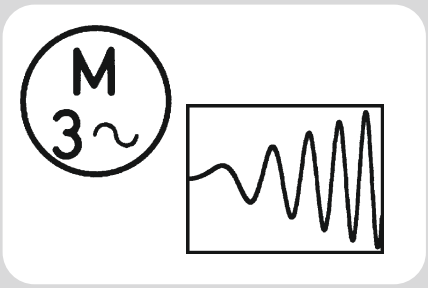


14

Motors

USA – Energy Policy and Conservation Act

Integral Horsepower Rule (IHP rule)

Department of Energy

10 CFR Part 431: Energy conservation Program: Energy Conservation Standards for Commercial and Industrial Electric Motors

Effective date: June 1, 2016

Motors, as shown below, covered under the IHP rule shall have a nominal full-load efficiency not less than Premium efficiency level shown under §431.25 and NEMA MG1, Table 12-12.

From the IHP rule covered Motors:

- Single speed motor
- Contains a squirrel-cage (MG 1) or cage (IEC) rotor
- Operated on polyphase alternating current (AC) 60-hertz sinusoidal line power
- Rated output PN between 1HP and 500 HP
- 2-, 4-, 6-, or 8-pole motors
- Rated voltage of UN up to 600 V
- Rated for continuous duty (MG 1) operation or for duty type S1 (IEC)

From the IHP rule exempt motors :
- Air-over electric motors
- Component sets of an electric motor
- Liquid-cooled electric motors
- Intermittent duty motors (S2-S8)
- Inverter-only electric motors (S9)
- Multi-speed motors (pole change motors)
- Submersible electric motors
- Where ambient temperatures exceed +40°C (NEMA MG1-2009 Part 14.2)
- Where ambient temperatures are less than -15°C (NEMA MG1-2009 Part 14.2)
- At altitudes exceeding 3300 feet (1000 meters) (NEMA MG1-2009 Part 14.2)
- Single phase motors
- Synchronous AC motors
- Permanent magnet rotor AC motors
- Servo motors

ErP Directive 2009/125/EC

Directive 2009/125/EC of the European Parliament and the Council, issued in 2009, specifies requirements for the environmentally responsible design of energy-related products (ErPs). In November 2009 it superseded Directive 2005/32/EC, which formed the framework for requirements for the environmentally responsible design of energy-using products (EuPs). This change has no effect on already proclaimed implementation measures.

Objectives

The ErP Directive has several objectives:

1. **Mitigating the environmental impact of energy-using products**
   This objective is intended to be achieved by the documentation and labelling of products, by regulations for inspection, and by the formulation of individual requirements in implementation measures. As the entire product life cycle is taken into consideration, action must be taken as early as the design phase.

2. **Climate protection**
   Achievement of the EU climate protection objectives is to be supported. This can be implemented by reducing energy consumption and the emission of global warming gasses in the production, operation and disposal of energy-using products.

3. **Harmonised legislation**
   The directive creates a framework for the European regulation of environmental design requirements. This avoids trade impediments resulting from differences in national regulations. This can be achieved by means of the proclamation of legally binding implementation measures for the entire Community and protection of free trade in goods against further-reaching regulations of the Member States.

Which motors are excluded from the scheme?

- Motors designed to be operated completely immersed in a liquid
- motors fully integrated into a product (e.g. a gearbox, a pump, a fan or a compressor) whose energy efficiency cannot be measured independently of that productn
- at altitudes above 4000 meters above sea level
- at ambient temperatures above 60 °C
- at ambient temperatures below - 30 °C (any motor) or at ambient temperatures below 0 °C (air-cooled motor)
- in potentially explosive atmospheres within the meaning of Directive 94/9/EC of the European Parliament and of the Council
- Brake motors

Example:

Regulation (EU) 2019/1781

To establish eco-design requirements for electric motors and variable speed drives pursuant to Directive 2009/125/EC

Valid from: 01.07.2021
- Frequency converter 0.12 - 1,000 kW: IE2
- 3-phase motors 0.12 < 0.75 kW/2.4, 6 or 8 poles: IE2 (Excluded: Ex eb (DXE))
- 3-phase motors 0.75 - 1,000 kW/2.4, 6 or 8 poles: IE3 (Excluded: Ex eb (DXE)

ATTENTION:
Brake motors are no longer exempt!!
IE2 for inverter operation is no longer permitted!!!

Valid from: 01.07.2023
- 1-phase motors ≥ 0.12 kW: IE2
- Ex eb (DXE) Motors ≥ 0,12 kW: IE2
- 3-phase motors 75 kW – 200 kW 2, 4 or 6 pole: IE4
  (Exempt: brake motor and all explosion-proof motors)

Scope
Induction electric motors without brushes, commutators, slip rings or electrical connections to the rotor, rated for operation on a 50 Hz, 60 Hz or 50/60 Hz sinusoidal voltage and having the following characteristics:
- 2-, 4-, 6- and 8-pole motors
- Rated power PN between 0,12 kW and 1000 kW
- Rated voltage UN over 50 V up to and including 1,000 V
- are designed for continuous operation (S1, S3 ≥ 80 % ED, S6 ≥ 80 % ED) and are intended for direct mains operation

Which engines are excluded from the scheme?

- Motors designed to be operated completely immersed in a liquid
- Motors fully integrated into a product (e.g. a gearbox, a pump, a fan or a compressor) whose energy efficiency cannot be measured independently of that product
- Motors with integrated frequency converter (compact drives) whose energy efficiency cannot be tested independently of the frequency converter
- Motors specifically designed and specified to operate exclusively
  - at altitudes exceeding 4000 m above sea-level
  - at ambient temperatures above 60 °C
  - at ambient temperatures below -30 °C
- Motors with integrated brake, which is an integral part of the inner motor construction and cannot be removed or supplied from a separate power source when testing the motor efficiency.
- Motors specifically qualified for the safety of nuclear installations, as defined in Article 3 of Council Directive 2009/71/EURATOM
- Motors with mechanical commutators
- Totally enclosed Non-Ventilated motors (TENV)
- Engines from the respective scope of application of the two deadlines 01.07.2021 or 01.07.2023, which were placed on the market before these deadlines, may continue to be placed on the market until 30.06.2029 as 1:1 replacements and may be specifically marketed as such
- Multi-speed motors, i.e. pole-changing motors
- Motors designed specifically for the traction of electric vehicles
- Motors in portable equipment whose weight is supported by hand during operation
- Motors in hand-held mobile equipment which are moved during operation
- Motors in cordless or battery-operated equipment
- Motors for underground mining (mines)

Method for determining the motor efficiency according to IEC 60034-2-1

Individual loss procedure
Additional losses according to residual loss method
Low measurement uncertainty

Motors

General

Bauer geared motors for connection to three-phase supply are supplied with specially designed induction motors. This design ensures maximum operating safety with high starting torque and minimum starting current.

The torque/speed characteristic is largely free of torque dips. Torque is optimized to suit requirements and application parameters. See “www.bauergears.com” for more information.

Torques

The torques as stated in the selection tables are fully available at the output shaft. These figures apply for continuous operation (S1-100%) at a maximum ambient temperature of 40 °C and at site elevations up to 1000 m above sea level. Drives for higher ambient temperatures and site elevations are available on request. Gear efficiencies, which are lower than the usual values for spur gears, are taken into account in the torques listed in the selection tables.

Line voltages

BAUER motors are available as standard for the following three-phase line voltages:

- 230 V / 460 V 60 HZ (Standard)
- 230 V / 400 V 50 Hz*
- 240 V / 415 V 50 Hz
- 440 V / 60 Hz
- 460 V / 60 Hz
- 480 V / 60 Hz
- 575 V / 60 Hz
- 380 V / 660 V 50 Hz
- 400 V / 690 V 50 Hz*
- 415 V / 50 Hz

*Voltage recommended world-wide by IEC 38 and in Europe by CENELEC.

**= Insulation Class F is necessary.

Designs for other voltages available on request and at extra cost.

Unless otherwise specified, motors for operation in conjunction with frequency converters with a 50 or 60 Hz frequency have a Y-circuit to optimise operating noise and winding load.

Unless otherwise stated, the tolerance for the rated voltage is +/- 5 %, in accordance with IEC 60034-1.

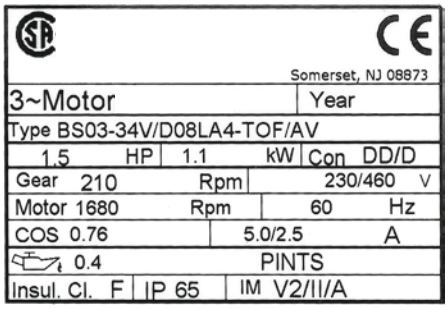
The D..04.. to D..18.. motors in 4 pole design can be operated within a tolerance of +/- 10 % of the rated voltage (400 V 50 Hz).

Line frequencies

All motors are available with the same power ratings for either 50 or 60 Hz . Increased power models are available on request.

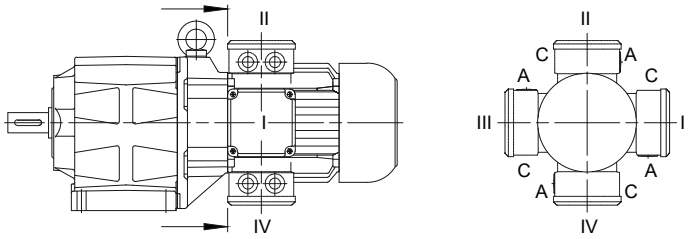
Rating plate

Bauer geared motors are supplied with a corrosion-proof rating plate as standard. The standard rating plate is made of special plastic tried and tested in many years of practical use and approved for hazardous areas by the Physikalisch-Technische-Bundesanstalt (PTB).



Terminal box

The cables of motors with and without brakes can be introduced into the motor terminal box from side A, B, C or side D.

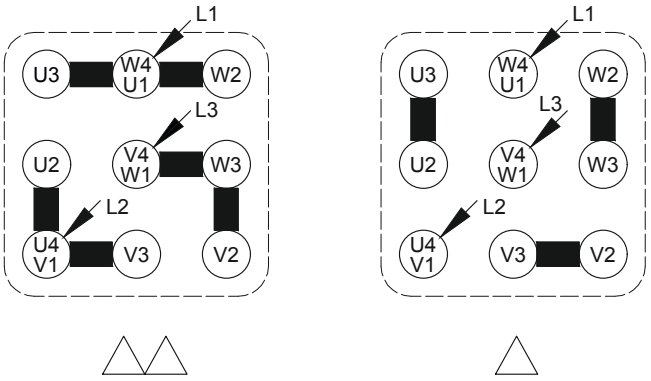


The standard position for the motor terminal box is shown in the dimensional drawings for the geared motors (see chapter 10,11,12 and 13). The terminal box can be installed at any of 3 other positions on request, if on-site space is restricted. The 4 possible positions are 90° offsets around the axis of the motor (dimensional drawing and designation for standard terminal box, see chapter 17 “Dimensional drawing standard terminal box”).

Screw- on terminal boxes, see pages 705 and 719 for inlet screw dimensions.

Please note holes on terminal box sides are for brake installation and are metric.

Motor for dual voltage connection 1 : 2 DD/D

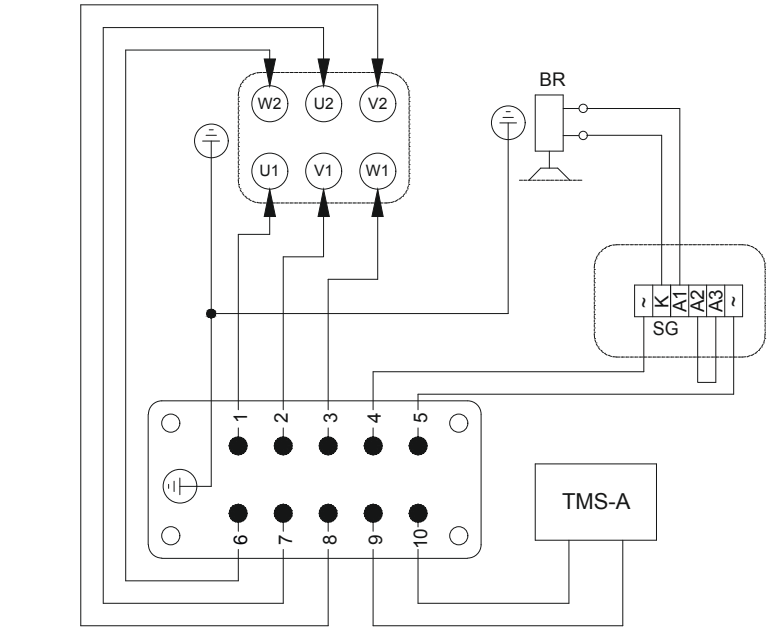


	IEC / EN 60034-8	NEMA MG 1	Colour
Supply lines	L1	L1	
	L2	L2	
	L3	L3	
Motor winding	U1 - U2	T1 - T4	black-black
	U3 - U4	T7 - T10	yellow-yellow
	V1 - V2	T2 - T5	blue-blue
	V1 - V2	T8 - T11	red-red
	W1 - W2	T3 - T6	brown-brown
	W3 - W4	T9 - T12	violet-violet
DD	Connections for the low rated voltage (e.g.: 230 V)		
D	Connections for the high rated voltage (e.g.: 460 V)		

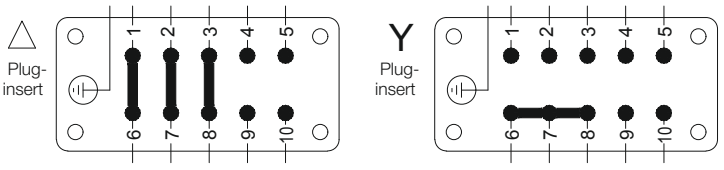
Plug-and-socket connection

D..06.. to D..16.. Bauer motors are available with plug-in motor connection. The socket housing is mounted on the fan-cowl side of the terminal box as standard. This layout minimizes the protrusion caused by the plug.
The standard plug-and-socket type connection incorporates the attachment housing, pin insert and cover. Grommet-type housings and jack inserts are available on request at extra cost. Pin assignments on request (dimensional drawing, see chapter 17 “Dimensional drawing, plug-connector terminal box”).

A design with single clamp lever according to the DESINA regulation of the „Verbandes Deutscher Werkzeugmaschinenhersteller“ (VDW) is also available.



△- or Y-Connection in the plughousing or installation cabinet is performed by the machine manufacturer.



Han 10ESS

Caution !
Motor shaft rotates clockwise for this connection looking at the motor A-side. The final rotation of the gear shaft is dependent on the gear design.

The motors are also available with a low-cost round plug connector as an alternative. This is fitted at the factory in the standard terminal box and is also suitable for brake connection, thermistors and thermostats. Additional information on request.

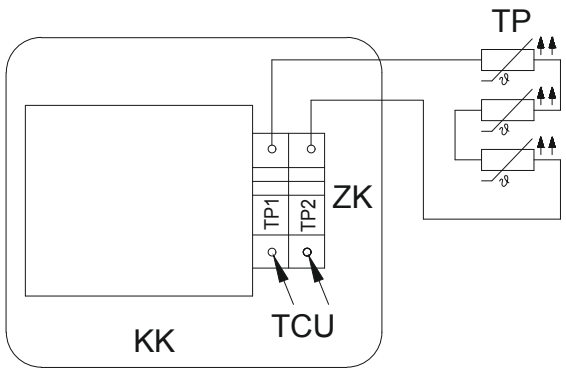
Bauer motors from D..08.. with motor-mounted brake are also available with plug-in brake connection. This means that if it requires attention, the brake can be replaced on site with no loss of time.

Motor protection

Each geared motor requires a current-dependent motor protection switch or an overcurrent relay with thermal delay in the switchgear to protect the motor windings. The rated motor currents required for settings are stated in the order acknowledgment. T hermal protection for the winding is recommended as an additional safety measure for special operating conditions (short-time or intermittent periodic duty, high switching frequency, severe voltage fluctuations or restricted cooling) and for operation in conjunction with a frequency converter.

Thermistors (PTC)

Thermistors are temperature-dependent resistors which are fitted in each phase winding. In conjunction with a motor protection switch, they ensure optimum protection for the winding in the event of rapid temperature rise. Characteristic to DIN 44081 and “Mark A” to IEC 34-11-2. Thermistors are available for all motors at extra cost. The requisite monitoring device is not included in the scope of supply.

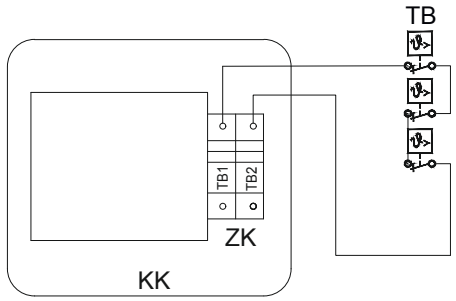


KK	Terminal box
ZK	Additional terminals
TP	PTC-thermistors DIN 44081/IEC 34-11-2 Mark A
TCU	Connection of thermistor control unit EN 60947 Max. permissible testing voltage 2.5 VDC / thermistor
	in case of ⟨Ex⟩ with auth. certificate: PTB 3.53 PTC/A

Thermostatic protection

Bimetal switches are used for slow-acting, independent temperature monitoring and are embedded in each winding section of the motor.
The bimetal disc is sized such that when the temperature rises above a specific, previously set value, the disc suddenly snaps from a convex state to a concave state and the contact moves vertically away from the contact plate. In this state the switch is either open (normally closed switch) or closed (normally open switch). A significant temperature change is necessary to allow the bimetal disc to independently snap back to its initial position. When it does, the switch is again closed (normally closed switch) or open (normally open switch). Thermal protection switches are available for all motors at additional cost. For technical reasons, this option is not recommended for large motors (D11 to D18).

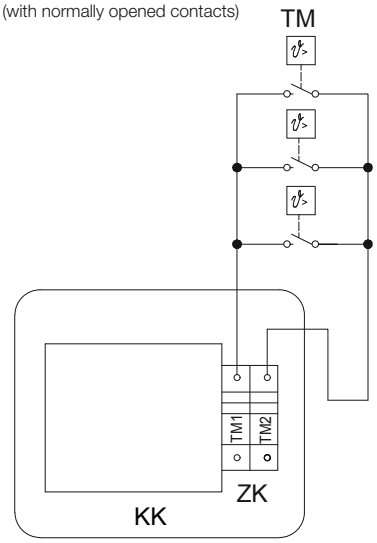
Thermal motor protection with thermostats
(with normally closed contacts)



KK	Terminal box
ZK	Additional terminals
TB	Thermostats with normally closed contacts max. 250VAC 1,6A

The location of the additional terminals in the drawing is not necessarily identical with the actual arrangement.

Thermal motor protection with thermostats
(with normally opened contacts)



KK	Terminal box
ZK	Additional terminals
TB	Thermostats with normally closed contacts max. 250VAC 1,6A

The location of the additional terminals in the drawing is not necessarily identical with the actual arrangement.

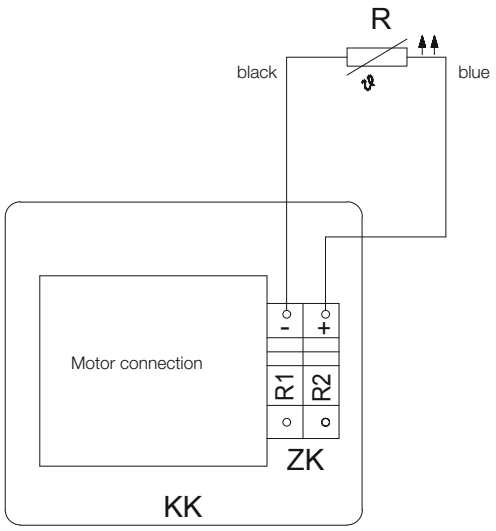
KTY sensors

KTY sensors with heat-shrink insulation can be used to measure and monitor critical surface temperatures and internal temperatures of motors and machines. These sensors are suitable for use in harsh industrial environments in all places where accurate measurements with a single sensor are required. KTY sensors are available for all types of motors at additional cost.

Type 84-130SH: primarily installed in motors that are operated with Siemens frequency converters.

Working principle: KTY sensors are temperature-dependent components. The resistance of the KTY sensor increases when its temperature rises. The characteristic curve is nearly linear in the sensor‘s measuring range; the reference resistance (at 100 °C) is 970 to 1030 ohms.

Resistance temperature sensor KTY84-130SH



KK	Terminal box
ZK	Additional terminals
TB	Resistance temperature sensor

The location of the additional terminals in the drawing is not necessarily identical with the actual arrangement.

PT100 sensors

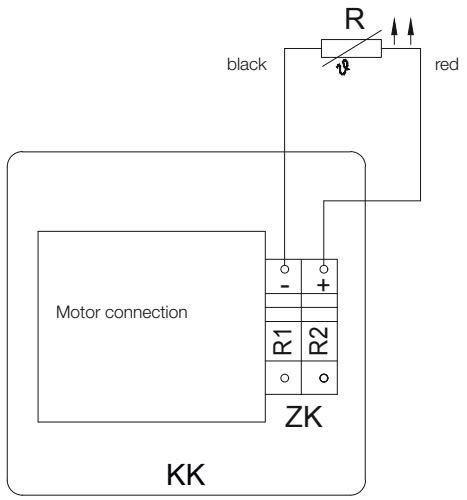
Precise monitoring of motor temperatures is necessary in many fields of industry. Pt100 sensors feature high accuracy, short response time and long-term stability, and they are suitable for use over a wide range of temperatures. Pt100 sensors are available for all motor types at additional cost.

Specifications

Nominal resistance: 100 Ω at 0 °C

The resistance characteristics are specified in EN 60751.

Resistance temperature sensor PT 100



KK	Terminal box
ZK	Additional terminals
TB	Resistance temperature sensor

The location of the additional terminals in the drawing is not necessarily identical with the actual arrangement.

Insulation

The gearmotors described in the selection tables of this catalog with the motor sizes D..04.., D..05.., D..06.., D..08.., D..09S and D..09L are executed in insulation class B. Temperature class F is available on request at extra cost.

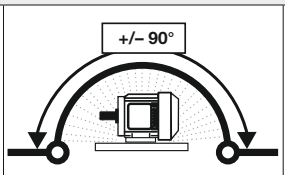
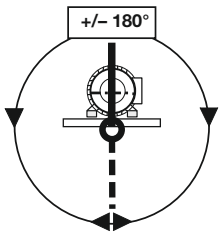
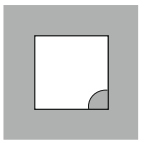
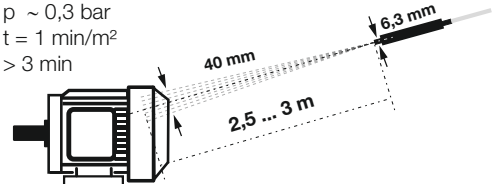
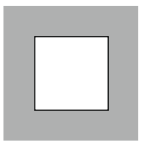
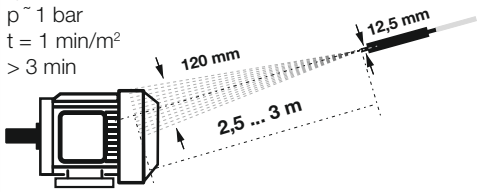
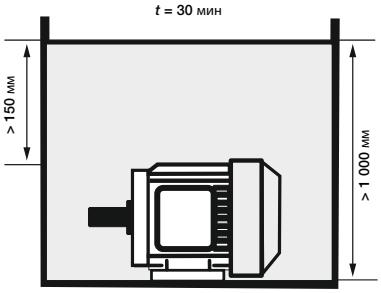
4-pole motors D..07.. and D..09XA4 (2.2 kW) to D..18XA4 (30 kW) and all multi-speed motors are rated in Temperature Class F as standard.
Insulation Class F bestows the winding a multiple protection against high humidity, acidic gases and heavy tropical influences while making the same shock resistant and more resistant to heat. Protection against insects (termites) is guaranteed through the complete enclosure (IP65) as long as the mains cables are encased in metal.

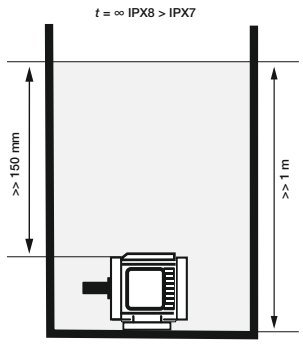
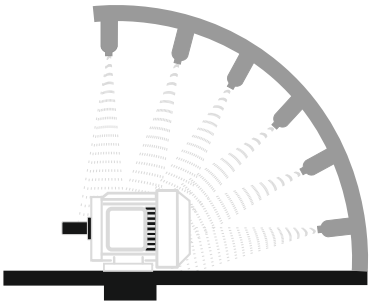
IP – Protection classes

Bauer motors from motor size D..06.. are manufactured to IP65 degree of protection as standard. Motor sizes D..04.. and D..05.. have smooth housings, degree of protection IP 54, on request in IP65 at extra cost. The motor terminal box is always IP 65.

Bauer motors from motor size D..06.. are manufactured to IP65 degree of protection as standard. Motor sizes D..04.. and D..05.. have a smooth motor housing of IP54. Higher IP protection classes on request.

Degrees of protection provided by enclosures for electrical equipment

First IP - code number after DIN EN 60529					Second IP - code number after DIN EN 60529		
	Protection against penetration of solid foreign bodies		Protection of persons against access to hazardous parts with			Protection against penetration of moisture or water	
4	diameter > = 1,0 mm		Wire		4	Splash water	 0,07 l/min per nozzle 
5	Dustproof				5	Jet water	qv = 12,5 l/min p ~ 0,3 bar t = 1 min/m² > 3 min 
6	Dust tight				6	Strong Jet water	qv = 100 l/min p ~ 1 bar t = 1 min/m² > 3 min 
					7	Temporary Submerge	

First IP - code number after DIN EN 60529		Second IP - code number after DIN EN 60529		
Protection against penetration of solid foreign bodies	Protection of persons against access to hazardous parts with		Protection against penetration of moisture or water	
		8	Permanent Submerge	 x = 5 m (Standard) or by agreement
		9 (9K= DIN 40050-9)	High pressure and high jet water temperature	Housing >= 250 mm t = 1 min /m² > 3 min Water temperature (80 +- 5) °C 15 l/min, 100 bar Distance (175 +- 25) mm 

Speed of output shaft

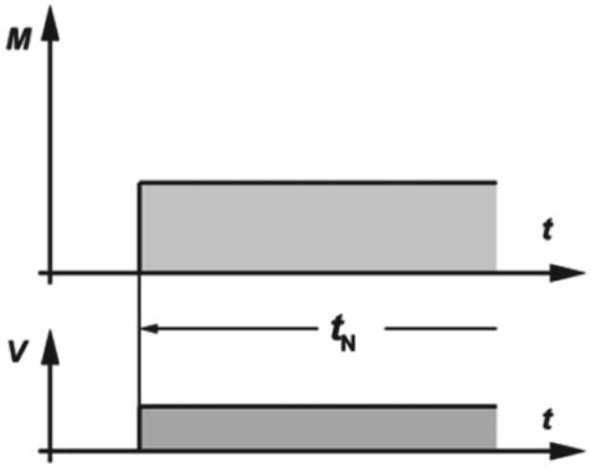
The rated speeds in the selection tables are guidelines for load at rated power. Speed can vary depending on degree of load and temperature (particularly in the case of relatively small motors). Combination gear units for lower speeds are available on request.

Duty types as defined by EN 60034

General

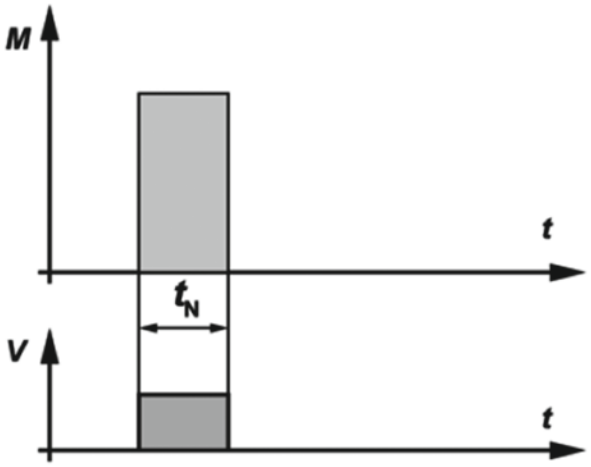
Aside from special drives (such as lifting equipment), standard motors are always designed for continuous running duty. If the drive is operated with frequent on/off cycles, it may be necessary to select a larger motor with a special design. On the other hand, with pronounced short-time duty it is often possible to select a smaller model. **For this reason, it is technically necessary or economically advantageous to inform the motor manufacturer of any duty type that differs from continuous running.**

Continuous running duty (S1)



Operation under rated load for sufficient time to allow temperature equilibrium to be attained, such that the temperature does not increase any more with continued operation. The equipment can operate continuously under the rated load without exceeding the allowable temperature.

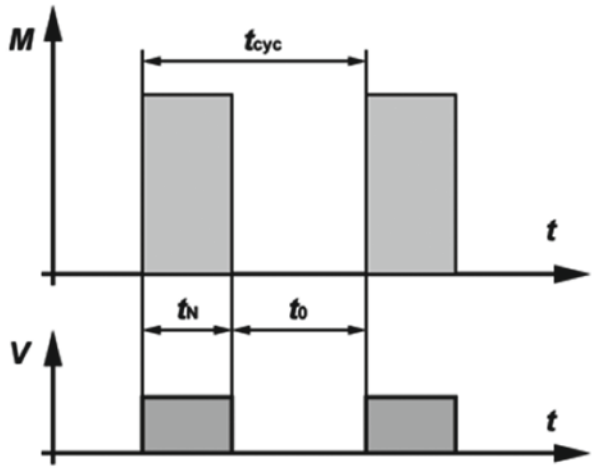
Short-time duty (S2)



The operating time under rated load is short compared with the subsequent rest period. The standard operating times are 10, 30, 60 and 90 minutes. The equipment can operate for this period under the rated load without exceeding the allowable temperature.

Example: S2 – 60 min

Intermittent periodic duty (S3)



S3 duty consists of a sequence of identical cycles, each composed of an operating time with constant load and a rest time with the windings de-energized. The cycle is such that the starting current does not significantly affect the temperature rise. The operating time under rated load and the subsequent pause are both short. The equipment can operate under load only during the period indicated by the duty cycle as a percentage of the total cycle time (cycle duration).
The standardized duty cycles are 15, 25, 40 and 60 %. The cycle duration is 10 minutes unless otherwise specified.

Intermittent periodic duty means that a state of thermal equilibrium is not reached during the load interval.

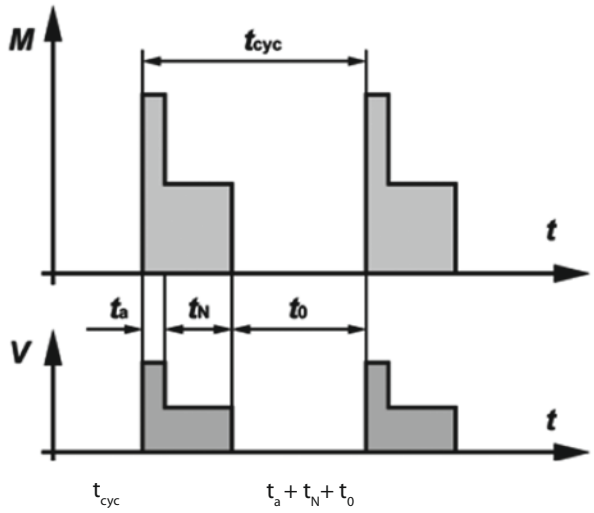
The duty cycle can be determined as follows:

$$ED = \frac{t_N}{t_{cyc}} \times 100\% = \frac{t_N}{t_N + t_0} \times 100\%$$

Example: S3 – 25%

Duty types as defined by EN 60034

Intermittent periodic duty with starting (S4)



S4 duty consists of a sequence of identical cycles, each of which is composed of a distinct starting time, a time of operation under constant load, and a rest period with the windings de-energized.

The operating time under rated load and the subsequent pause are both short. The equipment can operate under load only during the period indicated by the duty cycle as a percentage of the total cycle time (cycle duration).

The standardized duty cycles are 15, 20, 40 and 60 %. The cycle duration is 10 minutes unless otherwise specified.

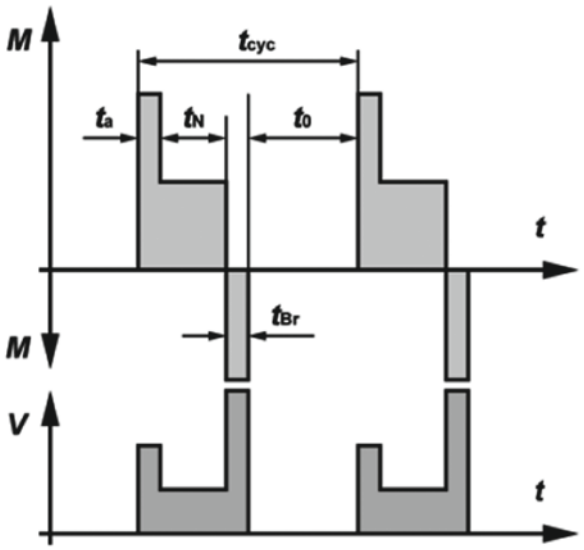
The load cycle corresponds to mode S3, but with additional heating during the starting time that must be taken into account.

The duty cycle can be determined as follows:

$$ED = \frac{(t_a + t_N)}{t_{cyc}} \times 100\% = \frac{t_a + t_N}{t_a + t_N + t_0} \times 100\%$$

Example: S4 – 25%, J_M = 0.15 kgm²

Intermittent periodic duty with electric braking (S5)



S5 duty consists of a sequence of identical cycles, each of which is composed of a starting time, a time of operation under constant load, a time of fast electric braking, and a rest period with the windings de-energized.
The operating time under rated load and the subsequent pause are both short. The equipment can operate under load only during the period indicated by the duty cycle as a percentage of the total cycle time (cycle duration).
The standardized duty cycles are 15, 20, 40 and 60 %. The cycle duration is 10 minutes unless otherwise specified.

The load cycle corresponds to S3 duty, but with additional warming during the starting time t_a and the braking time t_{Br} taken into account.

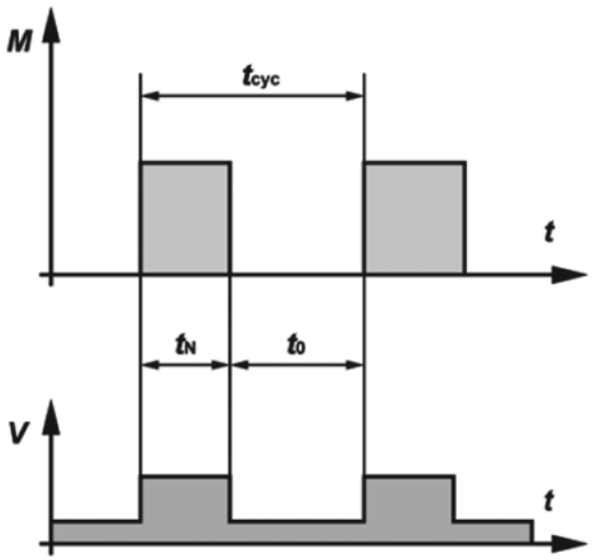
The duty cycle can be determined as follows:

$$ED = \frac{(t_a + t_N + t_{Br})}{t_{cyc}} \times 100\% = \frac{t_a + t_N + t_{Br}}{t_a + t_N + t_{Br} + t_0} \times 100\%$$

Example: S5 – 25%; J_M = 0.15 kgm², J_{ext} = 0.7 kgm²

Duty types as defined by EN 60034

Continuous-operation periodic duty (S6)



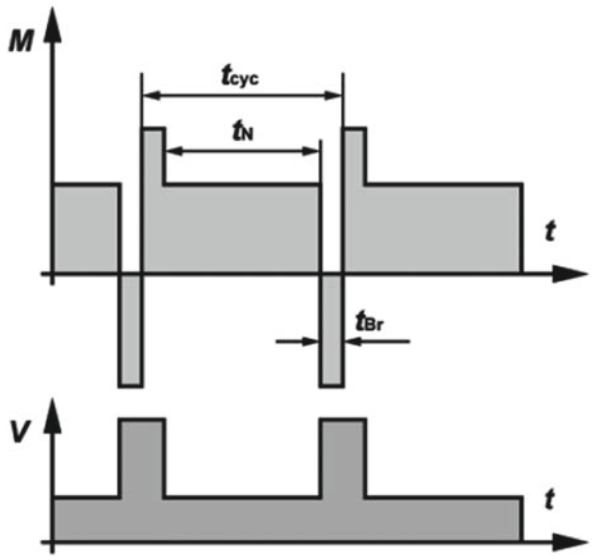
This type of duty corresponds to S3, with the exception that the equipment remains energized during the rest periods. In other words, it operates with no load during these periods. The duty cycle and cycle duration are specified the same way as for S3 duty.

The duty cycle can be determined as follows:

$$ED = \frac{t_N}{t_{cyc}} \times 100\% = \frac{t_N}{t_N + t_0} \times 100\%$$

Example: S6 – 40%

Continuous-operation periodic duty with electric braking (S7)

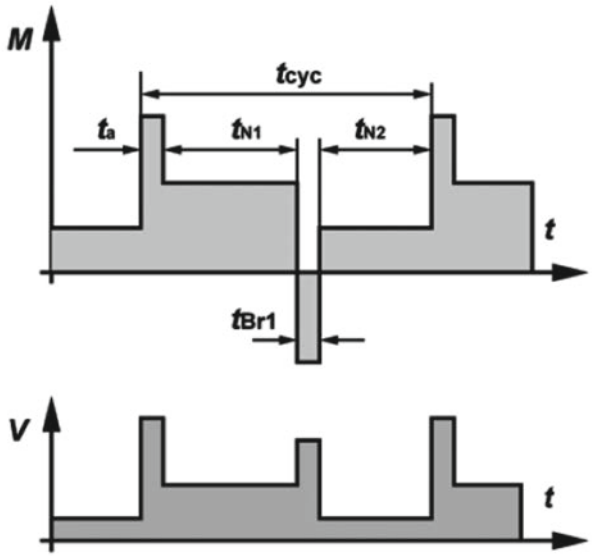


The machine starts up, operates under load, and then is braked electrically, for example by feeding it from a DC power source. Following this, it starts up again immediately. The machine can operate continuously in this manner if the specified moments of inertia of the motor J_M and of the load J_{Ext} as well as the specified duty cycle are not exceeded. If the cycle duration is not specified, it is assumed to be 10 minutes.

The duty cycle can be determined as follows: DC = 1

Example: S7 – J_M = 0.4 kgm², J_{ext} = 7.5 kgm²

Continuous-operation periodic duty with relative load/speed changes (S8)



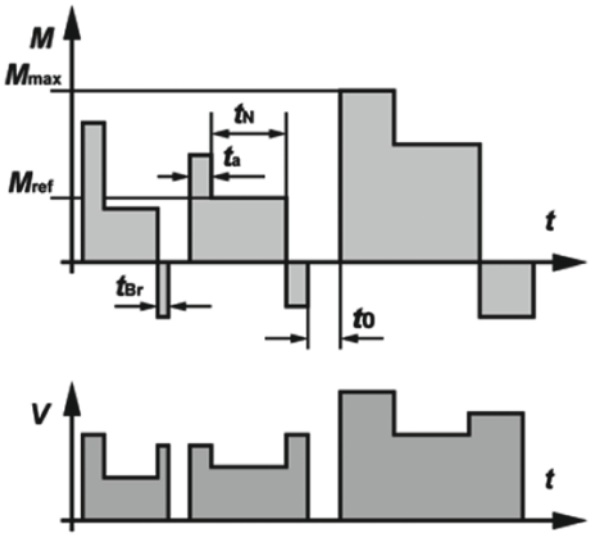
The machine runs continuously under variable load with frequent speed variations. The machine can operate continuously in this manner if at each speed the specified values are not exceeded (moments of inertia J_M and J_{Ext} cycle duration (if other than 10 minutes), rated output and duty cycle. With a moment of inertia of 1 kg m², the acceleration characteristics are the same as with a mass of 1 kg at a distance of 1 m from the axis of rotation).

The duty cycle can be determined as follows:

$$ED = \frac{t_a + t_{N1}}{t_{cyc}} \times 100\% = \frac{t_{Br} + t_{N2}}{t_{cyc}} \times 100\%$$

Example: S8 – J_M = 0.5 kgm², J_{ext} = 6 kgm²

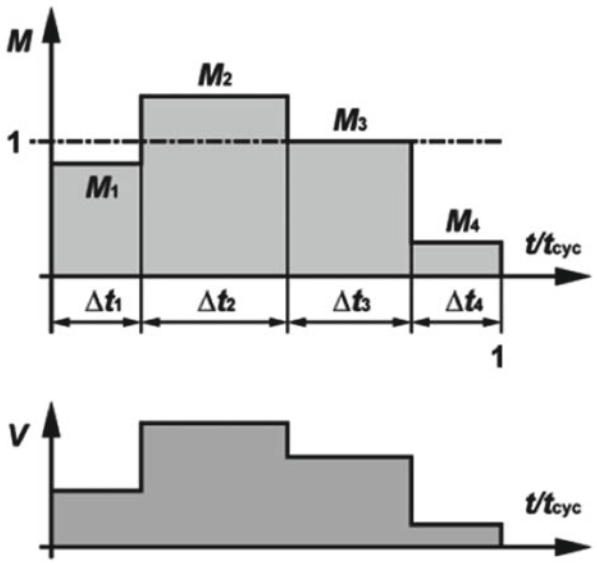
Duty with non-periodic load and speed variations (S9)



In S9 duty the load and the speed vary non-periodically within the permissible operating range. This includes frequently applied overloads, which must never exceed the reference load.
For this duty type, a constant load appropriately selected and based on duty type S1 shall be taken as the reference value M_{ref} for the overload.

Duty types as defined by EN 60034

Duty with discreet constant loads and speeds (S10)



S10 duty comprises operation with at most four different load levels, each of which is maintained long enough to allow the machine to reach thermal equilibrium.
The minimum load within a duty cycle may have a value of zero (no-load operation or at rest with the windings de-energized).
The appropriate abbreviation is S10 followed by the per unit quantities p/Δt for the respective load and its duration and the per unit quantity TL for the relative thermal life expectancy of the insulation system. The reference value for the thermal life expectancy is the thermal life expectancy at rating for continuous running duty and permissible limits of temperature rise based on duty type S1. For a time de-energized and at rest, the load shall be indicated by the letter r.

Example: S10 p/Δt = 1.1/0.4, 1/0.3, 0.9/0.2, r/0.1; TL = 0.6

4-pole TEFC motors for continuous running duty S1 and 60 Hz mains frequency (Y/D)

60 Hz

Except for brake motors

P		Type	n_N	M_N	Nm	I_N			cosφ	Nom. Eff. (100%-Load)	I_A/I_N	M_A/M_N	M_S/M_N	M_K/M_N	J_{rot}		Brake
HP	kW		[1/min]	lb.f-in		460 V A	575 V A			[%]					lbf.ft²	kgm²	
0.075	0.055	D04LA4	1620	2.8	0.32	0.27	0.22	Y	0.6	-	2.5	2.5	2.5	3	0.00415	0.000175	E003
0.1	0.075	D04LA4	1620	3.8	0.43	0.35	0.28	Y	0.6	-	2.2	2.1	2.1	2.4	0.00415	0.000175	
0.12	0.09	D04LA4	1620	4.6	0.52	0.38	0.3	Y	0.69	-	2.7	2.4	2.4	2.9	0.00415	0.000175	
0.15	0.11	D04LA4	1620	5.7	0.64	0.42	0.34	Y	0.73	-	2.5	2.1	2.1	2.3	0.00415	0.000175	
0.1	0.075	D05LA4	1620	4	0.45	0.32	0.26	Y	0.59	-	5.5	3.5	3.3	3.5	0.007	0.000295	E003
0.12	0.09	D05LA4	1620	4.7	0.53	0.35	0.28	Y	0.7	-	3.7	3.3	3.1	3.3	0.007	0.000295	
0.15	0.11	D05LA4	1620	5.8	0.65	0.38	0.3	Y	0.7	-	3.5	2.7	2.5	2.7	0.007	0.000295	
0.25	0.18	D05LA4	1620	9.4	1.06	0.6	0.48	Y	0.65	-	3.4	2.8	2.7	2.8	0.007	0.000295	
0.33	0.25	D05LA4	1620	13	1.47	0.8	0.64	Y	0.69	-	3.2	2.5	2.4	2.5	0.007	0.000295	
0.4	0.3	D05LA4	1620	15.5	1.75	0.93	0.74	Y	0.7	-	3.1	2.6	2.6	2.7	0.007	0.000295	
0.1	0.075	D06LA4	1620	4	0.45	0.32	0.26	Y	0.59	-	5.5	3.5	3.3	3.5	0.007	0.000295	E003
0.12	0.09	D06LA4	1620	4.7	0.53	0.35	0.28	Y	0.7	-	3.7	3.3	3.1	3.3	0.007	0.000295	
0.15	0.11	D06LA4	1620	5.8	0.65	0.38	0.3	Y	0.7	-	3.5	2.7	2.5	2.7	0.007	0.000295	
0.25	0.18	D06LA4	1620	9.4	1.06	0.6	0.48	Y	0.65	-	3.4	2.8	2.7	2.8	0.007	0.000295	
0.33	0.25	D06LA4	1620	13	1.47	0.8	0.64	Y	0.69	-	3.2	2.5	2.4	2.5	0.007	0.000295	
0.4	0.3	D06LA4	1620	15.5	1.75	1	0.8	Y	0.7	-	3.1	2.1	2	2.1	0.007	0.000295	
0.5	0.37	D07LA4	1620	18.6	2.1	1.24	0.99	Y	0.66	-	2.8	2.4	2.4	2.5	0.00914	0.000385	E003, E004
0.75	0.55	D08MA4	1680	27.4	3.1	1.4	1.12	Y	0.75	-	4.6	2.3	2.1	2.5	0.0273	0.00115	ES(X)010
1	0.75	DPE08XB4	1735	36.29	4.1	1.67	1.336	Y	0.67	85.5	6.4	3.6	3.1	4	0.0475	0.002	EH(X)010/027
1	0.75	DPE09LA4	1750	36.29	4.1	1.45	1.16	Y	0.76	85.5	7.7	3.7	3.4	4.2	0.0759	0.0032	
1.5	1.1	DPE09XB4	1755	53.10	6	2.2	1.76	Y	0.73	86.5	8.7	4.2	3.8	5	0.1163	0.0049	ES(X)010/027
2	1.5	DPE09XB4	1745	72.58	8.2	2.9	2.32	Y	0.76	86.5	7.6	3.6	3.4	4.3	0.1163	0.0049	EH(X)027/040
2.4	1.8	DPE09XB4C	1760	86.74	9.8	3.2	2.56	Y	0.8	86.5	8.3	2.6	2.1	4	0.1637	0.0069	
3	2.2	DPE11MA4	1760	106	12	4	3.2	Y	0.78	89.5	8.5	4.5	3.6	4.9	0.2492	0.0105	
4	3	DPE11LB4	1760	144	16.3	5.2	4.16	D	0.81	89.5	9	3.8	3.3	4.6	0.403	0.017	ES(X)027/040/070
5	3.7	DPE11LB4	1760	177	20	6.3	5.04	D	0.82	89.5	8.6	3.6	3.1	4.3	0.403	0.017	EH(X)070/125
5.5	4	DPE11LB4	1760	192	21.7	6.9	5.52	D	0.81	89.5	9.3	3.7	3	4.7	0.403	0.017	
6	4.5	DPE11LB4	1750	217	24.5	7.6	6.08	D	0.83	89.5	8.4	3.2	2.6	4.1	0.403	0.017	
7.5	5.5	DPE13XA4	1770	261	29.5	9.5	7.6	D	0.79	91.7	9	4.4	3.1	4.2	0.95	0.04	ES(X)040/070/125
10	7.5	DPE13XA4	1765	358	40.5	13.2	10.56	D	0.77	91.7	8.5	3.7	3	4.1	0.95	0.04	EH(X)200
12.75	9.5	DPE16LB4	1780	451	51	16.7	13.36	D	0.77	92.4	8.7	3.5	2.1	3.5	1.80	0.076	
15	11	DPE16LB4	1780	522	59	19.3	15.44	D	0.77	92.4	8	3.3	2	3.3	1.80	0.076	ES(X)125/200
16.8	12.5	DPE16XB4	1770	593	67	21	16.8	D	0.82	92.4	7.7	3	2	3	2.30	0.097	EH(X)400
20	15	DPE16XB4	1780	708	80	26.2	20.96	D	0.77	93	8.8	3.7	2.3	3.6	2.30	0.097	ZS(X)300
25	18.5	DPE18LB4	1780	876	99	31	24.8	D	0.8	93.6	9.6	4.3	2.7	3.7	4.03	0.17	ES(X)250
30	22	DPE18XB4	1780	1044	118	36.5	29.2	D	0.81	93.6	9.1	3.9	2.4	3.2	4.63	0.195	EH(X)400 ZS(X)500
40	30	DPE20XA4	1785	1416	160	46.5	37.2	D	0.86	94.1	9.5	3.4	2.9	3.9	9.23	0.389	ES(X)250
50	37	DPE22MA4	1780	1752	198	60	48	D	0.82	94.5	9.7	3.7	3.3	4.2	10.25	0.432	ZS(X)500

P	Rated torque at 60 Hz mains frequency
n_N	Typical rated rotor shaft speed at 60 Hz mains frequency
M_N	Rated torque at rotor shaft
I_N	Rated current at 460 V (for other special voltages, multiply by the inverse voltage ratio to convert the current at 460 V to the current at the desired voltage)
cos φ	Power factor
Nom. Eff.	Efficiency at full load
I_A/I_N	Relative starting current
M_A/M_N	Relative starting torque
M_S/M_N	Relative pull-up torque
M_K/M_N	Relative breakdown torque
J_{rot}	Rotor moment of inertia
Brake	Brake configuration (see Section 15)

The standard motor winding configuration is for 460 V / 60 Hz.

All motors designed for thermal class F are suitable for operation over the voltage range 440–480 V or 460 V +/- 10%.

Note: the current, power factor and torque vary depending on the deviation from 460 V.

See "www.bauergears.com" for more information.

Motors

Technical data of the 60 Hz motors

4-pole TEFC motors for continuous running duty S1 and 60 Hz mains frequency (D/DD)

60 Hz

Except for brake motors

P		Type	n_N	M_N	Nm	I_N			cosφ	Nom. Eff.	I_A/I_N	M_A/M_N	M_S/M_N	M_K/M_N	J_{rot}		Brake
HP	kW		[1/min]	lb.f-in		230 V A	460 V A			(100%-Load) [%]					lbf.ft²	kgm²	
0.075	0.055	D04LA4	1620	2.8	0.32	0.54	0.27	DD/D	0.6	-	2.5	2.5	2.5	3	0.00415	0.000175	E003
0.1	0.075	D04LA4	1620	3.8	0.43	0.70	0.35	DD/D	0.6	-	2.2	2.1	2.1	2.4	0.00415	0.000175	
0.12	0.09	D04LA4	1620	4.6	0.52	0.76	0.38	DD/D	0.69	-	2.7	2.4	2.4	2.9	0.00415	0.000175	
0.15	0.11	D04LA4	1620	5.7	0.64	0.84	0.42	DD/D	0.73	-	2.5	2.1	2.1	2.3	0.00415	0.000175	
0.1	0.075	D05LA4	1620	4	0.45	0.64	0.32	DD/D	0.59	-	5.5	3.5	3.3	3.5	0.007	0.000295	E003
0.12	0.09	D05LA4	1620	4.7	0.53	0.70	0.35	DD/D	0.7	-	3.7	3.3	3.1	3.3	0.007	0.000295	
0.15	0.11	D05LA4	1620	5.8	0.65	0.76	0.38	DD/D	0.7	-	3.5	2.7	2.5	2.7	0.007	0.000295	
0.25	0.18	D05LA4	1620	9.4	1.06	1.20	0.6	DD/D	0.65	-	3.4	2.8	2.7	2.8	0.007	0.000295	
0.33	0.25	D05LA4	1620	13	1.47	1.60	0.8	DD/D	0.69	-	3.2	2.5	2.4	2.5	0.007	0.000295	
0.4	0.3	D05LA4	1620	15.5	1.75	1.86	0.93	DD/D	0.7	-	3.1	2.6	2.6	2.7	0.007	0.000295	
0.1	0.075	D06LA4	1620	4	0.45	0.64	0.32	DD/D	0.59	-	5.5	3.5	3.3	3.5	0.007	0.000295	E003
0.12	0.09	D06LA4	1620	4.7	0.53	0.70	0.35	DD/D	0.7	-	3.7	3.3	3.1	3.3	0.007	0.000295	
0.15	0.11	D06LA4	1620	5.8	0.65	0.76	0.38	DD/D	0.7	-	3.5	2.7	2.5	2.7	0.007	0.000295	
0.25	0.18	D06LA4	1620	9.4	1.06	1.20	0.6	DD/D	0.65	-	3.4	2.8	2.7	2.8	0.007	0.000295	
0.33	0.25	D06LA4	1620	13	1.47	1.60	0.8	DD/D	0.69	-	3.2	2.5	2.4	2.5	0.007	0.000295	
0.4	0.3	D06LA4	1620	15.5	1.75	2.00	1	DD/D	0.7	-	3.1	2.1	2	2.1	0.007	0.000295	
0.5	0.37	D07LA4	1620	18.6	2.1	2.48	1.24	DD/D	0.66	-	2.8	2.4	2.4	2.5	0.00914	0.000385	E003, E004
0.75	0.55	D08MA4	1680	27.4	3.1	2.24	1.12	DD/D	0.75	-	4.6	2.3	2.1	2.5	0.0273	0.00115	ES(X)010
1	0.75	DPE08XB4	1735	36.29	4.1	2.67	1.34	DD/D	0.67	85.5	6.4	3.6	3.1	4	0.0474607204	0.002	EH(X)010/027
1	0.75	DPE09LA4	1750	36.29	4.1	2.32	1.16	DD/D	0.76	85.5	7.7	3.7	3.4	4.2	0.0759371526	0.0032	
1.5	1.1	DPE09XB4	1755	53.10	6	3.52	1.76	DD/D	0.73	86.5	8.7	4.2	3.8	5	0.1162787649	0.0049	ES(X)010/027
2	1.5	DPE09XB4	1745	72.58	8.2	4.64	2.32	DD/D	0.76	86.5	7.6	3.6	3.4	4.3	0.1162787649	0.0049	EH(X)027/040
2.4	1.8	DPE09XB4C	1760	86.74	9.8	5.12	2.56	DD/D	0.8	86.5	8.3	2.6	2.1	4	0.1637394852	0.0069	
3	2.2	DPE11MA4	1760	106	12	6.40	3.20	DD/D	0.78	89.5	8.5	4.5	3.6	4.9	0.2491687818	0.0105	ES(X)027/040/070 EH(X)070/125
4	3	DPE11LB4	1760	144	16.3	8.32	4.16	DD/D	0.81	89.5	9	3.8	3.3	4.6	0.403416123	0.017	
5	3.7	DPE11LB4	1760	177	20	10.08	5.04	DD/D	0.82	89.5	8.6	3.6	3.1	4.3	0.403416123	0.017	
5.5	4	DPE11LB4	1760	192	21.7	11.04	5.52	DD/D	0.81	89.5	9.3	3.7	3	4.7	0.403416123	0.017	
6	4.5	DPE11LB4	1750	217	24.5	12.16	6.08	DD/D	0.83	89.5	8.4	3.2	2.6	4.1	0.403416123	0.017	
7.5	5.5	DPE13XA4	1770	261	29.5	15.20	7.60	DD/D	0.79	91.7	9	4.4	3.1	4.2	0.949214407	0.04	ES(X)040/070/125
10	7.5	DPE13XA4	1765	358	40.5	21.12	10.56	DD/D	0.77	91.7	8.5	3.7	3	4.1	0.949214407	0.04	EH(X)200
12.75	9.5	DPE16LB4	1780	451	51	26.72	13.36	DD/D	0.77	92.4	8.7	3.5	2.1	3.5	1.8035073733	0.076	ES(X)125/200 EH(X)400 ZS(X)300
15	11	DPE16LB4	1780	522	59	30.88	15.44	DD/D	0.77	92.4	8	3.3	2	3.3	1.8035073733	0.076	
16.8	12.5	DPE16XB4	1770	593	67	33.60	16.80	DD/D	0.82	92.4	7.7	3	2	3	2.301844937	0.097	
20	15	DPE16XB4	1780	708	80	41.92	20.96	DD/D	0.77	93	8.8	3.7	2.3	3.6	2.301844937	0.097	
25	18.5	DPE18LB4	1780	876	99	49.60	24.80	DD/D	0.8	93.6	9.6	4.3	2.7	3.7	4.0341612298	0.17	ES(X)250 EH(X)400 ZS(X)500
30	22	DPE18XB4	1780	1044	118	58.40	29.20	DD/D	0.81	93.6	9.1	3.9	2.4	3.2	4.6274202341	0.195	
40	30	DPE20XA4	1785	1416	160	74.40	37.20	DD/D	0.86	94.1	9.5	3.4	2.9	3.9	9.2311101081	0.389	ES(X)250 ZS(X)500
50	37	DPE22MA4	1780	1752	198	96.00	48.00	DD/D	0.82	94.5	9.7	3.7	3.3	4.2	10.2515155956	0.432	

P	Rated torque at 60 Hz mains frequency
n_N	Typical rated rotor shaft speed at 60 Hz mains frequency
M_N	Rated torque at rotor shaft
I_N	Rated current at 460 V (for other special voltages, multiply by the inverse voltage ratio to convert the current at 460 V to the current at the desired voltage)
cos φ	Power factor
Nom. Eff.	Efficiency at full load
I_A/I_N	Relative starting current
M_A/M_N	Relative starting torque
M_S/M_N	Relative pull-up torque
M_K/M_N	Relative breakdown torque
J_{rot}	Rotor moment of inertia
Brake	Brake configuration (see Section 15)

The standard motor winding configuration is for 460 V / 60 Hz.

All motors designed for thermal class F are suitable for operation over the voltage range 440–480 V or 460 V +/- 10%.

Note: the current, power factor and torque vary depending on the deviation from 460 V.

See “www.bauergears.com” for more information.

4-pole motors for intermittent periodic duty (S3/S6) and 60 Hz mains frequency

60 Hz

P kW	DC	Type	n 1/min	M_N Nm	I_N (460 V) A	Connection	cos φ	I_A/I_N	M_A/M_N	M_S/M_N	M_K/M_N	J_{rot} kgm²
0.15	15%	D04LA4	1620	0.87	0.56	Y	0.77	2.2	1.8	1.7	1.8	0.000175
0.3	15%	D05LA4	1620	1.75	0.9	Y	0.75	2.8	2.1	2.0	2.1	0.000295
0.3	60%	D06LA4	1620	1.75	0.9	Y	0.75	2.8	2.1	2.0	2.1	0.000295
0.55	60%	D07LA4	1620	3.2	1.78	Y	0.86	3.7	1.8	1.6	1.8	0.000385
0.75	60%	D08MA4	1680	4.2	1.84	Y	0.81	3.7	1.8	1.5	1.9	0.00115
1.1	60%	D08LA4	1680	6.2	2.5	Y	0.82	3.6	1.6	1.5	1.9	0.0015
1.5	60%	D09SA4	1680	8.5	3.3	Y	0.84	4.3	1.9	1.6	2.2	0.00245
2.2	60%	D09LA4	1680	12.5	4.5	Y	0.86	4.3	1.8	1.6	2.1	0.0032
3.0	60%	D09XA4	1680	16.6	6.2	Y	0.86	3.7	1.9	1.8	2.1	0.0038
4.0	60%	D11SA4	1710	22	8.1	D	0.85	4.4	1.8	1.5	2.2	0.0081
5.5	60%	D11MA4	1710	30.5	10.7	D	0.87	4.7	1.6	1.6	2.2	0.0105
7.5	60%	D11LA4	1710	41.5	14.6	D	0.87	5.0	2.0	1.9	2.3	0.014
9.5	60%	D13MA4	1710	53	17.3	D	0.87	5.4	2.1	1.8	2.4	0.029
11	60%	D13LA4	1710	60	20	D	0.84	6.0	2.6	2.3	2.7	0.0335
13.5	60%	D16MA4	1760	73	25.5	D	0.84	6.1	2.3	1.8	2.2	0.057
18.5	60%	D16LA4	1760	100	35	D	0.84	5.6	2.1	1.8	2.3	0.076
22	60%	D16XA4	1760	120	42	D	0.84	5.9	2.3	1.4	2.2	0.087
30	60%	D18LA4	1760	163	53	D	0.89	4.9	2.0	1.6	1.9	0.16
37	60%	D18XA4	1760	200	68	D	0.85	6.0	2.7	2.2	2.5	0.195

P	Rated output at 60 Hz mains frequency, S3/S6 duty
DC	Permissible duty cycle
n	Typical rated rotor shaft speed at 60 Hz Mains frequency
M_N	Rated shaft torque
I_N	Rated current at 460 V (for other special voltages, multiply by the inverse voltage ratio to convert the current at 460 V to the current at the desired voltage)
cos φ	Power factor
I_A/I_N	Relative starting current
M_A/M_N	Relative starting torque
M_S/M_N	Relative pull-up torque
M_K/M_N	Relative breakdown torque
J_{rot}	Rotor moment of inertia

The standard motor winding configuration is for 460 V / 60 Hz.

See Bauer Publication SD4xx for additional information.

Motors

Operation with frequency converter

The figures given in the table below are for Bauer motors operating in conjunction with the frequency inverter. The torques referred to in tables can be entered for the respective frequencies in continuous operation (S1 = duty factor 100 %).

Motor torques for frequency-converter range 5 Hz - 80 Hz, line frequency 60 Hz / Imperial

P		Type	Connection	5 Hz M	10 Hz M	20 Hz M	30 Hz M	60 Hz M	70 Hz M	80 Hz M	5 Hz I	10 Hz I	20 Hz I	30 Hz I	60 Hz I	70 Hz I	80 Hz I
HP	kW			lb.f-in	lb.f-in	lb.f-in	lb.f-in	lb.f-in	lb.f-in	lb.f-in	A	A	A	A	A	A	A
0.075	0.055	D04LA4	Y	0.00	2.12	2.52	2.79	2.83	2.83	2.52	0.27	0.27	0.27	0.27	0.27	0.30	0.31
0.1	0.075	D04LA4	Y	2.26	2.83	3.41	3.72	3.81	3.81	3.19	0.31	0.33	0.34	0.35	0.35	0.39	0.38
0.12	0.09	D04LA4	Y	2.74	3.45	4.12	4.51	4.60	4.60	4.12	0.38	0.38	0.38	0.38	0.38	0.43	0.43
0.15	0.11	D04LA4	Y	3.36	4.25	5.04	5.58	5.66	5.66	4.51	0.41	0.41	0.42	0.42	0.42	0.47	0.43
0.1	0.075	D05LA4	Y	2.39	2.96	3.58	3.89	3.98	3.98	3.58	0.28	0.29	0.31	0.32	0.32	0.36	0.37
0.12	0.09	D05LA4	Y	2.79	3.50	4.20	4.60	4.69	4.69	4.20	0.33	0.34	0.35	0.35	0.35	0.39	0.40
0.15	0.11	D05LA4	Y	3.45	4.29	5.13	5.66	5.75	5.75	5.13	0.34	0.36	0.37	0.38	0.38	0.43	0.43
0.25	0.18	D05LA4	Y	5.58	6.99	8.41	9.20	9.38	9.38	8.41	0.54	0.56	0.59	0.60	0.60	0.67	0.68
0.33	0.25	D05LA4	Y	7.79	9.74	11.68	12.83	13.01	13.01	11.42	0.77	0.78	0.80	0.80	0.80	0.89	0.89
0.4	0.3	D05LA4	Y	9.29	11.59	13.90	15.22	15.49	15.49	13.90	0.89	0.91	0.92	0.93	0.93	1.03	1.06
0.1	0.075	D06LA4	Y	2.39	2.96	3.58	3.89	3.98	3.98	3.58	0.28	0.29	0.31	0.32	0.32	0.36	0.37
0.12	0.09	D06LA4	Y	2.79	3.50	4.20	4.60	4.69	4.69	4.20	0.33	0.34	0.35	0.35	0.35	0.39	0.40
0.15	0.11	D06LA4	Y	3.45	4.29	5.13	5.66	5.75	5.75	5.13	0.34	0.36	0.37	0.38	0.38	0.43	0.43
0.25	0.18	D06LA4	Y	5.58	6.99	8.41	9.20	9.38	9.38	8.41	0.54	0.56	0.59	0.60	0.60	0.67	0.68
0.33	0.25	D06LA4	Y	7.79	9.74	11.68	12.83	13.01	13.01	11.42	0.77	0.78	0.80	0.80	0.80	0.89	0.89
0.4	0.3	D06LA4	Y	9.29	11.59	13.90	15.22	15.49	14.87	11.42	0.84	0.90	0.96	1	1	1.07	0.97
0.5	0.37	D07LA4	Y	11.42	14.25	17.08	18.59	18.59	18.59	16.64	1.22	1.23	1.24	1.24	1.24	1.38	1.37
0.75	0.55	D08MA4	Y	16.46	20.36	24.78	26.55	27.44	27.44	23.90	1.22	1.28	1.35	1.40	1.40	1.55	1.55
1	0.75	DPE08XB4	Y	21.24	27.44	32.75	36.29	36.29	36.29	32.75	1.21	1.31	1.42	1.49	1.50	1.67	1.70
1	0.75	DPE09LA4	Y	21.24	26.55	31.86	35.40	36.29	36.29	31.86	1.01	1.13	1.26	1.34	1.35	1.50	1.53
1.5	1.1	DPE09XB4	Y	31.86	39.83	47.79	52.22	53.10	53.10	47.79	1.60	1.76	1.93	2.10	2.10	2.30	2.40
2	1.5	DPE09XB4	Y	43.37	53.99	64.61	71.69	72.58	72.58	64.61	2.20	2.40	2.70	2.80	2.80	3.10	3.20
2.4	1.8	DPE09XB4C	Y	51.33	64.61	77.89	84.97	86.74	86.74	77.89	2.40	2.70	3	3.20	3.20	3.60	3.70
3	2.2	DPE11MA4	Y	62.84	78.77	94.70	104	105	105	95	2.70	3.10	3.50	3.70	3.70	4.10	4.20
4	3	DPE11LB4	Y	85.85	108	129	142	144	144	129	3.90	4.40	4.90	5.20	5.20	5.80	5.90
5	3.7	DPE11LB4	Y	106	133	159	174	177	177	159	4.70	5.30	5.90	6.30	6.30	7	7.20
5.5	4	DPE11LB4	Y	115	143	173	186	190	190	173	5.20	5.80	6.50	6.90	6.90	7.70	7.80
6	4.5	DPE11LB4	Y	130	162	195	212	217	217	195	5.50	6.20	7.10	7.60	7.60	8.50	8.60
7.5	5.5	DPE13XA4	Y	157	195	235	257	261	261	235	7.10	7.90	8.90	9.50	9.50	10.60	10.80
10	7.5	DPE13XA4	Y	212	266	319	354	358	358	319	9	10.30	11.70	12.50	12.60	14	14.30
12.75	9.5	DPE16LB4	Y	270	336	403	443	451	451	403	11.80	13.30	15	16	16.10	17.90	18.20
15	11	DPE16LB4	Y	310	389	469	513	522	522	469	13.50	15.30	17.20	18.50	18.60	21	21.50
17	12.5	DPE16XB4	Y	354	443	531	584	593	593	531	14.60	16.80	19.30	21	21	23.50	24
20	15	DPE16XB4	Y	425	531	637	699	708	708	637	17.10	19.60	22.50	24.50	24.50	27.50	28
25	18.5	DPE18LB4	Y	522	655	788	859	876	876	788	22	25	28.50	30.50	30.50	34	34.50
30	22	DPE18XB4	Y	620	779	938	1027	1044	1044	938	26.50	30	34	36.50	36.50	40.50	41.50
40	30	DPE20XA4	Y	850	1062	1275	1398	1416	1416	1275	35.50	40.50	45.50	48.50	49	54	56
50	37	DPE22MA4	Y	1044	1310	1575	1726	1752	1752	1575	41.50	47.50	54	58	59	65	66

Field weakening for frequencies above 60 Hz, winding for standard voltage **460 V Y / 60 Hz**, Temperature Class F.

P Rated output
M permissible load torque (S1-100 %) for operation with frequency inverter
I Load current for operation with frequency inverter

Motors with standard windings can be switched from Y- to Δ- circuit for operation with a converter having a single-phase mains connection. This has no effect on the torques and frequencies as listed in the table above. As regards the choice of converter, however, note that currents are higher than those of the Y-circuit by a factor of 1.73.

The load currents in the table are guideline values for selecting the size of frequency inverter. Load current is lower if the load torque is below the values permitted for 30-70 Hz and the frequency inverter used is of the high-grade type. This means that a smaller inverter can sometimes be used, particularly in conjunction with large motors.

Motor torques for frequency-converter range 5 Hz - 80 Hz. line frequency 60 Hz / Metric

P		Type	Connection	5 Hz	10 Hz	20 Hz	30 Hz	60 Hz	70 Hz	80 Hz	5 Hz	10 Hz	20 Hz	30 Hz	60 Hz	70 Hz	80 Hz
				M	M	M	M	M	M	M	I	I	I	I	I	I	I
HP	kW			Nm	Nm	Nm	Nm	Nm	Nm	Nm	A	A	A	A	A	A	A
0.075	0.055	D04LA4	Y	0.19	0.24	0.285	0.315	0.32	0.32	0.285	0.265	0.27	0.27	0.27	0.27	0.3	0.31
0.1	0.075	D04LA4	Y	0.255	0.32	0.385	0.42	0.43	0.43	0.36	0.31	0.325	0.34	0.35	0.35	0.39	0.375
0.12	0.09	D04LA4	Y	0.31	0.39	0.465	0.51	0.52	0.52	0.465	0.38	0.38	0.38	0.38	0.38	0.425	0.43
0.15	0.11	D04LA4	Y	0.38	0.48	0.57	0.63	0.64	0.64	0.51	0.405	0.41	0.42	0.42	0.42	0.465	0.43
0.1	0.075	D05LA4	Y	0.27	0.335	0.405	0.44	0.45	0.45	0.405	0.275	0.29	0.31	0.32	0.32	0.355	0.365
0.12	0.09	D05LA4	Y	0.315	0.395	0.475	0.52	0.53	0.53	0.475	0.33	0.34	0.345	0.35	0.35	0.39	0.4
0.15	0.11	D05LA4	Y	0.39	0.485	0.58	0.64	0.65	0.65	0.58	0.34	0.355	0.37	0.38	0.38	0.425	0.43
0.25	0.18	D05LA4	Y	0.63	0.79	0.95	1.04	1.06	1.06	0.95	0.54	0.56	0.59	0.6	0.6	0.67	0.68
0.33	0.25	D05LA4	Y	0.88	1.1	1.32	1.45	1.47	1.47	1.29	0.77	0.78	0.8	0.8	0.8	0.89	0.89
0.4	0.3	D05LA4	Y	1.05	1.31	1.57	1.72	1.75	1.75	1.57	0.89	0.91	0.92	0.93	0.93	1.03	1.06
0.1	0.075	D06LA4	Y	0.27	0.335	0.405	0.44	0.45	0.45	0.405	0.275	0.29	0.31	0.32	0.32	0.355	0.365
0.12	0.09	D06LA4	Y	0.315	0.395	0.475	0.52	0.53	0.53	0.475	0.33	0.34	0.345	0.35	0.35	0.39	0.4
0.15	0.11	D06LA4	Y	0.39	0.485	0.58	0.64	0.65	0.65	0.58	0.34	0.355	0.37	0.38	0.38	0.425	0.43
0.25	0.18	D06LA4	Y	0.63	0.79	0.95	1.04	1.06	1.06	0.95	0.54	0.56	0.59	0.6	0.6	0.67	0.68
0.33	0.25	D06LA4	Y	0.88	1.1	1.32	1.45	1.47	1.47	1.29	0.77	0.78	0.8	0.8	0.8	0.89	0.89
0.4	0.3	D06LA4	Y	1.05	1.31	1.57	1.72	1.75	1.68	1.29	0.84	0.9	0.96	1	1	1.07	0.97
0.5	0.37	D07LA4	Y	1.29	1.61	1.93	2.1	2.1	2.1	1.88	1.22	1.23	1.24	1.24	1.24	1.38	1.37
0.75	0.55	D08MA4	Y	1.86	2.3	2.8	3	3.1	3.1	2.7	1.22	1.28	1.35	1.4	1.4	1.55	1.55
1	0.75	DPE08XB4	Y	2.4	3.1	3.7	4.1	4.1	4.1	3.7	1.43	1.51	1.61	1.67	1.67	1.85	1.89
1	0.75	DPE09LA4	Y	2.4	3	3.6	4	4.1	4.1	3.6	1.16	1.26	1.37	1.44	1.45	1.61	1.64
1.5	1.1	DPE09XB4	Y	3.6	4.5	5.4	5.9	6	6	5.4	1.8	1.94	2.1	2.2	2.2	2.5	2.5
2	1.5	DPE09XB4	Y	4.9	6.1	7.3	8.1	8.2	8.2	7.3	2.4	2.6	2.8	2.9	2.9	3.2	3.3
2.4	1.8	DPE09XB4C	Y	5.8	7.3	8.8	9.6	9.8	9.8	8.8	2.4	2.7	3	3.2	3.2	3.6	3.7
3	2.2	DPE11MA4	Y	7.1	8.9	10.7	11.7	11.9	11.9	10.7	2.8	3.1	3.5	3.7	3.7	4.1	4.2
4	3	DPE11LB4	Y	9.7	12.2	14.6	16.1	16.3	16.3	14.6	3.9	4.4	4.9	5.2	5.2	5.8	5.9
5	3.7	DPE11LB4	Y	12	15	18	19.7	20	20	18	4.7	5.3	5.9	6.3	6.3	7	7.2
5.5	4	DPE11LB4	Y	13	16.2	19.5	21	21.5	21.5	19.5	5.2	5.8	6.5	6.9	6.9	7.7	7.8
6	4.5	DPE11LB4	Y	14.7	18.3	22	24	24.5	24.5	22	5.5	6.2	7.1	7.6	7.6	8.5	8.6
7.5	5.5	DPE13XA4	Y	17.7	22	26.5	29	29.5	29.5	26.5	7.2	8	8.9	9.5	9.5	10.6	10.8
10	7.5	DPE13XA4	Y	24	30	36	40	40.5	40.5	36	10.2	11.3	12.4	13.1	13.2	14.7	15
12.75	9.5	DPE16LB4	Y	30.5	38	45.5	50	51	51	45.5	12.7	14.1	15.6	16.6	16.7	18.5	18.9
15	11	DPE16LB4	Y	35	44	53	58	59	59	53	14.6	16.3	18.1	19.2	19.3	21.5	22
17	12.5	DPE16XB4	Y	40	50	60	66	67	67	60	14.6	16.8	19.3	21	21	23.5	24
20	15	DPE16XB4	Y	48	60	72	79	80	80	72	19.9	22.5	24.5	26	26.5	29.5	30
25	18.5	DPE18LB4	Y	59	74	89	97	99	99	89	23	26	29	31	31	34.5	35.5
30	22	DPE18XB4	Y	70	88	106	116	118	118	106	26.5	30	34	36.5	36.5	40.5	41.5
40	30	DPE20XA4	Y	96	120	144	158	160	160	144	32.5	37.5	43	46.5	46.5	52	53
50	37	DPE22MA4	Y	118	148	178	195	198	198	178	44	49.5	56	60	60	67	68

Field weakening for frequencies above 60 Hz, winding for standard voltage **460 V Y / 60 Hz**, Temperature Class F.

P Rated output
M permissible load torque (S1-100 %) for operation with frequency inverter
I Load current for operation with frequency inverter

Motors with standard windings can be switched from Y- to Δ- circuit for operation with a converter having a single-phase mains connection. This has no effect on the torques and frequencies as listed in the table above. As regards the choice of converter, however, note that currents are higher than those of the Y-circuit by a factor of 1.73.

The load currents in the table are guideline values for selecting the size of frequency inverter. Load current is lower if the load torque is below the values permitted for 30-70 Hz and the frequency inverter used is of the high-grade type. This means that a smaller inverter can sometimes be used, particularly in conjunction with large motors.

Motor torques for frequency-converter range 5 Hz - 120 Hz, line frequency 60 Hz / Imperial

P		Type	Connection	5 Hz M	10 Hz M	20 Hz M	30 Hz M	104 Hz M	120 Hz M	5 Hz I	10 Hz I	20 Hz I	30 Hz I	104 Hz I	120 Hz I
HP	kW			lb.f-in	lb.f-in	lb.f-in	lb.f-in	lb.f-in	lb.f-in	A	A	A	A	A	A
0.075	0.055	D04LA4	D	1.68	2.12	2.52	2.79	2.83	2.83	0.46	0.465	0.47	0.47	0.47	0.52
0.1	0.075	D04LA4	D	2.26	2.83	3.41	3.72	3.81	3.81	0.54	0.56	0.59	0.61	0.61	0.67
0.12	0.09	D04LA4	D	2.74	3.45	4.12	4.51	4.6	4.6	0.66	0.66	0.66	0.66	0.66	0.73
0.15	0.11	D04LA4	D	3.36	4.25	5.04	5.58	5.66	5.66	0.7	0.71	0.72	0.73	0.73	0.8
0.1	0.075	D05LA4	D	2.39	2.96	3.58	3.89	3.98	3.98	0.475	0.5	0.54	0.56	0.56	0.61
0.12	0.09	D05LA4	D	2.79	3.5	4.2	4.6	4.69	4.69	0.57	0.59	0.6	0.61	0.61	0.67
0.15	0.11	D05LA4	D	3.45	4.29	5.13	5.66	5.75	5.75	0.59	0.61	0.64	0.66	0.66	0.73
0.25	0.18	D05LA4	D	5.58	6.99	8.41	9.2	9.38	9.38	0.93	0.97	1.01	1.04	1.04	1.15
0.33	0.25	D05LA4	D	7.79	9.74	11.68	12.83	13.01	13.01	1.34	1.35	1.38	1.39	1.39	1.53
0.4	0.3	D05LA4	D	9.29	11.59	13.9	15.22	15.49	15.49	1.54	1.57	1.6	1.61	1.62	1.78
0.1	0.075	D06LA4	D	2.39	2.96	3.58	3.89	3.98	3.98	0.475	0.5	0.54	0.56	0.56	0.61
0.12	0.09	D06LA4	D	2.79	3.5	4.2	4.6	4.69	4.69	0.57	0.59	0.6	0.61	0.61	0.67
0.15	0.11	D06LA4	D	3.45	4.29	5.13	5.66	5.75	5.75	0.59	0.61	0.64	0.66	0.66	0.73
0.25	0.18	D06LA4	D	5.58	6.99	8.41	9.2	9.38	9.38	0.93	0.97	1.01	1.04	1.04	1.15
0.33	0.25	D06LA4	D	7.79	9.74	11.68	12.83	13.01	13.01	1.34	1.35	1.38	1.39	1.39	1.53
0.4	0.3	D06LA4	D	9.29	11.59	13.9	15.22	15.49	15.22	1.45	1.55	1.66	1.73	1.74	1.88
0.5	0.37	D07LA4	D	11.42	14.25	17.08	18.59	18.59	18.59	2.2	2.2	2.2	2.2	2.2	2.4
0.75	0.55	D08MA4	D	16.46	20.36	24.78	26.55	27.44	27.44	2.2	2.2	2.4	2.5	2.5	2.7
1	0.75	DPE08XB4	D	21.24	27.44	32.75	36.29	36.29	36.29	2.5	2.7	2.8	2.9	2.9	3.2
1	0.75	DPE09LA4	D	21.24	26.55	31.86	35.40	36.29	36.29	2.1	2.2	2.4	2.5	2.6	2.8
1.5	1.1	DPE09XB4	D	31.86	39.83	47.79	52.22	53.10	53.10	3.2	3.4	3.7	3.8	3.8	4.2
2	1.5	DPE09XB4	D	43.37	53.99	64.61	71.69	72.58	72.58	4	4.4	4.8	5	5.1	5.6
2.4	1.8	DPE09XB4C	D	51.33	64.61	77.89	84.97	86.74	86.74	4.2	4.7	5.2	5.5	5.6	6.1
3	2.2	DPE11MA4	D	62.84	78.77	94.70	104	105	105	4.7	5.3	6	6.4	6.5	7.1
4	3	DPE11LB4	D	85.85	108	129	142	144	144	6.7	7.5	8.4	9	9.1	9.9
5	3.7	DPE11LB4	D	106	133	159	174	177	177	8.1	9.1	10.2	10.9	11	12
5.5	4	DPE11LB4	D	115	143	173	186	190	190	8.9	10	11.2	11.9	12	13.2
6	4.5	DPE11LB4	D	130	162	195	212	217	217	9.5	10.8	12.2	13.1	13.2	14.5
7.5	5.5	DPE13XA4	D	157	195	235	257	261	261	12.4	13.8	15.4	16.4	16.5	18.1
10	7.5	DPE13XA4	D	212	266	319	354	358	358	17.6	19.5	21.5	23	23	25.5
12.75	9.5	DPE16LB4	D	270	336	403	443	451	451	22	24.5	27.5	29	29	32
15	11	DPE16LB4	D	310	389	469	513	522	522	25.5	28.5	31.5	33.5	33.5	37
17	12.5	DPE16XB4	D	354	443	531	584	593	593	25.5	29.5	33.5	36	36.5	40
20	15	DPE16XB4	D	425	531	637	699	708	708	34.5	38.5	42.5	45.5	45.5	50
25	18.5	DPE18LB4	D	522	655	788	859	876	876	39.5	44.5	50	54	54	60
30	22	DPE18XB4	D	620	779	938	1027	1044	1044	45.5	52	59	63	64	70
40	30	DPE20XA4	D	850	1062	1275	1398	1416	1416	56	65	74	80	81	89
50	37	DPE22MA4	D	1044	1310	1575	1726	1752	1752	76	86	97	103	104	115

Field weakening for frequencies above 104 Hz, winding for standard voltage **265 V Δ / 60 Hz** (U_{max} = 460 V Δ/104 Hz), Temperature Class F.

P Rated output
M permissible load torque (S1-100 %) for operation with frequency inverter
I Load current for operation with frequency inverter

The load currents in the table are guideline values for selecting the size of frequency inverter. Load current is lower if the load torque is below the values permitted for 30-100 Hz and the frequency inverter used is of the high-grade type. This means that a smaller inverter

Motor torques for frequency-converter range 5 Hz - 120 Hz, line frequency 60 Hz / Metric

P		Type	Connection	5 Hz M	10 Hz M	20 Hz M	30 Hz M	104 Hz M	120 Hz M	5 Hz I	10 Hz I	20 Hz I	30 Hz I	104 Hz I	120 Hz I
HP	kW			Nm	Nm	Nm	Nm	Nm	Nm	A	A	A	A	A	A
0.075	0.055	D04LA4	D	0.19	0.24	0.285	0.315	0.32	0.32	0.46	0.465	0.47	0.47	0.47	0.52
0.1	0.075	D04LA4	D	0.255	0.32	0.385	0.42	0.43	0.43	0.54	0.56	0.59	0.61	0.61	0.67
0.12	0.09	D04LA4	D	0.31	0.39	0.465	0.51	0.52	0.52	0.66	0.66	0.66	0.66	0.66	0.73
0.15	0.11	D04LA4	D	0.38	0.48	0.57	0.63	0.64	0.64	0.7	0.71	0.72	0.73	0.73	0.8
0.1	0.075	D05LA4	D	0.27	0.335	0.405	0.44	0.45	0.45	0.475	0.5	0.54	0.56	0.56	0.61
0.12	0.09	D05LA4	D	0.315	0.395	0.475	0.52	0.53	0.53	0.57	0.59	0.6	0.61	0.61	0.67
0.15	0.11	D05LA4	D	0.39	0.485	0.58	0.64	0.65	0.65	0.59	0.61	0.64	0.66	0.66	0.73
0.25	0.18	D05LA4	D	0.63	0.79	0.95	1.04	1.06	1.06	0.93	0.97	1.01	1.04	1.04	1.15
0.33	0.25	D05LA4	D	0.88	1.1	1.32	1.45	1.47	1.47	1.34	1.35	1.38	1.39	1.39	1.53
0.4	0.3	D05LA4	D	1.05	1.31	1.57	1.72	1.75	1.75	1.54	1.57	1.6	1.61	1.62	1.78
0.1	0.075	D06LA4	D	0.27	0.335	0.405	0.44	0.45	0.45	0.475	0.5	0.54	0.56	0.56	0.61
0.12	0.09	D06LA4	D	0.315	0.395	0.475	0.52	0.53	0.53	0.57	0.59	0.6	0.61	0.61	0.67
0.15	0.11	D06LA4	D	0.39	0.485	0.58	0.64	0.65	0.65	0.59	0.61	0.64	0.66	0.66	0.73
0.25	0.18	D06LA4	D	0.63	0.79	0.95	1.04	1.06	1.06	0.93	0.97	1.01	1.04	1.04	1.15
0.33	0.25	D06LA4	D	0.88	1.1	1.32	1.45	1.47	1.47	1.34	1.35	1.38	1.39	1.39	1.53
0.4	0.3	D06LA4	D	1.05	1.31	1.57	1.72	1.75	1.72	1.45	1.55	1.66	1.73	1.74	1.88
0.5	0.37	D07LA4	D	1.29	1.61	1.93	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.4
0.75	0.55	D08MA4	D	1.86	2.3	2.8	3	3.1	3.1	2.2	2.2	2.4	2.5	2.5	2.7
1	0.75	DPE08XB4	D	2.4	3.1	3.7	4.1	4.1	4.1	2.5	2.7	2.8	2.9	2.9	3.2
1	0.75	DPE09LA4	D	2.4	3	3.6	4	4.1	4.1	2.1	2.2	2.4	2.5	2.6	2.8
1.5	1.1	DPE09XB4	D	3.6	4.5	5.4	5.9	6	6	3.2	3.4	3.7	3.8	3.8	4.2
2	1.5	DPE09XB4	D	4.9	6.1	7.3	8.1	8.2	8.2	4	4.4	4.8	5	5.1	5.6
2.4	1.8	DPE09XB4C	D	5.8	7.3	8.8	9.6	9.8	9.8	4.2	4.7	5.2	5.5	5.6	6.1
3	2.2	DPE11MA4	D	7.1	8.9	10.7	11.7	11.9	11.9	4.7	5.3	6	6.4	6.5	7.1
4	3	DPE11LB4	D	9.7	12.2	14.6	16.1	16.3	16.3	6.7	7.5	8.4	9	9.1	9.9
5	3.7	DPE11LB4	D	12	15	18	19.7	20	20	8.1	9.1	10.2	10.9	11	12
5.5	4	DPE11LB4	D	13	16.2	19.5	21	21.5	21.5	8.9	10	11.2	11.9	12	13.2
6	4.5	DPE11LB4	D	14.7	18.3	22	24	24.5	24.5	9.5	10.8	12.2	13.1	13.2	14.5
7.5	5.5	DPE13XA4	D	17.7	22	26.5	29	29.5	29.5	12.4	13.8	15.4	16.4	16.5	18.1
10	7.5	DPE13XA4	D	24	30	36	40	40.5	40.5	17.6	19.5	21.5	23	23	25.5
12.75	9.5	DPE16LB4	D	30.5	38	45.5	50	51	51	22	24.5	27.5	29	29	32
15	11	DPE16LB4	D	35	44	53	58	59	59	25.5	28.5	31.5	33.5	33.5	37
17	12.5	DPE16XB4	D	40	50	60	66	67	67	25.5	29.5	33.5	36	36.5	40
20	15	DPE16XB4	D	48	60	72	79	80	80	34.5	38.5	42.5	45.5	45.5	50
25	18.5	DPE18LB4	D	59	74	89	97	99	99	39.5	44.5	50	54	54	60
30	22	DPE18XB4	D	70	88	106	116	118	118	45.5	52	59	63	64	70
40	30	DPE20XA4	D	96	120	144	158	160	160	56	65	74	80	81	89
50	37	DPE22MA4	D	118	148	178	195	198	198	76	86	97	103	104	115

Field weakening for frequencies above 104 Hz, winding for standard voltage **265 V Δ / 60 Hz** (U_{max} = 460 V Δ/104 Hz), Temperature Class F.

P Rated output
M permissible load torque (S1-100 %) for operation with frequency inverter
I Load current for operation with frequency inverter

The load currents in the table are guideline values for selecting the size of frequency inverter. Load current is lower if the load torque is below the values permitted for 30-100 Hz and the frequency inverter used is of the high-grade type. This means that a smaller inverter can sometimes be used, particularly in conjunction with large motors.

Operation with frequency converter

Notes on design

Use the torque required at the lowest operating speed to select motors for applications which require constant torque over the entire speed range, as is the case, for example, with lifting gear and conveyors. Bear in mind, too, the possibility of torque being lower in the field-weakening range.

Use only the torque required at the highest operating speed to select motors for applications which require square-law torque over the speed range, as is the case, for example, with pumps and fans. Field weakening is not permissible.

The motor‘s power is frequency-dependent. It can be approximated in kW from torque M in Nm, the 50 Hz or 60 Hz speed n and the frequency f in Hz by means of the equation

P = M x n / 9550 x f/50
or
P = M x n / 9550 x f/60

If a frequency inverter is used in conjunction with a pulse generator, the full 50 Hz or 60 Hz rated torque is available as holding torque at motor standstill (independent fan required for prolonged periods at standstill). In many instances, however, a mechanical brake is necessary for holding a position exactly or for safety reasons.

The use of thermistors for the thermal protection of the motor winding for frequency inverter duty are strictly recommended (available at extra cost for all motor sizes).

Increased torque with reduced duty factor

A reduction in duty factor increases the torque available at the low end of the frequency range (up to the transition frequency for field weakening) in accordance with the factors in the table below:

Duty factor	Motor torque with reduced duty factor	Increase in current requirementapproximate
100 %	-	-
60 %	1.15 x S1 torque	1.15 x S1 current
40 %	1.30 x S1 torque	1.30 x S1 current
25 %	1.45 x S1 torque	1.45 x S1 current
15 %	1.60 x S1 torque	1.60 x S1 current

This, in turn, means that short-term overload by a factor of 1.6 is permissible for starting from a low speed, for example. An increase in torque in the field-weakening range due to a reduction in duty factor is possible only under certain conditions; the 1.6x S1 torque generally cannot be achieved

Increased torque with external fan

If an independent fan is used, the S1- torque in the lower frequency range (below 30 Hz) need not be reduced, i.e., when it has an independent fan the motor can provide the 50 Hz or 60 Hz rated torque throughout the entire frequency range to the cut-off frequency of the field weakening.

With a high quality frequency inverter of 160 %, when independent ventilation is combined with a reduced duty factor the 50 Hz or 60 Hz torque is available from rest through to the transition frequency of the field weakening range.

External ventilation is available for motor types D..08.. and larger (see chapter 16 “Motor-independent fan (FV). In many instances, a more economical alternative is to select a larger motor without external ventilation.