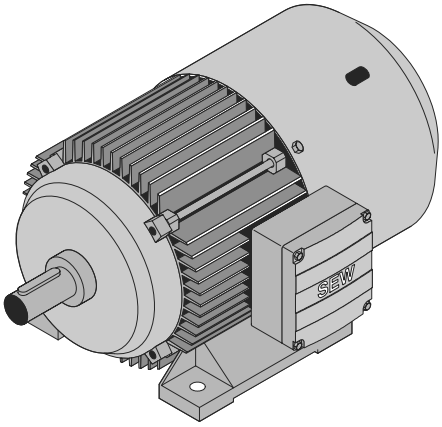
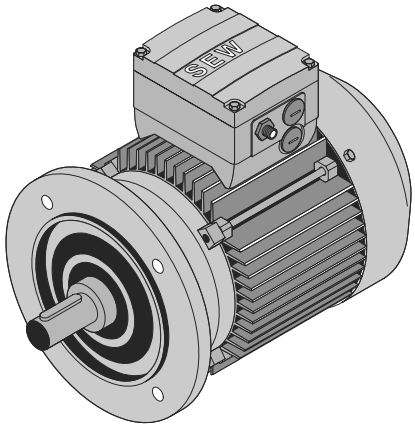
13 Project Planning for AC Motors

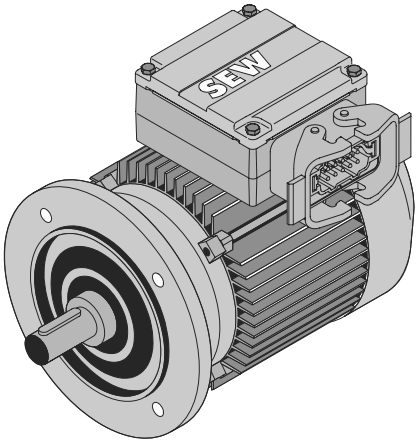
13.1 Examples for different versions



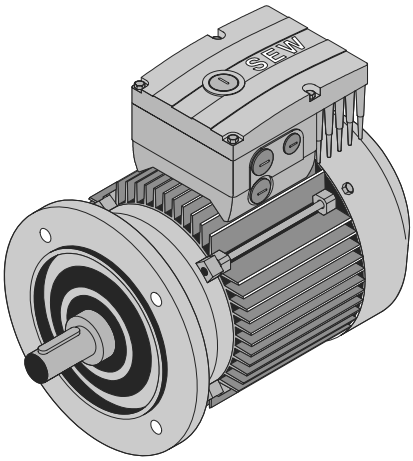
DT, DV../BM(G)



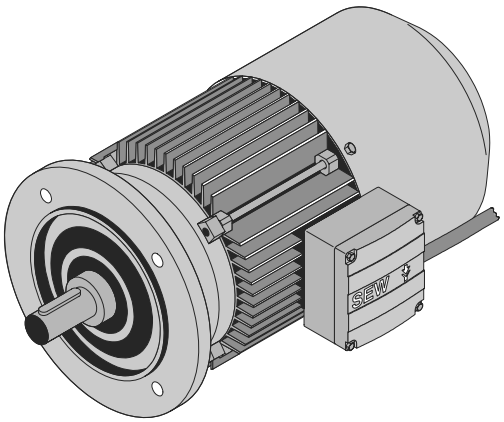
DFT, DFV../MSW



DFT, DFV../ASB1



DFT, DFV../MM



DFR../BR/IS, DFT, DFV../BM(G)/IS

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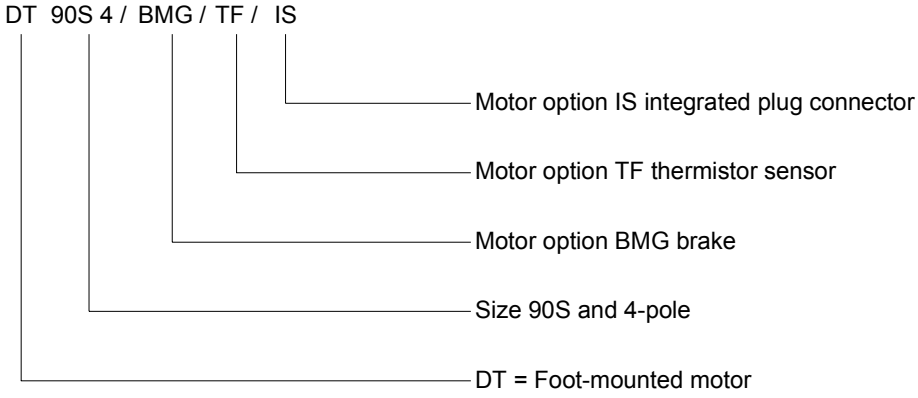
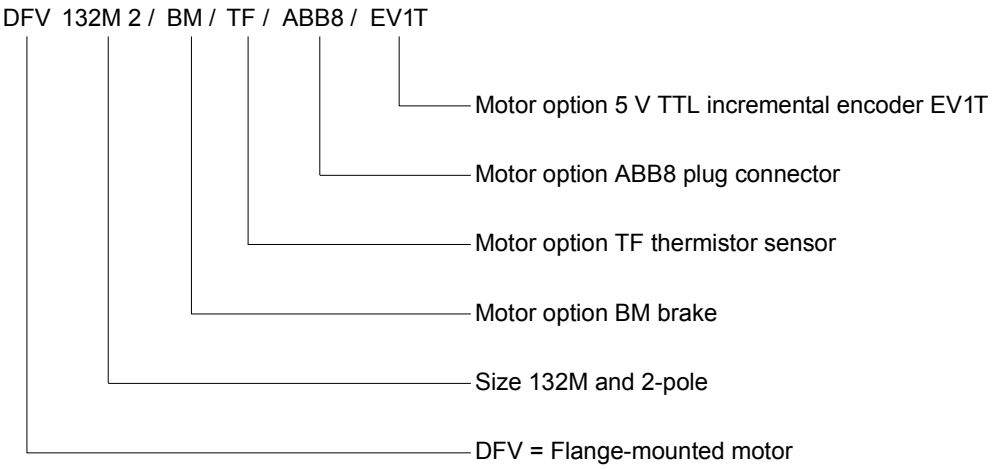
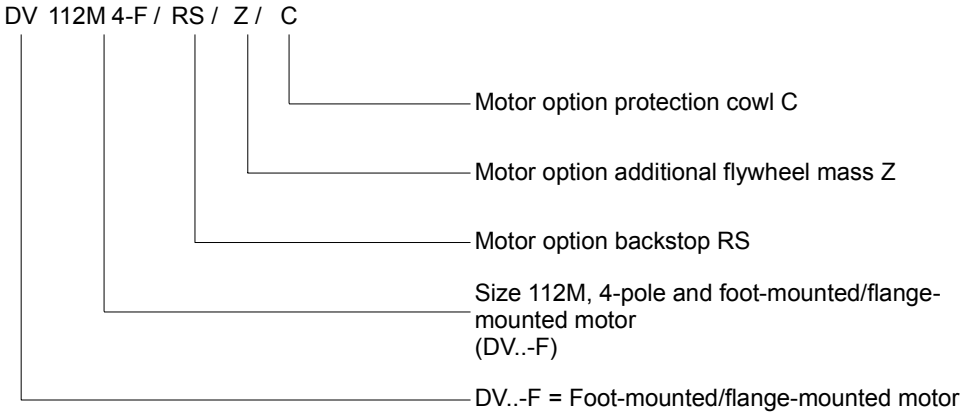
Figure 29: AC (brake) motors

13.2 Unit designation of AC (brake) motors

Examples







13.3 Available motor options

Overview

The following motor options can be supplied in various combinations:

- BM(G)/BR disc brakes
- IS integrated plug connector
- AB.., AD.., AM.., AS.., APG.. plug connectors
- RS backstop
- Additional flywheel mass Z (flywheel fan)
- Protection cowl C
- Encoders and pre-fabricated cables for encoder connection
- Mounting devices for encoders
- Forced cooling fan VR/VS/V
- MOVIMOT® integrated frequency inverter
- MOVI-SWITCH® integrated motor circuit breaker / motor protection
- Smooth pole-change unit WPU

Technical data and dimensions

The technical data and dimensions for the motor options are listed in Sec. "Mounting Positions, Technical data and dimension sheets for AC motors."

13.4 Standards and regulations

Conformance to standards

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

- IEC 60034-1, EN 60034-1
  Electrical rotating machinery, rating and performance.
- EN 60529
  IP degrees of protection for housings of electrical equipment.
- IEC 60072
  Dimensions and performance of electrical rotating machinery.
- EN 50262
  Metric threads of cable glands.
- EN 50347
  Standardized dimensions and power values.

Energy efficient motors

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 following different categories will be used: EFF3, EFF2 and EFF1. 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 size 90S and greater meet the requirements of efficiency class EFF 2. These motors are described in the "Gearmotors" catalog.

Type DTE/DVE four-pole AC motors of motor sizes 90S to 225S meet the requirements of efficiency class EFF 1. These motors are referred to as energy efficient motors. Energy efficient motors are described in a separate catalog. The "DTE/DVE Energy Efficient Motors" catalog contains the product description, technical data and detailed project planning notes.

International regulations

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

- Australia
- New Zealand

Preparations are in progress for the following countries:

- Brazil
- Canada
- USA

If required, you can request separate catalogs from SEW-EURODRIVE containing technical data applicable to a specific country.

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

These data are indicated 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 and a maximum altitude of 1000 m above sea level.

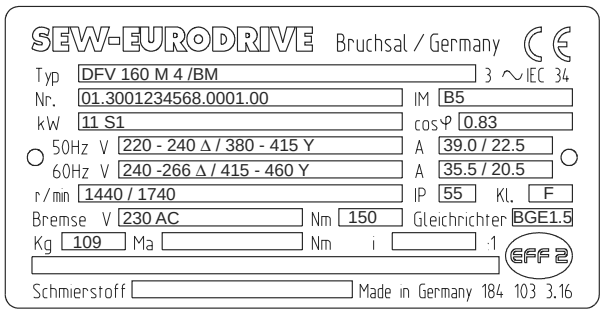


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Figure 30: Motor nameplate

Tolerances

In accordance with IEC60034 (EN 60034), the following tolerances are permitted for electric motors at rated voltage (also applies to the rated voltage range):

Voltage and frequency		Tolerance A
Efficiency η	$P_N \leq 50$ kW $P_N > 50$ kW	-0,15 • (1-η) -0,1 • (1-η)
Power factor cosφ		$-\frac{1 - \cos\varphi}{6}$
Slip	$P_N < 1$ kW $P_N \geq 1$ kW	±30% ±20%
Starting current		+20%
Starting torque		-15%...+25%
Breakdown torque		-10%
Mass moment of inertia		±10%

Tolerance A

The tolerance A describes 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.

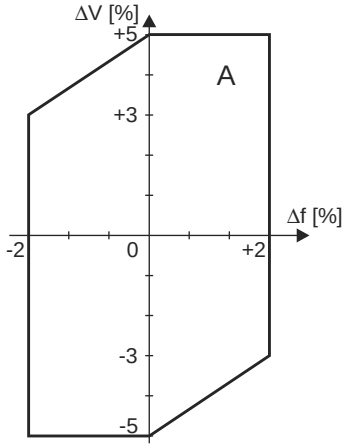

Figure 31: Range of tolerance A

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 applies in particular to the motor start-up in which the starting current is a multiple of the rated current.

13.5 Explosion protection to ATEX

Directive 94/9/EC or ATEX has also harmonized the legislation governing explosion-proof tools and fixtures throughout the European Union. The CE mark is applied to the nameplate as an external indication of this fact.

ATEX-compliant drives have also been certified for use in Switzerland by the SEV.

Another new directive, 1999/92/EC or ATEX 137 (118a), also regulates the conditions throughout Europe for operating machines in potentially explosive atmospheres. This directive also defines the zones within which the electrical drives may be operated, for example:

- Zone 1 and zone 2 with gas explosion hazard.
- Zone 21 and zone 22 with dust explosion hazard.

Based on ATEX, the previous identification of motors is now supplemented by:

- the unit group II
- the category 2 or 3
- the potentially explosive atmosphere G (gas) or D (dust)

Example:

Previously	To ATEX
EEx e II for a motor with protection type "Increased safety"	**II 2 G EEx e II** for use in zone 1

Other documents

The "Explosion-Proof Drives according. to EU Directive 94/9/EC" system description and the volume of the same name in the "Drive Engineering - Practical Implementation" series provide you with basic information about this topic.

Please refer to the "Explosion-Proof Drives" catalog and the "Variable Speed Gearmotors" catalog for detailed information on explosion-proof SEW-EURODRIVE products.

13.6 Circuit breaker and protective equipment

EMC measures

SEW-EURODRIVE AC motors and AC brake motors 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.

Mains operation

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 mains operation.

Switching operation

Please take suitable interference suppression measures on the switchgear if the motor is used in switching operation.

Inverter operation

Please refer to the installation and EMC instructions provided by the inverter manufacturer regarding inverter operation. 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. Collective 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 (minimum. distance 200 mm).

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. 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 include PTC thermistors or bimetallic switches (thermostats) in the winding. PTC thermistors or bimetallic switches are triggered when the maximum permitted winding temperature is reached. They offer the advantage that the temperatures are measured where they arise.

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 per h) and for high inertia starting. Under these circumstances, we recommend using positive temperature coefficient (PTC) thermistors TF as well.

PTC thermistors

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 switch cabinet. Motor protection with a positive temperature coefficient (PTC) thermistor offers comprehensive protection against thermal overload. Motors protected in this way can be used for high inertia starting, switching and braking operation and with fluctuating supply systems. 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 switches

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 against overloads. They are exclusively used for short-circuit protection.

The following table shows the qualification of the various protection devices for dealing with different causes of tripping.

○ = no protection ◑ = limited protection ● = comprehensive protection	Current-dependent protection device		Temperature-dependent protection device	
	Fuse	Motor circuit breakers	PTC thermistor (TF)	Bimetallic switch (TH)
Overcurrents up to 200 % I_N	○	●	●	●
High inertia starting, reversing	○	◑	●	◑
Switching operation up to Z = 30 per h	○	◑	●	●
Stalling	◑	◑	◑	◑
Single phasing	○	◑	●	●
Voltage deviation	○	●	●	●
Frequency deviation	○	●	●	●
Inadequate motor cooling	○	○	●	●
Bearing damage	○	○	●	●

Secure 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. These voltage peaks can destroy 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.

  SEW-EURODRIVE brake control systems contain 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.

13.7 Electrical characteristics

Suitable for operation 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.

Frequency

SEW-EURODRIVE AC motors are designed for 50 Hz or 60 Hz on request. As standard, the technical data for AC motors refers 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 supply systems

The **standard voltages** are:

Motors	Motor size	
	56 (4-pole only)	63...90
	Motor voltage	
2, 4 and 6-pole motors, applies to voltage range	220...240 V_{AC} Y 380...415 V_{AC} Y	220...240/380...415 V_{AC} Δ/Y
Single speed	-	230/400 V_{AC} Δ/Y 290/500 V_{AC} Δ/Y
Pole-changing, Dahlander	-	400 V_{AC} Δ/YY
Pole-changing, separate winding	-	400 V_{AC} YY/Y
	Brake voltage	
2, 4 and 6-pole motors, applies to 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 Does not apply to motor size 63

Motors	Motor size		
	100...132S	132M...225	225...280
	Motor voltage		
2, 4 and 6-pole motors, applies to voltage range	220...240/ 380...415 V_{AC} Δ/Y	220...240/380...415 V_{AC} Δ/Y 380...415/660...690 V_{AC} Δ/Y	
Single speed	230/400 V_{AC} Δ/Y 290/500 V_{AC} Δ/Y 400/690 V_{AC} Δ/Y 500 V_{AC} Δ		
Pole-changing, Dahlander	400 V_{AC} Δ/YY		
Pole-changing, separate winding	400 V_{AC} YY/Y		
	Brake voltage		
2, 4 and 6-pole motors, applies to voltage range	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}	-	-
Voltage range VS	1 × 220...266 V_{AC}	-	-
Voltage range V	-	3 × 380...415 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 are then slightly different.

Standard connections, 50 Hz motors

No. of poles	Synchronous speed n_{syn} at 50 Hz [1/min]	Connection
2	3000	⅄ / Δ
4	1500	⅄ ; ⅄ / Δ
6	1000	⅄ / Δ
8	750	⅄ / Δ
4/2	1500/3000	Δ/⅄⅄ Dahlander
8/4	750/1500	Δ/⅄⅄ Dahlander
6/2	1000/3000	⅄ / ⅄ Separate winding
8/2	750/3000	⅄ / ⅄ Separate winding
12/2	500/3000	⅄ / ⅄ Separate winding
6/4	1000/1500	⅄ / ⅄ 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	Modified rated data			
			n_N	P_N	M_N	M_A/M_N
230/400 V_{AC} Δ/⅄	Δ	230	+20%	0%	-17%	-17%
230/400 V_{AC} Δ/⅄	⅄	460	+20%	+20%	0%	0%
400/690 V_{AC} Δ/⅄	Δ					

For 60 Hz supply systems

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

Motors	Motor size		
	56	**63**	**71...90**
	Motor voltage		
2, 4 and 6-pole motors, applies to voltage range	**240...266 V_{AC}** ⅄ **415...460 V_{AC}** ⅄	**240...266/415...460 V_{AC}** Δ/⅄	
Single speed	-	**266/460 V_{AC}** Δ/⅄ 220/380 V_{AC} Δ/⅄ 330/575 V_{AC} Δ/⅄	**266/460 V_{AC}** Δ/⅄ 220/380 V_{AC} Δ/⅄ 330/575 V_{AC} Δ/⅄ 200/400 V_{AC} ⅄⅄/⅄ 220/440 V_{AC} ⅄⅄/⅄ 230/460 V_{AC} ⅄⅄/⅄
Pole-changing, Dahlander	-	460 V_{AC} Δ/⅄⅄	
Pole-changing, separate winding	-	-	460 V_{AC} ⅄ / ⅄
	Brake voltage		
2, 4 and 6-pole motors, applies to voltage range	**240...266 V_{AC}** **415...460 V_{AC}**	**240...266 V_{AC}** **415...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...266 V_{AC}**[1]

Motors	Motor size		
	100...132S	132M...225	250...280
	Motor voltage		
2, 4 and 6-pole motors, applies to voltage range	240...266/ 415...460 V_{AC} Δ/人	240...266/415...460 V_{AC} Δ/人 415...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		
Pole-changing, Dahlander	460 V_{AC} Δ / 人人		
Pole-changing, separate winding	460 V_{AC} 人 / 人		
	Brake voltage		
2, 4 and 6-pole motors, applies to voltage range	240...266 V_{AC} 415...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...266 V_{AC}	-	-
Voltage range V	-	3 × 415...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
4/2	1800/3600	Δ/人人 Dahlander
8/4	900/1800	Δ/人人 Dahlander
6/2	1200/3600	人 / 人 Separate 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, on a 50 Hz supply system:

Motor voltage at 60 Hz (USA)	Motor connection	U [V] at 50 Hz	Modified 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 the USA and Canada

Motors for the USA and Canada are configured according to NEMA or CSA regulations. NEMA or CSA single speed motors are registered by Underwriters Laboratories (UL). The following voltage assignments (60 Hz) are customary in the USA and Canada:

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

The standard in the USA are 230/460 V_{AC} / 60 Hz motors (→ Sec. 'International and national markets' onpage 628).

13.8 Thermal characteristics

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

The standard design for all single speed motors and Dahlander motors is temperature class B. Temperature classes F or H are available upon request. The standard design for all SEW-EURODRIVE pole-changing motors with a separate winding is temperature class F; temperature class H is available upon request. The following table lists the overtemperatures to IEC 60034-1 (EN 60034-1).

Temperature class	Overtemperature limit [K]
B	80 K
F	105 K
H	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 and a maximum altitude of 1,000 m above sea level. The rated power must be reduced according to the following formula given higher ambient temperatures or altitudes:

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

Refer to the following diagrams for factors f_T and f_H:

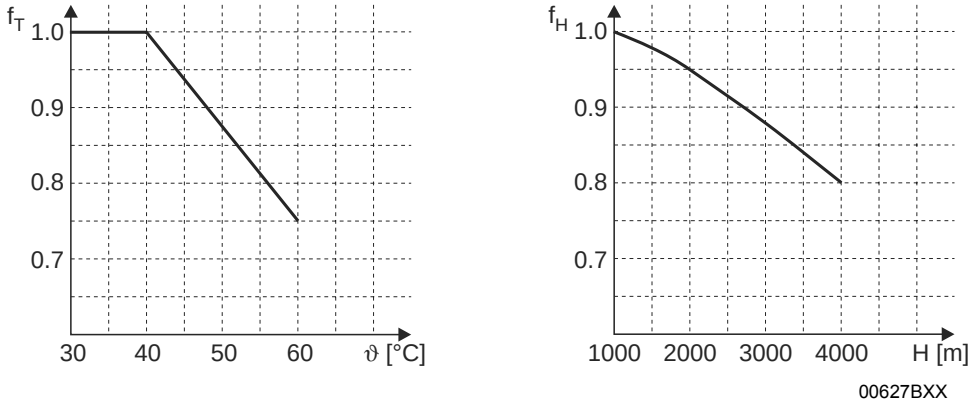

Figure 32: Power reduction dependent on ambient temperature and altitude

ϑ = Ambient temperature
H = Altitude above sea level

Duty types

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

Duty type	Explanation
S1	**Continuous running 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.

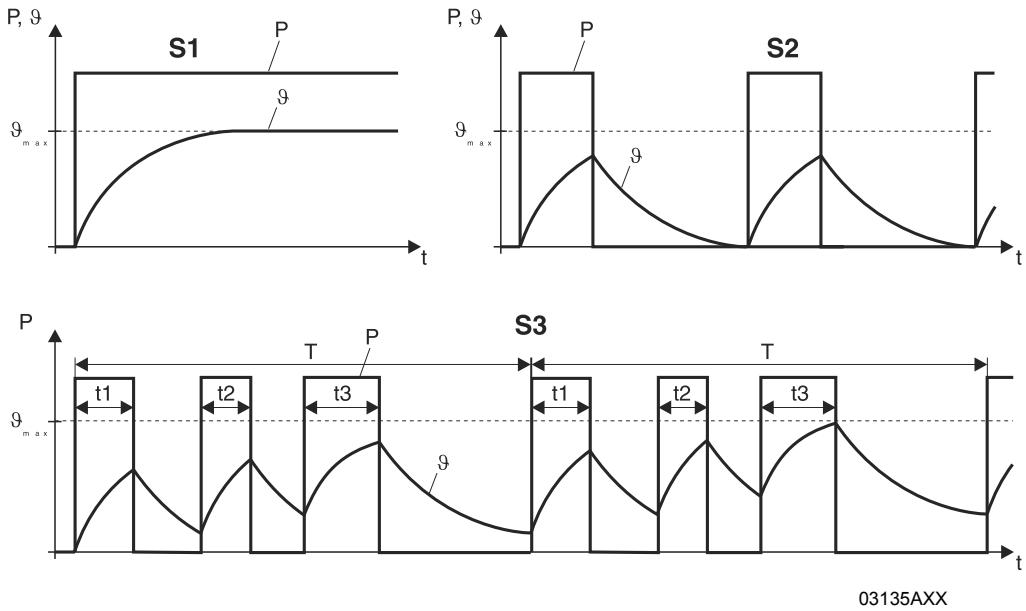

Figure 33: Duty types S1, S2 and S3

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	Operating time	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

Please contact SEW-EURODRIVE, quoting the precise technical data, in case of very high counter-torques and high mass moments of inertia (high inertia starting).

13.9 Starting frequency

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 on the basis of the load torque of the driven machine is equal to the rated power of the motor.

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 621).

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. The run-up time of the motor is increased if an additional mass moment of inertia has to be accelerated or if there is an extra load torque. 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 a motor

The permitted starting frequency Z of a motor in cycles/hour [per h] can be calculated using the following formula:

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

Refer to the following diagrams for the factors K_J, K_M and K_P:

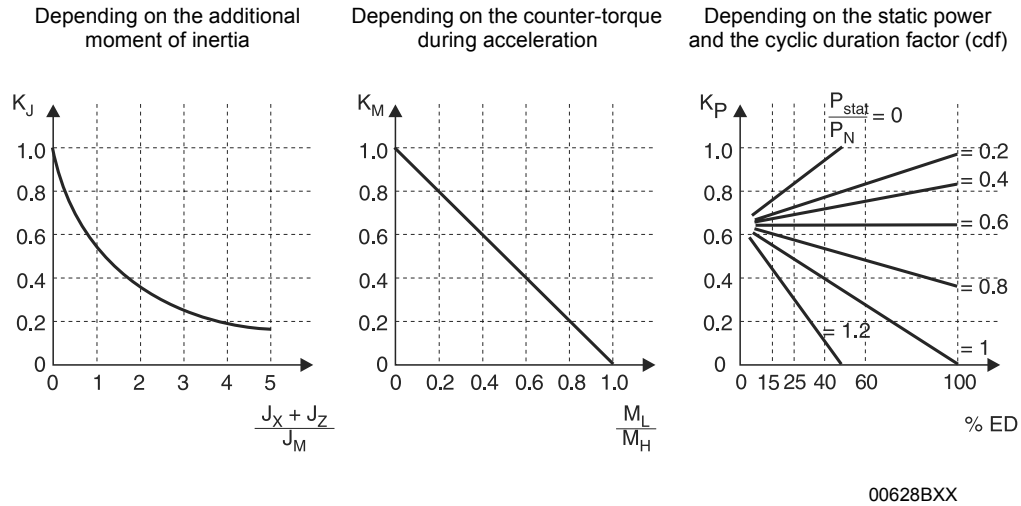

Figure 34: Starting frequency relationship

J_X=	Total of all external mass moments of inertia with reference to the motor axis	M_H=	Motor acceleration torque
J_Z=	Mass moment of inertia, flywheel fan	P_{stat}=	Power demand after acceleration (static power)
J_M=	Motor mass moment of inertia	P_N=	Rated motor power
M_L=	Counter-torque during acceleration	%cdf =	cyclic duration factor

Example

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

1. $(J_X + J_Z) / J_M = 3.5$ → $K_J = 0.2$
2. $M_L / M_H = 0.6$ → $K_M = 0.4$
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 • 0.2 • 0.4 • 0.65 = 728 c/h

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

Permitted starting frequency of 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 634.

Emergency stop features

The maximum possible braking work for the emergency stop significantly exceeds the permitted work done (for maximum work done see diagrams on page 634). Only a limited number of cycles is permitted with this maximum possible braking work. Please contact SEW-EURODRIVE if you require values for the maximum possible braking work and the resulting starting frequency.

13.10 Mechanical characteristics

Enclosures according to EN 60034 (IEC 60034-5)

The standard enclosure for AC motors and AC brake motors is IP54. Enclosures IP55, IP56 and IP65 are available upon request.

IP	1. code number Protection against foreign objects	2. code number Water protection
0	Not protected	Not protected
1	Protected against solid foreign objects ∅50 mm and larger	Protected against dripping water
2	Protected against solid foreign objects ∅12 mm and larger	Protected against dripping water if the housing is tilted by up to 15°
3	Protected against solid foreign objects ∅ 2.5 mm and larger	Protected against spraying water
4	Protected against solid foreign objects ∅ 1 mm and larger	Protected against splash water
5	Protected against dust	Protected against water jets
6	Dust-proof	Protected against powerful water jets
7	-	Protected against intermittent immersion in water
8	-	Protected against sustained 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.

Vibration severity grade of motors

The rotors of AC motors are dynamically balanced with a half key. The motors correspond to vibration severity grade "N" according. to IEC 60034-14 (EN 60034-14). If there are particular demands for smooth mechanical running, **4, 6 and 8-pole motors without add-on** can be supplied in the low-vibration design "vibration severity grade R".

13.11 Overhung loads

Refer to the section "Project Planning for Gear Unit/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	[1/min] No. of poles	Permitted overhung load F_R [N] Permitted axial force F_A [N]; $F_{A\_Zug} = F_{A\_Druck}$ Size													
		63	71	80	90	100	112	132S	132ML 132M	160M	160L	180	200	225	250 280
Foot-mounted motor	750 8	- -	680 200	920 240	1280 320	1700 400	1750 480	1900 560	2600 640	3600 960	3800 960	5600 1280	6000 2000	- -	- -
	1000 6	- -	640 160	840 200	1200 240	1520 320	1600 400	1750 480	2400 560	3300 800	3400 800	5000 1120	5500 1900	- -	- -
	1500 4	- -	560 120	720 160	1040 210	1300 270	1400 270	1500 270	2000 400	2600 640	3100 640	4500 940	4700 2400	7000 2400	8000 2500
	3000 2	- -	400 80	520 100	720 145	960 190	980 200	1100 210	1450 320	2000 480	2300 480	3450 800	3700 1850	- -	- -
Flange-mounted motor	750 8	- -	850 250	1150 300	1600 400	2100 500	2200 600	2400 700	3200 800	4600 1200	4800 1200	7000 1600	7500 2500	- -	- -
	1000 6	600 150	800 200	1050 250	1500 300	1900 400	2000 500	2200 600	2900 700	4100 1000	4300 1000	6300 1400	6800 2400	- -	- -
	1500 4	500 110	700 140	900 200	1300 250	1650 350	1750 350	1900 350	2500 500	3200 800	3900 800	5600 1200	5900 3000	8700 3000	9000 2600
	3000 2	400 70	500 100	650 130	900 180	1200 240	1200 250	1300 260	1800 400	2500 600	2900 600	4300 1000	4600 2300	- -	- -

Overhung load conversion for off-center force application

The permitted overhung loads must be calculated using the following formulae in the event of force application not in 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 service life

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

F_{xW} from the shaft strength

$$F_{xW} = \frac{c}{f + x} \text{ [N]}$$

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

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

a, b, f = Motor constants for overhung load conversion [mm]

c = Motor constant for overhung load conversion [Nmm]

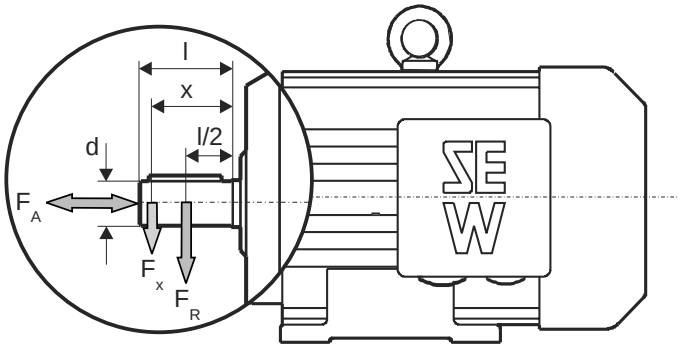

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Figure 35: Overhung load FX for off-center force application

Motor constants for overhung load conversion

Size	a	b	c				f	d	l
	[mm]	[mm]	2-pole [Nmm]	4-pole [Nmm]	6-pole [Nmm]	8-pole [Nmm]	[mm]	[mm]	[mm]
DFR63	161	146	$11.2 \bullet 10^3$	$16.8 \bullet 10^3$	$19 \bullet 10^3$	-	13	14	30
DT71	158.5	143.8	$11.4 \bullet 10^3$	$16 \bullet 10^3$	$18.3 \bullet 10^3$	$19.5 \bullet 10^3$	13.6	14	30
DT80	213.8	193.8	$17.5 \bullet 10^3$	$24.2 \bullet 10^3$	$28.2 \bullet 10^3$	$31 \bullet 10^3$	13.6	19	40
(S)DT90	227.8	202.8	$27.4 \bullet 10^3$	$39.6 \bullet 10^3$	$45.7 \bullet 10^3$	$48.7 \bullet 10^3$	13.1	24	50
SDT100	270.8	240.8	$42.3 \bullet 10^3$	$57.3 \bullet 10^3$	$67 \bullet 10^3$	$75 \bullet 10^3$	14.1	28	60
DV100	270.8	240.8	$42.3 \bullet 10^3$	$57.3 \bullet 10^3$	$67 \bullet 10^3$	$75 \bullet 10^3$	14.1	28	60
(S)DV112M	286.8	256.8	$53 \bullet 10^3$	$75.7 \bullet 10^3$	$86.5 \bullet 10^3$	$94.6 \bullet 10^3$	24.1	28	60
(S)DV132S	341.8	301.8	$70.5 \bullet 10^3$	$96.1 \bullet 10^3$	$112 \bullet 10^3$	$122 \bullet 10^3$	24.1	38	80
DV132M	344.5	304.5	$87.1 \bullet 10^3$	$120 \bullet 10^3$	$144 \bullet 10^3$	$156 \bullet 10^3$	20.1	38	80
DV132ML	404.5	364.5	$120 \bullet 10^3$	$156 \bullet 10^3$	$198 \bullet 10^3$	$216.5 \bullet 10^3$	20.1	38	80
DV160M	419.5	364.5	$150 \bullet 10^3$	$195.9 \bullet 10^3$	$248 \bullet 10^3$	$270 \bullet 10^3$	20.1	42	110
DV160L	435.5	380.5	$177.5 \bullet 10^3$	$239 \bullet 10^3$	$262.5 \bullet 10^3$	$293 \bullet 10^3$	22.15	42	110
DV180	507.5	452.5	$266 \bullet 10^3$	$347 \bullet 10^3$	$386 \bullet 10^3$	$432 \bullet 10^3$	22.15	48	110
DV200	537.5	482.5	$203.5 \bullet 10^3$	$258.5 \bullet 10^3$	$302.5 \bullet 10^3$	$330 \bullet 10^3$	0	55	110
DV225	626.5	556.5	-	$490 \bullet 10^3$	-	-	0	60	140
DV250	658	588	-	$630 \bullet 10^3$	-	-	0	65	140
DV280	658	588	-	$630 \bullet 10^3$	-	-	0	75	140

2nd motor shaft end

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
DT56	-	6302-Z	-	6001-2RS-J	
DFR63	6203-Z-J	6303-Z-J	-	6202-2Z-J	6202-2RS-J-C3
DT71-80	6204-Z-J	6303-Z-J	6204-Z-J	6203-2Z-J	6203-2RS-J-C3
DT90-DV100	6306-Z-J			6205-2Z-J	6205-2RS-J-C3
DV112-132S	6208-Z-J	6307-Z-J	6208-Z-J	6207-2Z-J	6207-2RS-J-C3
DV132M-160M	6309-Z-J-C3			6209-2Z-J-C3	
DV160L-180L	6312-Z-J-C3			6213-2Z-J-C3	
DV200-225	6314-Z-J-C3			6314-Z-J-C3	
DV250-280	6316-Z-J-C3			6315-Z-J-C3	

13.12 Special markets

CSA / NEMA

SEW-EURODRIVE offers the NEMA version or the "CSA/UL-R" option for drives delivered to North America (→ "Motors for the USA and Canada" on page 620). These versions have the following characteristic features:

- Terminal designation T1, T2, etc. in addition to U1, V1, etc.
- 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 × 1 1/2' NPT (with adapter)
DR63	2 × 1/2' NPT (with adapter)
DT71 ... DT90	2 × 1/2' NPT
DV100 ... DV132S	1 × 3/4' NPT + 1 × 1/2' NPT
DV132M ... DV160M	1 × 1 1/4' NPT + 1 × 1/2' NPT
DV160L ... DV225	2 × 1 1/4' NPT + 1 × 1/2' NPT
DV250M ... DV280S	2 × 2 1/4' NPT + 1 × +2/2' NPT

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

- Nameplate with the information: TEFC, K.V.A. code and design. With CSA/UL-R option, also CSA and UR identification (UL registration no. E189357).

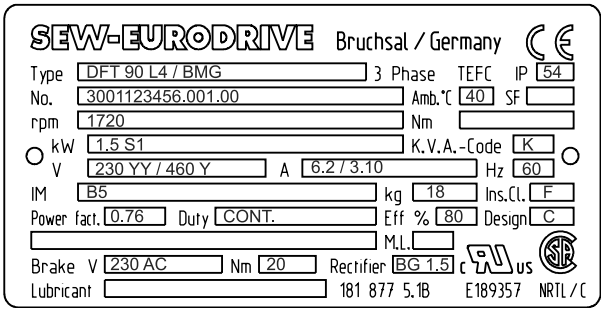

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Figure 36: Motor nameplate for CSA/UL-R version

JIS / JEC

Drives for delivery to Japan can be modified to comply with JIS. SEW-EURODRIVE supplies special motor terminal boxes on request. These terminal boxes have cable entries with the PF threads (straight inch thread) customary in Japan.

V.I.K.

The Association of the Energy and Power Generation Industry (V.I.K.) has published a recommendation for its members concerning the technical requirements for three-phase asynchronous motors.

SEW-EURODRIVE drives can be supplied in conformity with these requirements. The following deviations from the standard are involved:

- Motor with enclosure of at least IP55.
- Motor of thermal class F, permitted overtemperature only as in thermal class B.
- Corrosion protection for motor components.
- Terminal box made of gray cast iron.
- Protection cowl for vertical motor mounting positions with fan guard on top.
- Additional ground wire connection via an external terminal.
- Nameplate with V.I.K. information. A second nameplate on the inside of the terminal box cover.

Note

Technical requirements issued by the V.I.K. must be applied analogously to gearmotors, pole-changing motors and motors for high inertia starting, switching operation and speed control. The requirements result in the following necessary deviations:

- Mounting position: The position of the breather valves and the lubricant fill quantities, which depend on the mounting position, means that gearmotors cannot be used in either horizontal or vertical mounting positions.
- Labeling: There are no holes for attaching an additional identification plate.

CCC

After joining the World Trade Organization (WTO), the People's Republic of China issued a certification system - CCC "China Compulsory Certification" - for products. CCC became effective on 1 May 2002 and replaced the marks "Great Wall" (CCEE China Commission for Conformity of Electric Equipment) for domestic products and "CCIB" (China Commodity Inspection Bureau) for imported products. The Chinese government is trying to improve the safety for household appliances by introducing the CCC certification. The certification requirement became effective on 1 August 2003 for many products in household applications.

That means machines and systems supplied by our customers with permanently installed motors and gearmotors are usually not subject to this mandatory certification. The only known exception are welding machines. That means CCC certification will only become an issue for machine and system supplier in case they are exporting individual products, such as spare parts.

This certification affects SEW-EURORDRIVE products as well. The drive solutions from SEW-EURODRIVE received the necessary certification on 29 July 2003.

The SEW-EURODRIVE products affected by this certification are:

- 2-pole motors up to 2.2 kW
- 4-pole motors up to 1.1 kW
- 6-pole motors up to 0.75 kW
- 8-pole motors up to 0.55 kW

These motors may be identified with the CCC mark upon request and will be delivered with the certificate attached to the drive.

13.13 Brakes

General information

On request, SEW-EURODRIVE motors and gearmotors can be supplied with an integrated mechanical brake. The brake is an electromagnetic disc brake with a DC coil that opens electrically and brakes using spring force. The brake is applied in case of a power failure. This means it complies with fundamental safety requirements. The brake can also be released mechanically if equipped with manual brake release. For this purpose, either a hand lever or a setscrew is supplied with the brake. The hand lever springs back automatically and the setscrew is lockable. The brake is activated by a brake control system housed either in the wiring space of the motor or in the switch cabinet. Refer to the "Brakes and Accessories" manual for detailed information about SEW-EURODRIVE brakes.

A significant advantage of SEW-EURODRIVE brakes is their very short length. The brake end shield is a part of both the motor and the brake. The integrated design of the brake motor permits particularly compact and sturdy solutions.

Configuration principles

The illustration below shows the basic structure of the brake.

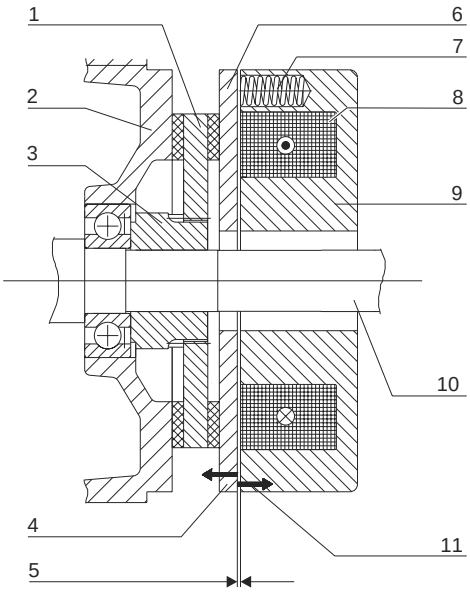

Figure 37: Basic structure of the brake

1	Brake disk	5	Working air gap	9	Brake coil body
2	Brake end shield	6	Pressure plate	10	Motor shaft
3	Carrier	7	Brake spring	11	Electromagnetic force
4	Spring force	8	Brake coil		

Rapid response times

A particular feature of the brake is its patented two coil system. It comprises the accelerator coil BS and the coil section 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 coil section is switched on. The result is a particularly short response time when releasing the brake. The brake disk moves clear very swiftly and the motor starts up with hardly any brake friction.

This principle of the two coil system also reduces self-induction so that the brake is applied more rapidly. The result is a reduced braking 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.

Overview

SEW-EURODRIVE AC brake motors are equipped with the following SEW brake types:

Brake type	For motor	Description
BR	DR63	Double-disc, spring-loaded brake
BMG	DT56, DT71...DV132S, DV250...DV280	Double-disc, spring-loaded brake
BMG..2	DV250...DV280	Double-disc, spring-loaded brake
BM	DV132M...DV225	Double-disc, spring-loaded brake
BM..2	DV180...DV225	Double-disc, spring-loaded brake

Technical data

The following table lists the technical data of the brakes. The type and number of brake springs determines the level of the braking torque. Maximum braking torque M_{Bmax} is installed as standard, unless specified otherwise in the order. Other brake spring combinations can result in reduced braking torque values M_{Bred}.

Brake Type	For motor size	M_{Bmax} [Nm]	Reduced braking torques M_{Bred} [Nm]							W [10^6 J]	t_1 [10^{-3} s]	t_2		P_B [W]
												t_2II [10^{-3} s]	t_2I [10^{-3} s]	
BMG02	**DT56**	1.2	0.8							15	28	10	100	7
BR03	**DR63**	3.2	2.4	1.6	0.8					200	25	3	30	24
BMG05	**DT71** **DT80**	5.0	4	2.5	1.6	1.2				120	30 20[1]	5	35	32
BMG1	**DT80**	10	7.5	6						120	50 20[1]	8	40	36
BMG2	**DT90** **DV100**	20	16	10	6.6	5				260	70 30[1]	12	80	40
BMG4	**DV100**	40	30	24						260	130 35[1]	15	80	50
BMG8	**DV112M**	55	45	37	30	19	12.6	9.5		600	30	12	60	65
	DV132S	75	55	45	37	30	19	12.6	9.5	600	35	10	50	65
BM15	**DV132M**	100	75	50	35	25				1000	40	14	70	95
	DV132ML **DV160M**	150	125	100	75	50	35	25		1000	50	12	50	95
BM30	**DV160L**	200	150	125	100	75	50			1500	55	18	90	130
	DV180M/L	300	250	200	150	125	100	75	50	1500	60	16	80	130
BM31	**DV200/225**	300	250	200	150	125	100	75	50	1500	60	16	80	130
BM32[2]	**DV180M/L**	300	250	200	150	100				1500	55	18	90	130
BM62[2]	**DV200/225**	600	500	400	300	250	200	150	100	1500	60	16	80	130
BMG61	**DV250/280**	600	500	400	300	200				2500	70	25	120	200
BMG122[2]	**DV250/280**	1200	1000	800	600	400				2500	70	25	120	200

1 for operation with the BGE/BME brake control system

2 Double disc brake

$M_{B\,max}$ = Maximum braking torque

$M_{B\,red}$ = Reduced braking torque

W = Braking work until service

t_1 = Response time

t_2I = Brake application time for cut-off in the AC circuit

t_2II = Brake application time for cut-off in the DC and AC circuit

P_B = Braking power

The response and application times are recommended values in relation to the maximum braking torque.

Current and braking torque

AC isolation:

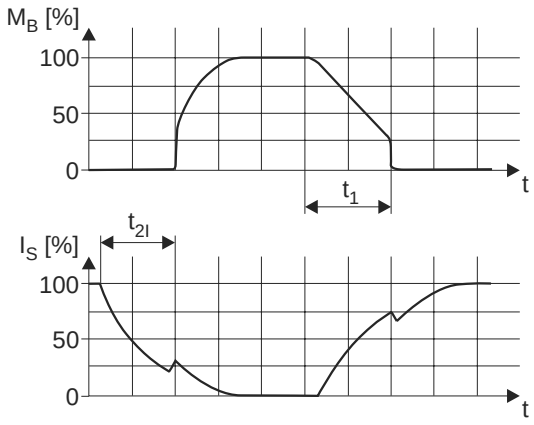

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Figure 38: Current and braking torque for AC isolation

DC and AC isolation:

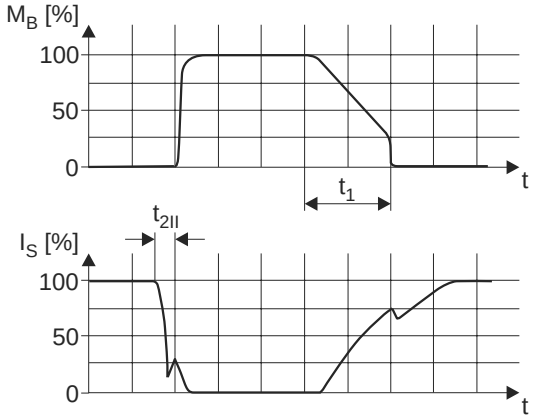

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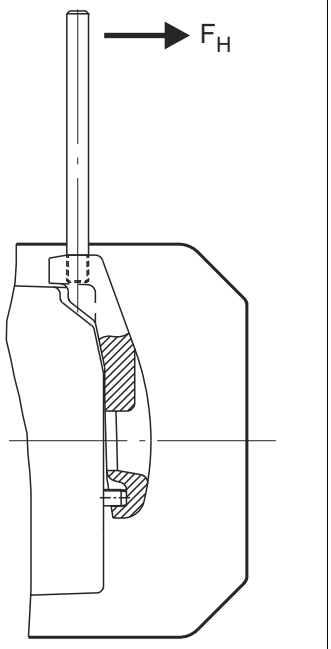
Figure 39: Current and braking torque for DC and AC isolation

M_B = Braking torque

I_S = Coil current

Actuation force for manual brake release

In brake motors with the .../HR option "brake with self-reengaging manual brake release", you can release the brake manually using the actuation lever provided. The following table specifies the actuation force required at maximum braking torque to release the brake by hand. It is assumed that the lever is operated at its top end.

Brake type	Actuation force F_H [N]	
BR03	20	
BMG05	20	
BMG1	40	
BMG2	70	
BMG4	140	
BMG8	170	
BM15	280	
BM30 ... BM62	500	
BMG61, BMG122	500	

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 the various brakes and rated speeds. The values are given with reference to the required starting frequency Z in cycles/hour (per h).

Example: The rated speed is 1500 min^{-1} and the brake BM 32 is used. At 200 cycles per hour, the permitted work done per cycle is 9000 J (→ Figure 40).

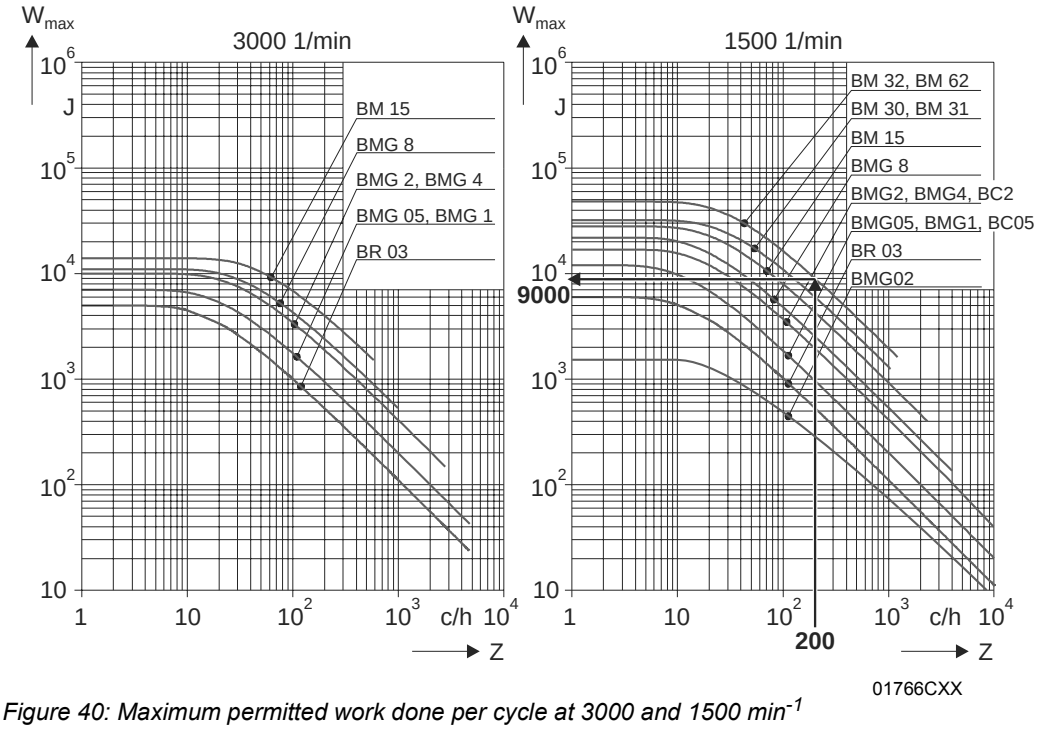


Figure 40: Maximum permitted work done per cycle at 3000 and 1500 min^{-1}

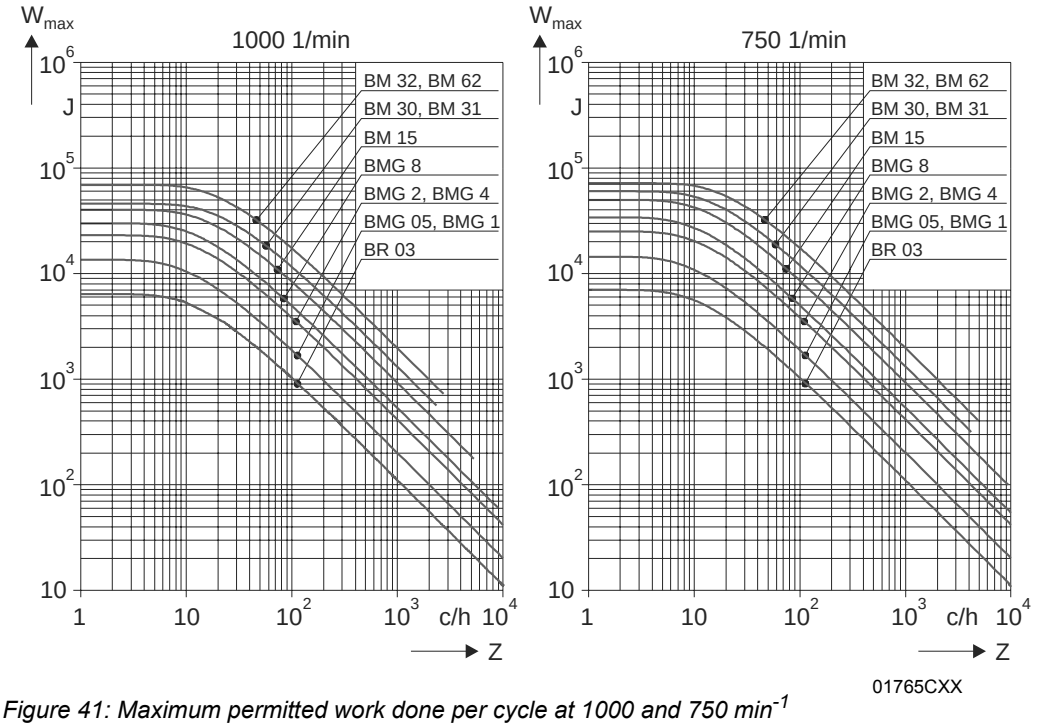


Figure 41: Maximum permitted work done per cycle at 1000 and 750 min^{-1}

BMG61, BMG122

You can obtain the values for the permitted work done by brakes BMG61 and BMG122 from SEW-EURODRIVE on request.

Brake control

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

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

Standard version

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

Motor type	AC connection	24 V_{DC} 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 client, for example using varistors.

Brake control system in wiring space

The supply voltage for brakes with an AC connection is either supplied separately or taken from the supply system of the motor in the wiring space. Only motors with a fixed 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.

In addition, it is necessary bear in mind that brake application is delayed by the residual voltage of the motor in case the brake is powered by the motor supply voltage. The brake application time t_2I stated in the technical data for cut-off in the AC circuit applies to a separate supply only.

Motor wiring space

The following table lists the technical data of brake control systems for installation in the motor wiring space and the assignments with regard to motor size and connection technology. The different housings have different colors (= color code) to make them easier to distinguish.

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BG	One-way rectifier	90...500 V_{AC}	1.2	BG 1.2	826 992 0	Black
		24...90 V_{AC}	2.4	BG 2.4	827 019 8	Brown
		42...500 V_{AC}	1.5	BG 1.0	825 590 3	Black
		150...500 V_{AC}	1.5	BG 1.5	825 384 6	Black
		42...500 V_{AC}	3.0	BG 3	825 386 2	Brown
BGE	One-way rectifier with electronic switching	150...500 V_{AC}	1.5	BGE 1.0	827 599 8	Red
		150...500 V_{AC}	1.5	BGE 1.5	825 385 4	Red
		42...150 V_{AC}	3.0	BGE 3	825 387 0	Blue
BSR	One-way rectifier + current relay for cut-off in the DC circuit	90...500 V_{AC}	1.2	BG1.2 + SR 11	826 992 0 + 826 761 8	
		42...87 V_{AC}	2.4	BG2.4 + SR 11	827 019 8 + 826 761 8	
		150...500 V_{AC}	1.0	BGE 1.5 + SR 11	825 385 4 + 826 761 8	
			1.0	BGE 1.5 + SR 15	825 385 4 + 826 762 6	
			1.0	BGE 1.5 + SR 19	825 385 4 + 826 246 2	
		42...150 V_{AC}	1.0	BGE 3 + SR11	825 387 0 + 826 761 8	
			1.0	BGE 3 + SR15	825 387 0 + 826 762 6	
			1.0	BGE 3 + SR19	825 387 0 + 826 246 2	
BUR	One-way rectifier + voltage relay for cut-off in the DC circuit	90...150 V_{AC}	1.2	BG 1.2 + UR 11	826 992 0 + 826 758 8	
		42...87 V_{AC}	2.4	BG 2.4 + UR 11	827 019 8 + 826 758 8	
		150...500 V_{AC}	1.2	BG 1.2 + UR 15	826 992 0 + 826 759 6	
		150...500 V_{AC}	1.0	BGE 1.5 + UR 15	825 385 4 + 826 759 6	
		42...150 V_{AC}	1.0	BGE 3 + UR 11	825 387 0 + 826 758 8	
BS	Varistor suppressor circuit	24 V_{DC}	5.0	BS24	826 763 4	Aqua
BSG	Electronic switch mode	24 V_{DC}	5.0	BSG	825 459 1	White

Type	Version	Standard terminal box	IS integrated plug connector	Plug connectors ASD.., AMD..	Plug connectors ACB.., ACE.., AMB.., AME.., ASB.., ASE..	Plug connectors ABB.., ABE.., ADB.., ADE..
BG	BG1.2	DT56-DR63	DR63	DR63	-	-
	BG2.4	DT56-DR63	DR63	DR63	-	-
	BG1.2, BG2.4	-	DT71-DT90	-	-	-
	BG1.5	DT71-DV100	DV100	-	DT71-DV100	-
	BG3	DT71-DV100	DV100	-	DT71-DV100	-
BGE	BGE1.0	-	DT71-DT90	DR63	-	-
	BGE1.5	DT71-DV280	DV100-DV132S	-	DT71-DV132S	DT71-DV180
	BGE3	DT71-DV225	DV100-DV132S	-	DT71-DV132S	DT71-DV180
BSR	BG1.2 + SR11	DR63	DR63	DR63	-	-
	BG2.4 + SR11	DR63	DR63	DR63	-	-
	BG1.0 + SR11	-	DT71-DT90	-	-	-
	BGE1.5 + SR11	DT71-DV225	DV100-DV132S	-	DT71-DV132S	DT71-DV180
	BGE1.5 + SR15	DT71-DV225	DV100-DV132S	-	DT71-DV132S	DT71-DV180
	BGE1.5 + SR19	DV200-DV225	-	-	-	-
	BGE3 + SR11	DT71-DV225	DV100-DV132S	-	DT71-DV132S	DT71-DV180
	BGE3 + SR15	DT71-DV225	DV100-DV132S	-	DT71-DV132S	DT71-DV180
	BGE3 + SR19	DV200-DV225	-	-	-	-
BUR	BG1.2 + UR11	DR63	DR63	DR63	-	-
	BG1.2 + UR15	DR63	DR63	DR63	-	-
	BG2.4 + UR11	DR63	DR63	DR63	-	-
	BG1.0 + UR11	-	DT71-DT90	-	-	-
	BGE1.5 + UR15	DT71-DV225	DV100-DV132S	-	DT71-DV132S	DT71-DV180
	BGE3 + UR11	DT71-DV225	DV100-DV132S	-	DT71-DV132S	DT71-DV180
BS	BS24	DT71-DV100	DV100	-	DT71-DV100	
BSG	BSG	DT71-DV225	DV100-DV132S	-	DT71-DV132S	DT71-DV180

Switch cabinet

The following table lists the technical data of brake control systems for installation in the switch cabinet and the assignments with regard to motor size and connection technology. The different housings have different colors (= color code) to make them easier to distinguish.

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BMS	One-way rectifier like BG	150...500 V_{AC}	1.5	BMS 1.5	825 802 3	Black
		24...150 V_{AC}	3.0	BMS 3	825 803 1	Brown
BME	One-way rectifier with electronic switching like BGE	150...500 V_{AC}	1.5	BME 1.5	825 722 1	Red
		42...150 V_{AC}	3.0	BME 3	825 723 X	Blue
BMH	One-way rectifier with electronic switching and heating function	150...500 V_{AC}	1.5	BMH 1.5	825 818 X	Green
		42...150 V_{AC}	3	BMH 3	825 819 8	Yellow
BMP	One-way rectifier with electronic switch mode, integrated voltage relay for cut-off in the DC circuit	150...500 V_{AC}	1.5	BMP 1.5	825 685 3	White
		42...150 V_{AC}	3.0	BMP 3	826 566 6	Light blue
BMK	One-way rectifier with electronic switch mode, 24 V_{DC} control input and separation in the DC circuit	150...500 V_{AC}	1.5	BMK 1.5	826 463 5	Aqua
		42...150 V_{AC}	3.0	BMK 3	826 567 4	Bright red

Type	Version	Standard terminal box	IS Integrated plug connector	Plug connectors APG1	Plug connectors ASD.., AMD..	Plug connectors ACB.., ACE.., AMB.., AME.., ASB.., ASE..	Plug connectors ABB.., ABE.., ADB.., ADE..
BMS	BMS1.5 BMS3	DT56-DV100	DR63-DV100	DT71-DT90	DR63	DT71-DV100	DT71-DV100
BME	BME1.5 BME3	DR63-DV280 DR63-DV225	DR63-DV132S			DT71-DV132S	DT71-DV180
BMP	BMP1.5 BMP3						
BMK	BMK1.5 BMK3						
BMH	BMH1.5 BMH3	DR63-DV225					

Operating currents

The following tables list the operating currents of the brakes at different voltages. The following values are specified:

- Inrush current ratio I_B/I_H; I_B = Accelerator current, I_H = Holding current
- Holding current I_H
- Direct current I_G with direct DC voltage supply with rated voltage V_N (V_{DC}), only permitted up to brake size BMG4
- Rated voltage V_N (rated voltage range)

The accelerator current I_B (= inrush current) only flows for a short time (max. 120 ms) when the brake is released or during voltage dips below 70 % of rated voltage. There is no increased inrush current when the brake control system BG is used or with direct DC voltage supply (only possible up to brake size BMG4).

The values for the holding currents I_H are r.m.s. values. Use suitable measuring instruments for current measurement.

Brake			**BMG02**		**BR03**	
For motor size			56		63	
$M_{B\,max}$ [Nm]			1.2		3.2	
P_B [W]			7		24	
Inrush current ratio I_B/I_H			-		4	
Rated voltage V_N			I_H [A_{AC}]	I_G [A_{DC}]	I_H [A_{AC}]	I_G [A_{DC}]
V_{AC}		**V_{DC}**				
		24	-	0.72	-	0.72
24	(23-26)	**10**	-	-	1.5	1.80
42	(40-45)	**18**	-	-	0.81	1.01
48	(46-50)	**20**	-	-	0.72	0.90
53	(51-56)	**22**	-	-	0.64	0.80
60	(57-63)	**24**	-	-	0.57	0.72
67	(64-70)	**27**	-	-	0.50	0.64
73	(71-78)	**30**	-	-	0.45	0.57
85	(79-87)	**36**	-	-	0.40	0.51
92	(88-98)	**40**	-	-	0.35	0.45
110	(99-110)	**44**	-	-	0.31	0.40
115	(111-123)	**48**	-	-	0.28	0.36
133	(124-138)	**54**	-	-	0.25	0.32
147	(139-154)	**60**	-	-	0.22	0.29
160	(155-173)	**68**	-	-	0.20	0.25
184	(174-193)	**75**	-	-	0.17	0.23
208	(194-217)	**85**	-	-	0.16	0.20
230	(218-243)	**96**	0.14	0.18	0.14	0.18
254	(244-273)	**110**	-	-	0.12	0.16
290	(274-306)	**125**	-	-	0.11	0.14
318	(307-343)	**140**	-	-	0.10	0.13
360	(344-379)	**150**	-	-	0.09	0.11
400	(380-431)	**170**	0.08	0.10	0.08	0.10
460	(432-500)	**190**	0.07	0.09	0.07	0.09

Brake			BMG05		BMG1		BMG2		BMG4	
For motor size			71-80		80		90-100		100	
$M_{B\ max}$ [Nm]			5.0		10		20		40	
P_B [W]			32		36		40		50	
Inrush current ratio I_B/I_H			4		4		4		4	
Rated voltage V_N			I_H [A_{AC}]	I_G [A_{DC}]	I_H [A_{AC}]	I_G [A_{DC}]	I_H [A_{AC}]	I_G [A_{DC}]	I_H [A_{AC}]	I_G [A_{DC}]
V_{AC}		V_{DC}								
		24	-	1.38	-	1.54	-	1.77	-	2.20
24	(23-25)	**10**	2.0	3.3	2.4	3.7	-	-	-	-
42	(40-46)	**18**	1.14	1.74	1.37	1.94	1.46	2.25	1.80	2.80
48	(47-52)	**20**	1.02	1.55	1.22	1.73	1.30	2.00	1.60	2.50
56	(53-58)	**24**	0.90	1.38	1.09	1.54	1.16	1.77	1.43	2.20
60	(59-66)	**27**	0.81	1.23	0.97	1.37	1.03	1.58	1.27	2.00
73	(67-73)	**30**	0.72	1.10	0.86	1.23	0.92	1.41	1.14	1.76
77	(74-82)	**33**	0.64	0.98	0.77	1.09	0.82	1.25	1.00	1.57
88	(83-92)	**36**	0.57	0.87	0.69	0.97	0.73	1.12	0.90	1.40
97	(93-104)	**40**	0.51	0.78	0.61	0.87	0.65	1.00	0.80	1.25
110	(105-116)	**48**	0.45	0.69	0.54	0.77	0.58	0.90	0.72	1.11
125	(117-131)	**52**	0.40	0.62	0.48	0.69	0.52	0.80	0.64	1.00
139	(132-147)	**60**	0.36	0.55	0.43	0.61	0.46	0.70	0.57	0.88
153	(148-164)	**66**	0.32	0.49	0.39	0.55	0.41	0.63	0.51	0.79
175	(165-185)	**72**	0.29	0.44	0.34	0.49	0.37	0.56	0.45	0.70
200	(186-207)	**80**	0.26	0.39	0.31	0.43	0.33	0.50	0.40	0.62
230	(208-233)	**96**	0.23	0.35	0.27	0.39	0.29	0.44	0.36	0.56
240	(234-261)	**110**	0.20	0.31	0.24	0.35	0.26	0.40	0.32	0.50
290	(262-293)	**117**	0.18	0.28	0.22	0.31	0.23	0.35	0.29	0.44
318	(294-329)	**125**	0.16	0.25	0.19	0.27	0.21	0.31	0.25	0.39
346	(330-369)	**147**	0.14	0.22	0.17	0.24	0.18	0.28	0.23	0.35
400	(370-414)	**167**	0.13	0.20	0.15	0.22	0.16	0.25	0.20	0.31
440	(415-464)	**185**	0.11	0.17	0.14	0.19	0.15	0.22	0.18	0.28
500	(465-522)	**208**	0.10	0.15	0.12	0.17	0.13	0.20	0.16	0.25

Brake			BMG8	BM15	BM30/31 BM32/62
For motor size			112 ... 132S	132M ... 160M	160L ... 225
$M_{B\ max}$ [Nm]			75	150	600
P_B [W]			65	95	130
Inrush current ratio I_B/I_H			6.3	7.5	8.5
Rated voltage V_N			I_H [A_{AC}]	I_H [A_{AC}]	I_H [A_{AC}]
V_{AC}		V_{DC}			
		24	2.77[1]	4.15[1]	3.80[1]
42	(40-46)		2.31	3.35	-
48	(47-52)		2.10	2.95	-
56	(53-58)		1.84	2.65	-
60	(59-66)		1.64	2.35	-
73	(67-73)		1.46	2.10	-
77	(74-82)		1.30	1.87	-
88	(83-92)		1.16	1.67	-
97	(93-104)		1.04	1.49	-
110	(105-116)		0.93	1.32	1.57
125	(117-131)		0.82	1.18	1.41
139	(132-147)		0.73	1.05	1.25
153	(148-164)		0.66	0.94	1.13
175	(165-185)		0.59	0.84	1.00
200	(186-207)		0.52	0.74	0.88
230	(208-233)		0.46	0.66	0.80
240	(234-261)		0.41	0.59	0.70
290	(262-293)		0.36	0.53	0.63
318	(294-329)		0.33	0.47	0.55
346	(330-369)		0.29	0.42	0.50
400	(370-414)		0.26	0.37	0.44
440	(415-464)		0.24	0.33	0.39
500	(465-522)		0.20	0.30	0.35

1 Direct current in BSG operation.

Brake			BMG61	BMG122
For motor size			250M ... 280S	250M ... 280S
$M_{B\ max}$ [Nm]			600	1200
P_B [W]			200	200
Inrush current ratio I_B/I_H			6	6
Rated voltage V_N			I_H [A_{AC}]	I_H [A_{AC}]
V_{AC}				
208	(194-217)		1.50	1.50
230	(218-243)		1.35	1.35
254	(244-273)		1.20	1.20
290	(274-306)		1.10	1.10
318	(307-343)		1.00	1.00
360	(344-379)		0.85	0.85
400	(380-431)		0.75	0.75
460	(432-484)		0.65	0.65
500	(485-500)		0.60	0.60

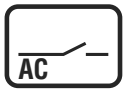
Cross section of the brake cable

Select the cross section of the brake cables according to the currents in your application. Bear in mind the inrush current of the brake when doing this. The voltage drop resulting from the inrush current must not cause the voltage to fall below 90 % of the supply voltage.

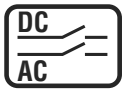
Wire cross sections of max. 2.5 mm^2 can be connected to the terminals of the brake control systems. Intermediate terminals must be used in case of larger cross sections. Keep the distance between the intermediate terminal and the brake control system as small as possible.

13.14 Block diagrams of brake control systems

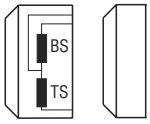
Legend



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



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



Brake
BS = Accelerator coil
TS = Coil section

Auxiliary terminal strip in the terminal box

Motor with delta connection

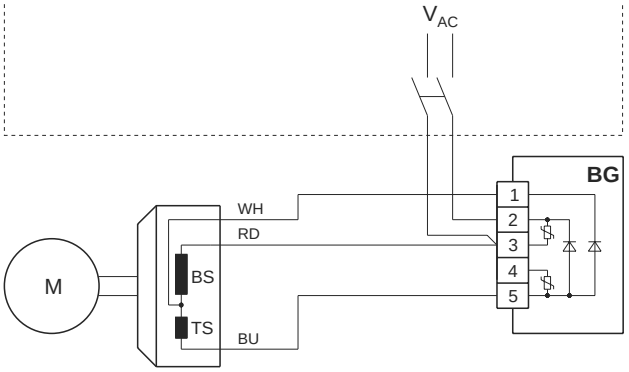
Motor with star connection

Color code according to IEC 757:

WH	White
RD	Red
BU	Blue
BN	Brown
BK	Black

Switch cabinet limit

BG, BMS



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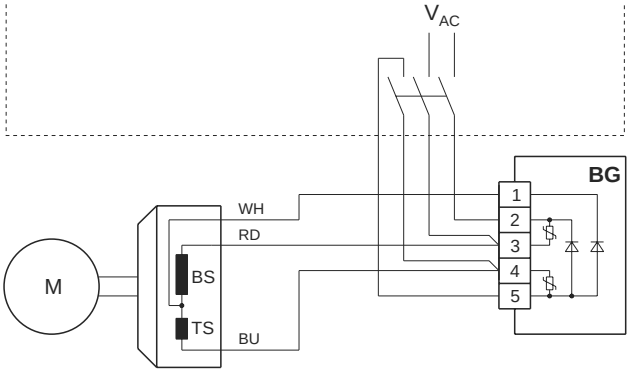

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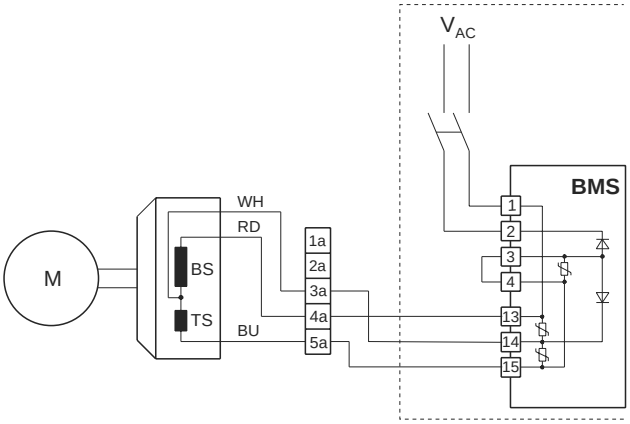

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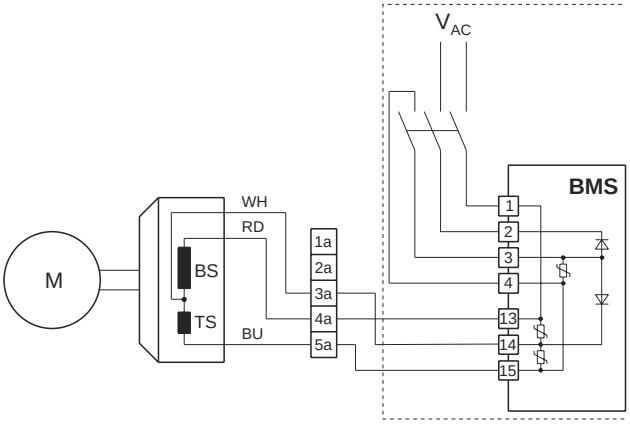
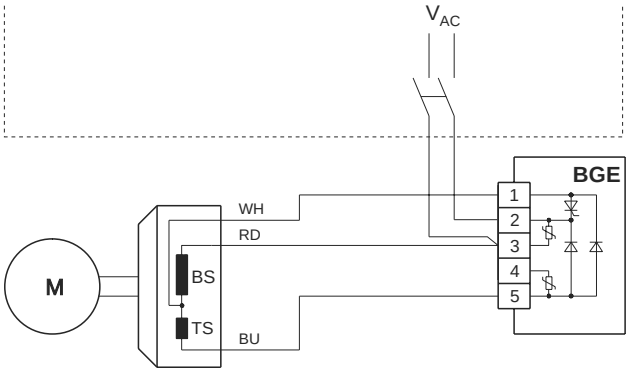


01527BXX

BGE, BME



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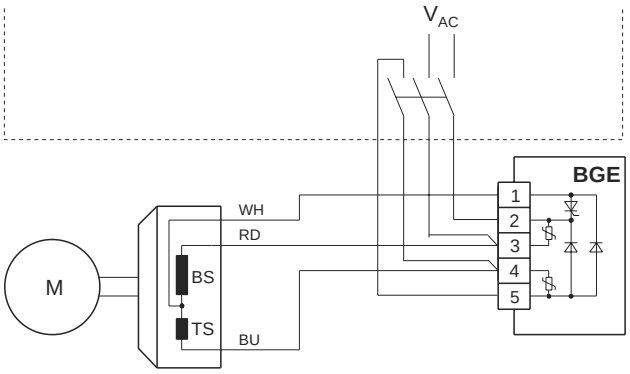

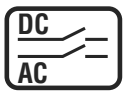

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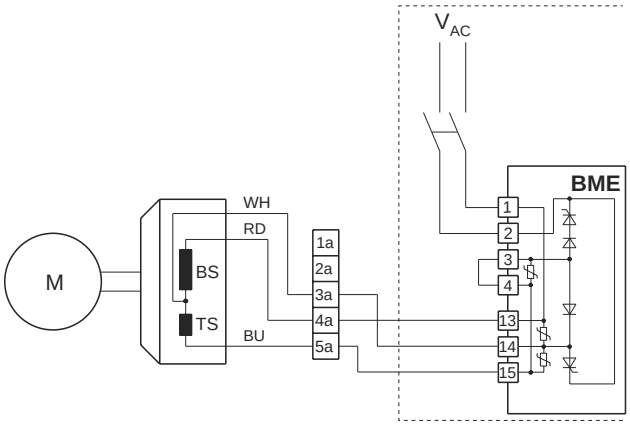

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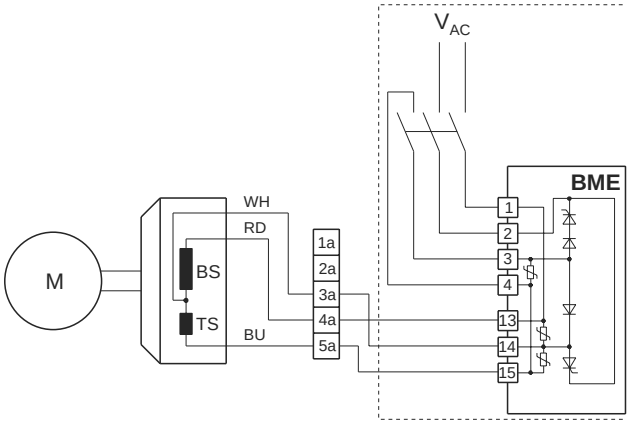

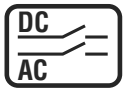

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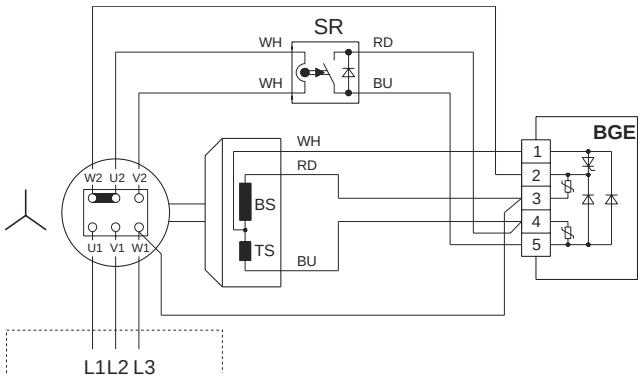
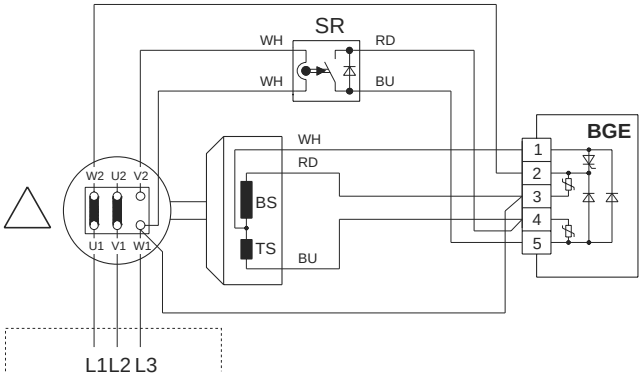
BSR



DC
AC

01537BXX



DC
AC

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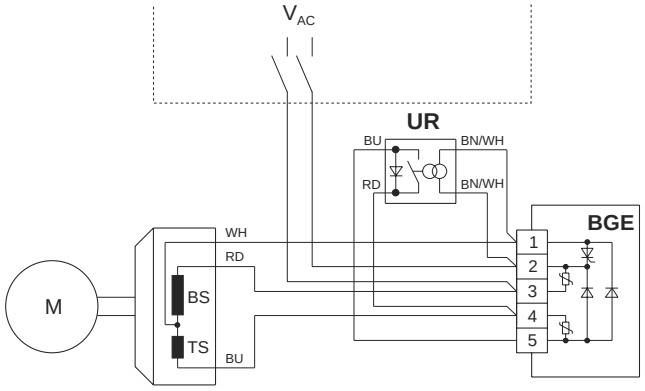
BUR



DC
AC

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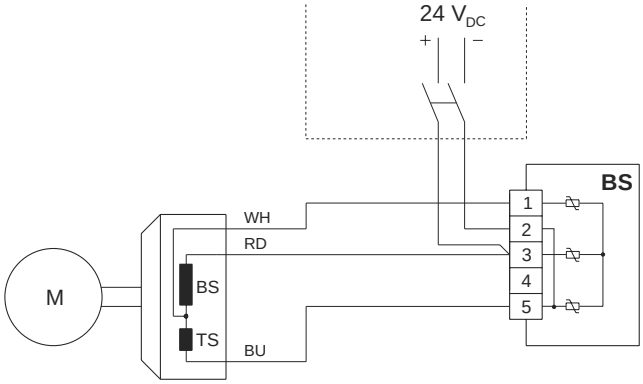
13

BS



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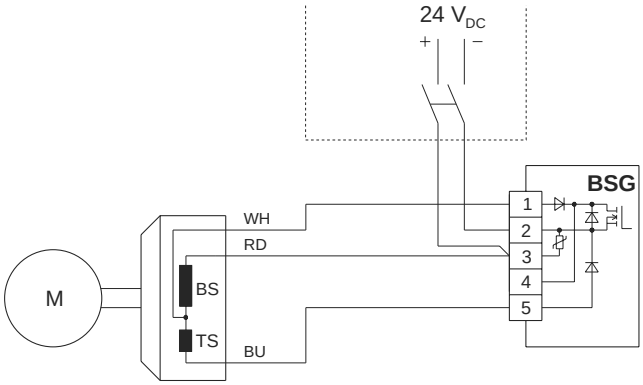
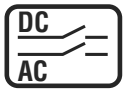
BSG





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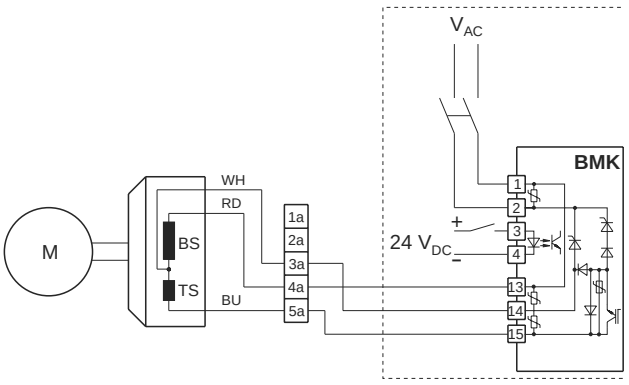
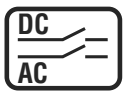
BMK





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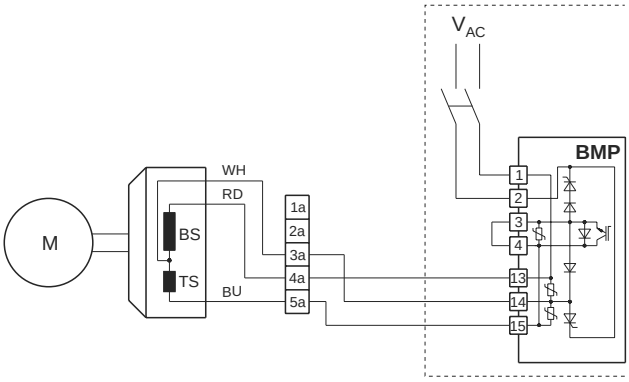
BMP, BMH



AC

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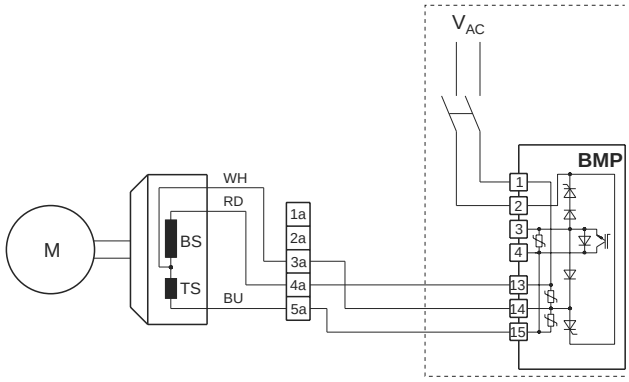

DC
AC

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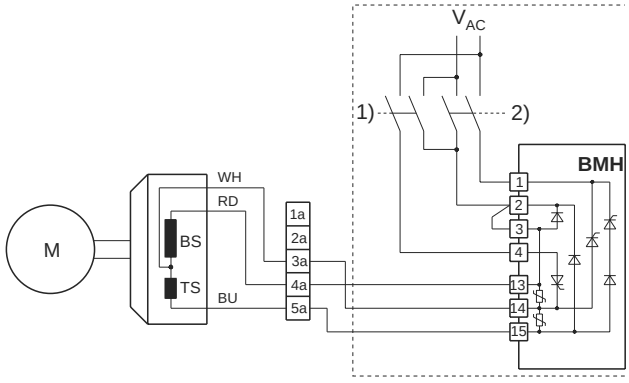
1) Heat
2) Ventilate



AC

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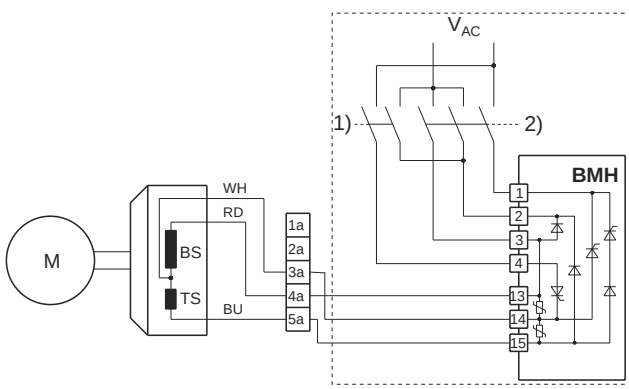
1) Heat
2) Ventilate



DC
AC

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13.15 Encoders and pre-fabricated cables for encoder connection

Tachometers

Various types of tachometers are available for installation on DT../DV.. AC motors as standard depending on the application and motor size. With only a few exceptions, the encoders can also be combined with other optional motor add-ons such as brakes and forced cooling fans.

Encoder overview

Designation	For motor	Type of encoder	Shaft	Specification	Supply	Signal
EH1T	DR63	Encoder	Hollow shaft	-	5 V_{DC} regulated	TTL/RS-422
EH1S					24 V_{DC}	1 V_{SS} sin/cos
EH1R						TTL/RS-422
ES1T	DT71...DV100		Spreadshaft		5 V_{DC} regulated	TTL/RS-422
ES1S					24 V_{DC}	1 V_{SS} sin/cos
ES1R						TTL/RS-422
ES2T	DV112...DV132S				5 V_{DC} regulated	TTL/RS-422
ES2S					24 V_{DC}	1 V_{SS} sin/cos
ES2R						TTL/RS-422
EV1T	DT71...DV280		Solid shaft		5 V_{DC} regulated	TTL/RS-422
EV1S					24 V_{DC}	1 V_{SS} sin/cos
EV1R						TTL/RS-422
NV11	DT71...DV100	Proximity sensor	Solid shaft	A track	24 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	Multiturn absolute encoder	Solid shaft	-	15/24 V_{DC}	MSSI interface and 1 V_{SS} sin/cos
AV1H[1]	DT71...DV280	Multiturn HIPERFACE® encoder	Solid shaft	-	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 with a cable capacitance ≤ 120 nF/km
- Core cross section: 0.20 ... 0.5 mm^2
- Use a shielded cable with twisted-pair conductors and the shield connected at both ends over a wide area:

  –to 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.
- Encoder with cable gland: Observe the permitted diameter of the encoder cable to ensure that the cable gland functions correctly.

Pre-fabricated cables for encoder connection

SEW-EURODRIVE offers pre-fabricated cables for a straightforward and reliable connection of encoder systems. It is necessary to differentiate between cables used for fixed installation or for use in cable carriers. The cables are pre-fabricated in 1 m steps for the required length.

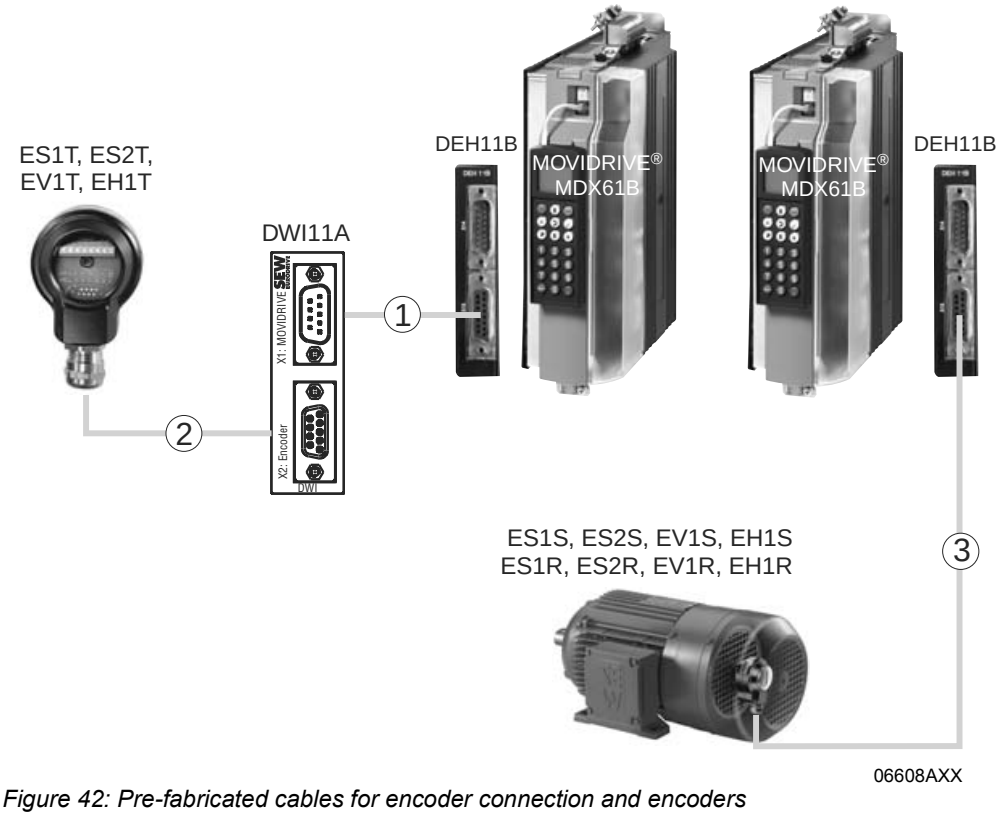

Figure 42: Pre-fabricated cables for encoder connection and encoders

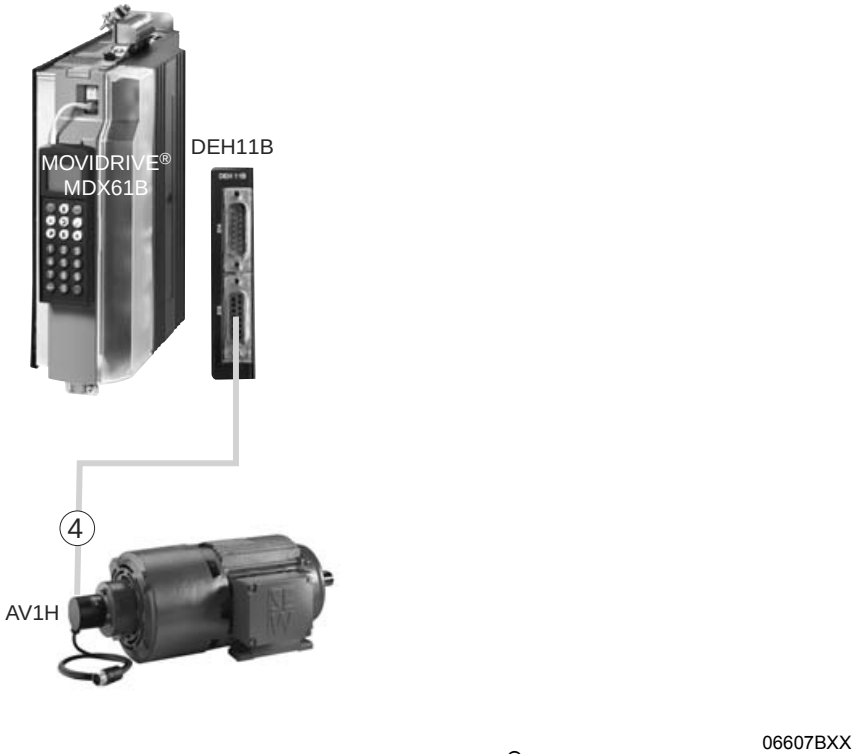

Figure 43: Pre-fabricated cables for HIPERFACE® encoders

(1) Pre-fabricated cables for encoder connection:

Part number	817 957 3
Installation	Fixed installation
For encoders with 5 V voltage supply	ES1T, ES2T, EV1T, EH1T
Line 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 line: Violet (VT)
Manufacturer and type **Lapp** **Helukabel**	 Unitronic Li2YCY (TP) Paar-Tronic-CY
For inverters	MOVIDRIVE® MDX61B with DEH11B option
Connection **to the DWI11A** **to the inverter**	 with 9-pin sub D socket with 15-pin sub D plug

(2) Pre-fabricated 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	
Line 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 line: Violet (VT)	
Manufacturer and type **Lapp** **Helukabel**	 Unitronic Li2YCY (TP) Paar-Tronic-CY	 Unitronic LiYCY Super-Paar-Tronic-C-PUR
For inverters	MOVIDRIVE® MDX61B with DEH11B option	
Connection to **encoder / motor** **DWI11A**	 with conductor end sleeves Connect the violet conductor (VT) with the encoder at UB. with 9-pin sub D plug	

③ Pre-fabricated 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	
Line 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 line: Violet (VT)	
Manufacturer and type **Lapp** **Helukabel**	 Unitronic Li2YCY (TP) Paar-Tronic-CY	 Unitronic LiYCY Super-Paar-Tronic-C-PUR
For inverters	MOVIDRIVE® MDX61B with DEH11B option	
Connection to **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 Pre-fabricated cables for HIPERFACE® encoders:

Part number	1332 453 5	1332 455 1
Installation	Fixed installation	Cable carrier installation
For encoder	AV1H	
Line cross section	6 × 2 × 0.25 mm^2 (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: Grey/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 inverters	MOVIDRIVE® MDX61B with DEH11B option	
Connection to **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
Line cross section	6 × 2 × 0.25 mm^2 (AWG 23)	
Conductor colors	→ HIPERFACE® cable	
Manufacturer and type	Lapp, PVC/C/PP 303 028 1	Nexans, 493 290 70
Connection to **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)	

13.16 Forced cooling fan

Forced cooling fans VR, VS and V

Motors can be equipped with a forced cooling fan if required. As a rule, no forced cooling fan is required by motors powered from the supply system in continuous duty. SEW-EURODRIVE recommends a forced cooling fan in the following applications:

- Drives with a high starting frequency
- Drives with an additional flywheel mass Z (flywheel fan)
- Inverter drives with a setting range ≥ 1:20
- Inverter drives which should also generate rated torque at low speeds or even when stationary

The 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.

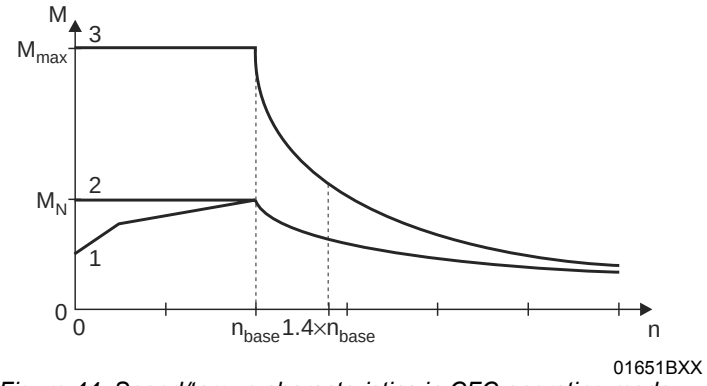

Figure 44: Speed/torque characteristics in CFC operating mode

M_N	= Rated torque of the motor	1	= With self-cooling
M_{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_{Eck} is above curve 1. The motor will be thermally overloaded without a fan.

Forced cooling fan VR

The forced cooling fan VR is supplied with a 24 V_{DC} voltage. For a 1 × 230 V_{AC} supply, SEW-EURODRIVE offers the switch-mode power supply type UWU51A (part number 187 441 1).

The switch-mode power supply UWU51A is mounted on the support rail in the switch 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	**71 ... 100**	•	-	-
ES2T, ES2R, ES2S	**112 ... 132S**	•	-	-
EV1T, EV1R, EV1S	**71 ... 132S**	•	•	-
EV1T, EV1R, EV1S	**132M ... 280S**	-	-	•
AV1Y, AV1H	**71 ... 132S**	•	•	-
AV1Y, AV1H	**132M ... 280S**	-	-	•

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

13.17 Additional flywheel mass Z, backstop RS and protection cowl C

Additional flywheel mass Z (flywheel fan)

The motor can be equipped with the additional flywheel mass Z, the flywheel fan, to permit smoother starting and braking response from mains operated motors. The fan gives the motor an additional mass moment of inertia J_Z. The flywheel fan replaces the normal fan; the external dimensions of the motor are unchanged. It can be installed on motors with and without a brake.

Please note the following points:

- Check the starting frequency, multiply the permitted no-load starting frequency Z_0 by 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. The values for the mass moments of inertia J_{mot} and J_Z can be found in Sec. "Technical data on additional flywheel mass Z and backstop RS" (→ page 724).
- Counter-current braking and running against a stop are no longer permitted.
- Not available with vibration severity grade R.
- **Only for DT80..:** The flywheel 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. $J_Z = 20 \bullet 10^{-4}$ kgm^2 must then be used during the selection.

Backstop RS

The mechanical backstop RS is used for protecting equipment against retrograde motion when the motor is switched off.

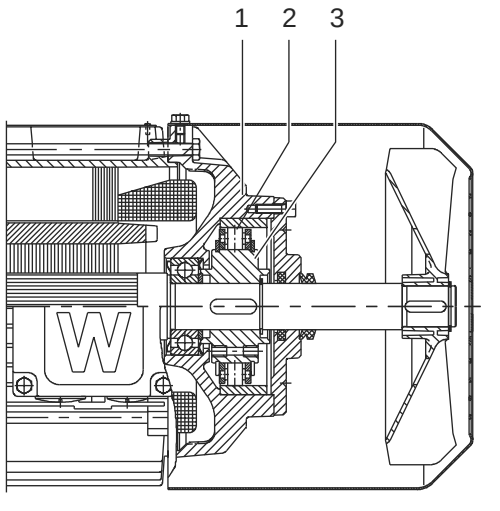

Figure 45: Design of the backstop RS

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

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. CCW rotation is the other way around.

Protection cowl 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 cowl C" for this purpose.

Explosion-proof AC motors and AC brake motors in a vertical mounting position with their output shaft pointing downwards must always be ordered with the protection cowl C. The same applies to motors in a vertical mounting position installed in the open.

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Figure 46: AC motor with protection cowl C

13.18 Low-noise fan guard

As a rule, noise from the motor or the brake motor is amplified by the fan guards of the drives.

SEW-EURODRIVE offers the "low-noise fan guard" option for motor sizes DT71D to DV132S. This guard will 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.

13.19 MOVIMOT®

MOVIMOT® is the combination of an AC (brake) motor and a digital frequency inverter in the power range 0.37 ... 3 kW. It is the perfect match for decentralized drive configurations.

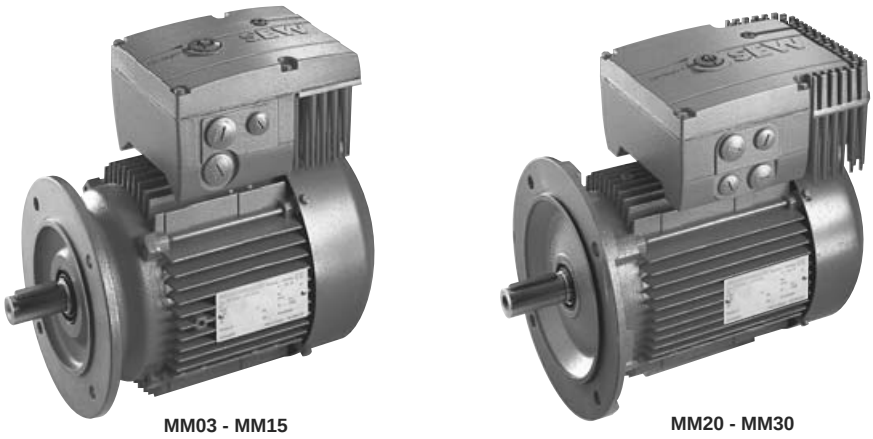

Figure 47: MOVIMOT® AC motor

Special characteristics of MOVIMOT®:

- Small total volume
- Interference-free connection between inverter and motor
- Enclosed construction with integrated protection functions
- Inverter cooling independent of the motor speed
- Does not take up any space in the switch cabinet
- Optimum parameter presets for the expected applications
- Compliance with EMC standards EN 50 081 (interference level A) and EN 50 082
- Simple 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 pole-changing motors or mechanical variable speed drives.

MOVIMOT® is available as a gearmotor / geared brake motor in many different standard versions and mounting positions.

Performance characteristics

Please refer to the "Drive Systems for Decentralized Installation" manual and the "MOVIMOT® Gearmotors" catalog for detailed information and project planning instructions about MOVIMOT®.

- Available power range: 0,37 ... 3 kW
- Supply voltages: 3 × 200 ... 240 V and 3 × 380 ... 500 V, 50/60 Hz
- Rated speeds: 1400 and 2900 1/min
- Available with optional AS-interface
- ECOFAST®-compliant on request
- According to NEMA (UL-listed) on request
- Design with dust/explosion protection 3D for zone 22 possible

13.20 MOVI-SWITCH®

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. Refer to the "Drive Systems for Decentralized Installation" manual for detailed information about MOVI-SWITCH®.

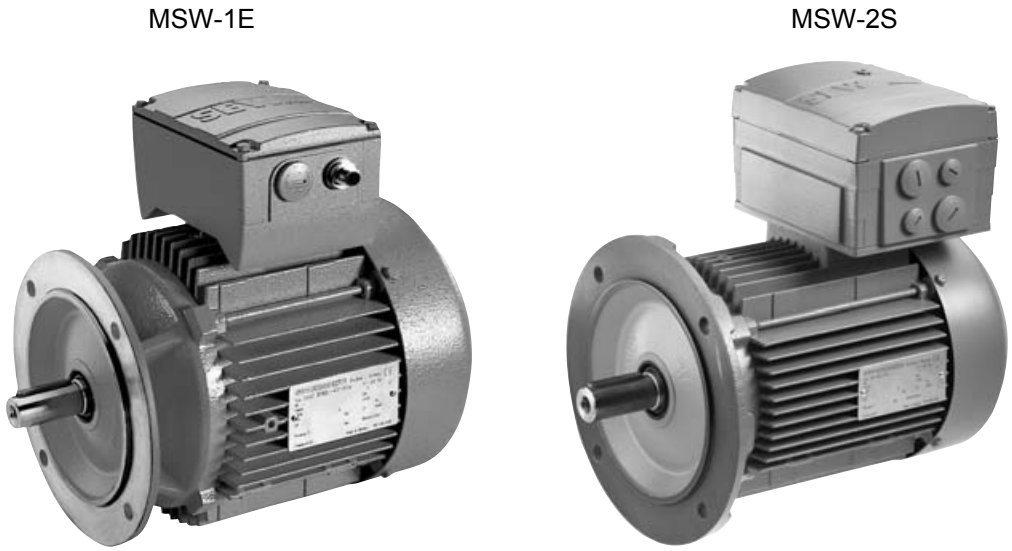

Figure 48: Gearmotor with MOVI-SWITCH®

Advantages of MOVI-SWITCH®

MOVI-SWITCH® offers the following advantages:

- The circuit breaker and protection functions are completely integrated, saving switch 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.

Two 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 a 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-2S

The direction of rotation is changed over 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 statuses are displayed by the diagnostic LED.

The connection assignment for clockwise speed (CW) is compatible with the MSW-1E connection. The integrated AS-interface connection is compatible with MLK11A.

Possible 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 [kW] with number of poles			
	2	4	6	8
DT71D.. (/BMG)/TF/MSW..	0.55	0.37	0.25	0.15
DT80K.. (/BMG)/TF/MSW..	0.75	0.55	0.37	-
DT80N.. (/BMG)/TF/MSW..	1.1	0.75	0.55	0.25
DT90S.. (/BMG)/TF/MSW..	1.5	1.1	0.75	0.37
DT90L.. (/BMG)/TF/MSW..	2.2	1.5	1.1	0.55
DV100M.. (/BMG)/TF/MSW..	3.0	2.2	1.5	0.75
DV100L.. (/BMG)/TF/MSW..	-	3.0	-	1.1

Technical data

MOVI-SWITCH®	MSW-1E	MSW-2S
Motor voltage	3 × 380...500 V_{AC}, 50/60 Hz, **motor winding only in ⅄ connection**.	
Brake voltage	= Motor voltage / $\sqrt{3}$ Alternative motor voltage	
Control voltage	24 V_{DC} to EN 61131-2	
Ambient temperature	-25 °C ... +40 °C (+60 °C)	
Enclosure	IP65	
Switching function	On/off with star bridge switch One direction of rotation Short-circuit proof solid-state switch according to class B limit to EN 55011 and EN 55014	On/off with switch element Two direction of rotations using reversing relay
Direction of rotation	CW or CCW depending on the phase sequence	CW and CCW, regardless of the phase sequence
Thermal motor protection	Integrated evaluation of positive temperature coefficient (PTC) thermistor TF, combined in logic operation with the enable signal.	Integrated evaluation of positive temperature coefficient (PTC) thermistor TF, combined in logic operation with the enable signal.
Control	Binary control signals RUN / OK Connection using 1 × M12 plug connector Optional with external AS-interface	Binary control signals CW / CCW / OK Connection using 2 × M12 plug connectors Optional with integrated AS-interface
Brake control	With integrated brake control system BGW as standard, therefore minimum brake reaction times.	With integrated brake control system BGW as standard, therefore minimum brake reaction times.

Order information

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

- Voltage only for winding in ⅄ connection.
- Only two brake voltages are possible, namely

  –motor voltage / $\sqrt{3}$ or
  –motor voltage.
- Preferred position of terminal box 270°, please contact SEW-EURODRIVE for other requirements.

Block diagram

MSW-1E

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

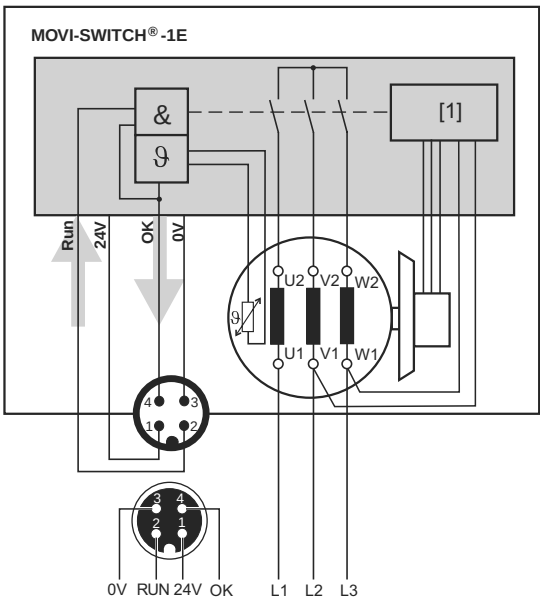

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Figure 49: Block diagram of MOVI-SWITCH® MSW-1E

[1] Brake control

MSW-2S with binary control

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

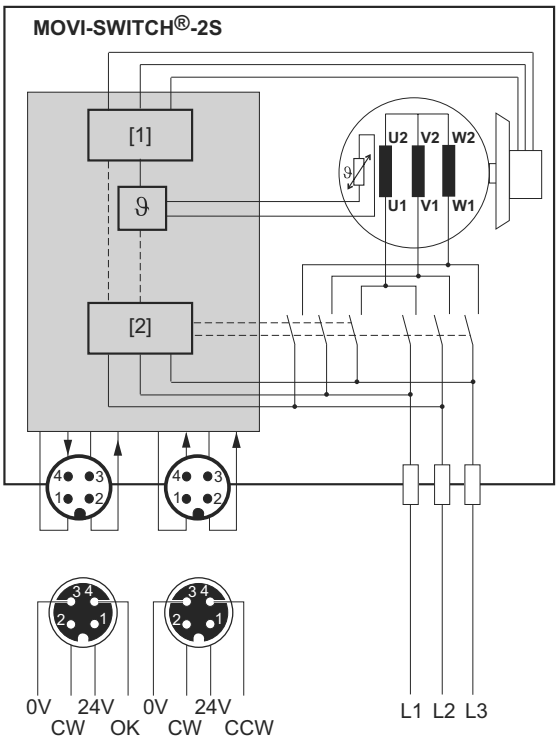

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Figure 50: Block diagram of MOVI-SWITCH® MSW-2S with binary control

[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:

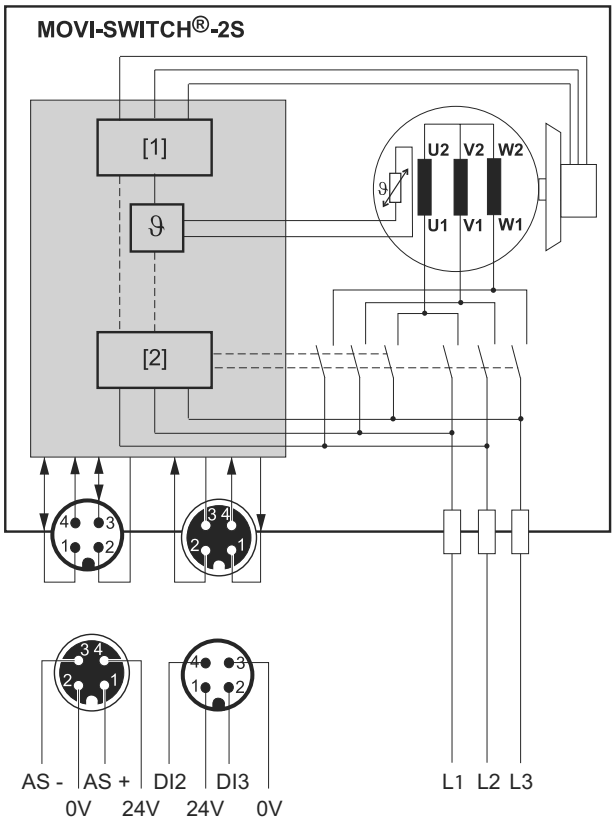

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Figure 51: Block diagram of MOVI-SWITCH® MSW-2S with AS-interface control

[1] Brake control

[2] Rotating field detection

AS AS-interface

13.21 Smooth pole-change unit WPU

Standard pole-changing motors can only be changed over smoothly from high to low speed by taking appropriate measures. To limit the regenerative braking torque which arises, the voltage is either reduced to a lower value at the moment of the changeover by chokes, a transformer or dropping resistors, or the changeover is only 2-phase. All these named measures involve additional complexity in installation and switchgear. The change back to normal voltage conditions in good time is triggered by a time delay relay which is set empirically. In contrast, smooth pole-change units WPU operate completely electronically.

Function

The changeover command blocks a phase of the supply voltage by means of a Triac, thereby reducing the shift-in torque to about one third. The third phase is switched back on with optimum current as soon as the synchronous speed of the multiple pole winding is reached.

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Figure 52: Smooth pole-change unit WPU

Advantages of WPU

- Not load dependent, wear free
- No power loss, therefore high efficiency
- No restriction on start-up and rated torque and no restriction on the motor starting frequency
- Minimum cabling
- 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 pole-changing motors with rated current in the 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 pole-changing motors with rated current in the 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 V_{mains}	$2 \times 150...500\ V_{AC}$			
Supply frequency f_{mains}	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_{amb}	-15 ... +45 °C			
Enclosure	IP20			
Weight	0.3 kg	0.3 kg	0.6 kg	1.5 kg
Mechanical design and construction	DIN rail housing with screw connections			Switch cabinet rear panel

13.22 ECOFAST® compliant AC Motors DT/DV..ASK1

Under the trademark ECOFAST® (Energy and Communication Field Installation System), filed by the Automation and Drives (A&D) division of SIEMENS, the system partners offer an open and innovative solution in the area of decentralization without switch cabinet for automation and drive engineering. This approach is based on the completely decentralized installation and direct installation of the units on the machines. In addition to the communication via PROFIBUS-DP and AS-interface, power supply of the consumers in the ECOFAST® system is also branch-like via power bus. All automation, drive and installation components are combined to form a standard complete solution with standardized connection technology for data and power transfer. The project planning tool ECOFAST® ES (Engineering Software) supports the power-specific dimensioning of a system. Communication via standardized fieldbuses and consistent use of standardized interfaces based on the DESINA specification make ECOFAST® an open, non-proprietary and flexible system solution. Refer to the "ECOFAST®" system manual for detailed information about ECOFAST®.

ECOFAST certified

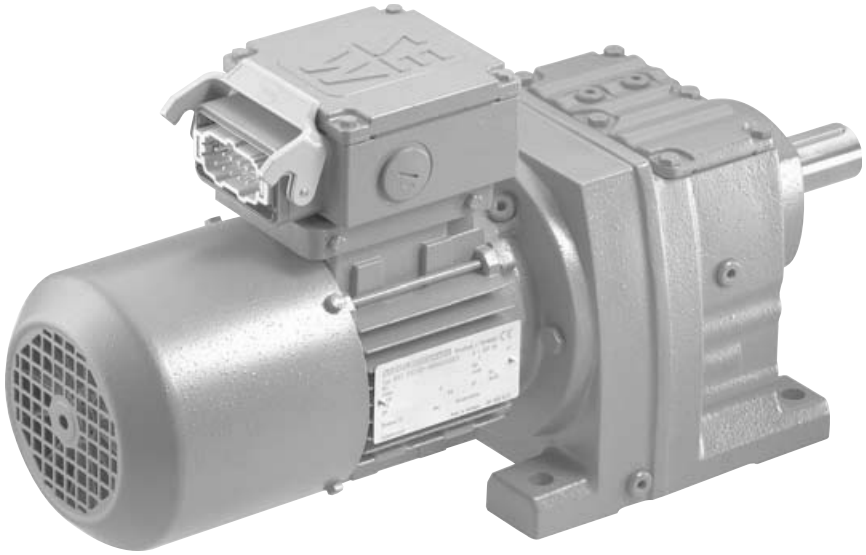

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Figure 53: AC motor with ASK1 plug connector

Function description

ECOFAST® compliant AC motors from SEW-EURODRIVE are equipped with the plug connector option ASK1 as standard. The plug connector ASK1 consists of:

- HAN10ES plug connector with pin insert, single-bracket easy lock and EMC frame.
- Possibility of installing an optional carrier plate for attaching switchgear and control units.

Possible combinations

Almost all gearmotor combinations based on the "Gearmotors" catalog can be supplied in ECOFAST® certified design. The following restrictions apply:

- Motor sizes DT71 to DV132S
- Motor voltage \always 230/400 V and 50 Hz
- Only motors with one speed
- Brake option: Brake voltage always 400 V_{AC}
- Temperature sensor option: only TF
- Brake control system option: only BGE, BG and BUR
- Only thermal classes "B" and "F"

Example unit designation

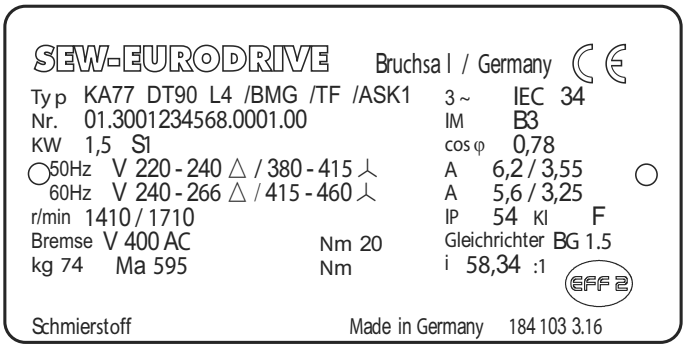

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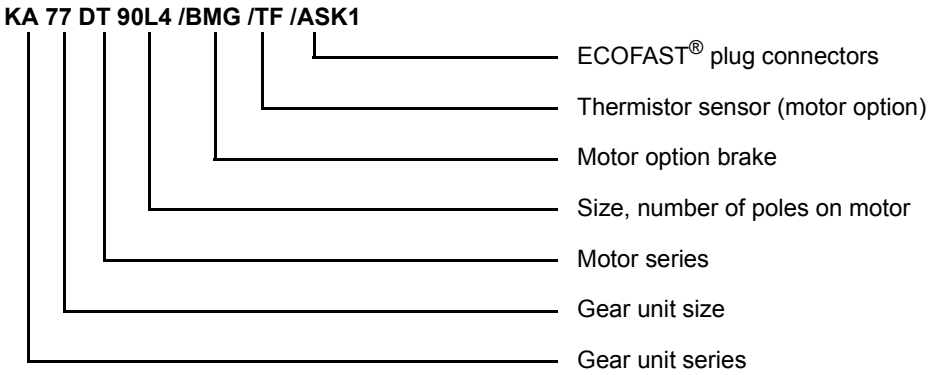
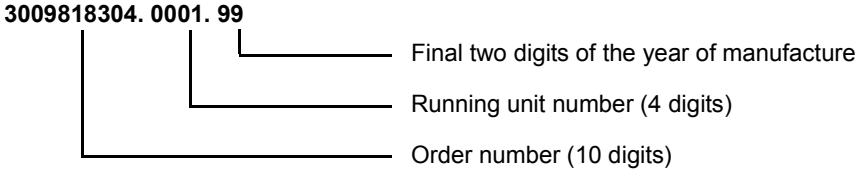
Figure 54: Example of nameplate for "AC motor with ASK1"



Structure of sample serial number:



13.23 Operation on inverter

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

- **MOVITRAC® MC07:** Compact and inexpensive frequency inverter for the power range 0.37 ... 45 kW. Single-phase and three-phase mains connection for 230 V_{AC} and three-phase mains connection for 400 ... 500 V_{AC}.
- **MOVIDRIVE® MDX60/61B:** High-performance drive inverter for dynamic drives in the power range 0.55 ... 160 kW. Wide range of applications thanks to extensive expansion options with technology and communication options. Three phase mains connection for 230 V_{AC} und 400 ... 500 V_{AC}

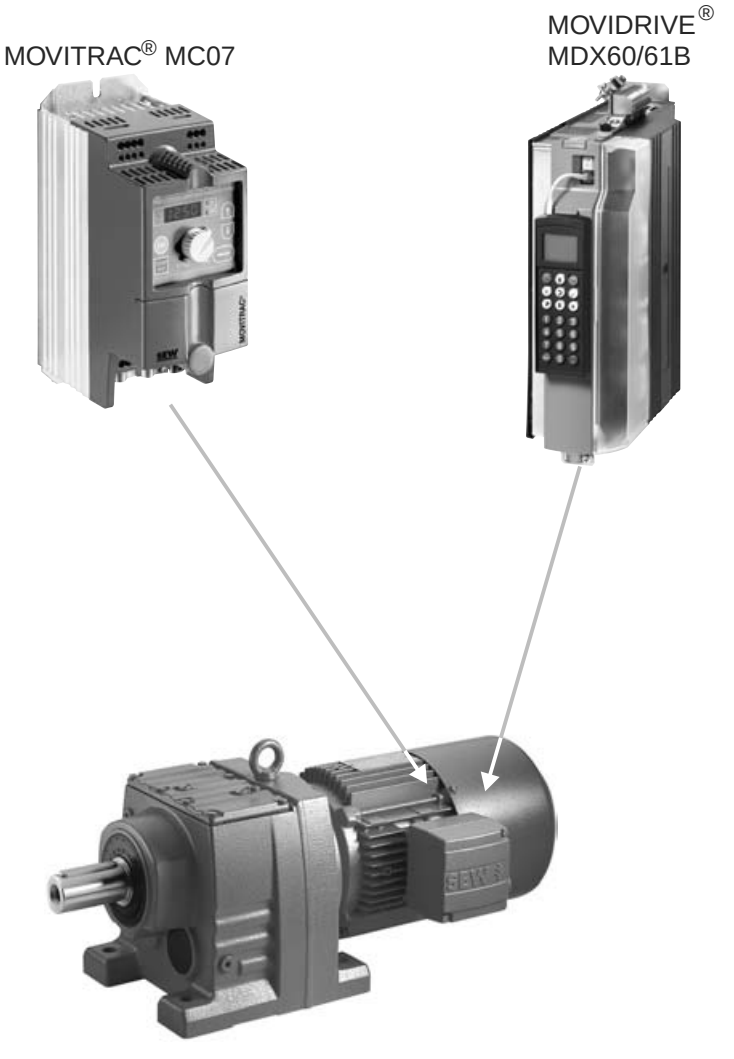


Figure 55: Range of inverters for AC motors

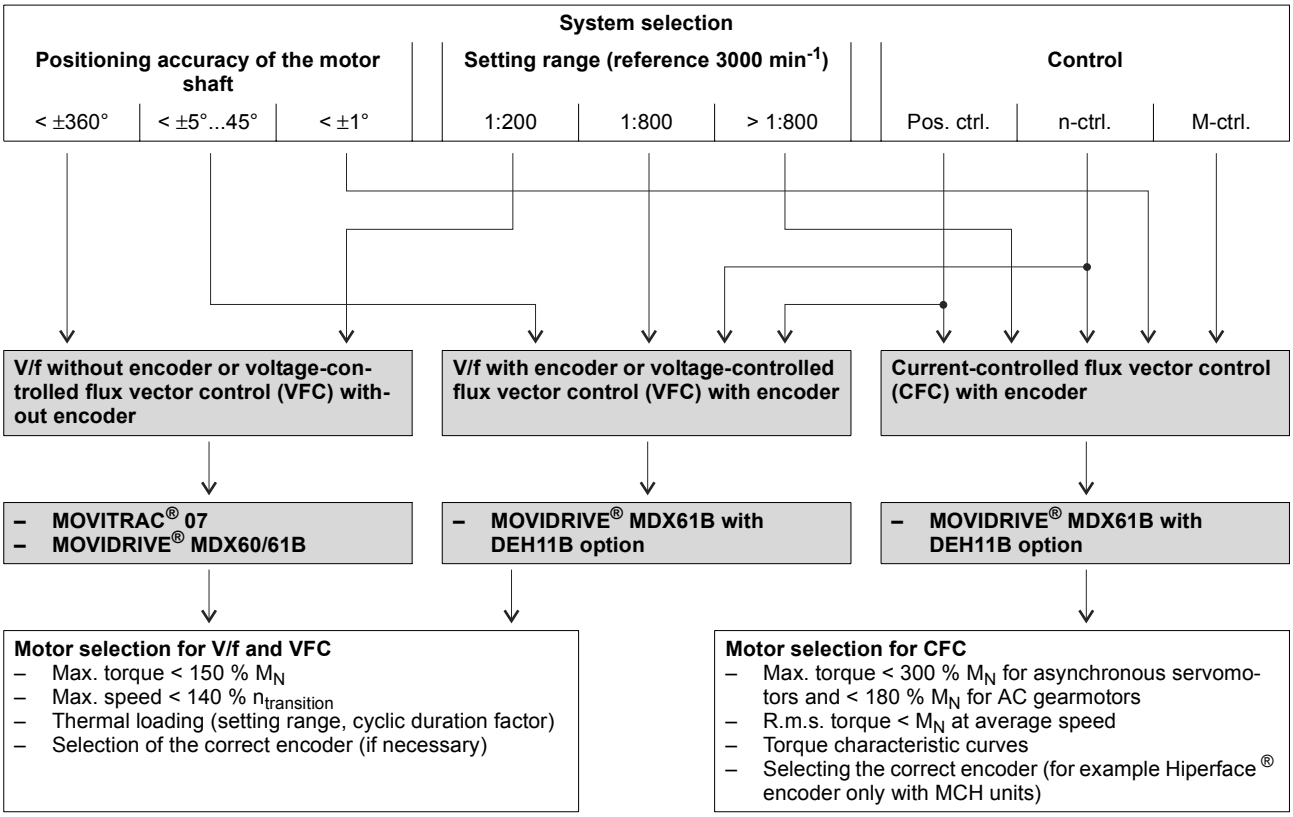
Product characteristics

The most important product characteristics are listed below for the various inverter series. You can use these product characteristics to decide which inverter series is suitable for your application.

Product characteristics	MOVITRAC® MC07	MOVIDRIVE® MDX60/61B
Voltage range	1×200 ... 240 V_{AC} 3×200 ... 240 V_{AC} 3×380 ... 500 V_{AC}	3×200 ... 240 V_{AC} (restricted power range) 3×380 ... 500 V_{AC}
Power range	0.37...45 kW	0.55...160 kW
Overload capacity	150 % I_N[1] Temporary and 125 % I_N continuous for operation without overload	
4Q-capable	Yes, as standard with integrated brake chopper.	
Integrated line filter	Yes, to class A or B limit	With sizes 0, 1 and 2 in accordance with class A limit
TF input	Yes	
Control process	U/f or voltage-controlled flux vector control (VFC)	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	System bus (SBus) and RS-485, optional RS-232
Fieldbus interfaces	No	Optional PROFIBUS-DP, INTERBUS, CAN, DeviceNet
Technology options	No	Input/output card Synchronous operation Absolute encoder card
Safe stop	No	Yes, Synchronous operation Absolute encoder card
Certificates	UL and cUL approval	

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

Drive properties The required drive properties are the main factors determining the selection of the inverter. The following figure is intended to provide assistance.

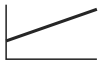


Legend

Pos. ctrl.	= Positioning control
n-ctrl.	= Speed control
M-ctrl.	= Torque control
VFC	= Voltage-controlled flux vector control (voltage flux control)
CFC	= Current-controlled flux vector control (current flux control)
M_N	= Rated torque of the motor
n_{Eck}	= Rated speed (transition speed) of the motor

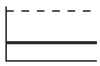
Inverter selection

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



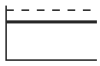
1. Drives with a base load and a speed-dependent load, e.g. conveyor belt drives.

- Low requirements with regard to the setting range.
  –MOVITRAC® 07
  –MOVIDRIVE® MDX60/61B
- High requirements with regard to the setting range (motor with encoder).
  –MOVIDRIVE® MDX61B with DEH11B option



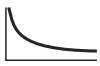
2. Dynamic load, e.g. trolleys; brief high torque demand for acceleration followed by low load.

- Low requirements with regard to the setting range.
  –MOVITRAC® 07
  –MOVIDRIVE® MDX60/61B
- High requirements with regard to 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



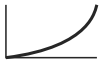
3. Static load, e.g. hoists; mainly steady high static load with overload peaks.

- Low requirements with regard to the setting range.
  –MOVITRAC® 07
  –MOVIDRIVE® MDX60/61B
- High requirements with regard to the setting range (motor with encoder).
  –MOVIDRIVE® MDX61B with DEH11B option



4. Load decreasing in inverse proportion to speed, e.g. winch 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 speed and no load peaks, 125 % utilization (I_D = 125 % I_N).
  –MOVITRAC® 07
  –MOVIDRIVE® MDX60/61B

Further selection criteria

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

Additional documentation

Please refer to the manuals and catalogs for the electronically controlled drives for detailed information and, above all, further project planning information about the individual inverter series. The SEW-EURODRIVE homepage (http://www.sew-eurodrive.com) provides links to a wide selection of our documentation in various languages for download as PDF files.

Electronic catalog EKAT

The electronic catalog EKAT from SEW-EURODRIVE provides a convenient way of selecting the drive components you require. Using the menus, you enter the necessary data for drive selection and the program does the rest. This catalog also includes selecting the appropriate inverter.

Electronic documentation

The list below includes other documents which are of interest in terms of project planning. It can be ordered from SEW-EURODRIVE.

- MOVITRAC® 07 system manual
- MOVIDRIVE® MDX60/61B system manual

Selection of the motor

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.