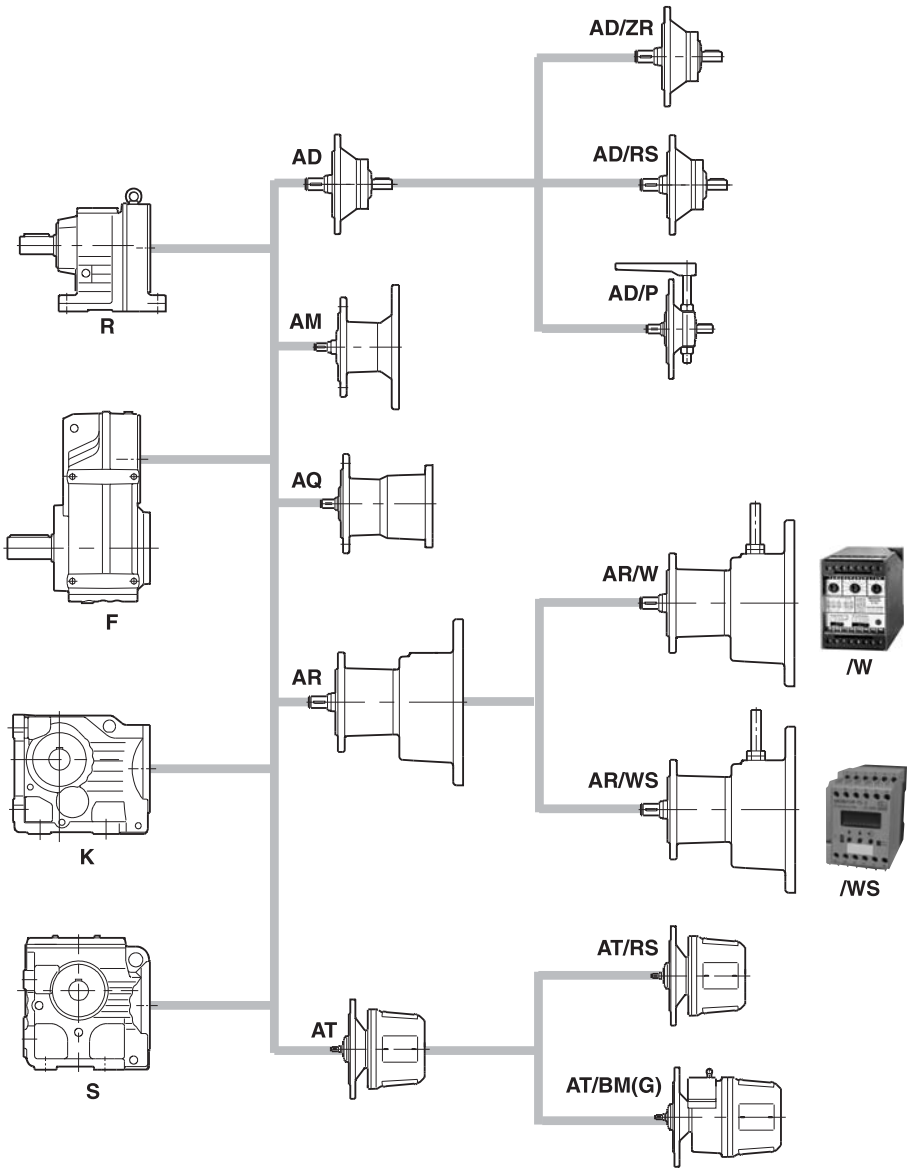

Figure 5: Overview of components on the input side

AD	Input shaft assembly	AR/W	Adapter with torque limiting coupling and speed monitoring
AD/ZR	Input shaft assembly with centering shoulder	AR/WS[1)]	Adapter with torque limiting coupling and slip monitoring
AD/RS	Input shaft assembly with backstop	/W	Speed monitor
AD/P	Input shaft assembly with motor mounting platform	/WS	Slip monitor
AM	Adapter for mounting IEC/NEMA motors	AT	Adapter with hydraulic centrifugal coupling
AQ	Adapter for mounting servomotors	AT/RS	Adapter with hydraulic centrifugal coupling and backstop
AR	Adapter with torque limiting coupling	AT/BM(G)	Adapter with hydraulic centrifugal coupling and disc brake

1) Only in conjunction with Varigear® variable speed gear unit

3.13 Types of AC (brake) motors (→ GM)

The following figure shows an example of components of AC (brake) motors:

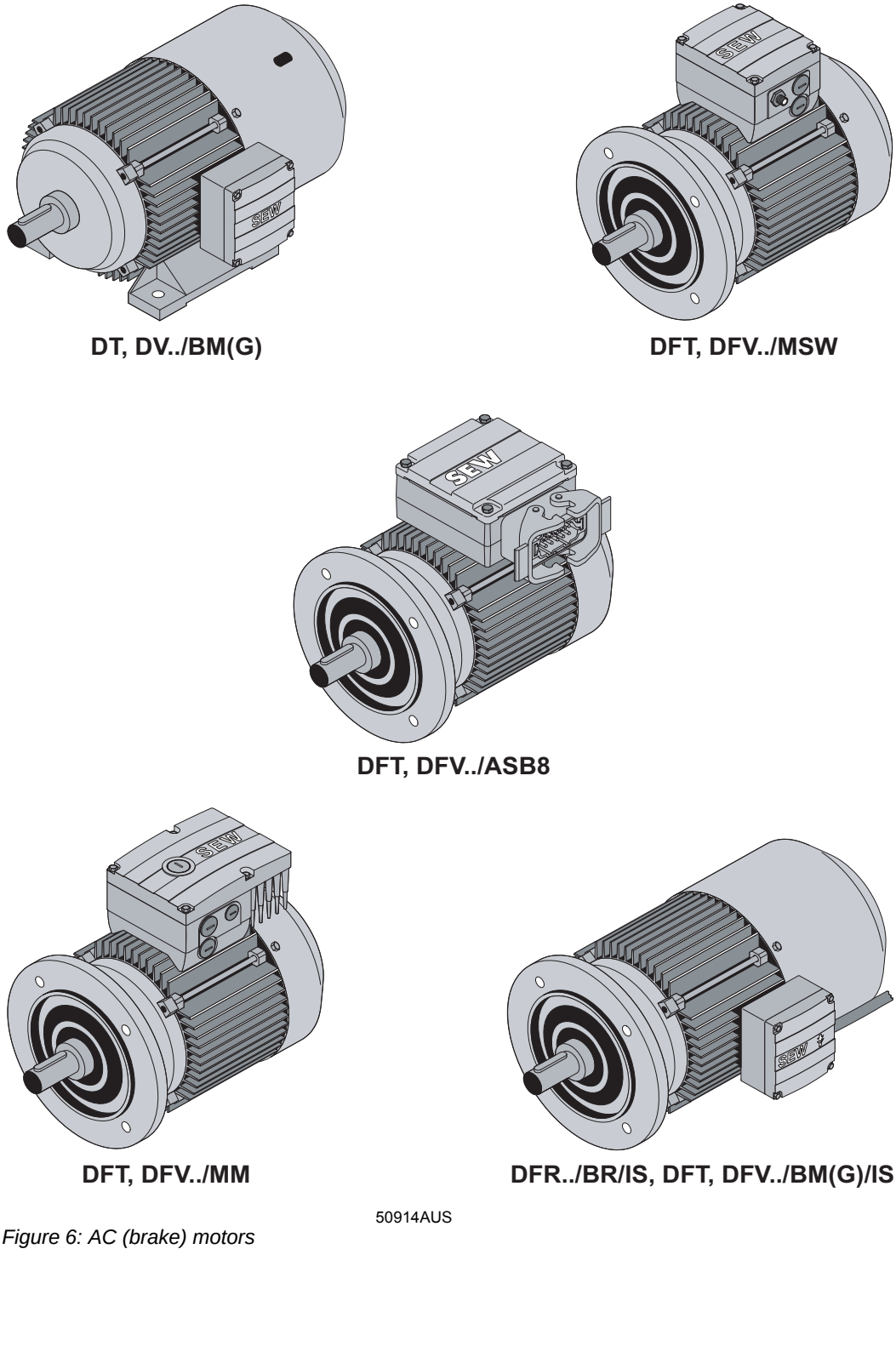

Figure 6: AC (brake) motors

4 Project Planning for Drives

4.1 Additional documentation

In addition to the information in this manual, SEW-EURODRIVE offers extensive documentation covering the entire topic of electrical drive engineering. These are mainly the publications in the "Drive Engineering – Practical Implementation" series as well as the manuals and catalogs for electronically controlled drives. The list below includes other documents that are of interest in terms of project planning. You can order these publications from SEW-EURODRIVE.

Drive Engineering - Practical Implementation

- Project Planning for Drives
- Controlled AC Drives
- EMC in Drive Engineering
- SEW Disc Brakes

Electronics documentation

- "Decentralized Installation" system folder (MOVIMOT®, MOVI-SWITCH®, communication and supply interfaces)
- "MOVITRAC® B" system manual
- "MOVIDRIVE® MDX60/61B" system manual

4.2 Drive selection data

Certain data is essential to specify the components for your drive precisely. These are:

Drive selection data			Your entry
n_{amin}	Minimum output speed	rpm	
n_{amax}	Maximum output speed	rpm	
P_a at n_{amin}	Output power at minimum output speed	[HP]	
P_a at n_{amax}	Output power at maximum output speed	[HP]	
T_a at n_{amin}	Output torque at minimum output speed	[lb-in]	
T_a at n_{amax}	Output torque at maximum output speed	[lb-in]	
F_R	Overhung loads acting on the output shaft. Force application in center of shaft end is assumed. If not, please specify the exact application point giving the application angle and direction of rotation of the shaft for recalculation.	[lb]	
F_A	Axial load (tension and compression) on the output shaft	[lb]	
J_{Last}	Mass moment of inertia to be driven	[lb-ft^2]	
R, F, K, S, W M1 - M6	Required gear unit type and mounting position (→ Sec. Mounting positions, churning losses)	-	
IP..	Required degree of protection	-	
ϑ_{Umg}	Ambient temperature	[°F]	
H	Installation altitude	[ft. above sea level]	
S.., ..% cdf	Duty type and cyclic duration factor (cdf) or exact load cycle can be entered.	-	
Z	Starting frequency; alternatively, exact load cycle can be specified	[1/h]	
f_{mains}	Supply frequency	[Hz]	
U_{Mot}, U_{Bremse}	Operating voltage of motor and brake	[V]	
T_B	Required braking torque	[lb-in]	
For inverter operation: **Required control type and setting range**			

Determining the motor data

It is first necessary to have data on the machine to be driven (mass, speed, setting range, etc.) to design the drive correctly.

These data help determine the required power, torque and speed. Refer to the "Drive Engineering - Practical Implementation, Drive Planning" publication or the PTPilot project planning software at www.ptpilot.com for assistance.

Selecting the correct drive

The appropriate drive can be selected once the power and speed of the drive have been calculated and with regard to other mechanical requirements.

4.3 Project planning sequence

Example

The following flow diagram illustrates the project planning procedure for a positioning drive. The drive consists of a gearmotor that is powered by an inverter.

Necessary information on the machine to be driven
- Technical data and environmental conditions
- Positioning accuracy
- Speed setting range (rotational accuracy)
- Calculating the travel cycle

↓

Calculate the relevant application data
- static, dynamic, regenerative power
- Speeds
- Torque ratings
- Travel diagram

↓

Select gear unit
- Definition of gear unit size, gear unit reduction ratio and gear unit type
- Check the positioning accuracy
- Check the gear unit utilization ($T_{a\ max} \geq T_{a\ (t)}$)

↓

Select the system depending on
- Positioning accuracy
- Setting range
- Control

↓

Inverter operation
- Voltage-controlled inverter without and with speed control
- Voltage-controlled, vector-controlled inverter without and with speed control
- Current-controlled, vector-controlled inverter

↓

Motor selection
- Maximum torque
- For particularly low output speeds: Limit motor power according to $T_{a\ max}$ of the gear unit
- For dynamic drives: Effective torque at medium speed
- Maximum speed
- For dynamic drives: Torque curves
- Thermal load (setting range, cyclic duration factor)
- Selection of the correct encoder
- Motor equipment (brake, plug connector, TF temperature monitoring, etc.)

↓

Selecting the inverter
- Motor/inverter assignment
- Continuous power and peak power in voltage-controlled inverters
- Continuous current and peak current in current-controlled inverters

↓

Selecting the braking resistor:
- Based on the calculated regenerative power and cdf

↓

Options
- EMC measures
- Operation/communication
- Additional functions

↓

Make sure that all requirements have been met.

5 Project Planning for Gear Units

5.1 Efficiency of gear units

General information

The efficiency of gear units is mainly determined by the gearing and bearing friction. Keep in mind that the starting efficiency of a gear unit is always less than its efficiency at operating speed. This factor is especially pronounced in the case of helical-worm and Spiroplan® right-angle gearmotors.

R, F, K gear units

The efficiency of helical, parallel shaft and helical-bevel gear units varies with the number of gear stages, between 94 % (3-stage) and 98 % (1-stage).

S and W gear units

The gearing in helical-worm and Spiroplan® gear units produces a high proportion of sliding friction. As a result, these gear units have higher gearing losses than R, F or K gear units and thus be less efficient.

The efficiency depends on the following factors:

- Gear ratio of the helical-worm or Spiroplan® stage
- Input speed
- Gear unit temperature

Helical-worm gear units from SEW-EURODRIVE are helical gear/worm combinations that are significantly more efficient than all worm type gear units. The efficiency may reach $\eta < 0.5$ if the helical-worm or Spiroplan® stage has a very high ratio.

Self-locking

Back-driving torques on helical-worm or Spiroplan® gear units produce an efficiency of $\eta' = 2 - 1/\eta$, which is significantly less favorable than the forward efficiency η. The helical-worm or Spiroplan® gear unit is self-locking if the forward efficiency $\eta \leq 0.5$. Some Spiroplan® gear units are also dynamically self-locking. Contact SEW-EURODRIVE if you wish to make technical use of the braking effect of self-locking characteristics.

Do not use the self-locking effect of helical-worm and Spiroplan® gear units as sole safety function for hoist or incline applications.

Run-in phase

The tooth flanks of new helical-worm and Spiroplan® gear units are not yet completely smooth. That fact makes for a greater friction angle and less efficiency than during later operation. This effect intensifies with increasing gear unit ratio. Subtract the following values from the listed efficiency during the run-in phase:

	Worm		Spiroplan®	
	i range	**η reduction**	**i range**	**η reduction**
1 start	approx. 50 ... 280	approx. 12 %	approx. 40 ... 75	approx. 15 %
2 start	approx. 20 ... 75	approx. 6 %	approx. 20 ... 30	approx. 10 %
3 start	approx. 20 ... 90	approx. 3 %	approx. 15	approx. 8 %
4 start	-	-	approx. 10	approx. 8 %
5 start	approx. 6 ... 25	approx. 3 %	approx. 8	approx. 5 %
6 start	approx. 7 ... 25	approx. 2 %	-	-
7 start	-	-	approx. 6	approx. 3 %

The run-in phase usually lasts 48 hours. Helical-worm and Spiroplan® gear units achieve their listed rated efficiency values when:

- the gear unit has been completely run in,
- the gear unit has reached nominal operating temperature,
- the recommended lubricant has been filled in and
- the gear unit is operating in the rated load range.

Churning losses

In certain gear unit mounting positions (→ Sec. "Mounting positions and important order information"), the first gearing stage is completely immersed in the lubricant. Considerable churning losses occur in larger gear units and high circumferential velocity of the input stage. Contact SEW-EURODRIVE if you wish to use gear units of this type.

If possible, use mounting position M1 for R, K and S gear units to keep the churning losses low.

5.2 Oil compensator

The oil compensator allows the lubricant/air space of the gear unit to expand. This means no lubricant can escape the breather valve at high operating temperatures.

SEW-EURODRIVE recommends to use oil compensators for gear units and gearmotors in M4 mounting position and for input speeds > 2000 rpm.

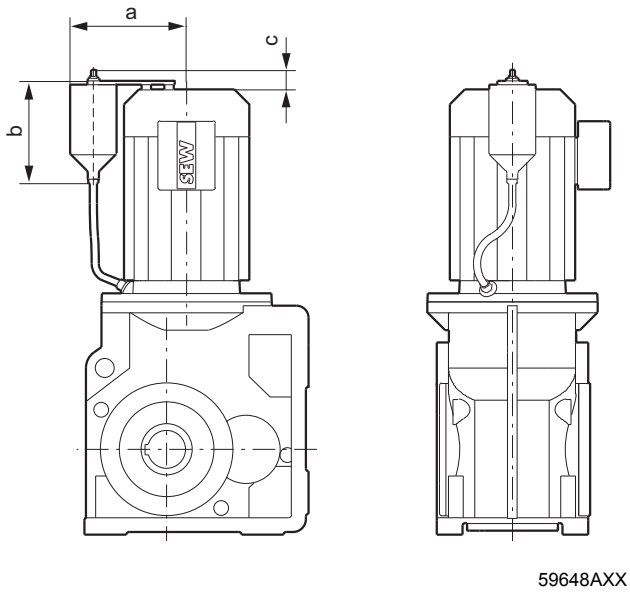

Figure 7: Oil compensator

Gear unit	Motor	Package no.	Dimension a [in]	Dimension b [in]	Dimension c [in]
R27 ... R67 F37 ... F67 K37 ... K67 S37 ... S67	DT80 ... DV132	0045 627 6	3.35	7.80	1.59
R77 ... R87 F77 ... F87 K77 ... K87 S77 ... S87	DT80 ... DV100	0045 648 9	3.35	7.80	1.59
	DV112 ... DV132	0045 628 4	3.35	11.93	1.59
	DV160 ... DV180	0045 649 7	3.35	11.93	1.59
R97 ... R137 F97 ... F107 K97 ... K107 S97	DT80 ... DV100	0045 629 2	3.35	7.80	1.59
	DV112 ... DV132	0045 650 0	4.92	11.93	1.59
	DV160 ... DV250	0045 630 6	4.92	11.93	1.59
R147 F127 K127	DV132	0045 631 4	4.92	11.93	1.59
	DV160 ... DV280	0045 632 2	4.92	11.93	1.59
R167 F157 K157 ... K187	DV160 ... DV180	0045 633 0	4.92	11.93	1.59
	DV200 ... D315	0045 634 9	4.92	11.93	1.59

The oil compensator is suppled as assembly kit. It is intended for mounting onto the gearmotor. However, if installation space is limited or if the compensator is intended for gear units without motor, it can be mounted to nearby machine parts.

5.3 Multi-stage gearmotors (→ GM)

General information

You can achieve particularly low output speeds by using multi-stage gear units or multi-stage gearmotors. This means an additional second gear unit, usually a helical gear unit, is installed in front of the gear unit or between gear unit and motor.

The resulting total reduction ratio may make it necessary to protect the gear units.

Limiting the motor power

You have to reduce the maximum output motor power according to the maximum permitted output torque on the gear unit ($T_{a\ max}$). For this purpose you first have to determine the allowable motor torque ($T_{N\ allowable}$).

You can calculate the allowable motor torque as follows:

$$T_{N\ allowable} = \frac{T_{a\ max}}{i_{total} \cdot \eta_{total}}$$

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Use this allowable motor torque $T_{N\ allowable}$ and the load diagram of the motor to determine the associated value for the motor current.

Take suitable measures to prevent the continuous current consumption of the motor from exceeding the previously determined value for the motor torque $T_{N\ allowable}$. A suitable measure is, for example, to set the trip current of the protective circuit breaker to this maximum current value. Besides, a protective circuit breaker can compensate for a brief overload, for example during the motor's starting phase. A suitable measure for inverter drives is to limit the output current of the inverter according to the determined motor current.

Checking brake torque

If you use a multi-stage brake motor, you will have to limit the braking torque (T_B) according to the maximum permitted motor torque $T_{N\ allowable}$. The maximum permitted braking torque is 200 % $T_{N\ allowable}$.

$T_{B\ max} \leq 200\ \%\ T_{N\ allowable}$

If you have questions on the starting frequency of multi-stage brake motors, please consult SEW-EURODRIVE.

Avoiding blockage

Blockage on the output side of the multi-stage gear unit or multi-stage gearmotor is not permitted. The reason is that indeterminable torques and uncontrolled overhung and axial loads may occur. This may destroy the gear units.

Consult SEW-EURODRIVE if blockages of the multi-stage gear unit or multi-stage gearmotor cannot be avoided due to the application.

5.4 Service factor

Determining the service factor

The effect of the driven machine on the gear unit is taken into account to a sufficient level of accuracy using the service factor f_B. The service factor is determined according to the daily operating time and the starting frequency Z. Three load classifications are taken into account depending on the mass acceleration factor. You can read off the service factor applicable to your application in Figure 8 . The service factor determined from this diagram must be smaller than or equal to the service factor according to the selection tables.

$$T_a \cdot f_b \leq T_{a\,max}$$

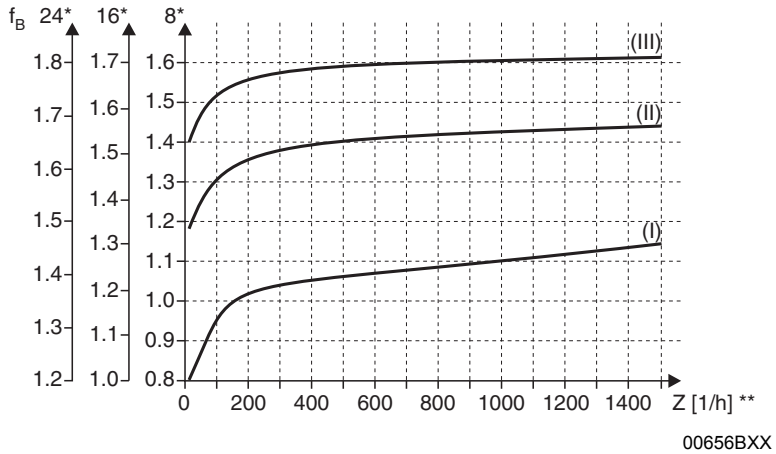

Figure 8: Service factor f_B

* Daily operating time in hours/day
** Starting frequency Z: The cycles include all starting and braking procedures as well as changes from low to high speed and vice versa.

Load classification

Three load classifications are distinguished:

(I) Uniform, permitted mass acceleration factor ≤ 0.2

(II) Non-uniform, permitted mass acceleration factor ≤ 3

(III) Extremely non-uniform, permitted mass acceleration factor ≤ 10

Mass acceleration factor

The mass acceleration factor is calculated as follows:

$$\textbf{Mass acceleration factor} = \frac{\textbf{All external mass moments of inertia}}{\textbf{Mass moment of inertia on the motor end}}$$

"All external mass moments of inertia" are the mass moments of inertia of the driven machine and the gear unit, scaled down to the motor speed. The calculation for scaling down to motor speed is performed using the following formula:

$$J_X = J \bullet \left(\frac{n}{n_M}\right)^2$$

J_X = Mass moment of inertia scaled down to the motor shaft
J = Mass moment of inertia with reference to the output speed of the gear unit
n = Output speed of the gear unit
n_M = Motor speed

"Mass moment of inertia at the motor end" is the mass moment of inertia of the motor and, if installed, the brake and the flywheel fan (Z fan).

Service factors f_B > 1.8 may occur with large mass acceleration factors (> 10), high levels of backlash in the transmission elements or large overhung loads. Contact SEW-EURODRIVE in such cases.

Service factor: SEW f_B

The method for determining the maximum permitted continuous torque $T_{a\,max}$ and using this value to derive the service factor $f_B = T_{a\,max} / T_a$ is not defined in a standard and varies greatly from manufacturer to manufacturer. Even an SEW service factor of f_B = 1, the gear units afford an extremely high level of safety and reliability in the fatigue strength range (exception: wearing of the worm wheel in helical-worm gear units). The service factor may differ from specifications of other gear unit manufacturers. If you are in doubt, contact SEW-EURODRIVE for more detailed information on your specific drive.

Example

Mass acceleration factor 2.5 (load classification II), 14 hours/day operating time (read off at 16 h/d) and 300 cycles/hour result in a service factor f_B = 1.51 according to Figure 8. According to the selection tables, the selected gearmotor must have an SEW f_B value of 1.51 or greater.

Helical-worm gear units

For helical-worm gear units, two additional service factors will have to be taken into consideration besides service factor f_B derived from Figure 8 . These are:

- f_{B1} = Service factor from ambient temperature
- f_{B2} = Service factor from cyclic duration factor

The additional service factors f_{B1} and f_{B2} can be determined by referring to the diagrams in Figure 9 . For f_{B1}, the load classification is taken into account in the same way as for f_B.

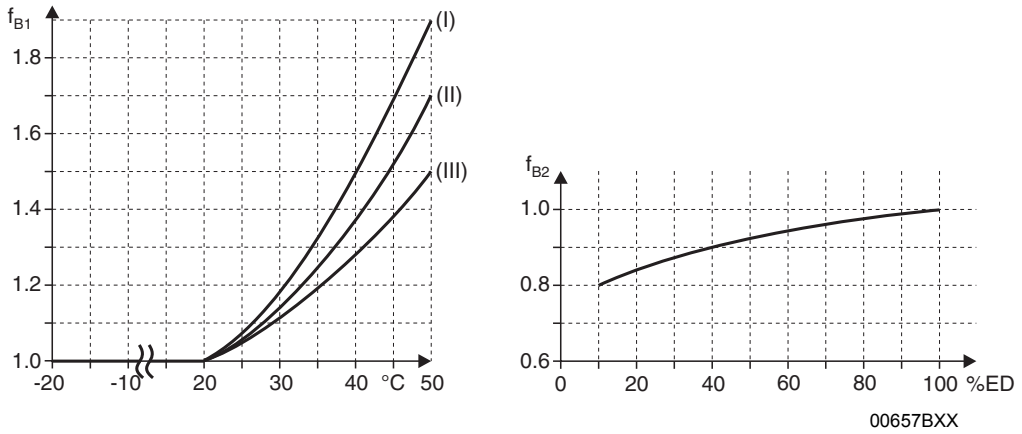

Figure 9: Additional service factors f_{B1} and f_{B2}

$$\textbf{ED (\%)} = \frac{\textbf{Time under load in min/h}}{\textbf{60}} \bullet \textbf{100}$$

Contact SEW-EURODRIVE in case of temperatures below -20 °C (-4 °F) ($\rightarrow f_{B1}$).

The total service factor for helical-worm gear units is calculated as follows:

$$\mathbf{f_{Bges} = f_B \bullet f_{B1} \bullet f_{B2}}$$

Example

The gearmotor with the service factor f_B = 1.51 in the previous example is to be a helical-worm gearmotor.

Ambient temperature ϑ = 40°C $\rightarrow$ f_{B1} = 1.38 (read off at load classification II)

Time under load = 40 min/h $\rightarrow$cdf = 66.67% $\rightarrow$ f_{B2} = 0.95

The total service factor is f_{Bges} = 1.51 • 1.38 • 0.95 = 1.98

According to the selection tables, the selected helical-worm gearmotor must have an SEW f_B service factor of 1.98 or greater.

5.5 Overhung and axial loads (→ GM, → MM, → GK)

Determining overhung load

An important factor for determining the resulting overhung load is the type of transmission element mounted to the shaft end. The following transmission element factors f_Z have to be considered for various transmission elements.

Transmission element	Transmission element factor f_Z	Comments
Gears	1.15	< 17 teeth
Chain sprockets	1.40	< 13 teeth
Chain sprockets	1.25	< 20 teeth
Narrow V-belt pulleys	1.75	Influence of the tensile force
Flat-belt pulleys	2.50	Influence of the tensile force
toothed belt pulleys	1.50	Influence of the tensile force

The overhung load exerted on the motor or gear shaft is calculated as follows:

$$F_R = \frac{T_d \bullet 2}{d_0} \bullet f_Z$$

F_R = Overhung load in lb

T_d = Torque in lb-in

d_0 = Mean diameter of the installed transmission element in inch

f_Z = Transmission element factor

Permitted overhung load

The basis for determining the permitted overhung loads is the computation of the rated bearing service life L_{10h} of the anti-friction bearings (according to ISO 281).

For special operating conditions, the permitted overhung loads can be determined with regard to the modified service life L_{na} on request.

The permitted overhung loads F_{Ra} for the output shafts of foot-mounted gear units with a solid shaft are listed in the selection tables for gearmotors. Contact SEW-EURODRIVE in case of other versions.

The values refer to force applied in the center of the shaft end (in right-angle gear units as viewed onto the B-end output). The worst-case conditions are assumed as regards the force application angle α and direction of rotation.

- Only 50% of the F_{Ra} value specified in the selection tables is permitted in mounting position M1 with wall attachment on the front face for K and S gear units.
- Helical-bevel gearmotors K167 and K187 in mounting positions M1 to M4: A maximum of 50% of the overhung load F_{Ra} specified in the selection tables in the case of gear unit mounting other than as shown in the mounting position sheets.
- Foot and flange-mounted helical gearmotors (R..F): A maximum of 50% of the overhung load F_{Ra} specified in the selection tables for torque transmission via flange mounting are permitted.

Higher permitted overhung loads

Exactly considering the force application angle α and the direction of rotation makes it possible to achieve a higher overhung load. Higher output shaft loads are permitted if heavy duty bearings are installed, especially with R, F and K gear units. Contact SEW-EURODRIVE in such cases.

Definition of force application point

Force application is defined according to the following figure:

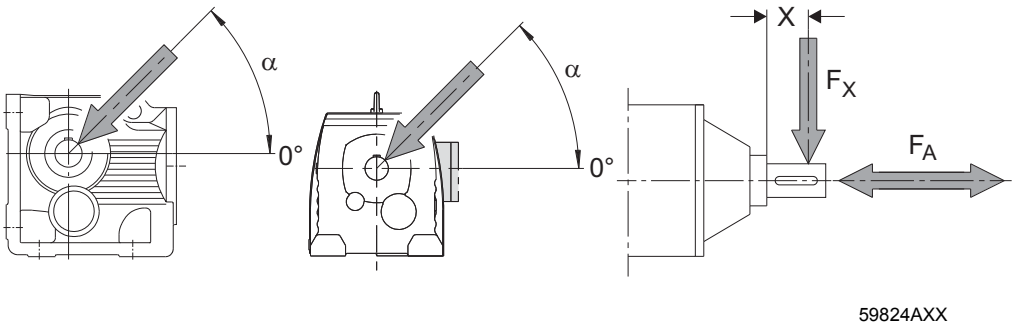

Figure 10: Definition of force application point

F_X = Permitted overhung load at point x [lb]

F_A = Permitted axial load [lb]

Permitted axial loads

If there is no overhung load, then an axial force F_A (tension or compression) amounting to 50 % of the overhung load given in the selection tables is permitted. This condition applies to the following gearmotors:

- Helical gearmotors except for R..137... to R..167...
- Parallel shaft and helical-bevel gearmotors with solid shaft except for F97...
- Helical-worm gearmotors with solid shaft

Contact SEW-EURODRIVE for all other types of gear units and in the event of significantly greater axial forces or combinations of overhung load and axial force.

On the input side: Overhung load conversion for off-center force application

Important: only applies to gear units with input shaft assembly:

Consult SEW-EURODRIVE for off-center force application on the drive end.

On the output side: Overhung load conversion for off-center force application

The permitted overhung loads must be calculated according the selection tables using the following formulae in the event that force is not applied at the center of the shaft end. The smaller of the two values F_{xL} (according to bearing life) and F_{xW} (according to shaft strength) is the permitted value for the overhung load at point x. Note that the calculations apply to $T_{a\ max}$.

F_{XL} according to bearing service life

$$F_{xL} = F_{Ra} \bullet \frac{a}{b + x}\ [lb]$$

F_{xW} from the shaft strength:

$$F_{xW} = \frac{c \bullet 10^3}{f + x}\ [lb]$$

F_{Ra} = Permitted overhung load (x = l/2) for foot-mounted gear units according to the selection tables in [lb]

x = Distance from the shaft shoulder to the force application point in [in]

a, b, f = Gear unit constant for overhung load conversion[in]

c = Gear unit constant for overhung load conversion[in]

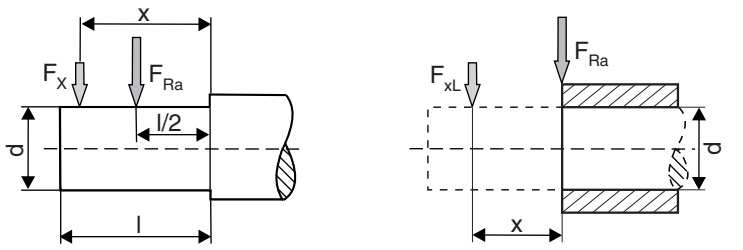

Figure 11: Overhung load F_x for off-center force application

Gear unit constants for overhung load conversion

Gear unit type	a [in]	b [in]	c [lb-in]	f [in]	d [in]	l [in]
RX57	1.71	0.93	1.34	1.35	0.750	1.57
RX67	2.07	1.08	2.14	1.56	1.000	1.97
RX77	2.38	1.20	1.73	0	1.250	2.36
RX87	2.89	1.32	6.81	1.93	1.625	3.15
RX97	3.41	1.44	12.66	2.12	2.125	3.94
RX107	4.04	1.67	21.86	2.45	2.375	4.72
R07	2.83	2.05	0.41	0.43	0.750	1.57
R17	3.48	2.70	0.58	0.67	0.750	1.57
R27	4.19	3.21	1.38	0.46	1.000	1.97
R37	4.65	3.66	1.10	0	1.000	1.97
R47	5.39	4.21	2.16	0.59	1.250	2.36
R57	5.81	4.43	3.34	0.71	1.375	2.76
R67	6.63	5.26	2.35	0	1.375	2.76
R77	6.84	5.26	3.51	0	1.625	3.15
R87	8.53	6.56	7.50	0	2.125	3.94
R97	10.06	7.70	10.53	0	2.375	4.72
R107	11.24	8.48	18.23	0	2.875	5.51
R137	13.52	10.18	54.34	1.18	3.625	6.69
R147	15.83	11.69	76.56	1.30	4.375	8.27
R167	17.72	13.58	111.52	0	4.750	8.27
F27	4.31	3.33	1.00	0	1.000	1.97
F37	4.86	3.88	0.95	0	1.000	1.97
F47	6.04	4.86	1.58	0	1.250	2.36
F57	6.72	5.34	4.86	1.26	1.375	2.76
F67	7.14	5.56	3.65	0	1.625	3.15
F77	8.50	6.53	6.97	0	2.000	3.94
F87	10.35	7.99	10.53	0	2.375	4.72
F97	13.78	11.02	18.50	0	2.875	5.51
F107	14.70	11.36	37.44	0	3.625	6.69
F127	17.42	13.29	83.64	0	4.375	8.27
F157	20.16	16.02	92.93	0	4.750	8.27
K37	4.86	3.88	1.25	0	1.000	1.97
K47	6.04	4.86	1.58	0	1.250	2.36
K57	6.68	5.30	6.02	1.22	1.375	2.76
K67	7.14	5.56	3.65	0	1.625	3.15
K77	8.50	6.53	6.81	0	2.000	3.94
K87	9.92	7.56	14.52	0	2.375	4.72
K97	12.56	9.80	24.78	0	2.875	5.51
K107	14.70	11.36	48.94	0	3.325	6.69
K127	17.46	13.33	73.55	0	4.375	8.27
K157	20.04	15.91	104.44	0	4.750	8.27
K167	24.47	19.55	166.39	0	6.250	9.84
K187	28.37	22.07	269.06	0	7.500	12.60
W10	3.34	2.55	0.32	0	0.625	1.57
W20	3.88	3.09	0.39	0	0.750	1.57
W30	4.31	3.52	0.53	0	0.750	1.57
S37	4.67	3.88	0.53	0	0.750	1.57
S47	5.12	4.13	1.18	0	1.000	1.97
S57	5.91	4.72	1.89	0	1.250	2.36
S67	7.24	5.87	2.69	0	1.375	2.76
S77	8.82	7.05	4.66	0	1.750	3.54
S87	11.08	8.72	14.87	0	2.375	4.72
S97	12.85	10.09	22.48	0	2.875	5.51

Values for types not listed are available on request.

5.6 RM gear units

Project planning You must take into account the higher overhung loads and axial forces when planning projects using RM helical gearmotors with extended bearing housing. Observe the following project planning procedure:

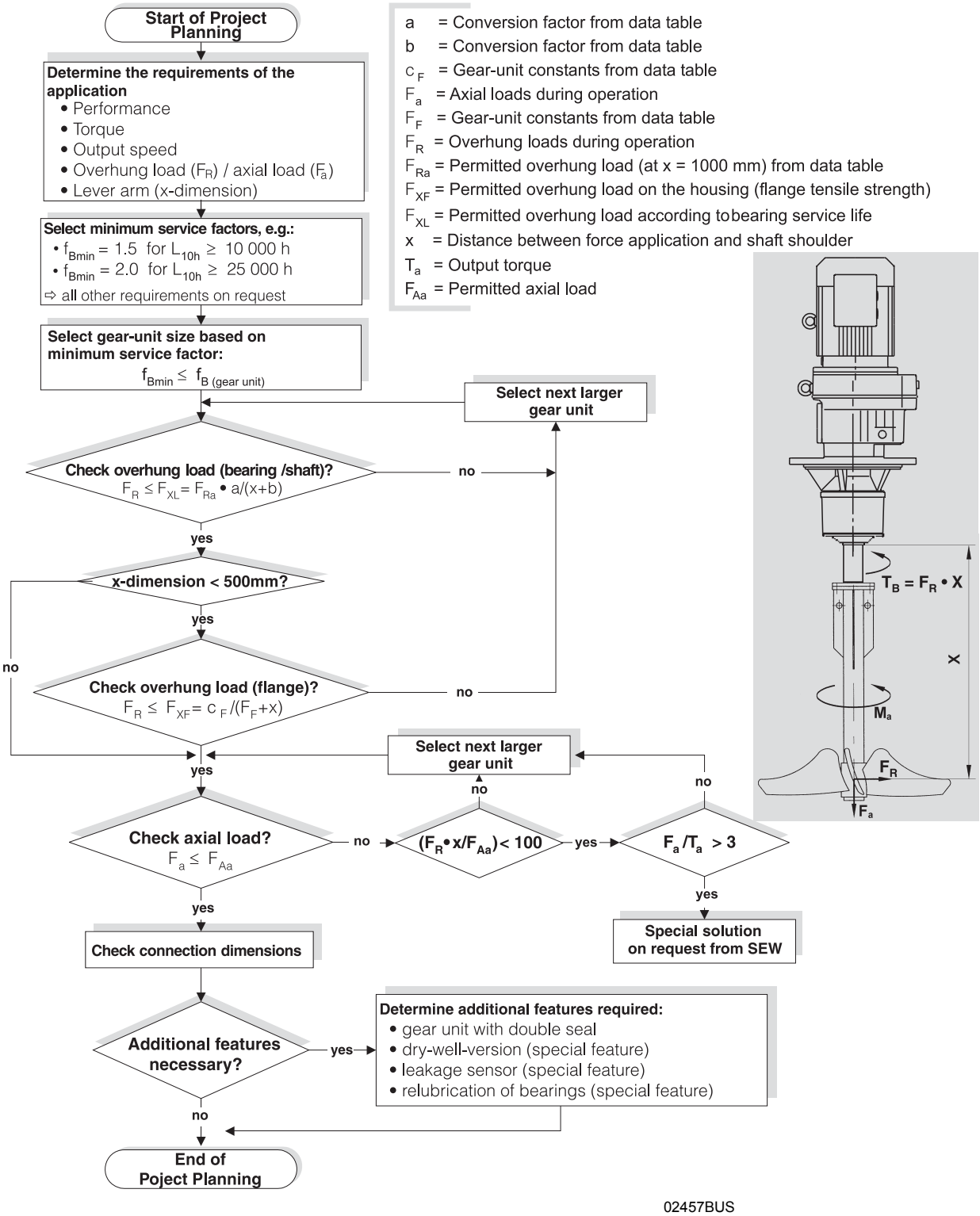

Figure 12: Project planning for RM gear units

Permitted overhung loads and axial forces

The permitted overhung loads F_{Ra} and axial forces F_{Aa} are specified for various service factors f_B and nominal bearing service life L_{10h}.

f_{Bmin} = 1.5; L_{10h} = 10,000 h

		n_a [1/min]							
		< 16	16-25	26-40	41-60	61-100	101-160	161-250	251-400
RM57	F_{Ra} [N]	400	400	400	400	400	405	410	415
	F_{Aa} [N]	18800	15000	11500	9700	7100	5650	4450	3800
RM67	F_{Ra} [N]	575	575	575	580	575	585	590	600
	F_{Aa} [N]	19000	18900	15300	11900	9210	7470	5870	5050
RM77	F_{Ra} [N]	1200	1200	1200	1200	1200	1210	1210	1220
	F_{Aa} [N]	22000	22000	19400	15100	11400	9220	7200	6710
RM87	F_{Ra} [N]	1970	1970	1970	1970	1980	1990	2000	2010
	F_{Aa} [N]	30000	30000	23600	18000	14300	11000	8940	8030
RM97	F_{Ra} [N]	2980	2980	2980	2990	3010	3050	3060	3080
	F_{Aa} [N]	40000	36100	27300	20300	15900	12600	9640	7810
RM107	F_{Ra} [N]	4230	4230	4230	4230	4230	4230	3580	3830
	F_{Aa} [N]	48000	41000	30300	23000	18000	13100	9550	9030
RM137	F_{Ra} [N]	8710	8710	8710	8710	7220	5060	3980	6750
	F_{Aa} [N]	70000	70000	70000	57600	46900	44000	35600	32400
RM147	F_{Ra} [N]	11100	11100	11100	11100	11100	10600	8640	10800
	F_{Aa} [N]	70000	70000	69700	58400	45600	38000	32800	30800
RM167	F_{Ra} [N]	14600	14600	14600	14600	14600	14700	-	-
	F_{Aa} [N]	70000	70000	70000	60300	45300	36900	-	-

f_{Bmin} = 2.0; L_{10h} = 25 000 h

		n_a [1/min]							
		< 16	16-25	26-40	41-60	61-100	101-160	161-250	251-400
RM57	F_{Ra} [N]	410	410	410	410	410	415	415	420
	F_{Aa} [N]	12100	9600	7350	6050	4300	3350	2600	2200
RM67	F_{Ra} [N]	590	590	590	595	590	595	600	605
	F_{Aa} [N]	15800	12000	9580	7330	5580	4460	3460	2930
RM77	F_{Ra} [N]	1210	1210	1210	1210	1210	1220	1220	1220
	F_{Aa} [N]	20000	15400	11900	9070	6670	5280	4010	3700
RM87	F_{Ra} [N]	2000	2000	2000	2000	2000	1720	1690	1710
	F_{Aa} [N]	24600	19200	14300	10600	8190	6100	5490	4860
RM97	F_{Ra} [N]	3040	3040	3040	3050	3070	3080	2540	2430
	F_{Aa} [N]	28400	22000	16200	11600	8850	6840	5830	4760
RM107	F_{Ra} [N]	4330	4330	4330	4330	4330	3350	2810	2990
	F_{Aa} [N]	32300	24800	17800	13000	9780	8170	5950	5620
RM137	F_{Ra} [N]	8850	8850	8850	8830	5660	4020	3200	5240
	F_{Aa} [N]	70000	59900	48000	37900	33800	31700	25600	23300
RM147	F_{Ra} [N]	11400	11400	11400	11400	11400	8320	6850	8440
	F_{Aa} [N]	70000	60600	45900	39900	33500	27900	24100	22600
RM167	F_{Ra} [N]	15100	15100	15100	15100	15100	13100	-	-
	F_{Aa} [N]	70000	63500	51600	37800	26800	23600	-	-

Conversion factors and gear unit constants

The following conversion factors and gear unit constants apply to calculating the permitted overhung load F_{xL} at point $x \neq 1000$ mm for RM gearmotors:

Gear unit type	a	b	c_F (f_B = 1.5)	c_F (f_B = 2.0)	F_F
RM57	1047	47	1220600	1260400	277
RM67	1047	47	2047600	2100000	297.5
RM77	1050	50	2512800	2574700	340.5
RM87	1056.5	56.5	4917800	5029000	414
RM97	1061	61	10911600	11124100	481
RM107	1069	69	15367000	15652000	554.5
RM137	1088	88	25291700	25993600	650
RM147	1091	91	30038700	31173900	756
RM167	1089.5	89.5	42096100	43654300	869

Additional weight RM gear units

Type	Additional weight compared to RF with reference to the smallest RF flange $\triangle$m [kg / lb]
RM57	12.0 / 26.4
RM67	15.8 / 34.8
RM77	25.0 / 55.1
RM87	29.7 / 65.5
RM97	51.3 / 113.1
RM107	88.0 / 194.0
RM137	111.1 / 244.9
RM147	167.4 / 369.1
RM167	195.4 / 430.8

5.7 Drives for overhead trolley systems

Special gearmotors with integrated coupling are required for operating overhead trolley systems. SEW-EURODRIVE offers a range of drives for overhead trolley systems. You will find detailed information on this topic in the "Drives for Overhead Trolley Systems" catalog.

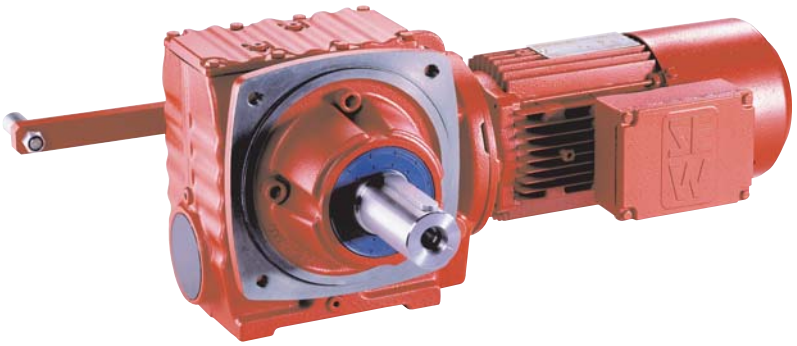

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Figure 13: Drive for overhead trolley systems

Type designation

Drives for overhead trolley systems have the following unit designation:

Type	Description
HW..	Overhead trolley drive based on Spiroplan® gear unit
HS..	Overhead trolley drive based on helical-worm gear unit
HK..	Overhead trolley drive based on helical-bevel gear unit

Division into two groups

Drives for overhead trolley systems are divided into two groups:

Group	Drives
Drives for overhead trolley systems according to VDI 3643 guideline (C1 standard)	HW30 HS40 (up to motor size DT80)
Drives for heavy duty overhead trolley systems	HS41 / HS50 / HS60 HK30 / HK40 / HK50 / HK60

Technical data

The following technical data apply to overhead trolley drives:

Type	$T_{a\ max}$ [lb-in]	F_{Ra} [lb]	Gear ratios i	Shaft end	
				d[mm]	l [mm]
HW30	620	1259	8.2 - 75	20 25	35 35
HS40	1060	1461	7.28 - 201	20 25	35 35
HS41	1640	2248	7.28 - 201	25	35
HS50	2660	3372	7.28 - 201	30 35	60 70
HS60	5310	5620	7.56 - 217.41	45	90
HK30	1770	2248	13.1 - 106.38	25	35
HK40	3540	4159	12.2 - 131.87	30 35	60 70
HK50	5310	5620	13.25 - 145.14	45	90
HK60	7260	8992	13.22 - 144.79	55	110

6 Project Planning for Components on the Input Side

6.1 Gear units with IEC or NEMA adapter AM (→ GK)

04588AXX

Figure 14: Helical-worm gear unit with adapter AM

For mounting motors according to IEC standard or NEMA (type C or TC) to SEW helical gear units, parallel shaft helical gear units, helical-bevel and helical-worm gear units.

Adapters are available for sizes 63 to 280 for IEC motors. Adapters are available for sizes 56 to 365 for NEMA motors.

The designation of the adapter size corresponds to the respective IEC or NEMA motor size.

Torque is transmitted between the motor and the gear unit via a positive and elastomeric spider. Vibrations and shocks occurring during operation are effectively weakened by the inserted polyurethane spider.

Power ratings, mass moments of inertia

Type (IEC)	Type (NEMA)	P_m [1] [HP]	$J_{adapter}$ [lb-ft²]
AM63	-	0.33	$10.45 \bullet 10^{-4}$
AM71	AM56	0.50	$10.45 \bullet 10^{-4}$
AM80	AM143	1.0	$45.125 \bullet 10^{-4}$
AM90	AM145	2.0	$45.125 \bullet 10^{-4}$
AM100	AM182	4	$123.5 \bullet 10^{-4}$
AM112	AM184	5.4	$123.5 \bullet 10^{-4}$
AM132S/M	AM213/215	10	$451.25 \bullet 10^{-4}$
AM132ML	-	12.5	$451.25 \bullet 10^{-4}$
AM160	AM254/256	20	$2161.25 \bullet 10^{-4}$
AM180	AM284/286	30	$2137.5 \bullet 10^{-4}$
AM200	AM324/326	40	$4132.5 \bullet 10^{-4}$
AM225	AM364/365	60	$4132.5 \bullet 10^{-4}$
AM250	-	75	$4108.75 \bullet 10^{-4}$
AM280	-	120	$16268.75 \bullet 10^{-4}$

1) Maximum rated power of the attached standard electric motor at 1750 rpm (applies to ambient temperatures of -22 °F to +140 °F)

Selecting the gear unit

Determine the gear unit type

↓

Determine the gear unit size by means of the
- maximum output torque ($T_{a\ max}$)
- Gear ratio (i)

in the gear unit selection tables with adapter AM

↓

Check the maximum permitted overhung load value on the output (F_{Ra})

↓

Check the maximum permitted input power at the adapter (P_m)
(see “Power ratings, mass moments of intertia” on page 60)

↓

Is the required adapter size available?

↓

Is the required combination feasible?

Check the input power at the gear unit (P_n)

The values in the selection tables refer to an input speed of n_e = 1750 rpm. The input power at the gear unit corresponds to a maximum torque at the input side. If the speed deviates, convert the input power by means of the maximum torque.

Backstop AM../RS

If the application requires only one direction of rotation, the AM adapter can be configured with a backstop. Backstops with centrifugal lift-off sprags are used. The advantage of this design is that the sprags move around inside the backstop without making contact above a certain speed (lift-off speed). This means backstops operate wear-free, maintenance-free and without losses and are suited for high speeds.

Dimensions:

The backstop is completely integrated in the adapter. This means the dimensions are the same as with adapter without backstop (see dimension sheets in the Adapter AM section).

Locking torques:

Type	Maximum locking torque backstop [lb-in]	Lift-off speed [rpm]
AM80, AM90, AM143, AM145	795	640
AM100, AM112, AM182, AM184	3010	600
AM132, AM213/215	6200	550
AM160, AM180, AM254/256, AM284/286	10600	630
AM 200, AM225, AM324/326 AM364/365	12800	430

Specify output direction of rotation when ordering

When you order a gear unit with adapter and backstop, it is necessary to indicate the direction of rotation for the output shaft/output side. The direction of rotation is given looking onto the output shaft/output side of the gear unit. For drives with shaft ends at sides A and B, the direction of rotation must be specified as looking onto side A.

Check the direction of rotation of the drive before starting up the system to avoid damage.

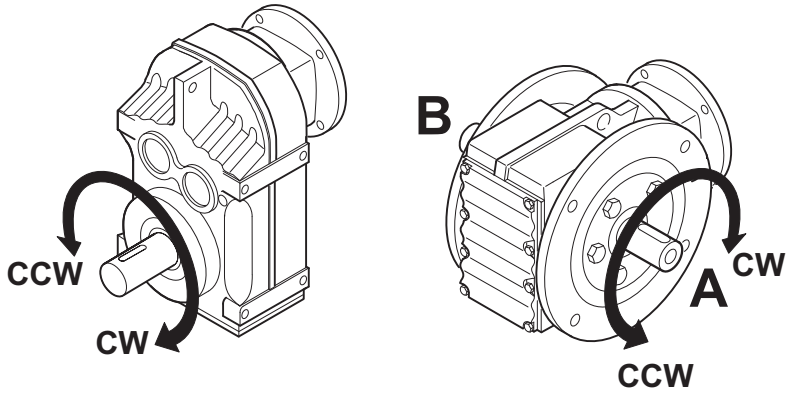


Figure 15: Direction of rotation of output

CCW = Counterclockwise rotation

CW = Clockwise rotation

6.2 Adapter AQ for servomotors (→ GK)

04595AXX

Figure 16: Helical gear unit with AQ adapter

An adapter with square flange is used for mounting servomotors onto SEW helical, parallel shaft helical, helical-bevel and helical-worm gear units.

The torque is transmitted via a elastomeric spider. Possible vibrations and shocks occurring during operation are effectively weakened and dissipated by an inserted polyurethane ring gear.

Configuration variants

The clutch half on the motor side can be configured either with a clamping ring hub (non-positive, for smooth motor shafts) or a keyway (positive) as required.

- AQH = with clamping ring hub
- AQA = with keyway

Torques, mass moments of inertia

Type	d_{RZ} [1] [mm]	$T_{e\ max}$ [2] [lb-in]	$J_{adapter}$ [3] [lb-ft²]
AQ..80/..	10	68	$21.375 \bullet 10^{-4}$
	12	115	
AQ..100/.. **AQ..115/1** **AQ..115/2**	10	68	38.10^{-4}
	12	115	
	14	133	
	16	133	
AQ..115/3	10	68	$87.875 \bullet 10^{-4}$
	12	115	
	14	168	
	16	265	
AQ..140/1 **AQ..140/2**	16	265	133.10^{-4}
	18	365	
	22	470	
AQ..140/3	16	265	$268.375 \bullet 10^{-4}$
	18	365	
	22	665	
AQ..190/1 **AQ..190/2**	22	665	$387.125 \bullet 10^{-4}$
	28	1280	
AQ..190/3	22	665	$688.75 \bullet 10^{-4}$
	28	1500	

1) The pinion diameter depends on the gear ratio, please contact SEW-EURODRIVE.

2) Maximum permitted input torque (applies to ambient temperatures of -22 °F to +140 °F; with AQH → diameter tolerance of the motor shaft k6)

3) Mass moment of inertia of the adapter to be driven

Required motor data

As the dimensions of servomotors are not standardized, the following motor data must be known to select the appropriate adapter:

- Shaft diameter and length
- Flange dimensions (edge length, diameter, centering shoulder and hole circle)
- Maximum torque

Do not hesitate to contact us if you have questions on selection and project planning.

Selecting the gear unit

Determine the gear unit type

↓

Determine the gear unit size by means of the
- Maximum output torque ($T_{a\ max}$)
- Gear ratio (i)

in the selection tables AQ

↓

Check the maximum permitted overhung load value on the output (F_{Ra})

↓

Check the permitted input torques on the gear unit ($T_{e\ max}$)
(see “Power ratings, mass moments of intertia" on the previous page)

↓

Is the required adapter size available?

↓

Is the required combination feasible?

6.3 Adapter AR with torque limiting coupling (→ GK)

04604AXX

Figure 17: Helical-bevel gear unit with AR adapter

SEW helical, parallel shaft helical, helical-bevel and helical-worm gear units are designed with adapter and torque limiting coupling to protect the machine and the drive against overload. IEC standard motors of sizes 71 to 180 can be mounted.

The torque is transmitted in a non-positive manner via friction ring pads. The slip torque of the coupling can be adjusted with a setting nut and cup springs. Different slip torques are possible depending on the thickness and arrangement of the cup springs. In the event of an overload, the coupling slips and interrupts the power flow between motor and gear unit. This prevents damages to the system and drive.

Multi-stage gear unit with adapter and torque limiting coupling

In combination with multi-stage gear units, the adapter with torque limiting coupling is preferably installed between the two gear units. Please contact SEW-EURODRIVE if required.

Selecting the gear unit

The type sizes of the AR adapter with torque limiting coupling correspond to those of the AM adapter for IEC motors.

This means you can select the gear unit using the selection tables for AM adapters. In this case, substitute the unit designation AM with AR and determine the required slip torque.

Determining the slip torque

The slip torque should be about 1.5 times the rated torque of the drive. When determining the slip torque, bear in mind the maximum permitted output torque of the gear unit as well as the variations in the slip torque of the coupling (+/-20 %) which are a feature of the design.

When you order a gear unit with adapter and torque limiting coupling, you have to specify the required slip torque of the coupling.

If you do not specify the slip torque, it will be set according to the maximum permitted output torque of the gear unit.

Torques, slip torques

Type	P_m 1) [HP]	T_R 2) [lb-in]	T_R 2) [lb-in]	T_R 2) [lb-in]
AR71	0.5	8.9 - 53	54 - 142	-
AR80	1.0	8.9 - 53	54 - 142	-
AR90	2.0	8.9 - 53	54 - 142	150 - 285
AR100	4.0	44 - 115	124 - 710	-
AR112	5.4	44 - 115	124 - 710	-
AR132S/M	10.0	133 - 1150	-	-
AR132ML	12.5	133 - 1150	-	-
AR160	20.0	265 - 750	760 - 1770	-
AR180	30.0	265 - 750	760 - 2655	-

1) Maximum rated power of the mounted standard electric motor at 1750 rpm

2) Adjustable slip torque according to the cup springs

Speed monitor /W option

We recommend monitoring the speed of the coupling using a speed monitor to avoid uncontrolled slippage of the coupling and the associated wear to the friction ring pads.

The speed of the output end coupling half of the torque limiting coupling is detected in a proximity-type method using a trigger cam and an inductive encoder. The speed monitor compares the pulses with a defined reference speed. The output relay (NC or NO contact) trips when the speed drops below the specified speed (overload). The monitor is equipped with a start bypass to suppress error messages during the startup phase. The start bypass can be set within a time window of 0.5 to 15 seconds.

Reference speed, start bypass and switching hysterisis can be set on the speed monitor.

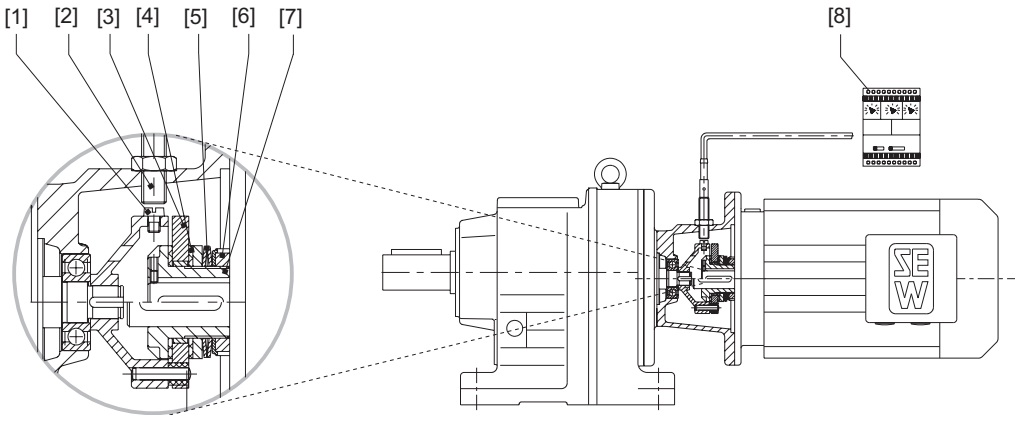


Figure 18: : Adapter with torque limiting coupling and speed monitor /W

[1] Trigger cam
[2] Encoder (adapter)
[3] Driving disc
[4] Friction ring pads
[5] Cup spring
[6] Slotted nut
[7] Friction hub
[8] Speed monitor

Slip monitor /WS option

In conjunction with Varigear® variable speed gear units (see Variable Speed Gear Units catalog), the speed monitor is replaced by a slip monitor for monitoring the speed difference between the input and output halves of the coupling.

The signal pick-up depends on the size of the variable speed gear unit and consists of two encoders or one encoder and an AC tachogenerator.

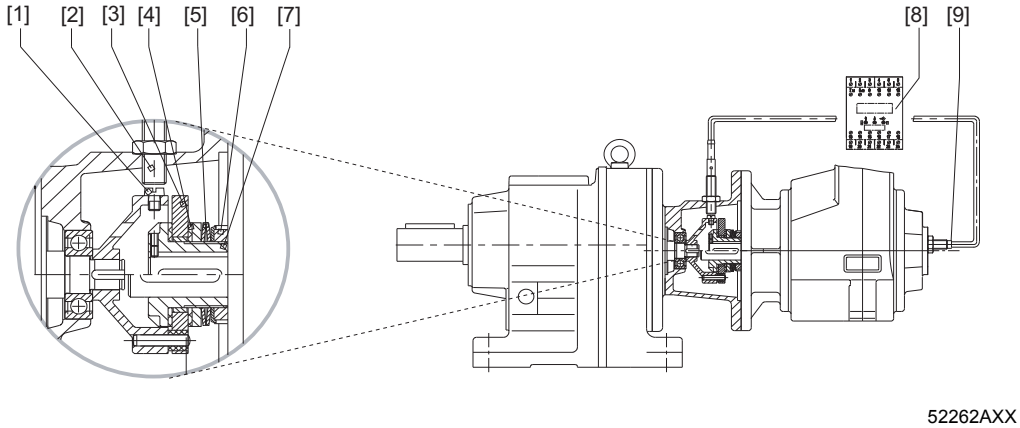


Figure 19: Adapter with a torque limiting coupling and slip monitor /WS

[1] Trigger cam
[2] Encoder (adapter)
[3] Driving disc
[4] Friction ring pads
[5] Cup spring
[6] Slotted nut
[7] Friction hub
[8] Slip monitor /WS
[9] Encoder IG

Connection

The encoder is connected to the slip monitor using a two or three-core cable (depending on the encoder type).

- Maximum cable length: 500 m (1640 ft) with a line cross section of 1.5 mm^2 (AWG14)
- Standard supply cable: 3-core / 2 m (6.5 ft)
- Route the signal lines separately (not in multicore cables) and shield them, if necessary.
- Enclosure: IP40 (terminals IP20)
- Operating voltage: 110...240 AC/DC (50...60 Hz) or 24V DC
- Voltage tolerance [%]: -20...+10
- Maximum switching capability of the output relay: 6 A (250 V AC)

Terminal assignment W

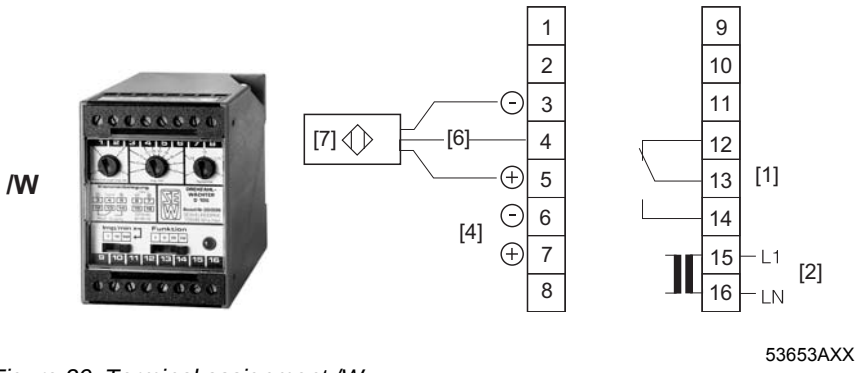


Figure 20: Terminal assignment /W

[1] Relay output
[2] Supply voltage AC 110 V (50...60Hz)
[3] External slip reset
[4] Supply voltage DC 24 V
[5] Jumper for synchronous operation monitoring
[6] Signal
[7] Encoder
[/W] Speed monitor

Terminal assignment WS

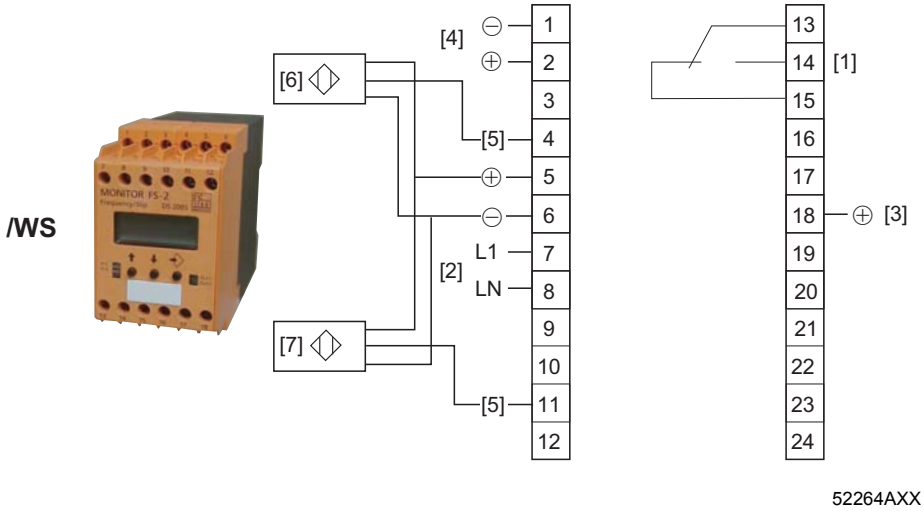


Figure 21: Terminal assignment /WS

[1] Relay output
[2] Supply voltage AC 110...240 V (50...60Hz)
[3] External slip reset
[4] Supply voltage DC 24 V
[5] Signal
[6] Encoder 1
[7] Encoder 2
[/WS] Slip monitor

Dimensions W

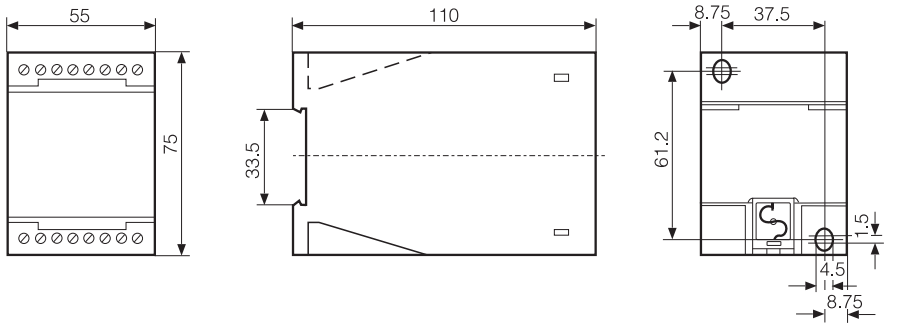


Figure 22: Dimensions /W in mm

Dimensions WS

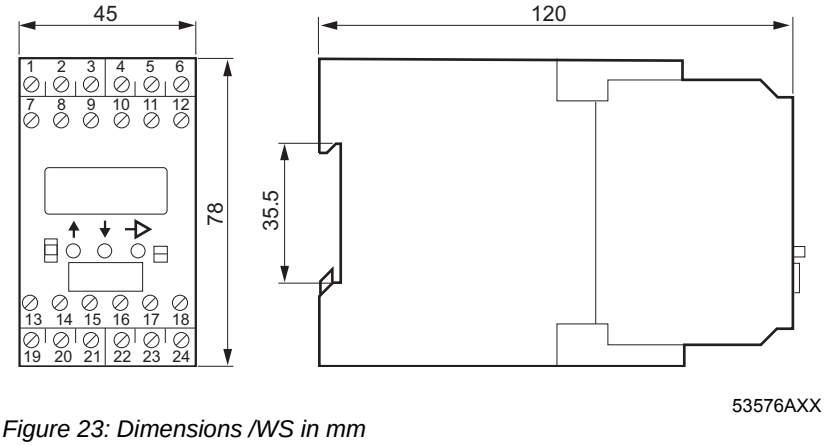


Figure 23: Dimensions /WS in mm

6.4 Adapter with hydraulic centrifugal coupling AT (→ GK)

04607AXX

Figure 24: Parallel shaft helical gear unit with adapter AT

SEW helical, parallel shaft helical, helical-bevel and helical-worm gear units can be combined with adapters and hydraulic centrifugal couplings for machines with high inertia starting (e.g. mixers, agitators, etc.). The hydraulic centrifugal coupling protects the motor and the driven machine against overload during the startup phase and ensures that the machine starts up smoothly. The coupling is installed in a housing to prevent anyone touching it. Cooling of the coupling is ensured via ventilation openings in the housing. It is possible to mount SEW motor sizes 71 to 180 (0.50 to 30 Hp)[1].

Preferred speeds are 1800 rpm and 3600 rpm, i.e. 4 or 2-pole attached motors. There is increased noise development in 2-pole drive combinations.

1) Helical-bevel gear units with a hydraulic centrifugal coupling on a swing base are available for motors of size 200 to 280 (40 to 120 Hp).

Centrifugal coupling

The centrifugal coupling used is a hydrodynamic coupling that operates according to the Föttinger principle. The coupling is filled with oil and consists of a pump wheel (motor side) and a turbine wheel (gear unit side). The pump wheel converts the input mechanical energy into fluid energy and the turbine wheel converts this energy back into mechanical energy.

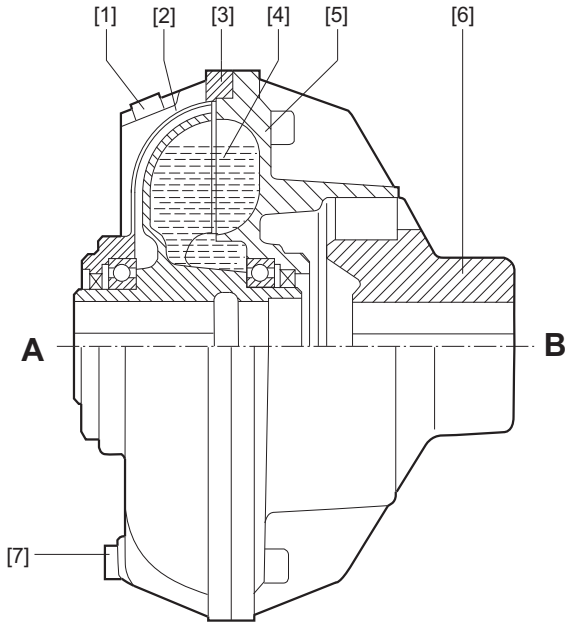


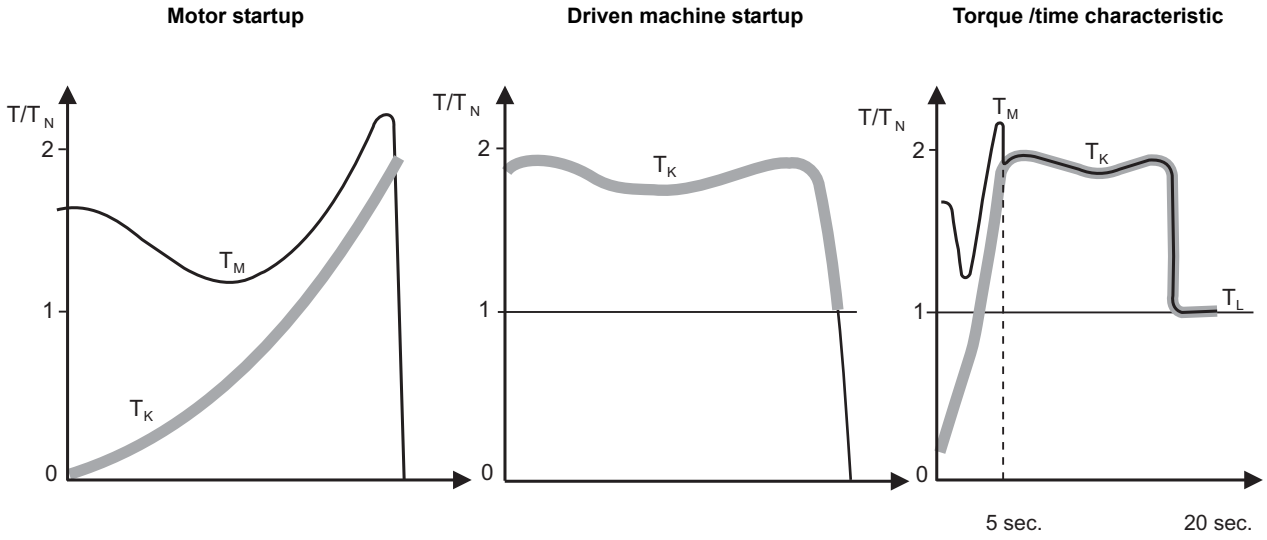
Figure 25: Centrifugal coupling

[1] Filling plug
[2] Turbine wheel
[3] Coupling half
[4] Operating fluid (hydraulic oil)
[5] Pump wheel
[6] Flexible connecting coupling
[7] Fusible safety plug
[A] Gear unit side
[B] Motor side

The power which the coupling can transmit significantly depends on the speed. A distinction is made between startup phase and stationary operation. During the startup phase, the motor starts without load until the coupling transmits torque. The machine is accelerated slowly and smoothly during this phase. Once stationary operation is reached, there will be an operating slip between motor and gear unit caused by the operating principle of the coupling. Only the load torque of the system is required from the motor. Load peaks are attenuated by the coupling.

The hydraulic centrifugal coupling is equipped with fusible safety plugs that allow the operating fluid to be evacuated in the event of excessive temperature (severe overload, blockage). In this way the coupling and system are protected from damage.

Characteristic curves



T_M Motor torque
T_L Load torque
T_K Coupling torque
T_N Fusible safety plug

Selecting the gear unit

Determine the gear unit type

↓

Determine the gear unit size by means of the
- Maximum output torque ($T_{a\ max}$)
- Gear ratio (i)

in the gear unit selection tables with **adapter AM**

↓

Determine the adapter type by means of the
- Motor speed (n_M)
- Gear unit size
- Rated power of the driving motor (P_m)

in the selection tables for **adapter AT**

Backstop AT../RS option

If the application requires only one permitted direction of rotation, the hydraulic centrifugal coupling can be configured with a backstop. Backstops with centrifugal lift-off sprags are used. The advantage of this design is that the sprags move around in the backstop without making contact above a certain speed. This means the backstops operate wear-free, maintenance-free, without losses, and are suited for high speeds.

Dimensions

The dimensions of the hydraulic centrifugal coupling with backstop AT../RS are identical to those of the hydraulic centrifugal coupling AT.. (see dimension drawings in the section Hydraulic centrifugal coupling AT..).

Locking torques

Type	Maximum locking torque backstop [lb-in]	Lift-off speed [rpm]
AT311/RS - AT322/RS	3010	600
AT421/RS - AT422/RS	6200	550
AT522/RS - AT542/RS	10600	630

Specify output direction of rotation when ordering

When you order a gear unit with adapter and backstop, it is necessary to indicate the direction of rotation for the output shaft/output side. The direction of rotation is given looking onto the output shaft/output side of the gear unit. For drives with shaft ends at sides A and B, the direction of rotation must be specified as looking onto side A.

Check the direction of rotation of the drive before starting up the system to avoid damage.

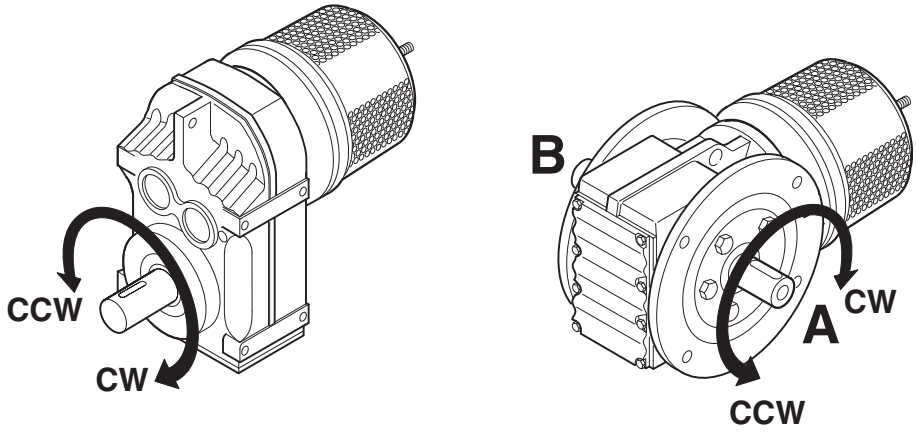


Figure 26: Specify output direction of rotation when ordering

CCW = Counterclockwise rotation

CW = Clockwise rotation

Disc brake AT../BM(G) option

04611AXX

Figure 27: Parallel shaft helical gear unit with adapter AT and disc brake BM(G)

The adapter with hydraulic centrifugal coupling can be configured with an SEW disc brake if the machine is to be braked in a defined manner. The brake is an electromagnetic disc brake with a DC coil which is released electrically and braked using spring force. As a result, the brake satisfies the safety requirement of braking in the event of a power failure. The braking torque can be varied by means of the type and number of brake springs used. The brake can be supplied with DC or AC voltage connection; the equipment needed for controlling the brake and the connection terminals are accommodated in a terminal box attached to the adapter. The brake can additionally be equipped with manual brake release on request.

Braking torques

Type	d_{rz} [1] [mm]	T_{Bmax} [2] [lb-in]	Reduced braking torques (guide values) [lb-in]					
AT311/BMG - AT322/BMG	10	84						
	12	112	84					
	16	265	168	112	84			
	22	485	400	325	265	168	112	84
AT421/BMG - AT422/BMG	16	265	168	112	84			
	22	485	400	325	265	168	112	84
	28	485	400	325	265	168	112	84
AT522/BM - AT542/BM	22	665	445					
	28	1330	1110	890	665	445		
	32	2210	1770	1330	1110	890	665	445

1) The pinion spigot diameter depends on the gear ratio, please contact SEW-EURODRIVE.

2) Maximum braking torque

Order information

Specify the required braking torque and brake voltage when ordering a gear unit with adapter, centrifugal coupling and brake. If you do not specify these values in your order, the maximum permitted braking torque will be set.

6.5 Project planning for helical-bevel gear units on swing base MK (→ GK)

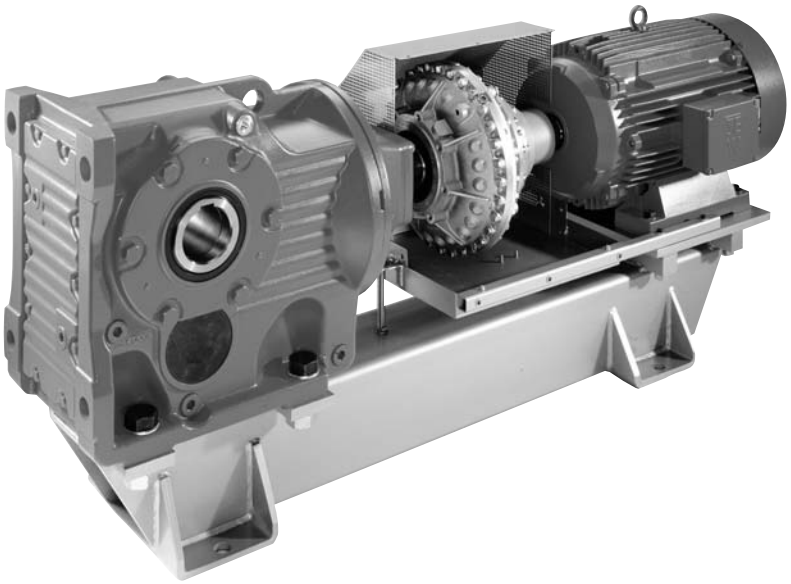


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Figure 28: Helical-bevel gear unit on swing base MK

Pre-assembled drive units comprising helical bevel gear units, hydraulic centrifugal couplings and electric motors are available especially for conveyor systems, bucket conveyors and other machines with high inertia starting. The complete arrangement is attached to a torsionally rigid mounting rail. A protective canopy serves as touch guard for the rotating parts and a collecting pan protects from leaking oil in the event of a failure. The collecting pan is only relevant for mounting position M1. For other mounting positions, the customer must take appropriate measures.

Helical-bevel gear units in type sizes 107 to 187 with 4-pole motors of sizes 200 to 280 (40 to 120 Hp) are available in combination with a swing base.[1)]. The gear units can be used with a solid shaft or as shaft-mounted versions. The mounting rail is equipped with a foot mounting option as standard for use as base plate (output free from overhung loads using elastic coupling). A torque arm is available as option for shaft mounted gear units.

Horizontal mounting positions are standard for the swing base MK. Please contact SEW-EURODRIVE for other mounting positions.

1) The adapter with hydraulic centrifugal coupling is available for motors of size 71 to 180 (0.5 to 30 Hp).

Structure

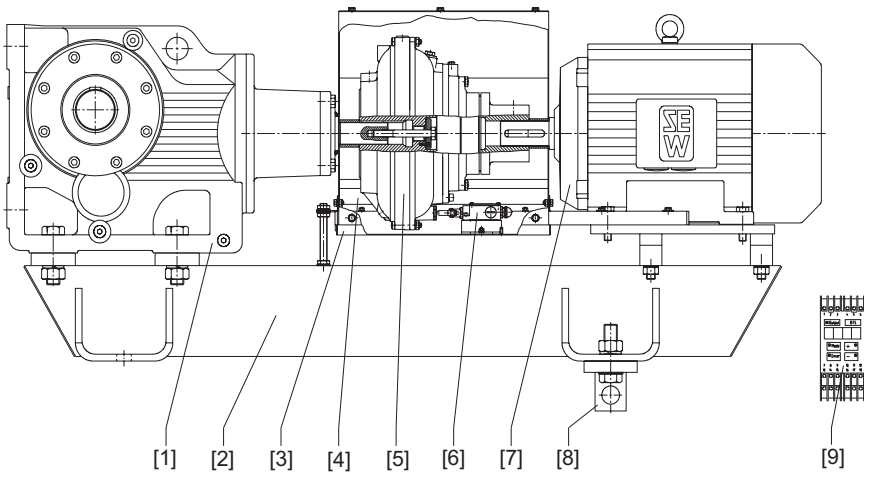

Figure 29: Helical-bevel gear unit on swing base MK

[1] Helical-bevel gear unit
[2] Mounting rail
[3] Oil pan
[4] Protective canopy
[5] Hydraulic centrifugal coupling
[6] Thermal monitoring device (optional design)
[7] Electric motor
[8] Torque arm (optional design)
[9] Speed monitor (optional design, only in conjunction with thermal monitoring BTS)

Select gear unit Please contact SEW-EURODRIVE.

Torque arm /T See dimension sheets "Helical-bevel gear unit on swing base MK" (for shaft-mounted gear units only).

Centrifugal coupling

The centrifugal coupling used is a hydrodynamic coupling that operates according to the Föttinger principle. The coupling is filled with oil and consists of a pump wheel (motor side) and a turbine wheel (gear unit side). The pump wheel converts the input mechanical energy into fluid energy and the turbine wheel converts this energy back into mechanical energy. Furthermore, the centrifugal couplings on the swing base have a deceleration chamber which holds part of the oil volume when the coupling is stationary. The oil is slowly returned to the pump and turbine wheels during the starting phase. This has a positive influence on the starting phase and reduces strain on the drive and the machine.

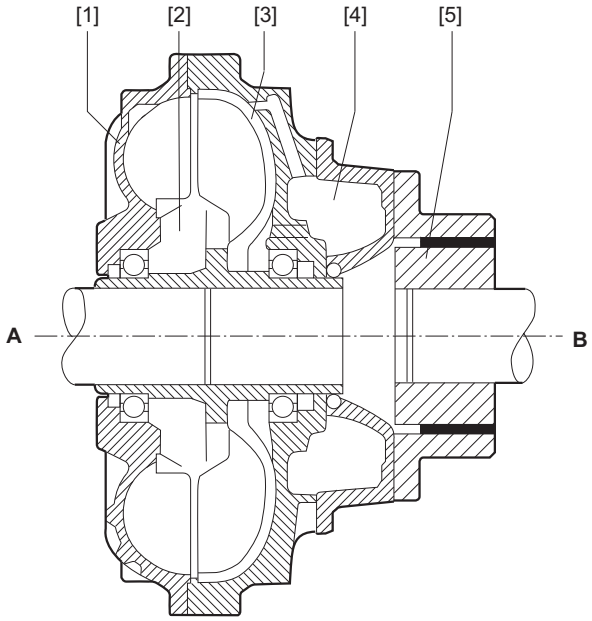

Figure 30: Centrifugal coupling

[1] Pump wheel
[2] Operating fluid (hydraulic oil)
[3] Turbine wheel
[4] Deceleration chamber
[5] Flexible connecting coupling
[A] Gear unit side
[B] Motor side

The hydraulic centrifugal coupling is equipped with fusible safety plugs that allow the operating fluid to be evacuated in the event of excessive temperature (severe overload, blockage). In this way the coupling and system are protected from damage. We recommend you use a thermal monitoring device (MTS or BTS option) to prevent the coupling from loosing oil and protect the environment in the event of an oil leakage.

Mechanical thermal monitoring device /MTS

Using a mechanical thermal monitoring device can prevent the operating fluid from being sprayed into the environment. A switch pin screwed into the coupling releases a spring-loaded switch pin if the temperature reaches an excessive level. This switch pin operates a switch by means of which a warning signal can be output or the machine can be switched off.

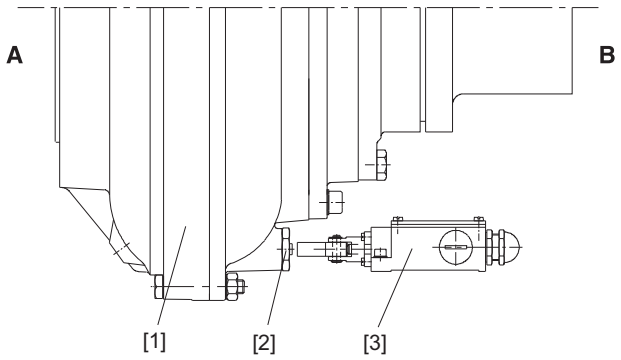

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Figure 31: Mechanical thermal monitoring device /MTS

[1] Hydraulic centrifugal coupling
[2] Switch bolt
[3] Switch
[A] Gear unit side
[B] Motor side

Apart from the monitoring device, the centrifugal coupling is equipped with fusible safety plugs. However, these react considerably later than the monitoring device.

Proximity-type thermal monitoring device /BTS

Using a contactless thermal monitoring device can prevent the operating fluid from being sprayed into the environment. The monitoring device consists of three components: a switch pin, which is screwed into the coupling and that changes its inductance if the temperature reaches an excessive level, a switch which detects that the inductance of the switch bolt has changed, and an evaluation unit (speed monitor), which evaluates the signals from the switch. In turn, a warning signal can be output via the speed monitor or the machine can be switched off.

The switch pin regenerates itself and is ready for use again once the coupling has cooled down.

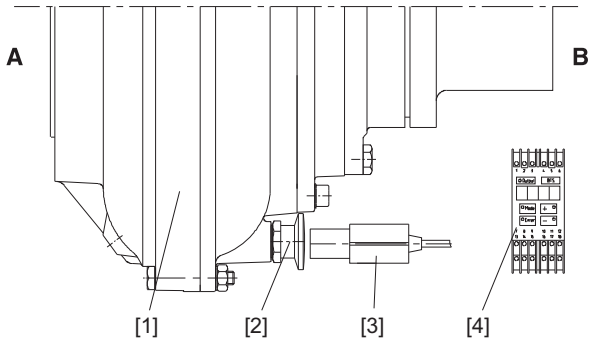

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Figure 32: Proximity-type thermal monitoring device /BTS

[1] Hydraulic centrifugal coupling
[2] Switch bolt
[3] Switch
[4] Speed monitor
[A] Gear unit side
[B] Motor side

6.6 Input shaft assembly AD (→ GK)

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Figure 33: Helical gear unit with AD input shaft assembly

SEW helical, parallel shaft helical, helical-bevel and helical-worm gear units are equipped with an input shaft assembly for drive via an exposed shaft extension. The dimensions of the drive shafts are given in metric units according to IEC standard (dimensions in inch on request). The end of the input shaft has a center bore to DIN 332 for mounting and attaching drive components.

The bearings of the input shaft are grease-lubricated. NBR oil seals and gap rings are used to seal the covers. The solid bearing of the drive shaft allows for high overhung loads.

Selecting the gear unit

Determine the gear unit type

↓

Determine the gear unit size by means of the
- Maximum output torque ($T_{a\ max}$)
- Gear ratio (i)

in the gear unit selection tables with input shaft assembly AD
When selecting AD/P, please observe the selection note on page 82.

↓

Check the maximum permitted overhung load value on the output (F_{Ra}).

↓

Check the maximum permitted input power at the gear unit (P_e) by taking account of the thermal limit rating (see page 83).

↓

Check the overhung load at the input (F_{Re}).

↓

In the case of other requirements (such as higher overhung loads on the input side), please contact SEW-EURODRIVE.

Centering shoulder AD../ZR

The input shaft assembly can be configured with a centering shoulder as an option. In this way, a customer's application can be attached to the cover centrally in relation to the input shaft side.

Backstop AD../RS

The input shaft assembly can be supplied with a backstop if the application only requires one permitted direction of rotation. Backstops with centrifugal lift-off sprags are used. The advantage of this design is that the sprags move around inside the backstop without making contact above a certain speed (lift-off speed). This means backstops operate wear-free, maintenance-free, without losses, and they are suited for high speeds.

Dimensions:

The backstop is completely integrated in the cover. This means there is no difference in dimensions between an input shaft assembly with or without backstop (see dimension sheets in the "Input shaft assembly AD" section).

Locking torques:

Type	Maximum locking torque backstop [lb-in]	Lift-off speed [rpm]
AD2/RS	795	640
AD3/RS	3010	600
AD4/RS	6200	550
AD5/RS	10600	630
AD6/RS	12800	430
AD7/RS	12800	430
AD8/RS	25300	430

Specify output direction of rotation in your order:

When you order a gear unit with input shaft assembly and backstop, it is necessary to indicate the direction of rotation of the output shaft/output side. The direction of rotation is given looking onto the output shaft/output side of the gear unit. For drives with shaft ends at sides A and B, the direction of rotation must be specified as looking onto side A.

Check the direction of rotation of the drive before starting up the system to avoid damage.

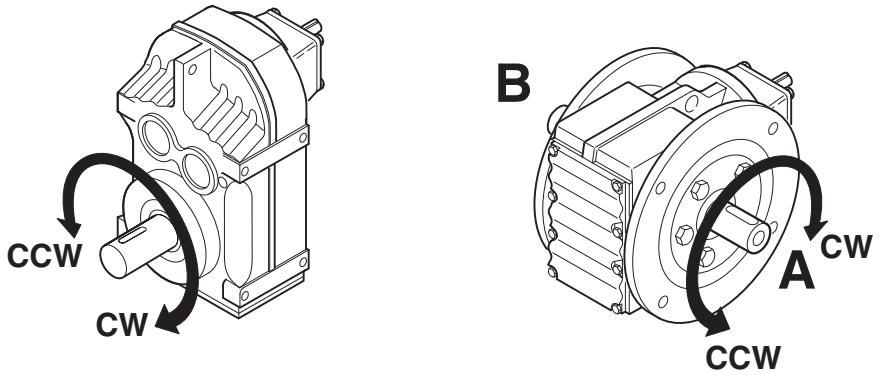

Figure 34: Specify output direction of rotation when ordering

CCW = Counterclockwise rotation

CW = Clockwise rotation

Motor mounting platform AD.. /P

Belt drives are available with adjustable motor mounting platform for space-saving installation. The motor mounting platform is arranged parallel to the drive shaft and is without tapped holes (also available with tapped holes for IEC standard on request). The distance from the input shaft can be adjusted using threaded columns.

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Figure 35: Helical gear unit with input shaft assembly and motor mounting platform AD../P

Thermal limit power for gear units with input shaft assembly

The power values given in the selection tables for gear units with input shaft assemblies are mechanical limit powers. Depending on the mounting position, however, gear units may become thermally overloaded before they reach the mechanical power limit. Relevant cases for mineral oils are identified in the selection tables (see column under the arrow) by giving their mounting position.

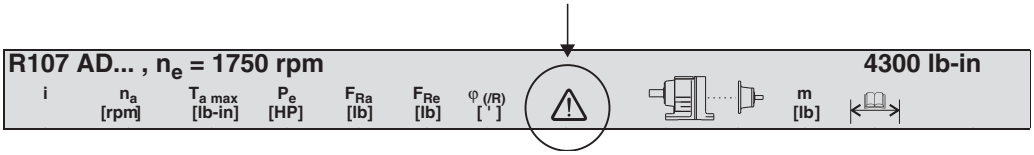

Figure 36: Selection table

If the required mounting position corresponds with an indicated one, please consult SEW. By considering the actual operating conditions, it will then be possible to recalculate the thermal limit rating based on the specific application. Alternatively, suitable measures can be taken (e.g. using a synthetic lubricant with higher thermal stability) to increase the thermal limit rating of the gear unit. The following data are required for recalculation:

Gear unit type			
Output speed [n_a]	..... rpm	**Gear ratio i**	.....
Ambient temperature	..... °F	**Cyclic duration factor cdf**	.....%
Power drawn [P]	..... HP		
Installation site:			
...in small, enclosed rooms			
...in large rooms, halls			
...outdoors			
Installation on site:			
.....			
e.g. base made of steel or concrete			

7 Project Planning for AC Motors

7.1 Possible motor options (→ GM, → MM)

Overview

The following motor options are available in various combinations:

- BM(G)/BR disc brakes (→ page 103)
- IS integrated plug connector (→ page 115)
- Plug connectors AS.., AC.., AM.., AB.., AD.., AK.. (→ page 116)
- Encoders and pre-fabricated cables for encoder connection (→ page 117)
- Encoder mounting adapter (→ page 120)
- Forced cooling fan VR/VS/V (→ page 125)
- Backstop RS (→ page 126)
- Additional flywheel mass Z (flywheel fan) (→ page 126)
- Protection canopy C (→ page 127)
- MOVIMOT® integrated frequency inverter (→ page 128)
- Integrated motor circuit breaker/motor protection MOVI-SWITCH® (→ page 137)
- Smooth pole-changing unit WPU (→ page 141)

Technical data and dimension drawings

The technical data and dimension drawings for the motor options are listed in the catalog "Gearmotors."

7.2 Standards and regulations (→ GM)

Conformance to standards

AC motors and AC brake motors from SEW-EURODRIVE conform to the relevant standards and regulations, in particular:

- IEC 60034-1, EN 60034-1

  Rotating electrical machinery, rating and performance.
- EN 60529

  IP degrees of protection provided by enclosures of electrical equipment.
- IEC 60072

  Dimensions and performance of rotating electrical machinery.
- EN 50262

  Metric threads of cable glands.
- EN 50347

  Standardized dimensions and power ratings.

Rated data

The specific data of an asynchronous AC motor (AC squirrel cage motor) are:

- Size
- Rated power
- Cyclic duration factor
- Rated speed
- Rated current
- Rated voltage
- Power factor cosφ
- Enclosure
- Thermal classification
- Efficiency class

This data is given on the nameplate of the motor. In accordance with IEC 60034 (EN 60034), the nameplate data apply to a maximum ambient temperature of 40 °C (104 °F) and a maximum altitude of 1000 m (3300 ft) above sea level.

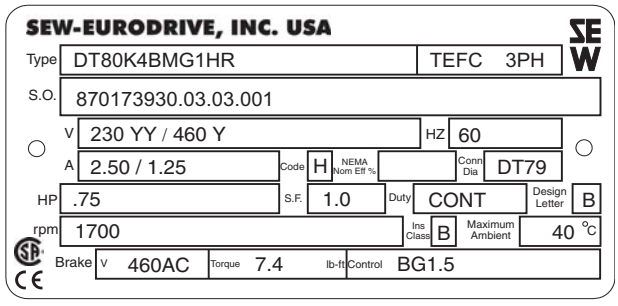

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Figure 37: Motor nameplate

Tolerances

According to IEC 60034 (EN 60034), the following tolerances are permitted for electric motors (also applies to the rated voltage range):

Voltage and frequency		Tolerance A or tolerance B
Efficiency η	$P_N \leq 67$ HP $P_N > 67$ HP	$-0.15 \bullet (1-\eta)$ $-0.1 \bullet (1-\eta)$
Power factor $\cos\varphi$		$-\frac{1 - \cos\varphi}{6}$
Slip	$P_N < 1.3$ HP $P_N \geq 1.3$ HP	±30% ±20%
Starting current		+20%
Tightening torque		-15%...+25%
Breakdown torque		-10%
Mass moment of inertia		±10%

Tolerance A, tolerance B

Tolerances A and B describe the permitted range within which the frequency and voltage are allowed to deviate from their respective rated points. The origin identified with "0" indicates the respective rated points for frequency and voltage.

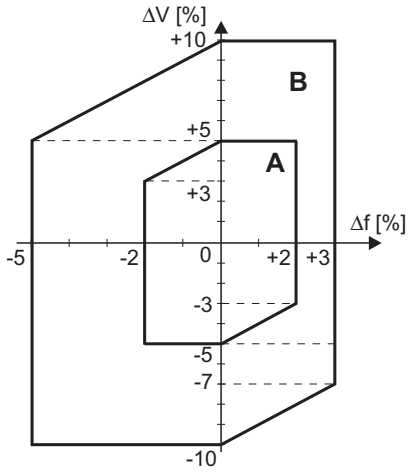


Figure 38: Tolerance ranges A and B

In the tolerance range A, the motor must be able to deliver the rated torque in continuous duty (S1). The other characteristic values and the increase in temperature may deviate slightly from the values for rated voltage and rated frequency.

In the tolerance range B, the motor must be able to deliver the rated torque but not in continuous duty. The increase in temperature and deviations from the rated data are higher than in tolerance range A. Avoid frequent operation of the motor at the limits of tolerance range B.

Undervoltage

It is not possible to achieve the values in the catalog such as power, torque and speed in the event of undervoltage due to weak supply systems or an insufficiently large motor cable. This is applies in particular to the starting up phase of the motor during which the starting current amounts to a multiple of the rated current.

7.3 Circuit breakers and protective equipment

EMC measures

AC motors, AC brake motors and MOVIMOT® drives from SEW-EURODRIVE are components for installation in machinery and systems. The designer of the machine or system is responsible for complying with the EMC Directive 89/336/EEC. Please refer to the publication "Drive Engineering - Practical Implementation, Electromagnetic Compatibility (EMC) in Drive Engineering" for detailed information about this topic. For specific information on MOVIMOT® drives, refer to the "Drive System for Decentralized Installation" system manual.

Line voltage operation, MOVIMOT® drives

SEW-EURODRIVE AC (brake) motors satisfy the EMC generic standards EN 50081 and EN 50082 when used in accordance with their designated use in continuous line voltage operation. Interference suppression measures are not necessary. MOVIMOT® drives also satisfy the EMC generic standards EN 50081 and EN 50082 when operated in accordance with their designated use.

Switching operation

For switching operation of the motor, take suitable measures for suppressing interference from the switchgear.

Inverter operation

Regarding inverter operation, please refer to the installation and EMC instructions provided by the inverter manufacturer. Also note the following points:

Brake motors on the inverter

Install the brake cables of brake motors separately from the other power cables, maintaining a distance of at least 200 mm (7.87 in). Joint installation is only permitted if either the brake cable or the power cable is shielded.

Tachometer connection on the inverter

Observe the following instructions when connecting the tachometer:

- Use a shielded cable with twisted pair conductors only.
- Connect the shield to the PE potential on both ends over a large surface area.
- Install signal cables separately from power cables or brake cables (min. distance or 200 mm or 7.87 in).

Positive temperature coefficient (PTC) thermistor TF connection on the inverter

Install the connecting lead of the positive temperature coefficient (PTC) thermistor TF separately from other power cables, maintaining a distance of at least 200 mm (7.87 in). Collective installation is only permitted if either the TF cable or the power cable is shielded.

Motor protection

Selecting the correct protection device is a significant factor in determining the operational reliability of the motor. We distinguish between protection devices that are current-dependent and those that depend on the motor temperature. Current-dependent protection devices include fuses or motor circuit breakers. Temperature dependent protection devices are PTC thermistors or bimetallic switches (thermostats) in the winding. PTC thermistors or bimetallic switches respond when the maximum permitted winding temperature is reached. Their advantage is that temperatures are measured right where they occur.

Motor circuit breakers

Motor circuit breakers offer adequate protection against overload in standard operation with a low starting frequency, brief start-ups and starting currents that are not excessive. The motor circuit breaker is set to the rated motor current.

Motor circuit breakers are not adequate as the sole means of protection given switching operation with a high starting frequency (> 60 1/h) and for high inertia starting. In these cases, we recommend you use positive temperature coefficient (PTC) thermistors TF in addition.

PTC thermistor

Three positive temperature coefficient (PTC) thermistors **TF** (PTC, characteristic curve according to DIN 44080) are connected in series in the motor and connected from the terminal box to the TF/TH input of the inverter or to a trip switch in the control cabinet. Motor protection with positive temperature coefficient (PTC) thermistors TF provide comprehensive protection against thermal overload. Motors protected in this way can be used for high inertia starting, switching and braking operation as well as with fluctuating mains power supply. A motor circuit breaker is usually installed in addition to the TF. SEW-EURODRIVE recommends always using motors equipped with TF for inverter operation.

Bimetallic switch

Three bimetallic switches **TH**, connected in series in the motor, are looped directly into the motor monitoring circuit from the terminal box.

Fuses

Fuses do not protect the motor from overload. Their only purpose is short-circuit protection.

The following table provides an overview of the various protection devices used for various causes.

○ = no protection ◑ = limited protection ● = comprehensive protection	Current dependent protection device		Temperature dependent protection device	
	Fuse	Protective circuit breaker	PTC thermistor (TF)	Bimetallic switch (TH)
Over-currents up to 200 % I_N	○	●	●	●
High inertia starting, reversal	○	◑	●	◑
Switching operation up to Z = 30 1/h	○	◑	●	●
Stalling	◑	◑	◑	◑
Single phasing	○	◑	●	●
Voltage deviation	○	●	●	●
Frequency deviation	○	●	●	●
Insufficient motor cooling	○	○	●	●

MOVIMOT® protection devices

- MOVIMOT® integrate protective equipment to prevent thermal damage.
- No other external devices are required for motor protection.

Secure switching of inductances

Note the following notes for switching of inductances:

- Switching of low-speed motor windings.

  If the cable is installed unfavorably, switching of low-speed motor windings can generate voltage peaks. Voltage peaks can damage windings and contacts. Install varistors in the incoming cable to avoid such problems.

- Switching of brake coils.

  Varistors must be used to avoid harmful switching overvoltages caused by switching operations in the DC circuit of disk brakes.

  Brake control systems from SEW-EURODRIVE are equipped with varistors as standard. Use contactors with contacts in utilization category AC3 or better to EN 60947-4-1 for switching of brake coils.

- Suppressor circuit on the switching devices.

  According to EN 60204 (Electrical Equipment of Machines), motor windings must be equipped with interference suppression to protect the numerical or programmable logic controllers. Because problems are primarily caused by switching operations, we recommend installing suppressor circuits on the switching devices.

7.4 Electrical characteristics (→ GM, → MM)

Suitability for use with an inverter

AC (brake) motors can be operated on inverters, for example SEW-EURODRIVE MOVIDRIVE®, MOVITRAC® and MOVIMOT®, thanks to the high quality of insulation (including phase separator) with which they are equipped as standard.

The winding option "reinforced insulation" is available for voltages higher than AC 500V. The SEW unit designation for this option is "/RI".

Frequency

SEW-EURODRIVE AC motors are designed for a system frequency of 50 Hz or 60 Hz on request. As standard, the technical data for AC motors refer to a 50 Hz supply frequency.

Motor voltage

AC motors are available for rated voltages from 220 to 690 V. Pole-changing motors in sizes 63 ... 90 are available for rated voltages from 220 ... 500 V only.

Motor sizes 71 to 132S are usually supplied in a version for the voltage range 220 ... 240/380 × 415 V_{AC}, 50 Hz. The jumpers for setting the star or delta connection are supplied with the motor in a bag inside the terminal box. For motor sizes >132S, the standard design is 380 ... 415/660 ... 690 V_{AC}, 50 Hz. The star or delta jumpers are mounted on the terminal board.

For 50 Hz power supply

The **standards voltages** are:

Motors	**Motor size**	
	56 (4-pole only)	**63...90**
	Motor voltage	
2, 4 and 6-pole motors, applies to the voltage range	**220...240 V_{AC} ⅄ 380...415 V_{AC} ⅄**	**220...240/380...415 V_{AC} Δ/⅄**
Single-speed	-	**230/400 V_{AC} Δ/⅄ 290/500 V_{AC} Δ/⅄**
Multi-speed, single winding	-	**400 V_{AC} Δ/⅄⅄**
Multi-speed, separate winding	-	**400 V_{AC} ⅄ / ⅄**
	Brake voltage	
2, 4 and 6-pole motors, applies to the voltage range	**220...240 V_{AC} 380...415 V_{AC}**	**220...240 V_{AC} 380...415 V_{AC}**
Standard voltages	**24 V_{DC} / 230 V_{AC} / 400 V_{AC}**	
	Forced cooling fan voltage	
Standard voltage VR	-	**24 V_{DC} 1)**
Voltage range VS	-	**1 × 220...266 V_{AC} 1) 1 x 115 V**

1) not applicable for motor size

Motors	**Motor size**		
	100...132S	**132M...225**	**225...280**
	Motor voltage		
2, 4 and 6-pole motors, applies to the voltage range	**220...240/ 380...415 V_{AC} Δ/⅄**	**220...240/380...415 V_{AC} Δ/⅄ 380...415/660..0.690 V_{AC} Δ/⅄**	
Single-speed	**230/400 V_{AC} Δ/⅄ 290/500 V_{AC} Δ/⅄ 400/690 V_{AC} Δ/⅄ 500 V_{AC} Δ**		
Multi-speed, single winding	**400 V_{AC} Δ/⅄⅄**		
Multi-speed, separate winding	**400 V_{AC} ⅄ / ⅄**		
	Brake voltage		
2, 4 and 6-pole motors, applies to the voltage range	**220..0.240 V_{AC} 380...415 V_{AC}**		
Standard voltages	**24 V_{DC} / 230 V_{AC} / 400 V_{AC}**		
	Forced cooling fan voltage		
Standard voltage VR	**24 V_{DC}**	-	-
Voltage range VS	**1 × 220...266 V_{AC} 1 x 115 V**	-	-

Motors	Motor size		
	100...132S	132M...225	225...280
Voltage range V	-	**3 × 380...415 V_{AC}** **3 x 230 V_{AC}** **3 x 460 V_{AC}**	**3 × 346...500 V_{AC}**

Motors and brakes for 230/400 V_{AC} and motors for 690 V_{AC} may also be operated on supply systems with a rated voltage of 220/380 V_{AC} or 660 V_{AC} respectively. The voltage dependent data will slightly change in this case.

Standard connections 50 Hz motors

No. of poles	Synchronous speed n_{syn} at 50 Hz [1/min]	Connection
2	3000	Y / Δ
4	1500	Y ; YY / Δ
6	1000	Y / Δ
8	750	Y / Δ
8/4	750/1500	Δ/YY Dahlander
8/2	750/3000	Y / YY separate winding

50 Hz motor on 60 Hz supply system

The rated data of motors designed for 50 Hz supply systems are slightly different when the motors are operated on 60 Hz supply systems.

Motor voltage at 50 Hz	Motor connection	U [V] at 60 Hz	Changed rated data			
			n_N	P_N	M_N	M_A/M_N
230/400 V_{AC} Δ/Y	Δ	230	+20%	0%	-17%	-17%
230/400 V_{AC} Δ/Y	Y	460	+20%	+20%	0%	0%
400/690 V_{AC} Δ/Y	Δ					

For 60 Hz power supply

The **standard voltages** are indicated in **bold**:

Motors	Motor size		
	56	63	71...90
	Motor voltage		
2, 4 and 6-pole motors, applies to the voltage range	240..0.266 **V_{AC}** Y 415..0.460 **V_{AC}** Y	240...266/415..0.460 **V_{AC}** Δ/Y	
Single-speed	-	266/460 **V_{AC}** Δ/Y 220/380 V_{AC} Δ/Y 330/575 V_{AC} Δ/Y **230/460 V_{AC}** YY/Y	266/460 **V_{AC}** Δ/Y 220/380 V_{AC} Δ/Y 330/575 V_{AC} Δ/Y 200/400 V_{AC} YY/Y 220/440 V_{AC} YY/Y **230/460 V_{AC}** YY/Y
Multi-speed, single winding	-	460 V_{AC} Δ/YY	
Multi-speed, separate winding	-	-	460 V_{AC} Y / Y
	Brake voltage		
2, 4 and 6-pole motors, applies to the voltage range	240..0.266 V_{AC} 415..0.460 **V_{AC}**	240..0.266 V_{AC} 415..0.460 V_{AC}	
Standard voltages	24 V_{DC} / 230 V_{AC} / 266 V_{AC} / 460 V_{AC}		
	Forced cooling fan voltage		
Standard voltage VR	-	-	**24 V_{DC}**
Voltage range VS	-	-	**1 × 220..0.266 V_{AC}** [1)] **1 x 115 V**

Motors	Motor size		
	100...132S	132M...225	250...280
	Motor voltage		
2, 4 and 6-pole motors, applies to the voltage range	**240...266/ 415..0.460 V_{AC} Δ/人**	**240...266/415..0.460 V_{AC} Δ/人 415..0.460 V_{AC} Δ**	
Single-speed	266/460 V_{AC} Δ/人 220/380 V_{AC} Δ/人 330/575 V_{AC} Δ/人 200/400 V_{AC} 人人/人 220/440 V_{AC} 人人/人 **230/460 V_{AC}** 人人/人		
Multi-speed, single winding	460 V_{AC} Δ/人人		
Multi-speed, separate winding	460 V_{AC} 人 / 人		
	Brake voltage		
2, 4 and 6-pole motors, applies to the voltage range	240..0.266 V_{AC} 415..0.460 V_{AC}		
Standard voltages	24 V_{DC} / 230 V_{AC} / 266 V_{AC} / 460 V_{AC}		
	Forced cooling fan voltage		
Standard voltage VR	24 V_{DC}	-	-
Voltage range VS	**1 × 220..0.266 V_{AC}** **1 x 115 V**	-	-
Voltage range V	-	**3 × 380...415 V_{AC}** **3 x 230 V_{AC}** **3 x 460 V_{AC}**	**3 × 346...500 V_{AC}**

Standard connections 60 Hz motors

No. of poles	Synchronous speed n_{syn} at 60 Hz [1/min]	Connection
2	3600	Δ/人; 人人 / 人
4	1800	Δ/人; 人人 / 人
6	1200	Δ/人; 人人 / 人
8/4	900/1800	Δ/人人 single winding
8/2	900/3600	人 / 人 separate winding

60 Hz motor on 50 Hz supply system

The rated data of motors designed for 60 Hz supply systems are slightly different when these motors are operated on 50 Hz supply systems.

Example: NEMA C-motor, designed for the USA, operation on a 50 Hz supply system:

Motor voltage at 60 Hz (USA)	Motor connection	U [V] at 50 Hz	Changed rated data			
			n_N	P_N	M_N	M_A/M_N
230/460 V_{AC} 人人 / 人	人	400	-17%	-17%	0%	0%

Motors for USA and Canada

Motors for USA and Canada are designed according to NEMA or CSA regulations. Single-speed motors in NEMA or CSA design are registered with Underwriters Laboratories (UL). The following voltage assignments (60 Hz) are customary in the USA and Canada:

	Rated voltage of the supply power	Rated voltage of the motor
USA	208 V	200 V
	240 V	230 V
	480 V	460 V
Canada	600 V	575 V

The motor voltage may deviate up to ±10 % from the rated voltage. This deviation corresponds to tolerance B (→ page 86).

In the USA, 230/460 V_{AC} / 60 Hz motors are usually used

7.5 Thermal characteristics (→ GM, → MM)

Thermal classes according to IEC 60034-1 (EN 60034-1)

AC motors, AC brake motors and MOVIMOT® drives are available in the following thermal classes:

- The standard design for all single-speed AC motors/AC brake motors and Dahlander motors is thermal class B. Thermal classes F or H are available on request.
- The standard design for all multi-speed AC motors/AC brake motors with separate winding is thermal class F. Thermal class H is available on request.
- Standard design for all MOVIMOT® drives is thermal class F. Other thermal classes are not possible for MOVIMOT® drives.

The table below lists the overtemperatures to IEC 60034-1 (EN 60034-1).

Thermal class		Overtemperature limit [K]
Old	New	
B	**130** °C	80 K
F	**155** °C	105 K
H	**180** °C	125 K

Power reduction

The rated power P_N of a motor depends on the ambient temperature and the altitude. The rated power stated on the nameplate applies to an ambient temperature of 40 °C (104 °F) and a maximum altitude of 1,000 m (3300 ft) above sea level. The rated power must be reduced according to the following formula in the case of higher ambient temperatures or altitudes:

$$P_{Nred} = P_N \bullet f_T \bullet f_H$$

AC motors

For AC motors, the factors f_T and f_H are listed in the following diagram:

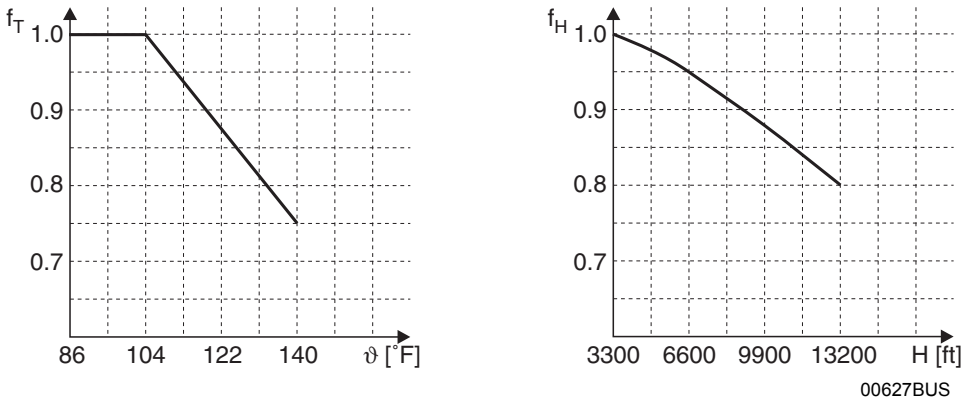


Figure 39: Power reduction dependent on ambient temperature and altitude

ϑ = Ambient temperature
H = Altitude above sea level

MOVIMOT® drives

For MOVIMOT® drives, the factors f_T und f_H are given in the following diagrams:

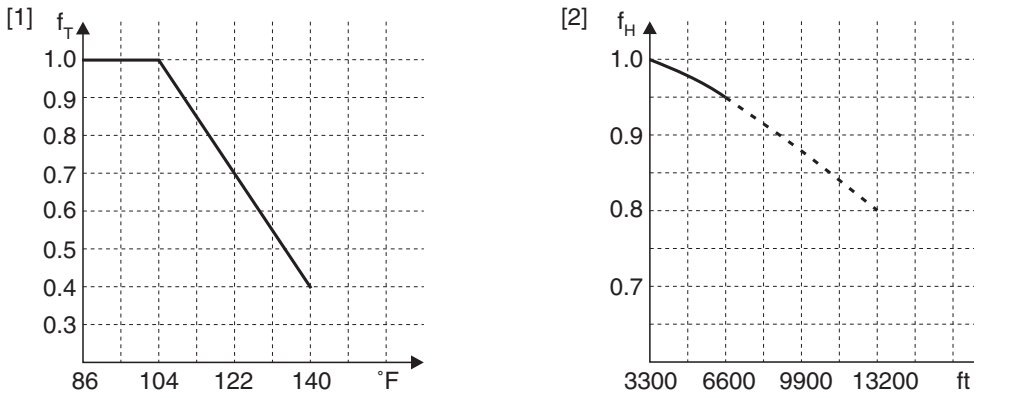


Figure 40: Power reduction dependent on ambient temperature and altitude

[1] Ambient temperature
[2] Altitude above sea level **(Altitudes of more than 6600 ft subject to limitations. Observe the installation notes in the "MOVIMOT® MM03C"MM03C-MM3XC** operating instructions.

Duty types

The following duty types are defined in IEC 60034-1 (EN 60034-1):

Duty type	Explanation
S1	**Continuous duty:** Operation at a constant load; the motor reaches thermal equilibrium.
S2	**Short-time duty:** Operation at constant load for a given time followed by a time at rest. The motor returns to ambient temperature during the rest period.
S3	**Intermittent periodic duty:** The starting current does not significantly affect the temperature rise. Characterized by a sequence of identical duty cycles, each including a time of operation at constant load and a time at rest. Described by the "cyclic duration factor (cdf)" in %.
S4...S10	**Intermittent periodic duty:** The starting current affecting the temperature rise. Characterized by a sequence of identical duty cycles, each including a time of operation at constant load and a time at rest. Described by the "cyclic duration factor (cdf)" in % and the number of cycles per hour.

For inverter operation, S1 continuous duty is usually assumed. For a great number of cycles per hour, it may be necessary to assume S9 intermittent periodic duty.

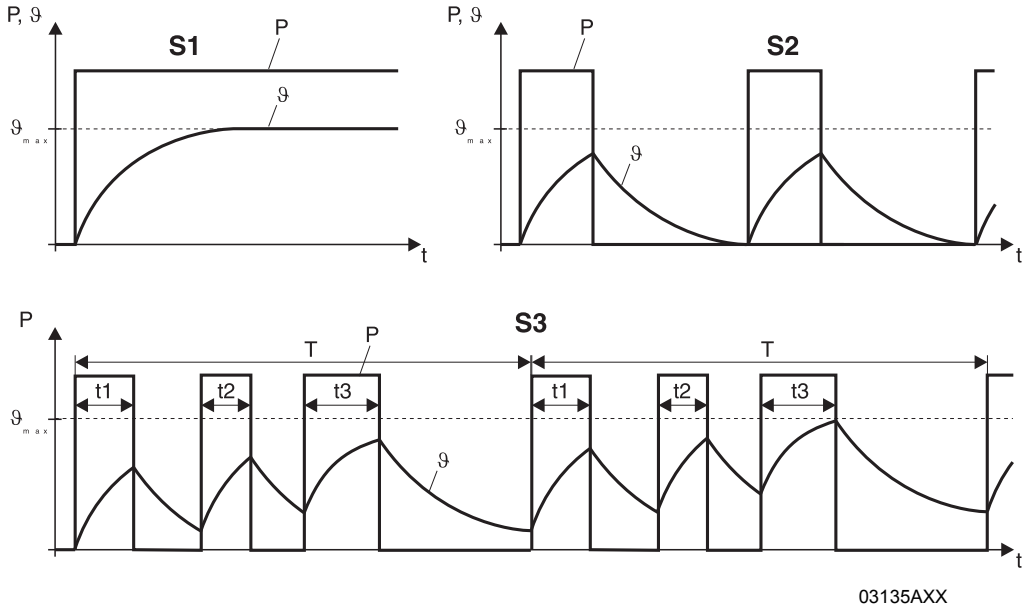


Figure 41: Duty types S1, S2 and S3

Cyclic duration factor (cdf)

The cyclic duration factor (cdf) is the ratio between the period of loading and the duration of the duty cycle. The duration of the duty cycle is the sum of times of operation and times at rest and de-energized. A typical value for the duration of the duty cycle is ten minutes.

$$\text{cdf} = \frac{\text{total on-times (t1 + t2 + t3)}}{\text{cycle duration (T)}} \bullet 100\ [\%]$$

Power increasing factor K

Unless specified otherwise, the rated power of the motor refers to duty type S1 (100 % cdf) according to IEC 60034 (EN 60034). If a motor designed for S1 and 100 % cdf is operated in mode S2 "short-time duty" or S3 "intermittent periodic duty", the rated power can be multiplied by the power increasing factor K specified on the nameplate.

Duty type			Power increasing factor K
S2	Period of operation	60 min 30 min 10 min	1.1 1.2 1.4
S3	Cyclic duration factor (cdf)	60% 40% 25% 15%	1.1 1.15 1.3 1.4
S4...S10	The following information must be specified to determine the rated power and the duty type: number and type of cycles per hour, starting time, time at load, braking type, braking time, idle time, cycle duration, period at rest and power demand.		On request

In the case of extremely high counter torques and high mass moments of inertia (high inertia starting), please contact SEW-EURODRIVE and provide the exact technical data.

7.6 Starting frequency (→ GM, → MM)

A motor is usually rated according to its thermal loading. In many applications the motor is started only once (S1 = continuous running duty = 100 % cdf). The power demand calculated from the load torque of the driven machine is the same as the rated motor power.

High starting frequency

Many applications call for a high starting frequency at low counter-torque, such as in travel drives. In this case, it is not the power demand that is the decisive factor in determining the size of the motor, but rather the number of times the motor has to start up. Frequent starting means the high starting current flows every time, leading to disproportionate heating of the motor. The windings become overheated if the heat absorbed is greater than the heat dissipated by the motor ventilation system. The thermal load capacity of the motor can be increased by selecting a suitable thermal classification or by means of forced cooling (→ Sec. "Thermal characteristics" on page 93).

No-load starting frequency Z_0

SEW-EURODRIVE specifies the permitted starting frequency of a motor as the no-load starting frequency Z_0 at 50 % cdf. This value indicates the number of times per hour that the motor can accelerate the mass moment of inertia of its rotor up to speed without counter-torque at 50 % cdf. If an additional mass moment of inertia has to be accelerated or if an additional load torque occurs, the starting time of the motor will increase. Increased current flows during this acceleration time. This means the motor is subjected to increased thermal load and the permitted starting frequency is reduced.

Permitted starting frequency of the motor

You can determine the permitted starting frequency Z of the motor in cycles/hour [1/h] using the following formula:

$$\mathbf{Z = Z_0 \bullet K_J \bullet K_M \bullet K_P}$$

You can determine the factors K_J, K_M and K_P using the following diagrams:

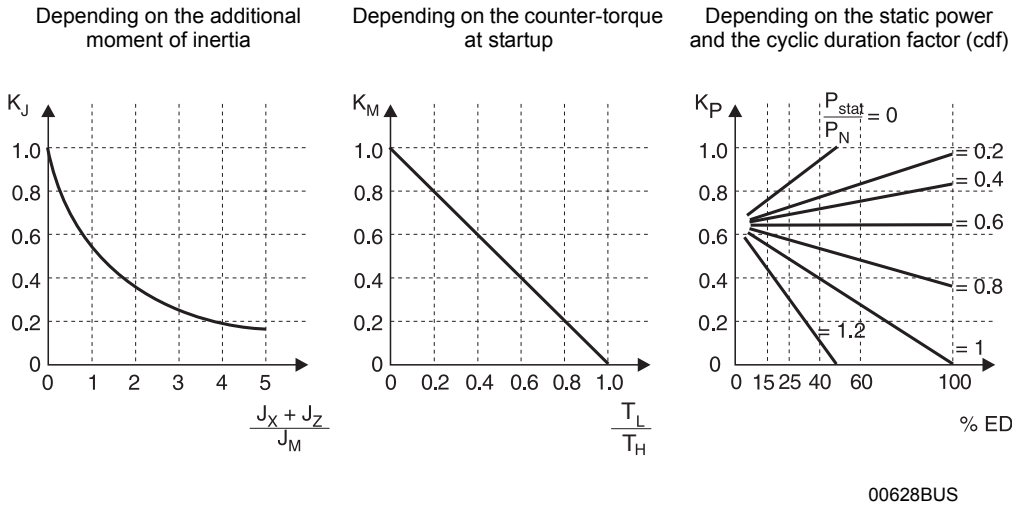


Figure 42: Dependency of the starting frequency

J_X	=	Total of all external mass moments of inertia in relation to the motor axis	T_H	=	Acceleration torque motor
J_Z	=	Mass moment of inertia flywheel fan	P_{stat}	=	Power requirement after start-up (static power)
J_M	=	Mass moment of inertia of the motor	P_N	=	Rated motor power
T_L	=	Load-torque during startup	%cdf	=	cyclic duration factor

Example

Motor: DT80N4/BMG (→ Sec. "Technical data of AC motors")
No-load starting frequency Z_0 = 14000 1/h

1. $(J_X + J_Z) / J_M = 3.5$ → $K_J = 0.2$
2. $T_L / T_H = 0.6$ → $K_M = 0.4$
3. $P_{stat} / P_N = 0.6$ and 60% cdf → $K_P = 0.65$

$Z = Z_0 \bullet K_J \bullet K_M \bullet K_P = 14000$ c/h $\bullet$ 0.2 $\bullet$ 0.4 $\bullet$ 0.65 = 728 c/h

The cycle duration is 5 s, the operating time 3 s.

Permitted work done by the brake

If you are using a brake motor, you have to check whether the brake is approved for use with the required starting frequency Z. Refer to the information in Sec. "Permitted work done by the brake" on page 105.

7.7 Mechanical characteristics (→ GM, → MM)

Degrees of protection according to EN 60034 (IEC 60034-5)

The standard degree of protection for AC motors, AC brake motors and MOVIMOT® drives is IP54. Enclosures IP55, IP56, IP65 or IP66 are available upon request.

IP	1st digit		2nd digit
	Touch guard	Protection against foreign objects	Protection against water
0	No protection	No protection	No protection
1	Protected against access to hazardous parts with the back of your hand	Protection against solid foreign objects ∅50 mm and larger	Protection against dripping water
2	Protected against access to hazardous parts with a finger	Protection against solid foreign objects ∅12 mm and larger	Protection against dripping water when tilted up to 15°
3	Protected against access to hazardous parts with a tool	Protection against solid foreign objects ∅2.5 mm and larger	Protection against spraying water
4	Protected against access to hazardous parts with a wire	Protection against solid foreign objects ∅1 mm and larger	Protection against splashing water
5		Protection against dust	Protection against water jets
6		Dust-proof	Protection against powerful water jets
7	-	-	Protection against temporary immersion in water
8	-	-	Protection against permanent immersion in water

Other options

Increased corrosion protection for metal parts and additional impregnation of the winding (protection against moisture and acid) is available as is the supply of explosion-proof motors and brake motors with EExe enclosure (increased safety), EExed (increased safety motor, flameproof brake) and EExd (flameproof). Refer to the information in in Sec. "Product Description and Overview of Types/General information" in this regard. Contact SEW-EURODRIVE for availability.

Vibration properties of motors

The rotors of AC motors are dynamically balanced with a half key. Motors according to vibration severity grade "N" according to DIN ISO 2373 (EN60034-14:1997) or vibration grade "A" according to IEC 60034-14:2003. In the case of specific requirements on the mechanical running smoothness, single-speed motors without brake, forced cooling fan, encoder, etc. are available in low-vibration design vibration class "R" according to DIN ISO 2373 or vibration grade "B" according to IEC 60034-14:2003.

7.8 Overhung loads (→ GM, → MM)

Refer to the section "Project Planning for Gear Units"Overhung loads and axial forces/ for general information about overhung loads. The following table lists the permitted overhung loads (top value) and axial forces (bottom value) of AC motors:

Mounting position	[rpm] No. of poles	Permitted overhung load F_R [lb] Permitted axial load F_A [lb]; $F_{A\_tension} = F_{A\_pressure}$ Size													
		63	71	80	90	100	112	132S	132ML 132M	160M	160L	180	200	225	250 280
Foot mounted motor	900 8	- -	156 45	205 54	790 72	380 90	395 108	425 126	585 144	810 215	850 215	1260 1290	1350 450	- -	- -
	1200 6	- -	144 36	189 45	270 54	340 72	360 90	395 108	540 126	740 180	765 180	1120 250	1240 425	- -	1800 560
	1800 4	- -	126 27	162 36	235 47	290 61	315 61	335 61	450 90	585 144	695 144	1010 210	1060 540	1570 540	1800 560
	3600 2	- -	90 18	117 22	162 33	215 43	220 45	245 47	325 72	450 108	515 108	775 180	830 415	- -	- -
Flange-mounted motor	900 8	- -	191 56	260 67	3600 90	470 112	495 135	540 157	7220 180	1030 270	1080 270	1570 360	1690 560	- -	- -
	1200 6	135 34	180 45	235 56	335 67	425 90	450 112	495 135	650 157	920 225	970 2250	1420 315	1530 540	- -	2470 675
	1800 4	112 25	157 31	200 45	290 56	370 79	395 79	425 79	560 112	720 180	880 180	1260 270	1330 675	1960 675	2020 585
	3600 2	90 16	112 22	146 29	200 40	270 54	270 56	290 58	405 90	560 135	650 135	970 225	1030 515	- -	- -

Overhung load conversion for off-center force application

The permitted overhung loads must be calculated using the following formulae in the event that force is not applied at the center of the shaft end. The smaller of the two values F_{xL} (according to bearing service life) and F_{xW} (according to shaft strength) is the permitted value for the overhung load at point x. Note that the calculations apply to M_N.

F_{xL} based on bearing life

$$F_{xL} = F_R \bullet \frac{a}{b + x} \text{ [lb]}$$

F_{xW} from the shaft strength

$$F_{xW} = \frac{c \bullet 10^3}{f + x} \text{ [lb]}$$

F_R = Permitted overhung load (x = l/2) [lb]

x = Distance from the shaft shoulder to the force application point [in]

a, b, f = Motor constant for overhung load conversion [in]

c = Motor constant for overhung load conversion [in]

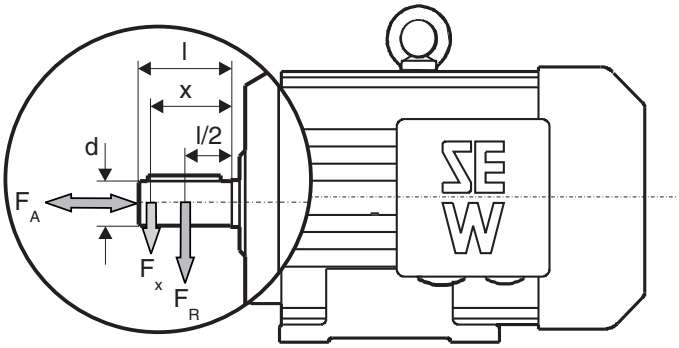


Figure 43: Overhung load FX for off-center force application

Motor constants for overhung load conversion

Size	a	b	c				f	d	l
	[in]	[in]	2-pole [lb-in]	4-pole [lb-in]	6-pole [lb-in]	8-pole [lb-in]	[in]	[mm]	[in]
63	6.34	5.75	0.10	0.15	0.17	-	0.51	14	1.18
71	6.24	5.66	0.10	0.14	0.16	0.17	0.54	14	1.18
80	8.42	7.63	0.15	0.21	0.25	0.27	0.54	19	1.57
90	8.97	7.98	0.24	0.35	0.40	0.43	0.52	24	1.97
SDT100	10.66	9.48	0.37	0.51	0.59	0.66	0.56	28	2.36
DV100	10.66	9.48	0.37	0.51	0.59	0.66	0.56	28	2.36
112M	11.29	10.11	0.47	0.67	0.77	0.84	0.95	28	2.36
132S	13.46	11.88	0.62	0.85	0.99	1.08	0.95	38	3.15
132M	13.56	11.99	0.77	1.06	1.27	1.38	0.79	38	3.15
132ML	15.93	14.35	1.06	1.38	1.75	1.92	0.79	38	3.15
160M	16.52	14.35	1.33	1.73	2.19	2.39	0.79	42	4.33
160L	17.15	14.98	1.57	2.12	2.32	2.59	0.87	42	4.33
180	19.98	17.81	2.35	3.07	3.42	3.82	0.87	48	4.33
200	21.16	19.00	1.80	2.29	2.68	2.92	0	55	4.33
225	24.67	21.91	-	4.34	-	-	0	60	5.51
250	25.91	23.15	-	5.58	-	-	0	65	5.51
280	25.91	23.15	-	5.58	-	-	0	75	5.51

2nd motor shaft

Contact SEW-EURODRIVE regarding permitted load for 2nd motor shaft end.

Motor bearings used

The following table shows which bearings are used in SEW-EURODRIVE AC (brake) motors:

Motor type	Drive-end bearing			Non drive-end bearing	
	Flange-mounted motor	Gearmotor	Foot mounted motor	without brake	with brake
56	-	6302-Z	-	6001-2RS-J	
63	6203-2Z-J	6303-2Z-J	-	6202-2Z-J	6202-2RS-J-C3
71 ... 80	6204-2RS-J-C3	6303-2RS-J-C3	6204-2RS-J-C3	6203-2RS-J-C3	6203-2RS-J-C3
90 ... 100	6306-2RS-J-C3			6205-2RS-J-C3	6205-2RS-J-C3
112 ... 132S	6208-2RS-J-C3	6307-2RS-J-C3	6208-2RS-J-C3	6207-2RS-J-C3	6207-2RS-J-C3
132M ... 160M	6309-2Z-J-C3			6209-2Z-J-C3	
160L ... 180L	63122Z-J-C3			6213-2Z-J-C3	
200 ... 225	6314-2Z-J-C3			6314-2Z-J-C3	
250 ... 280	6316-2Z-J-C3			6315-2Z-J-C3	

7.9 US market (→ GM, → MM)

CSA/NEMA/UL-R

SEW-EURODRIVE offers the NEMA MG1 version or the "CSA/UL-R" option for drives delivered to North America (→ " Motors for the USA and Canada" on page 92). These versions have the following characteristic features:

- Terminal designation T1, T2, etc. in addition to U1, V1, etc.
- In MOVIMOT® drives additional earth terminal via an external terminal.
- Some terminal boxes are made of gray-cast iron and others of aluminum:

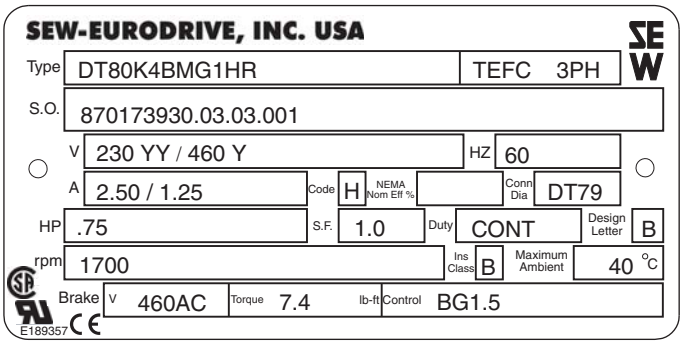
Motor size	Terminal box material
DT56/DR63	Aluminum (part of the motor housing)
DT71 ... DV132S	Gray-cast iron for wiring diagram DT79, otherwise aluminum
DT71 ... DV132S / BM(G) with BSR/BUR	Gray-cast iron
DV132M ... DV280	Always gray cast iron

- Cable entry in the terminal box compliant with ANSI / ASME B1.20.1.-1983 with NPT threads (conical inch threads). The following table shows the number of cable entries and NPT sizes for the respective motor sizes.

Motor size	Number and type of threads
DT56	1 × 1/2'' NPT + 1 × 3/8'' NPT (with adapter)
DR63	2 × 1/2'' NPT (with adapter)
DT71 ... DT90	2 × 1/2'' NPT
DT100 ... DV132S	1 × 3/4'' NPT + 1 × 1/2'' NPT
DV132M ... DV160M	1 × 1 1/4'' NPT + 1 × 1/2'' NPT
DV160L ... DV225	2 × 1 1/2'' NPT + 1 × 1/2'' NPT
DV250M ... DV280S	2 × 2 1/2'' NPT + 2 × 1/2'' NPT

The NPT openings are sealed with plugs for transportation and storage.

- For AC motors/AC brake motors modified nameplate with the following information: TEFC, K.V.A. code and design. With CSA/UL-R option also CSA and UR mark (UL registration no. E189357).



59773AUS

Figure 44: Motor nameplate for the CSA/UL-R version

- For MOVIMOT® drives modified nameplate with the following information: TEFC, UL identification character (UL registration no. 2D06).

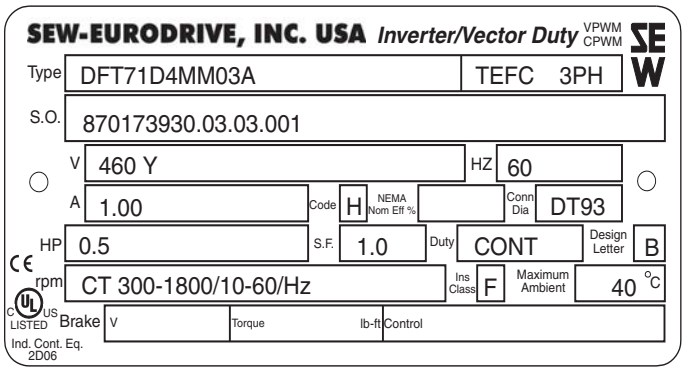


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Figure 45: Motor nameplate

7.10 Brakes (→ GM)

General

On request, SEW-EURODRIVE motors and gearmotors can be supplied with an integrated mechanical brake. The brake is a DC-operated electromagnetic disc brake that is released electrically and applied using spring force. The brake is applied in case of a power failure. It meets the basic safety requirements. The brake can also be released mechanically if equipped with a manual brake release. You will receive a manual lever with automatic reset. The brake is controlled by a control module that is either installed in the motor conduit box or the control cabinet. For detailed information on brakes from SEW-EURODRIVE, refer to the publication "Drive Engineering - Practical Implementation – SEW Disc Brake."

A main advantage of brakes from SEW-EURODRIVE is their very short length. The brake bearing end shield is an integral part of both the motor and the brake. The integrated construction of the brake motor permits particularly compact and sturdy solutions.

Basic structure

The illustration below shows the basic structure of the brake.

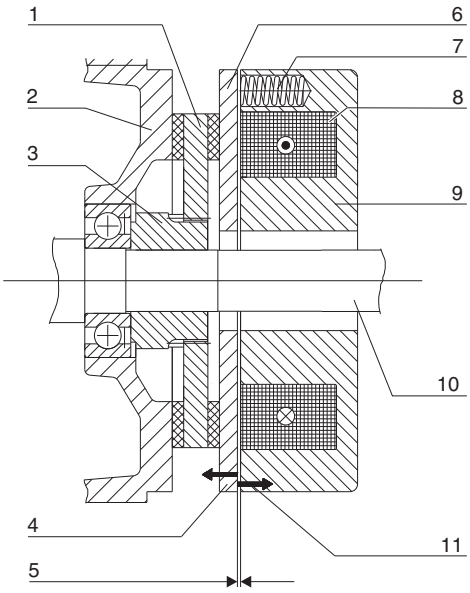

Figure 46: Basic structure of the brake

1	Brake disc	5	Working air gap	9	Brake coil body
2	Brake endshield	6	Pressure plate	10	Motor shaft
3	Driver	7	of brake spring	11	Electromagnetic force
4	Spring force	8	Brake coil		

Short response times

A primary feature of the brake is the patented two-coil system. This system consists of the accelerator coil (BS) and the holding coil (TS). The special SEW-EURODRIVE brake control system ensures that, when the brake is released, the accelerator coil is switched on first with a high current inrush, after which the holding coil is switched on. The result is a particularly short response time when releasing the brake.

The principle of the two coil system also reduces back EMF so that the brake is applied more rapidly. The result is a reduced stopping distance. The brake can be switched off in the DC and AC circuit to achieve particularly short response times when applying the brake, for example in hoists.

Permitted work done by the brake

If you are using a brake motor, you have to check whether the brake is approved for use with the required starting frequency Z. The following diagrams show the permitted work done W_{max} per cycle for different brakes and rated speeds. The values are given with reference to the required starting frequency Z in cycles/hour (1/h).

Example: The rated speed is 1800 rpm and the brake BM 32 is used. At 200 cycles per hour, the permitted work done per cycle is 9000 J (→ Figure 48).

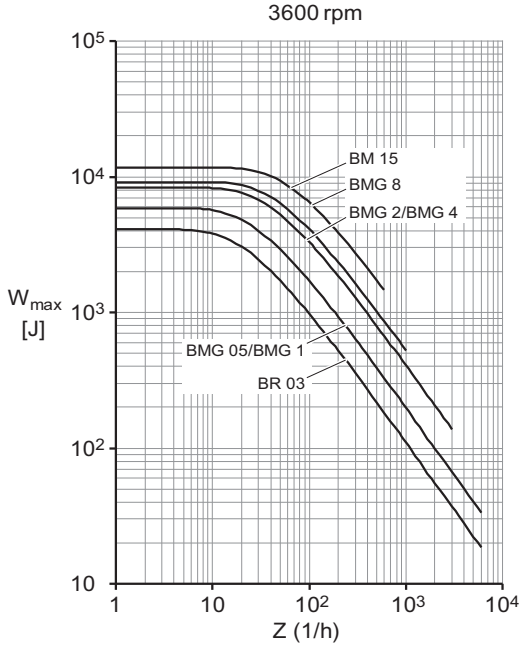

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Figure 47: Maximum permitted work done per cycle at 3600 rpm

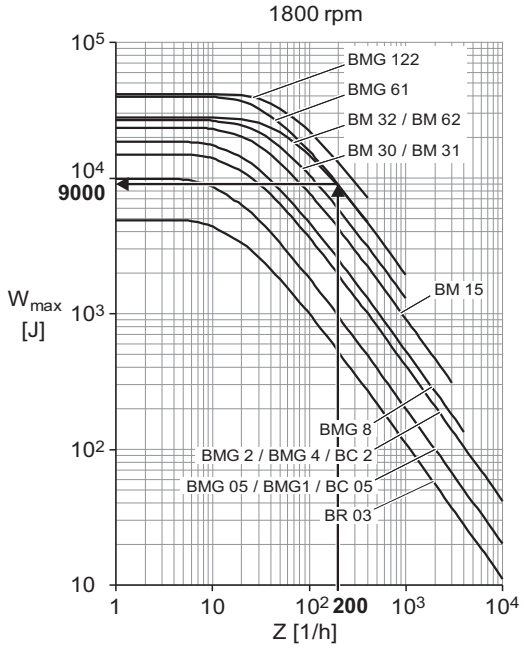

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Figure 48: Maximum permitted work done per cycle at 1800 rpm

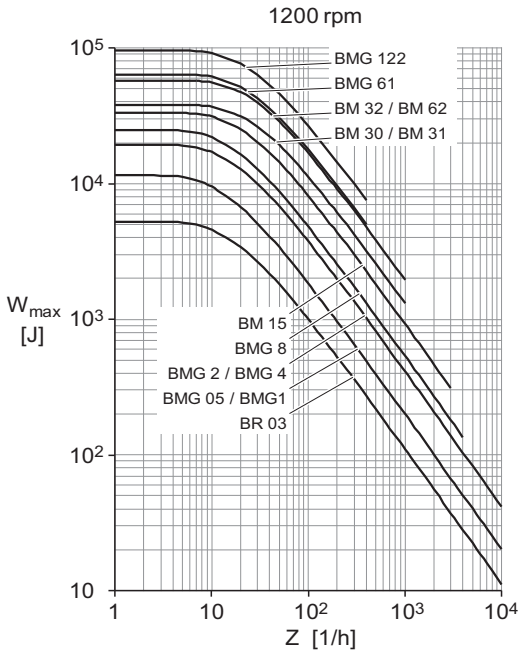


Figure 49: Maximum permitted work done per cycle at 1200 rpm

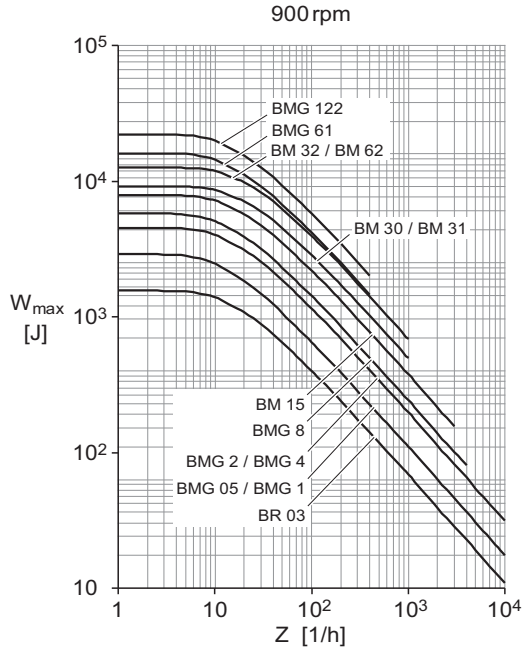


Figure 50: Maximum permitted work done per cycle at 900 rpm

Emergency stop features

In hoist applications it is mandatory that the limits of the permitted maximum work done (maximum work done see diagrams on page 105) are not exceeded even in the event of an emergency stop. In other applications, such as travel drives with reduced braking torques, much higher values can be permitted based on the type of application. Please consult SEW-EURODRIVE if you need values for increased brake work for emergency stops.

Brake control system

Various brake control systems are available for controlling disc brakes with a DC coil, depending on the requirements and the operating conditions. All brake control systems are fitted as standard with varistors to protect against overvoltage. Refer to the "Brakes and Accessories" manual for detailed information about SEW-EURODRIVE brakes.

The brake control systems are either installed directly in the motor conduit box or in the control cabinet. In case of motors of thermal class H and explosion-proof motors (eDT..BC), the control system must be installed in the control cabinet.

Standard version

As standard, DT/DV...BM(G) AC brake motors are delivered with integrated brake control system BG/BGE for AC connection or an installed control unit BS/BSG for DC 24 V connection. The motors are delivered completely ready for connection.

Motor type	AC connection	DC 24 V connection
DT56./BMG02, DR63../BR	BG	without control unit[1)]
DT71../BMG - DV100../BMG	BG	BS
DV112../BMG - DV225../BM	BGE	BSG
DV250../BMG - DV280../BMG	BGE	-

1) The overvoltage protection must be implemented by the customer, for example using varistors.

Brake control system in the motor conduit box

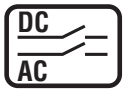
The supply voltage for brakes with an AC connection is either supplied separately or tapped from the supply system to the motor in the conduit box. Only motors with a single speed can be supplied from the motor supply voltage. With pole-changing motors and for operation on an inverter, the supply voltage for the brake must be supplied separately.

It is important to take into consideration the brake reaction is delayed by the residual voltage of the motor in case the brake is powered by the motor supply voltage. The brake reaction time t_2I stated in the technical data for cut-off in the AC circuit applies to a separate supply only.

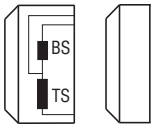
7.11 Block diagrams of brake control systems (→ GM)

Key

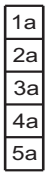
Cut-off in the AC circuit
(standard brake application)



Cut-off in the DC and AC circuits
(rapid brake application)



Brake
BS = Accelerator coil
TS = Coil section



Auxiliary terminal strip in terminal box

Motor with delta connection

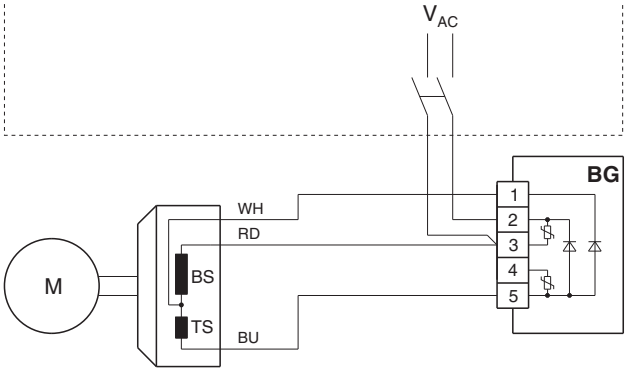
Motor with star connection

Color coding according to IEC 757:

WH	White
RD	Red
BU	Blue
BN	Brown
BK	Black

Control cabinet limit

BG, BMS



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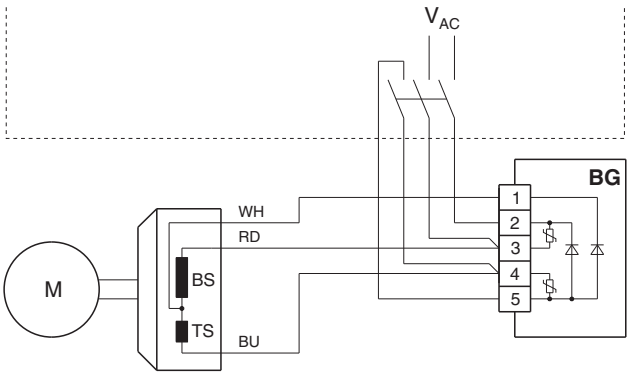
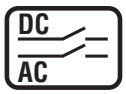
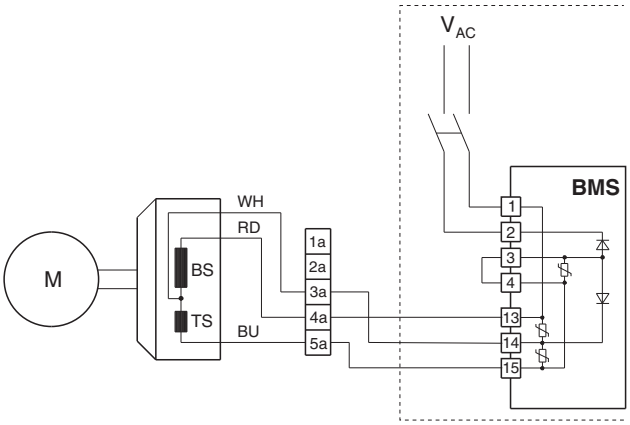
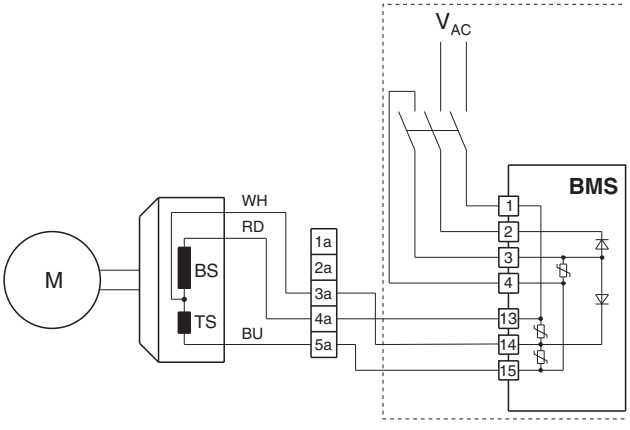


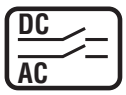


01525BXX



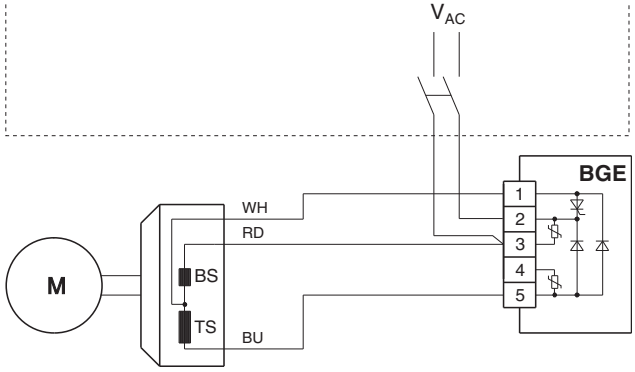
01526BXX



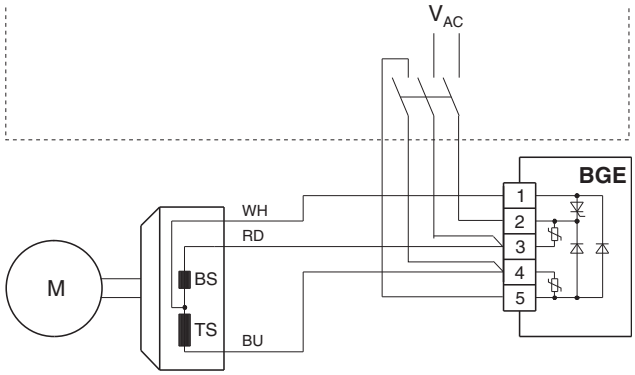


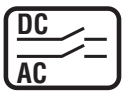
01527BXX

BGE, BME

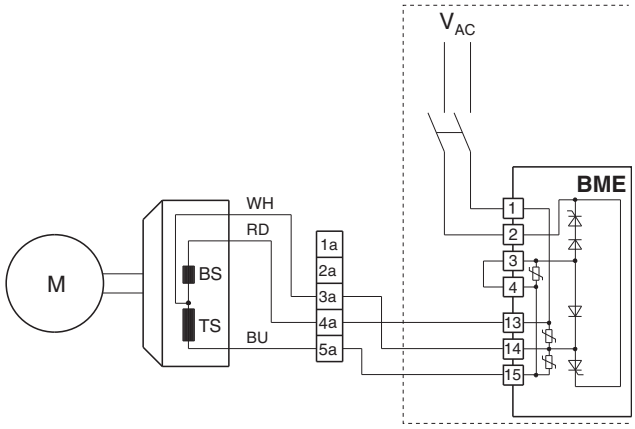


01533BXX





01534BXX



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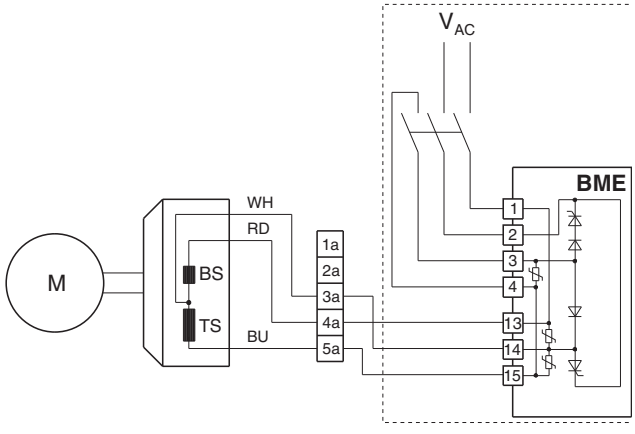
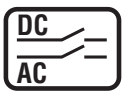
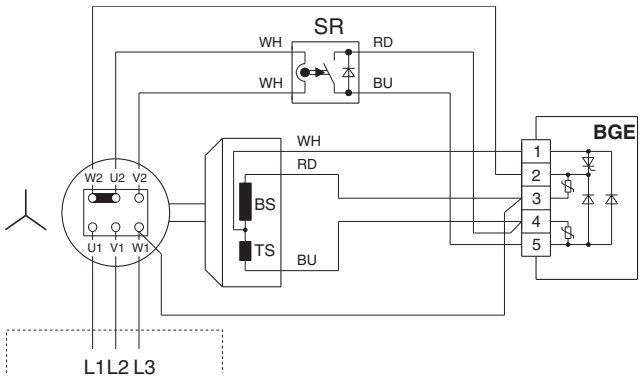




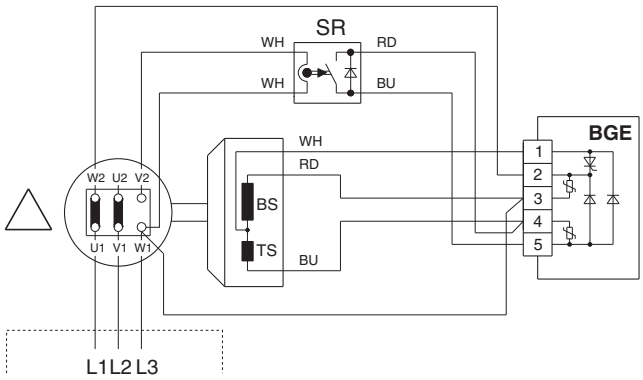
01536BXX

BSR



DC
AC

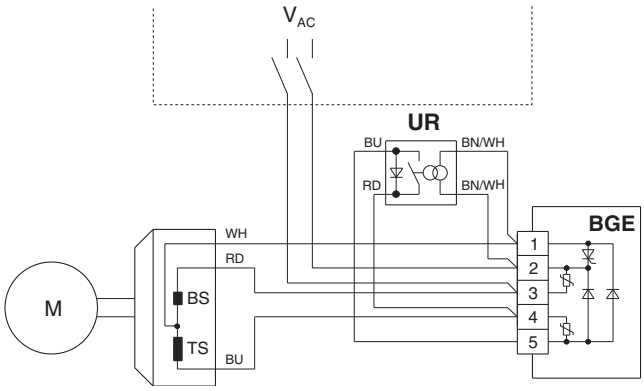
01537BXX



DC
AC

01538BXX

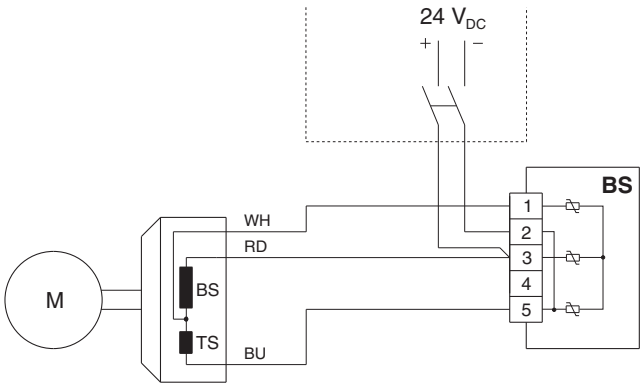
BUR



DC
AC

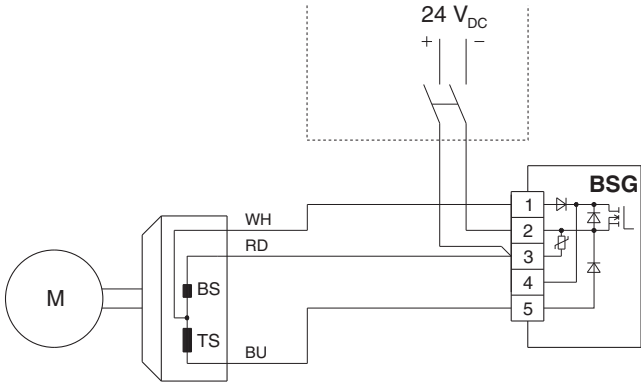
01634BXX

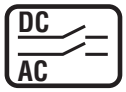
BS



03271AXX

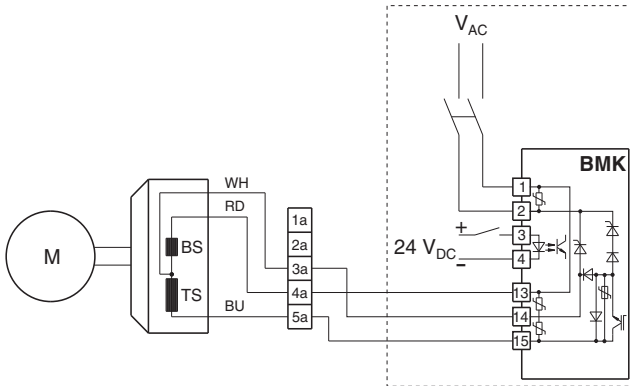
BSG

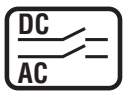




01539BXX

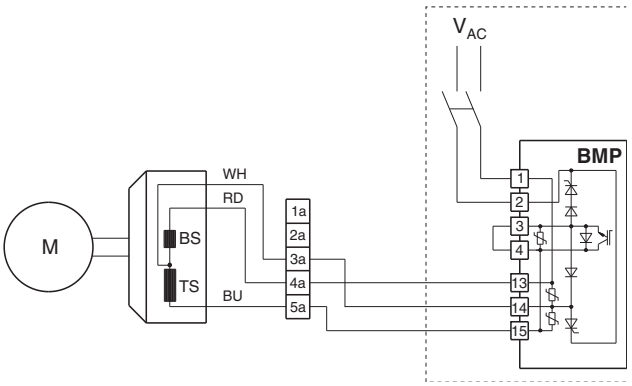
BMK





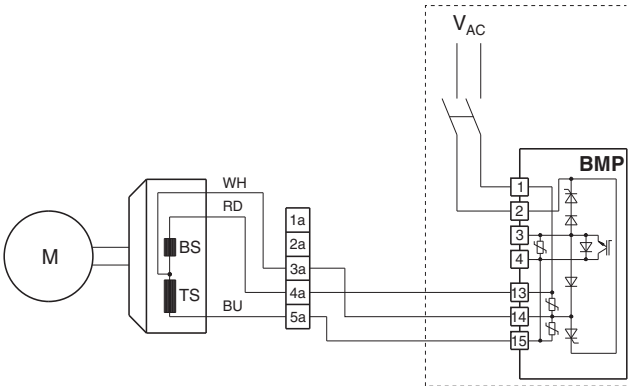
03252AXX

BMP, BMH



AC

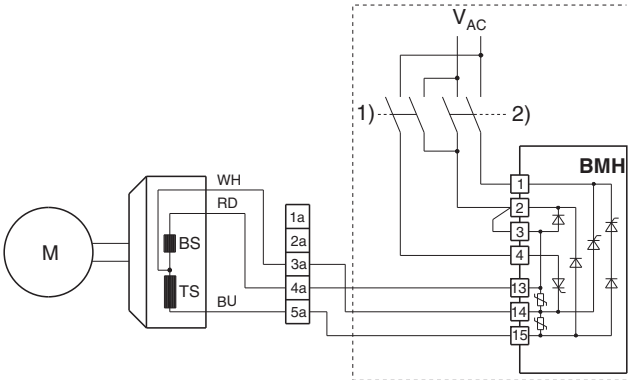
01540BXX



DC
AC

01541BXX

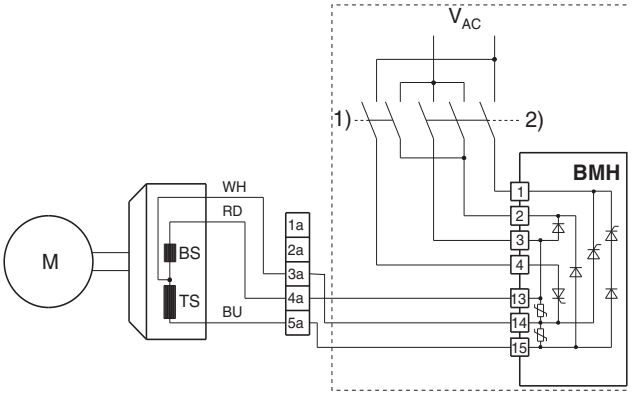
1) Heating
2) Ventilating



AC

01542BXX

1) Heating
2) Ventilating



DC
AC

01543BXX

7.12 Plug connectors (→ GM)

Contact rating depending on the temperature

The "Technical data" tables for plug connectors (→ "Gearmotors" catalog) lists electrical current values for the maximum permitted contact load (= max. contact load) of the plug connectors. These current values are valid for ambient temperatures of up to max. 40 °C (104 °F). Higher ambient temperatures apply for reduced current values. The following illustration shows the permitted contact load as a function of the ambient temperature.

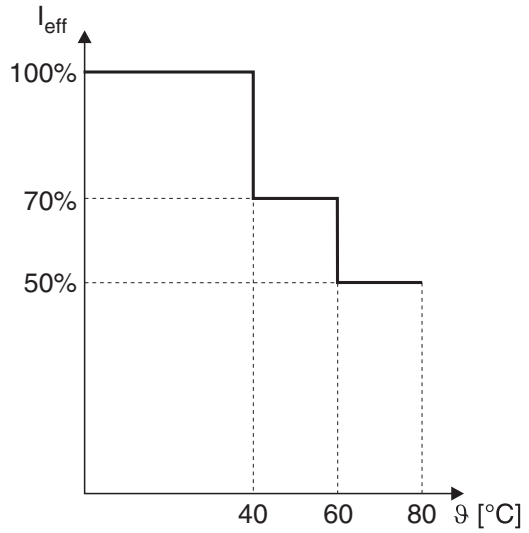


Figure 51: Permitted contact load as a function of the ambient temperature

I_{eff} = Current value of the maximum permitted contact load, 100% = value as listed in the "Technical data" table (→ "Gearmotors" catalog).

ϑ = Ambient temperature

IS integrated plug connector

03075AXX

Figure 52: AC gearmotor with IS integrated plug connector

On request, AC (brake) motors DR63 and DT71 ... DV132S.. can be supplied with the integrated, 12-pole IS plug connector instead of the standard terminal box. The upper section of the IS plug connector (mating connector) is included in the scope of delivery. The IS plug connector is particularly compact and offers the following connection options:

- Motor, single-speed or two-speed pole changing
- Brake
- Temperature monitoring (TF or TH)

As with the terminal box, the cable run with the IS integrated plug connector can be from four different directions offset at 90°.

- IS requires a clearance of 30 mm (1.18 in) for removing the connector.
- **For DR63 brake motors with IS size 1 only:** Only brake control systems BG1.2, BG2.4, BSR and BUR can be accommodated in the IS plug connector. Other brake control systems must be installed in the control cabinet.

Plug connectors AS.., AC.., AM.., AB.., AD.., AK..

05664AXX

Figure 53: AC motor with ASE.. plug connector

The plug connector systems AS.., AC.., AM.., AB.., AD.. and AK.. are based on plug connector systems from Harting.

- AS.., AC.. → Han 10E / 10ES
- AM.., AB.., AD.., AK.. → Han Modular®

The plug connectors are located at the side of the terminal box. They are locked either using two clamps or one clamp on the terminal box.

UL approval has been granted for the plug connectors.

The mating connector (sleeve housing) with socket contacts is not included in the scope of delivery.

AS.., AC..

The ten contacts of the AS.. and AC.. plug connector systems connect the motor winding (6 contacts), the brake (2 contacts) and the thermal motor protection (2 contacts) of single speed motors.

Types AS.. and AC.. differ as follows:

- AS = Spring cages
- AC = Crimp contacts and shortened contacts for thermal motor protection

Applies to AS.1 and AC.1:

For brakemotors, you can select the version with brake control in the terminal box only. In this case, the disconnection in the DC circuit has to take place electronically using BSR or BUR.

The ASE.. type with single clip longitudinal closure correspond to the DESINA regulation issued by the Association of German Machine Tool Manufacturers (VDW).

Note the following point:

- Cable entry in position 1 is not available for motor sizes DT71... DV132S.

AM.., AB.., AD.., AK..

Plug connectors AM.., AB.., AD.. and AK.. can be used for connecting single speed motors.

With brake motors, the brake control system can be either located in the terminal box or in the control cabinet. All versions of the brake control system are possible.

Some plug connectors may require longer delivery times.

7.13 Encoders and prefabricated cables for encoder connection (→ GM)

Tachometer

Various types of tachometers are available for installation on DT../ DV.. AC motors as standard depending on the application and motor size. With rare exceptions, the encoders can be combined with other optional components installed in the motor, such as brakes and forced cooling fans.

Overview of encoders

Name	For motor	Encoder type	Shaft	Specification	Power supply	Signal
EH1T	DR63	Encoders	Hollow shaft	1024 pulses/revolution	DC 5 V controlled	TTL/RS-422
EH1S					9 V_{DC} ... 26 V_{DC}	1 V_{SS} sin/cos
EH1R						TTL/RS-422
ES1T	DT71...DV100		Spreadshaft		DC 5 V controlled	TTL/RS-422
ES1S					9 V_{DC} ... 26 V_{DC}	1 V_{SS} sin/cos
ES1R						TTL/RS-422
ES2T	DV112...DV132S				DC 5 V controlled	TTL/RS-422
ES2S					9 V_{DC} ... 26 V_{DC}	1 V_{SS} sin/cos
ES2R						TTL/RS-422
EV1T	DT71...DV280		Solid shaft		DC 5 V controlled	TTL/RS-422
EV1S					10 V_{DC} ... 30 V_{DC}	1 V_{SS} sin/cos
EV1R						TTL/RS-422
ES12	DT71...DV100	Encoder	Spreadshaft	A+B tracks	9 V_{DC} ... 26 V_{DC}	Either 1 or 2 pulses/revolution
ES22	DV112...DV132S					
ES16	DT71...DV100					6 pulses/revolution
ES26	DV112...DV132S					
NV11	DT71...DV100	Proximity sensor	Solid shaft	A track	10 V_{DC} ... 30 V_{DC}	1 pulse/revolution, normally open contact
NV21				A+B tracks		
NV12	DT71...DV132S			A track		2 pulses/revolution, normally open contact
NV22				A+B tracks		
NV16				A track		6 pulses/revolution, normally open contact
NV26				A+B tracks		
AV1Y	DT71...DV280	Multi-turn-absolute encoder	Solid shaft	-	10 V_{DC} ... 30 V_{DC}	MSSI interface and 1 V_{SS} sin/cos
ES3H	DT71...DV100	Single-turn HIPERFACE® encoder	Spreadshaft	-	7 V_{DC} ... 12 V_{DC}	RS-485 interface and 1 V_{SS} sin/cos
ES4H	DV112...DV132S					
AS3H	DT71...DV100	Multi-turn HIPERFACE® encoder				
AS4H	DV112...DV132S					
AV1H[1)]	DT71...DV280	Multi-turn HIPERFACE® encoder	Solid shaft	-	7 V_{DC} ... 12 V_{DC}	RS-485 interface and 1 V_{SS} sin/cos

1) recommended encoder for operation with MOVIDRIVE® MDX61B with option DEH11B

Encoder connection

When connecting the encoders to the inverters, always follow the operating instructions for the relevant inverter and the wiring diagrams supplied with the encoders!

- Maximum line length (inverter – encoder): 100 m (330 ft) with a cable capacitance ≤ 120 nF/km
- Conductor cross section: 0.20 ... 0.5 mm^2 (AWG 20 - 24)
- Use shielded cable with twisted pair conductors and apply shield over large area on both ends :
  - At the encoder in the cable gland or in the encoder plug
  - To the inverter on the electronics shield clamp or to the housing of the sub D plug
- Install the encoder cables separately from the power cables, maintaining a distance of at least 200 mm (8 in).
- Encoder with cable gland: Observe the permitted diameter of the encoder cable to ensure that the cable gland functions correctly.

Incremental encoder (Encoder)

The encoders from SEW-EURODRIVE are available as incremental encoders with 1024 signals/revolution or as encoder with 1, 2 or 6 pulses/revolution.

Hollow shaft encoder and spreadshaft encoder

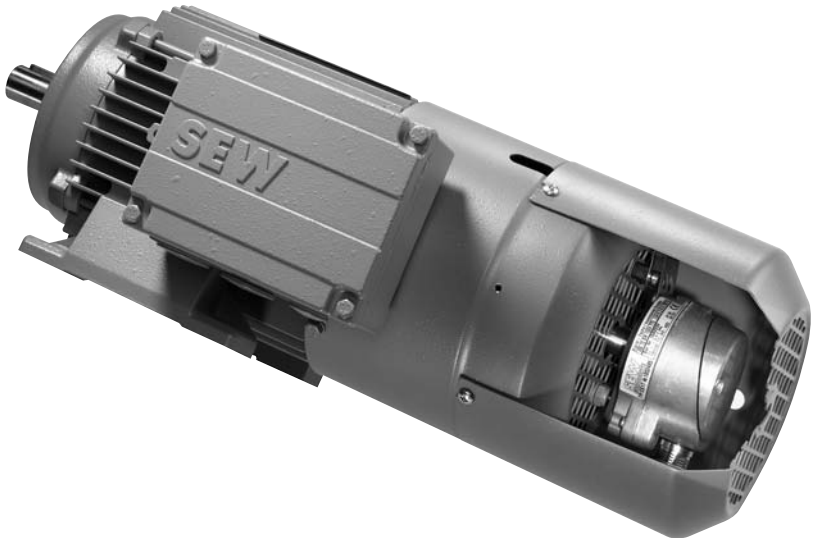


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Figure 54: Encoder with spreadshaft

Solid shaft encoder

01935CXX

Figure 55: AC motor with solid shaft encoder and forced cooling fan VR

Encoder mounting adapter

The motors can be equipped with various encoder mounting adapters for installing encoders from different manufacturers.

01949CXX

Figure 56: AC motor with encoder mounting adapter EV1A and forced cooling fan VR

The encoder is attached to the EV1A (synchro flange) using three encoder mounting clamps (bolts with eccentric discs) for 3 mm flange thickness.

Absolute encoder

The absolute encoders AV1Y from SEW-EURODRIVE are combination encoders. They contain a multi-turn absolute encoder and a high-resolution sinusoidal encoder.

03078BXX

Figure 57: AC motor with absolute encoder and forced cooling fan VR

HIPERFACE® encoder

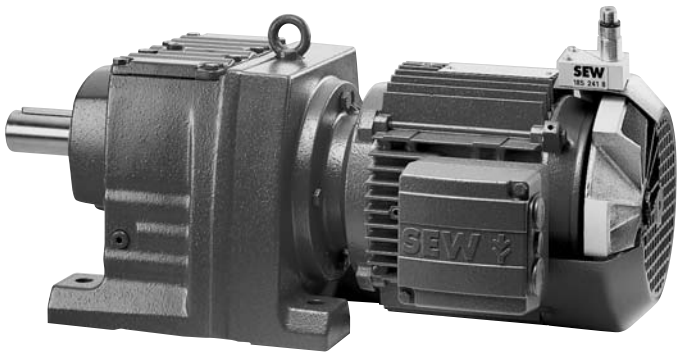
HIPERFACE® encoders are available as single-turn or multi-turn combination encoder. They contain an absolute encoder and a high-resolution sinusoidal encoder.

59810AXX

Figure 58: AC motor with HIPERFACE® encoder AS3H

Proximity sensor

The proximity sensors from SEW-EURODRIVE can be used to easily and inexpensively monitor whether the motor is turning. If a two-track proximity sensor is used, the direction of rotation of the motor can also be detected. Proximity sensors can either be installed on the side of the fan guard (motor maintains original length) or as spreadshaft encoder on the motor.



03242AXX

Figure 59: Proximity sensor NV..

The connection cable is not included in the scope of delivery. Contact your retailer to purchase the appropriate connection cable.

Prefabricated cables for encoder connection

SEW-EURODRIVE offers prefabricated cables for simple and reliable connection of encoder systems. It is necessary to differentiate between cables used for fixed installation or for use in cable carriers. Contact SEW-Eurodrive concerning availability and length.

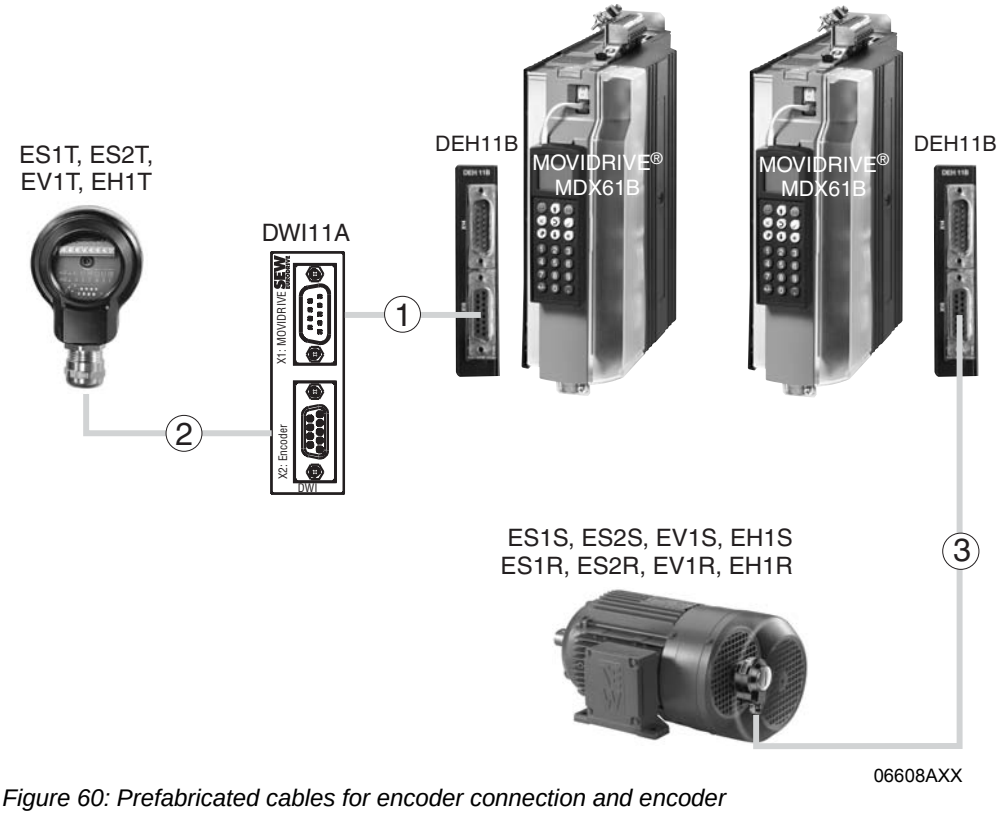


Figure 60: Prefabricated cables for encoder connection and encoder

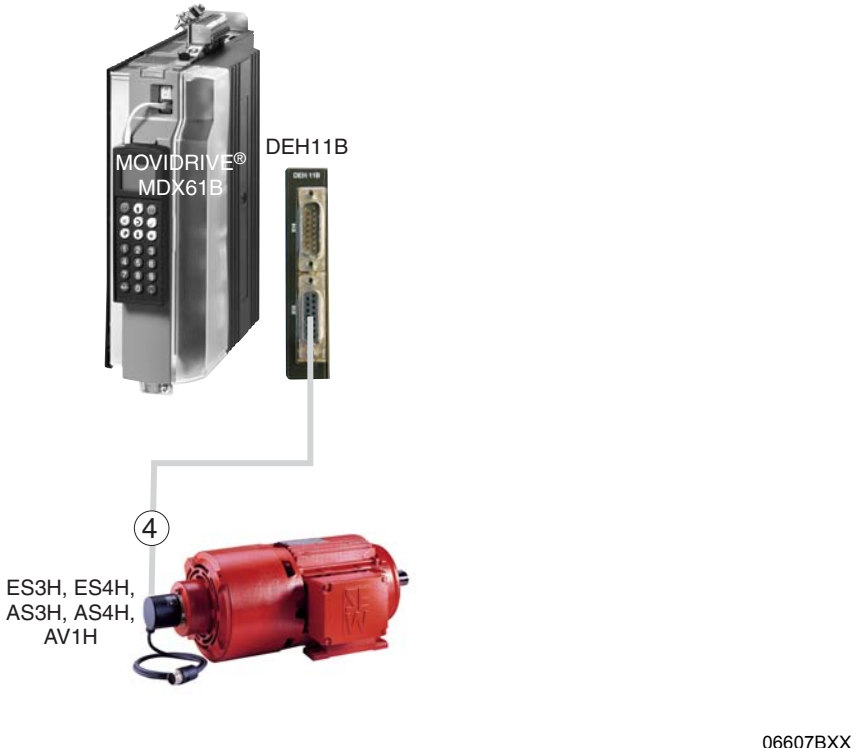


Figure 61: Prefabricated cables for HIPERFACE® encoders

(1) Prefabricated cables for encoder connection:

Part number	**817 957 3**
Installation	Fixed installation
for encoders with 5 V voltage supply	ES1T, ES2T, EV1T, EH1T
Cable cross section	4×2×0.25 mm^2 (AWG23) + 1×0.25 mm^2 (AWG23)
Conductor colors	A: Yellow (YE) A: Green (GN) B : Red (RD) B : Blue (BU) C : Pink (PK) C : Gray (GY) UB: White (WH) ⊥: Brown (BN) Sensor cable: Violet (VT)
Manufacturer and type **Lapp** **Helukabel**	 Unitronic Li2YCY (TP) Paar-Tronic-CY
For inverter	MOVIDRIVE® MDX61B with DEH11B option
Connection **on the DWI11A** **on the inverter**	 with 9-pin sub D socket with 15-pin sub D plug

(2) Prefabricated cables for incremental TTL encoders with 5V voltage supply:

Part number	**198 829 8**	**198 828 X**
Installation	Fixed installation	Cable carrier installation
for encoder	ES1T, ES2T, EV1T, EH1T via DWI11A and cable 817 957 3	
Cable cross section	4×2×0.25 mm^2 (AWG23) + 1×0.25 mm^2 (AWG23)	
Conductor colors	A: Yellow (YE) A: Green (GN) B : Red (RD) B : Blue (BU) C : Pink (PK) C : Gray (GY) UB: White (WH) ⊥: Brown (BN) Sensor cable: Violet (VT)	
Manufacturer and type **Lapp** **Helukabel**	 Unitronic Li2YCY (TP) Paar-Tronic-CY	 Unitronic LiYCY Super-Paar-Tronic-C-PUR
For inverter	MOVIDRIVE® MDX61B with DEH11B option	
Connection on **encoder / motor** **DWI11A**	 with conductor end sleeves Connect the violet conductor (VT) with the encoder at UB. with 9-pin sub D plug	

③ Prefabricated cables for incremental TTL sensors and sin/cos encoders (TTL sensors and sin/cos encoders) with 24V voltage supply:

Part number	1332 459 4	1332 458 6
Installation	Fixed installation	Cable carrier installation
for encoder	ES1S, ES2S, EV1S, EH1S, ES1R, ES2R, EV1R, EH1R	
Cable cross section	4×2×0.25 mm² (AWG23) + 1×0.25 mm² (AWG23)	
Conductor colors	A: Yellow (YE) A: Green (GN) B : Red (RD) B : Blue (BU) C : Pink (PK) C : Gray (GY) UB: White (WH) ⊥: Brown (BN) Sensor cable: Violet (VT)	
Manufacturer and type **Lapp** **Helukabel**	 Unitronic Li2YCY (TP) Paar-Tronic-CY	 Unitronic LiYCY Super-Paar-Tronic-C-PUR
For inverter	MOVIDRIVE® MDX61B with DEH11B option	
Connection on **encoder / motor** **Inverter**	 with conductor end sleeves Cut off the violet conductor (VT) of the cable at the encoder end. with 15-pin sub D plug	

④ Prefabricated cables for HIPERFACE® encoders:

Part number	1332 453 5	1332 455 1
Installation	Fixed installation	Cable carrier installation
for encoder	ES3H, ES4H, AS3H, AS4H, AV1H	
Cable cross section	6 × 2 × 0.25 mm² (AWG 23)	
Conductor colors	cos+: Red (RD) cos-: Blue (BU) sin+: Yellow (YE) sin-: Green (GN) D+: Black (BK) D-: Violet (VT) TF/TH/KTY+: Brown (BN) TF/TH/KTY-: White (WH) GND: Gray/pink + pink (GY-PK + PK) U_S: Red/blue + gray (RD-BU + GY)	
Manufacturer and type	Lapp, PVC/C/PP 303 028 1	Nexans, 493 290 70
For inverter	MOVIDRIVE® MDX61B with DEH11B option	
Connection on **encoder / motor** **Inverter**	 With 12-pin round connector plug (Intercontec, type ASTA021NN00 10 000 5 000) with 15-pin sub D plug	

Extension cables for HIPERFACE® cables

Part number	199 539 1	199 540 5
Installation	Fixed installation	Cable carrier installation
Cable cross section	6 × 2 × 0.25 mm² (AWG 23)	
Conductor colors	→ HIPERFACE® cable	
Manufacturer and type	Lapp, PVC/C/PP 303 028 1	Nexans, 493 290 70
Connection on **encoder / motor** **HIPERFACE® cable**	 With 12-pin round connector plug (Intercontec, type ASTA021NN00 10 000 5 000) with 12-pin round connector plug (Intercontec, type AKUA20)	

7.14 Forced cooling fan

Forced cooling fan VR, VS and V

The motors can be equipped with a forced cooling fan if required. A forced cooling fan is usually not required for mains operated motors in continuous duty. SEW-EURODRIVE recommends a forced cooling fan for the following applications:

- Drives with high starting frequency
- Drives with additional flywheel mass Z (flywheel fan)
- Inverter drives with a setting range ≥ 1:20
- Inverter drives that have to generate rated torque even at low speed or at standstill.

Following figure shows a typical speed-torque characteristic for a dynamic inverter drive, for example with MOVIDRIVE® MDX61B with DEH11B option in CFC operating mode.

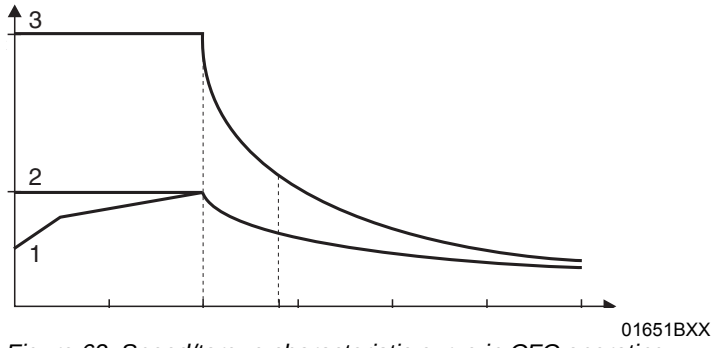


Figure 62: Speed/torque characteristic curve in CFC operating mode

T_N	= Rated torque of the motor	1	= With self-cooling
T_{max}	= Maximum torque of the motor	2	= With forced cooling
n_{base}	= Rated speed (transition speed) of the motor	3	= Maximum torque

A forced cooling fan must be used if the load torque in the 0 ... n_{base} is above curve 1. The motor becomes thermally overloaded without forced cooling.

VR forced cooling fan

The VR forced cooling fan is supplied with a voltage of DC 24 V. For voltage supply with 1 × AC 230 V, SEW-EURODRIVE offers switched-mode power supply type UWU52A (part number 188 181 7).

Switched-mode power supply UWU52A is mounted on a support rail in the control cabinet.

Combination with encoders

Forced cooling fans can be combined with the following motor encoders:

Motor encoder	For motor size	Forced cooling fan		
		VR	VS	V
ES1T, ES1R, ES1S, ES3H, AS3H	**71 ... 100**	•	-	-
ES2T, ES2R, ES2S, ES4H, AS4H	**112 ... 132S**	•	-	-
EV1T, EV1R, EV1S	**71 ... 132S**	•	•	-
EV1T, EV1R, EV1S	**132M ... 280**	-	-	•
AV1Y, AV1H	**71 ... 132S**	•	•	-
AV1Y, AV1H	**132M ... 280**	-	-	•

VR forced cooling fans can be combined with any encoder from SEW-EURODRIVE. Forced cooling fans VS and V can be combined with encoders with solid shaft only. In DV250M/DV280S motors, the motor encoder can only be installed in conjunction with a forced cooling fan.

7.15 Additional mass Z, backstop RS and protection canopy C (→ GM)

Additional flywheel mass Z (high inertia fan)

The motor can be equipped with additional mass, the cast iron fan, to achieve smooth startup and braking behavior of mains operated motors. In this way, the motor obtains additional mass moment of inertia J_Z. The cast iron fan replaces a normal fan. The outer motor dimensions remain the same. It can be installed on motors with and without a brake. For technical data of the "cast iron fan Z" option, refer to the "Gearmotors" catalog.

Note the following points:

- Check the starting frequency. Multiply the permitted no-load starting frequency Z_0 with the factor 0.8 or use a forced cooling fan.
- Use the total mass moment of inertia $J_{ges} = J_{mot} + J_Z$ at the motor end. You can find the values for the mass moments of inertia J_{Mot} and J_Z in the section "Technical data of additional flywheel mass Z and backstop RS."
- DC injection braking and moving against the RS backstop are not permitted.
- Not available in vibration grade R.
- **Only for DT80..:** The cast iron fan for DT71.. (part number 182 232 2) is used in combination with a solid shaft encoder or a mounting device for a solid shaft encoder . In this case $J_Z = 475 \bullet 10^{-4}$ lb-ft^2 must be used for configuration.

Backstop RS

The mechanical backstop RS is used for protecting equipment against reverse movement when the motor is switched off. For technical data of the "backstop Z" option, refer to the "Gearmotors" catalog.

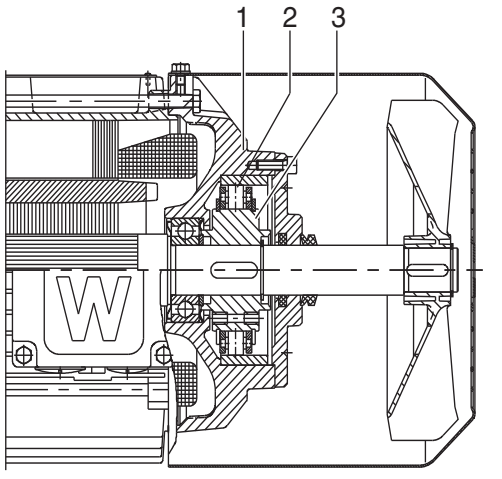


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Figure 63: Design of the RS backstop

1 Non drive-end bearing shield
2 Wedge element train
3 Driver

Specify the direction of rotation for the motor or gearmotor when placing your order. CW rotation means the output shaft rotates clockwise as viewed onto its face end and is blocked to prevent it from turning counterclockwise. The vice versa principle applies to counterclockwise direction of rotation.

Protection canopy C

Liquids and/or solid foreign objects can penetrate the air outlet openings of motors in a vertical mounting position with their input shaft pointing downwards. SEW-EURODRIVE offers the motor option protection canopy C for this purpose.

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Figure 64: AC motor with protection canopy C

7.16 Low-noise fan guard

The noise of the gearmotor is usually louder due to the fan guards of the drives.

SEW-EURODRIVE offers the "low-noise fan guard" option for motor sizes DT71D to DV132S. This guard can reduce the noise level by about 3 db(A) compared to the standard version.

This option is only available for motors and brake motors. The "low-noise fan guard"option cannot be combined with encoders or forced cooling fans. The option is indicated by the letters "LN" in the type designation.

7.17 MOVIMOT® (→ MM)

General notes

Note the following points during project planning for MOVIMOT® AC motors:

- For detailed project planning notes, technical data and information on the communication of MOVIMOT® via fieldbus interfaces or RS-485, refer to the system folder "Decentralized Installation" (MOVIMOT®, MOVI-SWITCH®, Communication and Supply Interfaces).
- The use of MOVIMOT® for lift applications is limited. Please contact SEW-EURODRIVE to inquire about suitable solutions with MOVITRAC® or MOVIDRIVE®.
- The suitable MOVIMOT® gearmotor is selected with regard to the speed, power, torque and spatial conditions of the application (see the selection tables in the "MOVIMOT® Gearmotors catalog). The options are then determined depending on the control type.

Functional description

MOVIMOT® is the combination of an AC (brake) motor and a digital frequency inverter in the power range 0.5 ... 5 Hp. It is the perfect match for decentralized drive configurations.

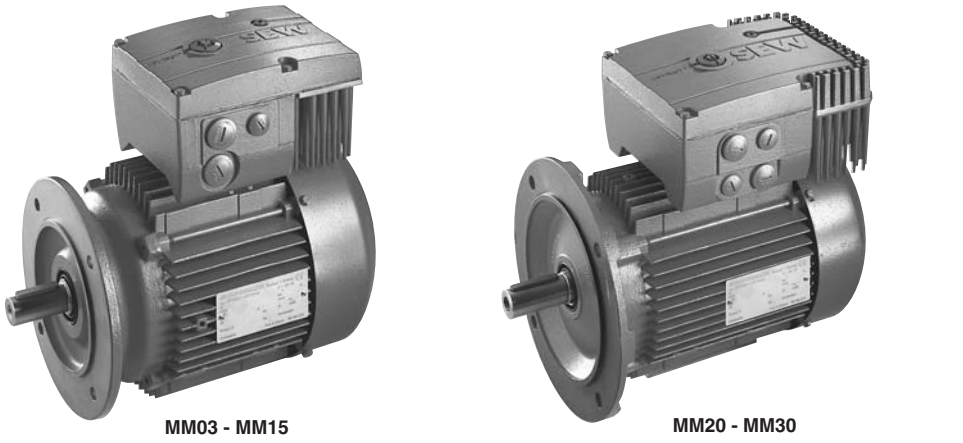

Figure 65: MOVIMOT® AC motor

Features of MOVIMOT®

MOVIMOT® is the ideal solution for a variety of decentralized drive tasks. The following functional description provides an overview of the most important features:

- MOVIMOT® is a gearmotor with integrated digital frequency inverter in the power range from 0.5 ... 5 Hp and integrated brake management.
- MOVIMOT® is available for the supply voltages 3 × 200...240 V, 50/60 Hz and 3 × 380...500 V, 50/60Hz.
- MOVIMOT® is available for rated speeds of 1800 rpm and 3000 rpm.
- The brake coil is used as braking resistor in motors with mechanical brake; an internal braking resistor will be a standard component of MOVIMOT® units for motors without brake.
- MOVIMOT® is available in two designs:
  - MM..C-503-**00**: Standard version
  - MM..C-503-**30**: with integrated AS-interface

- Control takes place via binary signals, via the serial interface RS-485 or optionally via all commercial fieldbus interfaces (PROFIBUS, INTERBUS, DeviceNet, CANopen or AS-interface).
- Overview of MOVIMOT® functions (all versions):
  - Clockwise, counterclockwise operation
  - Changeover between two fixed setpoints
  - Setpoint f1 can be scaled
  - Ready signal to controller
  - Diagnostics of MOVIMOT® via status LED
  - Additional functions for specific applications
- Additional functions of version with integrated AS-interface
  - Addressing via M12 (AS-interface address 1-31)
  - Connection option for two external sensors
  - Additional LED for AS-interface status
  - Additional diagnostic interface via modular jack 4/4 plug connector
- MOVIMOT® is supplied with UL approval (UL listed) on request.

Advantages of MOVIMOT®

MOVIMOT® offers the following advantages:

- Compact design
- Interference-free connection between inverter and motor
- Closed design with integrated protection functions
- Inverter cooling independent of the motor speed
- No space required in the control cabinet
- Optimum presetting of all parameters for the expected application
- Compliance with EMC standards EN 50 081 (interference suppression level A) and EN 50 082
- Easy installation, startup and maintenance
- Easy to service for retrofitting and replacement

MOVIMOT® can be used to equip extensive systems or can be integrated into existing systems. MOVIMOT® is also the electronic replacement for multi-speed motors or mechanical variable speed drives.

MOVIMOT® is available as motor, brake motor, gearmotors or geared brake motor in many different standard versions and mounting positions.

Connection technology MOVIMOT® standard design

Overview

MOVIMOT® MM..C-503-00 is supplied without plug connector if not specified otherwise in the order. The plug connectors listed in the following table are preferred components. For other types, please contact SEW-EURODRIVE.

Order designation	Function	Terminal box design	Manufacturer designation
MM../AVT1	RS-485	Standard	M12 x 1 round plug connector
MM../RE.A/ASA3 RE1A = MM03-15 RE2A = MM22-3X	Power	Modular	Harting HAN® 10 ES pin element (built-on housing with two clips)
MM../RE.A/ASA3/AVT1 RE1A = MM03-15 RE2A = MM22-3X	Power/RS-485	Modular	Harting HAN® 10 ES pin element (built-on housing with two clips) + M12 x 1 round plug connector
MM../RE.A/AMA6 RE1A = MM03-15 RE2A = MM22-3X	Power/RS-485	Modular	Harting HAN® modular pin element (built-on housing with two clips)

Terminal box design:

The modular terminal box offers the following functions compared to the standard terminal box:

- The position of the cable entries/plug connectors can later be turned to the opposite side (see "MOVIMOT®" operating instructions).
- Integration of brake control systems (see Sec. "Options")

Possible plug connector positions

The following positions are possible for plug connectors:

Plug connector	Possible positions
AVT1	X (standard)
	2
RE.A/ASA3	X (standard)
	2
RE.A/ASA3/AVT1	ASA3 = X (standard) + AVT1 = X (standard)
	ASA3 = 2 + AVT1 = 2
	ASA3 = X + AVT1 = 2
	ASA3 = 2 + AVT1 = X
RE.A/AMA6	X (standard)
	2

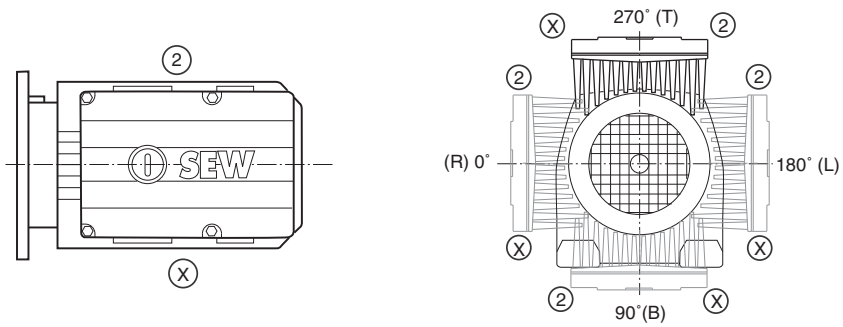

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Figure 66: Possible plug connector positions

MOVIMOT® operating modes

4Q operation of motors with mechanical brake

- The brake coil is used as braking resistor in 4Q operation.
- No external braking resistor may be connected.
- Brake voltage is generated internally within the unit, which means it is mains-independent.

Resistance and assignment of the brake coil:

Motor	Brake	Resistance of the brake coil[1)]	
		MOVIMOT® with 380–500 V_{AC} input voltage	MOVIMOT® with 200–240 V_{AC} input voltage
DT71	**BMG05**	277 Ω(230 V)	69,6 Ω(110 V)
DT80	**BMG1**	248 Ω(230 V)	62,2 Ω(110 V)
DT90	**BMG2**	216 Ω (230 V) / 54.2 Ω (110 V)	54,2 Ω(110 V)
DV100/DT100	**BMG4**	43.5 Ω(110 V)	27.3 Ω (88 V)

1) Rated value measured between the red connection (terminal 13) and the blue connection (terminal 15) at 20°C, temperature-dependent fluctuations in the range -25% / +40 % are possible.

Regenerative load capacity of the brake coil (MOVIMOT® with 380 – 500 V_{AC} supply voltage)

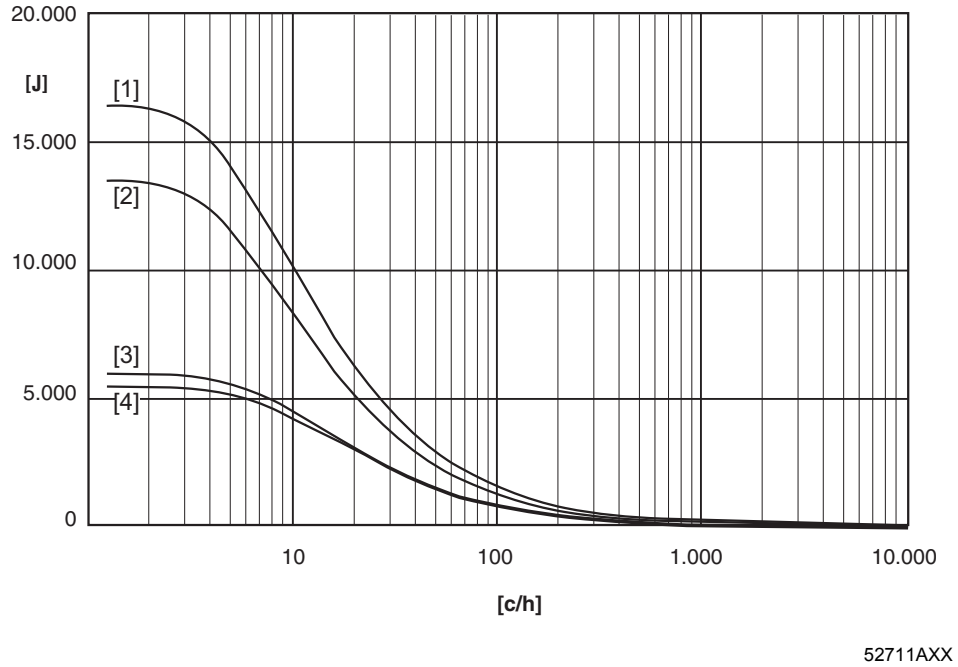

Figure 67: Regenerative load capacity

[c/h] Cycles per hour
[1] BMG2/BMG4 (110 V)
[2] BMG2 (230 V)
[3] BMG1 (230 V)
[4] BMG05 (230 V)

Regenerative load capacity of the brake coil (MOVIMOT® with 200...240 V_{AC} supply voltage)

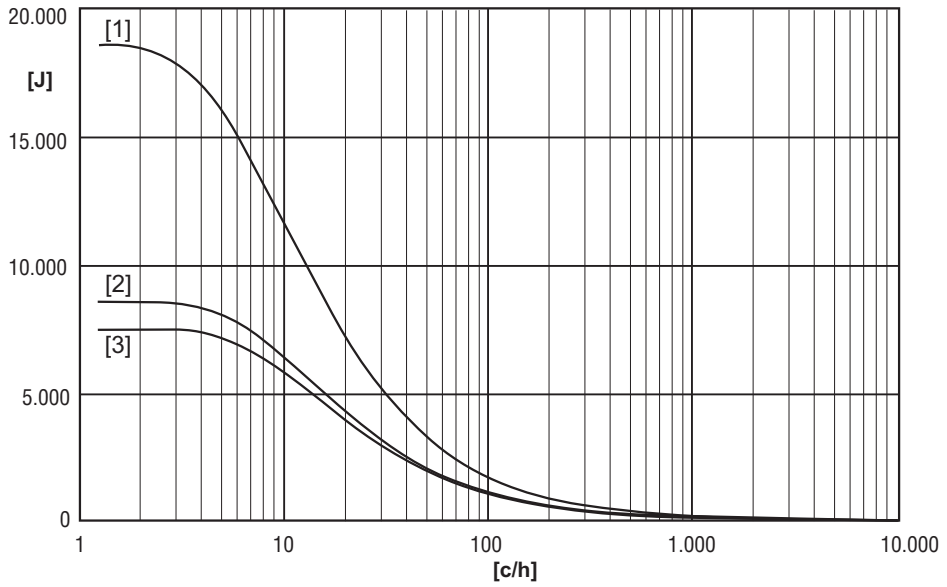

Figure 68: Regenerative load capacity

[c/h]	Cycles per hour
[1]	BMG2 (110 V), BMG4 (88 V)
[2]	BMG1 (110 V)
[3]	BMG05 (110 V)

4Q operation with integrated braking resistor BW..

- The brake resistor is integrated in the terminal box of MOVIMOT® as standard in motors without mechanical brake.
- 4Q operation with integrated braking resistor is recommended for applications in which the level of regenerative energy is low.
- The resistor protects itself (reversible) against regenerative overload by changing abruptly to high resistance and no longer consuming any more energy. The inverter then switches off and signals an overvoltage error (error code 04).
- Field distributors or P2.A option for mounting the MOVIMOT® unit in close proximity to the motor, the braking resistor must be ordered separately.

Assignment of internal braking resistors:

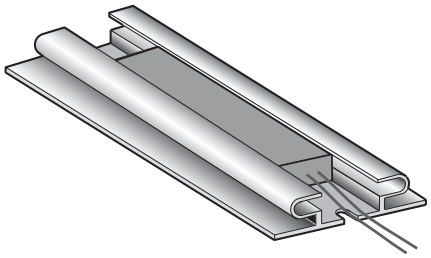

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Figure 69: Integrated BW.. braking resistor

MOVIMOT®	MOVIMOT® type	Braking resistor	Part number
with input voltage 380–500 V_{AC}	MM03..MM15	BW1	822 897 3[1)]
			800 621 0[2)]
	MM22..MM3X	BW2	823 136 2[1)]
			800 622 9[2)]
with input voltage 200–240 V_{AC}	MM03..MM07	BW3	823 598 8[2)]
	MM11..MM22	BW4	823 599 6[2)]

1) Two screws M4 x 8, included in delivery

2) Retaining screws not included in scope of delivery (not available in the US)

Regenerative load capacity of internal braking resistors:

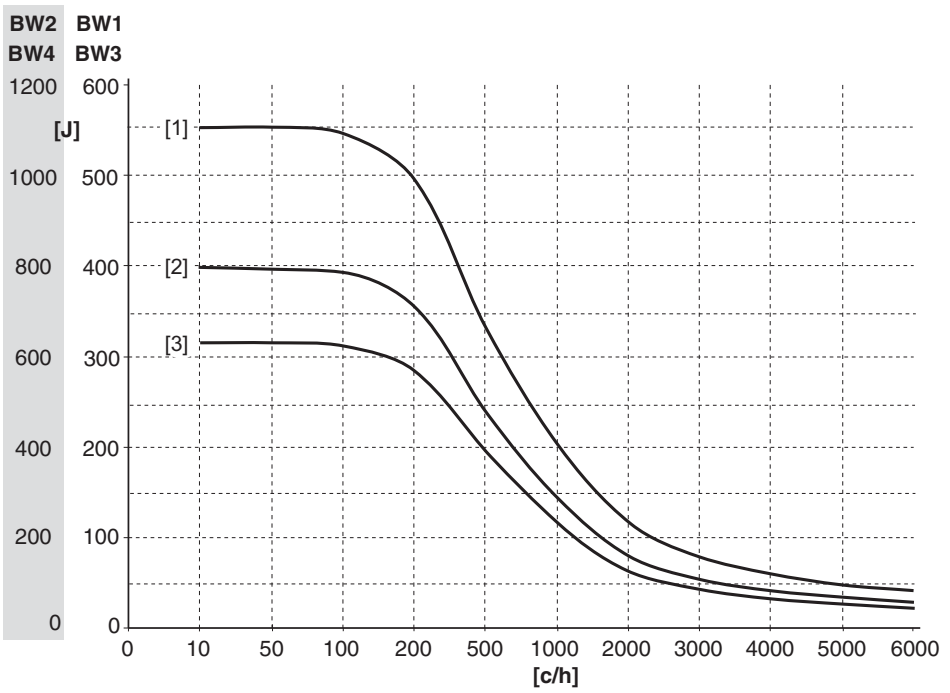


Figure 70: Regenerative load capacity

[c/h] Cycles per hour
[1] Brake ramp 10 s
[2] Brake ramp 4 s
[3] Brake ramp 0.2 s

4Q operation with brake and external braking resistor

- 4Q operation with external braking resistor is recommended for applications in which the level of regenerative energy is high.
- External braking resistors are only permitted with brake motors in combination with brake control BGM/BSM.
- When using external braking resistors and BGM/BSM brake control, MOVIMOT® special functions must be activated. Refer to the MOVIMOT® operating instructions for more information.

Assignment of external braking resistors:

MOVIMOT®	MOVIMOT® type	Braking resistor	Part number
with input voltage 380–500 V_{AC}	MM03..MM15	BW200-300	826 267 5
		BW200-005	826 270 5
		BW200-003/K-1.5	828 291 9
		BW200-005/K-1.5	828 283 8
		BW150-010	802 285 2
	MM22..MM3X	BW100-003	826 266 7
		BW100-005	826 269 1
		BW100-003/K-1.5	828 293 5
		BW100-005/K-1.5	828 286 2
		BW068-010	802 287 9
		BW068-020	802 286 0

Power diagrams of external braking resistors:

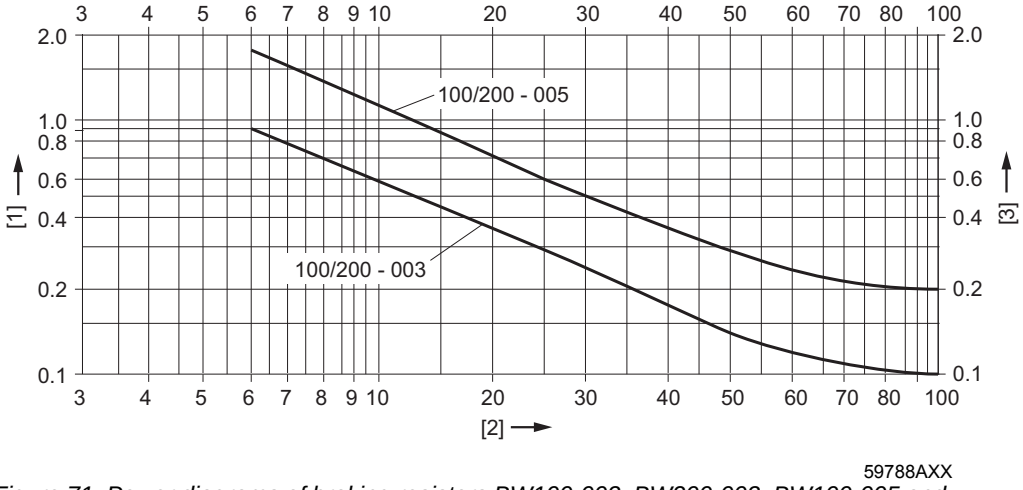


Figure 71: Power diagrams of braking resistors BW100-003, BW200-003, BW100-005 and BW200-005

[1] Short-term power in kW
[2] Cyclic duration factor cdf in %
[3] Continuous power 100 % cdf in kW

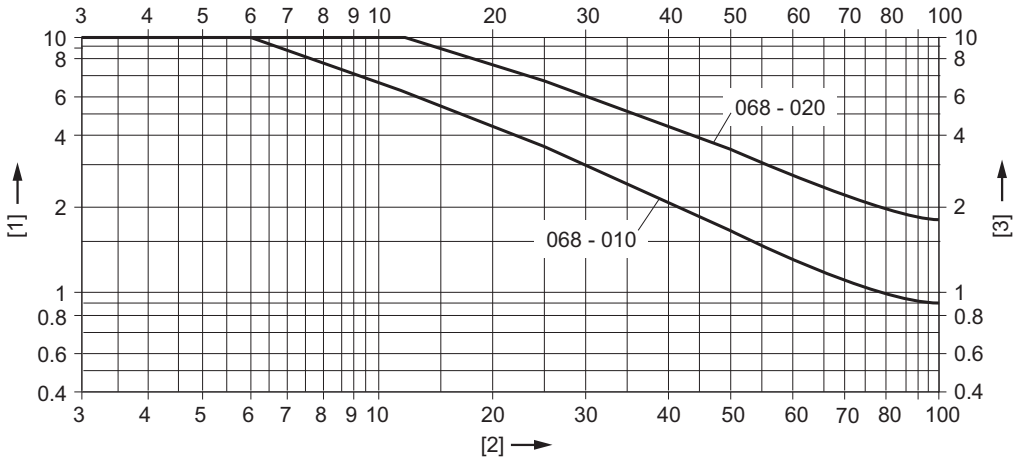


Figure 72: Power diagrams of braking resistors BW068-010 and BW068-020

[1] Short-term power in KW
[2] Cyclic duration factor cdf in %
[3] Continuous power 100 % cdf in KW

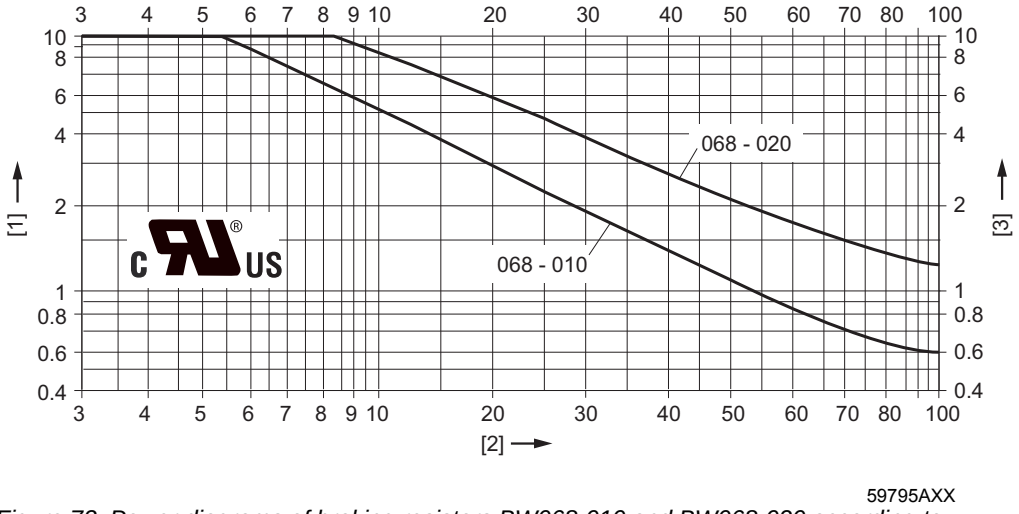


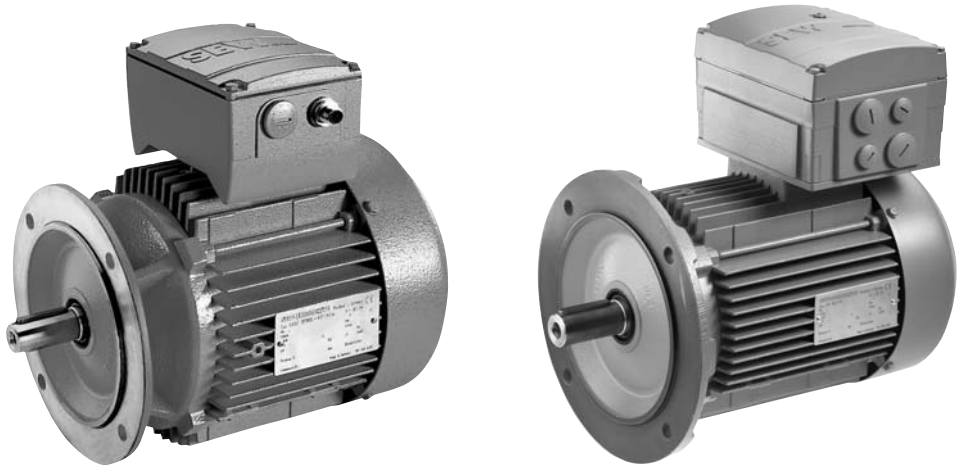
Figure 73: Power diagrams of braking resistors BW068-010 and BW068-020 according to UL approval

[1] Short-term power in KW
[2] Cyclic duration factor cdf in %
[3] Continuous power 100 % cdf in KW

7.18 MOVI-SWITCH® (→ GM)

MOVI-SWITCH® is the gearmotor with integrated switching and protection function. Single speed AC (brake) motors in sizes DT71 to DV100 can be combined with all appropriate gear units in the modular concept as part of the MOVI-SWITCH® product range. For detailed information on MOVI-SWITCH®, refer to the system folder "Decentralized Installation" (MOVIMOT®, MOVI-SWITCH®, Communication and Supply Interfaces).

MSW-1E MSW-2S



MSW1E_MSW2S

Figure 74: Gearmotor with MOVI-SWITCH®

Advantages of MOVI-SWITCH®

MOVI-SWITCH® offers the following advantages:

- The circuit breaker and protection functions are completely integrated, saving control cabinet space and cabling.
- Robust and compact, resulting in space-saving installation.
- Use MOVI-SWITCH® to operate motors in the voltage range 3 × 380 ... 500 V, 50 / 60 Hz.
- AC motors and AC brake motors with the same connection configuration, therefore simple installation.

2 versions

Two MOVI-SWITCH® versions are available: one for operation with one direction of rotation (MSW-1E); one for operation with direction of rotation reversal (MSW-2S).

The mains and control connections are the same for motors with or without brake.

MSW-1E

MOVI-SWITCH® MSW-1E is switched on and off without changing direction by means of a short circuit-proof star bridge switch. A thermal winding monitor (TF) is also integrated, which acts directly on the switch.

MSW-1E requires longer delivery time from Germany.

MSW-2S

The direction of rotation is reversed in MOVI-SWITCH® MSW-2S using a reversing relay combination with a long service life. Supply system monitoring, phase-sequence monitoring, brake control, circuit breaker and protection functions are grouped together in the controller. The various operating states are indicated by the diagnostic LED.

The pin assignment for clockwise direction of rotation (CW) is compatible with that of MSW-1E. The integrated AS-interface connection is compatible with MLK11A.

Available combinations

The following MOVI-SWITCH® AC motors and AC brake motors can be combined with all suitable gear unit types, mounting positions and versions in accordance with the selection tables for gearmotors.

Motor size	Power [HP] with pole number			
	2	4	6	8
DT71D.. (/BMG)/TF/MSW..	0.75	0.50	0.33	0.20
DT80K.. (/BMG)/TF/MSW..	1.0	0.75	0.50	-
DT80N.. (/BMG)/TF/MSW..	1.5	1.0	0.75	0.33
DT90S.. (/BMG)/TF/MSW..	2.0	1.5	1.0	0.50
DT90L.. (/BMG)/TF/MSW..	3.0	2.0	1.5	0.75
DV100M.. (/BMG)/TF/MSW..	4.0	3.0	2.0	1.0
DV100L.. (/BMG)/TF/MSW..	-	4.0	-	1.5

Order information

Note the following points when ordering AC (brake) motors or gearmotors with MOVI-SWITCH®:

- Voltage for winding in ⅄ connection only.
- Only two brake voltages are possible:
  - Motor voltage / $\sqrt{3}$ or
  - motor voltage.
- Position of the terminal box preferably 270°. Please consult SEW-EURODRIVE for other positions.

Block diagram

MSW-1E

Theory of operation of MOVI-SWITCH® MSW-1E:

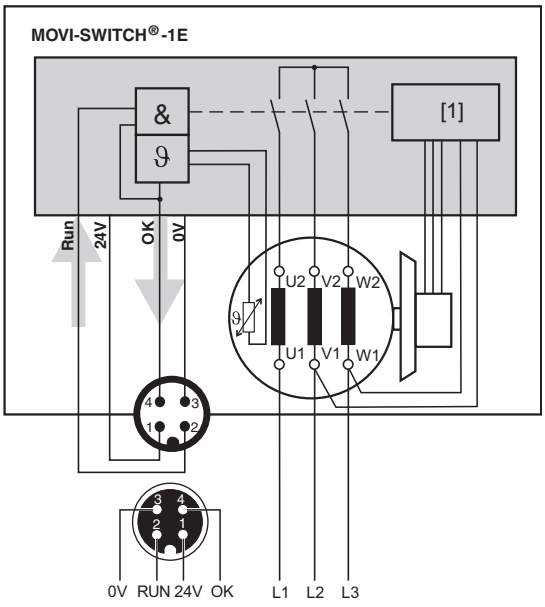


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Figure 75: Block diagram MOVI-SWITCH® MSW-1E

[1] Brake control

MSW-2S with binary control

Theory of operation of MOVI-SWITCH® MSW-2S with binary control:

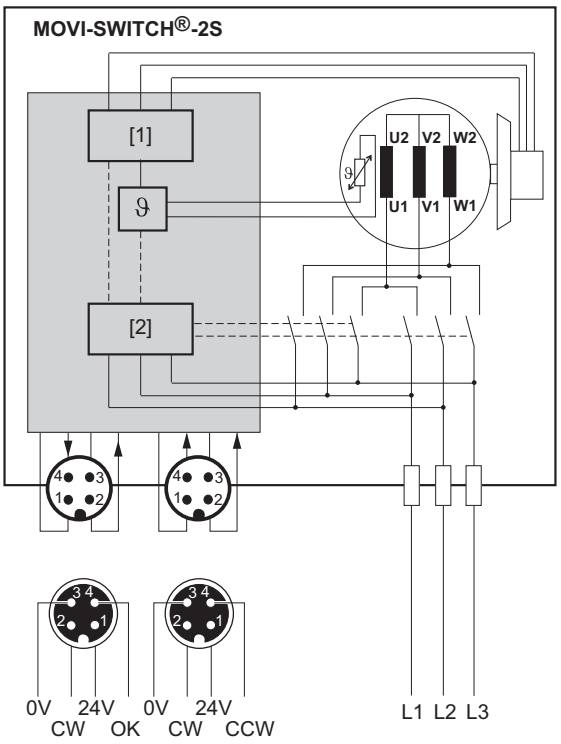

Figure 76: Block diagram MOVI-SWITCH® MSW-2S with binary control

[1] Brake control

[2] Rotating field detection

MSW-2S with AS-interface control

Theory of operation of MOVI-SWITCH® MSW-2S with AS-interface control:

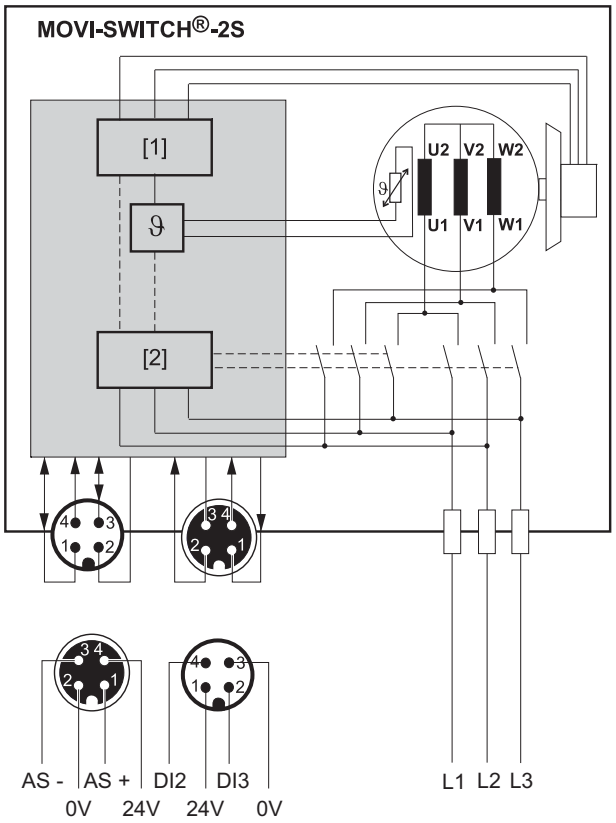

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Figure 77: Block diagram of MOVI-SWITCH® MSW-2S with AS-interface control

[1] Brake control

[2] Rotating field detection

AS AS-interface

7.19 WPU smooth multi-speed unit (→ GM)

Normal mulit-speed motors cannot switch from high to low speed without jerks unless special measures are taken. In order to limit the occurring regenerative braking torque, either the voltage is reduced to a lower value at the moment of changeover through chokes, a transformer or dropping resistors, or only 2-phase switchover takes place. All mentioned measures involve additional installation effort and switchgear. A time relay causes the voltage to return to normal voltage conditions. The relay is adjustable. The WPU unit operates purely electronically.

Function

The changeover command blocks a phase of the mains voltage using a triac and in this way reduces the shifting down torque to about a third. As soon as the synchronous speed of the high-pole winding is reached, the third phase is activated again in a current optimized manner.

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Figure 78: Smooth pole-change unit WPU

Advantages of WPU

- Load independent and wear-free
- No energy loss which means high efficiency
- No restriction on start-up and rated torque and no restriction on the motor starting frequency
- Minimum wiring
- Suitable for any standard motor

Technical data

Type	WPU 1001	WPU 1003	WPU 1010	WPU 2030
Part number	825 742 6	825 743 4	825 744 2	825 745 0
For multi-speed motors with rated current at low speed I_N in S1 continuous running duty	0.2 ... 1 A_{AC}	1 ... 3 A_{AC}	3 ... 10 A_{AC}	10 ... 30 A_{AC}
For mulit-speed motors with rated current at low speed I_N in S3 intermittent periodic duty 40/60% cdf	0.2 ... 1 A_{AC}	1 ... 5 A_{AC}	3 ... 15 A_{AC}	10 ... 50 A_{AC}
Rated supply voltage U_{supply}	2 × 150...500 V_{AC}			
Supply frequency f_{supply}	50/60 Hz			
Rated current in S1 continuous running duty I_N	1 A_{AC}	3 A_{AC}	10 A_{AC}	30 A_{AC}
Ambient temperature ϑ_{Umg}	-15 ... +45°C			
Enclosure	IP20			
Weight	0.66 lb	0.66 lb	1.32 lb	3.31 lb
Mechanical design	DIN rail housing with screw connections			Control cabinet rear panel

8 Project Planning for AC Motors with Inverter

8.1 Operation on inverter

Range of products

The extensive product range of SEW-EURODRIVE inverters is available for designing electronically controlled drives. SEW-EURODRIVE offers the following inverter series:

- **MOVITRAC® B:** Compact and inexpensive frequency inverter for the power range 0.3-175HP. Single-phase and three-phase supply connection for 230 V_{AC} and three-phase supply connection for 460 V_{AC}.
- **MOVIDRIVE® MDX60/61B:** High-performance drive inverter for dynamic drives in the power range 0.75-175HP. Great diversity of applications due to extensive-expansion options with technology and communication options. Three phase supply connection for 230 V_{AC} and 460 V_{AC}

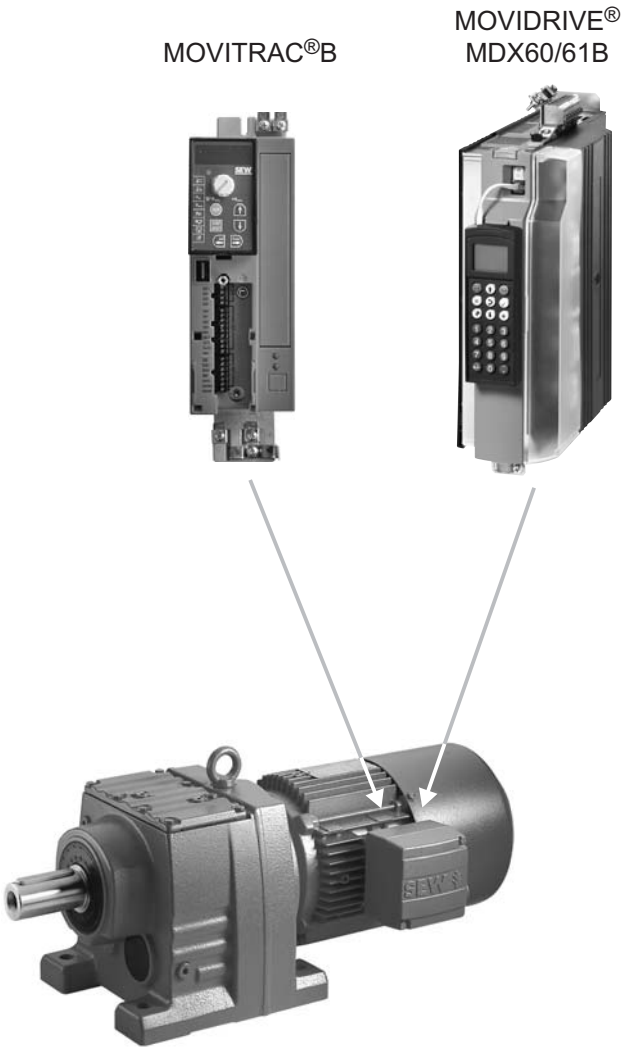


Figure 79: Range of inverters for AC motors

Product characteristics

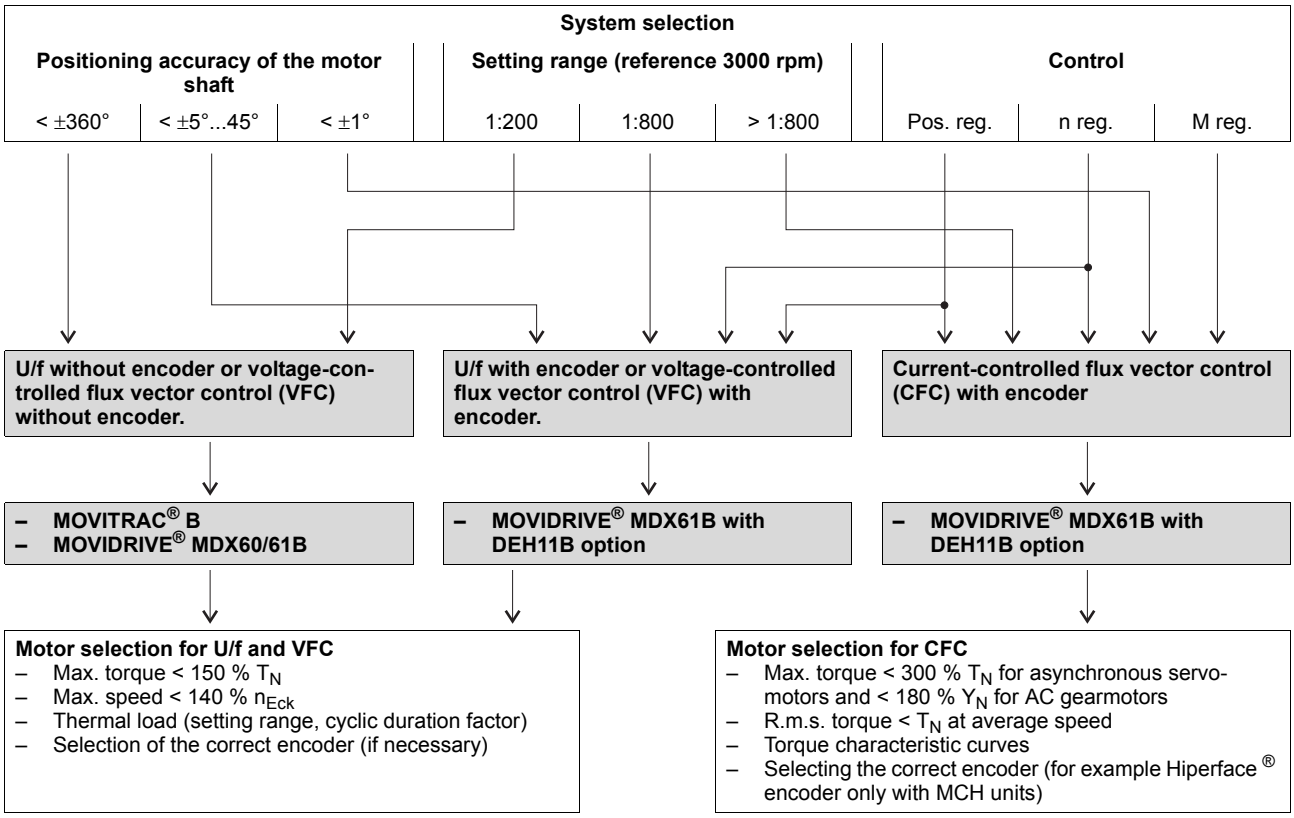
The following table lists the most important product characteristics for the various inverter series. The overview of product characteristics can help you to choose the suitable inverter series for your application.

Product characteristics	MOVITRAC® B	MOVIDRIVE® MDX60/61B
Voltage range	1 × 200 ... 240 V_{AC} (limited power range) 3 × 200 ... 240 V_{AC} (limited power range) 3 × 380 ... 500 V_{AC}	3 × 200 ... 240 V_{AC} (limited power range) 3 × 380 ... 500 V_{AC}
Power range	0.3-175HP	0.75-175HP
Overload capacity	150% I_N[1] briefly and 125% I_N permanently during operation without overload	
4Q capable	Yes, with integrated brake chopper as standard.	
Integrated line filter	At 1 × 200 ... 240 V_{AC}: according to class B limit At 3 × 200 ... 240 V_{AC} und 3 ×380 ... 500 V_{AC}: sizes 0, 1 and 2 according to class A limit	Sizes 0, 1 and 2 according to class A limit
TF input	Yes	
Control mode	U/f or voltage-controlled flux vector control (VFC)	U/f or voltage-controlled flux vector control (VFC), with speed feedback speed control and current-controlled flux vector control (CFC).
Speed feedback	No	Option
Integrated positioning and sequence control system	No	Standard
Serial interfaces	System bus (SBus) and RS-485	
Fieldbus interfaces	Optional via gateway PROFIBUS, INTERBUS, CANopen, DeviceNet, Ethernet	Optional PROFIBUS-DP, INTERBUS, INTERBUS LWL, CANopen, DeviceNet, Ethernet
Technology options	IEC 61131 control	Input/output card Synchronous operation Absolute encoder card IEC 61131 control
Safe stop	Yes	Yes
Approvals	UL and cUL approval, C-tick	

1) Only for MOVIDRIVE® MDX60/61B: The short-time overload capacity is 200% I_N for units of size 0 (0005 ...0014).

8.2 Drive properties

The required drive properties are the main factors determining the selection of the inverter. The following illustration serves as assistance for inverter selection.

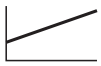


Key

Pos. reg.	= Positioning control
n reg.	= Speed control
T reg.	= Torque control
VFC	= Voltage flux control
CFC	= Current flux control
T_N	= Rated torque of the motor
n_{trans}	= Rated speed (transition speed) of the motor

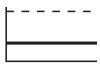
8.3 Selecting the inverter

Drive categories The large number of different drive applications can be divided into five categories. The five categories are listed below together with the recommended inverter. The assignment is based on the required setting range and the resulting control process.



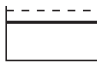
1. Drives with a base load and a speed dependent load, such as conveyor drives.

- Low requirements on the setting range.
  - MOVITRAC® B
  - MOVIDRIVE® MDX60/61B
- High requirements on the setting range (motor with encoder).
  - MOVIDRIVE® MDX61B with DEH11B option



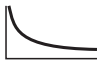
2. Dynamic load, e.g. trolleys; brief high torque demand for acceleration followed by low load.

- Low requirements on the setting range.
  - MOVITRAC® B
  - MOVIDRIVE® MDX60/61B
- High requirements on the setting range (motor with encoder).
  - MOVIDRIVE® MDX61B with DEH11B option
- High dynamic properties required (motor with encoder, preferably sin/cos encoder).
  - MOVIDRIVE® MDX61B with DEH11B option



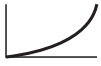
3. Static load, e.g. hoists; mainly steady high static load with overload peaks.

- Low requirements on the setting range.
  - MOVITRAC® B
  - MOVIDRIVE® MDX60/61B
- High requirements on the setting range (motor with encoder).
  - MOVIDRIVE® MDX61B with DEH11B option



4. Load falling in inverse proportion to speed, e.g. winding or coil drives.

- Torque control (motor with encoder, preferably sin/cos encoder).
  - MOVIDRIVE® MDX61B with DEH11B option



5. Variable torque load, e.g. fans and pumps.

- Low load at low speeds and no load peaks, 125% utilization (I_D = 125% I_N).
  - MOVITRAC® B
  - MOVIDRIVE® MDX60/61B

Further selection criteria

- Power range
- Communication options (serial interfaces, fieldbus)
- Expansion options (such as synchronous operation)
- PLC functionality (IPOS$^{plus®}$, application modules)

Additional documentation

For detailed information and additional project planning instructions on the individual inverter series, refer to the manuals and catalogs of electronically controlled drives. The SEW-EURODRIVE homepage (http://www.seweurodrive.com) provides links to a wide selection of our documentation in various languages for download as PDF files.

Electronics documentation

Other documents that are of interest in terms of project planning are given below. You can order these publications from SEW-EURODRIVE.

- MOVITRAC® B system manual
- MOVIDRIVE® MDX60/61B system manual

Motor selection

Note the thermally approved torque when selecting the motor. Section 14.3 lists the torque limiting curves of 4-pole asynchronous AC motor DR, DT, DV. Use these limiting curves to determine the thermally approved torque.

8.4 Torque limit curves with inverter operation

Thermally approved torque

Note thermally approved torque in project planning for operation of DR, DT, DV asynchronous AC motors with frequency inverter. The following factors determine the thermally permitted torque:

- Duty type
- Type of cooling: Self-ventilation or forced cooling
- Base frequency f_{base} = 60 Hz (460 V ⅄) or f_{base} = 120Hz (230 ⅄⅄

Use the torque limit curves to determine the thermally permitted torque. The projected, effective torque has to be less than the limit curve value. The following illustration shows the limit curves for 4-pole DR, DT, DV asynchronous AC motors with f_{base} = 60 Hz and f_{base} = 120 Hz. The following peripheral conditions apply to the shown limit curves:

- Duty type S1
- Supply voltage of the inverter $U_{supply} = 3 \times 460\ V_{AC}$
- Motor in thermal class F

f_{base} = 60 Hz (460 V ⅄/60 Hz)

The following diagram shows the limit curves for operation at f_{base} = 60 Hz. The curves are different for those motors with self-ventilation and those with forced cooling (= optional forced cooling fan).

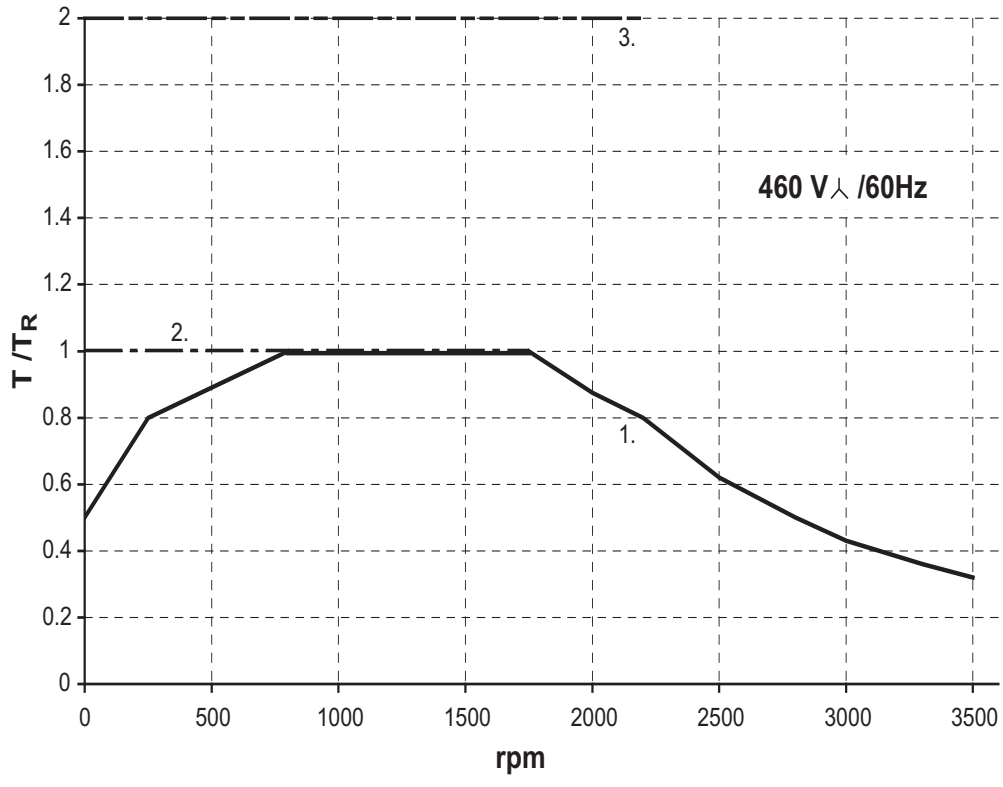


Figure 80: Torque limit curves for f_{base} = 60 Hz

1. S1 operation with self-ventilation (= without forced cooling fan)
2. S1 operation with forced cooling (= with forced cooling fan)
3. Mechanical limitations for gearmotors

f_{base} = 120 Hz (230 V ⅄⅄/60 Hz)

The following diagram shows the limit curves for operation at f_{base} = 120 Hz. The curves are different for those motors with self-ventilation and those with forced cooling (= optional forced cooling fan).

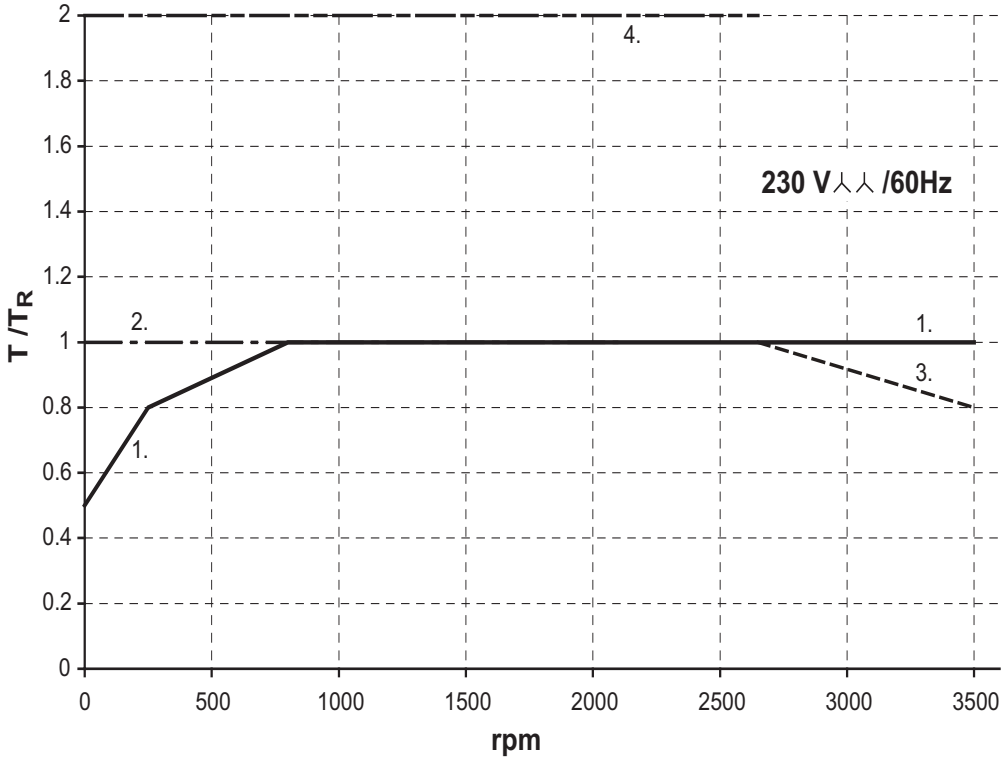


Figure 81: Torque limit curves for f_{base} = 120 Hz

1. S1 operation with self-ventilation (= without forced cooling fan)
2. S1 operation with forced cooling (= with forced cooling fan)
3. S1 operation with self-ventilation (+without forced cooling fan)>160M
4. Mechanical limitations for gearmotors

9 Mounting Positions and Important Order Information

9.1 General information on mounting positions

Mounting position designation

SEW-EURODRIVE differentiates between six mounting positions M1 ... M6 for gear units, gearmotors and MOVIMOT® gearmotors . The following figure shows the position of the gear unit in mounting positions M1 ... M6.

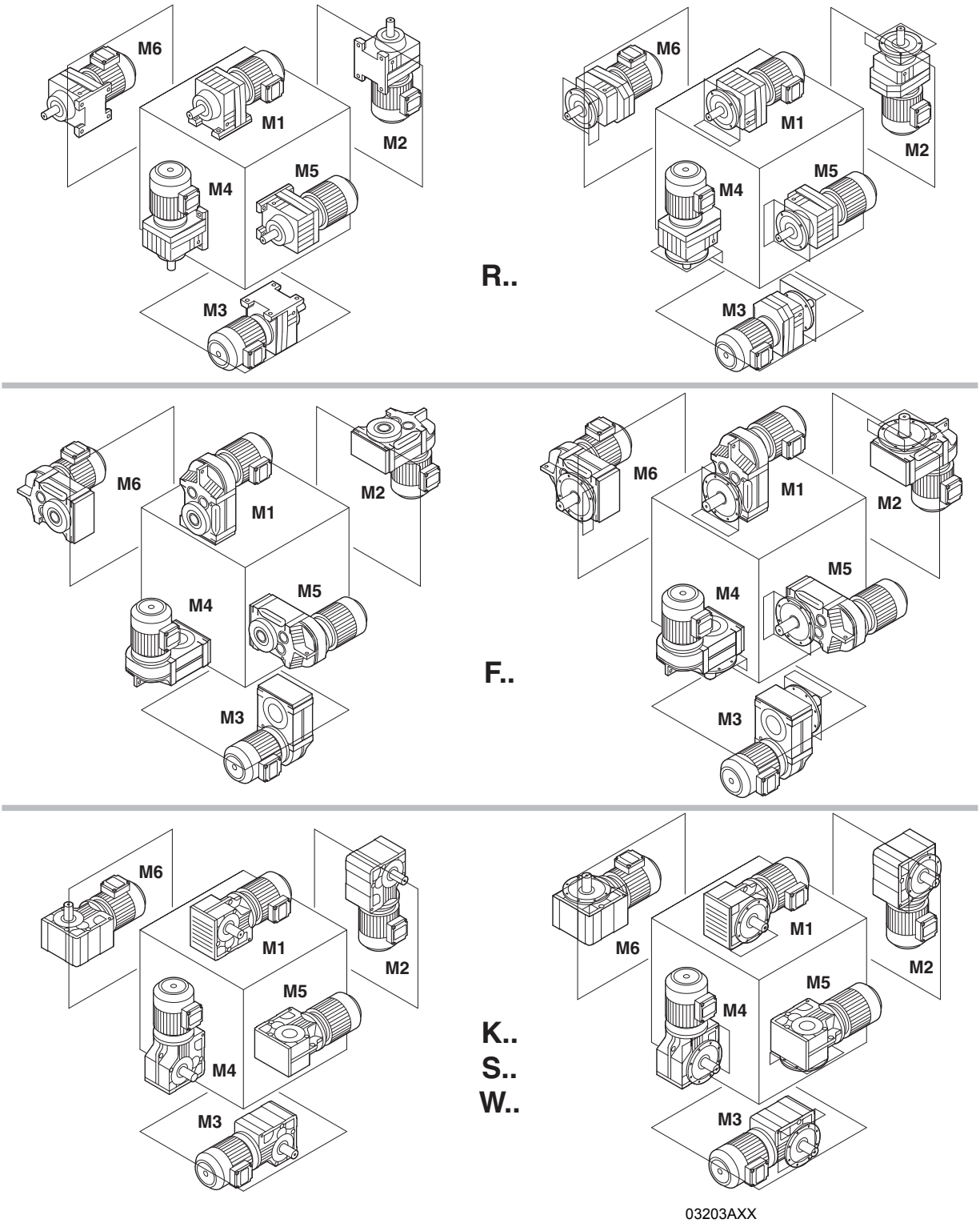


Figure 82: Depiction of mounting positions M1 ... M6

9.2 Important order information

The following order information is required for R, F, K and S gear units and gearmotors in addition to the mounting position to exactly determine the design of the drive.

This information is also required for Spiroplan® gearmotors (W gearmotors) that do not depend on a particular mounting position.

The following applies to all gear units and gearmotors

Observe the following notes for all gear units, gearmotors and MOVIMOT® gearmotors from SEW-EURODRIVE.

Direction of rotation of the output with a backstop

If the drive has a backstop RS, you have to indicate the direction of rotation of the output for the drive. The following definition applies:

As viewed at the output shaft: Clockwise (CW) = Rotating clockwise
Counterclockwise (CCW)= Rotating counterclockwise

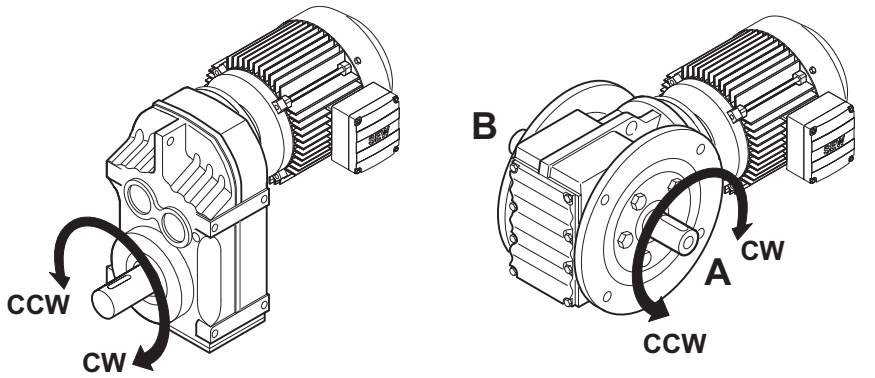


Figure 83: Direction of rotation of output

In right-angle gear units, you also have to indicate whether the direction of rotation is given looking onto the A or B end.

Position of the output shaft and output flange

In right-angle gear units, you also have to indicate the position of the output shaft and the output flange:

- A or B or AB (→ Figure 84)

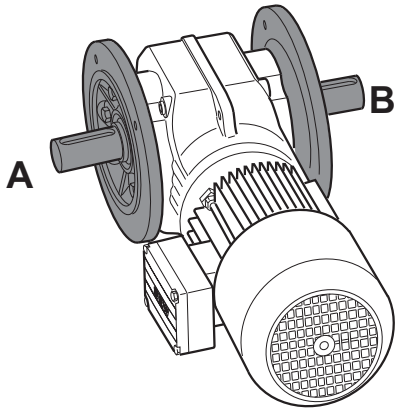


Figure 84: Position of the output shaft and the output flange

Position of output end in right-angle gear units

In shaft mounted right-angle gear units with a shrink disc, you also have to indicate whether the A or B end is the output end. In Figure 85, the A end is the output end. The shrink disc is located opposite the output end.

In shaft mounted right-angle gear units, the "output end" is equivalent to the "shaft position" of right-angle gear units with solid shaft.

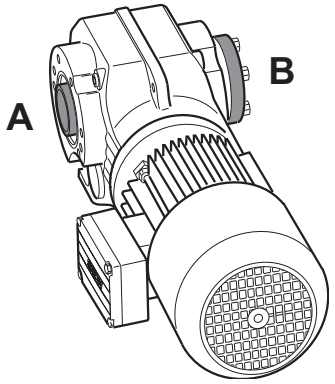


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Figure 85: Position of the output end

You will find the permitted mounting surfaces (= hatched area) in the mounting position sheets (page 156 and the following pages).

Example: Only the mounting surface at the bottom is possible with helical-bevel gear units K167/K187 in mounting positions M5 and M6.

For all gearmotors

Observe the following notes for all gearmotors and MOVIMOT® gearmotors from SEW-EURODRIVE.

Position terminal box and cable entry

The position of the motor terminal box has so far been specified indicated with 0°, 90°, 180° or 270° as viewed onto the fan guard = B-end (→ Figure 86). A change in the product standard EN 60034 specifies that the following designations will have to be used for terminal box positions for foot-mounted motors in the future:

- As viewed onto the output shaft = A-end
- Designation as R (right), B (bottom), L (left) and T (top)

This new designation applies to foot-mounted motors without a gear unit in mounting position B3 (= M1). The previous designation is retained for gearmotors. Figure 86 shows both designations. Where the mounting position of the motor changes, R, B, L and T are rotated accordingly. In motor mounting position B8 (= M3), T is at the bottom.

The position of the cable entry can be selected as well. The positions are "X" (= standard position), "1", "2" or "3" (→ Figure 86).

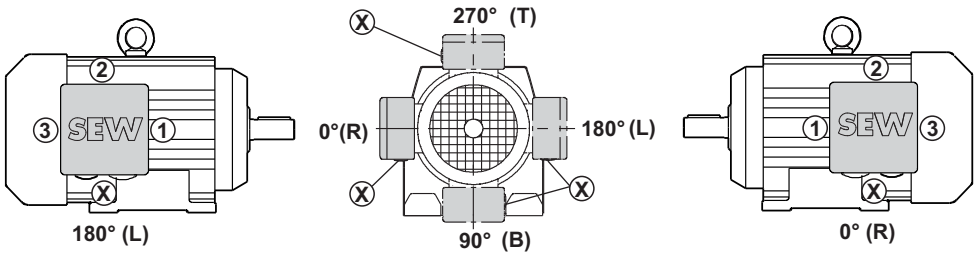

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Figure 86: Position of terminal box and cable entry

Unless indicated otherwise, you will receive the terminal box type 0° (R) with cable entry "X". We recommend selecting cable entry "2" with mounting position M3.

- **When the terminal box is in the 90° (B) position**, check to see if the gearmotor has to be supported.
- **Only** cable entries **"X"** and **"2"** are possible for **DT56 and DR63** motors. **Exception: Cable entry "3"** is also possible for DR63 **with IS plug connector.**
- The following cable entries are possible in the **DT71..BMG** motor with gear unit flange diameters 160 mm and 200 mm:

Terminal box position	0° (R)	90° (B)	180° (L)	270° (T)
Possible cable entries	"X", "3"	"X", "1", "3"	"1", "2"	"X", "1", "3"

Applies to all MOVIMOT® gearmotors

The following information applies to MOVIMOT® gearmotors in addition to the gearmotors.

Position terminal box and cable entry

Position of the terminal box (MOVIMOT® inverter):

Not all positions are possible with MOVIMOT® gearmotors. Note the information in section "Position of the terminal box (MOVIMOT® inverter)" on page 180.

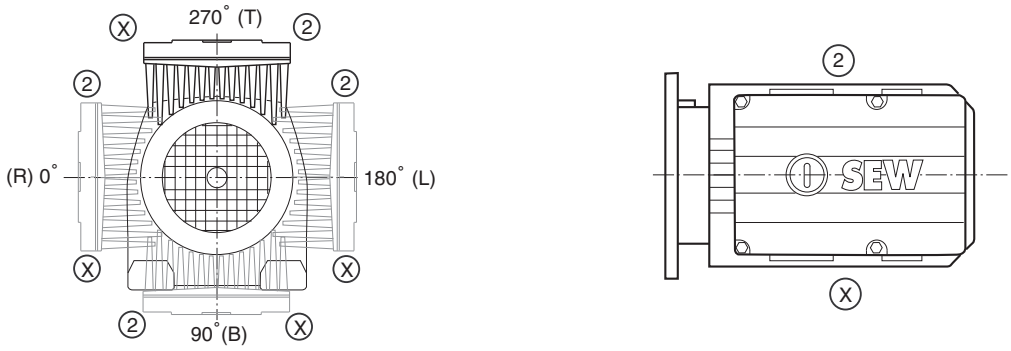
Position of the cable entry:

You do not have to select the position of the cable entry for MOVIMOT® gearmotors. Positions "X" (= standard position) and position "2" are always possible (see Figure 87).

Position of plug connectors options:

You will have to select the position for MOVIMOT® optional plug connectors (e.g. ASA3) (see Figure 87).

Not all position are possible. See the notes in the section "Mounting Positions, Technical Data and Dimension Sheets MOVIMOT®".



50947AXX

Figure 87: Position terminal box and cable entry, plug connectors

Sample orders

Type (Examples)	Mounting position	Shaft position	Flange position	Terminal box position	Position of cable entry	Direction of rotation of output
K47../RS	M2	A	-	0°	"X"	CW
SF77DV100L4	M6	AB	AB	90°	"3"	-
KA97DV132M4	M4	B	-	270°	"2"	-
KH107DV160L4	M1	A	-	180°	"3"	-
WF20DT71D4	-	A	A	0°	"X"	-
KAF67A	M3	A	B	-	-	-

Change in mounting position

Make sure to read the following information when you operate the gearmotor in a mounting position other than the one indicated in the order:

- Adjust lubricant fill quantity to match the new mounting position
- Adjust position of breather valve
- For helical-bevel gearmotors: Contact the SEW-EURODRIVE customer service prior to changing to mounting position M5 or M6 and when changing from M5 to M6 or vice versa.
- For helical-worm gearmotors: Contact the SEW-EURODRIVE customer service when changing to mounting position M2.

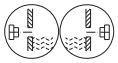
9.3 Key to the mounting position sheets

Spiroplan® gearmotors do not depend on any particular mounting position. However, mounting positions M1 to M6 are also shown for SPIROPLAN® gearmotors to assist you in working with this documentation.

Important: Spiroplan® gearmotors cannot be equipped with breather valves, oil level plugs or drain plugs.

Symbols used

The following table shows the symbols used in the mounting position sheets and their meaning:

Symbol	Meaning
	Breather valve
	Oil level plug
	Oil drain plug

Churning losses

* → page 45

Churning losses may occur in some mounting positions. Contact SEW-EURODRIVE in case of the following combinations:

Mounting position	Gear unit type	Gear unit size	Input speed [1/min]
M2, M4	R	97 ... 107	> 2500
		> 107	>1500
M2, M3, M4, M5, M6	F	97 ... 107	> 2500
		> 107	> 1500
	K	77 ... 107	> 2500
		> 107	> 1500
	S	77 ... 97	> 2500

Displayed shaft

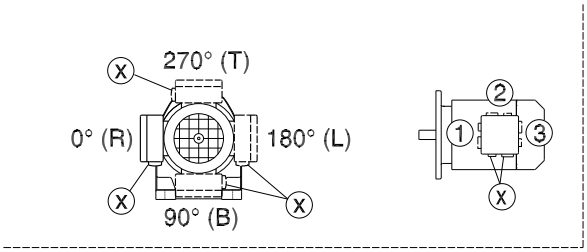
Note the following information regarding display of shafts in the mounting position sheets:

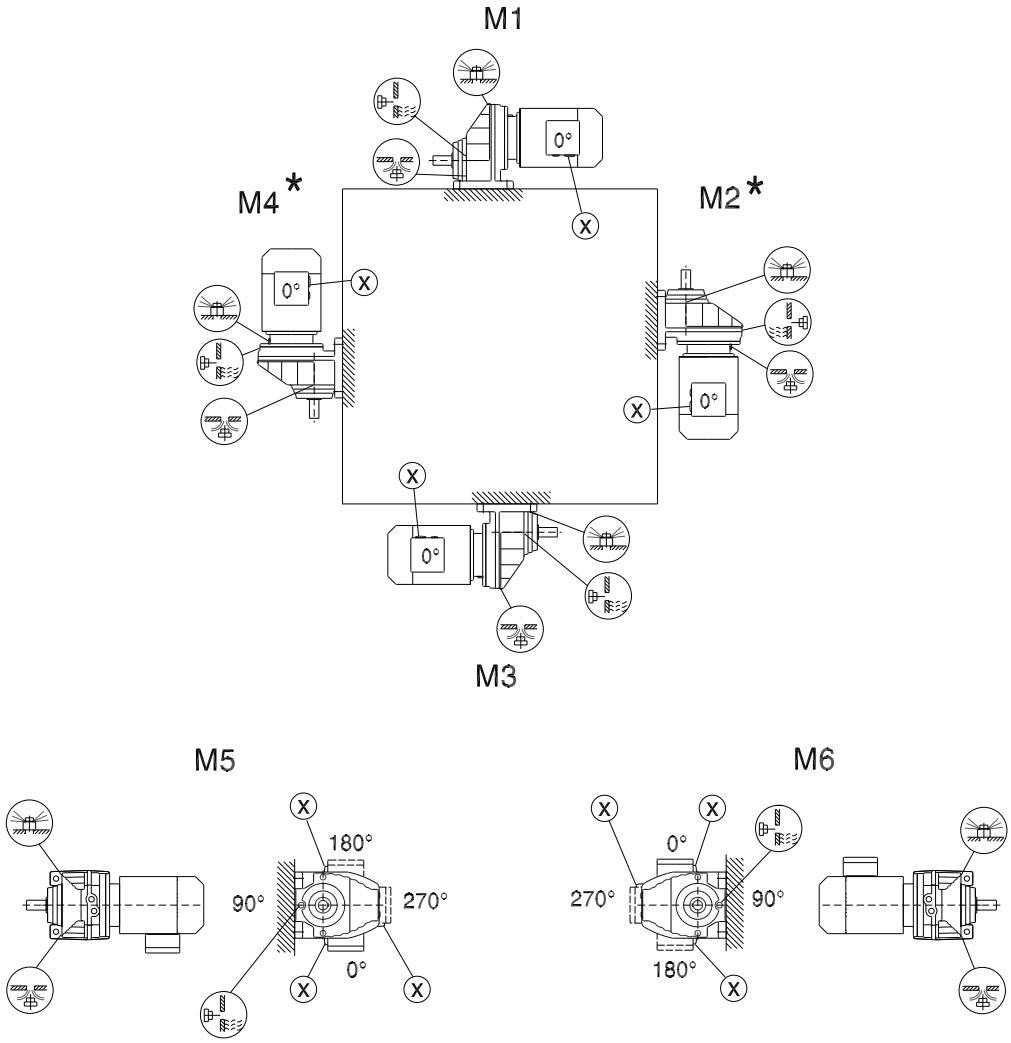
- **For gear units with solid shaft:** The displayed shaft is always on the A end.
- **For shaft mounted gear units:** The shaft with dashed lines represents the customer shaft. The output end (≙ shaft position) is always shown on the A end.

9.4 Mounting positions of helical gearmotors

RX57-RX107

04 043 02 00

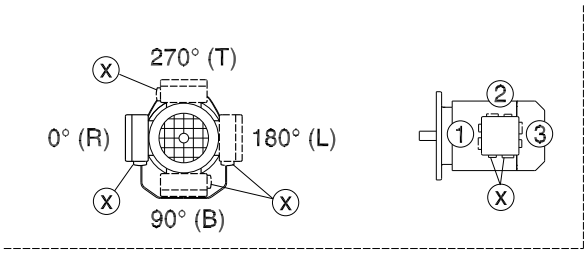


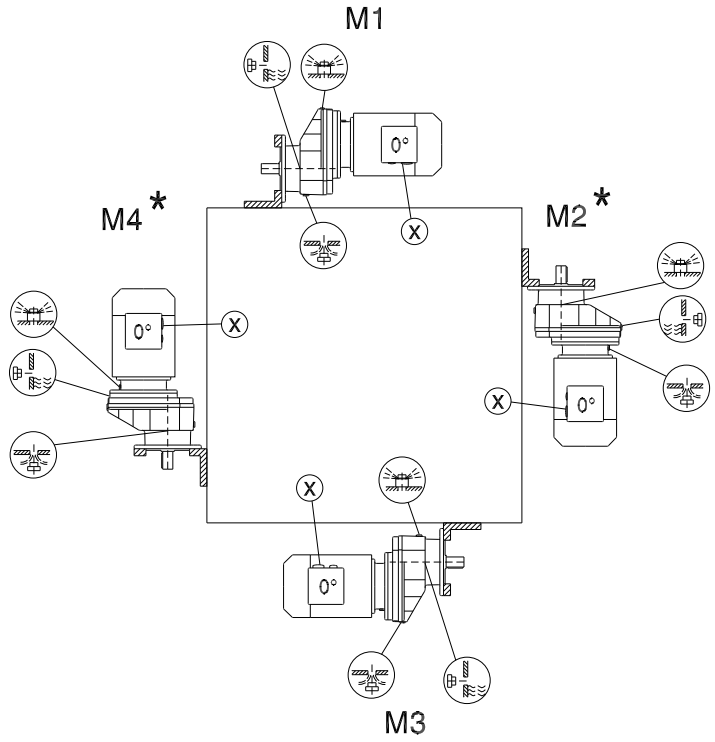


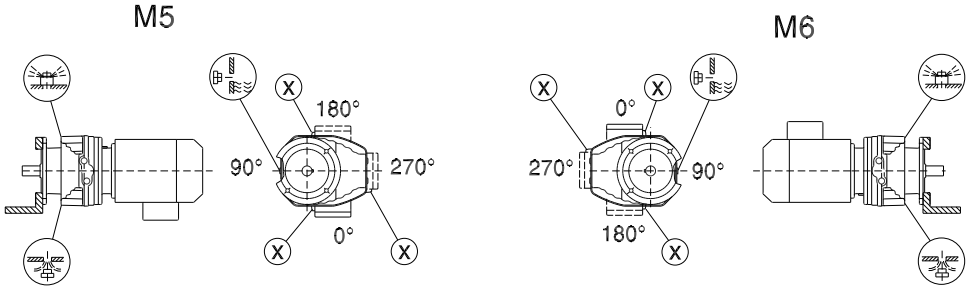
* → page 155

RXF57-RXF107

04 044 02 00



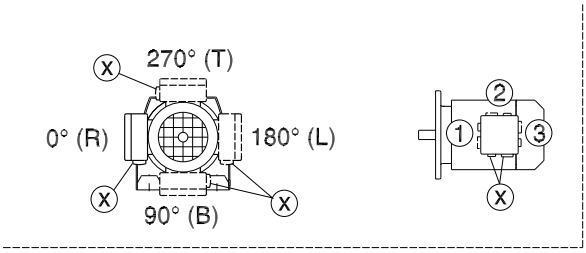


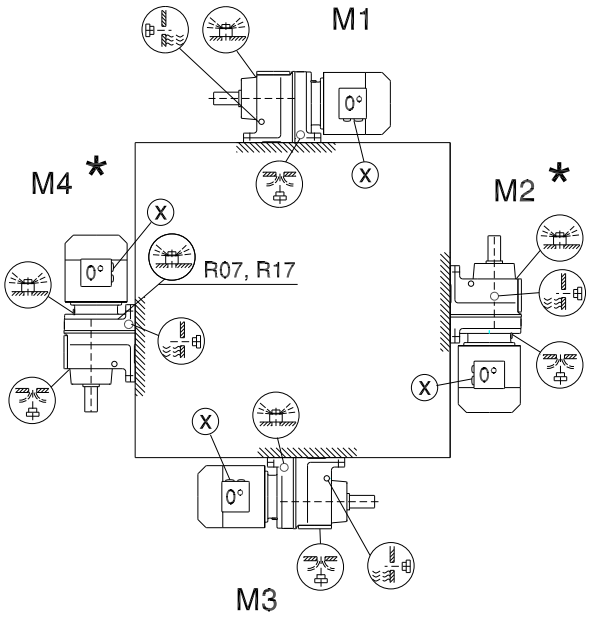


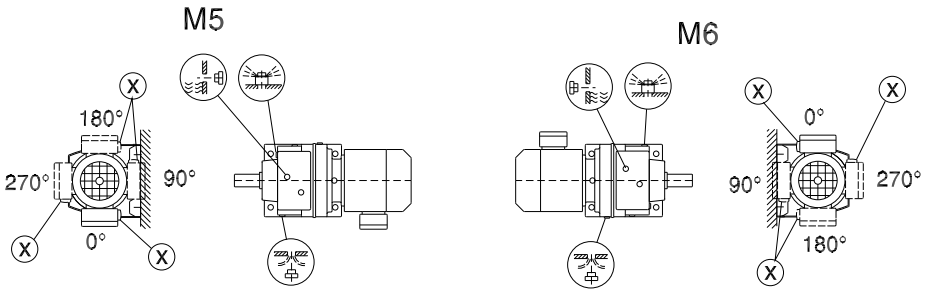
* → page 155

R07-R167

04 040 03 00





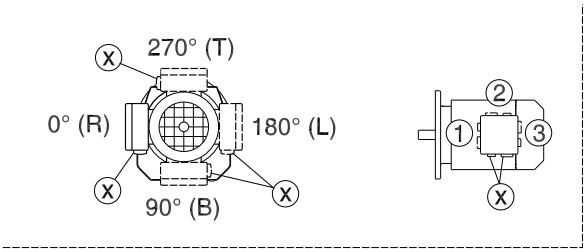


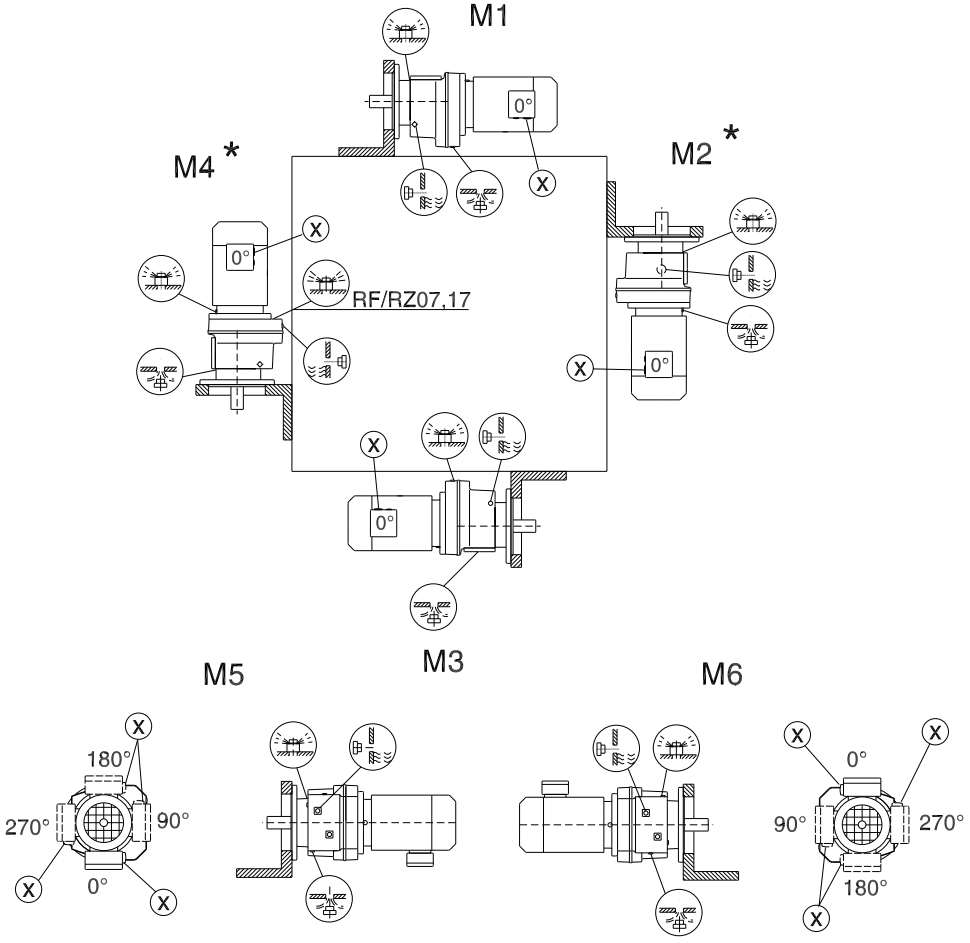
R07		M1, M2 , M3 , M5 , M6
R17, R27		M1, M3 , M5 , M6
R07, R17, R27		
R47, R57		M5

* → page 155

RF07-RF167, RZ07-RZ87

04 041 03 00



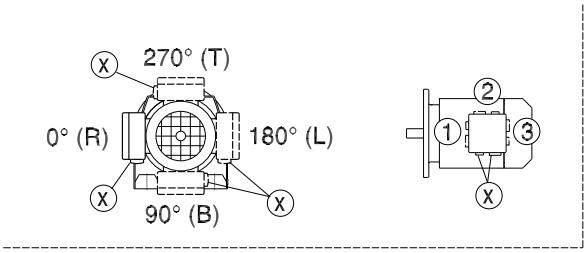


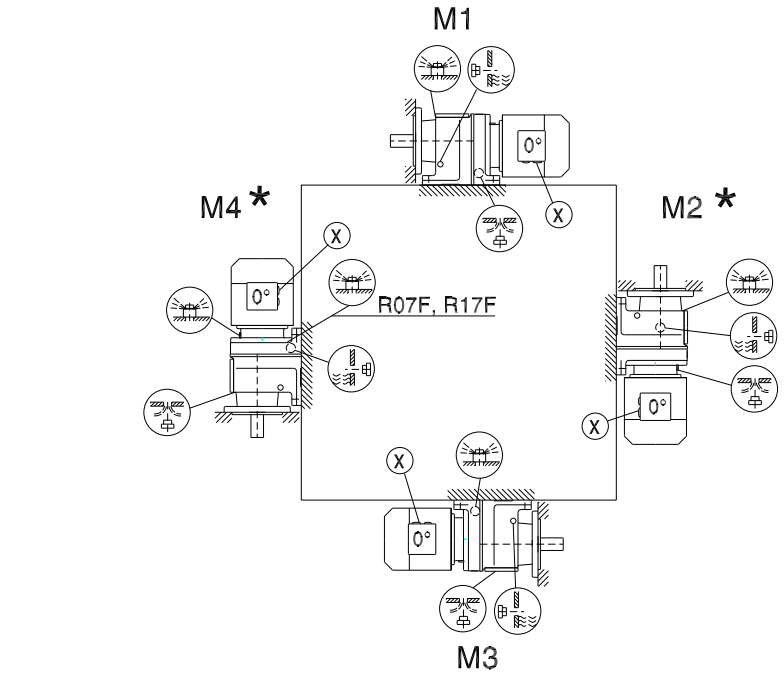
RF/RZ07		M1, M2 , M3 , M5 , M6
RF/RZ17,27		M1, M3 , M5 , M6
RF/RZ07, 17, 27		
RF/RZ47, 57		M5

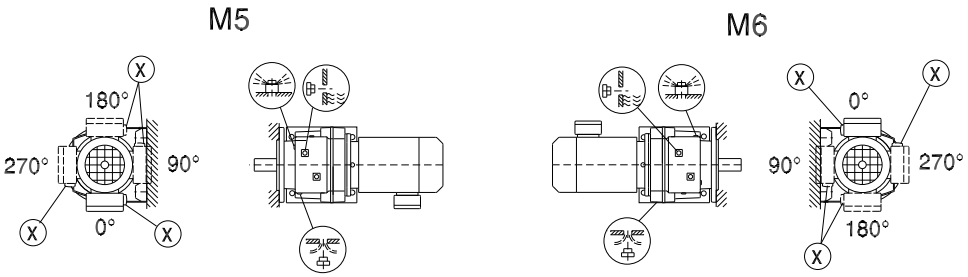
* → page 155

R07F-R87F

04 042 03 00







R07F	M1, M2 , M3 , M5 , M6
R17F, R27F	M1, M3 , M5 , M6
R07F, R17F, R27F	
R47F, R57F	M5

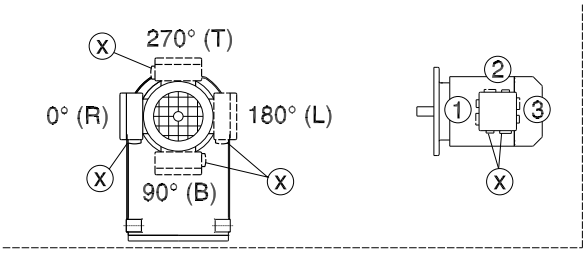
* → page 155

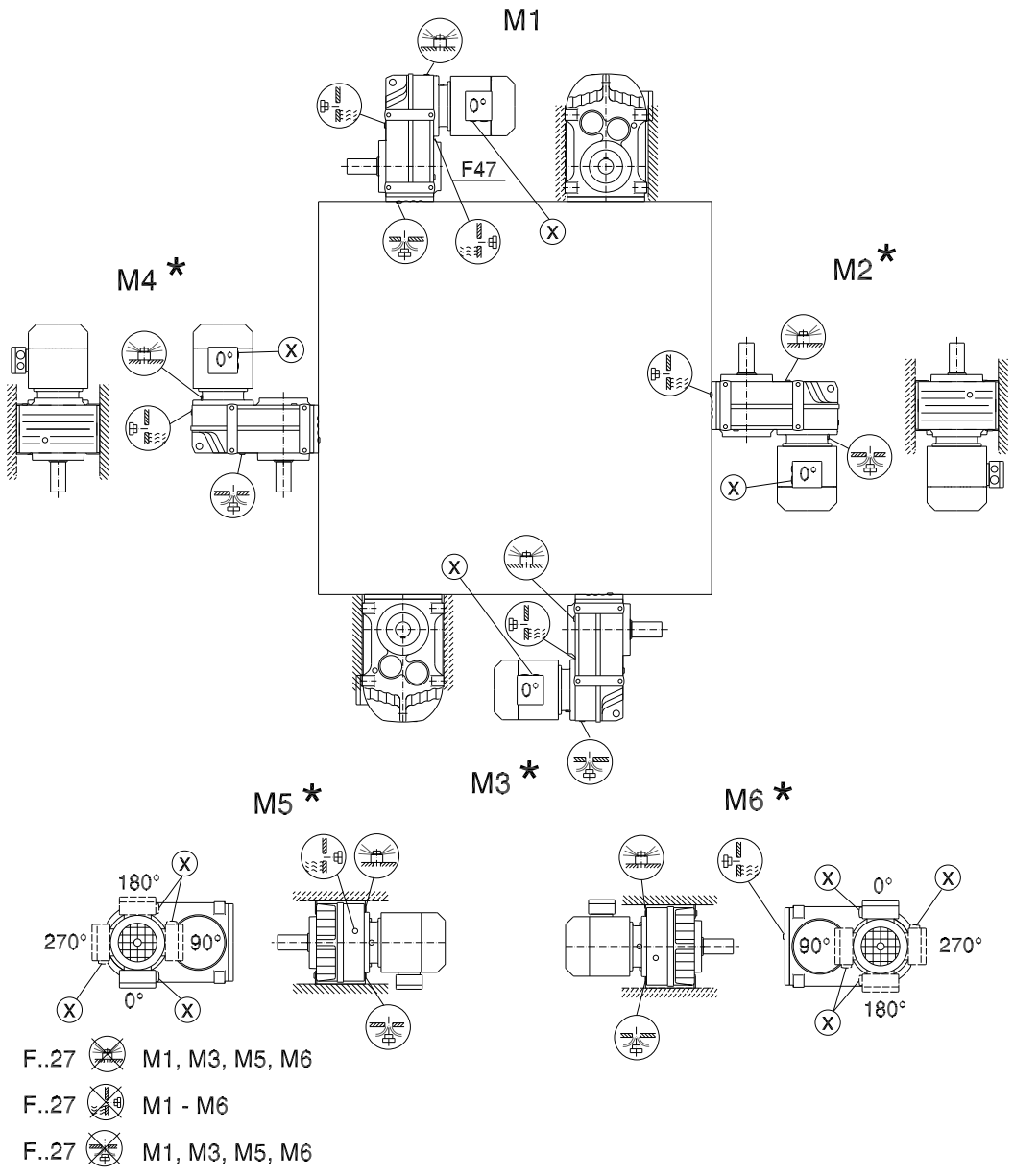
Important: See the (i) information in the section "Project Planning for Gear Units/Overhung and axial loads" (page 51).

9.5 Parallel shaft helical gearmotors

F/FA..B/FH27B-157B, FV27B-107B

42 042 03 00





F..27 M1, M3, M5, M6

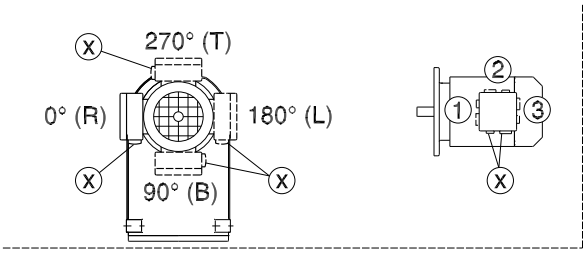
F..27 M1 - M6

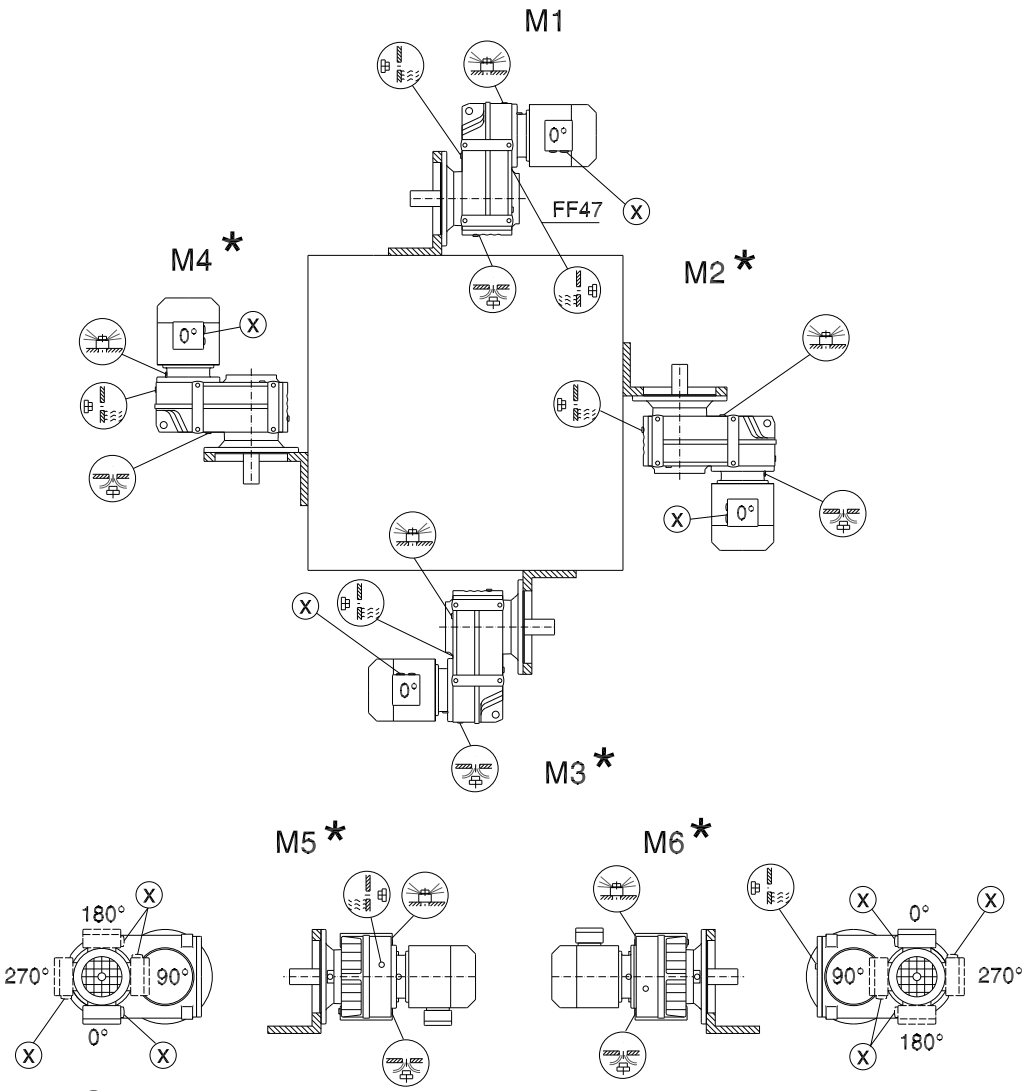
F..27 M1, M3, M5, M6

* → page 155

FF/FAF/FHF/FAZ/FHZ27-157, FVF/FVZ27-107

42 043 03 00





F..27 M1, M3, M5, M6

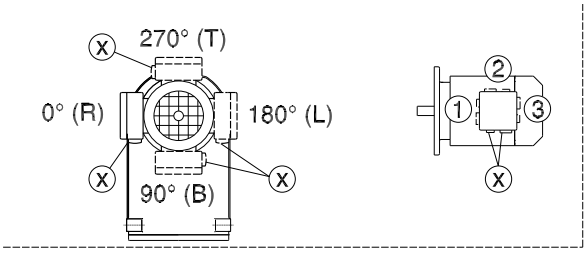
F..27 M1 - M6

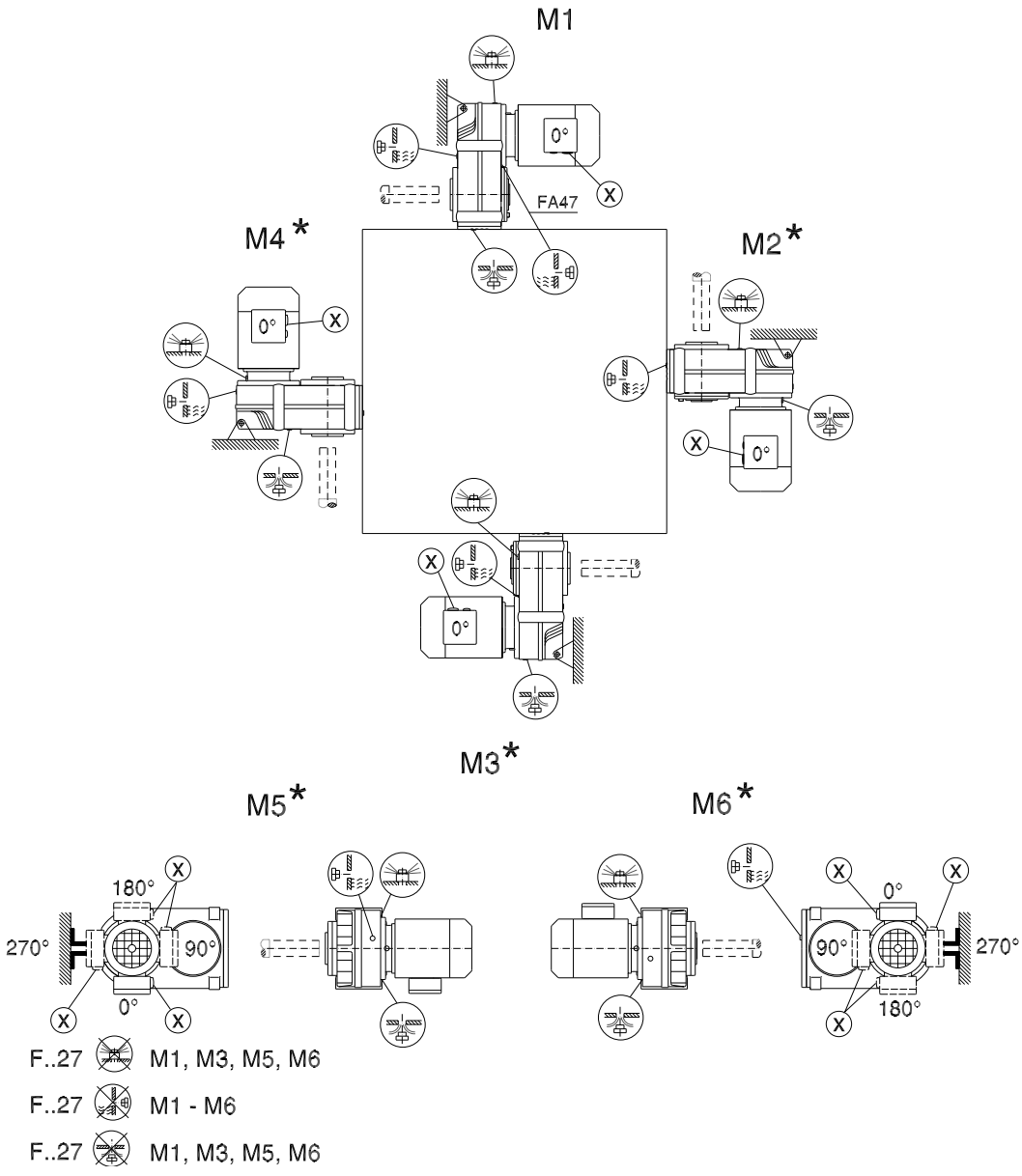
F..27 M1, M3, M5, M6

* → page 155

FA/FH27-157, FV27-107, FT37-97

42 044 03 00



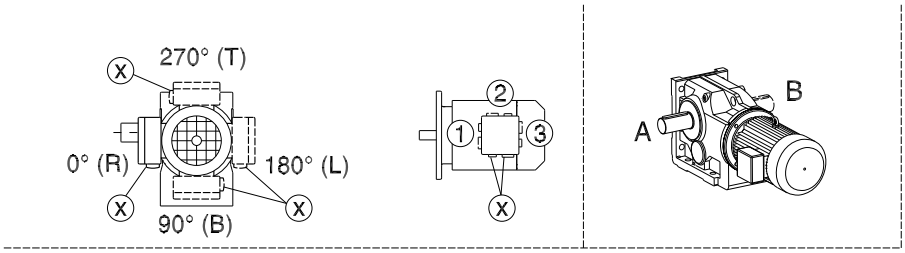


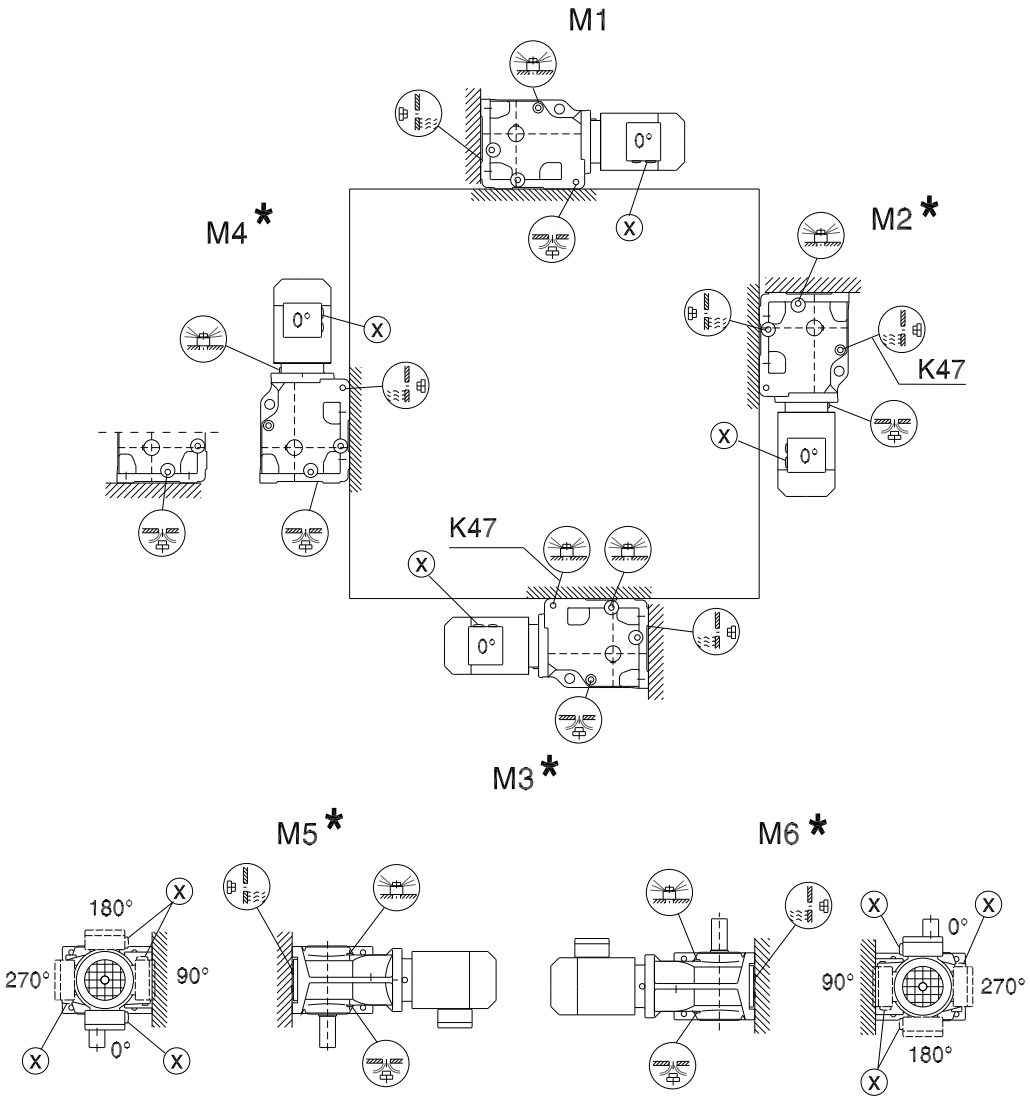
* → page 155

9.6 Mounting positions of helical-bevel gearmotors

K/KA..B/KH37B-157B, KV37B-107B

34 025 03 00



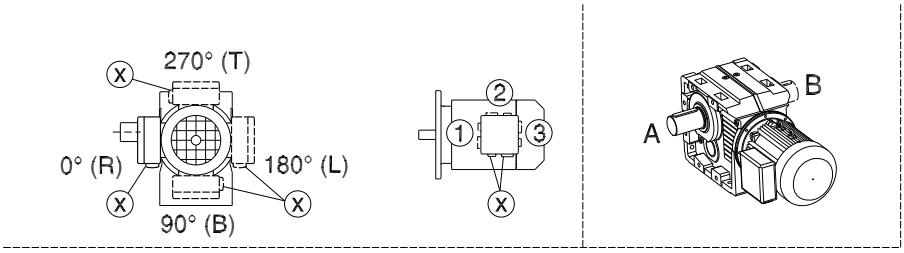


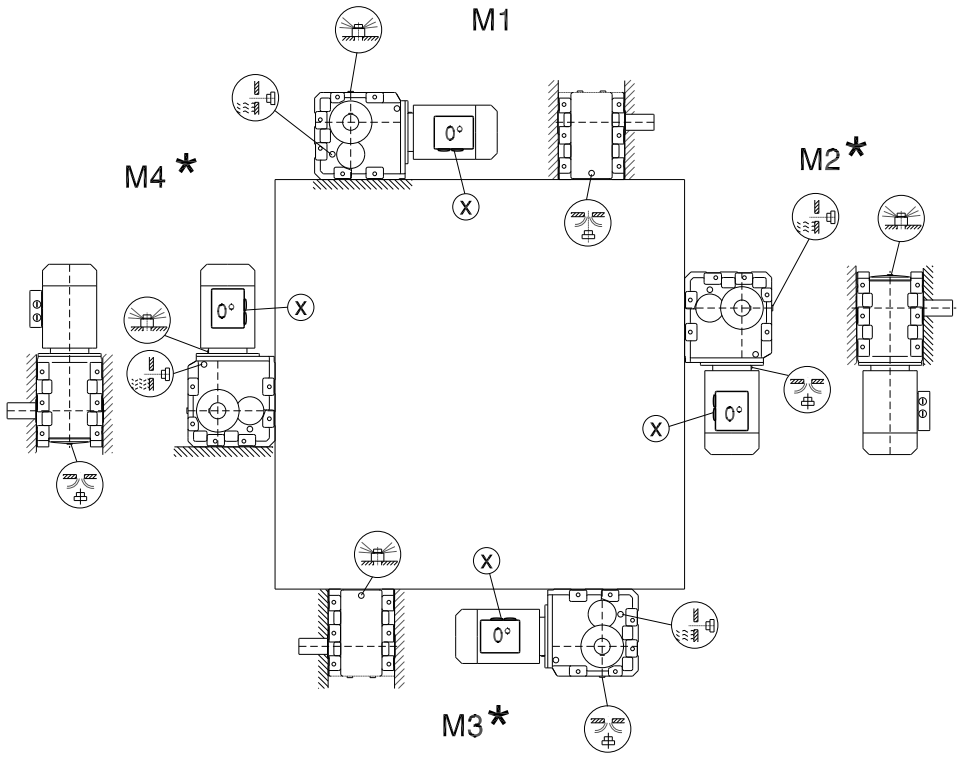
* → page 155

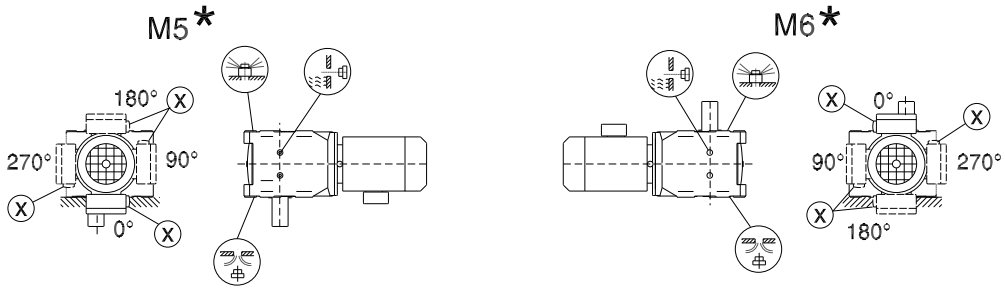
Important: See the (i) information in the section "Project Planning for Gear Units/Overhung and axial loads" (page 51).

K167-187, KH167B-187B

34 026 03 00





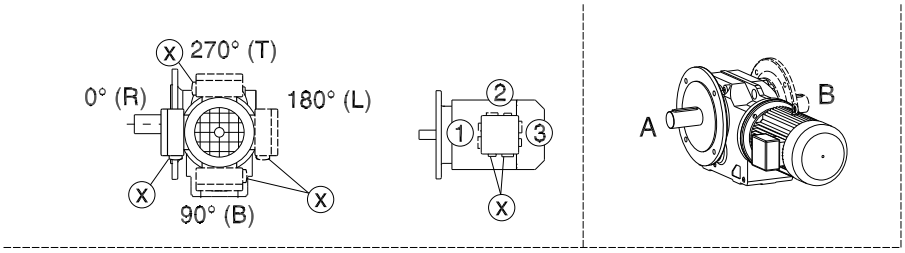


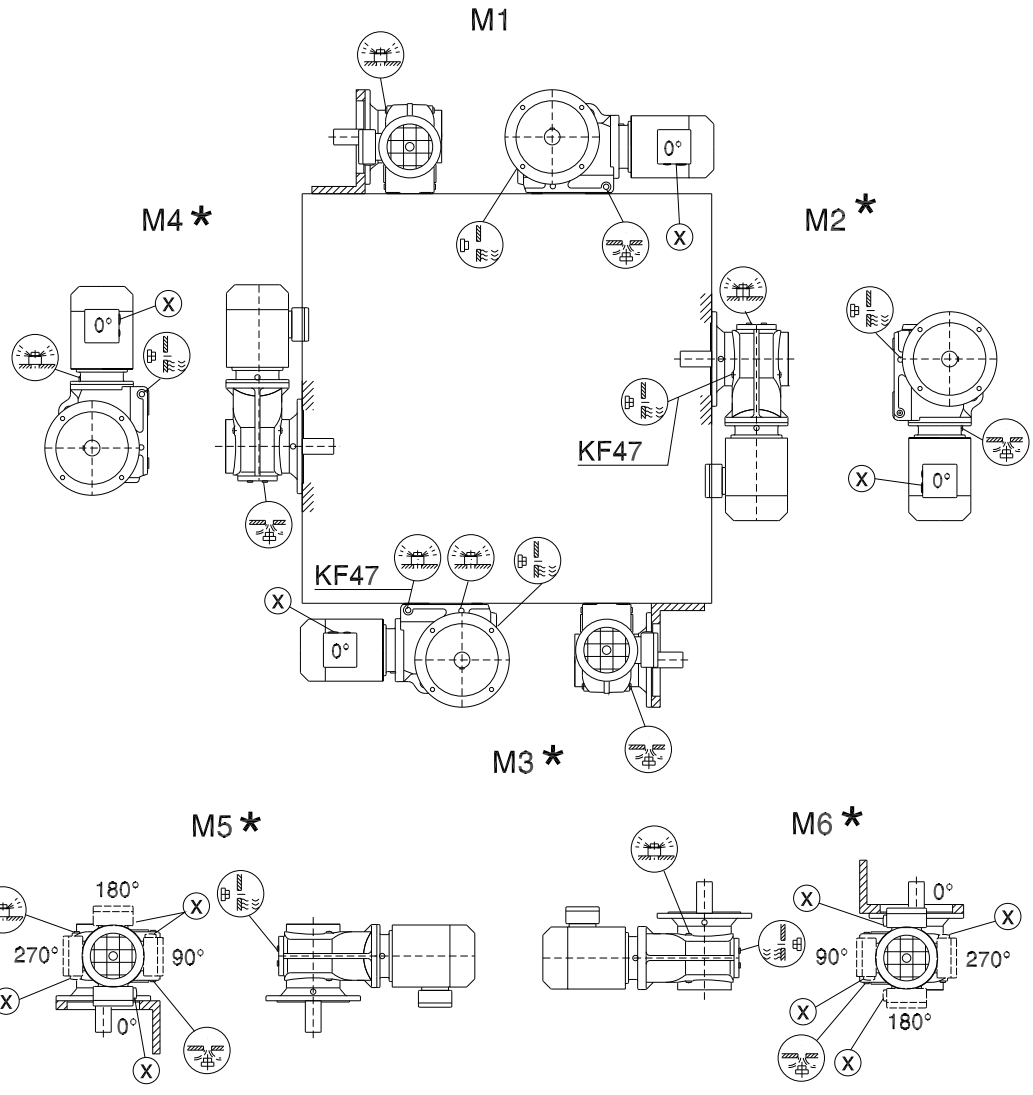
* → page 155

Important: See the (i) information in the section "Project Planning for Gear Units/Overhung and axial loads" (page 51).

KF/KAF/KHF/KAZ/KHZ37-157, KVF/KVZ37-107

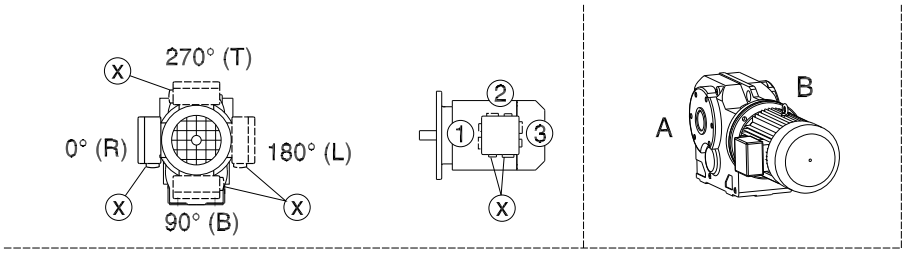
34 027 03 00

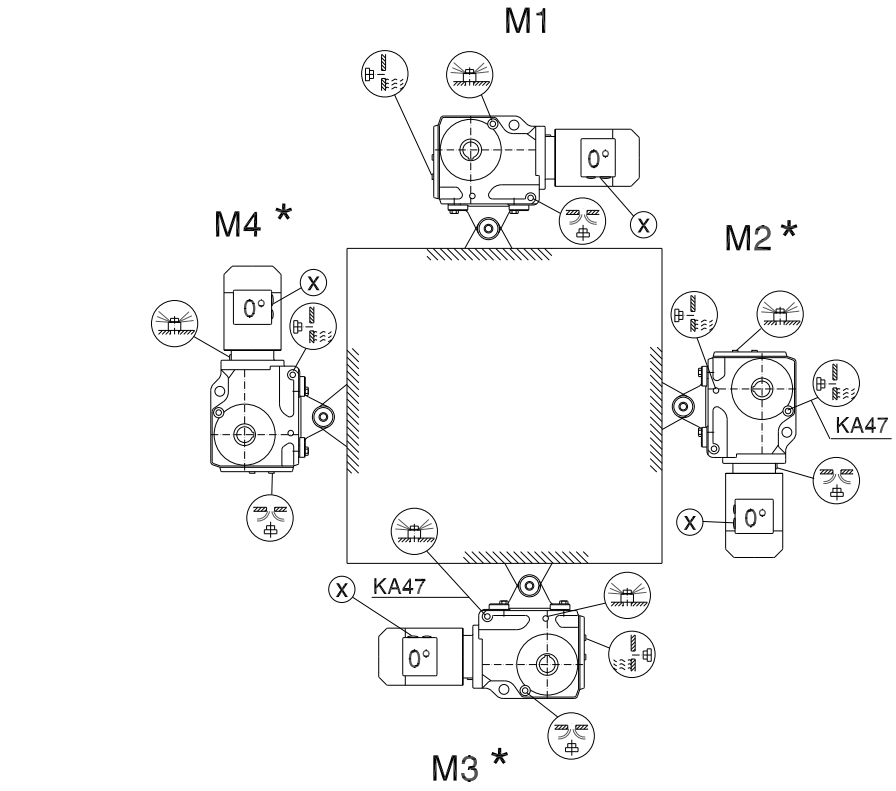


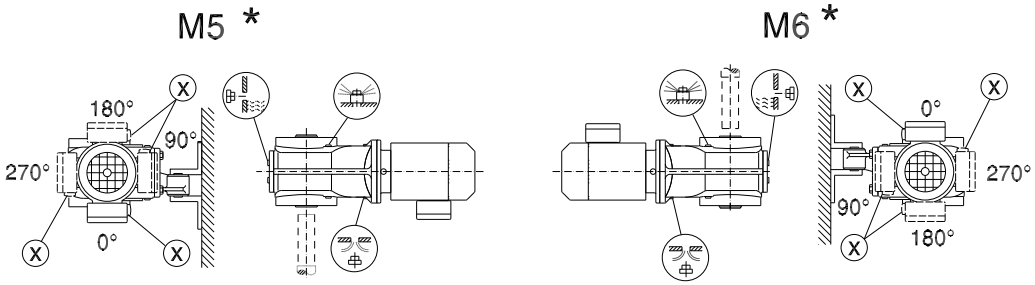


* → page 155

KA/KH37-157, KV37-107, KT37-97

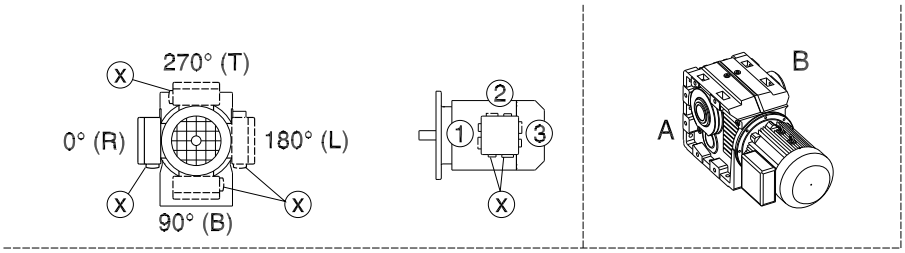




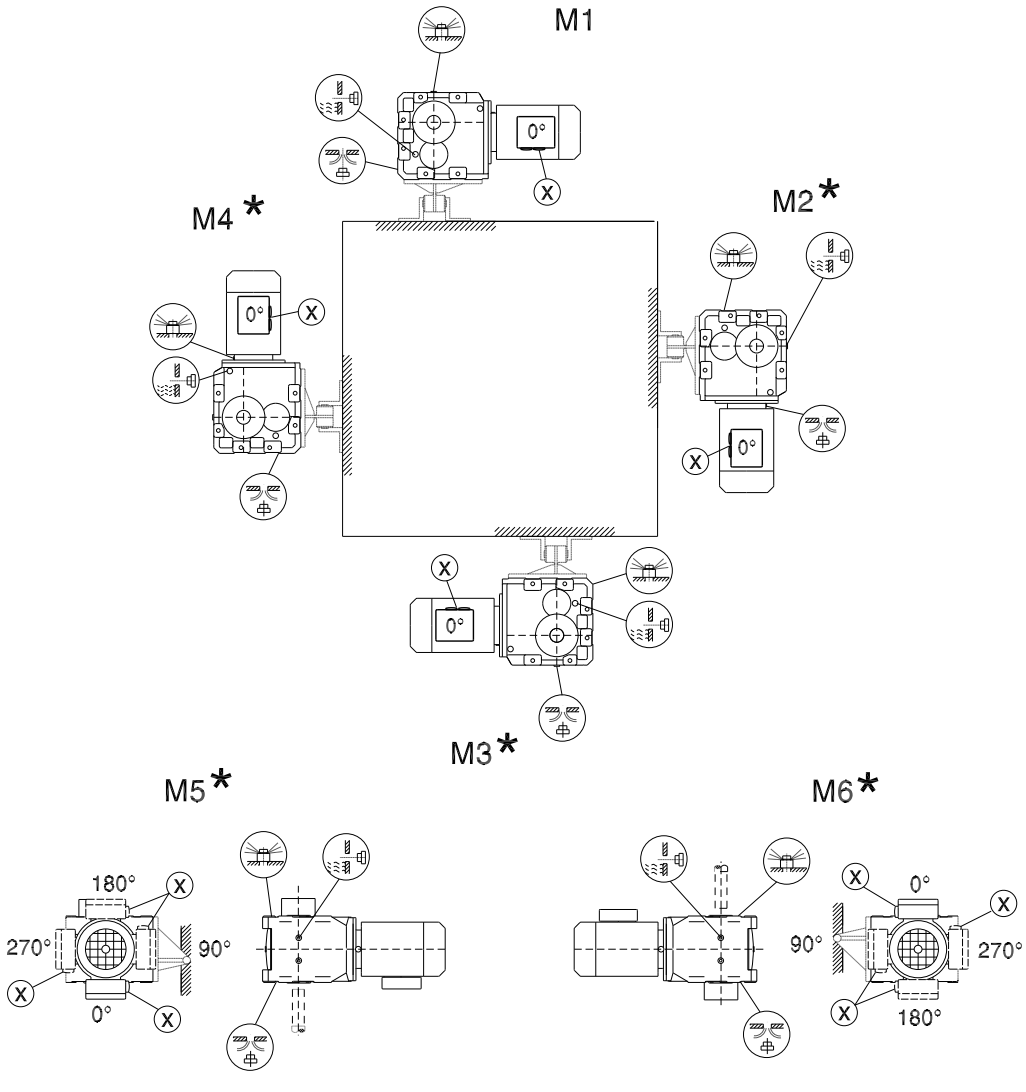


* → page 155

KH167-187



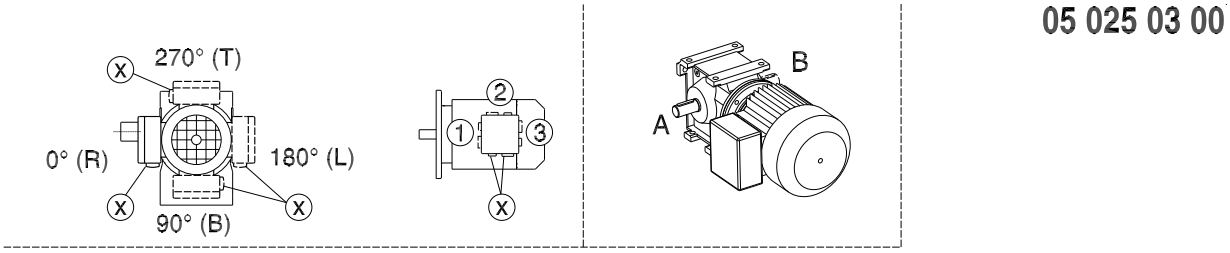
39 026 04 00

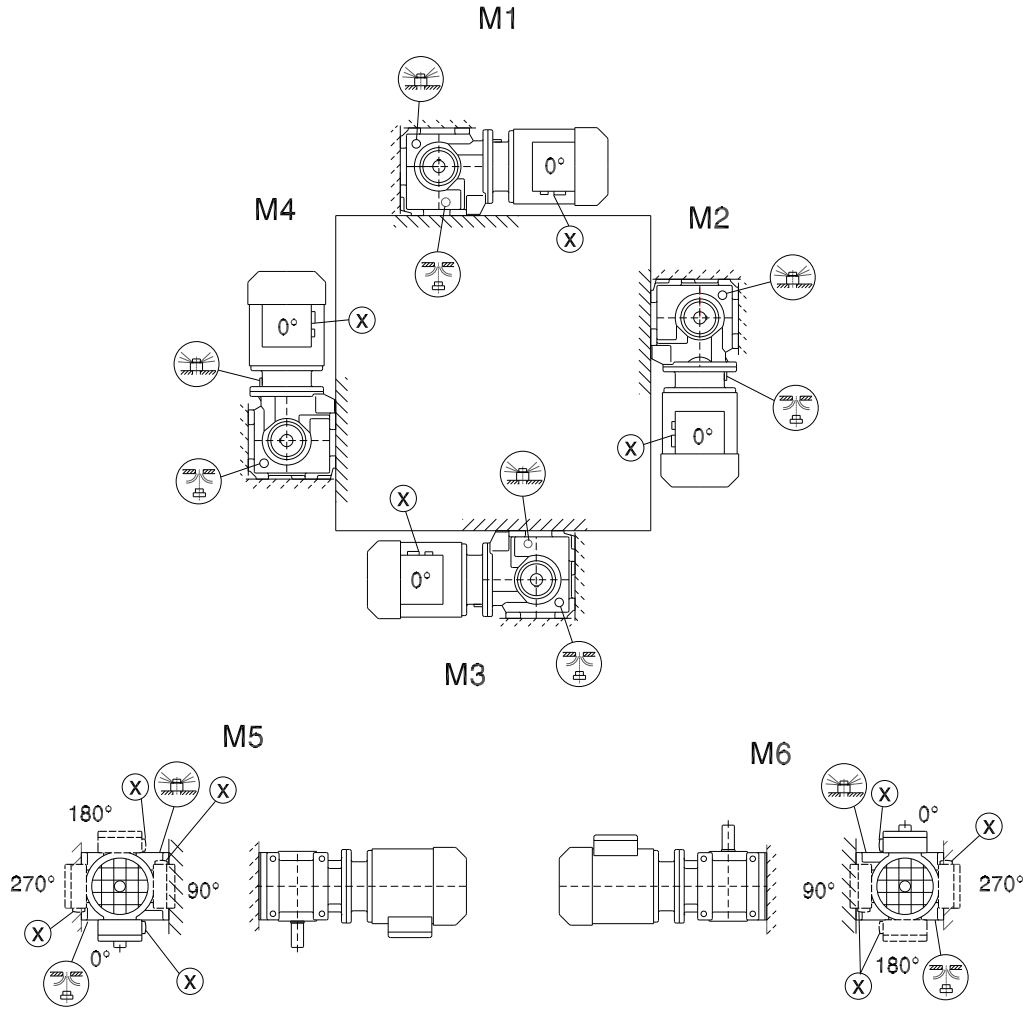


* → page 155

9.7 Mounting positions of helical-worm gearmotors

S37



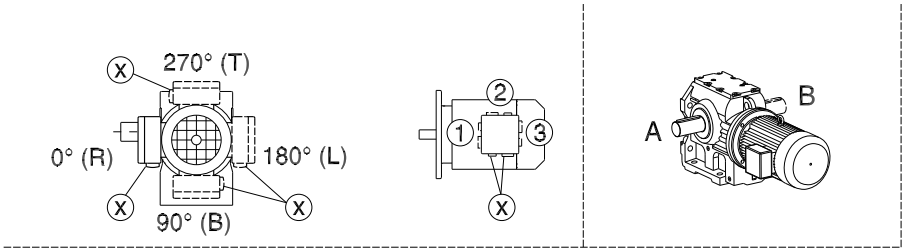


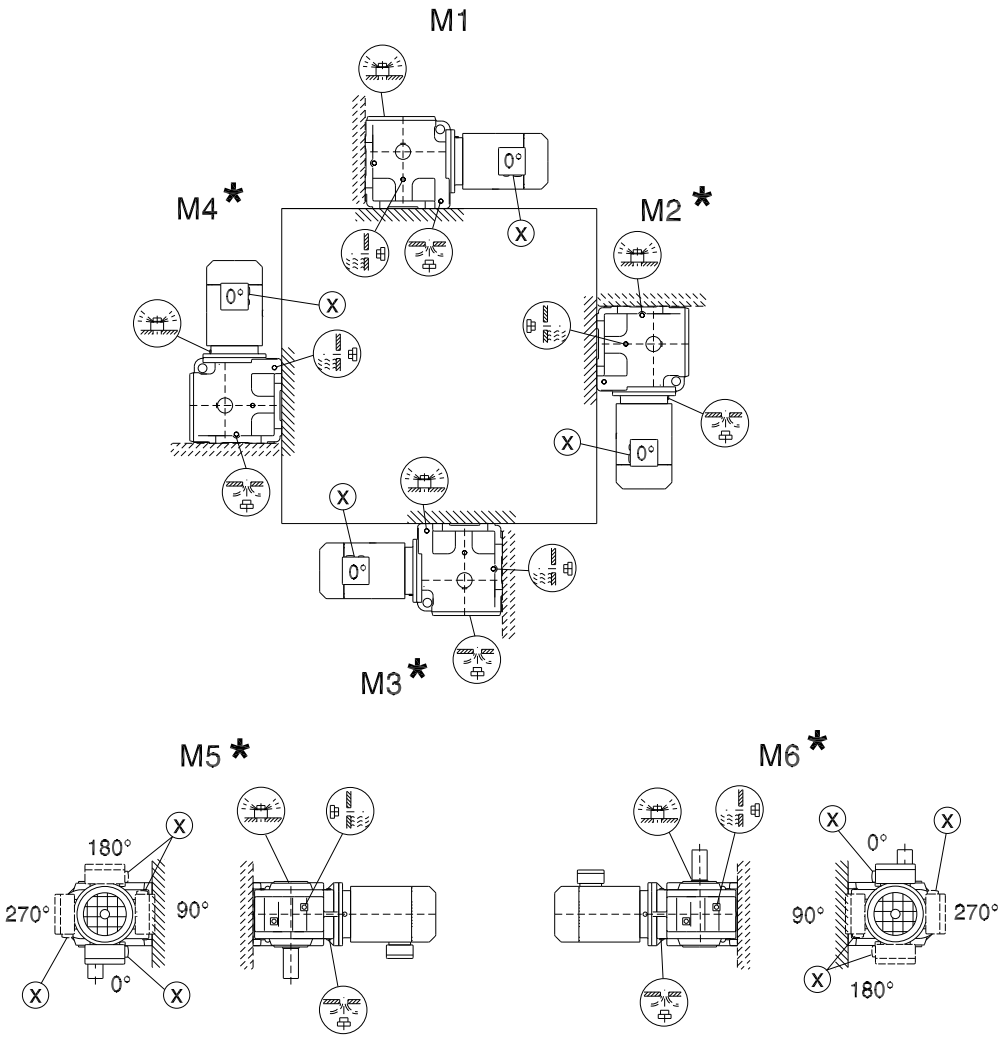
* → page 155

Important: See the (i) information in the section "Project Planning for Gear Units/Overhung and axial loads" (page 51).

S47 - S97

05 026 03 00

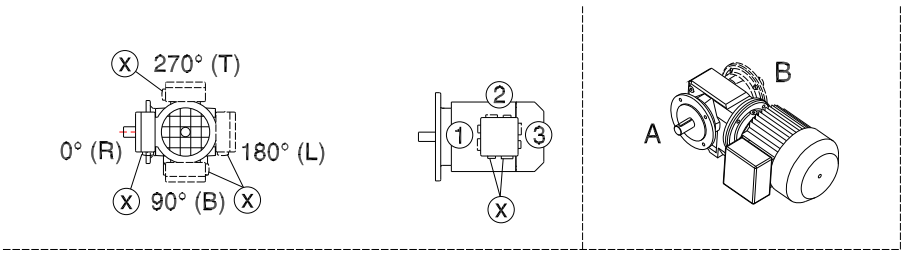


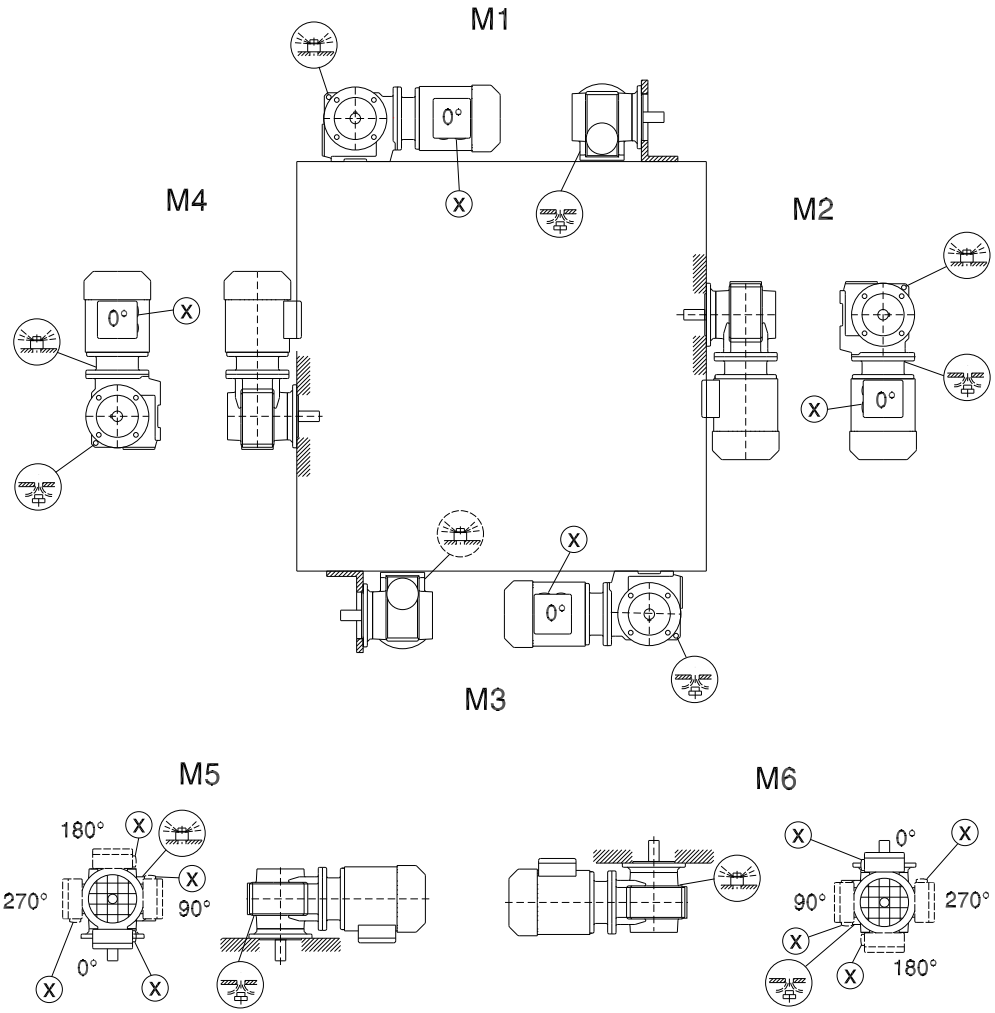


* → page 155

Important: See the ⓘ information in the section "Project Planning for Gear Units/Overhung and axial loads" (page 51).

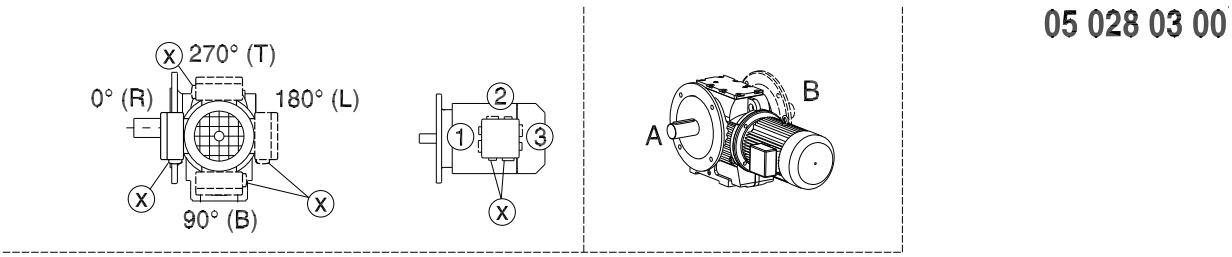
SF/SAF/SHF37

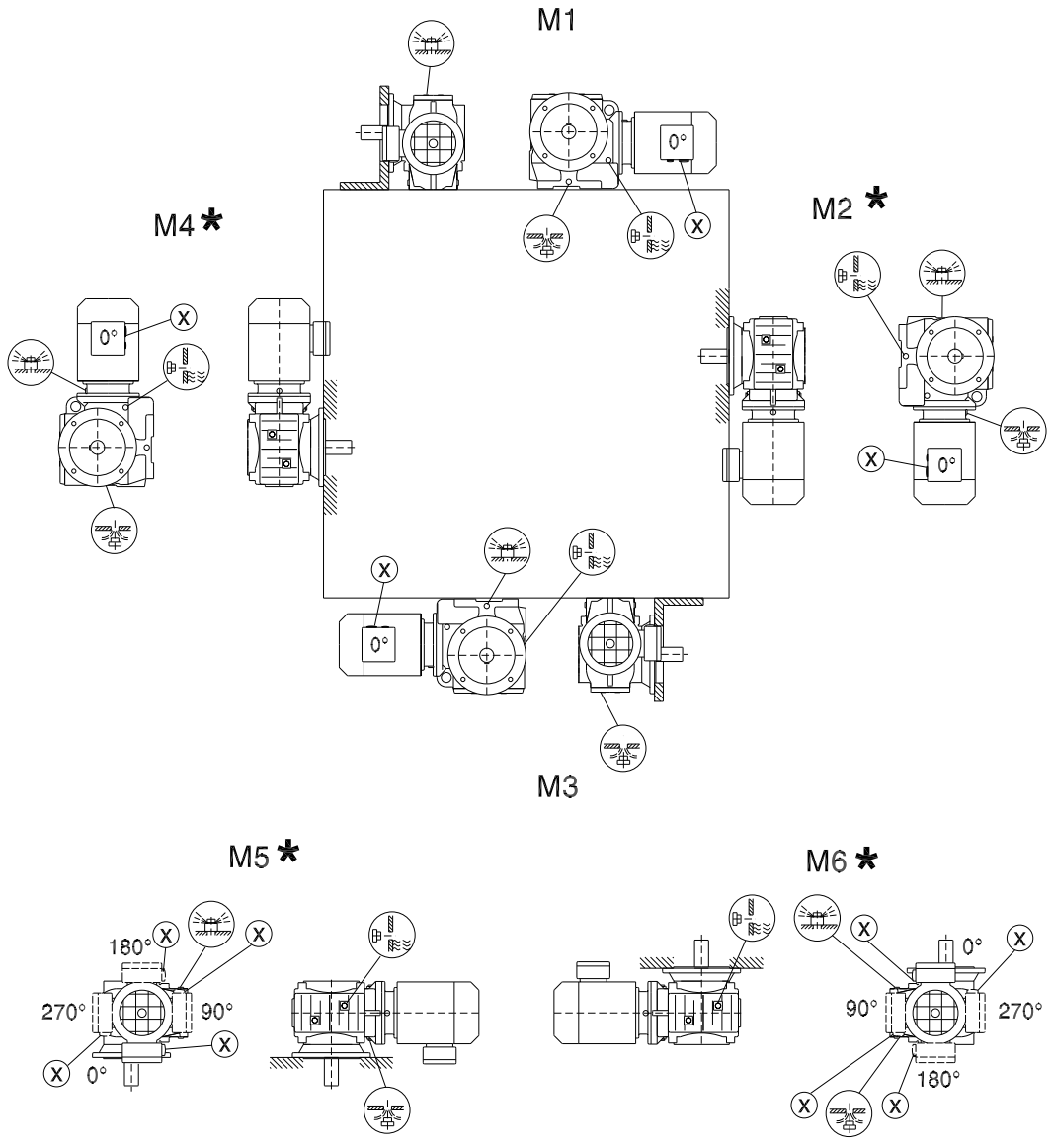




* → page 155

SF/SAF/SHF/SAZ/SHZ47-97

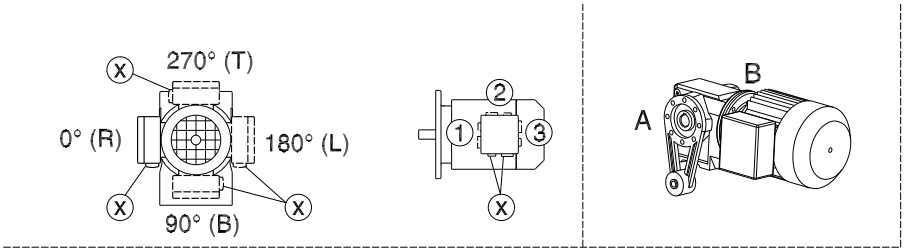


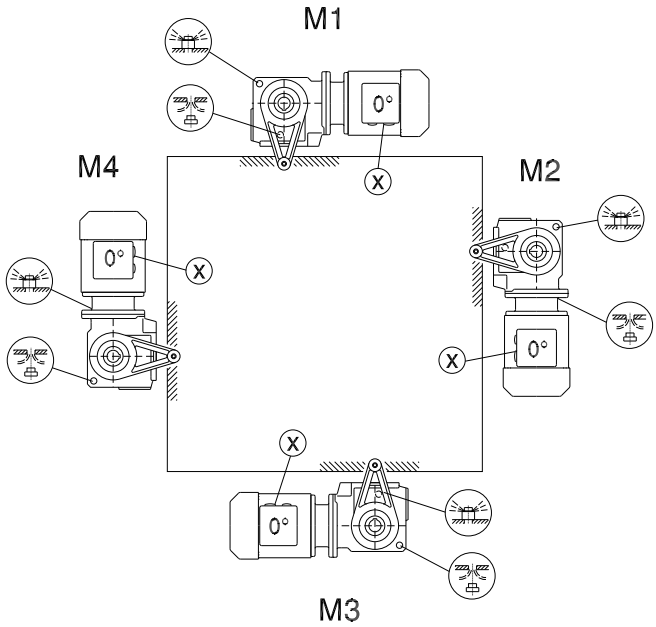


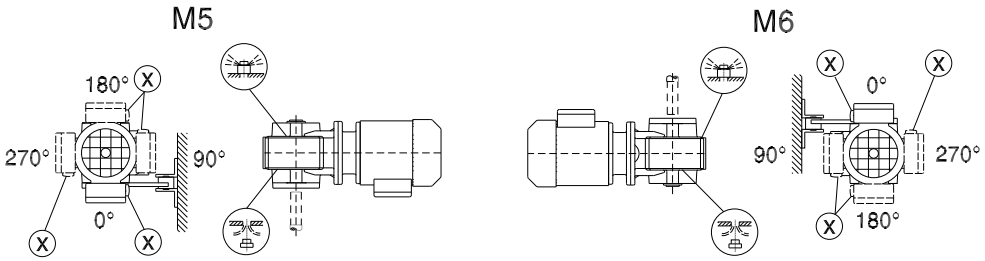
* → page 155

SA/SH/ST37

28 020 04 00



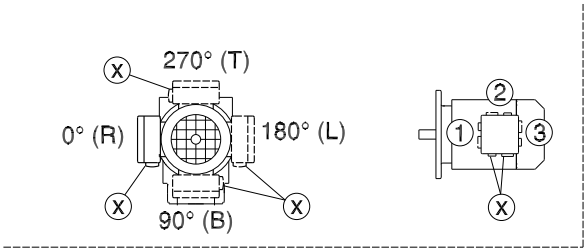


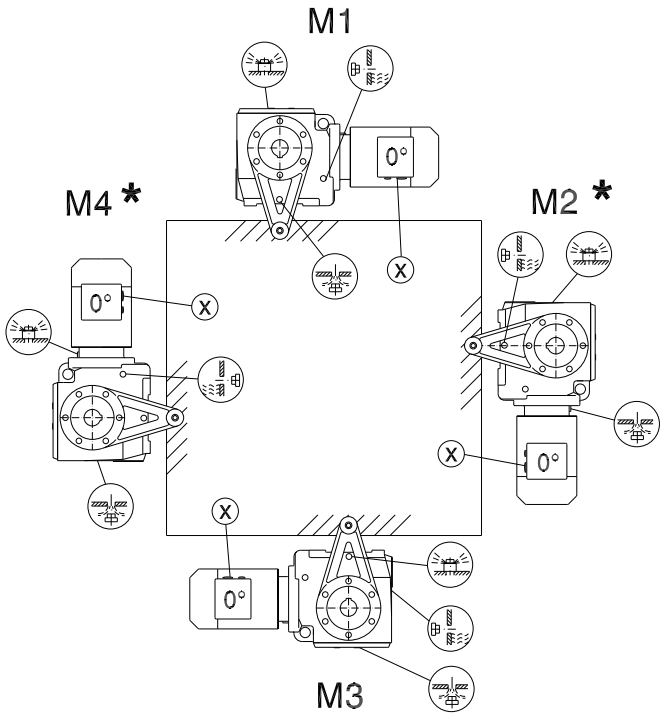


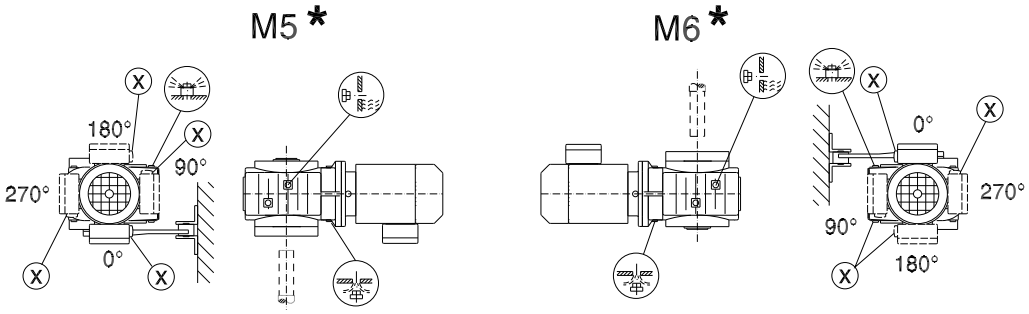
* → page 155

SA/SH/ST47-97

28 021 03 00



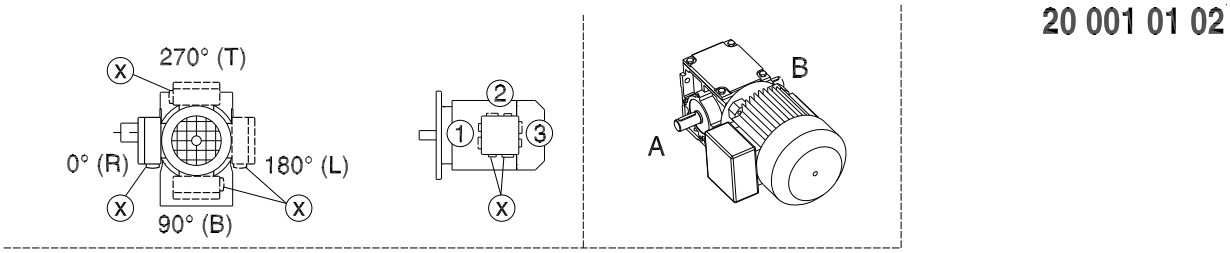


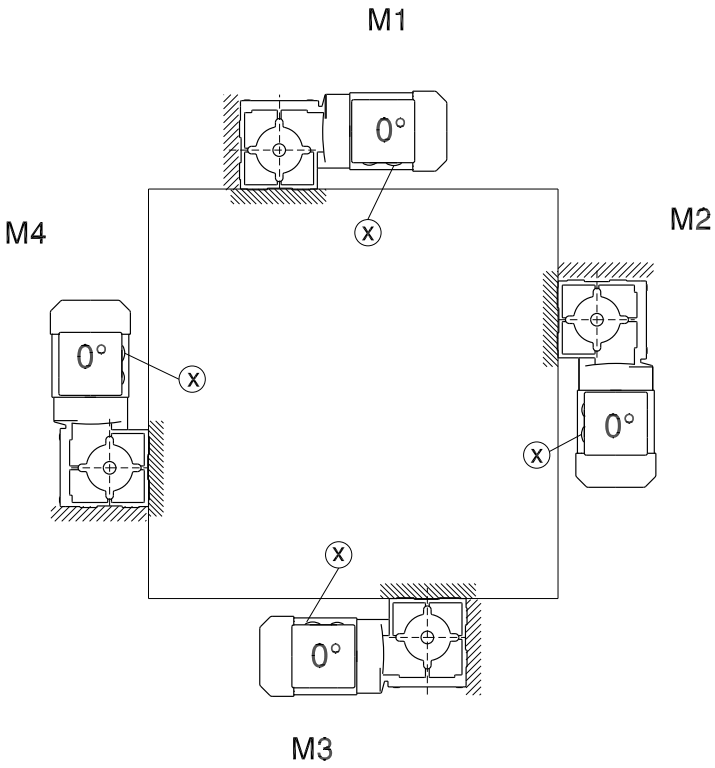


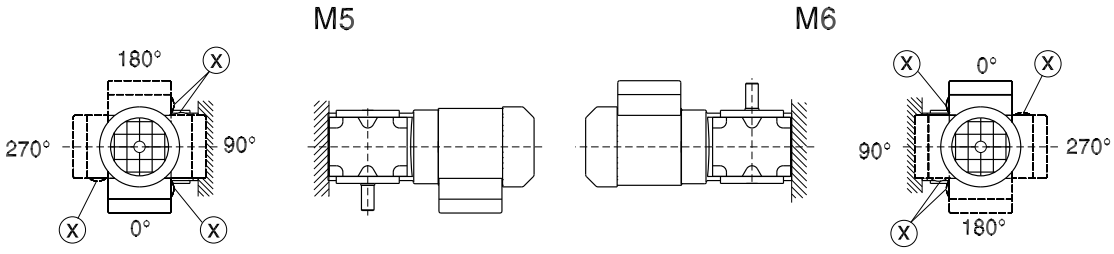
* → page 155

9.8 Mounting positions of Spiroplan® gearmotors

W10-30

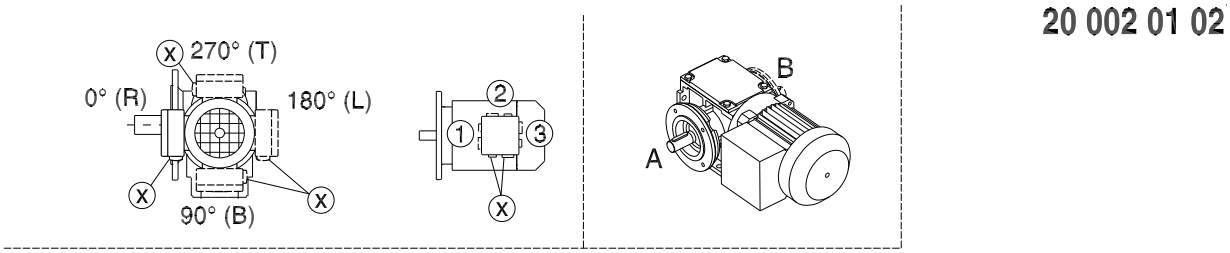


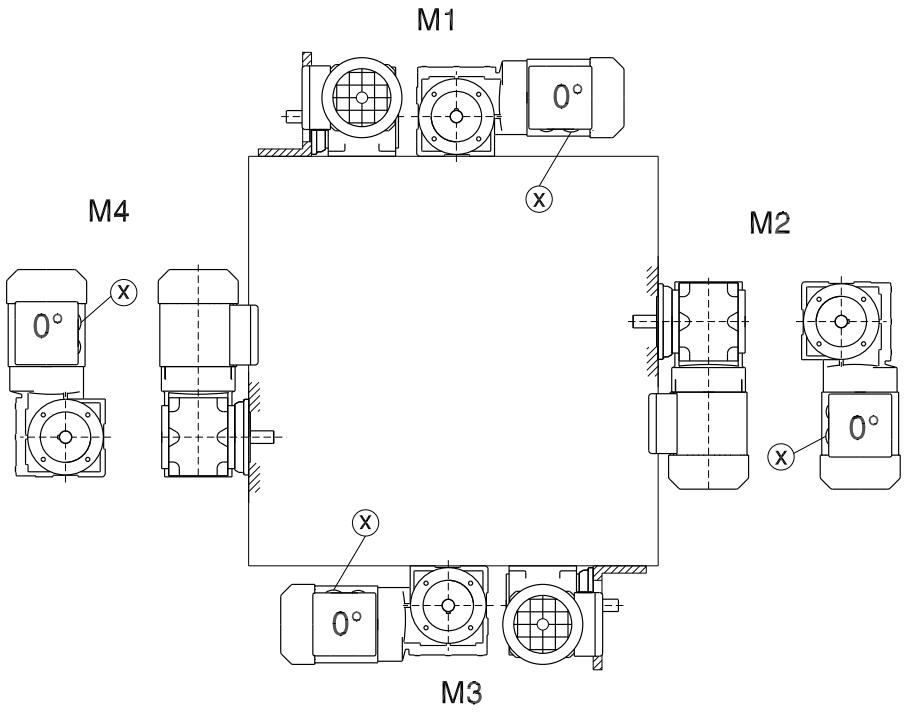


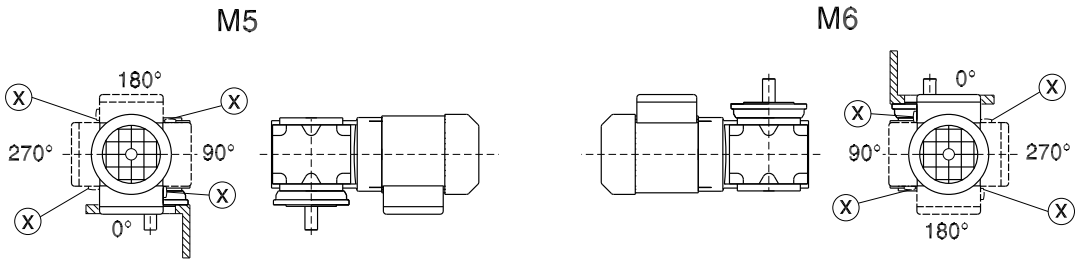


→ page 155

WF10-30







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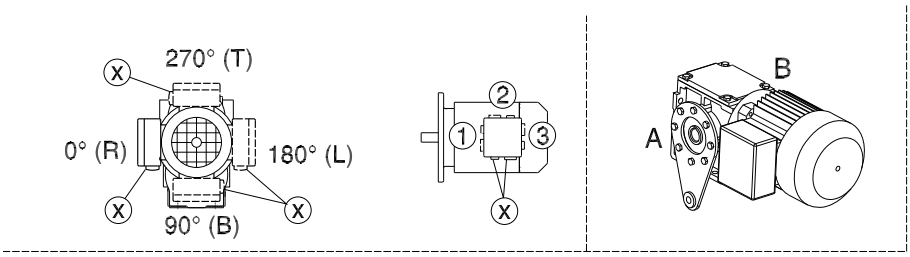
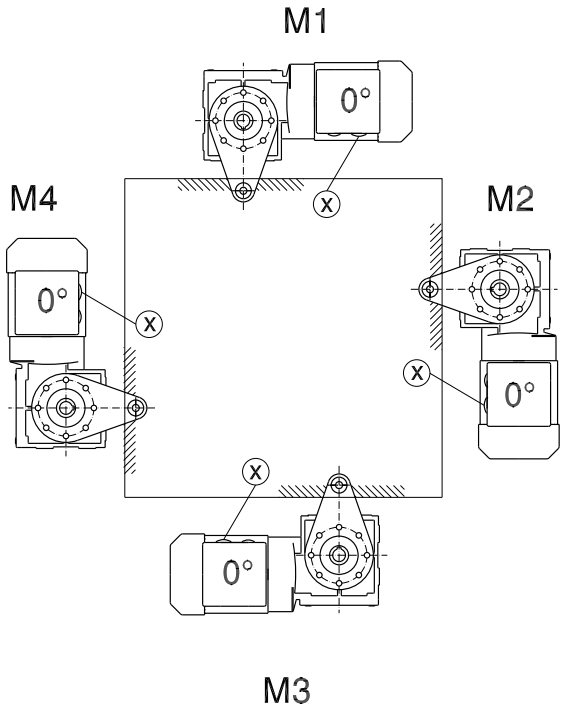
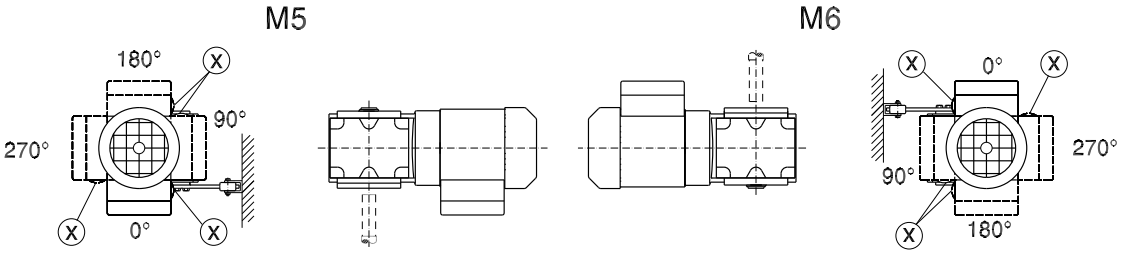
WA10-30

20 003 02 02



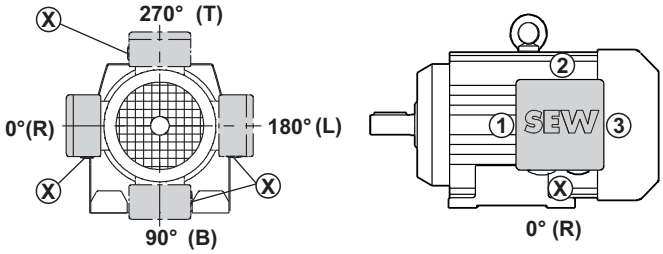




→ page 155

9.9 Mounting position designations AC motor

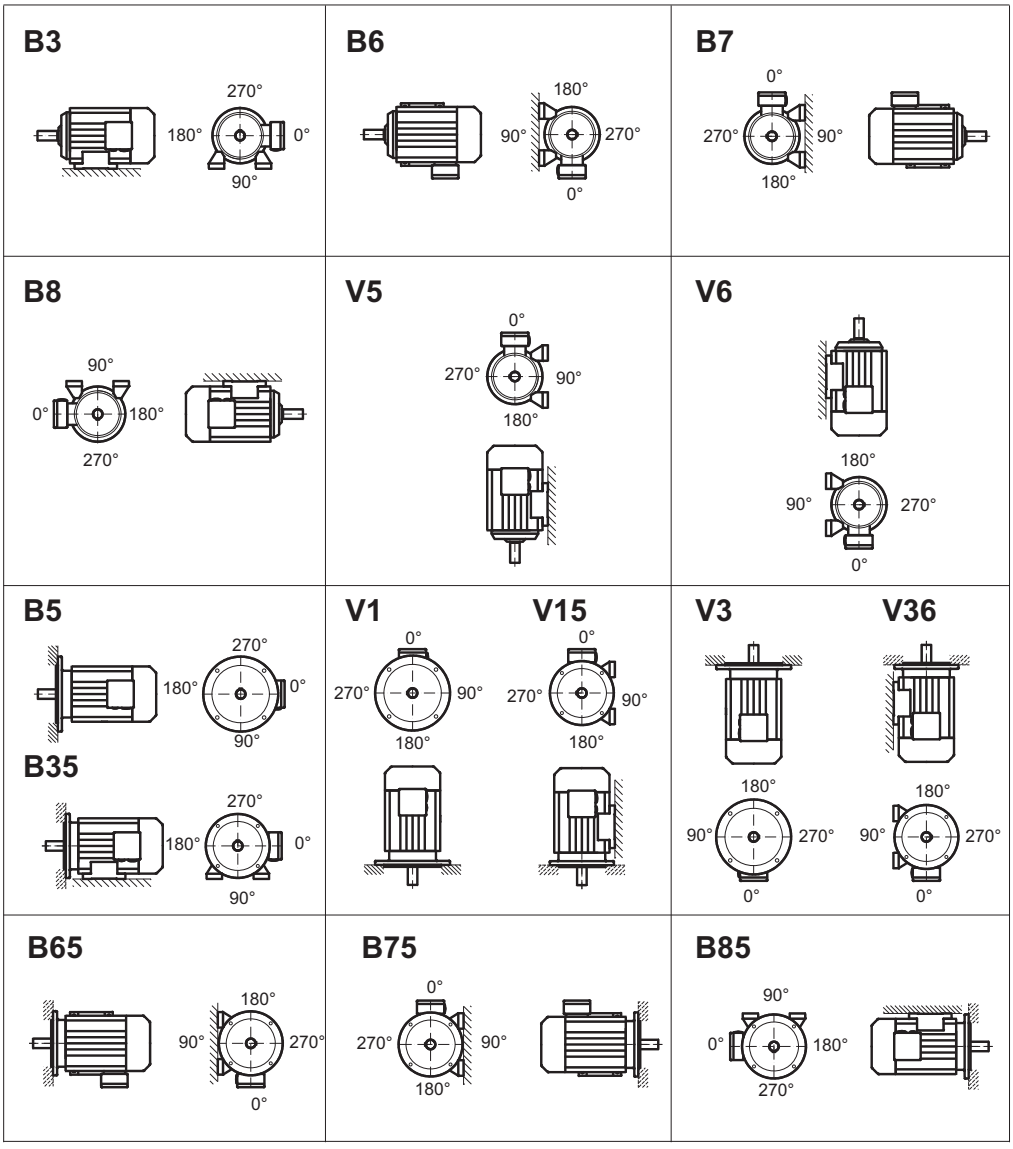
Position of motor terminal box and cable entry



51302AUS

Figure 88: Position of terminal box and cable entry

Mounting positions

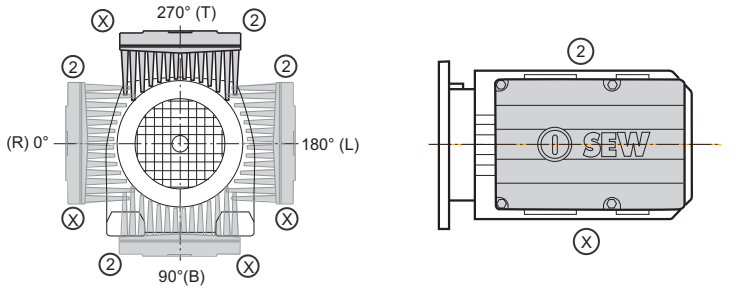


04375AXX

Figure 89: Mounting positions of AC motors

9.10 Mounting position designation MOVIMOT® drives

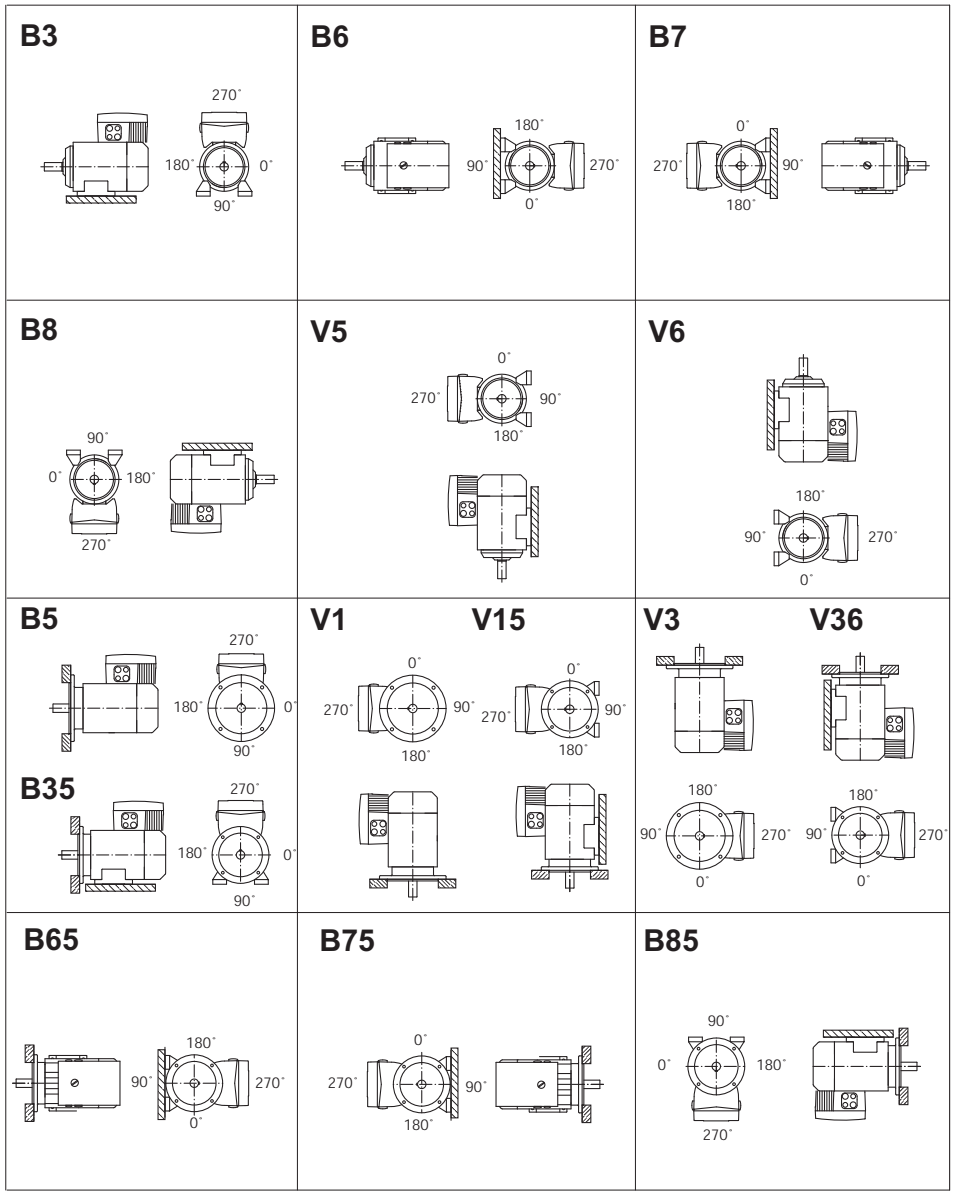
Position of terminal box and cable entry



59151AXX

Figure 90: Position of terminal box and cable entry

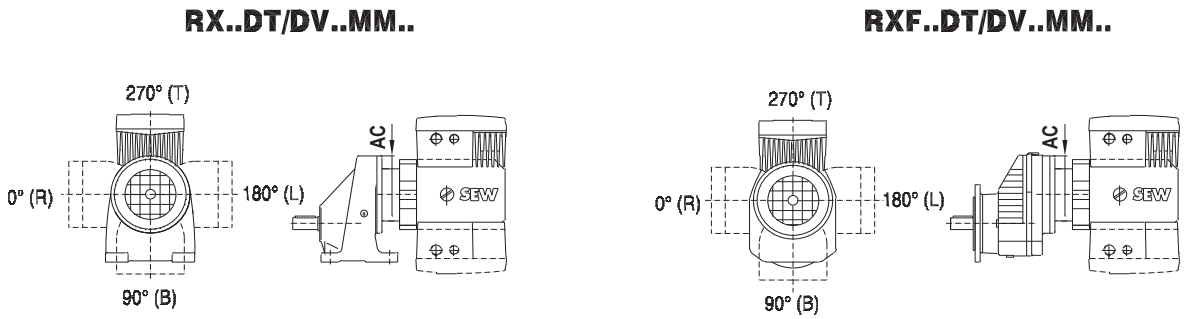
Mounting positions



04375AXX

Figure 91: Mounting positions of MOVIMOT® drives

9.11 Position terminal box and cable entry (MOVIMOT® drives)



00005102

Figure 92: Possible terminal box positions RX..D..MM..

Gear unit	Motor	AC	0°	90°	180°	270°[1]	Gear unit	Motor	AC	0°	90°	180°	270°[1]
RX57	DT71D MM..	∅ 6.30in		[2]			RXF57	DT71D MM..	∅ 6.30in				
	DT80..MM..			[2]				DT80..MM..					
	DT90..MM..			[2]				DT90..MM..					
	DV100..MM..			[2]				DV100..MM..					
RX67	DT71D MM..	∅ 6.30in		[2]			RXF67	DT71D MM..	∅ 6.30in				
	DT80..MM..			[2]				DT80..MM..					
	DT90..MM..			[2]				DT90..MM..					
	DV100..MM..			[2]				DV100..MM..					
RX77	DT80..MM..	∅ 7.87in		[2]			RXF77	DT80..MM..	∅ 7.87in				
	DT90..MM..			[2]				DT90..MM..					
	DV100..MM..			[2]				DV100..MM..					
RX87	DT80..MM..	∅ 9.84in					RXF87	DT80..MM..	∅ 9.84in				
	DT90..MM1..			[2]				DT90..MM1..					
	DV100..MM..			[2]				DV100..MM..					
RX97	DT80..MM..	∅ 11.81in					RXF97	DT80..MM..	∅ 11.81in				
	DT90..MM1..							DT90..MM1..					
	DV100..MM..							DV100..MM..					
RX107	DV100..MM..	∅ 13.78in					RXF107	DV100..MM..	∅ 13.78in				

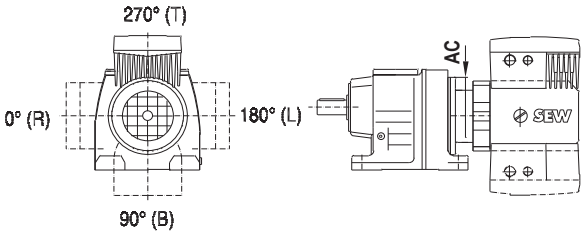
1) Standard position

2) Gear unit must be mounted on a base

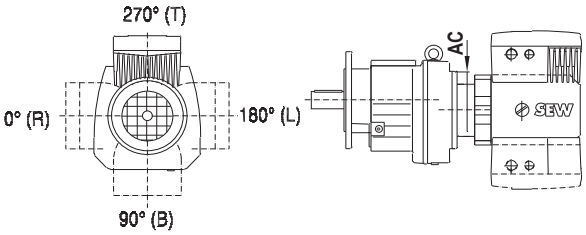
Possible terminal box position

When using plug connectors/MOVIMOT® options, the number of possible positions can be even more limited. Please contact SEW-EURODRIVE.

R..DT/DV..MM..



RF/RZ..DT/DV..MM..



00006102

Figure 93: Possible terminal box positions R..D..MM..

Gear unit	Motor	AC	0°	90°	180°	270°[1]	Gear unit	Motor	AC	0°	90°	180°	270°[1]
R07	DT71D MM..	∅ 9.31in	2)	2)	2)	2)	RF/RZ07	DT71D MM..	∅ 9.31in				
R17	DT71D MM..	∅ 9.31in		2)			RF/RZ17	DT71D MM..	∅ 9.31in				
	DT80..MM..			2)				DT80.. MM..					
R27	DT71D MM..	∅ 4.72in					RF/RZ27	DT71D MM..	∅ 4.72in				
	DT80..MM..			2)				DT80..MM..					
	DT90..MM..		2)	2)	2)	2)		DT90..MM..					
	DV100..MM..		2)	2)	2)	2)		DV100..MM..					
R37	DT71D MM..	∅ 4.72in		2)			RF/RZ37	DT71D MM..	∅ 4.72in				
	DT80..MM..			2)				DT80..MM..					
	DT90..MM..		2)	2)	2)	2)		DT90..MM..					
	DV100..MM..		2)	2)	2)	2)		DV100..MM..					
R47	DT71D MM..	∅ 6.30in					RF/RZ47	DT71D MM..	∅ 6.30in				
	DT80..MM..			2)				DT80..MM..					
	DT90..MM..			2)				DT90..MM..					
	DV100..MM..			2)				DV100..MM..					
R57	DT71D MM..	∅ 6.30in					RF/RZ57	DT71D MM..	∅ 6.30in				
	DT80..MM..			2)				DT80..MM..					
	DT90..MM..			2)				DT90..MM..					
	DV100..MM..			2)				DV100..MM..					
R67	DT71D MM..	∅ 6.30in					RF/RZ67	DT71D MM..	∅ 6.30in				
	DT80..MM..			2)				DT80..MM..					
	DT90..MM..			2)				DT90..MM..					
	DV100..MM..			2)				DV100..MM..					
R77	DT80..MM..	∅ 7.87in		2)			RF/RZ77	DT80..MM..	∅ 7.87in				
	DT90..MM1..			2)				DT90..MM1..					
	DT90L MM22							DT90L MM22					
	DV100..MM..			2)				DV100..MM..					
R87	DT80..MM..	∅ 9.84in					RF/RZ87	DT80..MM..	∅ 9.84in				
	DT90..MM1..			2)				DT90..MM1..					
	DV100..MM..			2)				DV100..MM..					
R97	DT80..MM..	∅ 11.81in					RF97	DT80..MM..	∅ 11.81in				
	DT90..MM1..							DT90..MM1..					
	DV100..MM..							DV100..MM..					
R107	DV100..MM..	∅ 13.78in					RF107	DV100..MM..	∅ 13.78in				

1) Standard position

2) Gear unit must be mounted on a base

Possible terminal box position

When using plug connectors/MOVIMOT® options, the number of possible positions can be even more limited. Please contact SEW-EURODRIVE.

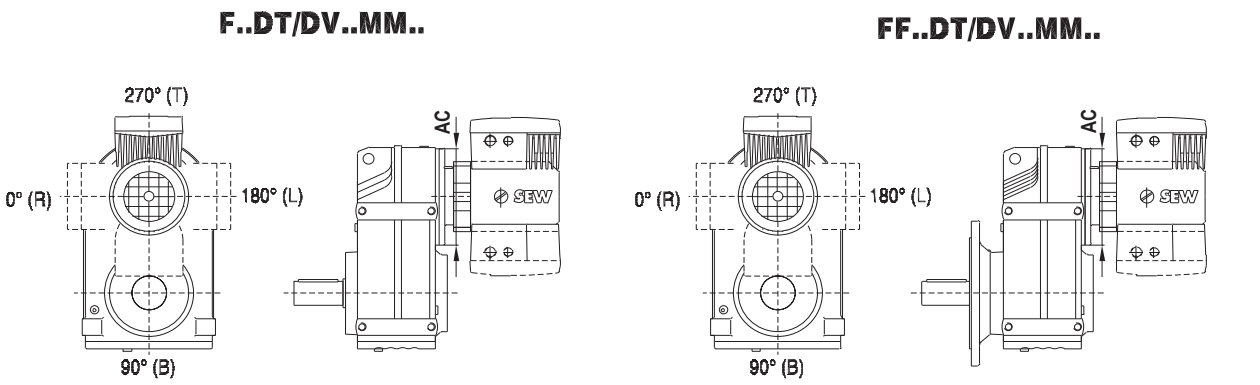


Figure 94: Possible terminal box positions F..D..MM..

Gear unit	Motor	AC	0°	90°	180°	270°[1)]	Gear unit	Motor	AC	0°	90°	180°	270°[1)]
F27	DT71D MM..	∅ 4.72in	[2)]		[2)]		FF27	DT71D MM..	∅ 4.72in				
	DT80..MM..		[2)]		[2)]			DT80..MM..					
	DT90..MM..		[2)]	[2)]	[2)]	[2)]		DT90..MM..					
F37	DT71D MM..	∅ 4.72in	[2)]		[2)]		FF37	DT71D MM..	∅ 4.72in				
	DT80..MM..		[2)]		[2)]			DT80..MM..					
	DT90..MM..		[2)]		[2)]			DT90..MM..					
	DV100..MM..		[2)]		[2)]			DV100..MM..					
F47	DT71D MM..	∅ 4.72in	[2)]		[2)]		FF47	DT71D MM..	∅ 4.72in				
	DT80..MM..		[2)]		[2)]			DT80..MM..					
	DT90..MM..		[2)]		[2)]			DT90..MM..					
	DV100..MM..		[2)]		[2)]			DV100..MM..					
F57	DT71D MM..	∅ 6.30in	[2)]		[2)]		FF57	DT71D MM..	∅ 6.30in				
	DT80..MM..		[2)]		[2)]			DT80..MM..					
	DT90..MM..		[2)]		[2)]			DT90..MM..					
	DV100..MM..		[2)]		[2)]			DV100..MM..					
F67	DT71D MM..	∅ 6.30in	[2)]		[2)]		FF67	DT71D MM..	∅ 6.30in				
	DT80..MM..		[2)]		[2)]			DT80..MM..					
	DT90..MM..		[2)]		[2)]			DT90..MM..					
	DV100..MM..		[2)]		[2)]			DV100..MM..					
F77	DT80..MM..	∅ 7.87in	[2)]		[2)]		FF77	DT80..MM..	∅ 7.87in				
	DT90..MM..		[2)]		[2)]			DT90..MM..					
	DV100..MM..		[2)]		[2)]			DV100..MM..					
F87	DT80..MM..	∅ 9.84in					FF87	DT80..MM..	∅ 9.84in				
	DT90..MM1..		[2)]		[2)]			DT90..MM1..					
	DV100..MM..		[2)]		[2)]			DV100..MM..					
F97	DT90..MM1..	∅ 11.81in					FF97	DT90..MM1..	∅ 11.81in				
	DV100..MM..							DV100..MM..					
F107	DV100..MM..	∅ 13.78in					FF107	DV100..MM..	∅ 13.78in				

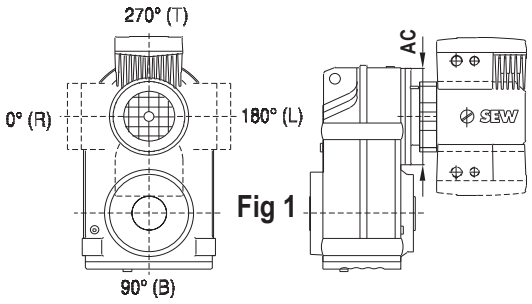
1) Standard position

2) The gear unit must be mounted on a base if the inverter is on the foot-mounting end

Possible terminal box position

When using plug connectors/MOVIMOT® options, the number of possible positions can be even more limited. Please contact SEW-EURODRIVE.

FA/FAF/FAZ..DT/DV..MM..
FV/FVF/FVZ..DT/DV..MM..



FH/FHF/FHZ..DT/DV..MM..

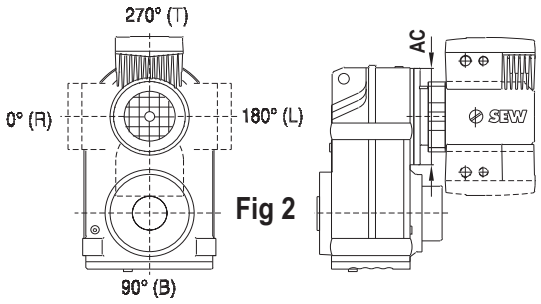


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Figure 95: Possible terminal box positions F..D..MM..

Gear unit	Motor	Fig	AC	0°	90°	180°	270°[1)]
F..27	DT71D MM..	1	∅ 4.72in				
	DT80..MM..						
	DT90..MM..						
F..37	DT71D MM..		∅ 4.72in				
	DT80..MM..						
	DT90..MM..						
	DV100..MM..						
F..47	DT71D MM..		∅ 4.72in				
	DT80..MM..						
	DT90..MM..						
	DV100..MM..						
F..57	DT71D MM..		∅ 6.30in				
	DT80..MM..						
	DT90..MM..						
	DV100..MM..						
F..67	DT71D MM..		∅ 6.30in				
	DT80..MM..						
	DT90..MM..						
	DV100..MM..						
F..77	DT80..MM..		∅ 7.87in				
	DT90..MM..						
	DV100..MM..						
F..87	DT80..MM..		∅ 9.84in				
	DT90..MM1..						
	DV100..MM..						
F..97	DT90..MM1..		∅ 11.81in				
	DV100..MM..						
F..107	DV100..MM..		∅ 13.78in				

Gear unit	Motor	Fig	AC	0°	90°	180°	270°[1)]
F..27	DT71D MM..	2	∅ 4.72in				
	DT80..MM..						
F..37	DT71D MM..		∅ 4.72in				
	DT80..MM..						
	DT90..MM..						
	DV100..MM..						
F..47	DT71D MM..		∅ 4.72in				
	DT80..MM..						
	DT90..MM..						
	DV100..MM..						
F..57	DT71D MM..		∅ 6.30in				
	DT80..MM..						
	DT90..MM..						
	DV100..MM..						
F..67	DT71D MM..		∅ 6.30in				
	DT80..MM..						
	DT90..MM..						
	DV100..MM..						
F..77	DT80..MM..		∅ 7.87in				
	DT90..MM..						
	DV100..MM..						
F..87	DT80..MM..		∅ 9.84in				
	DT90..MM1..						
	DV100..MM..						
F..97	DT90..MM1..		∅ 11.81in				
	DV100..MM..						
F..107	DV100..MM..		∅13.78in				

1) Standard position

Possible terminal box position

When using plug connectors/MOVIMOT® options, the number of possible positions can be even more limited. Please contact SEW-EURODRIVE.

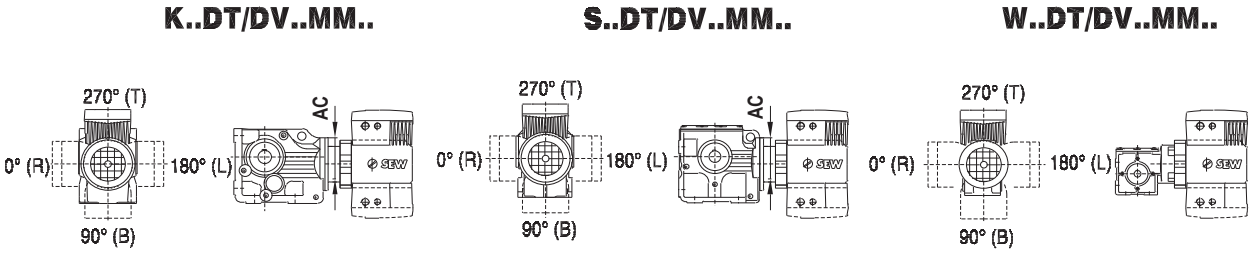

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Figure 96: Possible terminal box positions K..D..MM.., S..D..MM.., W..D..MM..

Gear unit	Motor	AC	0°	90°	180°	270°[1]
K37	DT71D MM..	∅ 4.72in		2)		
	DT80..MM..			2)		
	DT90..MM..			2)		
	DV100..MM..			2)		
K47	DT71D MM..	∅ 6.30in		2)		
	DT80..MM..			2)		
	DT90..MM..			2)		
	DV100..MM..			2)		
K57	DT71D MM..	∅ 6.30in		2)		
	DT80..MM..			2)		
	DT90..MM..			2)		
	DV100..MM..			2)		
K67	DT71D MM..	∅ 6.30in		2)		
	DT80..MM..			2)		
	DT90..MM..			2)		
	DV100..MM..			2)		
K77	DT80..MM..	∅ 7.87in		2)		
	DT90..MM..			2)		
	DV100..MM..			2)		
K87	DT80..MM..	∅ 9.84in				
	DT90..MM1..			2)		
	DV100..MM..			2)		
K97	DT90..MM1..	∅ 11.81in				
	DV100..MM..					
K107	DV100..MM..	∅ 13.78in				

Gear unit	Motor	AC	0°	90°	180°	270°[1]
S37	DT71D MM..	∅ 4.72in		2)		
	DT80..MM..			2)		
	DT90..MM1..			2)		
S47	DT71D MM..	∅ 4.72in		2)		
	DT80..MM..			2)		
	DT90..MM..			2)		
	DV100..MM..			2)		
S57	DT71D MM..	∅ 4.72in		2)		
	DT80..MM..			2)		
	DT90..MM..			2)		
	DV100..MM..			2)		
S67	DT71D MM..	∅ 6.30in		2)		
	DT80..MM..			2)		
	DT90..MM..			2)		
	DV100..MM..			2)		
S77	DT80..MM..	∅ 7.87in		2)		
	DT90..MM..			2)		
	DV100..MM..			2)		
S87	DT80..MM..	∅ 9.84in				
	DT90..MM1..			2)		
	DV100..MM..			2)		
S97	DT90..MM1..	∅ 11.81in				
	DV100..MM..					

Gear unit	Motor	0°	90°	180°	270°[1]
W20	DT71D MM..		2)		
W30	DT71D MM..		2)		
	DT80..MM..		2)		

1) Standard position

2) Gear unit must be mounted on a base

Possible terminal box position

When using plug connectors/MOVIMOT® options, the number of possible positions can be even more limited. Please contact SEW-EURODRIVE.

10 Design and Operating Notes

10.1 Lubricants

General information

Unless a special arrangement is made, SEW-EURODRIVE supplies the drives with a lubricant fill adapted for the specific gear unit and mounting position. The decisive factor is the mounting position (M1 – M6, → Sec. "Mounting positions and important order information" in the Gearmotor catalog) specified when ordering the drive. You must adapt the lubricant fill in case of any subsequent changes made to the mounting position (→ Lubricant fill quantities).

Lubricant table

The lubricant table on the following page shows the permitted lubricants for SEW-EURODRIVE gear units. Please refer to the following legend for the lubricant table.

Legend for the lubricant table

Abbreviations, meaning of shading and notes:

CLP	= Mineral oil
CLP PG	= Polyglycol (W gear units, NSF certified H1)
CLP HC	= Synthetic hydrocarbons
E	= Ester oil (water hazard class 1 (German regulation))
HCE	= Synthetic hydrocarbons + ester oil (NSF certified H1)
HLP	= Hydraulic oil
	= Synthetic lubricant (= synthetic-based anti-friction bearing grease)
	= Mineral lubricant (= mineral-based anti-friction bearing grease)
1)	Helical-worm gear units with PG oil: please contact SEW-EURODRIVE.
2)	Special lubricant for Spiroplan® gear units only
3)	SEW-$f_B \geq 1.2$ required
4)	Pay attention to critical starting behavior at low temperatures!
5)	Ambient temperature
	Lubricant for the food industry (food grade oil)
	Biodegradable oil (lubricant for agriculture, forestry, and fisheries)

Anti-friction bearing greases

The anti-friction bearings in gear units and motors are given a factory-fill with the greases listed below. SEW-EURODRIVE recommends regreasing anti-friction bearings with a grease fill at the same time as changing the oil or replacing the anti-friction bearings.

	Ambient temperature	Manufacturer	Type
Anti-friction bearing in gear unit	-10 °C ... +60°C	ExxonMobil	Mobilux EP2
	-40 °C ... +80 °C	ExxonMobil	Mobilith SHC 100
Anti-friction bearing in motor[1)2)]	-20 °C ... +80 °C	ExxonMobil	Polyrex EM
	+20 °C ... +100 °C	Klüber	Barrierta L55/2
	-40 °C ... +40 °C	ExxonMobil	Mobilith SHC 100[3)]
Special greases for anti-friction bearings in gear units:			
	-25 °C ... +80 °C	Shell	Shell Cassida Grease EPS 2
	-35 °C ... +60 °C	Klüber	Klübersynth UH1 14-151
	-15 °C ... +80 °C	Klüber	Klübersynth UH1 14-222
	-20 °C ... +40 °C	Klüber	Klüberbio M 32-82

1) The motor anti-friction bearings are covered on both sides and cannot be regreased.

2) Greases providing equivalent performance are acceptable

3) Recommended for continuous operation at ambient temperature below 0°C, example in a cold storage.

The following grease quantities are required:

- For high-rpm bearings (gear unit input end): Fill the cavities between the rolling elements one-third full with grease.
- For low-rpm bearings (in gear units and at gear unit output end): Fill the cavities between the rolling elements two-thirds full with grease.

Lubricant table

01 805 09 92US

	5) °C	DIN (ISO)	ISO,NLGI	ExxonMobil	Shell	Klüber	Aral	bp	Tribol	Texaco	Optimol	Fuchs	Total
R...	Standard -10 +40	CLP(CC)	VG 220	Mobilgear 600XP 220	Shell Omala 220	Klüberoil GEM 1-220 N	Aral Degol BG 220	BP Energol GR-XP 220	Tribol 1100/220	Meropa 220	Optigear BM 220	Renolin CLP 220	Carter EP 220
	-25 +80	CLP PG	VG 220	Mobil Glygoyle 30	Shell Tivela S 220	Klübersynth GH 6-220	Aral Degol GS 220	BP Enersyn SG-XP 220	Tribol 800/220	Synlube CLP 220	Optiflex A 220		Carter SY 220
K...(HK...)	4) -40 +80	CLP HC	VG 220	Mobil SHC 630	Shell Omala HD 220	Klübersynth GEM 4-220 N	Aral Degol PAS 220		Tribol 1510/220	Pinnacle EP 220	Optigear Synthetic A 220	Renolin Unisyn CLP 220	
	4) -40 +40		VG 150	Mobil SHC 629	Shell Omala HD 150	Klübersynth GEM 4-150 N				Pinnacle EP 150			Carter SH 150
F...	-20 +25	CLP (CC)	VG 150 VG 100	Mobilgear 600XP 100	Shell Omala 100	Klüberoil GEM 1-150 N	Aral Degol BG 100	BP Energol GR-XP 100	Tribol 1100/100	Meropa 150	Optigear BM 100	Renolin CLP 150	Carter EP 100
	-30 +10	HLP (HM)	VG 68-46 VG 32	Mobil D.T.E. 13M	Shell Tellus T 32	Klüberoil GEM 1-68 N	Aral Degol BG 46		Tribol 1100/68	Rando EP Ashless 46	Optigear 32	Renolin B 46 HVI	Equivis ZS 46
	4) -40 +10	CLP HC	VG 32	Mobil SHC 624		Klüber-Summit HySyn FG-32				Cetus PAO 46			Dacnis SH 32
	4) -40 -20	HLP (HM)	VG 22 VG 15	Mobil D.T.E. 11M	Shell Tellus T 15	Isoflex MT 30 ROT		BP Energol HLP-HM 15		Rando HDZ 15			Equivis ZS 15
S...(HS...)	Standard 0 +40	CLP (CC)	VG 680	Mobilgear 600XP 680	Shell Omala 680	Klüberoil GEM 1-680 N	Aral Degol BG 680	BP Energol GR-XP 680	Tribol 1100/680	Meropa 680	Optigear BM 680	Renolin CLP 680	Carter EP 680
	-20 +60	CLP PG	VG 680 1)		Shell Tivela S 680	Klübersynth GH 6-680		BP Enersyn SG-XP 680	Tribol 800/680	Synlube CLP 680			
	4) -30 +80	CLP HC	VG 460	Mobil SHC 634	Shell Omala HD 460	Klübersynth GEM 4-460 N				Pinnacle EP 460			
	4) -40 +10		VG 150	Mobil SHC 629	Shell Omala HD 150	Klübersynth GEM 4-150 N				Pinnacle EP 150			Carter SH 150
	-20 +10	CLP (CC)	VG 150 VG 100	Mobilgear 600XP 100	Shell Omala 100	Klüberoil GEM 1-150 N	Aral Degol BG 100	BP Energol GR-XP 100	Tribol 1100/100	Meropa 150	Optigear BM 100	Renolin CLP 150	Carter EP 100
	-25 +20	CLP PG	VG 220 1)	Mobil Glygoyle 30	Shell Tivela S 220	Klübersynth GH 6-220	Aral Degol GS 220	BP Enersyn SG-XP 220	Tribol 800/220	Synlube CLP 220	Optiflex A 220		Carter SY 220
	4) -40 0	CLP HC	VG 32	Mobil SHC 624		Klüber-Summit HySyn FG-32				Cetus PAO 46			Dacnis SH 32
R...,K...(HK...), F...,S...(HS...)	Standard -20 +40	CLP PG	VG 460 1)			Klübersynth UH1 6-460							
	4) -30 +40	HCE	VG 460		Shell Cassida Fluid GL 460	Klüberoil 4UH1-460 N	Aral Eural Gear 460				Optileb GT 460		
	-20 +40	E	VG 460			Klüberbio CA2-460	Aral Degol BAB 460				Optisynt BS 460		
W...(HW...)	Standard -20 +40	SEW PG	VG 460 2)			Klüber SEW HT-460-5							
	4) -40 +10	API GL5	SAE 75W90 (-VG 100)	Mobilube SHC 75 W90-LS									
	-20 +40	CLP PG	VG 460 3)			Klübersynth UH1 6-460							

Lubricant fill quantities

The specified fill quantities are **recommended values**. The precise values vary depending on the number of stages and gear ratio. When filling, it is essential to check the **oil level plug since it indicates the precise oil capacity**.

The following tables show guide values for lubricant fill quantities in relation to the mounting position M1 ... M6.

Helical (R) gear units

RX..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
RX57	0.60	0.80	1.30	1.30	0.90	0.90
RX67	0.80	0.80	1.70	1.90	1.10	1.10
RX77	1.10	1.50	2.60	2.70	1.60	1.60
RX87	1.70	2.50	4.80	4.80	2.90	2.90
RX97	2.10	3.40	7.4	7.0	4.80	4.80
RX107	3.90	5.6	11.6	11.9	7.7	7.7

RXF..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
RXF57	0.50	0.80	1.10	1.10	0.70	0.70
RXF67	0.70	0.80	1.50	1.40	1.00	1.00
RXF77	0.90	1.30	2.40	2.00	1.60	1.60
RXF87	1.60	1.95	4.90	3.95	2.90	2.90
RXF97	2.10	3.70	7.1	6.3	4.80	4.80
RXF107	3.10	5.7	11.2	9.3	7.2	7.2

R.., R..F

Gear unit	Fill quantity in liters					
	M1[1)]	M2[1)]	M3	M4	M5	M6
R07	0.12	0.20	0.20	0.20	0.20	0.20
R17	0.25	0.55	0.35	0.55	0.35	0.40
R27	0.25/0.40	0.70	0.50	0.70	0.50	0.50
R37	0.30/0.95	0.85	0.95	1.05	0.75	0.95
R47	0.70/1.50	1.60	1.50	1.65	1.50	1.50
R57	0.80/1.70	1.90	1.70	2.10	1.70	1.70
R67	1.10/2.30	2.60/3.50	2.80	3.20	1.80	2.00
R77	1.20/3.00	3.80/4.10	3.60	4.10	2.50	3.40
R87	2.30/6.0	6.7/8.2	7.2	7.7	6.3	6.5
R97	4.60/9.8	11.7/14.0	11.7	13.4	11.3	11.7
R107	6.0/13.7	16.3	16.9	19.2	13.2	15.9
R137	10.0/25.0	28.0	29.5	31.5	25.0	25.0
R147	15.4/40.0	46.5	48.0	52.0	39.5	41.0
R167	27.0/70.0	82.0	78.0	88.0	66.0	69.0

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

RF..

Gear unit	Fill quantity in liters					
	M1[1)]	M2[1)]	M3	M4	M5	M6
RF07	0.12	0.20	0.20	0.20	0.20	0.20
RF17	0.25	0.55	0.35	0.55	0.35	0.40
RF27	0.25/0.40	0.70	0.50	0.70	0.50	0.50
RF37	0.35/0.95	0.90	0.95	1.05	0.75	0.95
RF47	0.65/1.50	1.60	1.50	1.65	1.50	1.50
RF57	0.80/1.70	1.80	1.70	2.00	1.70	1.70
RF67	1.20/2.50	2.70/3.60	2.70	2.60	1.90	2.10
RF77	1.20/2.60	3.80/4.10	3.30	4.10	2.40	3.00
RF87	2.40/6.0	6.8/7.9	7.1	7.7	6.3	6.4
RF97	5.1/10.2	11.9/14.0	11.2	14.0	11.2	11.8
RF107	6.3/14.9	15.9	17.0	19.2	13.1	15.9
RF137	9.5/25.0	27.0	29.0	32.5	25.0	25.0
RF147	16.4/42.0	47.0	48.0	52.0	42.0	42.0
RF167	26.0/70.0	82.0	78.0	88.0	65.0	71.0

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

Parallel shaft helical (F) gear units

F.., FA..B, FH..B, FV..B

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
F..27	0.60	0.80	0.65	0.70	0.60	0.60
F..37	0.95	1.25	0.70	1.25	1.00	1.10
F..47	1.50	1.80	1.10	1.90	1.50	1.70
F..57	2.60	3.50	2.10	3.50	2.80	2.90
F..67	2.70	3.80	1.90	3.80	2.90	3.20
F..77	5.9	7.3	4.30	8.0	6.0	6.3
F..87	10.8	13.0	7.7	13.8	10.8	11.0
F..97	18.5	22.5	12.6	25.2	18.5	20.0
F..107	24.5	32.0	19.5	37.5	27.0	27.0
F..127	40.5	54.5	34.0	61.0	46.3	47.0
F..157	69.0	104.0	63.0	105.0	86.0	78.0

FF..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
FF27	0.60	0.80	0.65	0.70	0.60	0.60
FF37	1.00	1.25	0.70	1.30	1.00	1.10
FF47	1.60	1.85	1.10	1.90	1.50	1.70
FF57	2.80	3.50	2.10	3.70	2.90	3.00
FF67	2.70	3.80	1.90	3.80	2.90	3.20
FF77	5.9	7.3	4.30	8.1	6.0	6.3
FF87	10.8	13.2	7.8	14.1	11.0	11.2
FF97	19.0	22.5	12.6	25.6	18.9	20.5
FF107	25.5	32.0	19.5	38.5	27.5	28.0
FF127	41.5	55.5	34.0	63.0	46.3	49.0
FF157	72.0	105.0	64.0	106.0	87.0	79.0

FA.., FH.., FV.., FAF.., FAZ.., FHF.., FHZ.., FVF.., FVZ.., FT..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
F..27	0.60	0.80	0.65	0.70	0.60	0.60
F..37	0.95	1.25	0.70	1.25	1.00	1.10
F..47	1.50	1.80	1.10	1.90	1.50	1.70
F..57	2.70	3.50	2.10	3.40	2.90	3.00
F..67	2.70	3.80	1.90	3.80	2.90	3.20
F..77	5.9	7.3	4.30	8.0	6.0	6.3
F..87	10.8	13.0	7.7	13.8	10.8	11.0
F..97	18.5	22.5	12.6	25.2	18.5	20.0
F..107	24.5	32.0	19.5	37.5	27.0	27.0
F..127	39.0	54.5	34.0	61.0	45.0	46.5
F..157	68.0	103.0	62.0	104.0	85.0	77.0

Helical-bevel (K) gear units

K.., KA..B, KH..B, KV..B

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
K..37	0.50	1.00	1.00	1.25	0.95	0.95
K..47	0.80	1.30	1.50	2.00	1.60	1.60
K..57	1.20	2.30	2.50	2.80	2.60	2.40
K..67	1.10	2.40	2.60	3.45	2.60	2.60
K..77	2.20	4.10	4.40	5.8	4.20	4.40
K..87	3.70	8.0	8.7	10.9	8.0	8.0
K..97	7.0	14.0	15.7	20.0	15.7	15.5
K..107	10.0	21.0	25.5	33.5	24.0	24.0
K..127	21.0	41.5	44.0	54.0	40.0	41.0
K..157	31.0	62.0	65.0	90.0	58.0	62.0
K..167	33.0	95.0	105.0	123.0	85.0	84.0
K..187	53.0	152.0	167.0	200	143.0	143.0

KF..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
KF37	0.50	1.10	1.10	1.50	1.00	1.00
KF47	0.80	1.30	1.70	2.20	1.60	1.60
KF57	1.30	2.30	2.70	3.15	2.90	2.70
KF67	1.10	2.40	2.80	3.70	2.70	2.70
KF77	2.10	4.10	4.40	5.9	4.50	4.50
KF87	3.70	8.2	9.0	11.9	8.4	8.4
KF97	7.0	14.7	17.3	21.5	15.7	16.5
KF107	10.0	21.8	25.8	35.1	25.2	25.2
KF127	21.0	41.5	46.0	55.0	41.0	41.0
KF157	31.0	66.0	69.0	92.0	62.0	62.0

KA.., KH.., KV.., KAF.., KHF.., KVF.., KAZ.., KHZ.., KVZ.., KT..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
K..37	0.50	1.00	1.00	1.40	1.00	1.00
K..47	0.80	1.30	1.60	2.15	1.60	1.60
K..57	1.30	2.30	2.70	3.15	2.90	2.70
K..67	1.10	2.40	2.70	3.70	2.60	2.60
K..77	2.10	4.10	4.60	5.9	4.40	4.40
K..87	3.70	8.2	8.8	11.1	8.0	8.0
K..97	7.0	14.7	15.7	20.0	15.7	15.7
K..107	10.0	20.5	24.0	32.4	24.0	24.0
K..127	21.0	41.5	43.0	52.0	40.0	40.0
K..157	31.0	66.0	67.0	87.0	62.0	62.0
K..167	33.0	95.0	105.0	123.0	85.0	84.0
K..187	53.0	152.0	167.0	200	143.0	143.0

Helical-worm (S) gear units

S

Gear unit	Fill quantity in liters					
	M1	M2	M3[1)]	M4	M5	M6
S..37	0.25	0.40	0.50	0.55	0.40	0.40
S..47	0.35	0.80	0.70/0.90	1.00	0.80	0.80
S..57	0.50	1.20	1.00/1.20	1.45	1.30	1.30
S..67	1.00	2.00	2.20/3.10	3.10	2.60	2.60
S..77	1.90	4.20	3.70/5.4	5.9	4.40	4.40
S..87	3.30	8.1	6.9/10.4	11.3	8.4	8.4
S..97	6.8	15.0	13.4/18.0	21.8	17.0	17.0

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

SF..

Gear unit	Fill quantity in liters					
	M1	M2	M3[1)]	M4	M5	M6
SF37	0.25	0.40	0.50	0.55	0.40	0.40
SF47	0.40	0.90	0.90/1.05	1.05	1.00	1.00
SF57	0.50	1.20	1.00/1.50	1.55	1.40	1.40
SF67	1.00	2.20	2.30/3.00	3.20	2.70	2.70
SF77	1.90	4.10	3.90/5.8	6.5	4.90	4.90
SF87	3.80	8.0	7.1/10.1	12.0	9.1	9.1
SF97	7.4	15.0	13.8/18.8	22.6	18.0	18.0

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

SA.., SH.., SAF.., SHZ.., SAZ.., SHF.., ST..

Gear unit	Fill quantity in liters					
	M1	M2	M3[1)]	M4	M5	M6
S..37	0.25	0.40	0.50	0.50	0.40	0.40
S..47	0.40	0.80	0.70/0.90	1.00	0.80	0.80
S..57	0.50	1.10	1.00/1.50	1.50	1.20	1.20
S..67	1.00	2.00	1.80/2.60	2.90	2.50	2.50
S..77	1.80	3.90	3.60/5.0	5.8	4.50	4.50
S..87	3.80	7.4	6.0/8.7	10.8	8.0	8.0
S..97	7.0	14.0	11.4/16.0	20.5	15.7	15.7

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

Spiroplan® (W) gear units

The fill quantity of Spiroplan® gear units does not vary, irrespective of their mounting position.

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
W..10	0.16					
W..20	0.24					
W..30	0.40					

10.2 Installation/removal of gear units with hollow shafts and keys

- Always use the supplied NOCO® fluid for installation. The fluid prevents contact corrosion and facilitates subsequent removal.
- The keyway dimension X is specified by the customers, but X must > DK.

Installation

SEW-EURODRIVE recommends two variants for installation of gear units with hollow shaft and key onto the input shaft of the driven machine (= customer shaft):

1. Use the fastening parts supplied for installation.
2. Use the optional installation/removal tool for installation.

1) Supplied fastening parts

The following fastening parts are supplied as standard:

- Retaining screw with washer (2)
- Circlip (3)

Note the following points concerning the customer shaft:

- The installation length of the customer shaft with contact shoulder (A) must be L8 - 1 mm (0.04 in).
- The installation length of the customer shaft without contact shoulder (B) must equal L8.

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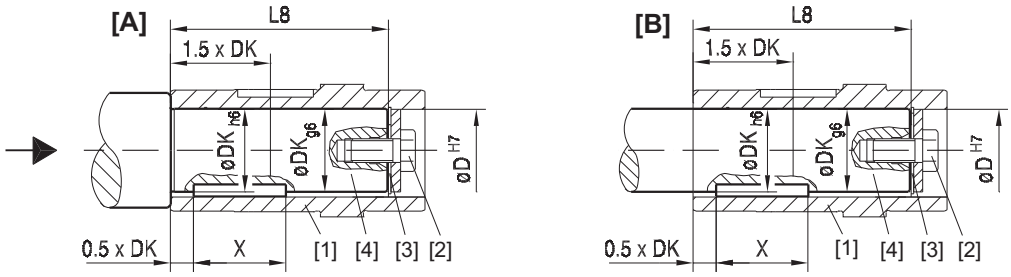

Figure 97: Customer shaft with contact shoulder (A) and without contact shoulder (B)

(1) Hollow shaft
(2) Retaining screw with washer
(3) Circlip
(4) Customer shaft

Dimensions and tightening torque:

The retaining screw (2) must be tightened to the tightening torque MS given in the following table.

Gear unit type	D^{H7} [mm]	DK [mm]	L8 [mm]	MS [Nm]
WA..10	16	16	69	8
WA..20	18	18	84	8
WA..20, WA..30, SA..37	20	20	84, 106, 104	8
FA..27, SA..47	25	25	88, 105	20
FA..37, KA..37, SA..47 **SA..57**	30	30	105 132	20
FA..47, KA..47, SA..57	35	35	132	20
FA..57, KA..57 **FA..67, KA..67** **SA..67**	40	40	142 156 144	40
SA..67	45	45	144	40
FA..77, KA..77, SA..77	50	50	183	40
FA..87, KA..87 **SA..77, SA..87**	60	60	210 180, 220	80
FA..97, KA..97 **SA..87, SA..97**	70	70	270 220, 260	80
FA..107, KA..107, SA..97	90	90	313, 313, 255	200
FA..127, KA..127	100	100	373	200
FA..157, KA..157	120	120	460	200

Gear unit type	D^{H7} [in]	DK [in]	L8 [in]	MS [lb-ft]
WA..10	0.625	0.625	2.72	5.9
WA..20	0.75	0.75	3.31	5.9
WA..30	0.75	0.75	4.17	5.9
SA..37	0.75	0.75	4.09	5.9
FA..27	1	1	3.5	15
FA..37, KA..37, SA.47	1.25	1.25	4.13	15
FA..47, KA..47, SA..57	1.375	1.375	5.2	15
FA..57, KA..57	1.5	1.5	5.59	30
SA..67	1.5	1.5	5.67	30
FA..67, KA..67	1.5	1.5	6.14	30
FA..77, KA..77, SA..77	2	2	7.2	30
FA..87, KA..87	2.375	2.375	8.27	59
SA..87	2.375	2.375	8.66	59
FA..97, KA..97	2.75	2.75	10.63	59
SA..97	2.75	2.75	10.23	59
FA..107, KA..107	3.625	3.625	12.32	148
FA..127, KA..127	4	4	14.69	148
FA..157, KA..157	4.5	4.5	18.11	148

2) Installation /removal tool

For information on the optional installation/removal tool, refer to Tech Note GM-024.

10.3 Gear units with hollow shaft

Chamfers on hollow shafts

The following illustration shows the chamfers on parallel shaft helical, helical-bevel and helical-worm gear units with hollow shaft:

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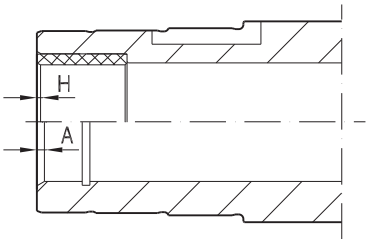

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Figure 98: Chamfers on hollow shafts

Gear unit	Version	
	with hollow shaft (A) [mm x°]	with hollow shaft and shrink disc (H) [mm x°]
F..27	2 × 30°	0.5 × 45°
F../K../S..37	2 × 30°	0.5 × 45°
F../K../S..47	2 × 30°	0.5 × 45°
S..57	2 × 30°	0.5 × 45°
F../K..57	2 × 30°	0.5 × 45°
F../K../S..67	2 × 30°	0.5 × 45°
F../K../S..77	2 × 30°	0.5 × 45°
F../K../S..87	3 × 30°	0.5 × 45°
F../K../S..97	3 × 30°	0.5 × 45°
F../K..107	3 × 30°	3 × 2°
F../K..127	5 × 30°	1.5 × 30°
F../K..157	5 × 30°	1.5 × 30°
KH167	-	1.5 × 30°
KH187	-	1.5 × 30°

Special motor/gear unit combinations

Please note for parallel shaft helical gearmotors with hollow shaft (FA..B, FV..B, FH..B, FAF, FVF, FHF, FA, FV, FH, FT, FAZ, FVZ, FHZ):

- If you are using a customer shaft pushed through on the motor end, there may be a collision when a "small gear unit" is used in combination with a "large motor".
- Check the motor dimension AC to decide whether there will be a collision with a pushed-through customer shaft.

10.4 TorqLOC® mounting system for gear units with hollow shaft

Description of TorqLOC®

The TorqLOC® hollow shaft mounting system is used for achieving a connection between customer shaft and the hollow shaft in the gear unit. As a result, the TorqLOC® hollow shaft mounting system is an alternative to the hollow shaft with shrink disc, the hollow shaft with key and the splined hollow shaft that have been used so far.

The TorqLOC® hollow shaft mounting system consists of the following components:

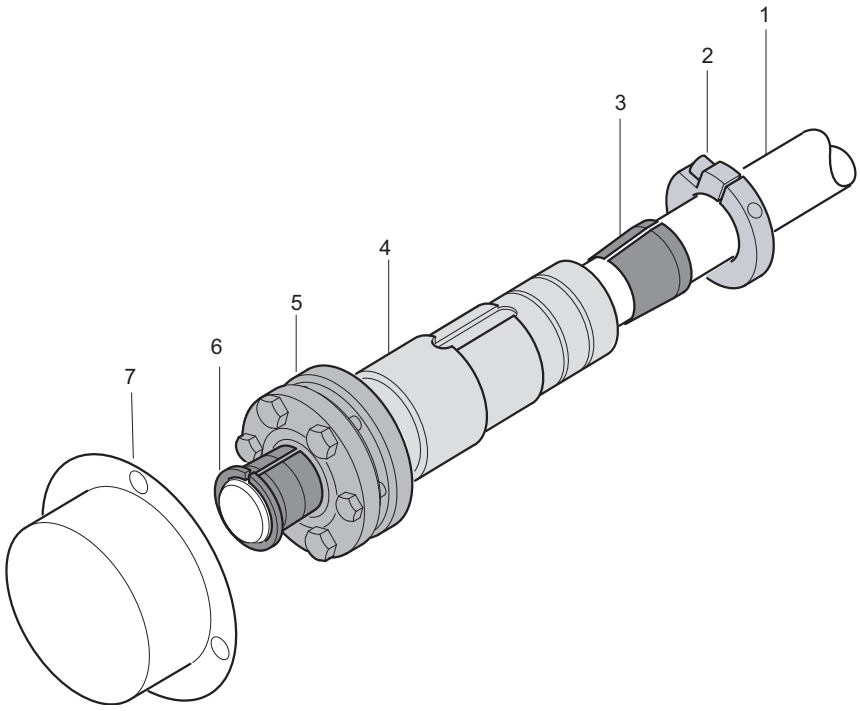

Figure 99: Components of the TorqLOC® hollow shaft mounting system

1. Customer shaft
2. Clamping ring
3. Tapered support bushing
4. Hollow shaft in gear unit
5. Shrink disc
6. Tapered torque bushing
7. Fixed cover

Advantages of TorqLOC®

The TorqLOC® hollow shaft mounting system is characterized by the following advantages:

- Cost saving because the customer shaft can be made from turned shaft stock or cold rolled stock without additional machining.
- Cost saving because different customer shaft diameters can be covered by one hollow shaft diameter and different bushings.
- Simple installation since there is no need to accommodate any shaft connections.
- Simple removal even after many hours of operation because the possibility of contact corrosion has been eliminated and the tapered connections can easily be released.

Technical data

The TorqLOC® hollow shaft mounting system is approved for output torques of 814 lb-in to 159300 lb-in.

The following gear units are available with TorqLOC® hollow shaft mounting system:

- Parallel shaft helical gear units in gear unit sizes 37 to 157 (FT37 ... FT157)
- Helical-bevel gear units in gear unit sizes 37 to 157 (KT37 ... KT157)
- Helical-worm gear units in gear unit sizes 37 to 97 (ST37 ... ST97)

Available options

The following options are available for gear units with TorqLOC® hollow shaft mounting system:

- Helical-bevel and helical-worm gear units with TorqLOC® (KT.., ST..): The "torque arm" (../T) option is available.
- Parallel shaft helical gear units with TorqLOC® (FT..): The "rubber buffer" (../G) option is available.

Bore sizes

Metric and inch bores are available as shown below.

Model	inch				
ST37	0.625	0.6875	0.75	-	-
FT37, KT37, ST47	1.00	1.1875	1.25	-	-
FT47, KT47, ST57	1.1875	1.25	1.375	1.4375	-
FT57, KT57	1.375	1.4375	1.50	1.625	-
FT67, KT67, ST67	1.375	1.4375	1.50	1.625	1.688
FT77, KT77, ST77	1.625	1.75	1.9375	2.00	-
FT87, KT87, ST87	1.9375	2.00	2.375	2.4375	-
FT97, KT97, ST97	2.4375	2.75	2.9375	-	-
FT107, KT107	3.250	3.4375	3.625	3.750	-
FT127, KT127	3.4375	3.750	4.00	4.1875	-
FT157, KT157	4.4375	4.50	4.9375	5.00	-

Model	mm		
ST37	16	19	20
FT37, KT37, ST47	25	30	-
FT47, KT47, ST57	30	35	-
FT57, KT57	35	38	40
FT67, KT67, ST67	35	38	40
FT77, KT77, ST77	50	-	-
FT87, KT87, ST87	51	62	65
FT97, KT97, ST97	62	70	75
FT107, KT107	80	90	95
FT127, KT127	105	-	-
FT157, KT157	110	125	-

10.5 Shouldered hollow shaft with shrink disc option

As an option, gear units with hollow shaft and shrink disc (parallel shaft helical gear units FH/FHF/FHZ37-157, helical-bevel gear units KH/KHF/KHZ37-157 and helical-worm gear units SH/SHF47-97) can be supplied with a larger bore diameter D'.

As standard, D' = D.

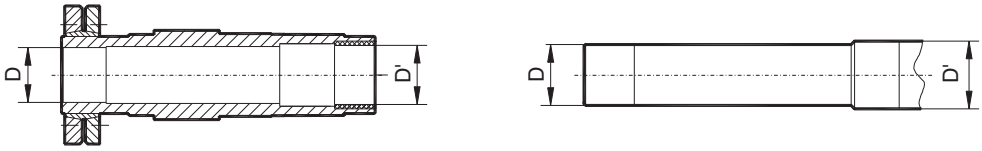

Figure 100: Optional bore diameter D'

Gear unit	Bore diameter D / optionally D' [mm]
FH/FHF/FHZ37, KH/KHF/KHZ37, SH/SHF/SHZ47	30 / 32
FH/FHF/FHZ47, KH/KHF/KHZ47, SH/SHF/SHZ57	35 / 36
FH/FHF/FHZ57, KH/KHF/KHZ57	40 / 42
FH/FHF/FHZ67, KH/KHF/KHZ67, SH/SHF/SHZ67	40 / 42
FH/FHF/FHZ77, KH/KHF/KHZ77, SH/SHF/SHZ77	50 / 52
FH/FHF/FHZ87, KH/KHF/KHZ87, SH/SHF/SHZ87	65 / 66
FH/FHF/FHZ97, KH/KHF/KHZ97, SH/SHF/SHZ97	75 / 76
FH/FHF/FHZ107, KH/KHF/KHZ107	95 / 96
FH/FHF/FHZ127, KH/KHF/KHZ127	105 / 106
FH/FHF/FHZ157, KH/KHF/KHZ157	125 / 126

Diameter D / D' must be specified when ordering gear units with a shouldered hollow shaft (optional bore diameter D').

Sample order FH37 DT80N4 with hollow shaft 30/32 mm

Parallel shaft helical gear units with shouldered hollow shaft (dimensions in mm):

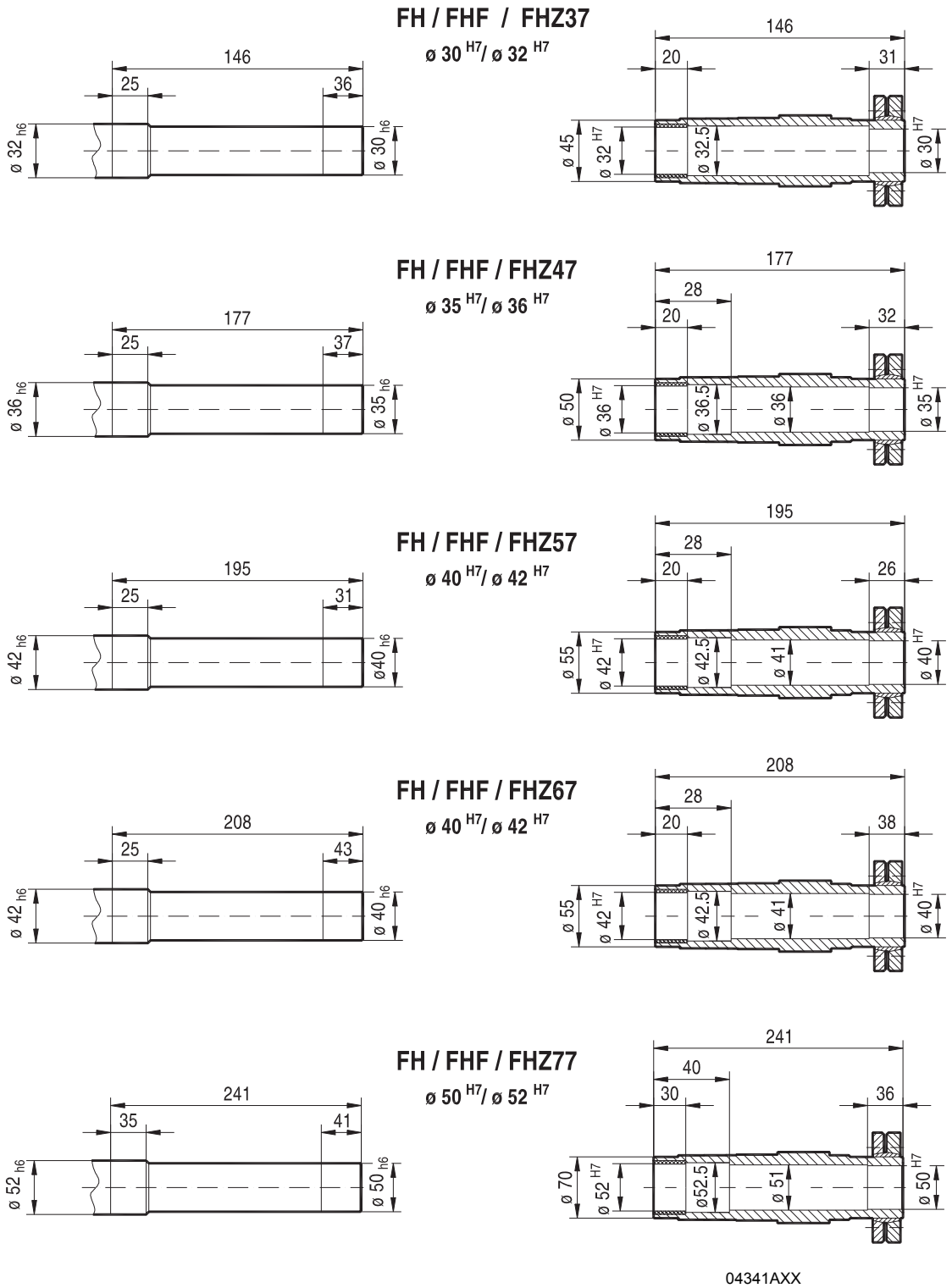

Figure 101: Shouldered hollow shaft FH/FHF/FHZ37...77

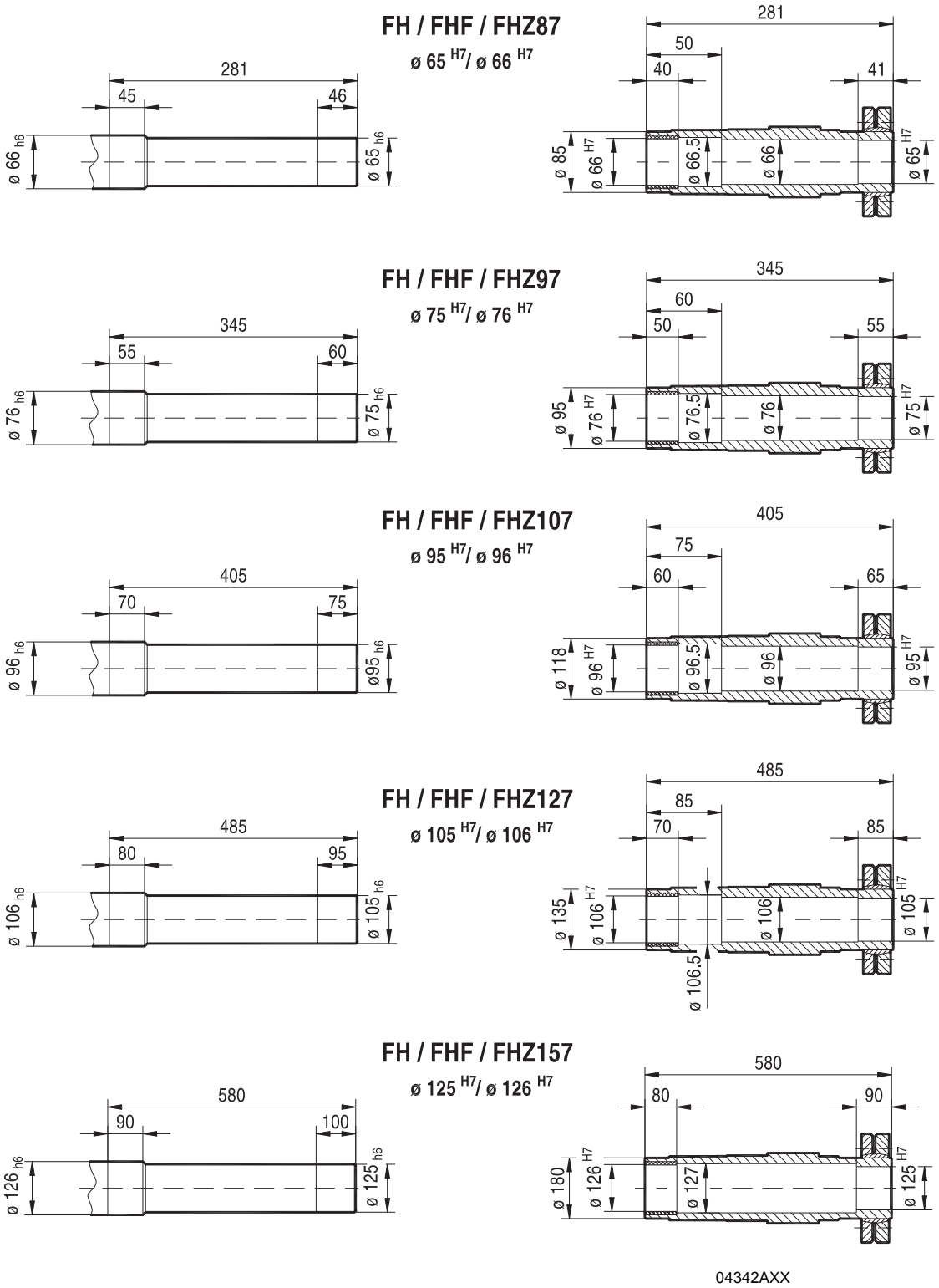

Figure 102: Shouldered hollow shaft FH/FHF/FHZ87...157

Helical-bevel gear unit with shouldered hollow shaft (dimensions in mm):

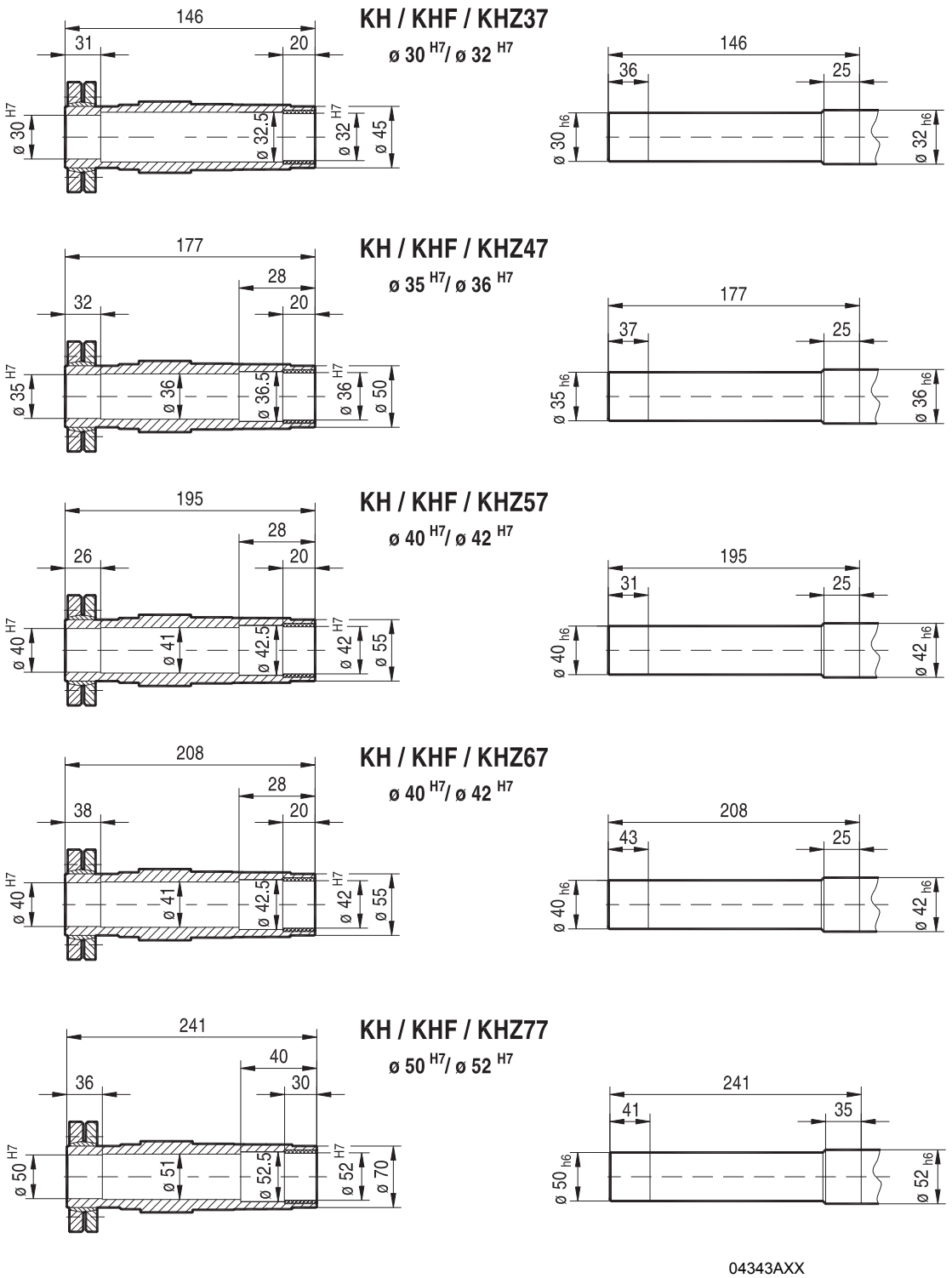

Figure 103: Shouldered hollow shaft KH/KHF/KHZ37...77

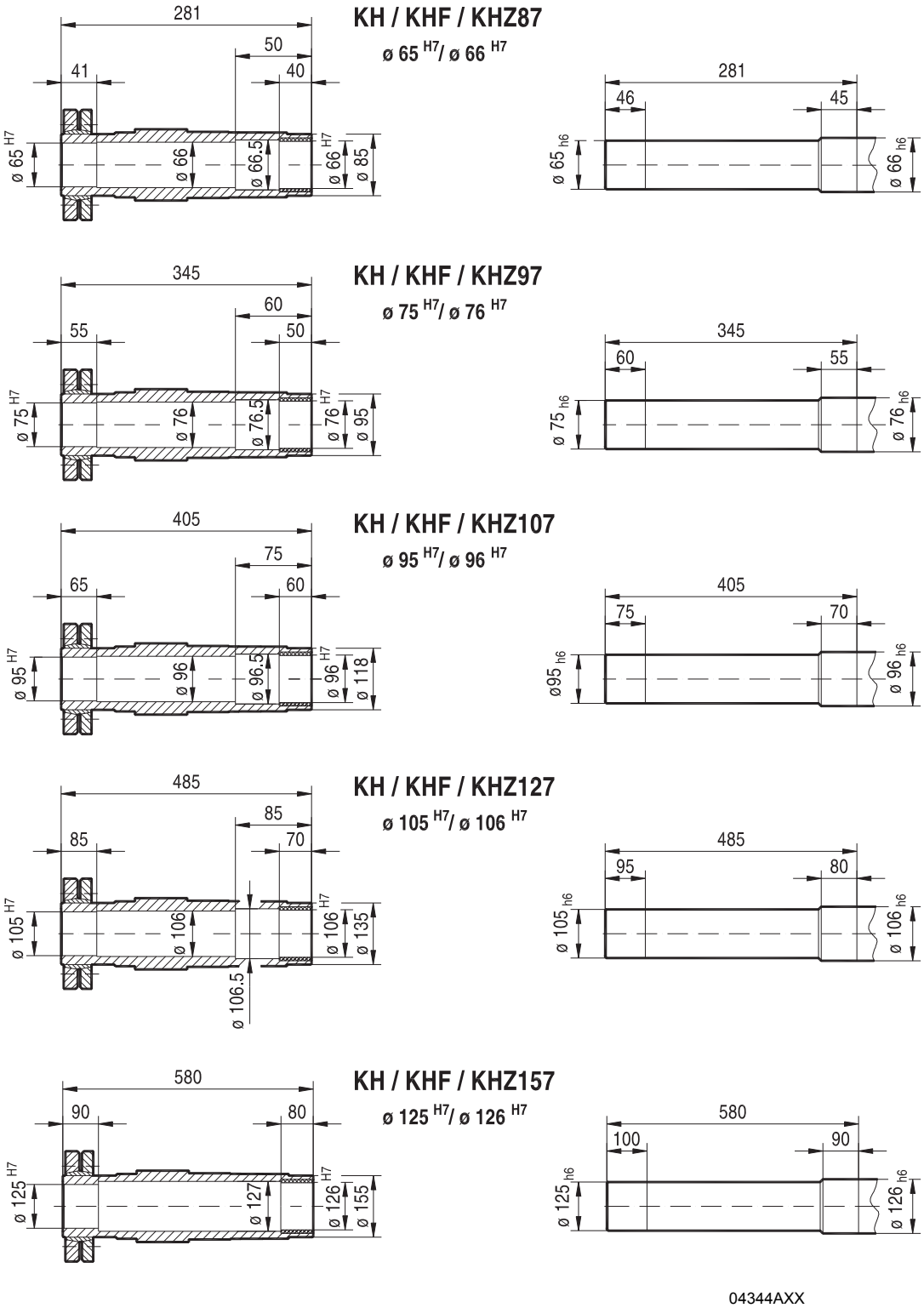

Figure 104: Shouldered hollow shaft KH/KHF/KHZ87...157

Helical-worm gear units with shouldered hollow shaft (dimensions in mm):

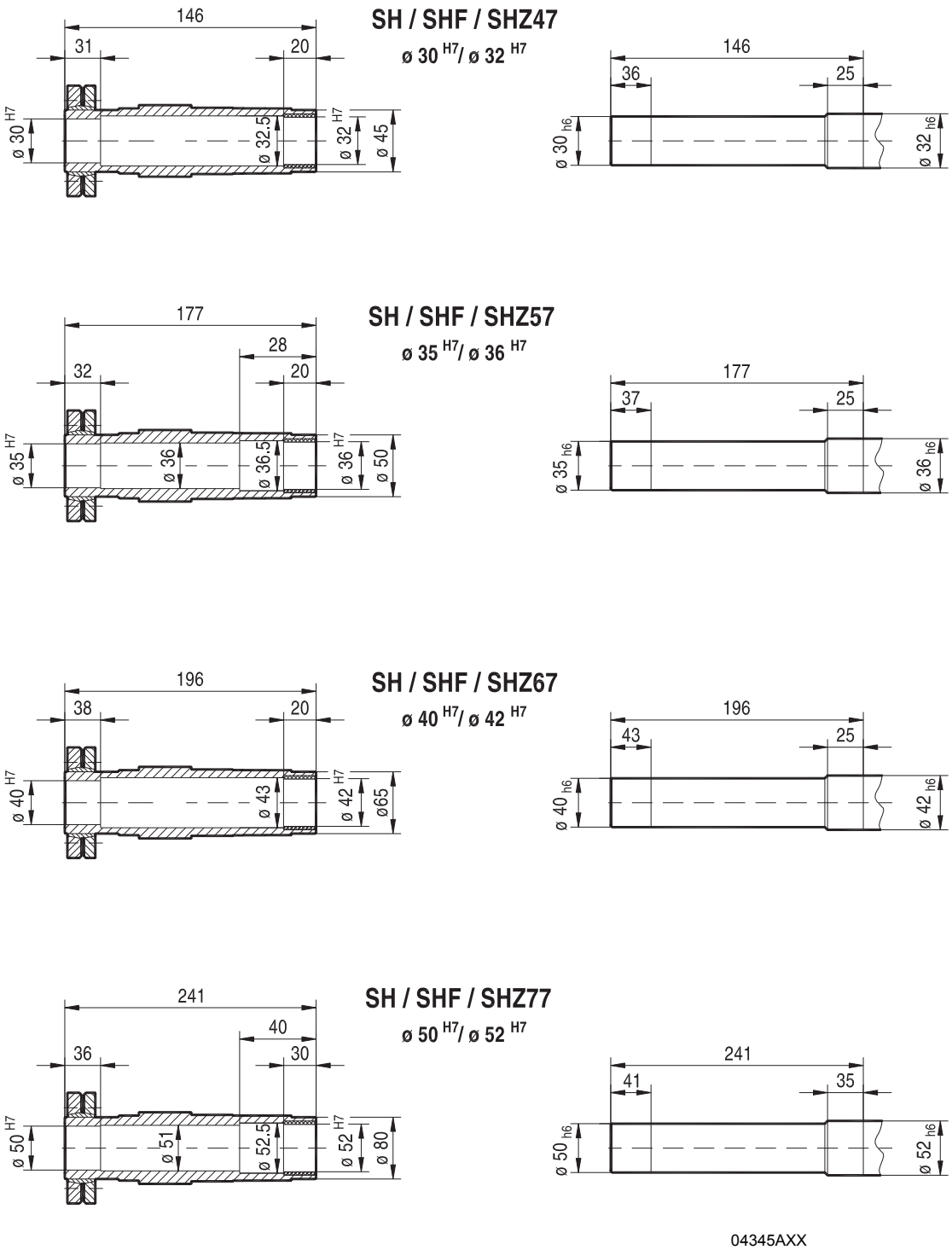

Figure 105: Shouldered hollow shaft SH/SHF/SHZ47...77

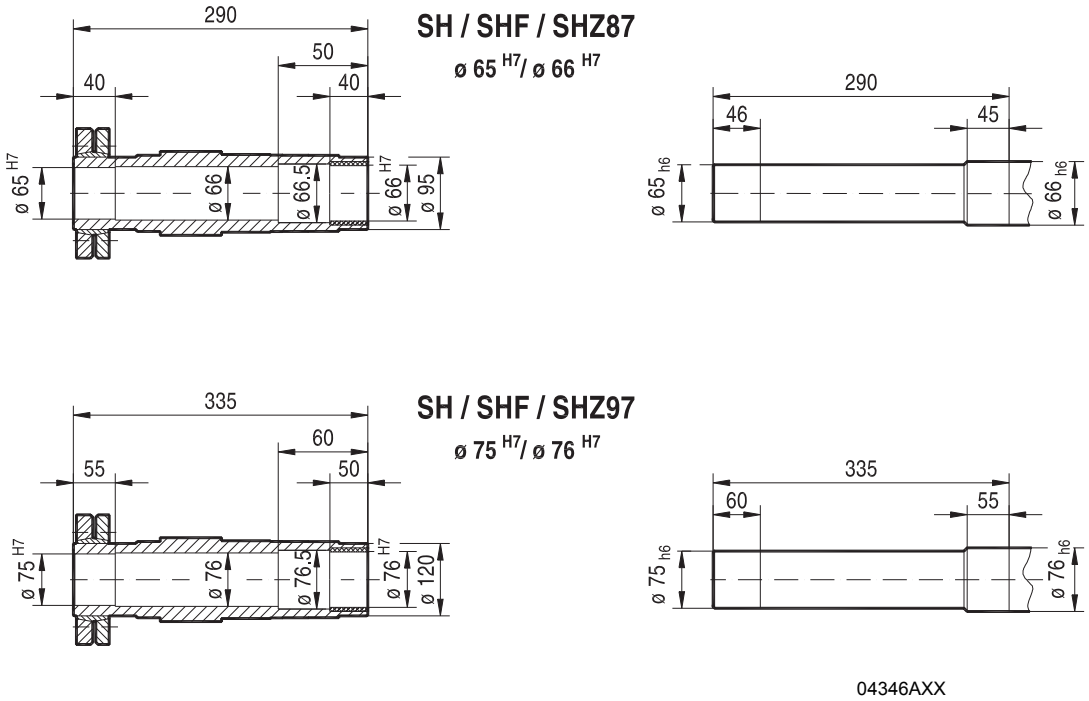

Figure 106: Shouldered hollow shaft SH/SHF/SHZ87...97

10.6 Adapters for mounting IEC motors

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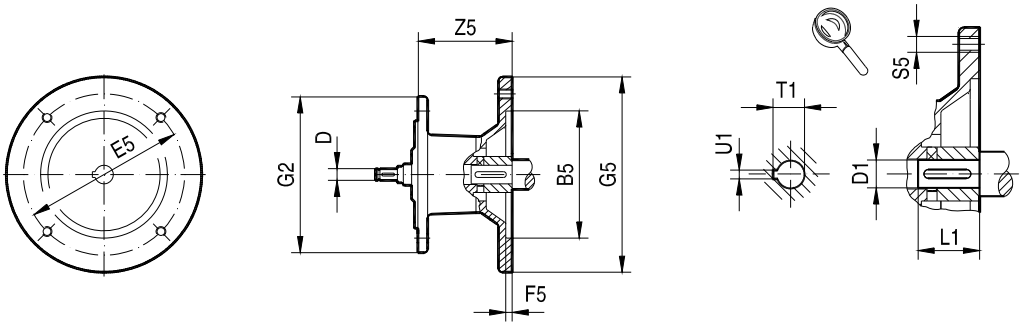

Gear unit type	Adapter type	Dimensions in mm											
		B5	D	E5	F5	G2	G5	S5	Z5	D1	L1	T1	U1
R..27, R..37 F..27, F..37, F..47 K..37 S..37, S..47, S..57	AM63	95	10	115	3.5	120	140	M8	72	11	23	12.8	4
	AM71[1]	110		130	4		160			14	30	16.3	5
	AM80[1]	130	12	165	4.5		200	M10	106	19	40	21.8	6
	AM90[1]		14							24	50	27.3	8
R..47[2], R..57, R..67 F..57, F..67 K..47[2], K..57, K..67 S..67	AM63	95	10	115	3.5	160	140	M8	66	11	23	12.8	4
	AM71	110		130	4		160			14	30	16.3	5
	AM80	130	12	165	4.5		200	M10	99	19	40	21.8	6
	AM90		14							24	50	27.3	8
	AM100[1]	180	16	215	5		250	M12	134	28	60	31.3	8
	AM112[1]		18										
	AM132S/M[1]	230	22	265			300		191	38	80	41.3	10
R..77 F..77 K..77 S..77	AM63	95	10	115	3.5	200	140	M8	60	11	23	12.8	4
	AM71	110		130	4		160			14	30	16.3	5
	AM80	130	12	165	4.5		200	M10	92	19	40	21.8	6
	AM90		14							24	50	27.3	8
	AM100[1]	180	16	215	5		250	M12	126	28	60	31.3	8
	AM112[1]		18										
	AM132S/M[1]	230	22	265			300		179	38	80	41.3	10
	AM132ML[1]		28										
R..87 F..87 K..87 S..87[3]	AM80	130	12	165	4.5	250	200	M10	87	19	40	21.8	6
	AM90		14							24	50	27.3	8
	AM100	180	16	215	5		250	M12	121	28	60	31.3	8
	AM112		18										
	AM132S/M	230	22	265			300		174	38	80	41.3	10
	AM132ML		28										
	AM160[1]	250	28	300	6		350	M16	232	42	110	45.3	12
	AM180[1]		32							48		51.8	14

1) Check dimension 2 G5 because component may protrude past foot-mounting surface if installed on R, K or S foot-mounted gear unit.

2) not with AM112

3) not with AM180

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Fig.1

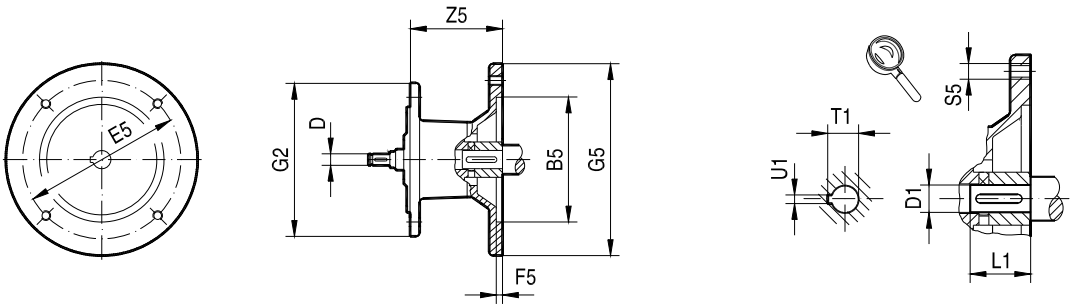
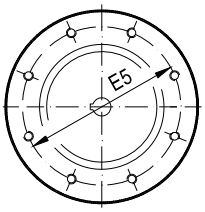


Fig.2



Gear unit type	Adapter type	Fig.	Dimensions in mm											
			B5	D	E5	F5	G2	G5	S5	Z5	D1	L1	T1	U1
R..97 F..97 K..97 S..97[1]	AM100	1	180	16	215	5	300	250	M12	116	28	60	31.3	8
	AM112			18										
	AM132S/M		230	22	265			300		169	38	80	41.3	10
	AM132ML			28										
	AM160		250	28	300	6		350	M16	227	42	110	45.3	12
	AM180			32							48		51.8	14
	AM200		300	38	350	7		400		268	55		59.3	16
R..107 F..107 K..107	AM100	1	180	16	215	5	350	250	M12	110	28	60	31.3	8
	AM112			18										
	AM132S/M		230	22	265			300		163	38	80	41.3	10
	AM132ML			28										
	AM160		250	28	300	6		350	M16	221	42	110	45.3	12
	AM180			32							48		51.8	14
	AM200		300	38	350	7		400		262	55		59.3	16
	AM225	2	350	38	400			450		277	60	140	64.4	18
R..137	AM132S/M	1	230	22	265	5	400	300	M12	156	38	80	41.3	10
	AM132ML			28										
	AM160		250	28	300	6		350	M16	214	42	110	45.3	12
	AM180			32							48		51.8	14
	AM200		300	38	350	7		400		255	55		59.3	16
	AM225	2	350	38	400			450		270	60	140	64.4	18

1) Not with AM200

23 004 100

Fig.1

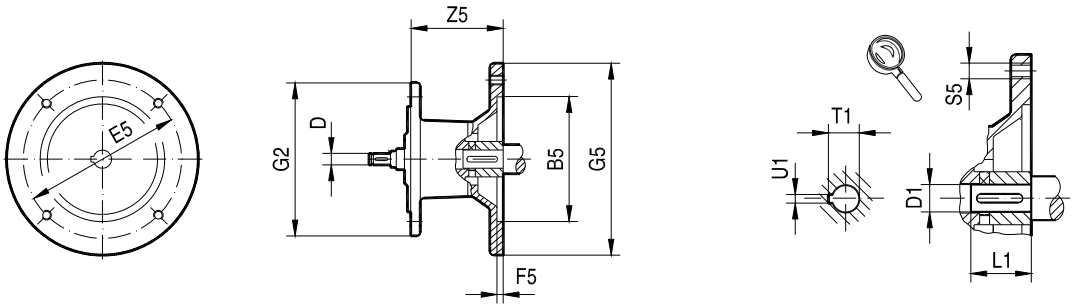
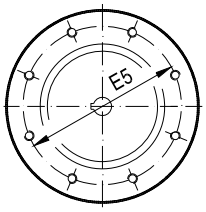
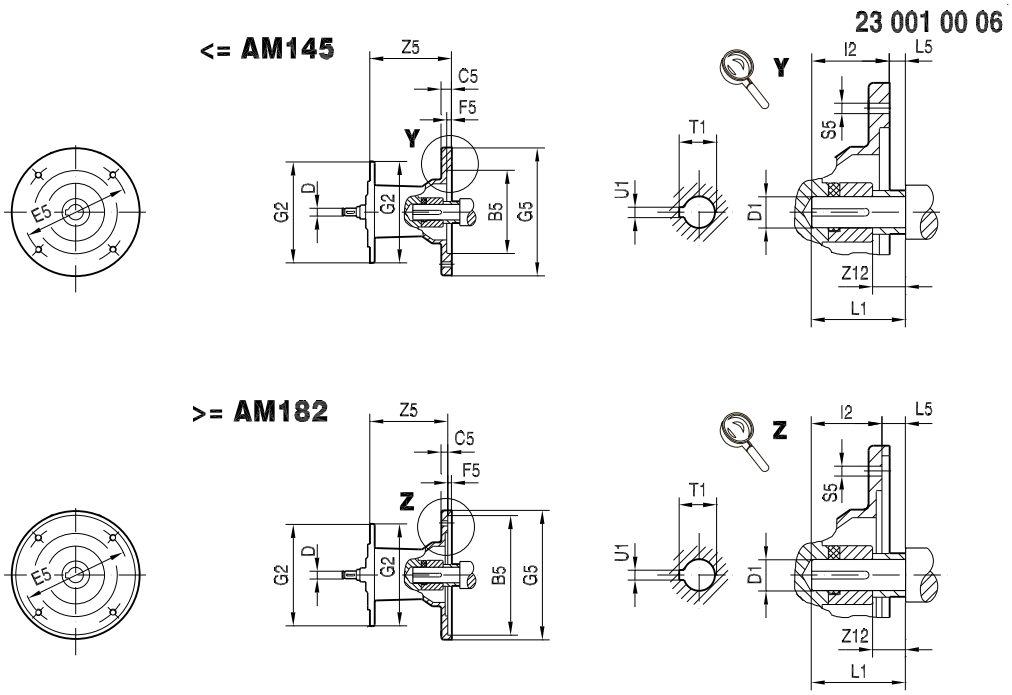


Fig.2



Gear unit type	Adapter type	Fig.	Dimensions in mm											
			B5	D	E5	F5	G2	G5	S5	Z5	D1	L1	T1	U1
R..147 F..127 K..127	**AM132S/M**	1	230	22	265	5	450	300	M12	148	38	80	41.3	10
	AM132ML			28							38			
	AM160		250	28	300	6		350	M16	206	42	110	45.3	12
	AM180			32							48		51.8	14
	AM200		300	38	350	7		400		247	55		59.3	16
	AM225	2	350	38	400			450		262	60	140	64.4	18
	AM250		450	48	500			550		336	65		69.4	
	AM280										75		79.9	20
R..167 F..157 K..157 K..167 K..187	**AM160**	1	250	28	300	6	550	350		198	42	110	45.3	12
	AM180			32							48		51.8	14
	AM200		300	38	350	7		400		239	55		59.3	16
	AM225	2	350	38	400			450		254	60	140	64.4	18
	AM250		450	48	500			550		328	65		69.4	
	AM280										75		79.9	20

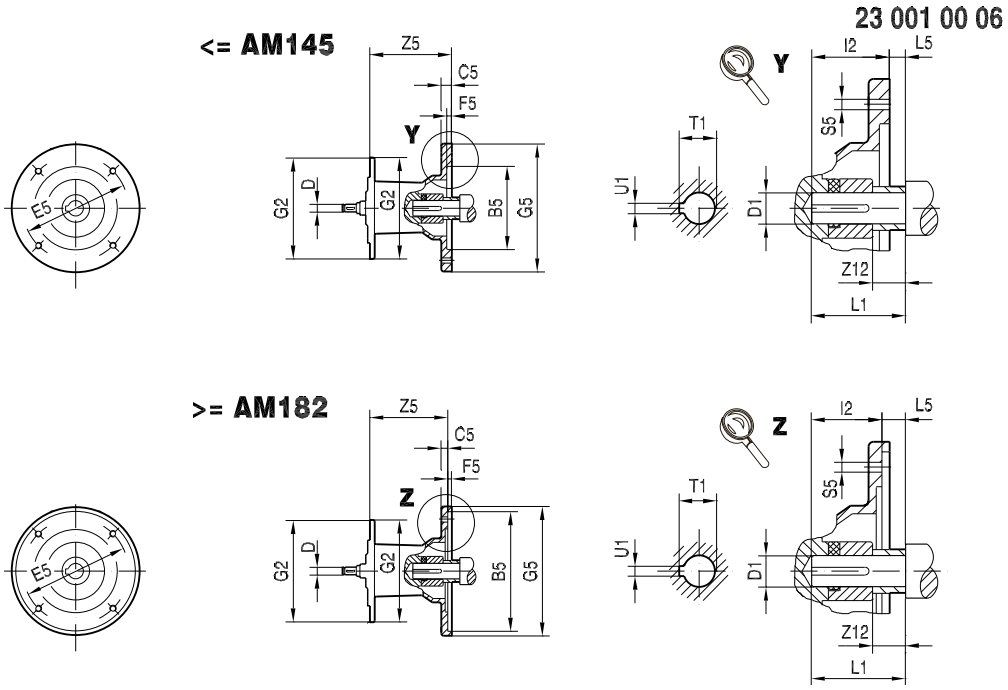
10.7 Adapters for mounting NEMA motors



Gear unit type	Adapter type	Dimensions in inch															
		B5	C5	D[1]	E5	F5	G2	G5	I2	L5	S5	Z5	Z12	D1	L1	T1	U1
R..27, R..37 F..27, F..37, F..47 K..37 S..37, S..47, S..57	AM56	4.50	0.43	10	5.87	0.18	4.72	6.69	2.07	-0.19	0.41	3.68	0.65	0.625	1.85	0.71	0.1875
	AM143		0.47	12					2.13	0.12		4.61	0.57	0.88	2.24	0.97	
	AM145			14													
R..47, R..57, R..67, F..57, F..67, K..47[2] K..57, K..67 S..67	AM56	4.50	0.43	10	5.87	0.18	6.30	6.69	2.07	-0.19	0.41	3.43	0.65	0.625	1.85	0.71	0.1875
	AM143		0.47	12					2.13	0.12		4.35	0.57	0.875	2.24	0.97	
	AM145			14													
	AM182	8.50	0.39	16	7.24	0.20		8.98	2.63	0.12	0.59	5.81	0.65	1.125	2.72	1.25	0.25
	AM184			18													
	AM213/215		0.43	22					3.13	0.25		7.89	0.62	1.375	3.35	1.52	0.3125
R..77 F..77 K..77 S..77	AM56	4.50	0.43	10	5.87	0.18	7.87	6.69	2.07	-0.19	0.41	3.19	0.65	0.625	1.85	0.71	0.1875
	AM143		0.47	12					2.13	0.12		4.07	0.57	0.875	2.24	0.97	
	AM145			14													
	AM182	8.50	0.39	16	7.24	0.20		8.98	2.63	0.12	0.59	5.49	0.65	1.125	2.72	1.25	0.25
	AM184			18													
	AM213/215		0.43	22					3.13	0.25		7.42	0.62	1.375	3.35	1.52	0.3125
R..87 F..87 K..87 S..87	AM143	4.50	0.47	12	5.87	0.18	9.84	6.69	2.13	0.12	0.41	3.88	0.57	0.875	2.24	0.97	0.1875
	AM145			14													
	AM182	8.50	0.39	16	7.24	0.20		8.98	2.63	0.12	0.59	5.30	0.65	1.125	2.72	1.25	0.25
	AM184			18													
	AM213/215		0.43	22					3.13	0.25		7.22	0.62	1.375	3.35	1.52	0.3125
	AM254/256		0.47	28					3.75			9.21	0.35	1.625	3.98	1.80	0.375
	AM284/286	10.50	0.59	32	9.00			11.26	4.37			9.49	0.62	1.875	4.61	2.10	0.5

1) Dimension in mm

2) Not with AM213/215

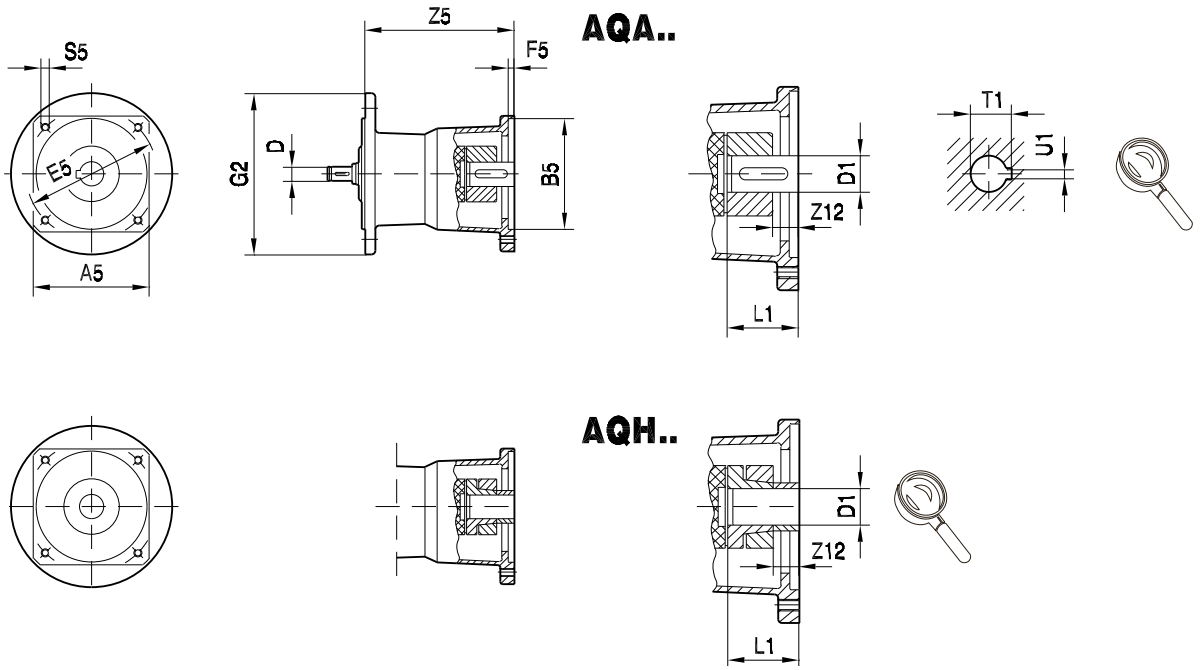


Gear unit type	Adapter type	Dimensions in inch															
		B5	C5	D[1]	E5	F5	G2	G5	I2	L5	S5	Z5	Z12	D1	L1	T1	U1
R..97 F..97 K..97 S..97	AM182	8.50	0.39	16	7.24	0.20	11.81	8.98	2.63	0.12	0.59	5.10	0.65	1.125	2.72	1.25	0.25
	AM184			18													
	AM213/215		0.43	22					3.13	0.25		7.03	0.62	1.375	3.35	1.52	0.3125
	AM254/256		0.47	28					3.75			9.02	0.35	1.625	3.98	1.80	0.375
	AM284/286	10.50	0.79	32	9.00			11.26	4.37			9.29	0.62	1.875	4.61	2.10	0.5
	AM324/326	12.50	0.67	38	11.00			14.02	5.00		0.69	11.65	1.37	2.125	5.24	2.36	
	AM364/365								5.63					2.375	5.87	2.66	0.625
R..107 F..107 K..107	AM182	8.50	0.39	16	7.24	0.20	13.78	8.98	2.63	0.12	0.59	4.86	0.65	1.125	2.75	1.25	0.25
	AM184			18													
	AM213/215		0.43	22					3.13	0.25		6.79	0.62	1.375	3.38	1.52	0.3125
	AM254/256		0.47	28					3.75			8.78	0.35	1.625	4.00	1.80	0.375
	AM284/286	10.50	0.59	32	9.00			11.26	4.37			9.06	0.62	1.875	4.62	2.10	0.5
	AM324/326	12.50	0.67	38	11.00			14.02	5.00		0.69	11.42	1.37	2.125	5.25	2.36	
	AM364/365								5.63					2.375	5.88	2.66	0.625
R..137	AM213/215	8.50	0.43	22	7.24	0.20	15.75	8.98	3.13	0.25	0.59	6.52	0.62	1.375	3.38	1.52	0.3125
	AM254/256		0.47	28					3.75			8.50	0.35	1.625	4.00	1.80	0.375
	AM284/286	10.50	0.59	32	9.00			11.26	4.37			8.78	0.62	1.875	4.62	2.10	0.5
	AM324/326	12.50	0.67	38	11.00			14.02	5.00		0.69	11.14	1.37	2.125	5.25	2.36	
	AM364/365								5.63					2.375	5.88	2.66	0.625
R..147 F..127 K..127	AM213/215	8.50	0.43	22	7.24	0.20	17.72	8.98	3.13	0.25	0.59	6.20	0.62	1.375	3.38	1.52	0.3125
	AM254/256		0.47	28					3.75			8.19	0.35	1.625	4.00	1.80	0.375
	AM284/286	10.50	0.59	32	9.00			11.26	4.37			8.46	0.62	1.875	4.62	2.10	0.5
	AM324/326	12.50	0.67	38	11.00			14.02	5.00		0.69	10.83	1.37	2.125	5.25	2.36	
	AM364/365								5.63					2.375	5.88	2.66	0.625
R..167 F..157 K..157, K..167, K..187	AM254/256	8.50	0.47	28	7.24	0.20	21.65	8.98	3.75	0.25	0.59	7.87	0.35	1.625	4.00	1.80	0.375
	AM284/286	10.50	0.59	32	9.00			11.26	4.37			8.15	0.62	1.875	4.62	2.10	0.5
	AM324/326	12.50	0.67	38	11.00			14.02	5.00		0.69	10.51	1.37	2.125	5.25	2.36	
	AM364/365								5.63					2.375	5.88	2.66	0.625

1) Dimension in mm

10.8 Adapters for mounting servomotors

23 005 01 00



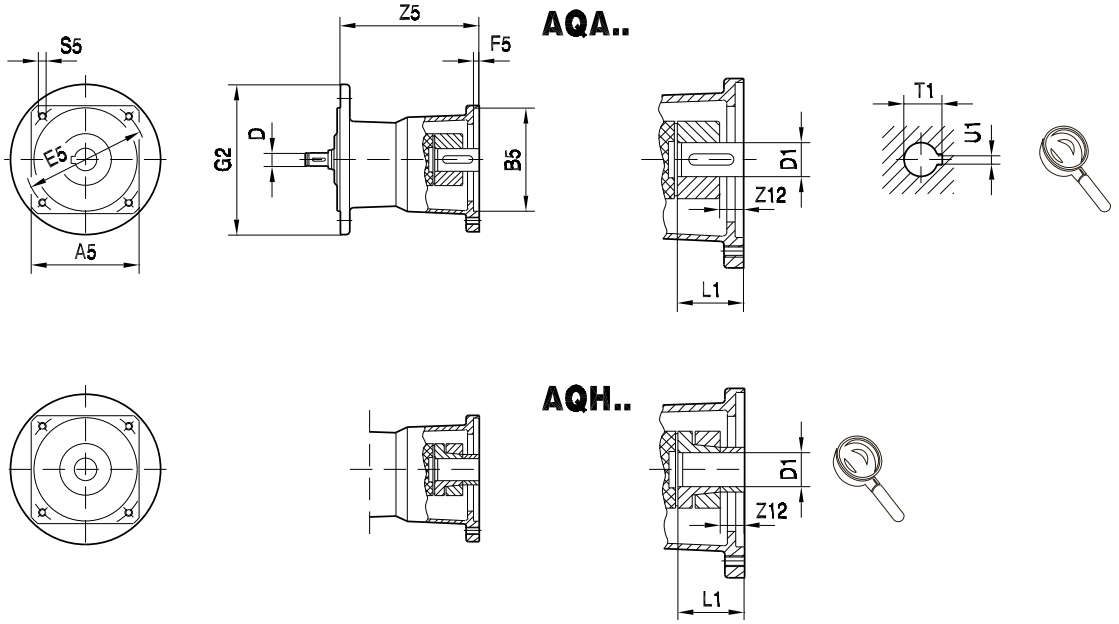
Gear unit type	Adapter type	Dimensions in mm													
		A5	B5	D	E5	F5	G2	S5	Z5	Z12[1]	Z12[2]	D1	L1	T1[1]	U1[1]
R..27, R..37 F..27, F..37, F..47 K..37 S..37, S..47, S..57	AQ..80/1	82	60	10 12	75	3	120	M5	104.5	5.5	5.5	11	23	12.8	4
	AQ..80/2											14	30	16.3	5
	AQ..80/3		50		95			M6							
	AQ..100/1	100	80	10 12 14 16	100	4		M6	129.5	-	-	14	30	16.3	5
	AQ..100/2		95		115			M8							
	AQ..100/3		80		100			M6	143.5	2	14	19	40	21.8	6
	AQ..100/4		95		115			M8							
	AQ..115/1	115	95		130			M8	152.5	11	23	19	40	21.8	6
	AQ..115/2		110												
	AQ..115/3									16	16	24	50	27.3	8
R..47, R..57, R..67 F..57, F..67 K..47[3], K..57, K..67 S..67	AQ..80/1	82	60	10 12	75	3	160	M5	98	5.5	5.5	11	23	12.8	4
	AQ..80/2											14	30	16.3	5
	AQ..80/3		50		95			M6							
	AQ..100/1	100	80	10 12 14 16	100	4		M6	122.5	-	-	14	30	16.3	5
	AQ..100/2		95		115			M8							
	AQ..100/3		80		100			M6	136.5	2	14	19	40	21.8	6
	AQ..100/4		95		115			M8							
	AQ..115/1	115	95		130			M8	145.5	11	23	19	40	21.8	6
	AQ..115/2		110												
	AQ..115/3									16	16	24	50	27.3	8
	AQ..140/1	140	110	16	165	5		M10	175	16	16	24	50	27.3	8
	AQ..140/2		130	18											
	AQ..140/3			22					188	22	22	32	60	35.5	10
	AQ..190/1	190	130	22 28	215			M12	237.5	24	24	32	60	35.3	10
	AQ..190/2		180												
	AQ..190/3								261.5	34	34	38	80	41.3	10

1) For versions with keyway (AQA..).

2) For version with clamping ring hub (AQH..).

3) Not with AQ190

23 006 01 00

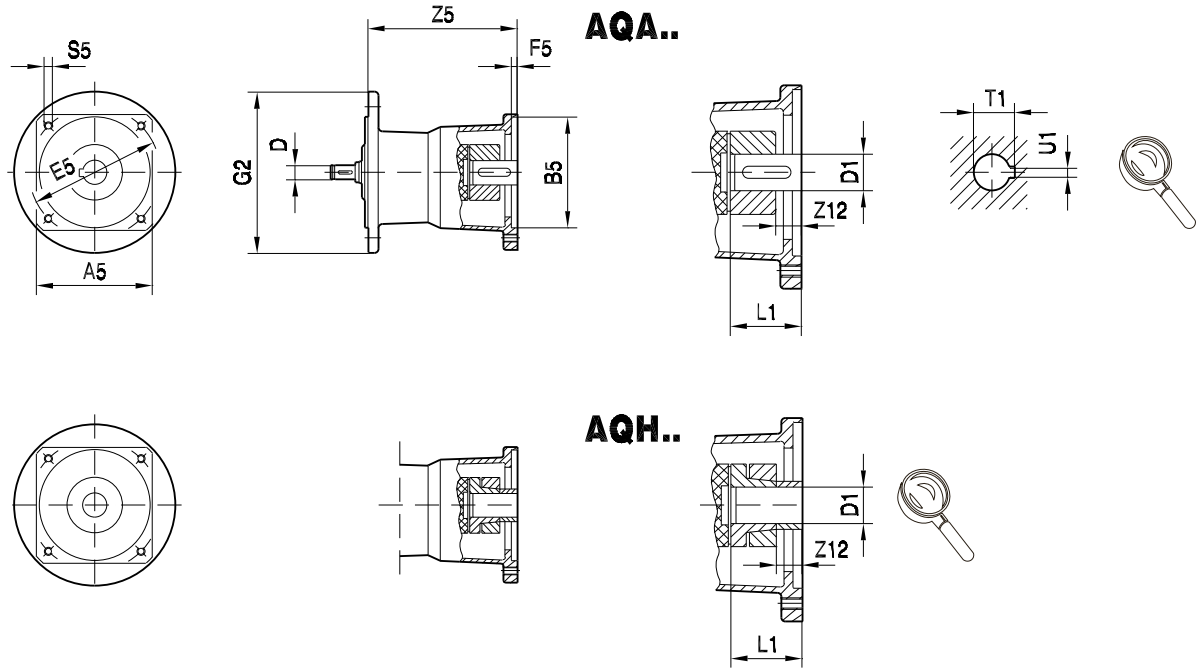


Gear unit type	Adapter type	Dimensions in mm													
		A5	B5	D	E5	F5	G2	S5	Z5	Z12[1)]	Z12[2)]	D1	L1	T1[1)]	U1[1)]
R..77 F..77 K..77 S..77	AQ..80/1	82	60	10 12	75	3	200	M5	92	5.5	5.5	11	23	12.8	4
	AQ..80/2				75							14	30	16.3	5
	AQ..80/3		50		95			M6							
	AQ..100/1	100	80	10 12 14 16	100	4		M6	115.5	-	-	14	30	16.3	5
	AQ..100/2		95		115			M8							
	AQ..100/3		80		100			M6	129.5	2	14	19	40	21.8	6
	AQ..100/4		95		115			M8							
	AQ..115/1	115	95		130			M8	138.5	11	23	19	40	21.8	6
	AQ..115/2		110												
	AQ..115/3									16	16	24	50	27.3	8
	AQ..140/1	140	110	16 18 22	165	5		M10	167	16	16	24	50	27.3	8
	AQ..140/2		130												
	AQ..140/3								180	22	22	32	60	35.3	10
	AQ..190/1	190	130	22 28	215			M12	225.5	24	24	32	60	35.3	10
	AQ..190/2		180												
	AQ..190/3								249.5	34	34	38	80	41.3	10
R..87 F..87 K..87 S..87	AQ..100/1	100	80	12 14 16	100	4	250	M6	110.5	-	-	14	30	16.3	5
	AQ..100/2		95		115			M8							
	AQ..100/3		80		100			M6	124.5	2	14	19	40	21.8	6
	AQ..100/4		95		115			M8							
	AQ..115/1	115	95		130			M8	133.5	11	23	19	40	21.8	6
	AQ..115/2		110												
	AQ..115/3									16	16	24	50	27.3	8
	AQ..140/1	140	110	16	165	5		M10	162	16	16	24	50	27.3	8
	AQ..140/2		130	18											
	AQ..140/3			22					175	22	22	32	60	35.3	10
	AQ..190/1	190	130	22 28	215			M12	220.5	24	24	32	60	35.3	10
	AQ..190/2		180												
	AQ..190/3								244.5	34	34	38	80	41.3	10

1) For versions with keyway (AQA..).

2) For version with clamping ring hub (AQH..).

23 007 01 00



Gear unit type	Adapter type	Dimensions in mm												
		A5	B5	D	E5	F5	G2	S5	Z5	Z12[1)]	Z12[2)]	D1	L1	T1[1)]	U1[1)]
R..97 F..97 K..97 S..97	AQ..140/1	140	110	16 18 22	165	5	300	M10	157	16	16	24	50	27.3	8
	AQ..140/2		130												
	AQ..140/3								170	22	22	32	60	35.3	10
	AQ..190/1	190	130	22 28	215			M12	215.5	24	24	32	60	35.3	10
	AQ..190/2		180												
	AQ..190/3								239.5	34	34	38	80	41.3	
R..107 F..107 K..107	AQ..140/1	140	110	16 18 22	165		350	M10	151	16	16	24	50	27.3	8
	AQ..140/2		130												
	AQ..140/3								164	22	22	32	60	35.3	10
	AQ..190/1	190	130	22 28	215			M12	209.5	24	24	32	60	35.3	10
	AQ..190/2		180												
	AQ..190/3								233.5	34	34	38	80	41.3	
R..137	AQ..190/1	190	130	22 28	215		400	M12	202.5	24	24	32	60	35.3	10
	AQ..190/2		180												
	AQ..190/3								226.5	34	34	38	80	41.3	
R..147 F..127 K..127	AQ..190/1		130	22 28			450		194.5	24	24	32	60	35.3	
	AQ..190/2		180												
	AQ..190/3								218.5	34	34	38	80	41.3	

1) For versions with keyway (AQA..).

2) For version with clamping ring hub (AQH..).

10.9 Fastening the gear unit

Use bolts of quality 8.8 to fasten gear units and gearmotors.

Exception

Use bolts of **quality 10.9** to fasten the customer flange to transmit the rated torques for the following flange-mounted helical gearmotors (RF ../RZ..) and foot/flange-mounted versions (R..F):

- RF37, R37F with flange ∅ 4.72 in
- RF47, R47F with flange ∅ 5.51 in
- RF57, R57F with flange ∅ 6.30 in
- RZ37 ... RZ87

10.10 Torque arms

Available torque arms

Gear unit	Size					
	27	37	47	57	67	77
KA, KH, KV, KT	-	643 425 8	643 428 2	643 431 2	643 431 2	643 434 7
SA, SH, ST	-	126 994 1	644 237 4	644 240 4	644 243 9	644 246 3
FA, FH, FV, FT Rubber buffer (2 pieces)	013 348 5	013 348 5	013 348 5	013 348 5	013 348 5	013 349 3

Gear unit	Size				
	87	97	107	127	157
KA, KH, KV, KT	643 437 1	643 440 1	643 443 6	643 294 8	-
SA, SH, ST	644 249 8	644 252 8	-	-	-
FA, FH, FV, FT Rubber buffer (2 pieces)	013 349 3	013 350 7	013 350 7	013 351 5	013 347 7

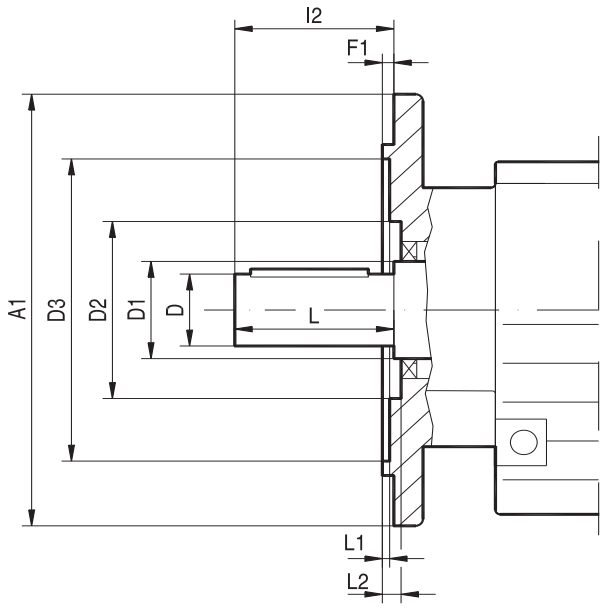
Gear unit	Size				
	10	20	30		
WA	1 061 021 9	168 073 0	168 011 0		

Torque arms for KH167.., KH187..

As standard, torque arms are not available for gear unit sizes KH167.. and KH187... Please contact SEW-EURODRIVE for design proposals if you require torque arms for these gear units.

10.11 Flange contours of RF.. and R..F gear units

04355AXX



Check dimensions L1 and L2 for selection and installation of output elements.

Type	Inch Dimensions											
	A1	D	D1	D2		D3	F1	I1	L	L1		L2
				RF	R..F					RF	R..F	
RF07, R07F	4.72	0.750	0.87	1.50	1.50	2.83	0.12	1.57	1.57	0.08	0.08	0.24
	5.51[1)]				-	3.35	0.12			0.08	-	0.24
	6.30[1)]				-	3.94	0.14			0.10	-	0.26
RF17, R17F	4.72	0.750	0.98	1.81	1.81	2.56	0.12	1.57	1.57	0.04	0.04	0.20
	5.51				-	3.07	0.12			0.04	-	0.20
	6.30[1)]				-	3.74	0.14			0.04	-	0.24
RF27, R27F	4.72	1.000	1.18	2.13	2.13	2.60	0.12	1.97	1.97	0.04	0.04	0.24
	5.51				-	3.11	0.12			0.12	-	0.28
	6.30				-	3.62	0.14			0.12	-	0.28
RF37, R37F	4.72	1.000	1.38	2.36	2.48	2.76	0.12	1.97	1.97	0.20	0.16	0.28
	6.30				-	3.78	0.14			0.04	-	0.30
	7.87[1)]				-	4.69	0.14			0.04	-	0.30
RF47, R47F	5.51	1.250	1.38	2.83	2.52	3.23	0.12	2.36	2.36	0.16	0.04	0.24
	6.30				-	3.78	0.14			0.02	-	0.26
	7.87				-	4.57	0.14			0.02	-	0.26
RF57, R57F	6.30	1.375	1.57	2.99	2.95	3.78	0.14	2.76	2.76	0.16	0.10	0.20
	7.87				-	4.57	0.14			0	-	0.20
	9.84[1)]				-	6.30	0.16			0.02	-	0.22
RF67, R67F	7.87	1.375	1.97	3.54	3.54	4.65	0.14	2.76	2.76	0.08	0.16	0.28
	9.84				-	6.30	0.16			0.04	-	0.30
RF77, R77F	9.84	1.625	2.05	4.41	3.94	6.30	0.16	3.15	3.15	0.02	0.10	0.28
	11.81[1)]				-	8.27	0.16			0.02	-	0.28
RF87, R87F	11.81	2.125	2.44	4.84	4.8	8.27	0.16	3.94	3.94	0	0.06	0.31
	13.78				-	8.90	0.205			0.04	-	0.35
RF97	13.78	2.375	2.83	5.35		9.29	0.20	4.72	4.72	0		0.35
	17.72					12.60						
RF107	13.78	2.875	3.23	6.18		9.13	0.20	5.51	5.51	0		0.43
	17.72			7.32		12.44						
RF137	17.72	3.625	4.25	7.09		12.44	0.20	6.69	6.69	0		0.39
	21.65					16.38						
RF147	17.72	4.375	4.92	8.27		12.44	0.20	8.27	8.27	0		0.39
	21.65					16.38						
RF167	21.65	4.750	5.71	11.42		16.38	0.20	8.27	8.27	0.04		0.39
	25.98					20.35	0.24			0.08		0.43

1) The flange contour protrudes from under the base surface.

10.12 Flange contours of FF.., KF.., SF.. and WF.. gear units

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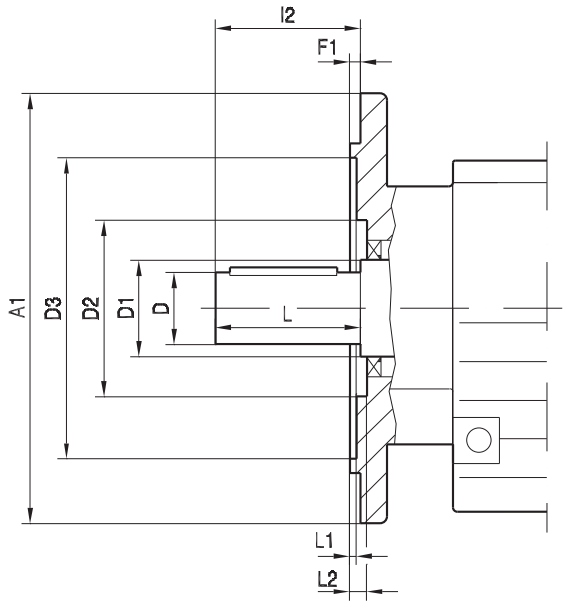

Check dimensions L1 and L2 for selection and installation of output elements.

Type	Inch Dimensions									
	A1	D	D1	D2	D3	F1	l2	L	L1	L2
FF27	6.30	1.000	0.98	-	3.78	0.14	0.79	1.97	0.41	0.73
FF37	6.30	1.000	1.18	-	3.70	0.14	0.94	1.97	0.08	0.39
FF47	7.87	1.250	1.38	2.76	4.53	0.14	0.98	2.36	0.33	0.14
FF57	9.84	1.375	1.57	2.99	6.10	0.16	0.93	2.76	0.18	0.47
FF67	9.84	1.625	1.57	2.99	6.10	0.16	0.91	3.15	0.16	0.16
FF77	11.81	2.000	1.97	3.74	8.07	0.16	1.46	3.94	0.71	0.20
FF87	13.78	2.375	2.36	4.72	8.66	0.20	1.18	4.72	0.35	0.20
FF97	17.72	2.875	2.76	7.56	12.60	0.20	1.63	5.51	0.61	0.20
FF107	17.72	3.625	3.54	8.82	12.60	0.20	1.61	6.69	1.14	0.63
FF127	21.65	4.375	3.94	7.28	16.54	0.20	2.01	8.27	1.89	0.24
FF157	25.98	4.750	4.72	7.87	20.47	0.24	2.36	8.27	2.56	0.39
KF37	6.30	1.000	1.18	2.44	3.70	0.14	0.94	1.97	0.08	0.39
KF47	7.87	1.250	1.38	2.76	4.53	0.14	0.98	2.36	0.33	0.14
KF57	9.84	1.375	1.57	2.99	6.10	0.16	0.93	2.76	0.18	0.47
KF67	9.84	1.625	1.57	2.99	6.10	0.16	0.93	3.15	0.18	0.47
KF77	11.81	2.000	1.97	3.74	8.07	0.16	1.46	3.94	0.71	0.20
KF87	13.78	2.375	2.36	4.72	8.66	0.20	1.18	4.72	0.35	0.20
KF97	17.72	2.875	2.76	7.56	12.60	0.20	1.63	5.51	0.61	0.20
KF107	17.72	3.625	3.54	8.82	12.60	0.20	1.61	6.69	1.14	0.63
KF127	21.65	4.375	3.94	7.28	16.54	0.20	2.01	8.27	1.89	0.24
KF157	25.98	4.750	4.72	7.87	20.47	0.24	2.36	8.27	2.56	0.39
SF37	4.72	0.750	0.79	-	2.68	0.12	0.59	1.57	0.24	0.24
SF37	6.30	0.750	0.79	-	3.86	0.14	0.59	1.57	0.26	0.26
SF47	6.30	1.000	1.18	-	3.70	0.14	0.94	1.97	0.08	0.39
SF57	7.87	1.250	1.38	2.95	4.53	0.14	0.98	2.36	0.33	0.14
SF67	7.87	1.375	1.57	3.74	4.53	0.14	1.67	2.76	0.45	0.16
SF77	9.84	1.750	1.97	4.53	6.46	0.16	1.79	3.54	0.85	0.20
SF87	13.78	2.375	2.36	5.51	8.66	0.20	2.07	4.72	1.08	0.24
SF97	17.72	2.875	2.76	6.89	13.98	0.20	2.36	5.51	1.34	0.26
WF10	3.15	0.625	0.63	1.57	1.57	0.10	0.91	1.57	1.18	1.18
WF10	4.72	0.625	0.63	1.93	2.91	0.12	0.91	1.57	0.20	0.94
WF20	4.33	0.750	0.71	2.17	4.09	0.12	1.18	1.57	0.91	0.91
WF20	4.33	0.750	0.79	2.17	4.09	0.16	1.18	1.57	0.91	0.91
WF20	4.72	0.750	0.71	1.81	1.81	0.10	1.18	1.57	1.26	1.26
WF20	4.72	0.750	0.79	1.81	1.81	0.10	1.18	1.57	1.26	1.26
WF30	4.72	0.750	0.79	2.52	2.52	0.10	0.77	1.57	0.55	0.87
WF30	5.35	0.750	0.79	2.52	2.52	0.10	0.77	1.57	1.00	1.24

10.13 Flange contours of FAF.., KAF.., SAF.. and WAF.. gear units

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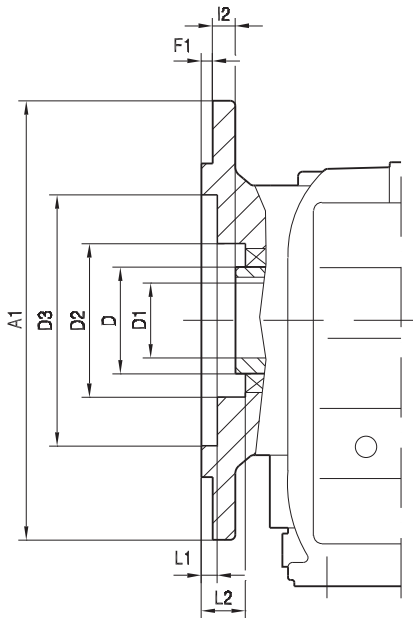

Check dimensions L1 and L2 for selection and installation of output elements.

Type	Inch Dimensions								
	A1	D	D1	D2	D3	F1	I2	L1	L2
FAF27	6.30	1.57	1.000	-	3.78	0.14	0.79	0.41	0.73
FAF37	6.30	1.77	1.250	-	3.70	0.14	0.94	0.08	0.39
FAF47	7.87	1.97	1.375	2.76	4.53	0.14	0.98	0.33	0.14
FAF57	9.84	2.17	1.500	2.99	6.10	0.16	0.93	0.18	0.47
FAF67	9.84	2.17	1.500	2.99	6.10	0.16	0.91	0.16	0.16
FAF77	11.81	2.76	2.000	3.74	8.07	0.16	1.46	0.71	0.20
FAF87	13.78	3.35	2.375	4.72	8.66	0.20	1.18	0.35	0.20
FAF97	17.72	3.74	2.750	7.56	12.60	0.20	1.63	0.61	0.20
FAF107	17.72	4.65	3.625	8.82	12.60	0.20	1.61	1.14	0.63
FAF127	21.65	5.31	4.000	7.28	16.54	0.20	2.01	1.89	0.24
FAF157	25.98	6.10	4.500	7.87	20.47	0.24	2.36	2.56	0.39
KAF37	6.30	1.77	1.250	2.44	3.70	0.14	0.94	0.08	0.39
KAF47	7.87	1.97	1.375	2.76	4.53	0.14	0.98	0.33	0.14
KAF57	9.84	2.17	1.500	2.99	6.10	0.16	0.93	0.18	0.47
KAF67	9.84	2.17	1.500	2.99	6.10	0.16	0.93	0.18	0.47
KAF77	11.81	2.76	2.000	3.74	8.07	0.16	1.46	0.71	0.20
KAF87	13.78	3.35	2.375	4.72	8.66	0.20	1.18	0.35	0.20
KAF97	17.72	3.74	2.750	7.56	12.60	0.20	1.63	0.61	0.20
KAF107	17.72	4.65	3.625	8.82	12.60	0.20	1.61	1.14	0.63
KAF127	21.65	5.31	4.000	7.28	16.54	0.20	2.01	1.89	0.24
KAF157	25.98	6.10	4.500	7.87	20.47	0.24	2.36	2.56	0.39
SAF37	4.72	1.38	0.750	-	2.68	0.12	0.59	0.24	0.24
SAF37	6.30	1.38	0.750	-	3.86	0.14	0.59	0.26	0.26
SAF47	6.30	1.77	1.250	-	3.70	0.14	0.94	0.08	0.39
SAF57	7.87	1.97	1.375	2.95	4.53	0.14	0.98	0.33	0.14
SAF67	7.87	2.56	1.500	3.74	4.53	0.14	1.67	0.45	0.16
SAF77	9.84	3.15	2.000	4.53	6.46	0.16	1.79	0.85	0.20
SAF87	13.78	3.74	2.375	5.51	8.66	0.20	2.07	1.08	0.24
SAF97	17.72	4.72	2.750	6.89	13.98	0.20	2.36	1.34	0.26
WAF10	3.15	0.98	0.625	1.57	1.57	0.10	0.91	1.18	1.18
WAF10	4.72	0.98	0.625	1.93	2.91	0.12	0.91	0.20	0.94
WAF20	4.33	1.18	0.750	2.17	4.09	0.12	1.18	0.91	0.91
WAF20	4.33	1.18	0.750	2.17	4.09	0.16	1.18	0.91	0.91
WAF20	4.72	1.18	0.750	1.81	1.81	0.10	1.18	1.26	1.26
WAF20	4.72	1.18	0.750	1.81	1.81	0.10	1.18	1.26	1.26
WAF30	4.72	1.18	0.750	2.52	2.52	0.10	0.77	0.55	0.87
WAF30	5.35	1.18	0.750	2.52	2.52	0.10	0.77	1.00	1.24

10.14 Fixed covers

Parallel shaft helical gear units, helical-bevel gear units and helical-worm gear units with hollow shafts and shrink discs of size 37 up to size 97 in some cases come equipped with a rotating cover. If for safety reasons fixed covers are required for these gear units, you can order them for the respective gear unit types by quoting the part numbers in the following tables. Parallel shaft helical gear units and helical-bevel gear units with hollow shafts and shrink disks of size 107 and higher as well as parallel shaft helical gear units of size 27 come equipped with a fixed cover as standard.

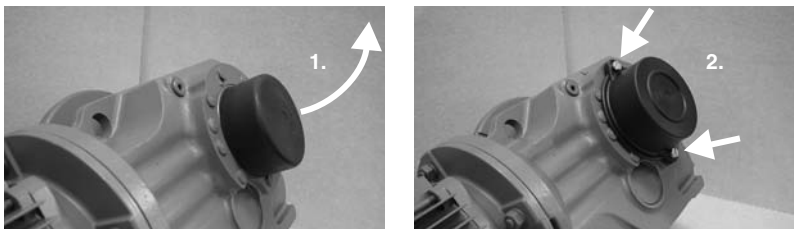

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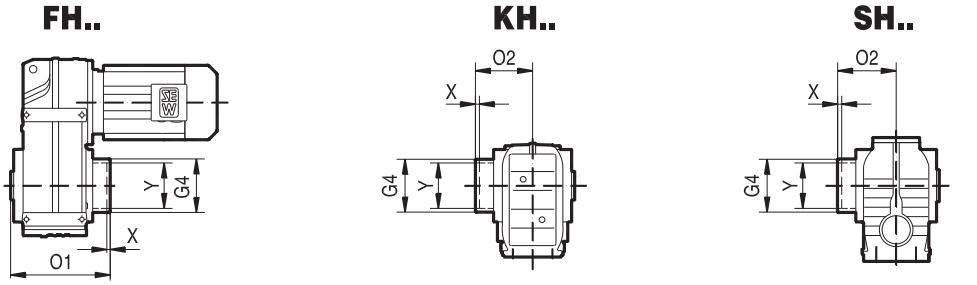
Figure 107: Replacing a rotating cover with a fixed cover

1. Pull off the rotating cover.
2. Install and fasten fixed cover.

Part numbers and dimensions



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Parallel shaft helical gearmotors	FH..37	FH..47	FH..57	FH..67	FH..77	FH..87	FH..97
Part number	643 513 0	643 514 9	643 515 7	643 515 7	643 516 5	643 517 3	643 518 1
Max. size of motor that can be mounted	DT80..	DT80..	DT80..	DV132S	DV160M	DV180..	DV180..
G4 [in]	3.07	3.46	3.94	3.94	4.76	6.46	7.28
O1 [in]	6.18	7.42	8.17	8.72	10.04	11.61	14.31
X [in]	0.08	0.18	0.30	0.24	0.24	0.16	0.26
Y [in]	2.95	3.27	3.27	3.66	4.49	6.26	6.85

Helical-bevel gearmotors[1)]	KH..37	KH..47	KH..57	KH..67	KH..77	KH..87	KH..97
Part number	643 513 0	643 514 9	643 515 7	643 515 7	643 516 5	643 517 3	643 518 1
G4 [in]	3.07	3.46	3.94	3.94	4.76	6.46	7.28
O2 [in]	3.74	4.39	4.82	5.08	5.79	6.77	8.29
X [in]	0	0.06	0.22	0.12	0.04	0.08	0.18
Y [in]	2.95	3.27	3.27	3.66	4.49	6.26	6.85

1) Not possible in foot-mounted helical-bevel gear units with hollow shafts and shrink discs (KH..B).

Helical-worm gearmotors	SH..37	SH..47	SH..57	SH..67	SH..77	SH..87	SH..97
Part number	643 512 2	643 513 0	643 514 9	643 515 7	643 516 5	643 517 3	643 518 1
G4 [in]	2.32	3.07	3.46	3.94	4.76	6.46	7.28
O2 [in]	3.46	3.74	4.39	4.94	5.79	6.93	8.05
X [in]	0.04	0	0.06	0.12	0.04	0	0.02
Y [in]	2.09	2.95	3.27	3.66	4.49	6.26	6.85

11 Appendix

11.1 Abbreviation Key

a, b, f	Constants for converting overhung loads	[in]
c	Constant for converting overhung load	[lb-in]
cosj	Power factor of the motor	
F_A	Axial load on the output shaft	[lb]
f_B	Service factor	
f_{supply}	Mains frequency	[Hz]
F_R	Overhung load on the output shaft	[lb]
f_T, f_H	Power reducing factors of the motor	
f_Z	Transmission element factor for determining the overhung load	
H	Installation altitude	[ft]
η	Forward efficiency	
h'	Retrodriving efficiency	
$h_{75\%}/h_{100\%}$	Efficiency of the motor at 75%/100% rated load	
I_A/I_N	Ratio between starting current and rated current of the motor	
I_N	Rated current	[A]
IP..	Degree of protection	
i_{ges}	Total gear reduction ratio	
i_{sch}	Helical-worm stage ratio	
J_{Umg}	Ambient temperature	[°F]
J_{Last}	Mass moment of inertia to be driven	[lb-ft^2]
J_{Mot}	Mass moment of inertia of the motor	[lb-ft^2]
J_X	Mass moment of inertia scaled down to the motor shaft	[lb-ft^2]
J_Z	Mass moment of inertia of the flywheel fan	[lb-ft^2]
T_a	Output torque	[lb-in]
T_B	Braking torque	[lb-in]
T_H/T_N	Ratio between acceleration torque and rated torque of the motor	
T_A/T_N	Ratio between run-up torque and rated torque of the motor	
n_a	Output speed	[rpm]
n_e	Input speed	[rpm]
n_M	Motor speed	[rpm]
n_N	Rated speed	[rpm]
P_a	Output power	[HP]
P_e	Calculated drive power of the gear unit	[HP]
P_N	Rated power	[HP]
S.., %ED	Duty type and cyclic duration factor cdf	
T	Duty cycle time	[min]
t1	Brake response time	[10^{-3} s]
t2	Brake application time	[10^{-3} s]
U_{Brake}	Operating voltage of the brake	[V]
U_{Mot}	Operating voltage of the motor	[V]
Z	Starting frequency	[1/h], [c/h]
Z_0	No-load starting frequency	[1/h], [c/h]

11.2 Index

11.3 Address List

USA			
Assembly Sales Service	**Ohio**	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Tel. 937 335-0036 Fax 937 440-3799 cstroy@seweurodrive.com
	New Jersey	SEW-EURODRIVE INC. Pureland Ind. Complex 2107 High Hill Road, P.O. Box 481 Bridgeport, New Jersey 08014	Tel. 856 467-2277 Fax 856 845-3179 csbridgeport@seweurodrive.com
	South Carolina	SEW-EURODRIVE INC. 1295 Old Spartanburg Highway P.O. Box 518 Lyman, SC 29365	Tel. 864 439-7537 Fax Sales 864 439-7830 Fax Ass. 864 439-0566 cslyman@seweurodrive.com
	Texas	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Tel. 214 330-4824 Fax 214 330-4724 csdallas@seweurodrive.com
	California	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, CA 94544	Tel. 510 487-3560 Fax 510 487-6381 cshayward@seweurodrive.com
Production	**South Carolina**	SEW-EURODRIVE INC. 1275 Old Spartanburg Highway P.O. Box 518 Lyman, SC 29365	Tel. 864 439-8792 Fax Manuf. 864 439-9948 http://www.seweurodrive.com
District Sales Offices	**Alabama**	Bob Whittlesey 5374 Pineywood Rd. Birmingham, AL 35242	Tel. 205 408-8886 Fax 205 408-8883 bwhittlesey@seweurodrive.com
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	California	Rick A. Burdick 3942 Canyon Terrace Yorba Linda, CA 92886	Tel./Fax 714 970-6197 rburdick@seweurodrive.com
		Michael Haskins 7750 Chisamore Ranch Lane Vacaville, CA 95688	Tel./Fax 707 453-1550 mhaskins@seweurodrive.com
		Steve Highley 15283 Rousseau Lane La Mariada, CA 90638	Tel. 323 219-9681 Fax 714 994-5882 shighley@seweurodrive.com
		John McNamee 5610 Havencrest Circle Stockton, CA 95219	Tel./Fax 209 473-4887 Mobile 209 481-6928 jmcnamee@seweurodrive.com
	Colorado	Leo Dudley 7773 S. Ames Way Littleton, CO 80128	Tel./Fax 303 948-2805 Mobile 720 670-6352 ldudley@seweurodrive.com
	Connecticut	David Danforth 9 Windmill Road Ellington, CT 06029	Tel. 860 875-7938 Fax 860 870-1025 ddanforth@seweurodrive.com
	Delaware	Edward Tucker 806 Front Street Glendora, NJ 08029	Tel. 856 939-2535 Fax 856 939 2114 etucker@seweurodrive.com
	District of Columbia	Edward Tucker 806 Front Street Glendora, NJ 08029	Tel. 856 939-2535 Fax 856 939 2114 etucker@seweurodrive.com

USA			
District Sales Offices (Cont.)	**Florida**	Tony O. Toledo 901 25th Avenue W. Palmetto, FL 34221	Tel. 941 729-0717 Fax 941 729-7507 ttoledo@seweurodrive.com
		Bob Whittlesey 5374 Pineywood Rd. Birmingham, AL 35242	Tel. 205 408-8886 Fax 205 408-8883 bwhittlesey@seweurodrive.com
	Georgia	Jim Garrett 3843 Boulder Creek Road Martinez, GA 30907	Tel. 706 210-0116 Fax 706 228-4990 jgarrett@seweurodrive.com
		Jim Walsh 1806 Scholar Drive Lawrenceville, GA 30044	Tel. 770 237-8734 Fax 770 237-5735 jwalsh@seweurodrive.com
		Abraham Masourian PO Box 27 Flowery Branch, GA 30542	Tel. 770 965-0077 Fax 770 965-0097 amasourian@seweurodrive.com
	Idaho	Duwayne Hogan 3622 Hillcrest Drive Coeur d'Alene, ID 83815	Tel. 208 667-0414 dhogan@sewdurodrive.com
		Steven Jacobson 5520 S. 225 E. Ogden, UT 84405	Tel. 801 612-9558 Fax 801 612-9561 sjacobson@seweurodrive.com
	Illinois	Tom Ellis 24146 Brancaster Dr. Naperville, IL 60564	Tel. 630 579-4500 Fax 630 579-4540 tellis@seweurodrive.com
		Dan Wittenberg 509 North Wooster Algona, IA 50511	Tel. 515 395-1414 Fax 888 313-1413 dwittenberg@seweurodrive.com
		Scott R. Johnson 52 Boxwood Lane Cary, IL 60013	Tel. 847 639-9774 Fax 847 639-9775 sjohnson@seweurodrive.com
		Ted Knue 2852 Coventry Lane Greenwood, IN 46143	Tel 317 422-9352 Fax 317 422-9357 tknue@seweurodrive.com
		Gregory R. Tucker 6808 Cottage Grove, Unit G St. Louis, MO 63129	Fax 314 845-6129 Mobile 314 973-7060 gtucker@seweurodrive.com
		Jeffrey L. Westrom 2 S. 111 Stratford Road Glen Ellyn, IL 60137	Tel. 630 790-2868 Fax 630 790-2878 jwestrom@seweurodrive.com
	Indiana	Tom Ellis 24146 Brancaster Dr. Naperville, IL 60564	Tel. 630 579-4500 Fax 630 579-4540 tellis@seweurodrive.com
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Technical Office	**Vlaanderen**	SEW Caron-Vector S.A. Verlorenbroodstraat, 122, bus 6 B-9820 Merelbeke	Tel. +32 92 1686 25 Fax +32 92 2741 55

Brazil			
Production **Sales** **Service**	**Sao Paulo**	SEW-EURODRIVE Brasil Ltda. Avenida Amâncio Gaiolli, 152 - Rodovia Presidente Dutra Km 208 Guarulhos - 07251-250 - SP SAT - SEW ATENDE - 0800 7700496	Tel. +55 11 2489-9133 Fax +55 11 2480-3328 http://www.sew-eurodrive.com.br sew@sew.com.br

Bulgaria			
Sales	**Sofia**	BEVER-DRIVE GmbH Bogdanovetz Str.1 BG-1606 Sofia	Tel. +359 2 9151160 Fax +359 2 9151166 bever@fastbg.net

Cameroon			
Sales	**Douala**	Electro-Services Rue Drouot Akwa B.P. 2024 Douala	Tel. +237 33 431137 Fax +237 33 431137

Chile			
Assembly **Sales** **Service**	**Santiago de Chile**	SEW-EURODRIVE CHILE LTDA. Las Encinas 1295 Parque Industrial Valle Grande LAMPA RCH-Santiago de Chile P.O. Box Casilla 23 Correo Quilicura - Santiago - Chile	Tel. +56 2 75770-00 Fax +56 2 75770-01 http://www.sew-eurodrive.cl ventas@sew-eurodrive.cl

China			
Production **Assembly** **Sales** **Service**	**Tianjin**	SEW-EURODRIVE (Tianjin) Co., Ltd. No. 46, 7th Avenue, TEDA Tianjin 300457	Tel. +86 22 25322612 Fax +86 22 25322611 info@sew-eurodrive.cn http://www.sew-eurodrive.cn
Assembly **Sales** **Service**	**Suzhou**	SEW-EURODRIVE (Suzhou) Co., Ltd. 333, Suhong Middle Road Suzhou Industrial Park Jiangsu Province, 215021	Tel. +86 512 62581781 Fax +86 512 62581783 suzhou@sew-eurodrive.cn
	Guangzhou	SEW-EURODRIVE (Guangzhou) Co., Ltd. No. 9, JunDa Road East Section of GETDD Guangzhou 510530	Tel. +86 20 82267890 Fax +86 20 82267891 guangzhou@sew-eurodrive.cn
	Shenyang	SEW-EURODRIVE (Shenyang) Co., Ltd. 10A-2, 6th Road Shenyang Economic Technological Development Area Shenyang, 110141	Tel. +86 24 25382538 Fax +86 24 25382580 shenyang@sew-eurodrive.cn
	Wuhan	SEW-EURODRIVE (Wuhan) Co., Ltd. 10A-2, 6th Road No. 59, the 4th Quanli Road, WEDA 430056 Wuhan	Tel. +86 27 84478398 Fax +86 27 84478388

Colombia			
Assembly **Sales** **Service**	**Bogotá**	SEW-EURODRIVE COLOMBIA LTDA. Calle 22 No. 132-60 Bodega 6, Manzana B Santafé de Bogotá	Tel. +57 1 54750-50 Fax +57 1 54750-44 http://www.sew-eurodrive.com.co carlos.gomez@sew.eurodrive.com.co

Croatia			
Sales **Service**	**Zagreb**	KOMPEKS d. o. o. PIT Erdödy 4 II HR 10 000 Zagreb	Tel. +385 1 4613-158 Fax +385 1 4613-158 kompeks@inet.hr

Czech Republic			
Sales	**Praha**	SEW-EURODRIVE CZ S.R.O. Business Centrum Praha Lužná 591 CZ-16000 Praha 6 - Vokovice	Tel. +420 255 709 601 Fax +420 220 121 237 http://www.sew-eurodrive.cz sew@sew-eurodrive.cz
Technical Offices	**Brno**	SEW-EURODRIVE CZ S.R.O. Křenová 52 CZ -60200 Brno	Tel. +420 543256151 + 543256163 Fax +420 543256845
	Hradec Králové	SEW-EURODRIVE CZ S.R.O. Čechova 498 CZ-50202 Hradec Králové	Tel. +420 495510141 Fax +420 495521313
	Plzeň	SEW-EURODRIVE CZ S.R.O. Areal KRPA a.s. Zahradni 173/2 CZ-32600 Plzeň	Tel. +420 378775300 Fax +420 377970710
	Klatovy	SEW-EURODRIVE CZ S.R.O. Technická kancelář Klatovy Domažlická 800 CZ-33901 Klatovy	Tel. +420 376310729 Fax +420 376310725

Denmark			
Assembly **Sales** **Service**	**Kopenhagen**	SEW-EURODRIVEA/S Geminivej 28-30 DK-2670 Greve	Tel. +45 43 9585-00 Fax +45 43 9585-09 http://www.sew-eurodrive.dk sew@sew-eurodrive.dk

Egypt			
Sales **Service**	**Cairo**	Copam Egypt for Engineering & Agencies 33 El Hegaz ST, Heliopolis, Cairo	Tel. +20 2 22566-299 + 1 23143088 Fax +20 2 22594-757 http://www.copam-egypt.com/ copam@datum.com.eg

Estonia			
Sales	**Tallin**	ALAS-KUUL AS Reti tee 4 EE-75301 Peetri küla, Rae vald, Harjumaa	Tel. +372 6593230 Fax +372 6593231 veiko.soots@alas-kuul.ee

Finland			
Assembly **Sales** **Service**	**Lahti**	SEW-EURODRIVE OY Vesimäentie 4 FIN-15860 Hollola 2	Tel. +358 201 589-300 Fax +358 3 780-6211 sew@sew.fi http://www.sew-eurodrive.fi
Technical Offices	**Helsinki**	SEW-EURODRIVE OY Luutnantintie 5 FIN-00410 Helsinki	Tel. +358 201 589-300 Fax + 358 9 5666-311 sew@sew.fi
	Vaasa	SEW-EURODRIVE OY Hietasaarenkatu 18 FIN-65100 Vaasa	Tel. +358 201 589-300 Fax +358 6 3127-470 sew@sew.fi
	Rovaniemi	SEW-EURODRIVE OY Valtakatu 4 A FIN-96100 Rovaniemi	Tel. +358 201 589-300 Fax +358 201 589-239 sew@sew.fi
Production **Assembly** **Service**	**Karkkila**	SEW Industrial Gears Oy Valurinkatu 6 FIN-03600 Karkkila	Tel. +358 201 589-300 Fax +358 201 589-310 sew@sew.fi http://www.sew-eurodrive.fi

France			
Production **Sales** **Service**	**Haguenau**	SEW-USOCOME 48-54, route de Soufflenheim B. P. 20185 F-67506 Haguenau Cedex	Tel. +33 3 88 73 67 00 Fax +33 3 88 73 66 00 http://www.usocome.com sew@usocome.com
Production	**Forbach**	SEW-EUROCOME Zone Industrielle Technopôle Forbach Sud B. P. 30269 F-57604 Forbach Cedex	Tel. +33 3 87 29 38 00
Assembly **Sales** **Service**	**Bordeaux**	SEW-USOCOME Parc d'activités de Magellan 62, avenue de Magellan - B. P. 182 F-33607 Pessac Cedex	Tel. +33 5 57 26 39 00 Fax +33 5 57 26 39 09
	Lyon	SEW-USOCOME Parc d'Affaires Roosevelt Rue Jacques Tati F-69120 Vaulx en Velin	Tel. +33 4 72 15 37 00 Fax +33 4 72 15 37 15
	Paris	SEW-USOCOME Zone industrielle 2, rue Denis Papin F-77390 Verneuil l'Etang	Tel. +33 1 64 42 40 80 Fax +33 1 64 42 40 88
Technical Offices	**Alsace Franche-Comté**	SEW-USOCOME 1, rue Auguste Gasser F-68360 Soultz	Tel. +33 3 89 74 51 62 Fax +33 3 89 76 58 71
	Alsace Nord	SEW-USOCOME 15, rue Mambourg F-68240 Sigolsheim	Tel. +33 3 89 78 45 11 Fax +33 3 89 78 45 12

France			
	Aquitaine	SEW-USOCOME Parc d'activités de Magellan 62, avenue de Magellan B.P.182 F-33607 Pessac Cedex	Tel. +33 5 57 26 39 00 Fax +33 5 57 26 39 09
	Ardennes Lorraine	SEW-USOCOME 1, rue de la Forêt F-54250 Champigneulles	Tel. +33 3 83 96 28 04 Fax +33 3 83 96 28 07
	Bourgogne	SEW-USOCOME 10, rue de la Poste F-71350 Saint Loup Géanges	Tel. +33 3 85 49 92 18 Fax +33 3 85 49 92 19
	Bretagne Ouest	SEW-USOCOME 4, rue des Châtaigniers F-44830 Brains	Tel. +33 2 51 70 54 04 Fax +33 2 51 70 54 05
	Centre Auvergne	SEW-USOCOME 27, avenue du Colombier F-19150 Laguenne	Tel. +33 5 55 20 12 10 Fax +33 5 55 20 12 11
	Centre Pays de Loire	SEW-USOCOME 9, rue des Erables F-37540 Saint Cyr sur Loire	Tel. +33 2 47 41 33 23 Fax +33 2 47 41 34 03
	Champagne	SEW-USOCOME Impasse des Ouises F-10120 Saint André les Vergers	Tel. +33 3 25 79 63 24 Fax +33 3 25 79 63 25
	Lyon Nord-Est	SEW-USOCOME Parc d'Affaires Roosevelt Rue Jacques Tati F-69120 Vaulx en Velin	Tel. +33 4 72 15 37 03 Fax +33 4 72 15 37 15
	Lyon Ouest	SEW-USOCOME Parc d'Affaires Roosevelt Rue Jacques Tati F-69120 Vaulx en Velin	Tel. +33 4 72 15 37 04 Fax +33 4 72 15 37 15
	Lyon Sud-Est	SEW-USOCOME Montée de la Garenne F-26750 Génissieux	Tel. +33 4 75 05 65 95 Fax +33 4 75 05 65 96
	Nord	SEW-USOCOME 30, rue Léon Garet F-62520 Le Touquet	Tel. +33 3 21 90 21 40 Fax +33 3 21 90 21 44
	Normandie	SEW-USOCOME 5 rue de la Limare F-14250 Brouay	Tel. +33 2 31 37 92 86 Fax +33 2 31 74 68 15
	Paris Est	SEW-USOCOME 45, rue des Cinelles F-77700 Bailly Romainvilliers	Tel. +33 1 64 17 02 47 Fax +33 1 64 17 66 49
	Paris Ouest	SEW-USOCOME 42 avenue Jean Jaurès F-78580 Maule	Tel. +33 1 30 90 89 86 Fax +33 1 30 90 93 15
	Paris Picardie	SEW-USOCOME 25 bis, rue Kléber F-92300 Levallois Perret	Tel. +33 1 41 05 92 74 Fax +33 1 41 05 92 75
	Paris Sud	SEW-USOCOME 6. chemin des Bergers Lieu-dit Marchais F-91410 Roinville sous Dourdan	Tel. +33 1 60 81 10 56 Fax +33 1 60 81 10 57

France			
	Provence	SEW-USOCOME Résidence Les Hespérides Bât. B2 67, boulevard des Alpes F-13012 Marseille	Tel. +33 4 91 18 00 11 Fax +33 4 91 18 00 12
	Pyrénées	SEW-USOCOME 179, route de Grazac F-31190 Caujac	Tel. +33 5 61 08 15 85 Fax +33 5 61 08 16 44
	Sud-Atlantique	SEW-USOCOME 12, rue des Pinsons F-44120 Vertou	Tel. +33 2 40 80 32 23 Fax +33 2 40 80 32 13

Gabon			
Sales	**Libreville**	Electro-Services B.P. 1889 Libreville	Tel. +241 7340-11 Fax +241 7340-12

Great Britain			
Assembly **Sales** **Service**	**Normanton**	SEW-EURODRIVE Ltd. Beckbridge Industrial Estate P.O. Box No.1 GB-Normanton, West- Yorkshire WF6 1QR	Tel. +44 1924 893-855 Fax +44 1924 893-702 http://www.sew-eurodrive.co.uk info@sew-eurodrive.co.uk
Technical Offices	**London**	SEW-EURODRIVE Ltd. 764 Finchely Road, Temple Fortune GB-London N.W.11 7TH	Tel. +44 20 8458-8949 Fax +44 20 8458-7417
	Midlands	SEW-EURODRIVE Ltd. 5 Sugar Brook court, Aston Road, Bromsgrove, Worcs B60 3EX	Tel. +44 1527 877-319 Fax +44 1527 575-245
	Scotland	SEW-EURODRIVE Ltd. Scottish Office No 37 Enterprise House Springkerse Business Park GB-Stirling FK7 7UF Scotland	Tel. +44 17 8647-8730 Fax +44 17 8645-0223
	Northern Ireland	Heyn Engineering (NI) Ltd. 1 Corry Place, Belfast, BT3 9AH	Tel. +44 02890350022 Fax +44 02890350012 info@heyn.co.uk http://www.heyn.co.uk

Greece			
Sales **Service**	**Athen**	Christ. Boznos & Son S.A. 12, Mavromichali Street P.O. Box 80136, GR-18545 Piraeus	Tel. +30 2 1042 251-34 Fax +30 2 1042 251-59 http://www.boznos.gr info@boznos.gr
Technical Office	**Thessaloniki**	Christ. Boznos & Son S.A. Maiandrou 21 562 24 Evosmos, Thessaloniki	Tel. +30 2 310 7054-00 Fax +30 2 310 7055-15 info@boznos.gr

Hong Kong			
Assembly **Sales** **Service**	**Hong Kong**	SEW-EURODRIVE LTD. Unit No. 801-806, 8th Floor Hong Leong Industrial Complex No. 4, Wang Kwong Road Kowloon, Hong Kong	Tel. +852 36902200 Fax +852 36902211 contact@sew-eurodrive.hk

Hungary			
Sales **Service**	**Budapest**	SEW-EURODRIVE Kft. H-1037 Budapest Kunigunda u. 18	Tel. +36 1 437 06-58 Fax +36 1 437 06-50 office@sew-eurodrive.hu

Iceland			
Sales	**Reykjavik**	Vélaverk ehf. Bolholti 8, 3h. IS - 105 Reykjavik	Tel. +354 568 3536 Fax +354 568 3537 velaverk@velaverk.is

India			
Assembly **Sales** **Service**	**Vadodara**	SEW-EURODRIVE India Private Limited Plot No. 4, GIDC POR Ramangamdi • Vadodara - 391 243 Gujarat	Tel. +91 265 2831086 Fax +91 265 2831087 http://www.seweurodriveindia.com sales@seweurodriveindia.com subodh.ladwa@seweurodriveindia.com
Technical Offices	**Bangalore**	SEW-EURODRIVE India Private Limited 308, Prestige Centre Point 7, Edward Road Bangalore - 560052 - Karnataka	Tel. +91 80 22266565 Fax +91 80 22266569 salesbang@seweurodriveindia.com ganesh@seweurodriveindia.com
	Kolkata	SEW EURODRIVE India Private Limited 2nd floor, Room No. 35 Chowringhee Court 55, Chowringhee Road Kolkata - 700 071 - West Bengal	Tel. +91 33 22827457 Fax +91 33 22894204 saleskal@seweurodriveindia.com a.j.biswas@seweurodriveindia.com
	Chandigarh	SEW EURODRIVE India Private Limited Sujit Kumar Mishra H.No.5464/3 Modern Housing Complex Manimajra Chandigarh -160101	Tel. +91 9878469579 Fax +91 1722738664 saleschand@seweurodriveindia.com
	Chennai	SEW-EURODRIVE India Private Limited 2nd Floor, Josmans Complex, No. 5, McNichols Road, Chetpet Chennai - 600031 - Tamil Nadu	Tel. +91 44 42849813 Fax +91 44 42849816 saleschen@seweurodriveindia.com c.v.shivkumar@seweurodriveindia.com
	Coimbatore	SEW-EURODRIVE India Private Limited Office No 60 Arpee Centre (Opp Annapoorna Hotel) 420 N, NSR Road, Saibaba Colony Coimbatore 641 0111 - Tamil Nadu	Tel. +91 422 2455420 Fax +91 422 2443988 salescmb@seweurodriveindia.com p.selvakumar@seweurodriveindia.com
	Madgaon	SEW-EURODRIVE India Private Limited Flat No.-G1, Shivas-Laxmi Prasad Co-Operative Housing Society, Padmanarayan Estate, Near Jivottaam Math, Gagole Madgao, Goa - 403 602	samrat.chakravorty@seweurodriveindia.com
	Hyderabad	SEW-EURODRIVE India Private Limited 408, 4th Floor, Meridian Place Green Park Road Amerpeet Hyderabad - 500016 - Andhra Pradesh	Tel. +91 40 23414698 Fax +91 40 23413884 saleshyd@seweurodriveindia.com ma.choudary@seweurodriveindia.com
	Jaipur	SEW-EURODRIVE India Private Limited 55/102, Rajat Path Mansarovar Jaipur 302020 - Rajasthan	Tel. +91 9784742348 amit.nigam@seweurodriveindia.com

India			
	Jamshedpur	SEW-EURODRIVE India Private Limited Flat No.: B/2, B.S. Apartment Road No.: 4, Contractor's area, Bistupur Jamshedpur 831 001 - Chhattisgarh	Tel. +91 9934123671 siddaratha.mishra@seweurodriveindia.com
	Lucknow	SEW-EURODRIVE India Private Limited 69, Shiv Vihar Colony Vikas Nagar-5 Lucknow 226022 - Uttar Pradesh	Tel. +91 9793627333 amit.nigam@seweurodriveindia.com
	Mumbai	SEW-EURODRIVE India Private Limited 312 A, 3rd Floor, Acme Plaza, J.B. Nagar, Andheri Kurla Road, Andheri (E) Mumbai - 400059 - Maharashtra	Tel. +91 22 28348440 Fax +91 22 28217858 salesmumbai@seweurodriveindia.com p.s.ray@seweurodriveindia.com
	New Delhi	SEW-EURODRIVE India Private Limited 418-419, Suneja Tower-1 District Centre, Janak Puri New Delhi 110 058	Tel. +91 11 25544111 Fax +91 11 25544113 salesdelhi@seweurodriveindia.com vikram.juneja@seweurodriveindia.com
	Pune	SEW-EURODRIVE India Private Limited Office No. 2 & 7, First Floor, Triveni Apartment Model Colony, Gokhale Road Pune 411016 - Maharashtra	Tel. +91 20 25671751 Fax +91 20 25661668 salespune@seweurodriveindia.com praveen.hosur@seweurodriveindia.com
	Raipur	SEW-EURODRIVE India Private Limited A-42 Fourth Floor Ashoka Millenium Complex Ring Road-1 Raipur 492 001 - Chhattisgarh	Tel. +91 9893290624 sutanu.sarkar@seweurodriveindia.com

Indonesia			
Technical Office	**Jakarta**	SEW-EURODRIVE Pte Ltd. Jakarta Liaison Office, Menara Graha Kencana Jl. Perjuangan No. 88, LT 3 B, Kebun Jeruk, Jakarta 11530, Indonesia	Tel. +62 21 5359066 Fax +62 21 5363686 Service Hotline: +65 61000 739 sew@cbn.net.id

Ireland			
Sales **Service**	**Dublin**	Alperton Engineering Ltd. 48 Moyle Road Dublin Industrial Estate Glasnevin, Dublin 11	Tel. +353 1 830-6277 Fax +353 1 830-6458 info@alperton.ie http://www.alperton.ie

Israel			
Sales	**Tel-Aviv**	Liraz Handasa Ltd. Ahofer Str 34B / 228 58858 Holon	Tel. +972 3 5599511 Fax +972 3 5599512 http://www.liraz-handasa.co.il office@liraz-handasa.co.il

Italy			
Assembly **Sales** **Service**	**Milano**	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Via Bernini,14 I-20020 Solaro (Milano)	Tel. +39 02 96 9801 Fax +39 02 96 799781 http://www.sew-eurodrive.it sewit@sew-eurodrive.it
Technical Offices	**Bologna**	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Via della Grafica, 47 I-40064 Ozzano dell'Emilia (Bo)	Tel. +39 051 65-23-801 Fax +39 051 796-595
	Caserta	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Viale Carlo III Km. 23,300 I-81020 S. Nicola la Strada (Caserta)	Tel. +39 0823 219011 Fax +39 0823 421414

Italy			
	Firenze	RIMA Via Einstein, 14 I-50013 Campi Bisenzio (Firenze)	Tel. +39 055 898 58-21 Fax +39 055 898 58-30
	Pescara	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Viale Europa,132 I-65010 Villa Raspa di Spoltore (PE)	Tel. +39 085 41-59-427 Fax +39 085 41-59-643
	Torino	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Filiale Torino c.so Unione Sovietica 612/15 - int. C I-10135 Torino	Tel. +39 011 3473780 Fax +39 011 3473783
	Verona	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Via P. Sgulmero, 27/A I-37132 Verona	Tel. +39 045 89-239-11 Fax +39 045 97-6079

Ivory Coast			
Sales	**Abidjan**	SICA Ste industrielle et commerciale pour l'Afrique 165, Bld de Marseille B.P. 2323, Abidjan 08	Tel. +225 2579-44 Fax +225 2584-36

Japan			
Assembly **Sales** **Service**	**Iwata**	SEW-EURODRIVE JAPAN CO., LTD 250-1, Shimoman-no, Iwata Shizuoka 438-0818	Tel. +81 538 373811 Fax +81 538 373814 http://www.sew-eurodrive.co.jp sewjapan@sew-eurodrive.co.jp
Technical Offices	**Fukuoka**	SEW-EURODRIVE JAPAN CO., LTD. C-go, 5th-floor, Yakuin-Hiruzu-Bldg. 1-5-11, Yakuin, Chuo-ku Fukuoka, 810-0022	Tel. +81 92 713-6955 Fax +81 92 713-6860 sewkyushu@jasmine.ocn.ne.jp
	Osaka	SEW-EURODRIVE JAPAN CO., LTD. B-Space EIRAI Bldg., 3rd Floor 1-6-9 Kyoumachibori, Nishi-ku, Osaka, 550-0003	Tel. +81 6 6444--8330 Fax +81 6 6444--8338 sewosaka@crocus.ocn.ne.jp
	Tokyo	SEW-EURODRIVE JAPAN CO., LTD. Izumi-Bldg. 5 F 3-2-15 Misaki-cho Chiyoda-ku, Tokyo 101-0061	Tel. +81 3 3239-0469 Fax +81 3 3239-0943 sewtokyo@basil.ocn.ne.jp

Korea			
Assembly **Sales** **Service**	**Ansan-City**	SEW-EURODRIVE KOREA CO., LTD. B 601-4, Banweol Industrial Estate 1048-4, Shingil-Dong Ansan 425-120	Tel. +82 31 492-8051 Fax +82 31 492-8056 http://www.sew-korea.co.kr master@sew-korea.co.kr
	Busan	SEW-EURODRIVE KOREA Co., Ltd. No. 1720 - 11, Songjeong - dong Gangseo-ku Busan 618-270	Tel. +82 51 832-0204 Fax +82 51 832-0230 master@sew-korea.co.kr
Technical Offices	**Daegu**	SEW-EURODRIVE KOREA Co., Ltd. No.1108 Sungan officetel 87-36, Duryu 2-dong, Dalseo-ku Daegu 704-712	Tel. +82 53 650-7111 Fax +82 53 650-7112
	DaeJeon	SEW-EURODRIVE KOREA Co., Ltd. No. 1502, Hongin officetel 536-9, Bongmyung-dong, Yusung-ku Daejeon 305-301	Tel. +82 42 828-6461 Fax +82 42 828-6463

Korea			
	Kwangju	SEW-EURODRIVE KOREA Co., Ltd. 4fl., Dae-Myeong B/D 96-16 Unam-dong, Buk-ku Kwangju 500-170	Tel. +82 62 511-9172 Fax +82 62 511-9174
	Seoul	SEW-EURODRIVE KOREA Co., Ltd. No.504 Sunkyung officetel 106-4 Kuro 6-dong, Kuro-ku Seoul 152-054	Tel. +82 2 862-8051 Fax +82 2 862-8199

Latvia			
Sales	**Riga**	SIA Alas-Kuul Katlakalna 11C LV-1073 Riga	Tel. +371 7139253 Fax +371 7139386 http://www.alas-kuul.com info@alas-kuul.com

Lebanon			
Sales	**Beirut**	Gabriel Acar & Fils sarl B. P. 80484 Bourj Hammoud, Beirut	Tel. +961 1 4947-86 +961 1 4982-72 +961 3 2745-39 Fax +961 1 4949-71 gacar@beirut.com

Lithuania			
Sales	**Alytus**	UAB Irseva Naujoji 19 LT-62175 Alytus	Tel. +370 315 79204 Fax +370 315 56175 info@irseva.lt http://www.sew-eurodrive.lt

Luxembourg			
Assembly **Sales** **Service**	**Brüssel**	CARON-VECTOR S.A. Avenue Eiffel 5 B-1300 Wavre	Tel. +32 10 231-311 Fax +32 10 231-336 http://www.sew-eurodrive.lu info@caron-vector.be

Malaysia			
Assembly **Sales** **Service**	**Johore**	SEW-EURODRIVE SDN BHD No. 95, Jalan Seroja 39, Taman Johor Jaya 81000 Johor Bahru, Johor West Malaysia	Tel. +60 7 3549409 Fax +60 7 3541404 sales@sew-eurodrive.com.my
Technical Offices	**Kota Kinabalu**	SEW-EURODRIVE Sdn Bhd (Kota Kinabalu Branch) Lot No. 2,1st Floor, Inanam Baru Phase III, Miles 5.1 /2, Jalan Tuaran, Inanam 89350 Kota Kinabalu Sabah, Malaysia	Tel. +60 88 424792 Fax +60 88 424807
	Kuala Lumpur	SEW-EURODRIVE Sdn. Bhd. No. 2, Jalan Anggerik Mokara 31/46 Kota Kemuning Seksyen 31 40460 Shah Alam Selangor Darul Ehsan	Tel. +60 3 5229633 Fax +60 3 5229622 sewpjy@po.jaring.my
	Kuching	SEW-EURODRIVE Sdn. Bhd. Lot 268, Section 9 KTLD Lorong 9, Jalan Satok 93400 Kuching, Sarawak East Malaysia	Tel. +60 82 232380 Fax +60 82 242380

Malaysia			
	Penang	SEW-EURODRIVE Sdn. Bhd. No. 38, Jalan Bawal Kimsar Garden 13700 Prai, Penang	Tel. +60 4 3999349 Fax +60 4 3999348 seweurodrive@po.jaring.my

Mauritania			
Sales	**Zouérate**	AFRICOM - SARL En Face Marché Dumez P.B. 88 Zouérate	Tel. +222 54 40134 Fax +222 54 40538 cybertiris@mauritel.mr

Mexico			
Assembly **Sales** **Service**	**Quéretaro**	SEW-EURODRIVE MEXICO SA DE CV SEM-981118-M93 Tequisquiapan No. 102 Parque Industrial Quéretaro C.P. 76220 Quéretaro, México	Tel. +52 442 1030-300 Fax +52 442 1030-301 http://www.sew-eurodrive.com.mx scmexico@seweurodrive.com.mx

Morocco			
Sales	**Casablanca**	Afit 5, rue Emir Abdelkader MA 20300 Casablanca	Tel. +212 22618372 Fax +212 22618351 ali.alami@premium.net.ma

Netherlands			
Assembly **Sales** **Service**	**Rotterdam**	VECTOR Aandrijftechniek B.V. Industrieweg 175 NL-3044 AS Rotterdam Postbus 10085 NL-3004 AB Rotterdam	Tel. +31 10 4463-700 Fax +31 10 4155-552 http://www.vector.nu info@vector.nu
		VECTOR Aandrijftechniek B.V. Gelderhorst 10 NL-7207 BH Zutphen Industrieterrein de Revelhorst	Tel. +31 575 57 44 94 Fax +31 575 57 24 43 oost@vector.nu
		VECTOR Aandrijftechniek B.V. Mercuriusweg 8A NL-5971 LX Grubbenvorst	Tel. +31 77 36 61 873 Fax +31 77 36 62 109 zuid@vector.nu
		VECTOR Aandrijftechniek B.V. Weberstraat 74 NL-1446 VV Purmerend Industrieterrein "De Baanstee"	Tel. +31 299 66 63 38 Fax +31 299 47 60 55 noordwest@vector.nu

New Zealand			
Assembly **Sales** **Service**	**Auckland**	SEW-EURODRIVE NEW ZEALAND LTD. P.O. Box 58-428 82 Greenmount drive East Tamaki Auckland	Tel. +64 9 2745627 Fax +64 9 2740165 http://www.sew-eurodrive.co.nz sales@sew-eurodrive.co.nz
	Christchurch	SEW-EURODRIVE NEW ZEALAND LTD. 10 Settlers Crescent, Ferrymead Christchurch	Tel. +64 3 384-6251 Fax +64 3 384-6455 sales@sew-eurodrive.co.nz
Technical Office	**Palmerston North**	SEW-EURODRIVE NEW ZEALAND LTD. C/-Grant Shearman, RD 5, Aronui Road Palmerston North	Tel. +64 6 355-2165 Fax +64 6 355-2316 sales@sew-eurodrive.co.nz

Norway			
Assembly **Sales** **Service**	**Moss**	SEW-EURODRIVE A/S Solgaard skog 71 N-1599 Moss	Tel. +47 69 24 10 20 Fax +47 69 24 10 40 http://www.sew-eurodrive.no sew@sew-eurodrive.no

Peru			
Assembly **Sales** **Service**	**Lima**	SEW DEL PERU MOTORES REDUCTORES S.A.C. Los Calderos, 120-124 Urbanizacion Industrial Vulcano, ATE, Lima	Tel. +51 1 3495280 Fax +51 1 3493002 http://www.sew-eurodrive.com.pe sewperu@sew-eurodrive.com.pe

Philippines			
Technical Office	**Manila**	SEW-EURODRIVE Pte Ltd Manila Liaison Office Suite 110, Ground Floor Comfoods Building Senator Gil Puyat Avenue 1200 Makati City	Tel. +63 2 894275254 Fax +63 2 8942744 sewmla@i-next.net

Poland			
Assembly **Sales** **Service**	**Lodz**	SEW-EURODRIVE Polska Sp.z.o.o. ul. Techniczna 5 PL-92-518 Łódź	Tel. +48 42 67710-90 Fax +48 42 67710-99 http://www.sew-eurodrive.pl sew@sew-eurodrive.pl
		24 Hour Service	Tel. +48 602 739 739 (+48 602 SEW SEW) sewis@sew-eurodrive.pl
Technical Office	**Tychy**	SEW-EURODRIVE Polska Sp.z.o.o. ul. Nad Jeziorem 87 PL-43-100 Tychy	Tel. +48 32 2175026 + 32 2175027 Fax +48 32 2277910
	Bydgoszcz	SEW-EURODRIVE Polska Sp.z.o.o. ul. Fordońska 246 PL-85-959 Bydgoszcz	Tel. +48 52 3606590 Fax +48 52 3606591
	Poznan	SEW-EURODRIVE Polska Sp.z.o.o. ul. Romana Maya 1 PL-61-371 Poznań	Tel. +48 61 8741640 Fax +48 61 8741641
	Szczecinek	SEW-EURODRIVE Polska Sp.z.o.o. ul. Mickiewicza 2 pok. 36 PL-78-400 Szczecinek	Tel. +48 94 3728820 Fax +48 94 3728821

Portugal			
Assembly **Sales** **Service**	**Coimbra**	SEW-EURODRIVE, LDA. Apartado 15 P-3050-901 Mealhada	Tel. +351 231 20 9670 Fax +351 231 20 3685 http://www.sew-eurodrive.pt infosew@sew-eurodrive.pt
Technical Offices	**Lisboa**	SEW-EURODRIVE, LDA. Núcleo Empresarial I de São Julião do Tojal Rua de Entremuros, 54 Fracção I P-2660-533 São Julião do Tojal	Tel. +351 21 958-0198 Fax +351 21 958-0245 esc.lisboa@sew-eurodrive.pt
	Porto	SEW-EURODRIVE, LDA. Av. 25 de Abril, 68 4440-502 Valongo	Tel. +351 229 350 383 Fax +351 229 350 384 MobilTel. +351 9 32559110 esc.porto@sew-eurodrive.pt

Romania			
Sales **Service**	**Bucureşti**	Sialco Trading SRL str. Madrid nr.4 011785 Bucuresti	Tel. +40 21 230-1328 Fax +40 21 230-7170 sialco@sialco.ro

Russia			
Assembly **Sales** **Service**	**St. Petersburg**	ZAO SEW-EURODRIVE P.O. Box 36 195220 St. Petersburg Russia	Tel. +7 812 3332522 +7 812 5357142 Fax +7 812 3332523 http://www.sew-eurodrive.ru sew@sew-eurodrive.ru
Technical Office	**Yekaterinburg**	ZAO SEW-EURODRIVE Kominterna Str. 16 Office 614 RUS-620078 Ekaterinburg	Tel. +7 343 310 3977 Fax +7 343 310 3978 eso@sew-eurodrive.ru
	Irkutsk	ZAO SEW-EURODRIVE 5-Armii Str., 31 RUS-664011 Irkutsk	Tel. +7 3952 25 5880 Fax +7 3952 25 5881 iso@sew-eurodrive.ru
	Moskau	ZAO SEW-EURODRIVE RUS-107023 Moskau	Tel. +7 495 9337090 Fax +7 495 9337094 mso@sew-eurodrive.ru
	Novosibirsk	ZAO SEW-EURODRIVE pr. K Marksa, d.30 RUS-630087 Novosibirsk	Tel. +7 383 3350200 Fax +7 383 3462544 nso@sew-eurodrive.ru
	Togliatti	ZAO SEW-EURODRIVE Sportivnaya Str. 4B, office 2 Samarskaya obl. RUS-445057 Togliatti	Tel. +7 8482 710529 Fax +7 8482 810590

Senegal			
Sales	**Dakar**	SENEMECA Mécanique Générale Km 8, Route de Rufisque B.P. 3251, Dakar	Tel. +221 338 494 770 Fax +221 338 494 771 senemeca@sentoo.sn

Serbia			
Sales	**Beograd**	DIPAR d.o.o. Ustanicka 128a PC Košum, IV floor SCG-11000 Beograd	Tel. +381 11 347 3244 / +381 11 288 0393 Fax +381 11 347 1337 office@dipar.co.yu

Singapore			
Assembly **Sales** **Service**	**Singapore**	SEW-EURODRIVE PTE. LTD. No 9, Tuas Drive 2 Jurong Industrial Estate Singapore 638644	Tel. +65 68621701 Fax +65 68612827 http://www.sew-eurodrive.com.sg sewsingapore@sew-eurodrive.com

Slovakia			
Sales	**Bratislava**	SEW-Eurodrive SK s.r.o. Rybničná 40 SK-831 06 Bratislava	Tel. +421 2 33595 202 Fax +421 2 33595 200 sew@sew-eurodrive.sk http://www.sew-eurodrive.sk
	Žilina	SEW-Eurodrive SK s.r.o. Industry Park - PChZ ulica M.R.Štefánika 71 SK-010 01 Žilina	Tel. +421 41 700 2513 Fax +421 41 700 2514 sew@sew-eurodrive.sk
	Banská Bystrica	SEW-Eurodrive SK s.r.o. Rudlovská cesta 85 SK-974 11 Banská Bystrica	Tel. +421 48 414 6564 Fax +421 48 414 6566 sew@sew-eurodrive.sk

Slovakia			
	Košice	SEW-Eurodrive SK s.r.o. Slovenská ulica 26 SK-040 01 Košice	Tel. +421 55 671 2245 Fax +421 55 671 2254 sew@sew-eurodrive.sk

Slovenia			
Sales **Service**	**Celje**	Pakman - Pogonska Tehnika d.o.o. UI. XIV. divizije 14 SLO - 3000 Celje	Tel. +386 3 490 83-20 Fax +386 3 490 83-21 pakman@siol.net

South Africa			
Assembly **Sales** **Service**	**Johannesburg**	SEW-EURODRIVE (PROPRIETARY) LIMITED Eurodrive House Cnr. Adcock Ingram and Aerodrome Roads Aeroton Ext. 2 Johannesburg 2013 P.O.Box 90004 Bertsham 2013	Tel. +27 11 248-7000 Fax +27 11 494-3104 http://www.sew.co.za info@sew.co.za
	Cape Town	SEW-EURODRIVE (PROPRIETARY) LIMITED Rainbow Park Cnr. Racecourse & Omuramba Road Montague Gardens Cape Town P.O.Box 36556 Chempet 7442 Cape Town	Tel. +27 21 552-9820 Fax +27 21 552-9830 Telex 576 062 cfoster@sew.co.za
	Durban	SEW-EURODRIVE (PROPRIETARY) LIMITED 2 Monaceo Place Pinetown Durban P.O. Box 10433, Ashwood 3605	Tel. +27 31 700-3451 Fax +27 31 700-3847 hengela@sew.co.za
	Nelspruit	SEW-EURODRIVE (PTY) LTD. 7 Christie Crescent Vintonia P.O.Box 1942 Nelspruit 1200	Tel. +27 13 752-8007 Fax +27 13 752-8008 robermeyer@sew.co.za
Technical Offices	**Port Elizabeth**	SEW-EURODRIVE PTY LTD. 8 Ruan Access Park Old Cape Road Greenbushes 6000 Port Elizabeth	Tel. +27 41 3722246 Fax +27 41 3722247 dtait@sew.co.za
	Richards Bay	SEW-EURODRIVE PTY LTD. 103 Bulion Blvd Richards Bay P.O. Box 458 Richards Bay, 3900	Tel. +27 35 797-3805 Fax +27 35 797-3819 jswart@sew.co.za

Spain			
Assembly **Sales** **Service**	**Bilbao**	SEW-EURODRIVE ESPAÑA, S.L. Parque Tecnológico, Edificio, 302 E-48170 Zamudio (Vizcaya)	Tel. +34 94 43184-70 Fax +34 94 43184-71 http://www.sew-eurodrive.es sew.spain@sew-eurodrive.es
Technical Offices	**Barcelona**	Delegación Barcelona Avenida Francesc Maciá 40-44 Oficina 4.2 E-08208 Sabadell (Barcelona)	Tel. +34 93 7162200 Fax +34 93 7233007
	Lugo	Delegación Noroeste Apartado, 1003 E-27080 Lugo	Tel. +34 639 403348 Fax +34 982 202934

Spain			
	Madrid	Delegación Madrid Gran Via. 48-2° A-D E-28220 Majadahonda (Madrid)	Tel. +34 91 6342250 Fax +34 91 6340899
	Seville	MEB Pólogono Calonge, C/A Nave 2 - C E-41.077 Sevilla	Tel. +34 954 356 361 Fax +34 954 356 274 mebsa.sevilla@mebsa.com
	Valencia	MEB Músico Andreu i Piqueres, 4 E-46.900 Torrente (Valencia)	Tel. +34 961 565 493 Fax +34 961 566 688 mebsa.valencia@mebsa.com

Sri Lanka			
Sales	**Colombo**	SM International (Pte) Ltd 254, Galle Raod Colombo 4, Sri Lanka	Tel. +94 1 2584887 Fax +94 1 2582981

Sweden			
Assembly **Sales** **Service**	**Jönköping**	SEW-EURODRIVE AB Gnejsvägen 6-8 S-55303 Jönköping Box 3100 S-55003 Jönköping	Tel. +46 36 3442 00 Fax +46 36 3442 80 http://www.sew-eurodrive.se info@sew-eurodrive.se
Technical Offices	**Göteborg**	SEW-EURODRIVE AB Gustaf Werners gata 8 S-42132 Västra Frölunda	Tel. +46 31 70968 80 Fax +46 31 70968 93
	Malmö	SEW-EURODRIVE AB Borrgatan 5 S-21124 Malmö	Tel. +46 40 68064 80 Fax +46 40 68064 93
	Stockholm	SEW-EURODRIVE AB Björkholmsvägen 10 S-14146 Huddinge	Tel. +46 8 44986 80 Fax +46 8 44986 93
	Skellefteå	SEW-EURODRIVE AB Trädgårdsgatan 8 S-93131 Skellefteå	Tel. +46 910 7153 80 Fax +46 910 7153 93

Switzerland			
Assembly **Sales** **Service**	**Basel**	Alfred Imhof A.G. Jurastrasse 10 CH-4142 Münchenstein bei Basel	Tel. +41 61 417 1717 Fax +41 61 417 1700 http://www.imhof-sew.ch info@imhof-sew.ch
Technical Offices	**Rhaetian Switzerland**	André Gerber Es Perreyres CH-1436 Chamblon	Tel. +41 24 445 3850 Fax +41 24 445 4887
	Bern / Solothurn	Rudolf Bühler Muntersweg 5 CH-2540 Grenchen	Tel. +41 32 652 2339 Fax +41 32 652 2331
	Central Switzerland and Ticino	Beat Lütolf Baumacher 11 CH-6244 Nebikon	Tel. +41 62 756 4780 Fax +41 62 756 4786
	Zürich	René Rothenbühler Nörgelbach 7 CH-8493 Saland	Tel. +41 52 386 3150 Fax +41 52 386 3213
	Bodensee and East Switzerland	Markus Künzle Eichweg 4 CH-9403 Goldach	Tel. +41 71 845 2808 Fax +41 71 845 2809

Taiwan (R.O.C.)			
Sales	**Nan Tou**	Ting Shou Trading Co., Ltd. No. 55 Kung Yeh N. Road Industrial District Nan Tou 540	Tel. +886 49 255353 Fax +886 49 257878
	Taipei	Ting Shou Trading Co., Ltd. 6F-3, No. 267, Sec. 2 Tung Hwa South Road, Taipei	Tel. +886 2 27383535 Fax +886 2 27368268 Telex 27 245 sewtwn@ms63.hinet.net

Thailand			
Assembly **Sales** **Service**	**Chonburi**	SEW-EURODRIVE (Thailand) Ltd. 700/456, Moo.7, Donhuaroh Muang Chonburi 20000	Tel. +66 38 454281 Fax +66 38 454288 sewthailand@sew-eurodrive.com
Technical Offices	**Bangkok**	SEW-EURODRIVE (Thailand) Ltd. 6th floor, TPS Building 1023, Phattanakarn Road Suanluang Bangkok,10250	Tel. +66 2 7178149 Fax +66 2 7178152 sewthailand@sew-eurodrive.com
	Hadyai	SEW-EURODRIVE (Thailand) Ltd. Hadyai Country Home Condominium 59/101 Soi.17/1 Rachas-Utid Road. Hadyai, Songkhla 90110	Tel. +66 74 359441 Fax +66 74 359442 sewthailand@sew-eurodrive.com
	Khonkaen	SEW-EURODRIVE (Thailand) Ltd. 4th Floor, Kaow-U-HA MOTOR Bldg, 359/2, Mitraphab Road. Muang District Khonkaen 40000	Tel. +66 43 225745 Fax +66 43 324871 sew-thailand@sew-eurodrive.com

Tunisia			
Sales	**Tunis**	T. M.S. Technic Marketing Service Zone Industrielle Mghira 2 Lot No. 39 2082 Fouchana	Tel. +216 71 4340-64 + 71 4320-29 Fax +216 71 4329-76 tms@tms.com.tn

Turkey			
Assembly **Sales** **Service**	**Istanbul**	SEW-EURODRIVE Hareket Sistemleri San. ve Tic. Ltd. Sti. Bagdat Cad. Koruma Cikmazi No. 3 TR-34846 Maltepe ISTANBUL	Tel. +90 216 4419164, 3838014, 3738015 Fax +90 216 3055867 http://www.sew-eurodrive.com.tr sew@sew-eurodrive.com.tr
Technical Offices	**Adana**	SEW-EURODRIVE Hareket Sistemleri San. ve Tic. Ltd. Sti. Kizilay Caddesi 8 Sokak No 6 Daðtekin Is Merkezi Kat 4 Daire 2 TR-01170 SEYHAN / ADANA	Tel. +90 322 359 94 15 Fax +90 322 359 94 16
	Ankara	SEW-EURODRIVE Hareket Sistemleri San. ve Tic. Ltd. Sti. Özcelik Is Merkezi, 14. Sok, No. 4/42 TR-06370 Ostim/Ankara	Tel. +90 312 3853390 / +90 312 3544715 / +90 312 3546109 Fax +90 312 3853258
	Bursa	SEW-EURODRIVE Hareket Sistemleri San. ve Tic. Ltd. Sti. Besevler Küçük Sanayi Parkoop Parçacilar Sitesi 48. Sokak No. 47 TR Nilüfer/Bursa	Tel. +90 224 443 4556 Fax +90 224 443 4558

Turkey			
	Izmir	SEW-EURODRIVE Hareket Sistemleri San. ve Tic. Ltd. Sti. 1203/11 Sok. No. 4/613 Hasan Atli Is Merkezi TR-35110 Yenisehir-Izmir	Tel. +90 232 4696264 Fax +90 232 4336105

Ukraine			
Sales **Service**	**Dnepropetrovsk**	SEW-EURODRIVE Str. Rabochaja 23-B, Office 409 49008 Dnepropetrovsk	Tel. +380 56 370 3211 Fax +380 56 372 2078 http://www.sew-eurodrive.ua sew@sew-eurodrive.ua
Sales	**Kiev**	SEW-EURODRIVE GmbH S. Oleynika str. 21 02068 Kiev	Tel. +380 44 503 95 77 Fax +380 44 503 95 78 kso@sew-eurodrive.ua
	Donetsk	SEW-EURODRIVE GmbH 25th anniversary of RKKA av. 1-B, of. 805 Donetsk 83000	Tel. +380 62 38 80 545 Fax +380 62 38 80 533 dso@sew-eurodrive.ua

Uruguay			
Sales	**Montevideo**	SEW-EURODRIVE Uruguay, S. A. German Barbato 1526 CP 11200 Montevideo	Tel. +598 2 90181-89 Fax +598 2 90181-88 sewuy@sew-eurodrive.com.uy

11.4 SEW-EURODRIVE, INC. Terms and Conditions of Sale

1 GENERAL

All orders for products and drawings furnished in connection therewith (hereinafter collectively called “products”) manufactured or supplied by SEW--Eurodrive, Inc. (“Eurodrive”), shall be subject to these terms and conditions of sale. No modifications or additions hereto will be binding unless agreed to in writing by an authorized officer of Eurodrive.

2. QUOTATIONS

Price quotations by Eurodrive are subject to change without notice. All products sold are subject to price in effect at time of shipment.

3. TAXES

Prices do not include Sales, Use, Excise, or other taxes payable to any governmental authority in respect of the sale of Eurodrive's products. The purchaser shall pay the amount of any such taxes or shall reimburse Eurodrive for the amount thereof that Eurodrive may be required to pay.

4. PAYMENTS

Unless otherwise provided, terms of payment are 30 days net from date of invoice for purchasers whose credit is approved. Eurodrive reserves the right to charge interest on any balance outstanding at 2% per month (or fraction thereof) or as Eurodrive shall determine, up to the maximum rate allowed by law, from the date payment is due to the date payment is actually received. Pro rata payments shall become due as shipments are made. If shipments are delayed by or at the request of the purchaser, payment shall become due when Eurodrive is prepared to make shipment. If the cost to Eurodrive of products is increased by reason of delays caused by the purchaser, such additional cost incurred by Eurodrive shall be paid by the purchaser. Eurodrive may, if it deems itself insecure by reason of the financial condition of purchaser or otherwise, require full or partial payment in advance and as a condition to the continuance of production or shipment on the terms specified herein.

5. ACCEPTANCE

No order or other offer shall be binding upon Eurodrive until accepted in writing by an authorized officer of Eurodrive.

6. CHANGES

Eurodrive will not accept changes in specification unless such changes are requested in writing and agreed to in writing by an authorized officer of Eurodrive and the purchaser agrees to pay, if necessary, in addition to the original purchase price a sum so set by Eurodrive.

7. CANCELLATION

Any order when placed with and accepted by Eurodrive is not subject to cancellation unless agreed to in writing by an authorized officer of Eurodrive. Cancellations are subject to reasonable charges based upon expenses already incurred and commitments made by Eurodrive.

8. DELIVERY

Any indicated dates of delivery are approximate only, but Eurodrive will attempt to meet them where possible. Eurodrive shall not be liable for delays in manufacturing or delivery or failure to manufacture or deliver due to any event in the nature of force majeure or any cause beyond Eurodrive's reasonable control. Eurodrive will not be bound by any penalty clause contained in any specification or order submitted by the purchaser unless such clause is agreed to in writing by an authorized officer of Eurodrive. Delivery of products shall be made FOB Eurodrive's factory unless otherwise agreed to in writing by authorized officer of Eurodrive.

9. PATENTS

Eurodrive shall indemnify and hold harmless the purchaser against all claims or actions that are instituted against the purchaser on the grounds that the purchaser has infringed the patent rights of others by using, reselling, or promoting the sale or resale of Eurodrive's products, provided that Eurodrive shall not be obligated hereunder if:

a) The purchaser fails to give Eurodrive prompt notice of any such claim or actions, or

b) Such claims or actions against the purchaser are based wholly or in part on the existence or operation of any complete installation or apparatus incorporating Eurodrive's products as components and which is designed or manufactured by the purchaser or its customers.

10.REGULATORY LAWS OR STANDARDS

Eurodrive makes no representation that its products conform to state or local laws, ordinances, regulations, codes or standards except as may be otherwise agreed to in writing by an authorized officer of Eurodrive.

11.LIMITED WARRANTY

Eurodrive warrants all its products against defects in material and workmanship for a period of one (1) year from the date the product is placed in service to a maximum of eighteen (18) months from date of shipment. Parts subject to replacement due to operational wear and tear, viz. Varigear® belts and Varimot® traction elements, are not covered by this Limited Warranty. Notwithstanding the foregoing, any equipment or components of the products not of Eurodrive's own manufacture and/or specified by the purchaser is sold under only such warranty as the maker thereof gives Eurodrive and Eurodrive is able to enforce, but such items are not warranted by Eurodrive in any way. Use of products above rated capacity, misuse, field alterations of products, damage due to lack of maintenance or improper storage, neglect or accident are also excluded from this Limited Warranty.

This Limited Warranty is effective provided:

a) The purchaser notifies Eurodrive in writing of the alleged defect immediately after it becomes known to the purchaser; and

b) no alterations, repairs, or services have been performed by the purchaser or third parties on the products without written approval of an authorized officer of Eurodrive.

Eurodrive's obligation under this Limited Warranty is limited to the repair or replacement FOB Eurodrive's factory or any part or parts found to be defective in material or workmanship.

Eurodrive shall, in no event, be liable to the user/purchaser under this Limited Warranty, or otherwise, for claims, expenditures or losses arising from operational delays or work stoppages or damages to property or people caused by defective products or for consequential or indirect damage of any nature whatsoever.

THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

12.ASSIGNMENT

No contract to purchase goods from Eurodrive may be assigned by the purchaser without prior agreement in writing by an authorized officer of Eurodrive.

13.SECURITY INTEREST

Unless and until the products are fully paid for, Eurodrive reserves a security interest in them to secure the unpaid balance of the price and all other obligations of the purchaser to Eurodrive however arising. The purchaser hereby grants Eurodrive a power of attorney to execute and file on behalf of purchaser all necessary financing statements and other similar documents required to protect the security interest granted herein.

14.DAMAGES; LIMITATION

In the event of breach of this agreement by Eurodrive, the rights of the purchaser are limited to the amount therefore paid to Eurodrive for the goods. THE PURCHASER SHALL HAVE NO RIGHT TO CONSEQUENTIAL OR INDIRECT DAMAGES, WHETHER FOR INJURES TO PERSON, PROPERTY OR OTHERWISE.

15.DEFAULT

If the purchaser defaults in performing any of its obligations to Eurodrive under this agreement, or any other agreements, Eurodrive may, at its option and without incurring any liability thereby, elect to terminate this agreement or to terminate any or all other agreements with the purchaser or to terminate this agreement together with any or all such other agreements. Furthermore, Eurodrive shall have a right to all damages sustained, including loss of profits.

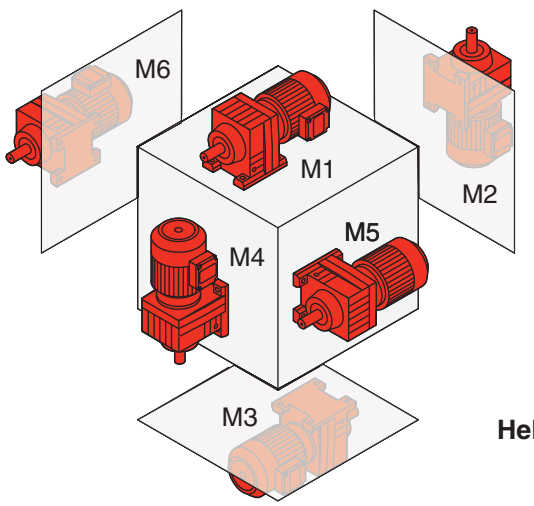
16.INSOLVENCY

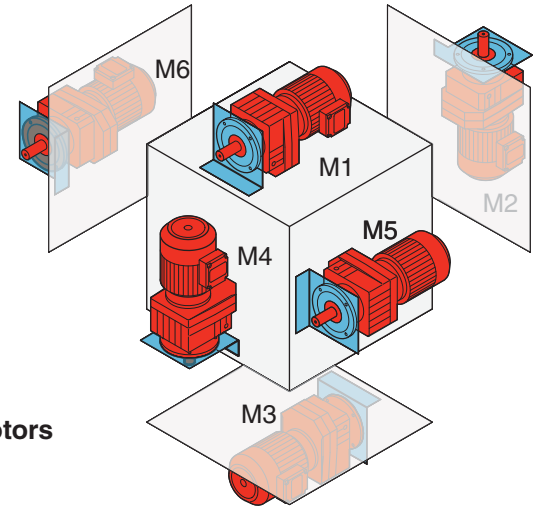
If the purchaser shall be insolvent or cease doing business or be the subject of any proceedings under any bankruptcy, insolvency, reorganization or arrangement statute or law, such act shall at the option of Eurodrive, be deemed a default under this agreement, and Eurodrive may elect to cease performing and cancel this agreement with respect to any products not delivered or received prior to the election. All of the foregoing shall be without prejudice to recovery by Eurodrive of damages for work performed and for loss of profits and material and products delivered.

17.MISCELLANEOUS

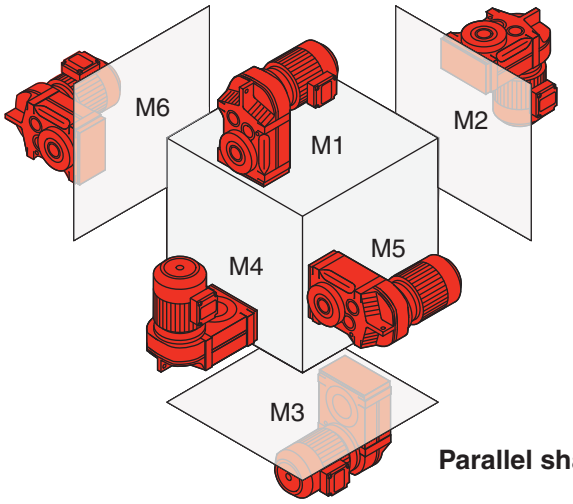
The provisions of this agreement shall be governed and construed in accordance with the laws of the State of South Carolina. These terms and conditions set forth the entire understanding and agreement of the parties hereto in respect to the subject matter hereof, and all prior undertakings between the parties hereto, together with all representations and obligations of such parties in respect to such subject matter, shall be superseded by and merged into this agreement. No provisions hereof shall be waived, changed, terminated, modified, discharged or rescinded, orally or otherwise, except by a writing signed by the party to be charged by any such waiver, change, termination, modification, discharge, or rescission. No waiver of any breach of any provision of this agreement shall constitute an amendment or modification of this agreement, or any provision thereof. If any provision of this agreement shall be held to be unenforceable or inapplicable in any way or respect, such holding shall not affect the enforceability of any other provision of this agreement under any other circumstances. The provisions of this agreement shall bind and inure to the benefits of the parties hereto and their respective heirs, executors, administrators, successors, and (subject to any restrictions on assignment hereinabove set forth) assigns. In the event unspecified redress or commitments develop not covered above, terms of the Uniform Commercial Code under the laws of South Carolina will be construed as being effective as they may pertain.

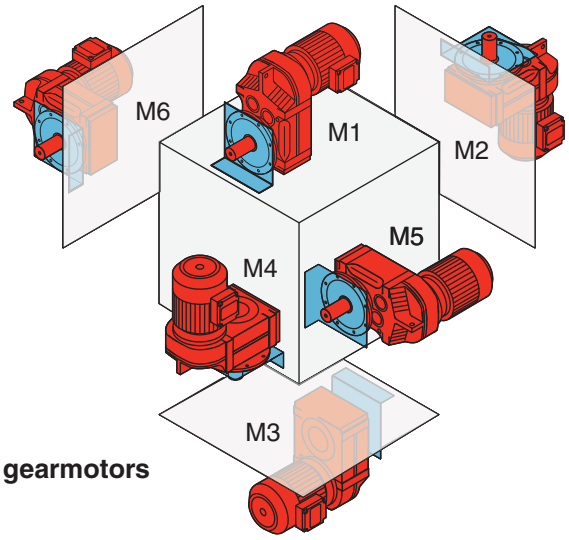
Overview of Mounting Positions*



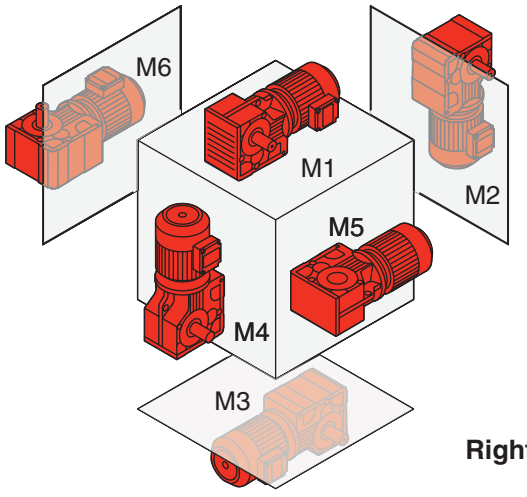


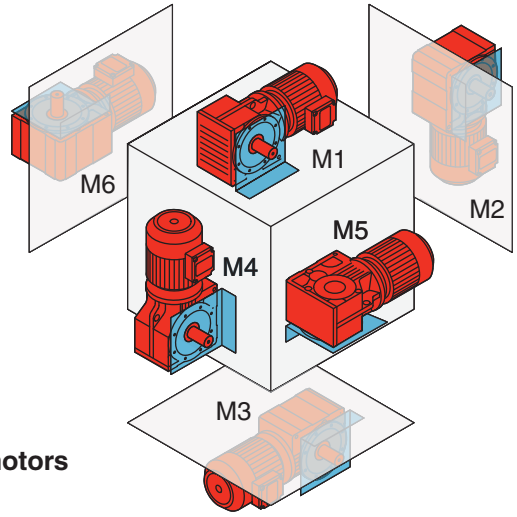
Helical gearmotors





Parallel shaft helical gearmotors





Right-angle gearmotors

03343AEN

* Refer to the main document for detailed information on mounting positions for SEW gearmotors.

How we're driving the world

With a global presence that offers responsive and reliable solutions. Anywhere.

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