6 Drive selection

6.1 Electrical characteristics

6.1.1 Suitability for operating with an inverter

DR.. series AC motors and AC brakemotors can be operated on inverters thanks to the high quality windings and insulation material with which they are equipped as standard. Please also refer to the "Drive selection – controlled motor (→ 🗎 179)".

6.1.2 Frequency

SEW-EURODRIVE AC motors are designed for a line frequency of 50 Hz or 60 Hz on request. The technical data in this motor catalog is based on a line frequency of 50 Hz as standard.

A corresponding design is available for DRS.. and DRE.. motors that can be operated on both a 50 Hz and 60 Hz grid: the global motor. This allows different regional electrical regulations to be complied with in a single motor. In particular, it brings together the different national regulations on minimum efficiency levels. See the "The global motor" (→ 🗎 45) chapter.

6.1.3 Motor voltage

AC motors in the standard and energy efficient design are available for rated voltages of 220 - 725 V.

2-, 4-, 6-pole DRS.., DRE.., DRP.. motors

The 2-, 4- or 6-pole motors with power ratings up to 5.5 kW are usually delivered in the following voltage designs:

- for voltage range 220 – 242 V △ / 380 – 420 V ⅄ , 50 Hz

  or

- for nominal voltage 230 V △ / 400 V ⅄ , 50 Hz.

These voltage ranges are available up to the following power ratings / motor sizes:

- 75 kW in energy efficiency classes IE1 and IE2 in size 280S
- 75 kW in energy efficiency class IE3 in size 280M

The 2-, 4- or 6-pole motors with power ratings up to 7.5 kW are usually delivered in the following voltage designs:

- for voltage range 380 – 420 V △ / 690 – 725 V ⅄, 50 Hz

  or

- for nominal voltage 400 V △ / 690 V ⅄ , 50 Hz.

These voltage ranges are available up to the following power rating / motor size:

- 0.18 kW in size 71S

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The other optional motor voltages available as standard are listed in the following table.

Motors		Motor sizes up to 5.5 kW	Motor sizes from 7.5 kW	
2-pole motors				
Standard	IE1	DRS71S2 – 132S2	DRS132M2 – 132MC2	-
High	IE2	DRE80M2 – 132M2	DRE132MC2	-
Premium	IE3	DRP80M2 – 132M2	-	-
4-pole motors				
Standard	IE1	DRS71S4 – 132S4	DRS132M4 – 280S4	DRS280M4 – 315L4
High	IE2	DRE80S4 – 132M4	DRE132MC4 – 280S4	DRE280M4 – 315L4
Premium	IE3	DRP90M4 – 160S4	DRP160MC4 – 280M4	DRP315K4 – 315L4
6-pole motors				
Standard	IE1	DRS71S6 – 160S6	DRS160M6	-
High	IE2	DRE71M6 – 160M6	-	-
Premium	IE3	DRP90L6 – 160M6	-	-
Voltage range	△/⅄	AC 220 – 242 / 380 – 420 V	AC 380 – 420 / 690 – 725 V	
Nominal voltage	△/⅄	AC 230 / 400V		-
	△/⅄	AC 290 / 500 V		AC 290 / 500 V
	△/⅄	AC 400 / 690 V		AC 400 / 690 V
	△/⅄	AC 500 / -		AC 500 / -

The table with the brake voltages is located in the "Brake voltage" (→ 126) chapter.

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

The technical data for motor size DR.250 – DR.315 only refers to a rated voltage of 400 / 690 V. Please consult SEW-EURODRIVE for other voltages.

4/2- and 8/4-pole DRS.. motors with Dahlander windings

Multi-speed AC motors with Dahlander windings are available for nominal voltages of 220 V – 720 V.

They are generally available in the following voltage types for a power rating of up to 5.5 kW in one of the two pole numbers:

- Nominal voltage 400 V △ / ⅄⅄, 50 Hz

Dahlander winding motors with a power rating over 5.5 kW in one of the two pole numbers are generally available with star topology capacity at low speed in the following voltage types:

- Nominal voltage 400 V △- ⅄/⅄⅄ , 50 Hz

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The other motor voltages available as standard are listed in the following table.

		Motor sizes		
		up to 5.5 kW		over 5.5 kW
		4/2-pole motors		
Standard		**DRS71S4/2 – 132M4/2**	**-**	**DRS160S4/2 – 180L4/2**
		8/4-pole motors		
Standard		**DRS71S8/4 – 100L8/4**	**DRS112M8/4 – 132M8/4**	**DRS160S8/4 – 225M8/4**
Nominal voltage (AC)	△ /⅄⅄	400 V		
	△- ⅄/⅄⅄	-	400 V	

If not specified in the order, the motors are designed for a nominal voltage of 50 Hz in the above-mentioned voltages.

8/2-pole DRS.. motors with separate windings

Multi-speed AC motors with separate windings are available for nominal voltages of 220 V – 690 V.

The following connection and voltage types are the only ones available for all motor sizes:

- Nominal voltage 400 V ⅄ / ⅄, 50 Hz

If not specified in the order, the motors are designed for a nominal voltage of 50 Hz in the above-mentioned voltage.

12-pole DRM.. torque motors

DRM.. torque motors are only available in nominal voltage.

All sizes up to 346 V △ / 600 V ⅄, 50 Hz can be constructed in the S1 design, besides the DRM71S12. The S1 limit voltage for the DRM71S12 is 277 V △ / 480 V ⅄ in the 50 Hz grid. The smallest design voltage amounts to 88 V △ / 153 V ⅄, 50 Hz for all S1-DRM.. sizes.

All sizes up to 346 V △ / 600 V ⅄, 50 Hz can be constructed in the S3 / 15% design. The smallest design voltage amounts to 153 V △ / 266 V ⅄, 50 Hz for all S3 / 15% DRM.. sizes.

The standard voltage for the torque motors is 230 / 400 V, 50 Hz.

If not specified in the order, the S1 or S3 / 15% torque motors are designed for a nominal voltage of 50 Hz in the above-mentioned voltage.

The torque motor values for operation on the 60 Hz grid are available separately. Please contact SEW-EURODRIVE in this case.

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6.1.4 Voltage for the global motors

The global motors are available in three voltage blocks in the standard ≤ 0.55 kW design as motor type DRS.. and in the energy saving design ≥ 0.75 kW as motor type DRE.., please refer to the "The global motor" (→ 🗎 45) chapter. The design as a voltage range cannot be changed and nominal voltage data cannot be provided.

The 2-, 4- and 6-pole DRS.. and DRE.. motors with power ratings of up to 5.5 kW are available in the following variants as standard:

- voltage range 220 – 242 V △ / 380 – 420 V ⅄, 50 Hz

  voltage range of 254 – 277 V △ / 440 – 480 V ⅄, 60 Hz

This voltage range version is available up to the following power rating / motor size:

- 45 kW in energy efficiency class IE2 size DRE225M4

The 2-, 4- and 6-pole DRE.. motors with power ratings of over 7.5 kW are available in the following variants as standard:

- voltage range 380 – 420 V △ / 690 – 725 V ⅄, 50 Hz

  voltage range of 440 – 480 V △, 60 Hz

This voltage range version is available up to the following power rating / motor size:

- 0.18 kW in size DRS71S

The other motor voltages available as standard are listed in the following table.

Energy efficiency class		Motor sizes	
		up to 5.5 kW	from 7.5 kW
		2-pole motors	
Standard	**IE1**	**DRS71S2**	**-**
High Efficiency	**IE2**	**DRE80M2 – 132M2**	**DRE132MC2**
		4-pole motors	
Standard	**IE1**	**DRS71S4 – 71M4**	**-**
High Efficiency	**IE2**	**DRE80M4 – 132M4**	**DRE132MC4 – 250M4**
		6-pole motors	
Standard	**IE1**	**DRS71S6**	**-**
High Efficiency	**IE2**	**DRE71M6 – 160M6**	**-**
Voltage range (AC)	50 Hz	220 – 242 V / 380 – 420 V	
	60 Hz	254 – 277 V / 440 – 480 V	
Voltage range (AC)	50 Hz	380 – 420 V / 690 – 725 V	
	60 Hz	440 – 480 V / -	

75 and 90 kW	Voltage at 50 Hz	Voltage at 60 Hz
DRE280S and 280M	380 – 420 V / 660 – 725 V	460 V

If not specified in the order, the global motors are delivered for the combined 50 Hz / 60 Hz voltage range in the standard designs mentioned above.

The DRE315 motor size is not available in the combined 50 Hz and 60 Hz global motor voltage range. The 50 Hz voltage range is possible, please refer to the "Motor voltage" (→ 🗎 121) chapter.

6.1.5 Forced cooling fan voltage

The forced cooling fan for the DR.. motor series can either be delivered in two three-phase current-AC voltage ranges or in a DC voltage design.

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The three-phase current-AC voltage designs are also able to operate in the 50 Hz as well as the 60 Hz grid and up to three versions can be operated by switching the connection type.

The capacitor required for the AC voltage operation in a Steinmetz circuit is included in the delivery by SEW-EURODRIVE and is located in the forced cooling fan's wiring space.

The following table shows the possible voltage designs.

<table>
<tr><th colspan="3" rowspan="2">Forced cooling fan</th><th colspan="3">Motor sizes</th></tr>
<tr><th>DR.71 – 132</th><th>DR.160 – 180</th><th>DR.200 – 315</th></tr>
<tr><td colspan="2">DC 24 V</td><td>+ / -</td><td>1 × 24 V</td><td>-</td><td>-</td></tr>
<tr><td rowspan="6">AC 120 V</td><td rowspan="3">50 Hz</td><td>△ with capacitor</td><td>1 × 100 – 127 V</td><td>-</td><td>-</td></tr>
<tr><td>△</td><td>3 × 100 – 127 V</td><td>-</td><td>-</td></tr>
<tr><td>⅄</td><td>3 × 175 – 220 V</td><td>-</td><td>-</td></tr>
<tr><td rowspan="3">60 Hz</td><td>△ with capacitor</td><td>1 × 100 – 135 V</td><td>-</td><td>-</td></tr>
<tr><td>△</td><td>3 × 100 – 135 V</td><td>-</td><td>-</td></tr>
<tr><td>⅄</td><td>3 × 175 – 230 V</td><td>-</td><td>-</td></tr>
<tr><td rowspan="6">AC 230 V</td><td rowspan="3">50 Hz</td><td>△ with capacitor</td><td colspan="2">1 × 230 – 277 V</td><td>-</td></tr>
<tr><td>△</td><td colspan="3">3 × 200 – 290 V</td></tr>
<tr><td>⅄</td><td colspan="3">3 × 346 – 500 V</td></tr>
<tr><td rowspan="3">60 Hz</td><td>△ with capacitor</td><td colspan="2">1 × 200 – 277 V</td><td>-</td></tr>
<tr><td>△</td><td colspan="3">3 × 220 – 330 V</td></tr>
<tr><td>⅄</td><td colspan="3">3 × 380 – 575 V</td></tr>
</table>

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6.1.6 Brake voltage

The BE brake is available in voltage designs of AC 120 V – 575 V and DC 24 V / AC 60 V.

The standard brake voltage design is

- nominal voltage AC 230 V: DR.71 BE05 – DR.132 BE11

  and

- nominal voltage AC 400 V: DR.160 BE11 – DR.315 BE122

If not specified in the order, the brakes are delivered for the above mentioned voltages as standard.

The following rules also apply:

- The brake voltage is also confirmed as a voltage range for motors that are designed in the voltage range.
- The brake voltage is also indicated as a nominal voltage for motors with a confirmed nominal voltage.

The other optional motor voltages available as standard for the brake voltage of BE brakes are listed in the following table.

Design		**Motor sizes and brake sizes**		
		DR.71 – 132	**DR.160 – 180**	**DR.180 – 315**
		BE05 – BE11	**BE11 – BE20**	**BE30 – 122**
Voltage range	AC	220 – 242 V		
	AC	380 – 420 V		
Nominal voltage	AC	230 V		
	AC	400 V		
	DC	24 V		-

An extended voltage range applies for the supply voltage of brakes for the global motors:

Design		**Motor sizes and brake sizes**		
		DR.71 – 132	**DR.160 – 180**	**DR.180 – 225**
		BE05 – BE11	**BE11 - BE20**	**BE30 – 32**
Voltage range	AC	220 – 277 V		
	AC	380 – 480 V		

The permanent operation of the brake on the global motor with a connection voltage above AC 254 V or AC 440 V is only permitted with the simultaneous operation of the global motor, as otherwise the brake ventilation cannot be guaranteed.

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6.1.7 Standard 50 Hz connections

The standard motor connections are defined depending on the number of poles. The following table provides an overview as well as the theoretical synchronous speed on the 50 Hz grid based on the number of poles.

Number of poles	Connection	Synchronous speed n_{syn} on the 50 Hz grid
2-pole	△ / ⅄	3000
4-pole	△ / ⅄	1500
6-pole	△ / ⅄	1000
12-pole	△ / ⅄	0 (500)
	△ [1] / ⅄	
4/2-pole	△ / ⅄⅄	1500 / 3000
	⅄ - △ / ⅄⅄	
8/4-pole	△ / ⅄⅄	750 / 1500
	⅄ - △ / ⅄⅄	
8/2-pole	⅄ / ⅄	750 / 3000

1) Torque motors with tapped winding in the delta connection to limit the torque to a maximum of 3 times the value of the star connection are available on request.

6.1.8 50 Hz motors on 60 Hz grids

The rated data of motors designed for 50 Hz grids differ as follows when the motors are operated on 60 Hz supply systems:

Motor voltage at 50 Hz	Connection	Voltage at 60 Hz	Modified rated data			
			Speed	Power	torque limit	Starting torque
AC 230 △ / 400 V ⅄	△	230	+20 %	0 %	-17 %	-17 %
AC 230 △/ 400 V ⅄	⅄	460	+20 %	+20 %	0 %	0 %
AC 400 △/ 690 V ⅄	△					

If you want to operate motors designed for 50 Hz supply systems on a 60 Hz grid, please consult SEW-EURODRIVE. Some countries and regions provide regulations for the efficiency of motors for 50 Hz grids, even though only 60 Hz grids are available.

6.1.9 60 Hz motors

This motor catalog contains technical information on motors for grids with a frequency of 50 Hz.

The motors are also available for grids with a frequency of 60 Hz. The standard and energy-efficient designs are implemented in precisely the same manner.

Regional regulations, such as NEMA MG1 (USA), CSA C22.2 (Canada) or ABNT (Brazil) and others are complied with.

The power assignment differs between the 60 Hz and 50 Hz motors for some sizes.

Power ratings with a local market significance and which are outside of the IEC series are taken into account. Example: a motor with 3.7 kW / 5 hp is included as well as a 4.5 kW / 6 hp motor.

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6.2 Thermal characteristics

6.2.1 Thermal classes pursuant to IEC / EN60034-1 and IEC 62114

In addition to motor standard IEC / EN 60034-1, the IEC 62114 also describes the thermal class designs and identifications. They define the limit overtemperature based on a maximum ambient temperature of +40 °C and a reserve of 10 K or 15 K for potential voltage tolerances.

A number identification is required. The addition of a long-standing letter in brackets is permitted. SEW-EURODRIVE identifies the motors using a combination of numbers and letters.

Thermal class	SEW identification	Limit overtemperature in K (permitted heating at the rated torque)
130	130 (B)	80 K
155	155 (F)	105 K
180	180 (H)	125 K

The various motor measurements result in different basic thermal class designs.

Motor design	Basic thermal class design
DRS.. (one speed)	130 (B) with copper rotor 155 (F)
DRS.. (two speed)	Dahlander winding 130 (B), occasionally 155 (F) separate winding 130 (B)
DRE.. and DRP..	130 (B)
DRL..	155 (F)
DRM..	155 (F)

The DRS.., DRE.. and DRP.. motors can also be built and delivered in higher thermal classes 155 (F) and 180 (H). In some cases, mounted options require a higher basic thermal class design.

DRL.. servomotors and DRM.. torque motors are not available in thermal class 180 (H), as the entire motor would then reach prohibited temperatures in the gaskets, ball bearings and bearing lubricants. The reasons for this decision are as follows:

- the non-ventilated rated operation at a standstill for the DRM.. torque motors
- the constant ventilation of the fan-cooled DRL.. servomotors in inverter mode.

6.2.2 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 for an ambient temperature of 40 °C and a maximum installation altitude of 1,000 m above sea level. The rated power must be reduced according to the following formula in the case of higher ambient temperatures or altitudes:

$$\mathbf{P_{Nred} = P_N \times f_T \times f_H}$$

The following diagrams show the power reduction depending on the ambient temperature and installation altitude.

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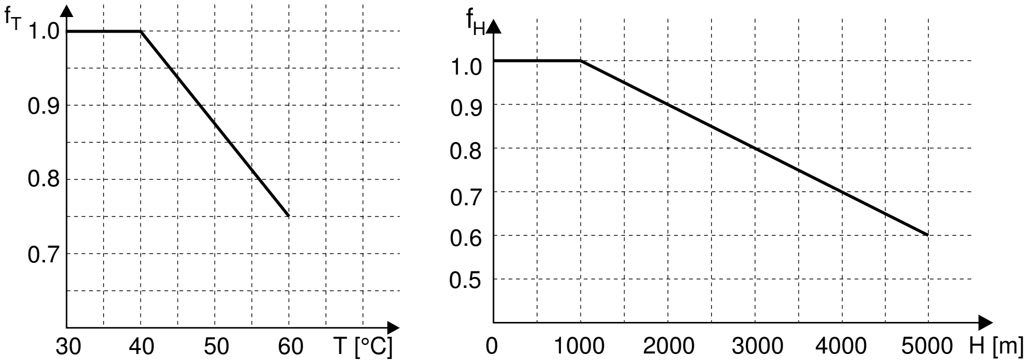
The factors f_T and f_H apply for the motors:



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T = ambient temperature

H= Installation altitude above sea level

Please contact SEW-EURODRIVE for ambient temperatures above 60 °C and installation altitudes over 5000 m.

6.2.3 Operating modes

Motor standard IEC / EN 60034-1: 2011-02 defines the following operating modes, among other things.

Designation of the operating mode	Text explanation
S1	Continuous duty: Operation with a constant load. Operation at a constant load, with a duration long enough for the machine to reach a steady thermal condition.
S2	Short-time duty: Operation with a constant load and idling time. Operation at a constant load for a time which is less than the time required for reaching a steady thermal condition. The subsequent standstill time when the windings are de-energized is long enough for the motor temperature to deviate less than 2K from the temperature of the cooling agent. S2 is supplemented by the operating time in minutes.
S3	Periodic intermittent duty: without affecting the starting procedure. This duty is a sequence of identical duty cycles, with each cycle including a period of operation at constant load and a standstill period with de-energized windings. The starting current does not have any significant effect on the temperature rise. S3 is supplemented by the relative cyclic duration factor in %.
S6	Periodic cycle: continuous periodic operation. This duty is a sequence of identical cycles, with each cycle including a period of operation at constant load and a period of idle time. There is no standstill period in which the windings are de-energized. S6 is supplemented by the relative time under load in %.
S9	Non-periodic cycle: non-periodic load and speed changes. Operation with usually non-periodic changes in load and speed within the permitted operating range. In this cycle, overloads often occur that significantly exceed the reference load. A constant load in line with duty type S1 is selected as the reference value for the overload for this duty type.

INFORMATION

S1 continuous duty is normally assumed when operating the motor on an inverter. In the case of a high number of cycles per hour, it might be necessary to assume S9 intermittent duty.

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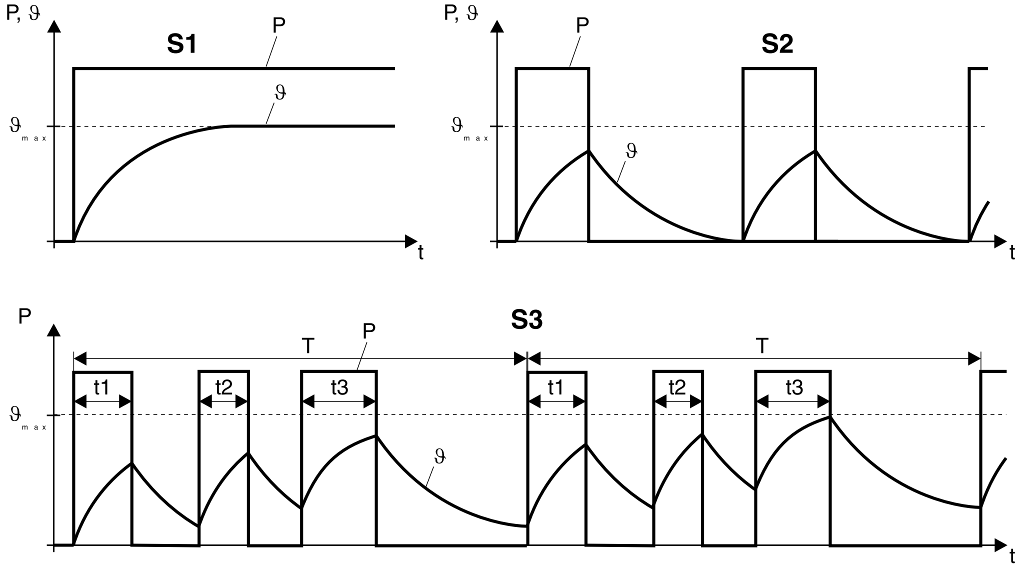
The following figure shows duty types S1, S2 and S3.



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Determining the relative CDF

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

$$\mathbf{cdf = \frac{Total\ number\ of\ times\ of\ operation\ (t1 + t2 + t3)}{Cycle\ duration\ (T)} \bullet 100\ [\%]}$$

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Power increasing factor K

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

Duty type			Power increasing factor K
S2	Operating time	60 min	1.1
		30 min	1.2
		10 min	1.4
S3	Relative cyclic duration factor (cdf)	75 %	1.1
		40 %	1.15
		25 %	1.3
		15 %	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, run-up time, time at load, braking type, braking time, idle time, cycle duration, period at rest and power demand.		On request

In the case of high counter-torques and high mass moments of inertia (heavy starting), please contact SEW-EURODRIVE with exact information about the technical data when changing the duty type.

6.2.4 Thermal monitoring

In accordance with the standard, two fundamental states are taken into account when monitoring a motor against thermal overload.

Thermal overload with gradual change

If a motor is exposed to a thermal overload with a gradual rise in temperature, the thermal protection system must prevent a rise in the winding temperature over the following values.

Thermal classification	Maximum winding temperature
130 (B)	145 °C
155 (F)	170 °C
180 (H)	195 °C

Possible causes could be:

- Failure of the cooling or the cooling system due to excessive dust in the cooling ducts or the cooling fins on the motor housing.
- Reduction in the air volume due to the partial covering of the fan grille.
- Renewed drawing in of heated cooling air.
- An excessive rise in the ambient temperature or the coolant temperature.
- Gradually rising mechanical overload.

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- Voltage drop, overvoltage or asymmetry in the motor supply over an extended period.
- Excessive operating time for a motor rated for intermittent duty.
- Frequency deviations.

Thermal overload with rapid change

If a motor is exposed to a thermal overload with a rapid rise in temperature, the thermal protection system must prevent a rise in the winding temperature over the following values.

Thermal classification	Maximum winding temperature
130 (B)	225 °C
155 (F)	240 °C
180 (H)	260 °C

Possible causes could be:

- Motor blockage.
- Phase failure.
- Start-up under abnormal conditions, e.g. with excess mass moment of inertia, insufficient voltage or abnormally high load torque.
- Sudden and marked rise in the load.
- Repeated start-up within a short space of time.

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Determining the right 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 that are generally operated from the control cabinet, include:

- Fuses

  or

- Motor overload circuit breakers.

Temperature-dependent protection devices in the winding are

- PTC thermistors (thermistor sensors)

  or

- Bimetallic switches (thermostats).

PTC thermistors or bimetallic switches respond when the maximum permitted winding temperature is reached. The advantage is that temperatures are recorded where they actually occur.

Fuses	Fuses do not protect the motor from overload. They are exclusively used as short-circuit protection and may detect a motor blockage, as this condition is similar to a short-circuit on the terminals.
Motor overload circuit breaker	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 protection switches are not adequate as the sole means of protection given switching operation with a high starting frequency (> 60 / h) and for heavy starting. In these cases we recommend to use a positive temperature coefficient thermistor TF in addition.
PTC thermistor	Three positive temperature coefficient (PTC) thermistors TF (PTC, characteristic curve according to DIN 44080) are connected in series in the motor and connected from the terminal box to an inverter input or to a trip switch in the control cabinet. Motor protection with positive temperature coefficient (PTC) thermistors (SEW designation /TF) provide comprehensive protection against thermal overload. Motors protected in this way can be used for high inertia starting, switching and braking operation as well as with fluctuating power supplies. A motor circuit breaker is usually installed in addition to the TF. SEW-EURODRIVE recommends using motors equipped with TF for inverter operation.
Bimetallic switch	Three bimetallic switches (SEW designation /TH), connected in series in the motor, are integrated directly into the motor monitoring circuit from the terminal box. Due to the size and the insulation required for the motor winding, the TH does not reach the reaction speed of the PTC thermistor. The switching hysteresis may not permit a motor switching frequency depending on the design.
MOVIMOT® protection devices	MOVIMOT® drives contain integrated protection devices to prevent thermal damage. No other external devices are required for motor protection.

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Comparison of the safety mechanisms

The following tables show the qualification of the various protection devices for different causes of tripping.

Key:

Scope of protection	Icon
Comprehensive protection	x
Limited protection	•
No protection	-

Reason for the additional thermal load	Current-dependent protection device		Temperature-dependent protection device	
	Fuse	Motor overload circuit breaker	PTC thermistor /TF	/TH bimetallic switch
Over-currents up to 200 % I_N	-	x	x	x
Heavy start	-	•	x	•
Direct switching of the direction of rotation	-	•	x	•
Switching operation up to Z = 30 1/h	-	•	x	x
Stalling	•	•	•	•
Phase failure	-	•	x	x
Voltage deviation (greater than tolerance B)	-	x	x	x
Frequency deviation (greater than tolerance B)	-	x	x	x
Insufficient motor cooling	-	-	x	x

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6.3 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 % cyclic duration factor).

The power demand calculated from the load torque of the driven machine is the same as the rated motor power.

6.3.1 High starting frequency

Many applications call for a high starting frequency at low counter-torque, such as for a travel drive. 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 (see the "Thermal characteristics" (→ 🗎 129) chapter).

6.3.2 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 % cyclic duration factor. 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 % cyclic duration factor.

If an additional mass moment of inertia of a load has to be accelerated or if an additional load torque occurs, the run-up time of the motor will increase. Increased current flows during this run-up time. This means the motor is subjected to increased thermal load and the permitted starting frequency is reduced.

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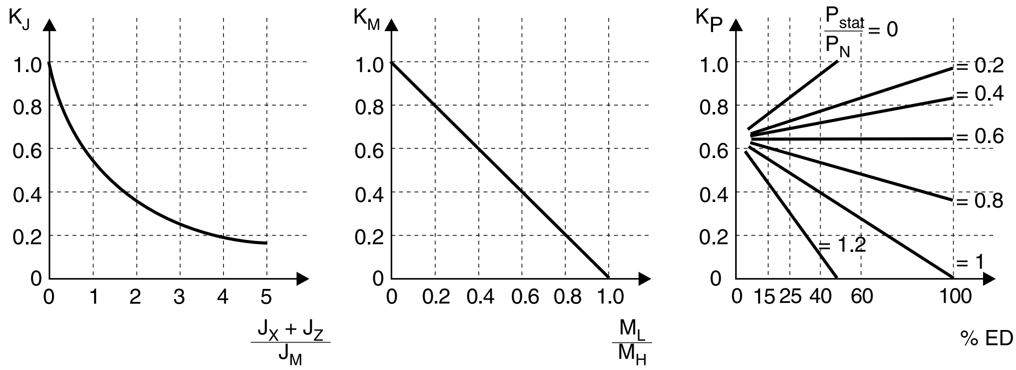
6.3.3 Permitted starting frequency of the motor

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

$Z = Z_0 \times K_J \times K_M \times K_P$

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

Depending on the additional moment of inertia	Depending on the counter-torque at startup	Depending on the static power and the cyclic duration factor (cdf)



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

Example

Brakemotor: DRS71M4 BE1

No-load starting frequency Z_0 = 11000 1/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 : $K_P = 0.65$

$Z = Z_0 \times K_J \times K_M \times K_P = 11000\ 1/h \times 0.2 \times 0.4 \times 0.65 = 572\ 1/h$

The cycle duration amounts to 6.3 s.

The switch-on time amounts to 3.8 s.

6.3.4 Permitted work done by the brake

If you are using a brakemotor, you have to check whether the brake is approved for use with the required duty type. Please also refer to the information in the "Permitted braking work of the BE brake during working brake actions (→ 🗎 376)" or the "Permitted braking work of the BE brake in case of an emergency stop (→ 🗎 385)" chapters.

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6.4 Mechanical designs

6.4.1 Degrees of protection pursuant to EN /IEC 60034-5

Designs

AC motors and AC brakemotors are available with degree of protection IP54 as standard. Degrees of protection IP55, IP56, IP65 or IP66 are available upon request.

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

In addition to the protection classification using the above code, further identification with more information may be required pursuant to the standard.

SEW-EURODRIVE uses the additional designation with the letter "W" to identify internal corrosion protection.

Example:

- IP55: Dust- and water jet-resistant
- IP55W: Corrosion- Dust- and water jet-resistant

6.4.2 Vibration class

The motors comply with vibration class A. If special requirements for the mechanical running smoothness exist, 2-, 4-, or 6-pole motors without add-ons (no brake, forced cooling fan, encoder, etc.) can be delivered in a low-vibration design in vibration class B.

For vibration classes A or B, the motor rotors are always dynamically balanced with a half key.

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6.4.3 Vibration stress

The normal motor setup requires a vibration-free attachment and duty type. Make sure that the supports are even, the foot or flange mounting is correct and if there is direct coupling, align with precision. Resonances between the rotational frequency and the double network frequency caused by the structure are to be avoided.

Only install the (gear)motor in the mounting position specified on the nameplate on a level, vibration-free and torsionally rigid support structure. Align the (gear)motor and the driven machine carefully in order to prevent the output shaft from being exposed to unacceptable strain. Pay attention to the permitted overhung and axial loads and avoid impacts on the shaft end when applying transmission elements. We recommend heating the elements prior to assembly.

If all of these requirements cannot be ensured in the application, the motors can be delivered in a design for vibration stress.

Vibration level 1 (VL1) ensures that the motors are able to deal with an external influence. The values in the following table are based on standardized information pursuant to DIN ISO 10816-1.

Motor size	**Periodic vibrations**	**Shock stress** **1g = 9.81 m/s²**
DR.71 – DR.132	Effective vibration speed ≤ 4.5 mm/s	Maximum acceleration = 10 g
DR.160 – DR.315	Effective vibration speed ≤ 7.1 mm/s	Maximum acceleration = 15 g

If you require a drive in line with VL1, or if the required values exceed the information for VL1, please contact SE-EURODRIVE.

The following design types and options are not available for vibration stress:

Term	**Designation**
Brake monitoring	/DUB
Built-in encoder	/EI7.
Air filter	/LF
Forced cooling fan	/V
MOVIMOT®	/MM
MOVI-SWITCH®	/MSW
Foot-mounted motors DR.71 – DR.132	/FI

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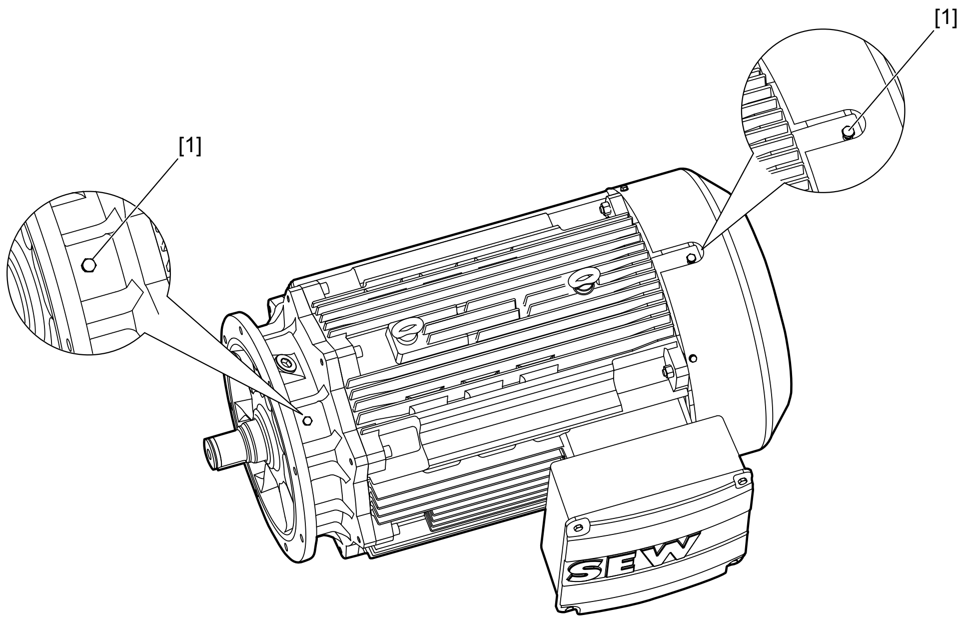
6.4.4 Vibration monitoring

External influences can gradually lead to the failure of important motor functions, such as defects in the bearings. In particular, for motors with higher power ratings, the investments can be maintained by preventive maintenance and inspection. Vibration monitoring supports the timely detection of the need for maintenance.

SEW-EURODRIVE provides a mounting adapter for vibration recorders and tapped holes for SPM measuring nipples.

Tapped holes to mount the measuring nipple can be applied on the A- and B-side in the flanges and covers of motor sizes DR.160 – 315.



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The SEW-EURODRIVE delivery components may include:

- only the bores
- the bores and the mounted measuring nipple.

Please contact SEW-EURODRIVE if required.

6.4.5 Shaft ends

The A-side shaft ends of the foot- and/or flange-mounted motor design are usually delivered with a keyway pursuant to DIN 6885 Sheet 1 (ISO 773). The shaft ends can also be delivered smooth and without a key and keyway on request.

Motors are balanced with a half key as standard, please also refer to the "Vibration class" (→ 🗎 139) chapter.

In particular, when replacing older motors, there may be a need to balance the motors with a full key in order to continue using the existing transmission and connecting elements, such as couplings.

The full-key balancing must be specified in the order if required. SEW-EURODRIVE identifies motor rotors balanced in this manner with a "V" on the front shaft end face in line with the standard regulations.

Whether balanced with a full- or half-key, the motors are always delivered with full keys, which are secured against loss during transport.

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The special form of the A-side shaft end for direct mounting to the SEW gear units is the pinion shaft end. A standardized diameter is provided depending on the number of poles, power and motor size. Smaller dimensions must be precisely inspected with the application data. Larger pinion shaft ends limit the potential reduction ratio variations, but are required in rare cases due to the high dynamic loads.

6.4.6 Integral motors

If the motor or gear unit is replaced for a SEW-EURODRIVE gearmotor, the following needs to be observed:

To ensure an oil-tight reassembly, SEW-EURODRIVE recommends using the sealant included in the delivery.

Both the gear unit housing and the motor flange are made from aluminum as well as gray cast iron. This must be noted during assembly.

6.4.7 Flange-mounted motors

The flange-mounted motors in the DR.. modular motor system are available in three different specifications.

- Flange-mounted design with metric through bore, also referred to as B5 motors in the standard for the basic design.
- Flange-mounted design with metric thread, also referred to as B14 motors in the standard for the basic design.
- Flange-mounted design with inch thread, also referred to as C-Face in the US standard for the basic design.

The regulations for the metric flange dimensions are provided in IEC 72-1, while the dimensions for inch flanges are provided in MENA MG1.

Flange-mounted motor in	possible sizes
IM B5 design	DR.71 – DR.315
IM B14 design	DR.71 – DR.100
C-Face design	DR.71 – DR.80

All motor flanges pursuant to standard IEC 72-1, also generally referred to as IEC motors, are produced from gray cast iron (GG20).

If the dimensions of the metric flange are also designed for the respective motor power in the size in line with EN 50347, this is indicated as follows in the catalog designation:

- For B5 motors, with /FF.
- For B14 motors, with /FT.
- For flanges that deviate from EN, with /FL.

The inch flanges pursuant to C-Face are identified with /FC in the SEW catalog designation.

The parallel design as a flange- and foot-mounted design is possible for flanges with metric measurements. These combinations have their own type and catalog designations.

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6.4.8 Foot-mounted motors

The foot-mounted motor design follows a range of construction principles:

- Aluminum bed plates for sizes DR.71 – DR.132.
- Two single gray cast iron feet for sizes DR.160 – DR.315.

As standard, the only parts of the motor that are treated are the sides and surfaces to which the bed plate/feet are connected. A retroactive modification to attach the bed plate/feet to another side of the motor is generally not possible without great expense.

If the required position of the bed plate/feet is not in place when ordering, all sides of the motor can be machined to attach the bed plate/feet at the factory for DR.71 – 132 and DR.250/280 motors. This means that the customer can freely select the position of the bed plate/feet.

When ordering the DR.250/280, it is possible to specify if the feet should be delivered unattached or attached. SEW-EURODRIVE identifies this decision by attaching the letter A or B to the selected foot-mounted design.

Example:

Designation	Type	Explanation
/FE	Foot- and flange-mounted design	A position machined, feet attached
/FEA		Three positions machined, feet delivered unattached
/FEB		Three positions machined, feet attached to a position

6.4.9 Oil seals

The motors are constructed as flange-mounted motors, gearmotors or integral motors with oil seals. In the standard designs, nitrite butadiene rubber (NBR) oil seals are used.

Fluorocarbon rubber (FKM) oil seals can also be used up to a lower temperature limit of -25 °C.

The following motors are constructed using fluorocarbon rubber (FKM) oil seals in the series design up to a minimum temperature of -20 °C.

- 2-pole motors
- 4-pole motors

For gearmotors, the lubricant also influences the oil seal.

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6.5 Mounting positions

The motor standard IEC 60034-7 only recognizes mounting positions that are rotated or tilted within a 90° grid, please also refer to the "Motor design designation" (→ 🗎 89) chapter.

6.5.1 Inclined mounting positions

In most cases, the defined and established positions in line with the standard are sufficient. The standard does not recognize inclined mounting positions.

The motors are also available for inclined mounting positions if the initial design, target design and the angle are specified. There is a restriction for two position specifications. Further rotation towards a third position is not possible.

Example: IM B3 → IM V5: with an angle of 40°

SEW-EURODRIVE confirms the permissibility of the inclined mounting position by providing the following information on the nameplate and the order confirmation in line with the data specified by the customer:

B3/V5/40°

The mounting position-dependent designs on the motor side are identified, defined and attached depending on this information, e.g. the condensation drain holes.

If a gearmotor is delivered for an inclined mounting position, the lubricant quantities and the placement of the oil fittings are adapted accordingly.

Any application that deviates from the specification may only be performed in coordination with SEW-EURODRIVE.

6.5.2 Moving mounting position

Depending on the application, it may be necessary for the DR. motor to cyclically and/or permanently switch between two mounting positions. This situation is also not described in the standard.

The motors are also available for moving mounting positions if the initial design, target design and the angle are specified. There is a restriction for two position specifications. A further switching movement towards a third position is not possible.

Example: IM B3 → IM V5: with a starting angle of 10°, with an end angle of 80°

SEW-EURODRIVE confirms the permissibility of the moving mounting position by providing the following information on the nameplate and the order confirmation in line with the data specified by the customer:

B3/V5/10-80°

The mounting position-dependent designs on the motor side are identified, defined and attached in multiple position, if necessary, depending on this information, e.g. the condensation drain holes.

If a gearmotor is delivered for a moving mounting position, the lubricant quantities and the placement of the oil fittings are adapted accordingly.

Any application that deviates from the specification may only be performed in coordination with SEW-EURODRIVE.

Please also contact SEW-EURODRIVE for moving mounting positions with angles over 90°.

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6.6 Maximum speeds

The duty cycle of motors and gearmotors on the 50 Hz and 60 Hz grid will never reach a critical value, if you follow the information and regulations described in this chapter.

The maximum speed is irrelevant for multi-speed motors and brakemotors. The "Drive selection of pole-changing motors" (→ 🗎 170) chapter covers the torque behavior of this drive type.

For electric motors that operate on a frequency inverter, the maximum torque and the maximum speed must be viewed as mechanical limits.

The maximum torque is based on the load limit of the mechanical design of the shaft, the bearings and the shaft sealing system.

Motors in the DRL.. design can be briefly and dynamically operated and loaded with a higher torque due to their better dimensioned mechanical design. Please also refer to the "Drive selection – DRL.. motors" (→ 🗎 186) chapter.

Additional loads that arise at the customer's location must be taken into account for all DR. motors, e.g. additionally occurring overhung or axial loads due to belt drives.

The motor's maximum speed must not be exceeded. The following table displays these values for standard motors. They apply to motors with fluorocarbon rubber oil seals (FKM).

Additional motor options will influence these speeds. Please contact SEW-EURODRIVE in such cases.

Please also pay attention to the following for brakemotors:

- The applicable drive selection regulations with regard to the braking work.
- Braking from speeds of over 1800 rpm is not permitted for brake sizes BE30 and above. Use the controller to reduce the speed before activating the mechanical brake.
- For 4/2-pole brakemotors with brake sizes BE30 and BE32, first switch from the 2-pole speed to the 4-pole speed. The motor can then be switched off and the brake activated when the 4-pole speed is reached.

Motor size	Mounted brakes	Maximum mechanical speed n_{max} in rpm	
		Motor	Brakemotor
DT56	BMG02	6000	4500
DR 63	BR03	6000	4500
DR.71	BE05 or BE1	6000	4500
DR.80	BE05, BE1 or BE2	6000	4500
DR.90	BE1, BE2 or BE5	6000	4500
DR.100	BE2 or BE5	6000	3600
DR.112	BE5 or BE11	5000	3600
DR.132	BE5 or BE11	5000	3600
DR.160	BE11 or BE20	4500	3600
DR.180	BE20, BE30 or BE32	4500	3600
DR.200	BE30 or BE32	3500	3600
	BE60 or BE62[1)]	2600	2500

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Motor size	Mounted brakes	Maximum mechanical speed n_{max} in rpm	
		Motor	Brakemotor
DR.225	BE30 or BE32	3500	3600
	BE60 or BE62[1)]	2600	2500
DR.250	BE60 or BE62	2600	2500
	BE120 or BE122	2500	2500
DR.280	BE60 or BE62	2600	2500
	BE120 or BE122	2500	2500
DR.315	BE120 or BE122	2500	2500

1) Please contact SEW-EURODRIVE when attaching the BE60/62 to the DR.200/225.

If a motor is equipped with a backstop, the sprag's lift-off speed represents the lower speed limit during operation on a frequency inverter. The upper speed limit is limited to 5000 rpm, please also refer to the "Backstop" (→ 🗎 471) chapter.

Motor size	Locking torque in Nm	Sprag lift-off speed in rpm	Maximum speed in rpm
DR.71	95	890	5000
DR.80	130	860	5000
DR.90	370	750	5000
DR.100	370	750	5000
DR.112	490	730	5000
DR.132	490	730	5000
DR.160	700	700	4500
DR.180	1400	610	4500
DR.200	2500	400	3500
DR.225	2500	400	3500
DR.250	2600	400	2600
DR.280	2600	400	2600
DR.315	6300	320	2500

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6.7 Bearings

6.7.1 Bearing types used

The standard motor bearings for sizes 71 – 225 are deep groove ball bearings, design 2Z-C3, on the A- and B-side.

2RS-C3 bearings are installed on the B-side for brakemotors up to motor size DR. 225.

If insufficient load values are achieved for axial and overhung loads with the deep groove ball bearings, cylindrical roller bearings (SEW designation /ERF) can be installed on the A-side instead of the deep groove ball bearings for motor sizes 250 – 315. The cylindrical roller bearings can only be used in connection with the relubrication device (SEW designation /NS).

To prevent destructive shaft currents during operation on the inverter, the standard deep groove ball bearings on the B-side for motor sizes 250 – 315 can be replaced with ball bearings with insulated bearing surface. The bearing sizes remain unchanged, but the designation changes to C3-EI or J-C3-EI.

The following tables display the bearing sizes used.

Motor type	A-side bearings		B-side bearings	
	Foot-mounted and/or Flange-mounted motor	Gearmotor	Motor	Brakemotor
DR.71	6204-2Z-J-C3	6303-2Z-J-C3	6203-2Z-J-C3	6203-2RS-J-C3
DR.80	6205-2Z-J-C3	6304-2Z-J-C3	6304-2Z-J-C3	6304-2RS-J-C3
DR.90/100	6306-2Z-J-C3		6205-2Z-J-C3	6205-2RS-J-C3
DR.112/132	6308-2Z-J-C3		6207-2Z-J-C3	6207-2RS-J-C3
DR.160	6309-2Z-J-C3		6209-2Z-J-C3	6209-2RS-J-C3
DR.180	6312-2Z-J-C3		6213-2Z-J-C3	6213-2RS-J-C3
DR.200/225	6314-2Z-J-C3		6214-2Z-J-C3	6214-2RS-J-C3

<table>
<tr><th rowspan="2">Motor type</th><th colspan="2">A-side bearings</th><th colspan="2">A-side bearings</th></tr>
<tr><th>Foot-mounted and/or Flange-mounted motor</th><th>Gearmotor</th><th>Foot-mounted and/or Flange-mounted motor</th><th>Gearmotor</th></tr>
<tr><td>DR.250</td><td rowspan="2" colspan="2">6317-2Z-C4</td><td rowspan="2" colspan="2">6315-2Z-C3</td></tr>
<tr><td>DR.280</td></tr>
<tr><td>DR.250../NS</td><td rowspan="2" colspan="2">6317-C4</td><td rowspan="4" colspan="2">6315-C3</td></tr>
<tr><td>DR.280../NS</td></tr>
<tr><td>DR.250../ERF/NS</td><td rowspan="2" colspan="2">NU 317 E C3</td></tr>
<tr><td>DR.280../ERF/NS</td></tr>
</table>

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<table>
<tr><th rowspan="2">Motor type</th><th colspan="2">A-side bearings</th><th colspan="2">A-side bearings</th></tr>
<tr><th>Foot-mounted and/or Flange-mounted motor</th><th>Gearmotor</th><th>Foot-mounted and/or Flange-mounted motor</th><th>Gearmotor</th></tr>
<tr><td>DR.315K
DR.315K../NS</td><td rowspan="4">6319-J-C3</td><td rowspan="2">6319-J-C3</td><td rowspan="4">6319-J-C3</td><td rowspan="2">6319-J-C3</td></tr>
<tr><td>DR.315S
DR.315S../NS</td></tr>
<tr><td>DR.315M
DR.315M../NS</td><td rowspan="2">6322-J-C3</td><td rowspan="2">6322-J-C3</td></tr>
<tr><td>DR.315L
DR.315L../NS</td></tr>
<tr><td>DR.315K../ERF/NS</td><td colspan="2" rowspan="4">NU 319 E</td><td rowspan="4">6319-J-C3</td><td rowspan="2">6319-J-C3</td></tr>
<tr><td>DR.315S../ERF/NS</td></tr>
<tr><td>DR.315M../ERF/NS</td><td rowspan="2">6322-J-C3</td></tr>
<tr><td>DR.315L../ERF/NS</td></tr>
</table>

6.8 Ventilation on the motor

6.8.1 Standard ventilation

The standard motor ventilation consists of a plastic fan that generates an air flow. The air is conducted directly onto and into the cooling fins on the motor's stator housing by the structural design of the fan guard and the fan grille. The fan guard consists of a galvanized sheet steel.

Free air access

The fan-cooled motors require adequate space behind the fan guard in order to draw in the air required for cooling. A distance of half the diameter of the fan guard is normally sufficient.

In order to inspect and maintain the brake, SEW-EURODRIVE recommends extending this distance to the full diameter of the fan guard for the brakemotor. This ensures that the fan guard can be removed in an axial direction.

When integrating a motor or brakemotor into a machine or system, ensure that the heated air is not immediately drawn back in.

Space required to disassemble the fan guard.

Motor size	Mounted brakes	Free space required	
		Axial for normal motor fan guards in mm	Axial for normal brakemotor fan guards in mm
DR.71	BE05 or BE1	70	139
DR.80	BE05, BE1 or BE2	80	156
DR.90	BE1, BE2 or BE5	90	179
DR.100	BE2 or BE5	100	197
DR.112	BE5 or BE11	115	221
DR.132	BE5 or BE11	115	221
DR.160	BE11 or BE20	135	270
DR.180	BE20, BE30 or BE32	160	316
DR.200	BE30, BE32, BE60 or BE62	200	394
DR.225	BE30, BE32, BE60 or BE62	200	394
DR.250	BE60, BE62, BE120 or BE122	255	510
DR.280	BE60, BE62, BE120 or BE122	255	510
DR.315	BE120 or BE122	315	624

6.8.2 Low noise fan guard

Low-noise fan guards (SEW designation /LN) are available for motor and brakemotor sizes DR.71 – 132, either as an option or as part of the design. The noise is reduced by 3 – 5 dB(A).

These guards are not available for encoder mounting and for forced cooling fans.

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The low-noise fan guard is part of the series production for:

- 2-pole motors in sizes DR.71 – 132,
- MOVIMOT® combinations in delta connection type.

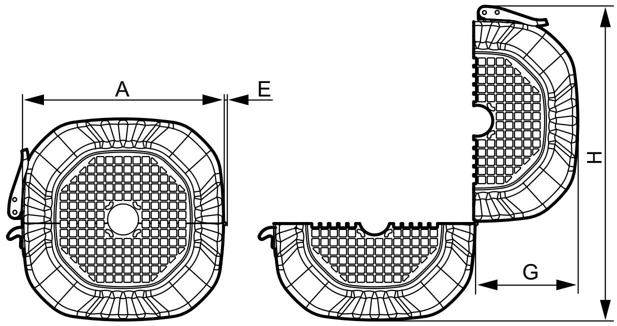
6.8.3 Axially separable fan guards on the brakemotor, brakemotor with encoder or with a second shaft end

Brake wear parts must be inspected and maintained on a cyclical basis for brakemotors. The information in the dimension sheets refers to the sufficient extra space in the axial direction in order to be able to remove the brakemotor fan guard.

If this space is not structurally possible in the system or machine due to the installation situation, the axially separable fan guard is an option that still allows the brake to be inspected. This special brakemotor fan guard design is available for motor sizes DR.71 – DR.225.

In this case, the brakemotor fan guard is split in half, please refer to the following diagram. The closing lever is normally positioned so it is aligned with the terminal box. Please contact SEW-EURODRIVE for different orientations.

When using the axially separable fan guards, please note that radial space is available for opening the guard, please refer to the following diagram.



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Motor size	Mounted brakes	Free space required	
		Axial for normal brakemotor fan guards in mm	Radial for separated brakemotor fan guards (A+E+G) × H in mm × mm
DR.71	BE05 or BE1	139	230 × 230
DR.80	BE05, BE1 or BE2	156	250 × 250
DR.90	BE1, BE2 or BE5	179	285 × 285
DR.100	BE2 or BE5	197	315 × 315
DR.112	BE5 or BE11	221	350 × 350
DR.132	BE5 or BE11	221	350 × 350
DR.160	BE11 or BE20	270	425 × 425
DR.180	BE20, BE30 or BE32	316	485 × 485
DR.200[1)]	BE30, BE32, BE60 or BE62	394	610 × 610
DR.225[1)]	BE30, BE32, BE60 or BE62	394	610 × 610

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Motor size	Mounted brakes	Free space required	
		Axial for normal brakemotor fan guards in mm	Radial for separa-ted brakemotor fan guards (A+E+G) × H in mm × mm
DR.250	BE60, BE62, BE120 or BE122	510	-
DR.280	BE60, BE62, BE120 or BE122	510	-
DR.315	BE120 or BE122	624	-

1) Please contact SEW-EURODRIVE when attaching the BE60/62 to the DR.200/225.

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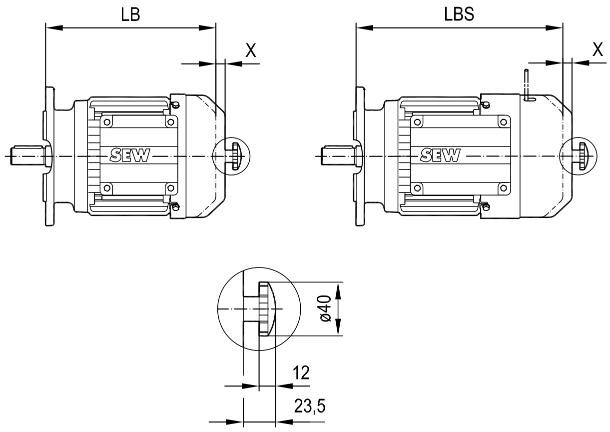
6.8.4 Air filter

In an environment with high amounts of dust or suspended particles, the air required to cool the motor blows these dirt particles around. In unfavorable conditions, this leads to the constant increase in particle deposits between the cooling fins, so that the dirt can no longer be blown away by the cooling air flow. In the worst case, the space between the cooling fins is completely filled and the motor is no longer cooled, resulting in the thermal risk that the motor may be destroyed.

In these cases, an air filter can prevent this swirling effect and the resulting damage to the motor. Conversely, the filtered particles must continuously be removed from the filter, as otherwise ventilation can no longer take place.

As a result, the air filter is fastened to the inner guard by an additional external guard using a single bolt.

When using an air filter, please consider the space required to remove the additional filter guard.



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Motor size	Mounted brakes	Free space required	
		Additional length X (LB or LBS, see dimension sheet) in mm	Axial for disassembling the attachment guard in mm
DR.71	BE05 or BE1	10	70
DR.80	BE05, BE1 or BE2	13	78
DR.90	BE1, BE2 or BE5	17	90
DR.100	BE2 or BE5	16	99
DR.112	BE5 or BE11	23	111
DR.132	BE5 or BE11	23	111

6.8.5 Non-ventilated motors – without fan

The improvements described in the "Air filter" (→ 🗎 152) chapter can also be achieved by not installing a fan. The lack of cooling means that the rated power in the sizes up to DR.225 has to be reduced to about 50% of the ventilated operation. The required power reduction is higher for sizes DR.250 and above.

In general, this means that the motor has to be two to three sizes larger for the same power output.

Please contact SEW-EURODRIVE to obtain the precise size.

The non-ventilated design is released from the efficiency provisions in all countries. As a result, non-ventilated motors are generally selected based on the DRS.. motor types.

6.8.6 Non-ventilated motors – closed B-side

An alternative to the non-ventilated motor (without fan) is the motor design for which the fan guard is not installed and the rotor is shortened so that the B-side endshield can be designed in a closed form.

Once again, the motor only has a rated power of about 50% of the ventilated operation for sizes up to DR.225. The required power reduction is also higher for sizes DR.250 and above.

This design is possible for sizes DR.71 – DR.280. Please contact SEW-EURODRIVE to obtain the precise size.

6.8.7 Canopy

If a vertical motor design with upright fan guard is installed in the system or machine, ensure that foreign bodies cannot penetrate through the fan grille into the fan wheel. Two options are available:

- structural measures in the system or the machine

  or

- the use of a canopy.

The canopy extends the motor or brakemotor. The specifications are provided in the "Dimension sheets" (→ 🗎 199) chapter.

Please contact SEW-EURODRIVE if there is the risk that parts may penetrate through the side of the canopy, between the fan guard and the canopy. A canopy with a different design may be a solution.

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6.9 Second shaft end

The motors are also available with a B-side shaft end. This so-called second shaft end is constructed with a traditional keyway and key in accordance with DIN 6885 Sheet 1 (ISO 773).

These are available in the following designs for the series:

- with a cover for motors/brakemotors DR.71 – DR.132
- without a cover for motors/brakemotors DR.160 – DR.315, as the diameter of the second shaft end is so large that damage during transport is unlikely.

  A cover can be ordered for these sizes as an additional option.

6.9.1 Standard design

The standard design of the second shaft end for motors is generally smaller than described in EN 50347 for each number of poles and power.

SEW-EURODRIVE has decided to take this path in order to meet the demand for combination with different brake sizes.

6.9.2 Reinforced design

The reinforced design of the second shaft end was developed as an alternative. This design considers the maximum possible dimension of the second shaft end and can only be combined with one brake size.

6.9.3 Second shaft end combinations with other design types

The second shaft end can be combined with the following design types and options.

Brakes

- With fields marked with "•": Standard design and reinforced design is possible for the second shaft end.
- Fields marked with "**x**": only possible with a standard design of the second shaft end.

	BE05	BE1	BE2	BE5	BE11	BE20	BE30	BE32
DR.71S	•	•						
DR.71M	•	•						
DR.80S	•	•	•					
DR.80M	x	x	•					
DR.90M		x	x	•				
DR.90L		x	x	•				
DR.100M			x	•				
DR.100L			x	•				
DR.100LC			x	•				
DR.112M				x	•			
DR.132S				x	•			
DR.132M				x	•			

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	BE05	BE1	BE2	BE5	BE11	BE20	BE30	BE32
DR.132MC				x	•			
DR.160S					x	•		
DR.160M					x	•		
DR.160MC					x	•		
DR.180S						x	•	•
DR.180M						x	•	•
DR.180L						x	•	•
DR.180LC							•	•
DR.200L							•	•
DR.225S							•	•
DR.225M							•	•
DR.225MC							•	•

Built-in encoder

Built-in encoders EI71, EI72, EI76 or EI7C can only be combined with the standard design of the second shaft end, not with the reinforced second shaft end.

Fan guards

The second shaft end can be combined with normal fan guards for motors and brakemotors or the separated fan guards for the brakemotor.

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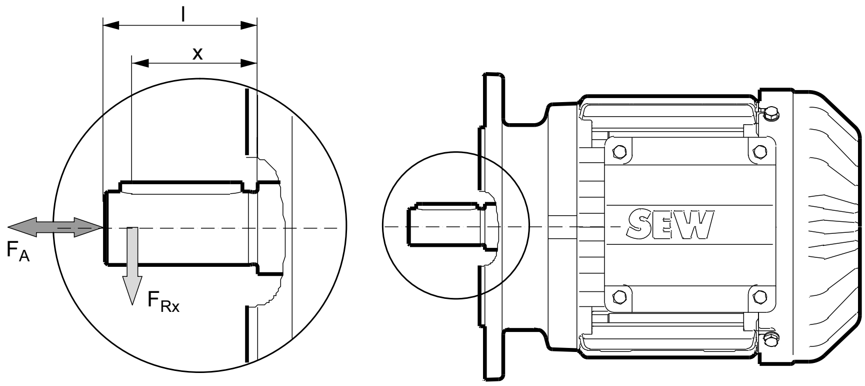
6.10 Overhung and axial loads

Refer to the following diagrams for the permitted overhung load F_{Rx} for AC motors/ brakemotors. In order to read the permitted overhung load from the diagram, you must know what the distance x is between the force application point of the overhung load F_R and the shaft shoulder.

All overhung load diagrams are designed for a bearing service life of 20000 hours. A detailed bearing service life calculations is available on request.

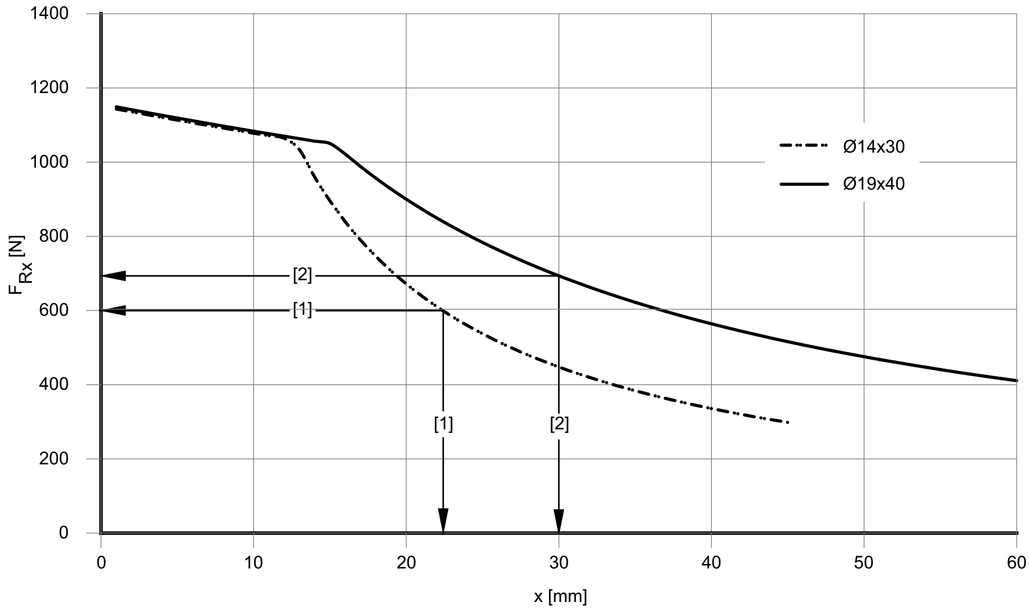
The following figure shows the point of force application of the overhung load F_{Rx} at point X.



3980490891

l	= Length of the shaft end
x	= Distance between overhung load application point and shaft shoulder
F_{Rx}	= Overhung load at force application point
F_A	= Axial force

The following diagram shows an example of how you can read the overhung load from the diagram:



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[1] Motor with shaft diameter 14 mm, force application x at 22 mm, permitted overhung load F_{Rx} = 600 N

[2] Motor with shaft diameter 19 mm, force application x at 30 mm, permitted overhung load F_{Rx} = 700 N

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During determining the overhung load, the transmission element factors f_Z must be considered. The transmission element factor depends on the used transmission element, such as gears, chains, V-belts, flat belts or toothed belts. When belt pulleys are used, the initial belt tension must be considered as well. The overhung loads F_R calculated with the transmission element factor must not exceed the permitted overhung load of the motor.

Transmission element	Transmission element factor f_Z	Comments
Direct drive	1.0	–
Gears	1.0	≥ 17 teeth
Gears	1.15	< 17 teeth
Sprockets	1.0	≥ 20 teeth
Sprockets	1.25	< 20 teeth
Narrow V-belt	1.75	Influence of the pre-tensioning force
Flat belt	2.50	Influence of the pre-tensioning force
Toothed belt	1.50	Influence of the pre-tensioning force
Gear rack	1.15	< 17 teeth (pinion)

The following equation is used to calculate the overhung load with the transmission element factor f_Z:

$F_R = f_z \times F_{Rx}$

6.10.1 Permitted overhung load – 2-, 4-, 6-, 12-pole motors

The permitted overhung loads for 2-, 4-, 6- and 12-pole motors are displayed in the individual size diagrams in the "Overhung load diagrams for 2-, 4-, 6- and 12-pole motors" (→ 🗎 159) chapter.

Only the sizes, not the design lengths, are displayed separately. The different shaft ends are shown as separate curves, parallel in the diagram, if available.

6.10.2 Permitted overhung load – pole-changing motors

The determined F_{Rx} value for the motors is multiplied by a factor of 0.8 in order to define the permitted overhung load $F_{Rx\text{-}DRx/y}$ for the relevant pole-changing motors.

$F_{Rx\text{-}DRx/y} = 0.8 \times F_{Rx}$

The assignment for the conversion is as follows:

- 2-pole motors are used for the
  - 4/2-pole motors with Dahlander winding
  - 8/2-pole motors with separate winding
- 4-pole motors are used for the
  - 8/4-pole motors with Dahlander winding

6.10.3 Permitted overhung load of DRL.. motors

The determined F_{Rx} value for the 4-pole DRL.. motors of the same size is multiplied by a factor of 0.8 in order to define the permitted overhung load $F_{Rx\text{-}DRL}$ for the 4-pole DRL.. motors.

$F_{Rx\text{-}DRL} = 0.8 \times F_{Rx}$

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6.10.4 Permitted overhung load of DRM.. motors

The permitted overhung loads for the 12-pole torque motors are identical to the overhung loads for the 6-pole motors, please refer to the "Overhung load diagrams for 2-, 4-, 6-, 12-pole motors" (→ 🗎 159).

6.10.5 Permitted axial load

The permitted axial load F_A is calculated by multiplying the determined overhung load F_{Rx} by a factor of 0.2 for all DR.. series motor types:

- $F_A = 0.2 \times F_{Rx}$

The axial load F_A can load the motor's shaft end at the same time as the calculated overhung load F_R.

6.10.6 Overhung and axial loads at the second shaft end

The "Overhung load diagrams for 2-, 4-, 6-, 12-pole motors" (→ 🗎 159) also displays the diagrams for the permitted overhung loads at the second shaft end for every motor size. A distinction is made between motors and brakemotors as well as between standard and reinforced second shaft ends.

Axial loads at the second shaft end may not exceed the information from the "Permitted axial load" (→ 🗎 158) chapter based on a directional addition.

6.10.7 Torques and duty types

The customer's motor shaft and bearings are designed for the overhung and axial loads in the following diagrams in this chapter. The information is based on the nominal speed n_N and the superimposed nominal torque M_N in S1, S2 and S3 motor operation.

The second shaft end of the motor, shown as /2W in the diagrams, can transfer a maximum of the motor's nominal torque M_N in S1 operation.

If conditions occur which are not considered in the descriptions or diagrams in this chapter, consult SEW-EURODRIVE.

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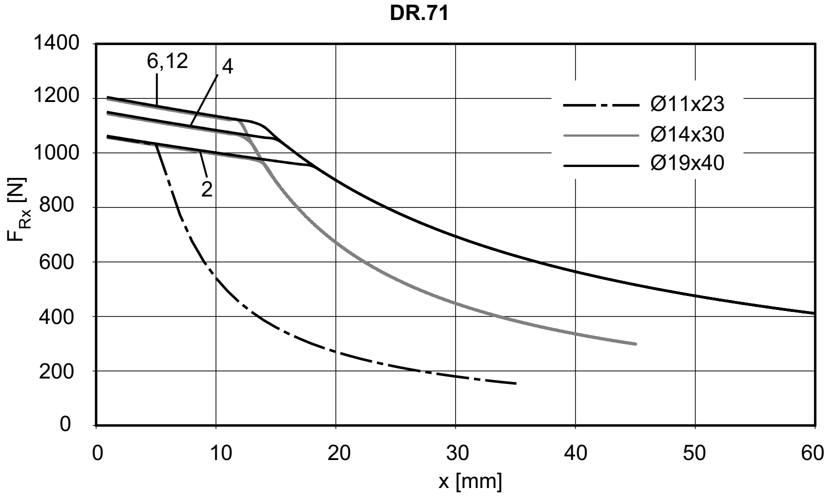
6.10.8 Overhung load diagrams for 2-, 4-, 6-, 12-pole motors

Overhung load diagram for DR.71

Overhung load diagrams for 2-, 4-, 6-, 12-pole DR.71 motors:



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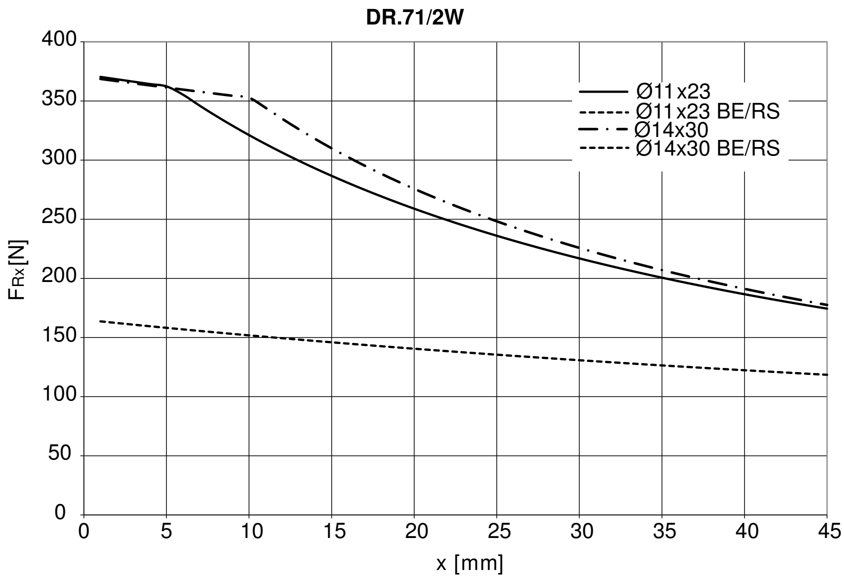
2: 2-pole 4: 4-pole 6, 12: 6- and 12-pole

Overhung load diagram for DR.71 at the second shaft end

Overhung load diagram for 2-, 4-, 6-, 12-pole DR.71 motors at the second shaft end:



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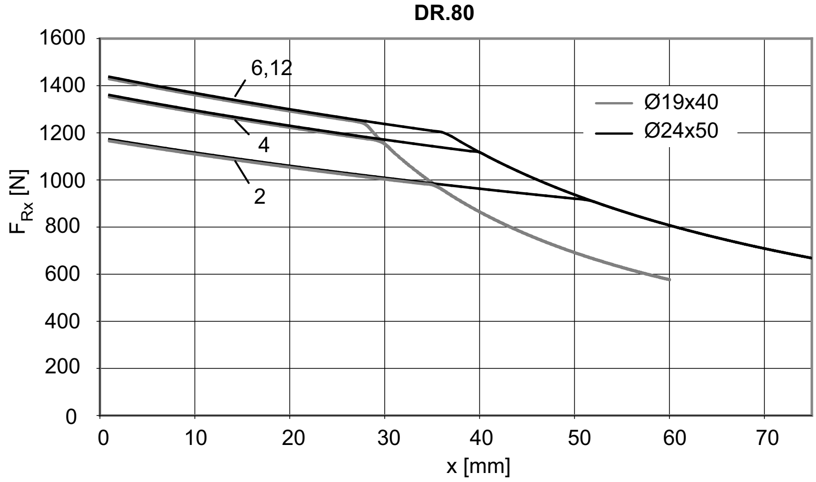
Overhung load diagram for DR.80

Overhung load diagram for 2-, 4-, 6-, 12-pole DR.80 motors:

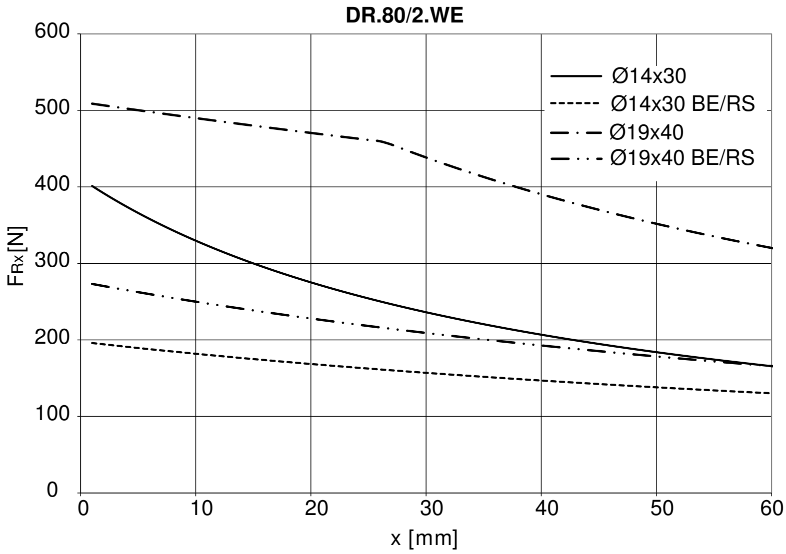


9007203235245707

2: 2-pole 4: 4-pole 6, 12: 6- and 12-pole

Overhung load diagram for DR.80 at the second shaft end

Overhung load diagram for 2-, 4-, 6-, 12-pole DR.80 motors at the second shaft end:



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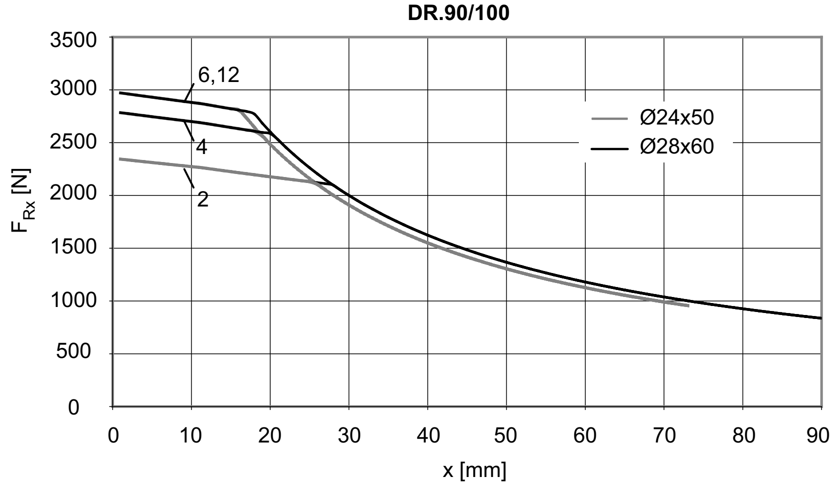
Overhung load diagram for DR.90 and DR.100

Overhung load diagram for 2-, 4-, 6-, 12-pole DR.90 and DR.100 motors:

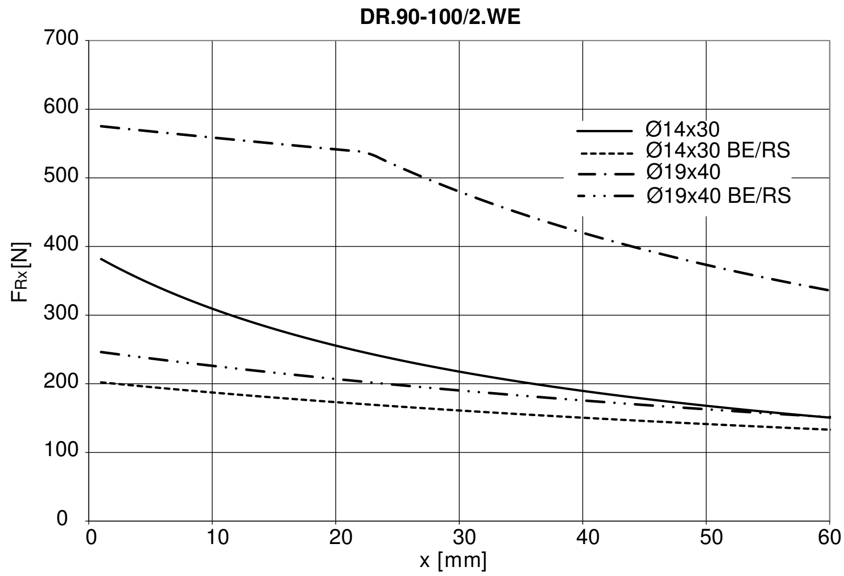


9007203235251083

2: 2-pole 4: 4-pole 6, 12: 6- and 12-pole

Overhung load diagram for DR.90 and DR.100 at the second shaft end

Overhung load diagram for 2-, 4-, 6-, 12-pole DR.90 and DR.100 motors at the second shaft end:



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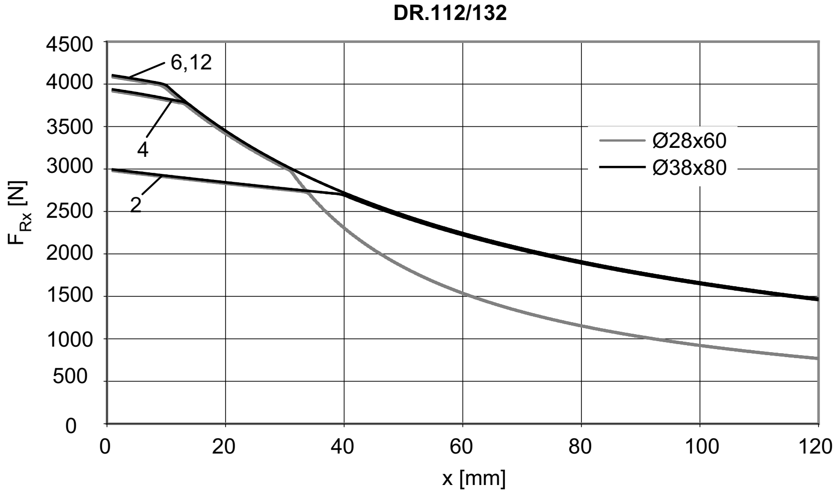
Overhung load diagram for DR.112 and DR.132

Overhung load diagram for 2-, 4-, 6-, 12-pole DR.112 and DR.132 motors:

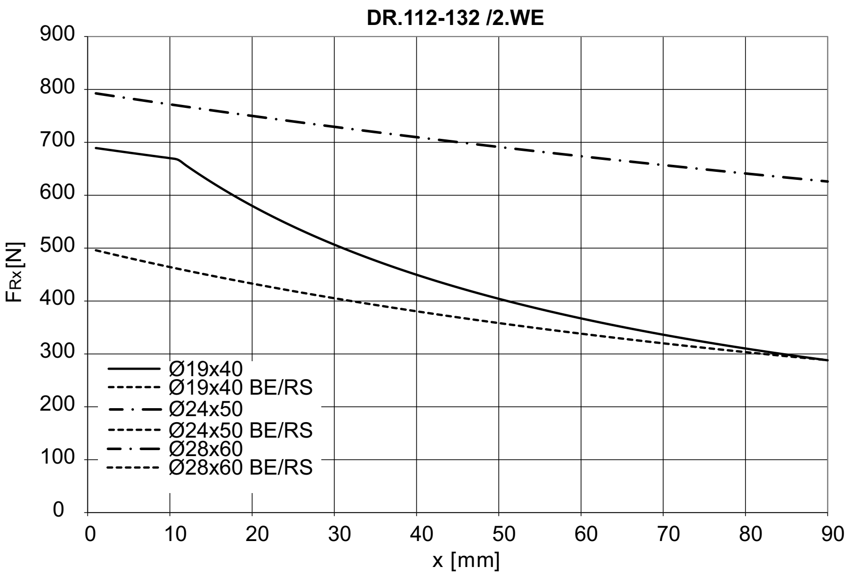


9007203235256459

2: 2-pole 4: 4-pole 6, 12: 6- and 12-pole

Overhung load diagram for DR.112 and DR.132 at the second shaft end

Overhung load diagram for 2-, 4-, 6-, 12-pole DR.112 and DR.132 motors at the second shaft end:



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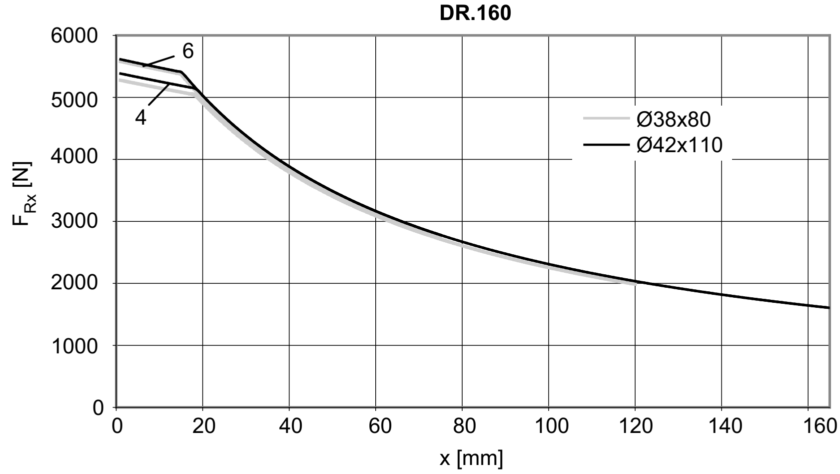
Overhung load diagram for DR.160

Overhung load diagram for 4- and 6-pole DR.160 motors:



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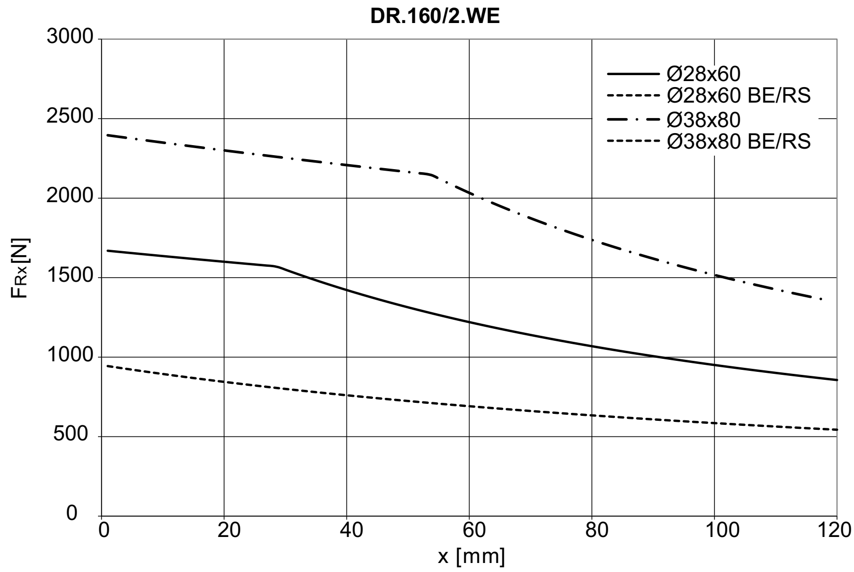
4: 4-pole 6: 6-pole

Overhung load diagram for DR.160 at the second shaft end

Overhung load diagram for 4- and 6-pole DR.160 motors at the second shaft end:



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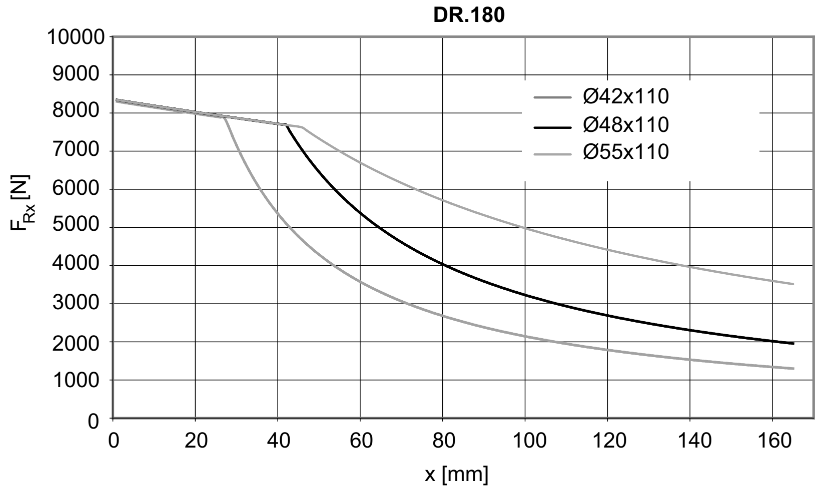
Overhung load diagram for DR.180

Overhung load diagram for 4-pole DR.180 motors:



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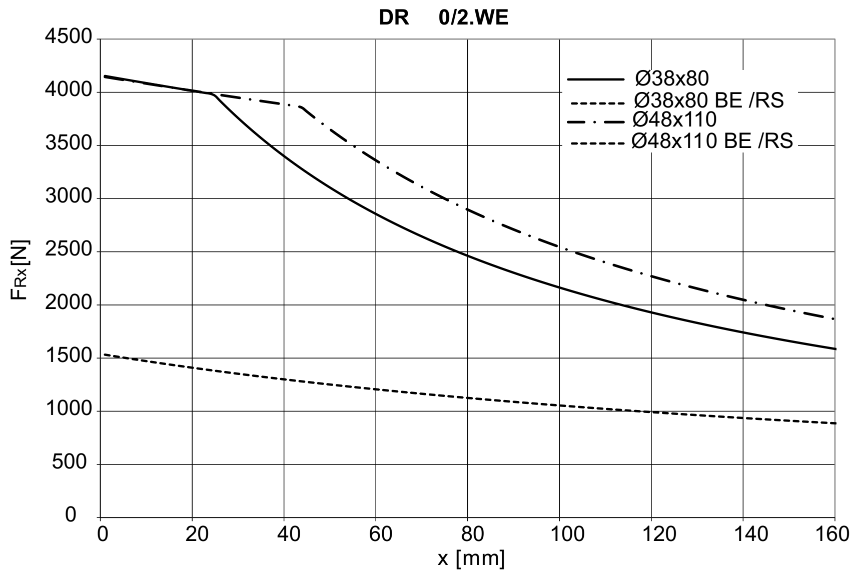
Overhung load diagram for DR.180 at the second shaft end

Overhung load diagram for 4-pole DR.180 motors at the second shaft end:



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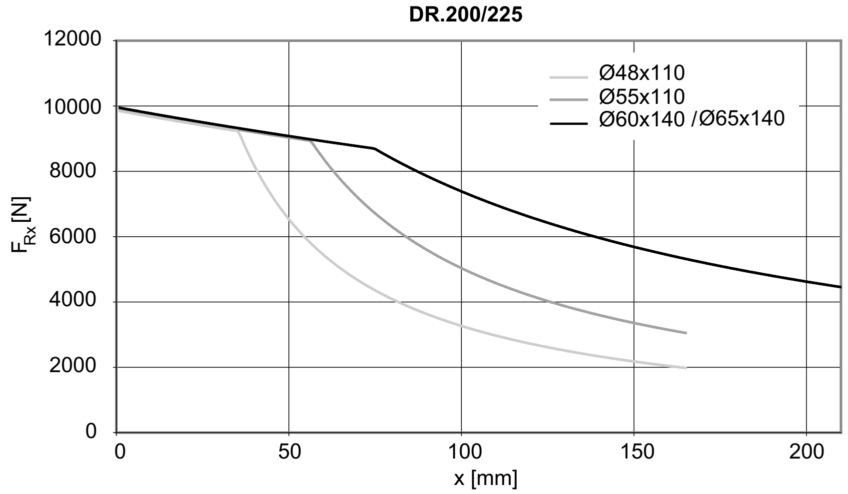
Overhung load diagram for DR.200 and DR.225

Overhung load diagram for 4-pole DR.200 and DR.250 motors:



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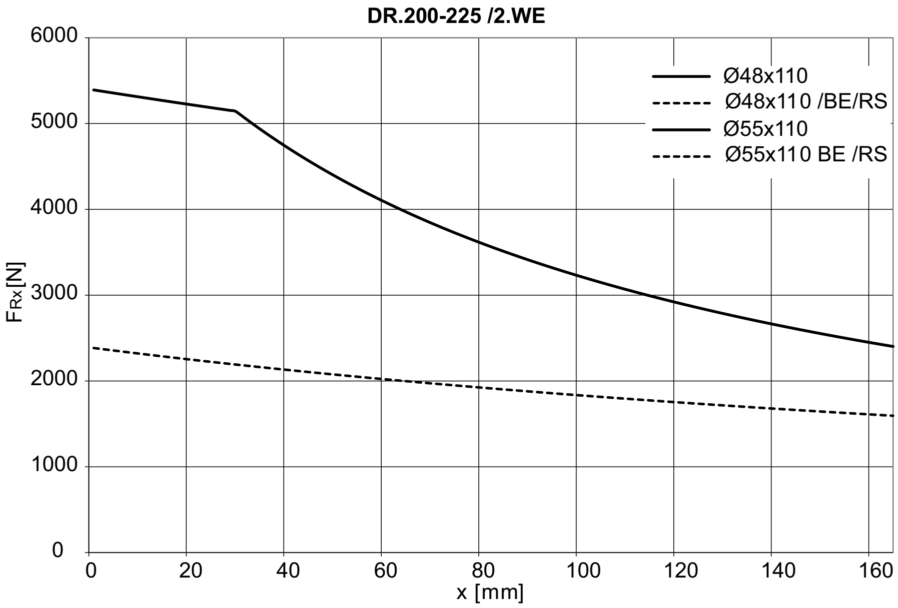
Overhung load diagram for DR.200 and DR.225 at the second shaft end

Overhung load diagram for 4-pole DR.200 and DR.225 motors at the second shaft end:



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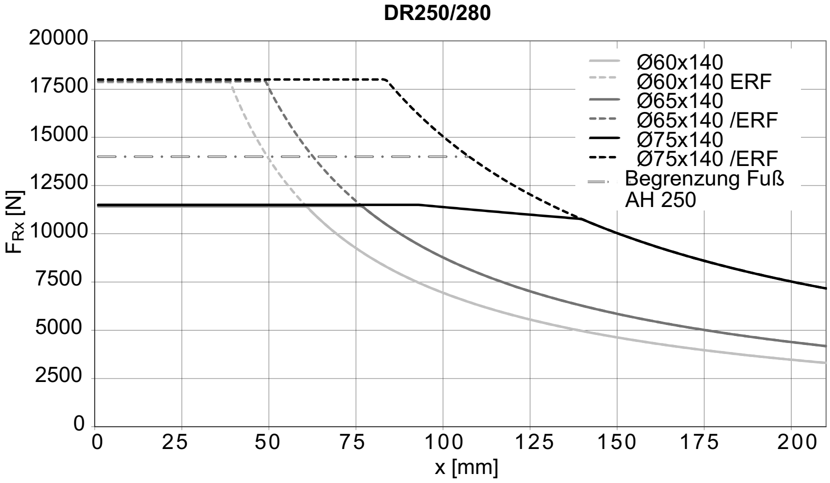
Overhung load diagram for DR.250 and DR.280

Overhung load diagram for 4-pole DR.250 and DR.280 motors:



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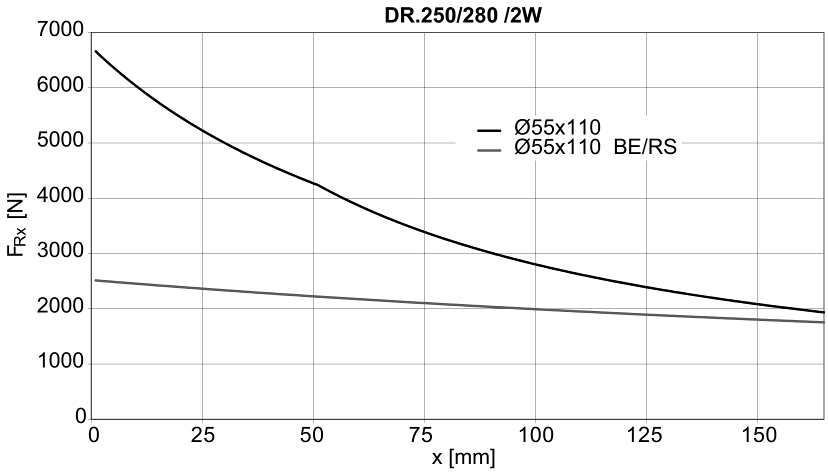
Overhung load diagram for DR.250 and DR.280 at the second shaft end

Overhung load diagram for 4-pole DR.250 and DR.280 motors at the second shaft end:



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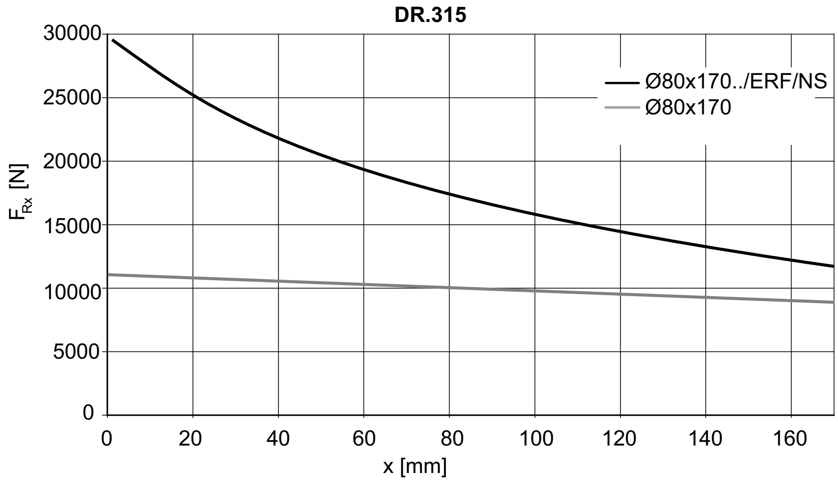
Overhung load diagram for DR.315

Overhung load diagram for 4-pole DR.315 motors:



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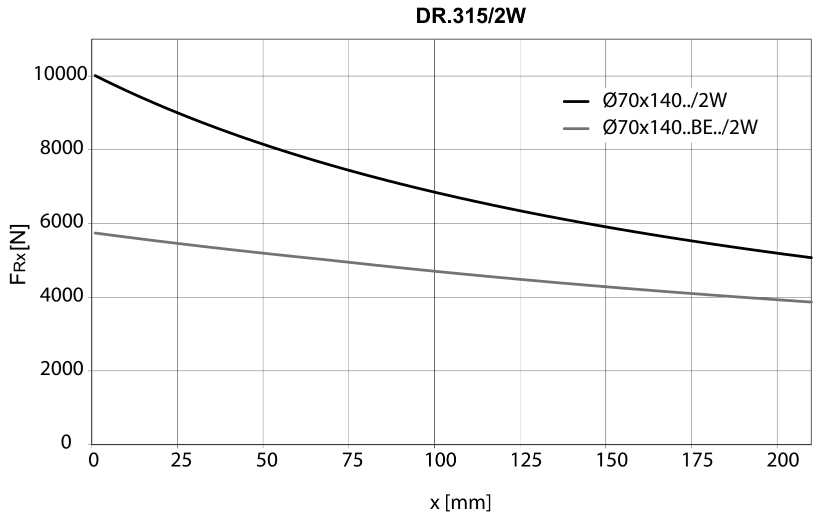
INFORMATION

The conversion of the overhung load into the axial load (→ 🗎 158) must not be used with reinforced bearings (../ERF).

The standard bearing value (lower curve) at point x is used for the conversion instead of the value for /ERF (upper curve).

Overhung load diagram for DR.315 at second shaft end

Overhung load diagram for 4-pole DR.315 motors at the second shaft end:



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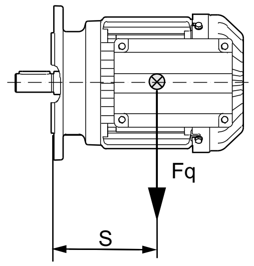
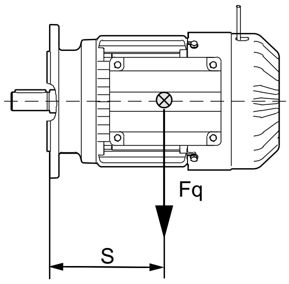
6.11 Center of gravity of motors

The center of gravity of a motor is a theoretical variable which assumes that the entire mass of the motor is concentrated in one point and acts on this point with the weight F_q. The mass of the motor can be found in the chapter "Technical motor data" (→ 🗎 91).

The center of gravity of the motor must also be taken into account when combining gear units with flange motors and, if applicable, with feet attached with the aid of adapters.

Motor type	Center of gravity S in mm	Brakemotor type	Brake	Center of gravity S in mm
 Fq S 3980543755		 Fq S 3980546443		
DR.71S	86	DR.71S	BE05	108
DR.71M	92	DR.71M	BE1	112
DR.80S	106	DR.80S	BE1	148
DR.80M	119	DR.80M	BE2	150
DR.90M	118	DR.90M	BE2	142
DR.90L	124	DR.90L	BE5	151
DR.100M	137	DR.100M	BE5	165
DRP100M	140			
DR.100L / LC	153	DR.100L / LC	BE5	180
DR.112M	153	DR.112M	BE5	179
DR.132S	167	DR.132S	BE11	202
DR.132M / MC	193	DR.132M / MC	BE11	226
DR.160S	205	DR.160S	BE20	265
DR.160M / MC	205	DR.160M / MC	BE20	255
DR.180S	224	DR.180S	BE20	287
DR.180M	224	DR.180M	BE30	302
DR.180L	237	DR.180L	BE32	321
DR.180LC	237	DR.180LC	BE32	318
DR.200L	228	DR.200L	BE32	340
DR.225S	250	DR.225S	BE32	340
DR.225M	264	DR.225M	BE32	363
DR.225MC	264	DR.225MC	BE32	354
DR.250M	321	DR.250M	BE62	420
DR.280S	341	DR.280S	BE62	433
DR.280M	341	DR.280M	BE122	442
DR.315K / S	419	DR.315K / S	BE122	489
DR.315M / L	505	DR.315M / L	BE122	550

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6.12 Drive selection – non-controlled motor

The following flow diagram illustrates the project planning procedure for a non-controlled drive. The drive consists of a gearmotor operated on the grid.

6.12.1 Flow diagram

Necessary information on the machine to be driven
- Technical data and environmental conditions
- Positioning accuracy
- Speed setting range
- Calculation of the travel cycle

↓

Calculation of the relevant application data
- Travel diagram
- Speeds on 50 Hz or 60 Hz supply system
- Static, dynamic torques
- Regenerative power

↓

Gear unit selection
- Define gear unit size, gear unit ratio, and gear unit type
- Check positioning accuracy
- Check gear unit utilization ($M_{a\ max} \geq M_{a\ (t)}$)
- Check input speed (churning losses)

↓

Motor selection
- Maximum torque
- With dynamic drives: effective torque at medium speed
- Maximum speed
- Determine energy efficiency class IE
- Observe dynamic and thermal torque curves
- Select the correct encoder
- Motor equipment (brake, plug connector, thermal motor protection, etc.)

↓

Braking resistor selection
- Based on the calculated regenerative power, cdf, and peak breaking power.

↓

Make sure that all requirements have been met.

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6.12.2 Drive selection for pole-changing motors

The following windings are distinguished for pole-changing motors:

- Separate winding: 8/2-pole DRS.. motors
- Dahlander winding: 4/2, 8/4-pole DRS.. motors

Description of switching torque

The functioning of the switchover from the 2-pole to the 8-pole winding is explained on the basis of the 8/2 pole motor.

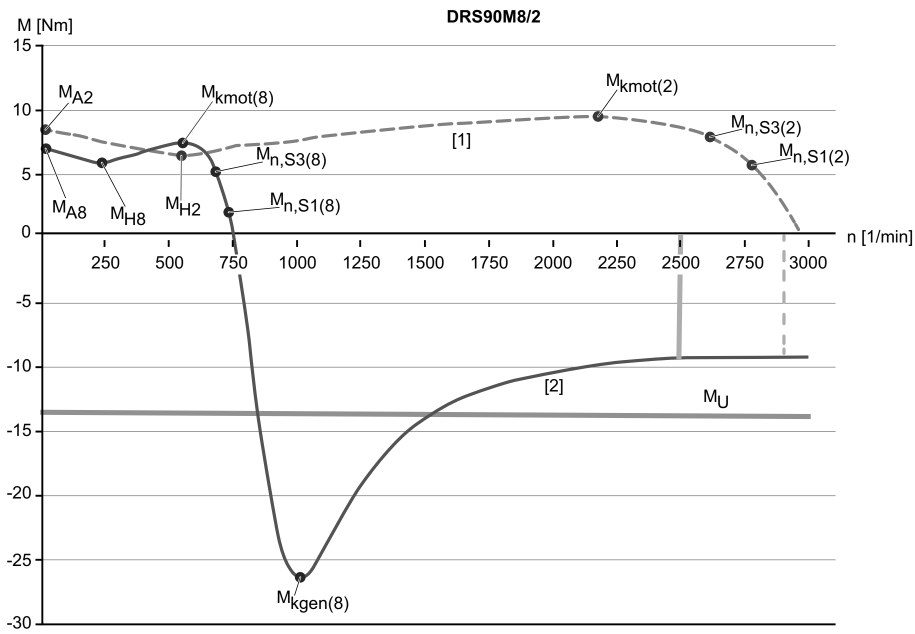
If the 8-pole winding is connected to the supply system from the operation of the 2-pole speed, with virtually no period of no-load operation, the motor briefly functions as a generator due to the above-synchronous speed. The transformation of kinetic energy into electrical energy decelerates it to the lower speed in a low-loss, wear-free manner.

To be able to calculate the mean switching torque as a first approximation, the available kinematic data is employed.

$M_U = f_U \times M_{A8}$

M_U =	geometrically averaged switching torque from high to low speed in Nm.
M_{A8} =	starting torque in low speed in Nm.
f_U =	averaged factor of 8-pole winding's regenerative torque curve.

If the switching torque is too high, SEW-EURODRIVE recommends the use of the WPU smooth-pole change unit.



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[1]	Characteristic curve: 2-pole	M_{kmot} =	motor breakdown torque
[2]	Characteristic curve: 8-pole	M_{kgen} =	regenerative breakdown torque
M_{A8} =	starting torque: 8-pole	M_H =	acceleration torque
M_{A2} =	starting torque: 2-pole	M_U =	mean switching torque from high to low speed

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M_U values of 8/4 pole motors (S1)

The following table shows the factors f_U and the MU torques of the 8/4-pole motors.

Motor type	M_{A8} in Nm	f_U	M_U in Nm
DRS71S8/4	2.3	2.4	5.5
DRS71M8/4	3.8	2.4	9.1
DRS80M8/4	5.3	2.3	12.3
DRS90M8/4	8.5	2.2	18.6
DRS90L8/4	10.8	2.2	23.8
DRS100M8/4	15.5	2.0	31.0
DRS100L8/4	21.3	2.0	42.5
DRS112M8/4	32.3	2.0	64.6
DRS132S8/4	45.0	2.0	90.0
DRS132M8/4	56.0	2.0	112
DRS160S8/4	74.8	2.0	150
DRS160M8/4	99.4	2.0	199
DRS180S8/4	158	2.0	316
DRS180L8/4	234	2.0	468
DRS200L8/4	343	2.0	686
DRS225S8/4	455	2.0	910
DRS225M8/4	557	2.0	1114

M_U values of 8/2 pole motors

The following table shows the factors f_U and the M_U torques of the 8/2-pole motors.

Motor type (S3/40/60%)	M_{A8} in Nm	f_U	M_U in Nm
DRS71S8/2	1.42	2.1	2.98
DRS71M8/2	2.29	2.5	5.72
DRS80S8/2	3.26	2.3	7.49
DRS80M8/2	5.25	2.1	11.0
DRS90M8/2	5.64	2.3	13.0
DRS90L8/2	8.36	1.8	15.0
DRS100M8/2	12.0	1.8	21.6
DRS112M8/2	16.2	1.8	29.2
DRS132M8/2	22.2	2.2	48.8

Motor type (S1)	M_{A8} in Nm	f_U	M_U in Nm
DRS71S8/2	1.04	2.1	2.19
DRS80S8/2	3.26	2.3	7.49
DRS80M8/2	5.25	2.1	11.0
DRS90L8/2	7.47	1.8	13.5
DRS100M8/2	10.0	1.8	18.0
DRS132M8/2	22.2	2.2	48.8

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M_U values of 4/2 pole motors

The following table shows the factors f_U and the M_U torques of the 4/2-pole motors.

Motor type	M_{A4} in Nm	f_U	M_U in Nm
DRS71S4/2	2.57	3.1	7.95
DRS71M4/2	4.43	3.1	13.7
DRS80M4/2	10.1	3.4	34.4
DRS90M4/2	14.7	3.3	48.5
DRS90M4/2	19.1	3.3	63.0
DRS100M4/2	27.0	3.5	94.5
DRS100L4/2	37.6	3.5	132
DRS132S4/2	39.1	2.0	78.1
DRS132M4/2	54.9	2.0	110
DRS160S4/2	97.5	2.0	195
DRS160M4/2	126	2.0	253
DRS180L4/2	219	2.0	440
DRS180L4/2	288	2.0	575

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6.13 Drive selection – global motor

When selecting a global motor, the following properties should be taken into account.

6.13.1 Gear unit reduction ratios for the global motor

The global motor is supplied with the electrical specifications for 50 Hz and 60 Hz. If the motor is combined with an additional transmission or a gear unit, it should be noted that the reduction ratio is generally only determined for one of the two frequencies.

If the reduction ratio is calculated for 50 Hz and the gear unit configured accordingly, this results in the behavioral changes described in the chapter "50 Hz motors on 60 Hz supply systems" (→ 🗎 127) when operated on a 60 Hz system.

If operation on the 60 Hz supply system represents the initial situation, the ratios from the chapter "50 Hz motors on 60 Hz supply systems" (→ 🗎 127) are reversed.

These ratio changes must be taken into account when designing machines and systems.

6.13.2 Identification of degrees of protection

SEW-EURODRIVE classifies the motor degrees of protection according to the international standard IEC 60034-5; see chapter "Degrees of protection to EN/IEC 60034-5" (→ 🗎 139).

In North America, on the other hand, identification of a different degree of protection is required by the relevant standards.

The degree of protection is represented by an abbreviation made up of four characters. In the case of the global motor, SEW-EURODRIVE employs the following identifications and includes this information on the nameplate.

Abbreviation	English designation	German translation
TEFC	Totally Enclosed Fan Cooled	völlig geschlossen, Lüfter gekühlt
TEBC	Totally Enclosed Blower Cooled	völlig geschlossen, Fremdlüfter gekühlt

In NEMA MG1, degrees of protection IP54 to IP66 are all classified as fully enclosed.

6.13.3 Voltage tolerances

If multiple voltages are included on a motor nameplate, the actual limit values and tolerances must be considered.

The motor standard IEC 60034 comprises two tolerance ranges. If no tolerance is specified on the nameplate, a voltage tolerance of ± 5% applies. For more information, refer to the chapter "Motor standard IEC 60034" (→ 🗎 25).

The voltages in 50 Hz supply systems are generally based on the standard IEC 38. Here, the tolerance range is ±10%.

In 60 Hz systems, the usual tolerance is ±10 % and normally indicated without additional information on the nameplate.

In order to implement motor and supply system standards for products such as the global motor, the voltage range was created.

The specification of an upper and lower voltage, each with a ± 5% tolerance, results in a combined tolerance of ± 10% for the median voltage.

This procedure is employed for the tolerances of the voltage blocks specified in the chapter "Global motor" (→ 🗎 45).

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6.13.4 Global motor with brake

In many drive situations and applications, it is sufficient to tap the brake voltage from the supply voltage of the motor.

If the motor is configured for the 50 Hz and 60 Hz voltage range, the brake voltage covers a very large range.

As described in the chapter "Brake voltage" (→ 🗎 126), the brake must not be released at the upper voltages in these cases without activating the motor in order to cool the brake with the motor cooling air.

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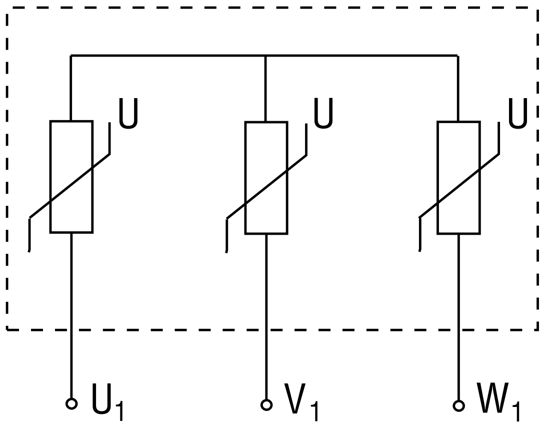
6.14 Drive selection – DRM.. torque motors

6.14.1 Special aspects of torque motors and low-speed motors

Due to the design of torque motors and low-speed motors, very high induction voltages may be generated when they are switched off. SEW-EURODRIVE recommends using the varistor circuit shown below for protection. The size of the varistors depends, amongst other factors, on the starting frequency. This must be taken into account during project planning.



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The varistor protection circuit can be obtained from SEW-EURODRIVE. Please specify the desired starting frequency with your order.

6.14.2 R13 wiring diagram

The conventional torque motor operation is measured in a star connection in S1 continuous duty.

If the same torque motor is used in a delta connection, the usual factor of 3 for AC motors no longer applies due to the weak magnetic field saturation of the star connection. The influence of the magnetic stray fields in the star or delta connection is no longer proportional. As a result, the torque motor in the delta connection develops a higher torque than that produced by the factor of 3. In return, the operating time must be reduced to S3/15%.

Alternatively, the reduction of the operating time can be compensated by means of a forced cooling fan.

6.14.3 R23 wiring diagram

For applications that use the two connection types star and delta alternately and must not have more than the 3 times the torque of the star connection in the delta connection, SEW-EURODRIVE offers the connection type R23. Only part of the winding is activated in the case of the delta connection.

Please consult SEW-EURODRIVE if necessary.

6.14.4 Restrictions due to combinations with options and variations

As a result of the non-ventilated operation, the components and component parts of the torque motors are subject to greater thermal stress at a standstill than a normal AC motor.

Therefore, all variations and options that cannot be subjected to high thermal loads must be excluded from the combination with torque motors.

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These include:

- The backstop: The grease used within the backstop to ensure the mobility of the blocking bodies reaches impermissibly high temperatures, which can affect the torque motor when at a standstill.
- The EI7 built-in encoders: When used with a torque motor, the installation space before the fan and behind the B-side flange is heated to a point that the electronic components of the sensor technology may be damaged.
- The EI7 built-in encoders are only approved for use in combination with the optional /V forced cooling fan. Without additional cooling, the rise in temperature before the fan and behind the B-side flange is too high.
- The add-on encoders with direct shaft-shaft connection: Due to the transfer of heat energy from the rotor to the shaft of the encoder, the latter reaches impermissibly high temperatures. The use of a coupling for the encoder mounting, as a means of interrupting the heat transfer, is permitted.
- The thermal class 180 (H): Use of the thermal class 180 (H) would stress the gaskets, bearings, and bearing lubricants beyond the permitted temperature thresholds.

6.14.5 Flow diagram

The following diagram illustrates the basic drive selection process for a geared torque motor.

INFORMATION

SEW-EURODRIVE recommends the use of a /TF temperature sensor in duty type S3/15% cdf or when operated with a /V forced cooling fan.

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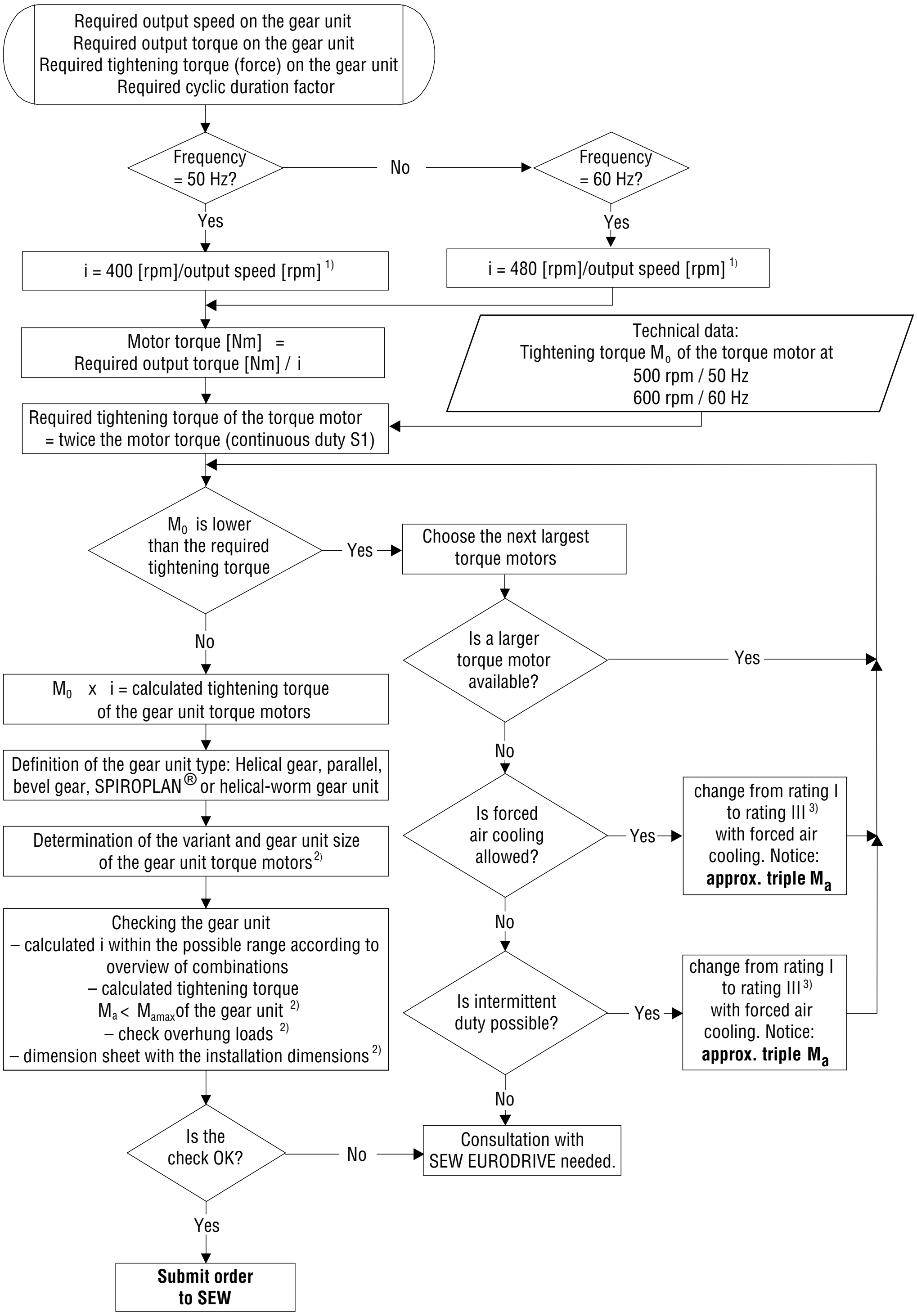

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1) The speeds of 400 and 480 rpm during operation with approx. half the initial torque only serve to calculate the required gear ratio

2) See "Geared torque motor" catalog

3) **Rating I**: duty type S1/100% cdf;

Rating II: duty type S3/15% cdf: 3x to 5x standstill torque (R13)

Rating III: duty type S3/15% cdf: 3x standstill torque (R23)

Rating IV: duty type S1 with /V forced cooling fan

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6.15 Drive selection – controlled motor

6.15.1 Flow diagram

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

Necessary information on the machine to be driven
- Technical data and environmental conditions
- Positioning accuracy
- Speed setting range
- Calculation of the travel cycle

↓

Calculation of the relevant application data
- Travel diagram
- Speeds on 50 Hz or 60 Hz supply system
- Static, dynamic torques
- Regenerative power

↓

Gear unit selection
- Define gear unit size, gear unit ratio, and gear unit type
- Check positioning accuracy
- Check gear unit utilization ($M_{a\ max} \geq M_{a\ (t)}$)
- Check input speed (churning losses)

↓

Motor selection
- Maximum torque
- With dynamic drives: effective torque at medium speed
- Maximum speed
- Determine the necessary energy efficiency class IE
- Observe dynamic and thermal torque curves
- Select the correct encoder based on the required positioning
- Motor equipment (brake, plug connector, thermal motor protection, etc.)

↓

Inverter selection
- Motor/inverter assignment
- Continuous current and peak current for current-controlled inverters/axes

↓

Braking resistor selection
- Based on the calculated regenerative power, cdf
- Based on the cyclic duration factor and peak braking power

↓

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Options

- EMC measures
- Operation/communication
- Additional functions

↓

Make sure that all requirements have been met.

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6.15.2 Inverter operation in VFC and VFC-n mode

SEW frequency inverter range

The extensive product range of SEW-EURODRIVE inverters is available for designing electronically controlled drives.

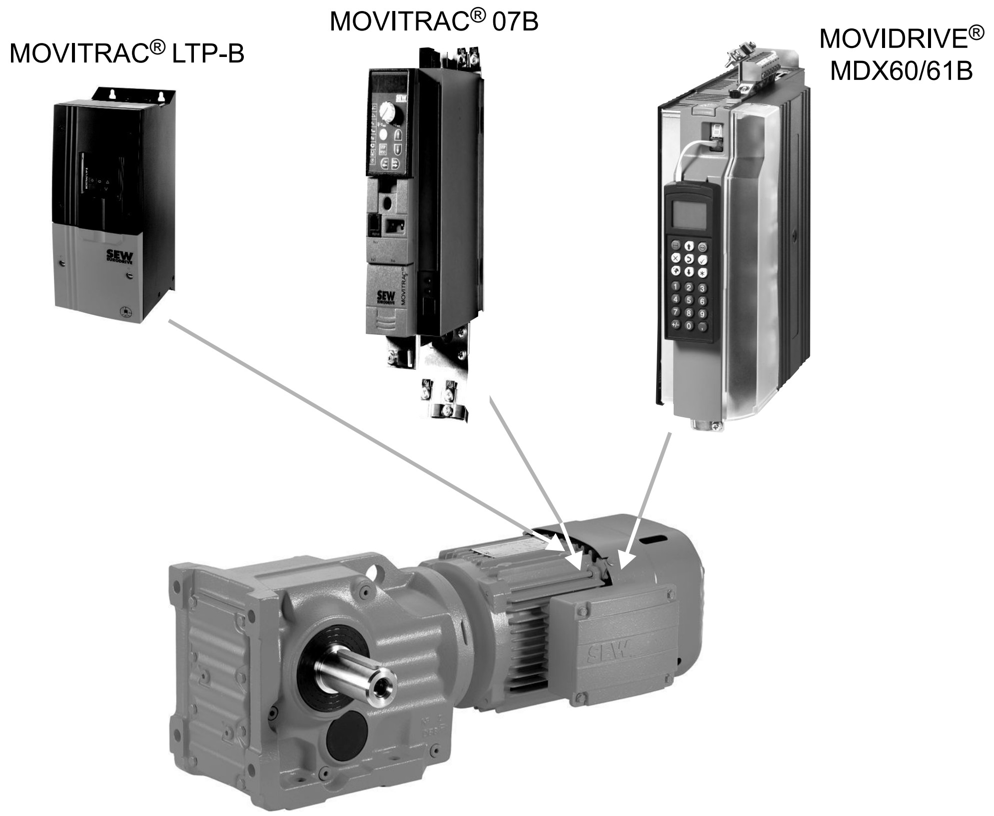
The following inverters are available for voltage-controlled flux vector control (VFC):

- **MOVITRAC® LTP-B:** Simple and inexpensive frequency inverter for the 0.75 – 160 kW power range. Single-phase line connection for 230 V AC (up to 2.2 kW power rating) and three-phase 200 – 240 V AC / 380 – 480 V AC / 500 – 600 V AC (as of 0.75 kW power rating).
- **MOVITRAC® 07B:** Compact and inexpensive frequency inverter for the 0.25 – 160 kW power range. Single-phase and three-phase line connection for 230 V AC and three-phase line connection for 400 – 500 V AC.
- **MOVIDRIVE® MDX60/61B:** High-performance drive inverter for dynamic drives in the 0.55 – 250 kW power range. Great diversity of applications due to extensive expansion options with technology and communication options. Three-phase line connection for 230 V AC and 400 – 500 V AC.

The following inverter is available for voltage-controlled flux vector control with speed feedback (VFC-n):

- **MOVIDRIVE® MDX60/61B:** High-performance drive inverter for dynamic drives in the 0.55 – 250 kW power range. Great diversity of applications due to extensive expansion options with technology and communication options. Three-phase line connection for 230 V AC and 400 – 500 V AC

The DRS.., DRE.., DRP.. AC motors can be operated with the inverters listed above.



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Product characteristics of inverters

The following table lists the most important product characteristics for the various inverter series. You can choose the inverter series matching your application based on these product characteristics.

Product characteristics	MOVITRAC® LTP-B	MOVITRAC® 07B	MOVIDRIVE® MDX60/61B
Voltage range	1 × 200 – 240 V AC (0.75 to 2.2 kW) 3 × 200 – 240 V AC (0.75 to 75 kW) 3 × 380 – 480 V AC (0.75 to 160 kW) 3 × 500 – 600 V AC (0.75 to 110 kW)	1 × 200 – 240 V AC (limited power range) 3 × 200 – 240 V AC (limited power range) 3 × 380 – 500 V AC	3 × 200 – 240 V AC (limited power range) 3 × 380 – 500 V AC
Power range	0.75 – 15 kW (IP20) 0.75 – 160 kW (IP55)	0.25 – 75 kW	0.55 – 250 kW
Nominal current range of the axis modules	–		4 – 250 A
Overload capacity	150% I_N for 60 seconds 175% I_N for 2 seconds	150% I_N [1] briefly and 125% I_N continuously in operation without overload	
4Q capable	Yes, with integrated brake chopper as standard.		
Integrated line filter	At 1 × 200 – 240 V AC: according to limit value class B At 3 × 200 – 240 V AC and 3 × 380 – 480 V AC: according to limit value class A	At 1 × 200 – 240 V AC: according to limit value class B At 3 × 200 – 240 V AC and 3 × 380 – 500 V AC: according to limit value class A for sizes 0, 1, and 2	According to limit value class A for sizes 0, 1, and 2
TF input	Yes		
Control modes	U/f or voltage-controlled flux vector control (VFC)	U/f or voltage-controlled flux vector control (VFC)	U/f or voltage-controlled flux vector control (VFC), with speed feedback speed control and current-controlled flux vector control (CFC).
Speed feedback	Option in preparation	No	Option
Integrated positioning and sequence control system	No	No	Standard
Serial interfaces	System bus (SBus) and RS485		

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Product characteristics	MOVITRAC® LTP-B	MOVITRAC® 07B	MOVIDRIVE® MDX60/61B
Fieldbus interfaces	CANopen, Modbus RTU, optional via gateway PROFIBUS, EtherCAT®, PROFINET, DeviceNet, Ethernet/IP	Optional via gateway PROFIBUS, INTERBUS, CANopen, DeviceNet, Ethernet	Optional PROFIBUS-DP, INTERBUS, INTERBUS LWL, CANopen, DeviceNet, Ethernet
Technology options	No	IEC-61131 control	Input/output card Synchronous operation Absolute encoder card IEC-61131 control
Max. speed	30,000 rpm at 500 Hz	5,500 rpm	6,000 rpm
STO – Safe Torque Off	Yes	Yes	Yes
Approvals	UL and cUL approval, C-Tick		

1) Only for MOVIDRIVE® MDX60/61B: The temporary overload capacity of size 0 units (0005 – 0014) is 200% IN.

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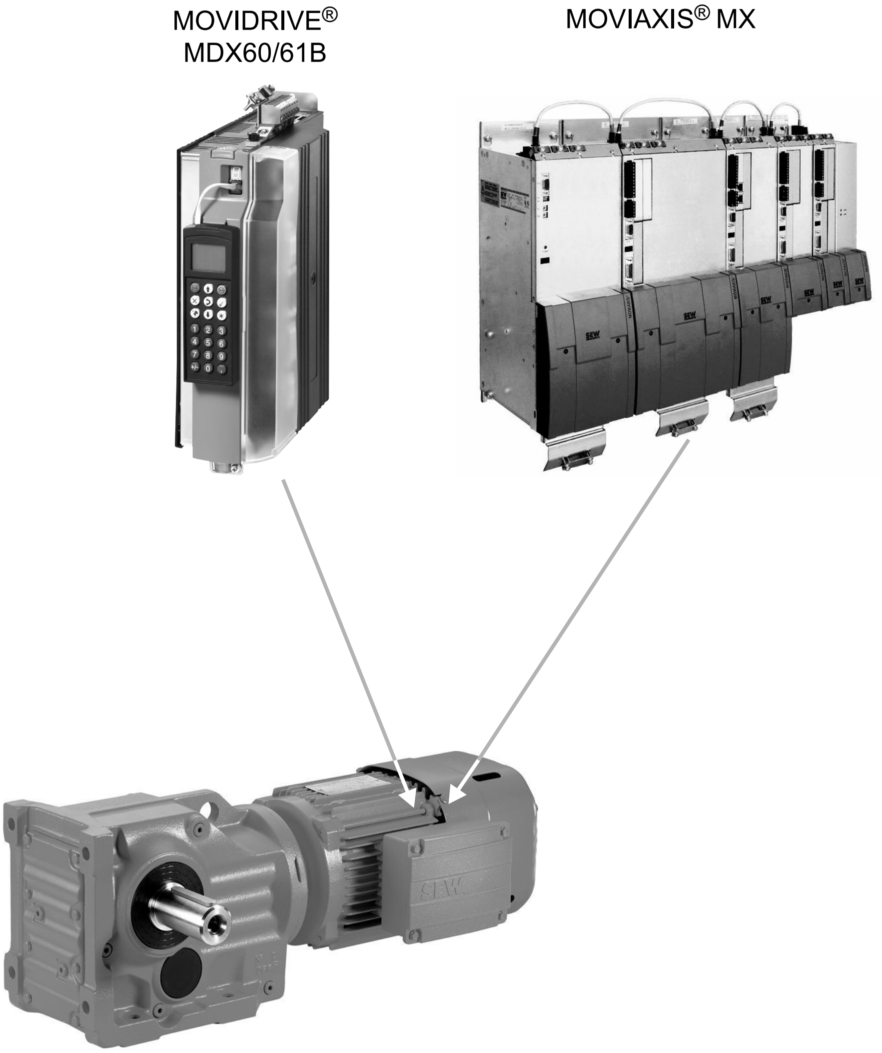
6.15.3 Inverter operation of DRL.. motors in CFC mode

Range of products

The extensive product range of SEW-EURODRIVE inverters is available for designing electronically controlled drives with current-controlled flux vector control (CFC).

- **MOVIDRIVE® MDX60/61B:** High-performance drive inverter for dynamic drives in the 0.55 – 250 kW power range. Great diversity of applications due to extensive expansion options with technology and communication options. Three-phase line connection for 230 V AC and 400 – 500 V AC.
- **MOVIAXIS® MX:** Powerful and versatile multi-axis servo inverter with axis module nominal currents of 2 – 133 A. Great diversity of applications thanks to extensive expansion options with technology and communication options, as well as optional sinusoidal or block-shaped regenerative power supply. Three-phase line connection for 380 – 500 V AC.

The asynchronous DRL.. servomotors can be operated with the inverters listed above.



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Product characteristics

The following table lists the most important product characteristics for the various inverter series. You can choose the inverter series matching your application based on these product characteristics.

Product characteristics	MOVIDRIVE® MDX60/61B	MOVIAXIS® MX
Voltage range	3 × 200 – 240 V AC (1.5 to 30 kW) 3 × 380 – 500 V AC (0.55 to 250 kW)	3 × 380 – 500 V AC
Power range	0.55 – 250 kW	10 – 75 kW
Nominal current range of the axis modules	4 – 250 A	2 – 133 A
Overload capacity	150 % I_N[1)] briefly and 125% I_N continuously in operation without overload	250% for max. 1 second
4Q capable	Yes, with integrated brake chopper as standard.	
Integrated line filter	Sizes 0, 1, and 2 according to limit value class A	External line filter
TF input	Yes	
Control modes	U/f or voltage-controlled flux vector control (VFC), with speed feedback speed control and current-controlled flux vector control (CFC).	Current-controlled flux vector control
Speed feedback	Option	Integrated in basic unit
Integrated positioning and sequence control system	Standard	
Serial interfaces	System bus (SBus) and RS485	CAN-based system bus, optional EtherCAT®-compatible system bus
Fieldbus interfaces	Optional PROFIBUS-DP, INTERBUS, INTERBUS LWL, CANopen, DeviceNet, Ethernet	Optional PROFIBUS-DP, EtherCAT®
Technology options	Input/output card Synchronous operation Absolute encoder card IEC-61131 control	Synchronous operation, electronic gear unit, touch probe, event control, electronic cam, virtual encoder, single-axis positioning
Max. speed	6,000 rpm	10,000 rpm
STO – Safe Torque Off	Yes	Option

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Product characteristics	MOVIDRIVE® MDX60/61B	MOVIAXIS® MX
Approvals	UL and cUL approval, C-Tick	

1) The temporary overload capacity of size 0 units (0005 – 0014) is 200% IN.

6.15.4 Drive selection –DRL.. motors

Tapping the full potential of an asynchronous servomotor requires the selection of an appropriate drive.

The schematic procedure is detailed in the chapter "Drive selection – controlled motor" (→ 🗎 179).

Dynamics package D1 or D2

During the drive selection, you must decide which dynamics package is required and will be implemented.

Predeterminations will then be made on this basis, particularly with regard to the size of the inverter.

The higher inertia levels of the DRL.. motor when compared to synchronous servomotors – roughly a factor of 10 or more – are of great benefit when controlling loads with high mass moments of inertia, even when taking gear unit reduction ratios into account.

For detailed information, refer to the chapter "Product description – asynchronous servomotors of the DRL.. series" (→ 🗎 50).

The technical data for the DRL.. motors and the limit values of the D1 or D2 dynamics packages are provided in the chapter "Technical data – DRL.. asynchronous servomotors.." (→ 🗎 117).

Sine encoder

The standard drive package of the of the DRL.. motors includes a sine encoder:

- DRL71 – DRL132 with ES7S
- DRL160 – DRL225 with EG7S

This sine encoder has a resolution of 1024 sine cycles.

The interpolation of the sin/cos signals in the inverter greatly increases the available speed information, resulting in a usable speed setting range of 1:5000 and highly accurate operation at speeds below 1 rpm.

Startup is simplified by the electronic nameplate included in the encoder.

Detailed information can be found in the chapter "Encoders" (→ 🗎 431).

Absolute encoder

Instead of the sine encoder, an absolute encoder can be installed at the same location without additional length.

- DRL71 – DRL132 with AS7W or AS7Y
- DRL160 – DRL225 with AG7W or AG7Y

The SSI encoder (A.7**Y**) establishes the connection to the functional safety elements in the control cabinet.

Startup is simplified by the electronic nameplate included in the encoder.

Detailed information can be found in the chapter "Encoders" (→ 🗎 431).

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Forced cooling fan

The use of a /V forced cooling fan prevents the reduction in permissible load torque at speeds below 900 rpm.

In fact, the relationship is reversed, meaning that the permitted torque at speed "0" is approx. 10 – 15% higher than the nominal torque when a forced cooling fan is used.

Detailed information can be found in the chapter "Forced cooling fans" (→ 🗎 503).

The limit characteristic curves of the DRL.. motors are covered separately in the manual "AC motors – inverter assignments and characteristic curves".

Inverter utilization

When selecting the drive for an asynchronous servomotor, the following variables apply:

- The mean (effective) speed
- The mean (effective) torque
- The maximum speed
- The maximum dynamic torque

To select a suitable inverter, you must check the thermally decisive elements in the limit characteristic curves with 100% I_N and the peak values in the diagrams with 150%/200% I_N.

Technical data for the DRL.. motors can be found in the chapter "Technical data – asynchronous DRL.. servomotors" (→ 🗎 117).

The combinations and limit characteristic curves of the DRL.. motors with MOVIDRIVE® and MOVIAXIS® are covered in full in the manual "AC motors – inverter assignments and characteristic curves".

The maximum speeds of the motors are specified in the chapter "Maximum speeds" (→ 🗎 145).

6.15.5 Drive selection example – asynchronous DRL.. servomotor

The schematic drive selection procedure is detailed below using the example of a vehicle.

Description of the application

The following data is provided.

Description	Symbol	Value	Unit
Mass of the load	m_L	300	kg
Mass of the carriage	m_W	800	kg
Traveling velocity	v	2	m/s
Acceleration	a_1	2	m/s^2
Deceleration	a_2	2	m/s^2
Diameter of gear rack pinion	D_0	80	mm
Resistance to vehicle motion	FF	90	N/t
Efficiency of the system	η	90	%

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This results in the following data.

Description	Symbol	Value	Unit
Maximum output torque	M	102.2	Nm
Maximum output speed	n	477.5	rpm

Gear unit selection

The following data is provided:

Description	Symbol	Value	Unit
Gear unit ratio	i_{target}	6.28	-

Selecting the gear unit size and reduction ratio:

Description	Symbol	Value	Unit
Gear unit size	K47	-	-
Gear unit ratio	i_{actual}	5.81	-

INFORMATION

The overhung load is too high with the recommended transmission element factor for gear rack pinions of f_z = 2 (F_R = 5437 N); see section "Overhung and axial loads" (→ 🗎 156). This must either be compensated by a suitable bearing for the gear rack pinion, or a larger gear unit must be selected.

Motor selection

Maximum operating point

Conversion of the torque to the motor side:

$M_{max} = M / \eta / i_{actual}$

M_{max} = 102.2 Nm / 0.9 / 5.81

M_{max} = 19.56 Nm

Conversion of the speed to the motor side:

$n_{max} = n \times i_{actual}$

n_{max} = 477.5 rpm × 5.81

n_{max} = 2774 rpm

M_{max} and n_{max} denote the maximum operating point; in this case, M_{max} is required at n_{max}.

Effective operating point

The effective operating point was calculated as

M_{eff} = 8.26 Nm

at a speed of

n_n = 1981 rpm

Motor preselection

The motor size DRL90L4 was preselected.

M_{base} = 19.9 Nm

n_{base} = 2683 rpm

Checking the relationship of the mass moment of inertia results in the following:

J_{ext}/J_{mot} = 12.03

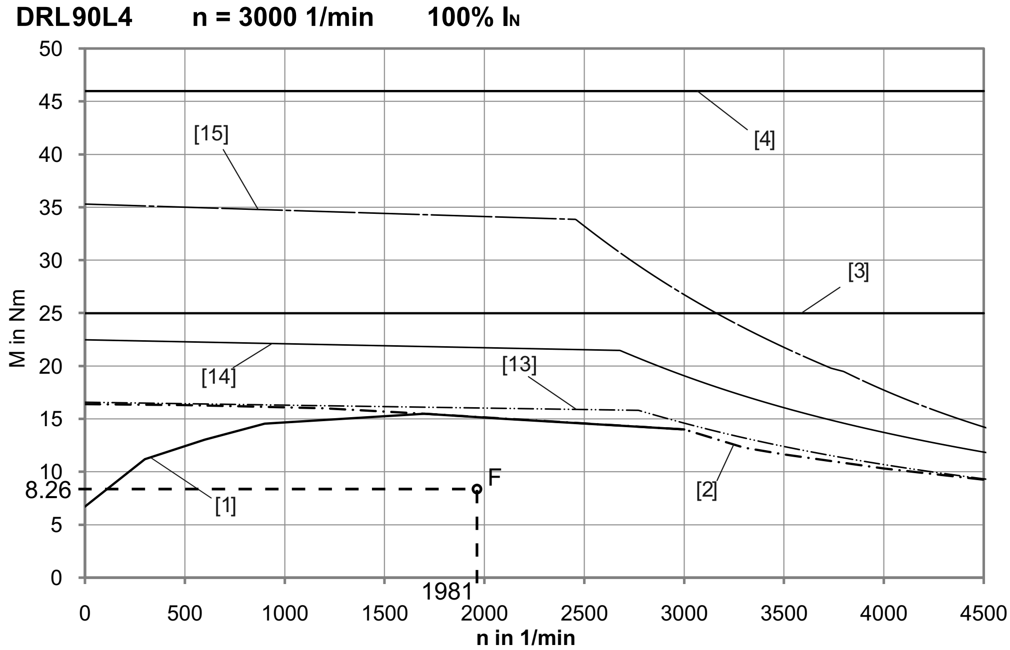
The ratio of 12.03 is acceptable for a dynamic vehicle drive.

MOVIDRIVE® B inverter selection

- The effective operating point (F) for the motor must be below the S_1 limit curve. The thermal load on the motor is thus within the permitted range.
- The effective operating point (F) in the speed/torque diagram for 100% inverter utilization must be below the characteristic curve for the motor/inverter combination to be selected. The load on the inverter (continuous duty) is thus within the permitted range.
- In the speed/torque diagram for 150% inverter utilization, the maximum operating point (M) (possibly two different points for maximum speed and maximum torque) must be below the characteristic curve for the motor/inverter combination to be selected. The load on the inverter (maximum operation) is thus within the permitted range.

DRL90L4, n_N = 3000 rpm, 100% I_N

Determining the effective operating point:



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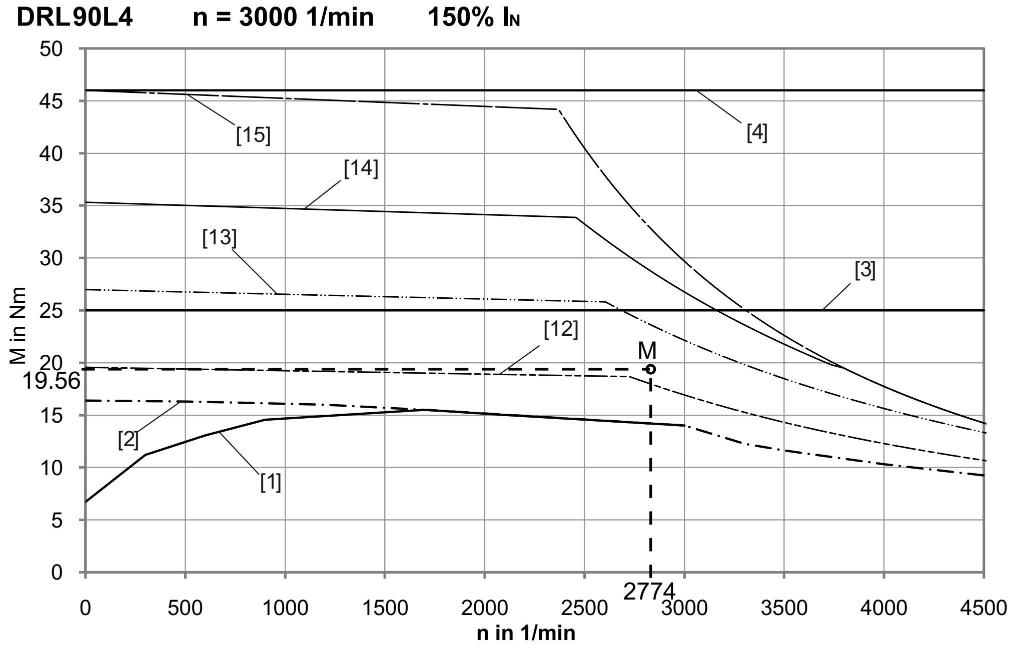
[1]	S1 characteristic curve	[13]	5.5 kW inverter power
[2]	S1 characteristic curve with forced cooling fan	[14]	7.5 kW inverter power
[3]	Maximum limit torque of dynamics package 1	[15]	11 kW inverter power
[4]	Maximum limit torque of dynamics package 2		

DRL90L4, n_N = 3000 rpm, 150% I_N

Determining the maximum operating point:



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[1]	S1 characteristic curve	[12]	4 kW inverter power
[2]	S1 characteristic curve with forced cooling fan	[13]	5.5 kW inverter power
[3]	Maximum limit torque of dynamics package 1	[14]	7.5 kW inverter power
[4]	Maximum limit torque of dynamics package 2	[15]	11 kW inverter power

INFORMATION

The inverter current at motor standstill should be less than 70% of the nominal motor current.

The required drive inverter has thus been determined:

- MDX61B0055-5A3

Result of the drive selection

Selected gearmotor in dynamics package 1 and speed class 3000 rpm:

- K47 DRL90L4/F./TF/ES7S

Selected drive inverter:

- MDX61B0055-5A3 with 5.5 kW inverter power

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6.15.6 Reinforced insulation for inverter operation > 500 V AC

Standard insulation

The operation of an AC asynchronous motor with a frequency inverter places a much greater load on the winding than in the case of non-controlled operation.

The inverters pulse the DC voltage of the DC link (U_z) to the supply cables to the motor. This pulsing takes place in the kHz range, which means several thousand ON and OFF switchings per second – at SEW-EURODRIVE usually with 4, 8, 16 kHz.

The standard windings of the motors are constructed with copper wires and surface insulating materials, which can easily withstand the voltage peaks specified below.

- Line-to-line voltages U_{LL} = 1560 V
- Line-to-ground voltages U_{LG} = 1100 V

The DR. motors can therefore be used with the normal winding on frequency inverters with up to 500 V.

If a DR. motor is operated with a frequency inverter supplied with 600 V or 690 V, or the DC link voltage of which is raised to over 742.5 V DC, the double voltage pulse can exceed the maximum permissible value of the standard winding of 1560 V.

Design measures must therefore be taken to protect the motor from these high voltages.

Reinforced insulation (/RI)

The electric strength of the winding insulation is achieved by reinforcing the coat thickness of the inner layer for the copper wires.

This insulating system for motors carries the type and catalog designation /RI.

The standard surface insulating materials are sufficient for line-to-line and line-to-ground insulation.

The RI windings of the motors withstand voltage peaks of up to

- Line-to-line voltages U_{LL} = 1800 V
- Line-to-ground voltages U_{LG} = 1250 V

See also chapter "DR.. AC motors on non-SEW inverters" (→ 🗎 198).

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Reinforced insulation with increased resistance against partial discharge (/RI2)

If the voltage peaks exceed the 1800 V threshold, enameled wires with higher resistance against partial discharge must be used. This higher resistance is achieved by the addition of inorganic additives to the coating of the inner layer.

The standard surface insulating materials for line-to-line and line-to-ground separation are also no longer sufficient. To protect against these very high voltages, thicker surface insulating materials and enhanced impregnation must be used.

This insulating system for DR.. motors carries the type and catalog designation /RI2.

The RI2 windings of the DR.. motors easily withstand voltage peaks of up to

- Line-to-line voltages U_{LL} = 2150 V
- Line-to-ground voltages U_{LG} = 1800 V

See also chapter "DR.. AC motors on non-SEW inverters" (→ 🗎 198).

6.15.7 Limit characteristic curves of the motors in inverter operation

The thermal curves for the asynchronous AC motors of the DR.. series are distinguished with regard to their energy efficiency class.

The asynchronous servomotors are distinguished according to their speed class.

Thermally permitted torques – DRS.. motors

When DRS.. motors are used with inverters, the thermally permitted torque must be observed during the drive selection. The following factors determine the thermally permitted torque:

- Energy efficiency class: none or IE1
- Operating mode
- Type of cooling: Self-cooling or forced cooling
- Base frequency: f_{base} = 50 Hz (400 V ⅄) or f_{base} = 87 Hz (400 V △)

You can determine the thermally permitted torque on the basis of torque limit curves. The effective torque calculated during project planning must be below the limit curve with regard to the mean speed.

Below are the limit curves for 4-pole DRS.. motors with the following line frequencies:

- f_{base} = 50 Hz
- f_{base} = 87 Hz

The following conditions apply to the shown limit curves:

- Motor in duty type S1 on 50 Hz supply system
- Line voltage of motor 230 V △ / 400 V ⅄ or corresponding voltage range
- Supply voltage of the inverter U_{line} = 3 × 400 V AC
- Motor in thermal class 155 (F)

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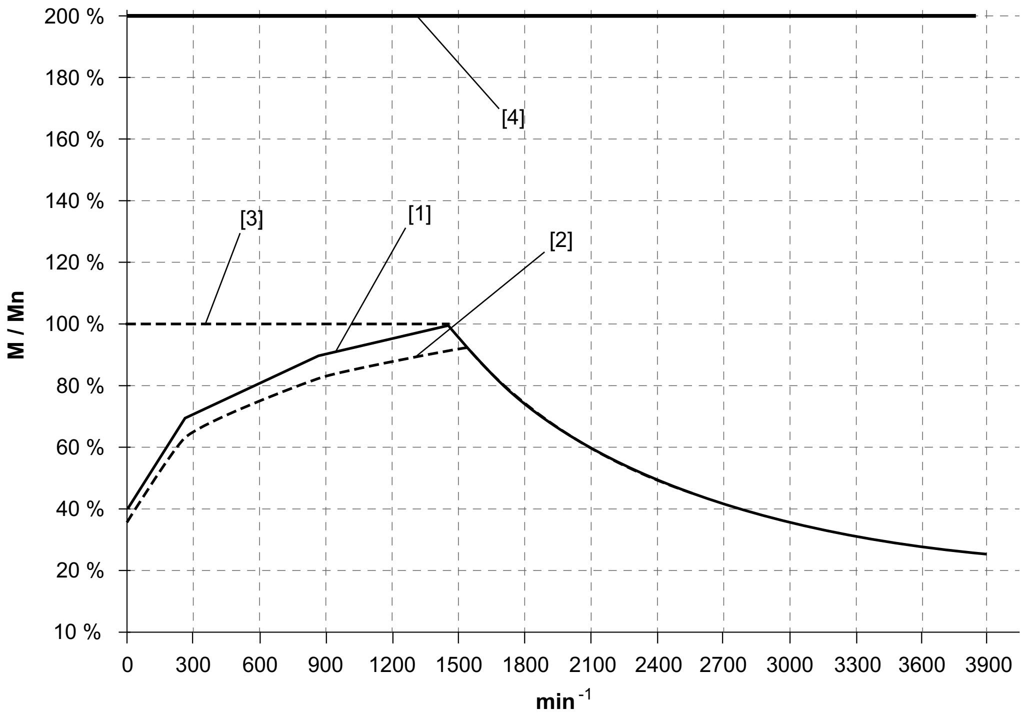
f_{base} = 50 Hz (400 V ⅄, 50 Hz) – DRS.. motor

The following diagram shows the limit curves of the DRS.. motor for operation at base frequency f_{base} = 50 Hz. Separate curves are provided for motors with self-cooling and forced cooling (optional /V forced cooling fan).



9007208204121099

[1] S1 operation with self-cooling (= without optional forced cooling fan)

[2] S1 operation with self-cooling (= without optional forced cooling fan) for DRS280M4

[3] S1 operation with forced cooling (= with optional forced cooling fan)

[4] Mechanical limitations for gearmotors

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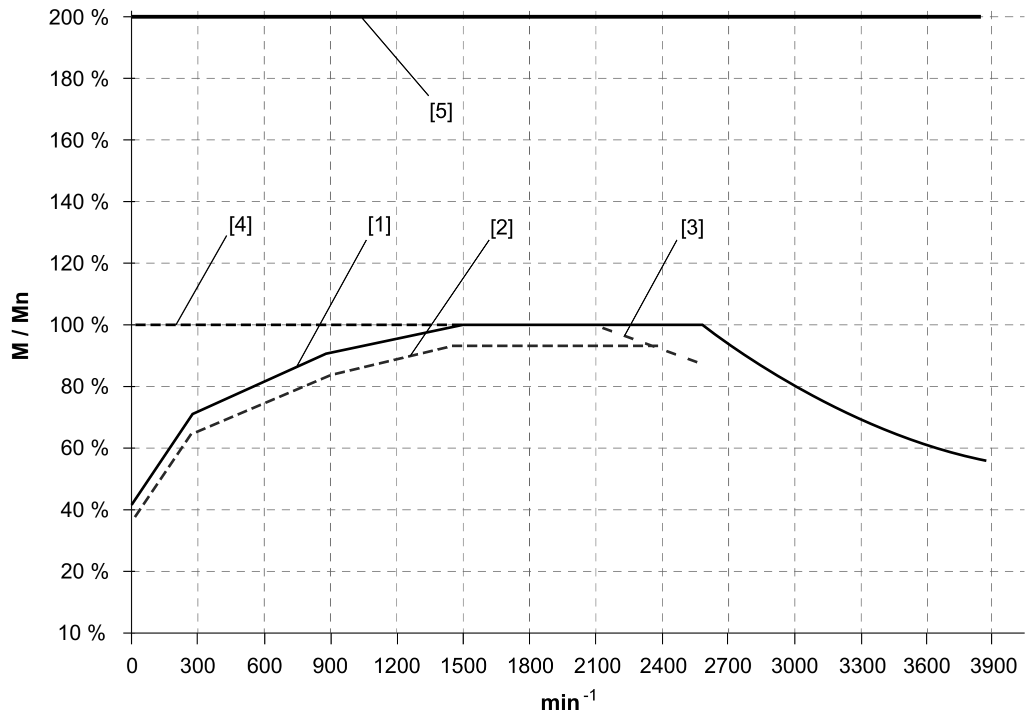
f_{base} = 87 Hz (400 V △, 50 Hz) – DRS.. motor

The following diagram shows the limit curves of the DRS.. motor for operation at base frequency f_{base} = 87 Hz. Separate curves are provided for motors with self-cooling and forced cooling (optional /V forced cooling fan).



9007208204123531

[1] S1 operation with self-cooling (= without optional forced cooling fan)

[2] S1 operation with self-cooling (= without optional forced cooling fan) for DRS280M4

[3] S1 operation with forced cooling (= with optional forced cooling fan) for DRS250 – 315

[4] S1 operation with forced cooling (= with optional forced cooling fan)

[5] Mechanical limitations for gearmotors

Thermally permitted torques – DRE.. and DRP.. motors

When DRE.. or DRP.. motors are used with inverters, the thermally permitted torque must be observed during the drive selection. The following factors determine the thermally permitted torque:

- Energy efficiency class: IE2 or IE3
- Operating mode
- Type of cooling: Self-cooling or forced cooling
- Base frequency: f_{base} = 50 Hz (400 V ⅄) or f_{base} = 87 Hz (400 V △)

Due to the lower thermal load of the IE2/IE3 design, the nominal torque of the motor on the supply system can be subjected to a constant load down to approx 20 Hz.

The thermally permitted torque is determined on the basis of torque limit curves. The effective torque calculated during project planning must be below the limit curve with regard to the mean speed.

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Below are the limit curves for 4-pole DRE.. and DRP.. motors with the following line frequencies:

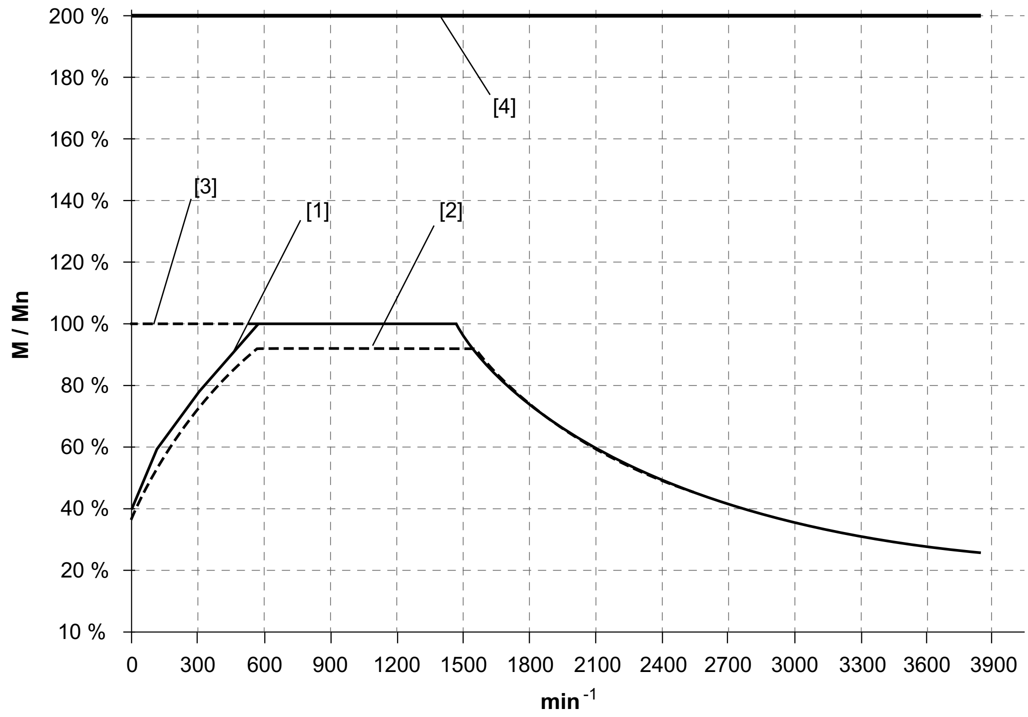
- f_{base} = 50 Hz
- f_{base} = 87 Hz

The following conditions apply to the shown limit curves:

- Motor in duty type S1 on 50 Hz supply system
- Line voltage of motor 230 V △ / 400 V ⅄ or corresponding voltage range
- Supply voltage of the inverter U_{line} = 3 × 400 V AC
- Motor in thermal class 155 (F)

f_{base} = 50 Hz (400 V ⅄ , 50 Hz) – DRE.. and DRP.. motor

The following diagram shows the limit curves of the DRE.. / DRP.. motors for operation at base frequency f_{base} = 50 Hz, star connection "⅄" at 400 V. Separate curves are provided for motors with self-cooling and forced cooling (optional /V forced cooling fan).



9007208204127243

[1] S1 operation with self-cooling (= without optional forced cooling fan)

[2] S1 operation with self-cooling (= without optional forced cooling fan) for DRE280M4

[3] S1 operation with forced cooling (= with optional forced cooling fan)

[4] Mechanical limitations for gearmotors

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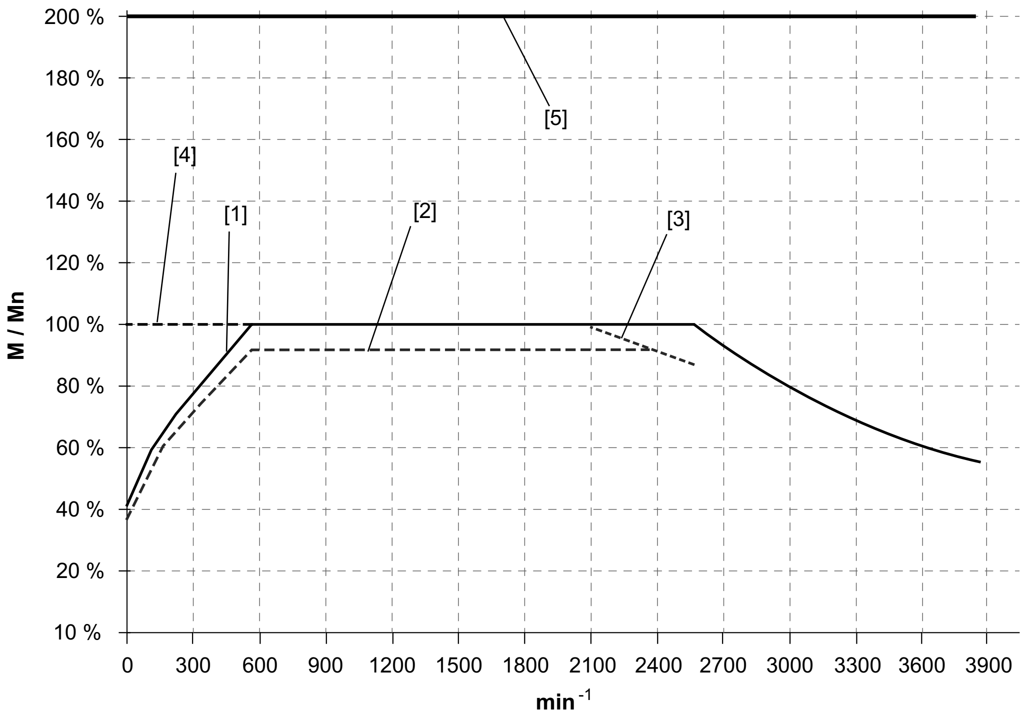
f_{base} = 87 Hz (400 V △ , 50 Hz) – DRE.. and DRP.. motor

The following diagram shows the limit curves of the DRE.. / DRP.. motors for operation at base frequency f_{base} = 87 Hz, delta connection "△" at 400 V. Separate curves are provided for motors with self-cooling and forced cooling (optional /V forced cooling fan).



9007208204180875

[1] S1 operation with self-cooling (= without optional forced cooling fan)

[2] S1 operation with self-cooling (= without optional forced cooling fan) for DRE280M4

[3] S1 operation with forced cooling (= with optional forced cooling fan) for DRE250 – 315

[4] S1 operation with forced cooling (= with optional forced cooling fan)

[5] Mechanical limitations for gearmotors

Thermally permitted torques – DRL.. motor

When asynchronous DRL.. servomotors are used with inverters, the thermally and dynamically permitted torque must be observed during the drive selection. The following factors determine the thermally permitted torque:

- Type of cooling: Self-cooling or forced cooling
- Speed class

The thermally permitted torque is determined on the basis of torque limit curves. The effective torque calculated during project planning must be below the limit curve with regard to the mean speed. The limit curves for the 4-pole asynchronous DRL.. servomotors in the following speed classes are provided in the manual "AC motors – inverter assignments and characteristic curves":

- 1200 rpm (corresponds to f_{base} of approx. 41 – 43 Hz)
- 1700 rpm (corresponds to f_{base} of approx. 58 – 61 Hz)

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- 2100 rpm (corresponds to f_{base} of approx. 72 – 76 Hz)
- 3000 rpm (corresponds to f_{base} of approx. 102 – 108 Hz)

The dynamically permitted torque is limited by the following:

- The mechanical limit value according to dynamics package D1 or D2, which is independent of the selected speed class
- The dynamic maximum and temporary current of the inverter

The following conditions apply to the basic limit curves shown:

- DRL.. motor according to technical data, see chapter "Asynchronous DRL.. servomotors" (→ 🗎 117)
- Supply voltage of the inverter U_{line} = 3 × 400 V AC
- /TF thermal motor protection

The potential dynamics of the inverter and motor are illustrated by the diagram for 150% current of the inverter, while the thermal limit for the inverter and motor is shown in the diagram for 100% current of the inverter.

A separate overview of all limit curves is provided in the manual "AC motors – inverter assignments and characteristic curves".

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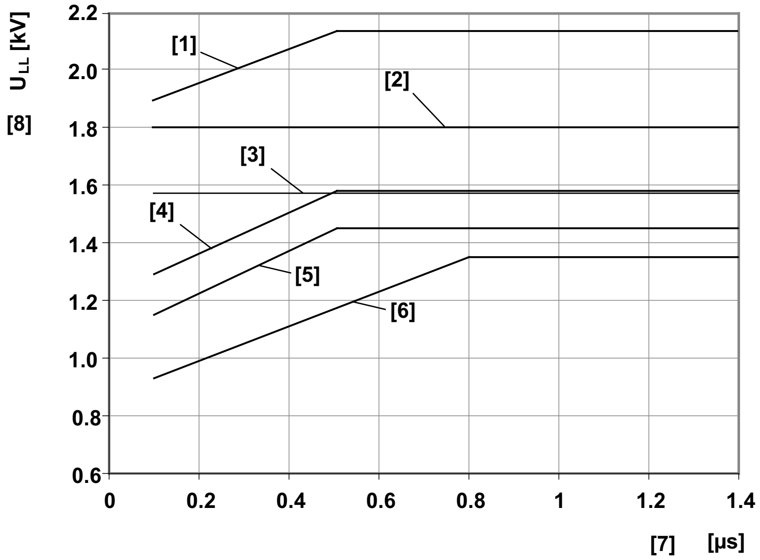
6.15.8 DR.. AC motors on non-SEW inverters

In the case of inverter-supplied motors, you must adhere to the wiring instructions issued by the inverter manufacturer. It is essential to observe the operating instructions for the frequency inverter.

Operating SEW motors on non-SEW frequency inverters is permitted if the pulse voltages at the motor terminals indicated in the following figure are not exceeded.



9007203235332235

[1] Permitted pulse voltage for motors with reinforced insulation and increased resistance against partial discharge (/RI2)

[2] Permitted pulse voltage for motors with reinforced insulation (/RI)

[3] Permitted pulse voltage according to NEMA MG1 part 31, $U_N \leq 500$ V

[4] Permitted pulse voltage according to IEC 60034-25, limit value curve A for nominal voltage $U_N \leq 500$ V, star connection

[5] Permitted pulse voltage according to IEC 60034-25, limit value curve A for nominal voltage $U_N \leq 500$ V, delta connection

[6] Permitted pulse voltage according to IEC 60034-17

[7] Duration of voltage increase

[8] Permitted pulse voltage

INFORMATION

Compliance with the limit values must be checked and taken into account as follows:

- The supply voltage level at the non-SEW inverter
- The threshold of the brake chopper voltage
- The operating mode of the motor (motoring/regenerative operation)

→ If the permitted pulse voltage is exceeded, limiting measures, such as filters, chokes, or special motor cables must be used. Contact the manufacturer of the frequency inverter for more information.

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