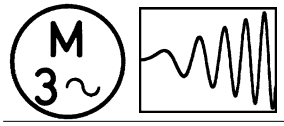
14



General

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 In November 2009 it superseded Directive 2005/32/EC, which formed the framework for requirements for the environmentally responsible design of energy-using products (EuPs).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.
From 16 June 2011 onward, new motors or geared motors marketed in the EU must comply with the requirements of **energy efficiency class IE2**. **From 1 January 2015 onward, motors with rated outputs from 7.5 to 375 kW** destined for the European market must comply with **energy efficiency class IE3**, and **from 1 January 2017 onward this requirement also applies to smaller motors rated at 0.75 kW or more.**

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.

IEC 60034-30-1

Rotating electrical machines. Efficiency classes of line operated AC motors (IE-code)

This new edition of IEC 60034-30-1 specifies efficiency classes for single-speed electric motors that are rated according to IEC 60034-1 or IEC 60079-0, are rated for operation on a sinusoidal voltage supply IEC 60034-30-1 widens the product range with no distinction between motor technologies, supply voltage and frequency. All technical constructions of electric motors are covered as long as they are rated for on-line operation including Line-Start-Permanent-Magnet-Motors.

This IEC standard provides for the global harmonization of energy-efficiency classes IE1, IE2, IE3 and IE4 of electric motors.

Efficiency class designation		**Comparison with CEMEP classification**	
Efficiency	**Code**	**Efficiency**	**Logo**
Super Premium	**IE4**	**-**	**-**
Premium	**IE3**	**-**	**-**
High	**IE2**	**High**	EFF 1
Standard	**IE1**	**Improved**	EFF 2
Lower than Standard	**No designation**	**Standard**	EFF 3

General

Motors subject to the ErP Directive as specified by the Electric Motors Regulation 640/2009/EC

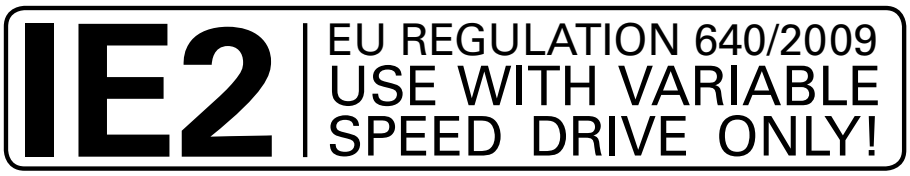
The new Electric Motors Regulation has a broader scope than the standard previously used in Europe.

- → Single-speed, three-phase, 50 Hz and 50/60 Hz
- → 2-, 4- or 6-pole motors
- → Rated output from 0.75 to 375 kW
- → Rated voltage up to 1000 V
- → Duty type S1 (continuous running)
- → For operation directly from the mains (50 Hz or 60 Hz)
- → For Design N motors complying with IEC 60034-12
- → Motors with two switchable rated voltages, under the condition that the magnetic flux is the same with both voltages
- → Geared motors

Motors excluded from regulation

- → Motors exclusively manufactured for converter operation in accordance with IEC 60034-25
- → Pole-changing motors
- → Motors fully integrated into a machine (such as pumps, fans and compressors) that cannot be tested separately from the machine
- → At altitudes exceeding 4000 meters above sea-level
- → Where ambient air temperarures exceed 60° C
- → Where ambient air temperarures are less than -30° C
- → From 16 June 2011 onward: IE1 motors for none S1 duty destined for the European market
- → Explosion-proof motors (explosion protection has higher priority)
- → Brake motors
- → as from 2015/2017, IE2-Motors for use with variable speed drives (Additional name plate)

Example :



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

Individual loss method
Additional losses using the residual loss method
Low measurement uncertainty

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 breakaway torque and minimum starting current.

The torque/speed characteristic is largely free of torque dips. Torque is optimised 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:

Motor size	Standard voltages:
D04LA4 - D09XA4	220 V Δ/ 380 V Y 50 Hz
0,06 - 2,2 kW	230 V Δ/**400 V Y 50 Hz* (anm-iec38)**
	240 V Δ / 415 V Y 50 Hz**
	440 V Y / 60 Hz 460 V Y / 60 Hz
from D11SA4	220 V Δ/ 380 V Y 50 Hz
from 3,0 kW	230 V Δ/ 400 V Y 50 Hz
	240 V Δ/ 415 V Y 50 Hz**
	440 V Y / 60 Hz460 V Y / 60 Hz
	380 V Δ/ 660 V Y 50 Hz
	400 V Δ/ 690 V Y**50 Hz***
	415 V Δ / 50 Hz**
	440 V Δ/ 60 Hz
	460 V Δ/ 60 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 D04 to D18 motors in 4 pole design can be operated within a tolerance of +/- 10 % of the rated voltage (400 V 50 Hz).

General

Line frequencies

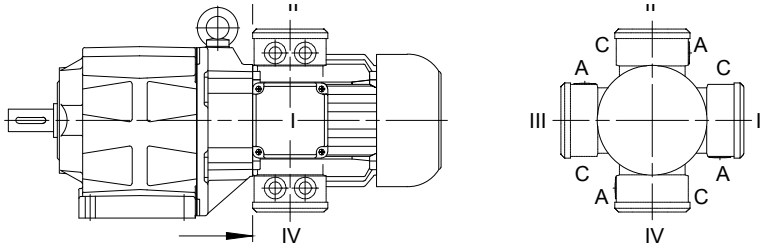
All motors are available with the same power ratings for either 50 or 60 Hz . Increased power models are available on request.

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 or side C.



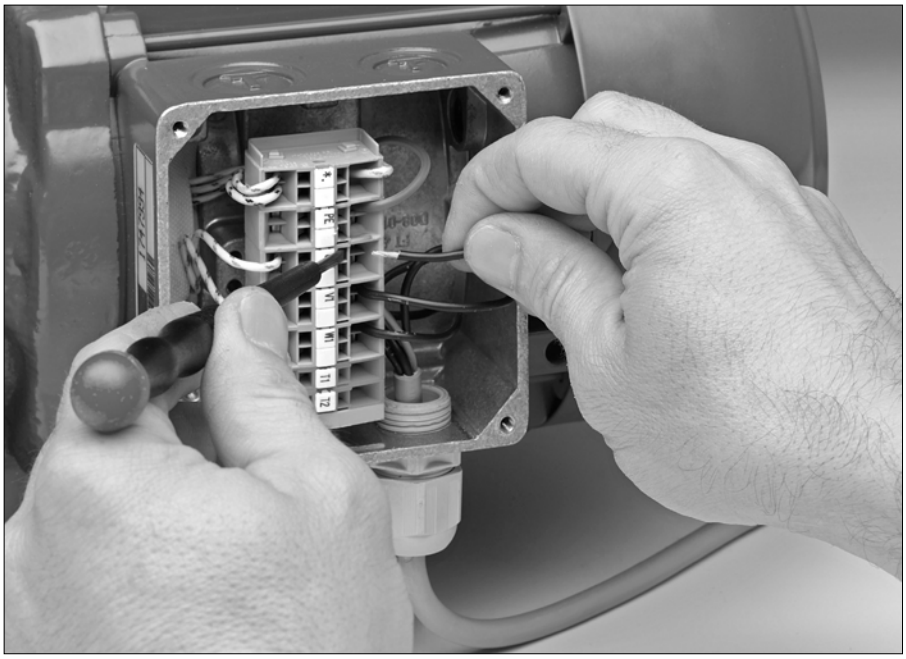
The standard position for the motor terminal box is shown in the dimensional drawings for the geared motors (see chapter 10,11,12 and 13). The terminal box can be installed at any of 3 other positions on request, if on-site space is restricted. The 4 possible positions are 90° offsets around the axis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

Cast-on terminal boxes (KAG) are supplied with knock out entries with metric nut for cable gland. Screw- on terminal boxes (TBI...4 are supplied with a metric screw thread as standard.

General

Motor connections

The electrical connection of gear motors is time consuming and creates costs, which cannot be neglected both during initial installation and in service cases. These costs are reduced considerably by the use of BAUER Gear Motors, have CAGE CLAMP® connection technology instead of the conventional terminal block – and that without extra charge.



What are the advantages for you ?

Cost reduction during connection
Public timing test have confirmed, that the electrical connection of a cable by means of CAGE CLAMP® technology saves up to 75 % working time compared with the classic screw connection.

Simple Handling
Cable connection from the top, very easily accessible: The CAGE CLAMP® spring is pressed, and the cable inserted from the front, i.e. in the field of vision of the installation engineer.

Which cable core diameters ?
Suitable for all copper wires from 0,5 mm^2 to 25 mm^2.

Cost saving in material and tooling
- multicore cable ends, cable eyes or cable ring eyes are no longer needed
- Tools such as crimping pliers are no longer needed
- Inadvertently over tightening or breaking of the terminal bolts and the procurement of a new terminal block belong in the past.
- Searching and procurement of nuts and washers for the terminal blocks, which have fallen down, also belongs in the past.

Vibration and shock resistant
Vibration and shock result neither in conductor damage nor in a measurable contact interruption. The connection is service free.

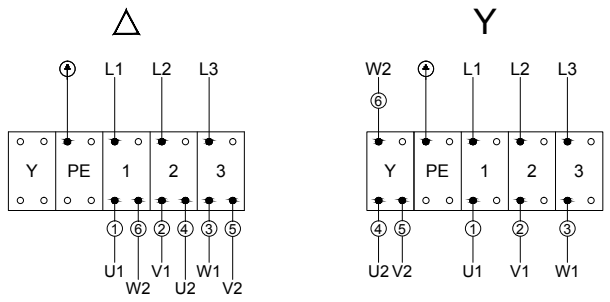
Type of conductors
The CAGE CLAMP®-connector can clamp fine stranded, stranded and solid cores wires.

General

Terminal connections for single speed motors

Standard connection of three phase motors via CAGE CLAMP®.
D..04 - D..09

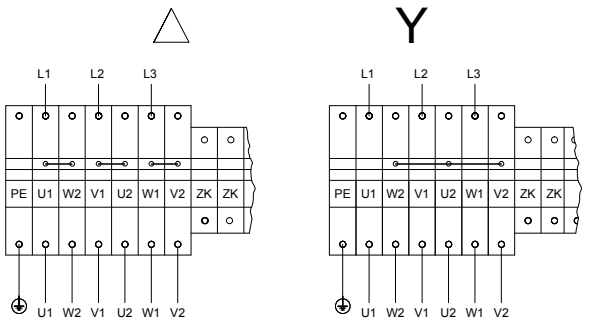
Three Phase motor means of CAGE CLAMP ®



	IEC / EN 60034-8	NEMA MG 1	Colour
Supply lines	L1 L2 L3	L1 L2 L3	
Motor winding	U1 V1 W1 U2 V2 W2	T1 T2 T3 T4 T5 T6	black blue brown yellow red violet
△	Connections for the low rated voltage (e.g.: 230 V)		
Y	Connections for the high rated voltage (e.g.: 400 V)		

D..11 - D..18

Connection of three phase motor via CAGE CLAMP



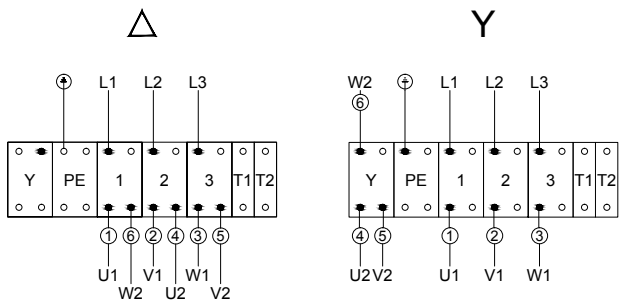
	IEC / EN 60034-8	NEMA MG 1	Colour
Supply lines	L1 L2 L3	L1 L2 L3	
Motor winding	U1 V1 W1 U2 V2 W2	T1 T2 T3 T4 T5 T6	black blue brown yellow red violet
△	Connections for the low rated voltage (e.g.: 230 V)		
Y	Connections for the high rated voltage (e.g.: 400 V)		
ZK	Optional additional connection		

General

Terminal connections for single speed motors with thermal motor protection

Standard connection of three phase motors with thermal motor protection via CAGE CLAMP®.
D..04 - D..09

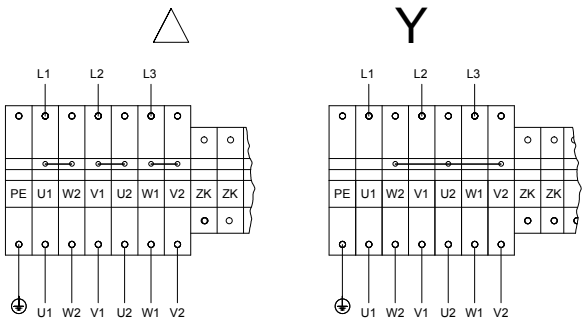
Three Phase motor and thermal protection connection by means of CAGE CLAMP®



	IEC / EN 60034-8	NEMA MG 1	Colour
Supply lines	L1 L2 L3	L1 L2 L3	
Motor winding	U1 V1 W1 U2 V2 W2	T1 T2 T3 T4 T5 T6	black blue brown yellow red violet
△	Connections for the low rated voltage (e.g.: 230 V)		
Y	Connections for the high rated voltage (e.g.: 400 V)		
T1 T2	Thermal motor protection		

D..11 - D..18

Connection of three phase motor via CAGE CLAMP

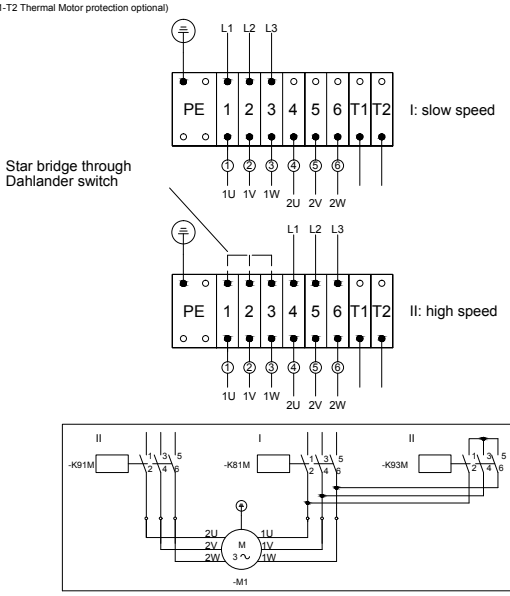


	IEC / EN 60034-8	NEMA MG 1	Colour
Supply lines	L1 L2 L3	L1 L2 L3	
Motor winding	U1 V1 W1 U2 V2 W2	T1 T2 T3 T4 T5 T6	black blue brown yellow red violet
△	Connections for the low rated voltage (e.g.: 230 V)		
Y	Connections for the high rated voltage (e.g.: 400 V)		
ZK	Optional additional connection		

General

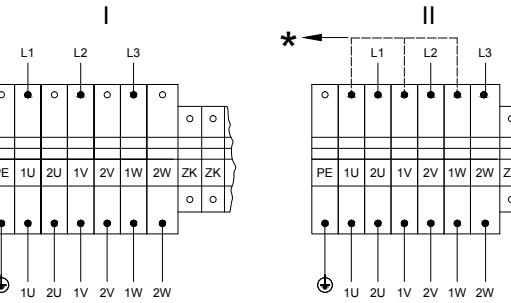
Terminal connections for pole changing motors in Dahlander connection (Δ/YY or Y/YY)

Standard connection of three phase motors without motor protection via CAGE CLAMP®.
D04 ... D..09



	IEC / EN 60034-8	NEMA MG 1	Colour
Supply lines	L1 L2 L3	L1 L2 L3	
Motor winding	1U 1V 1W 2U 2V 2W	T1 T2 T3 T5 T6 T4	black blue brown yellow red violet
I	Low speed		
II	High speed		

D..11 ....D..18.

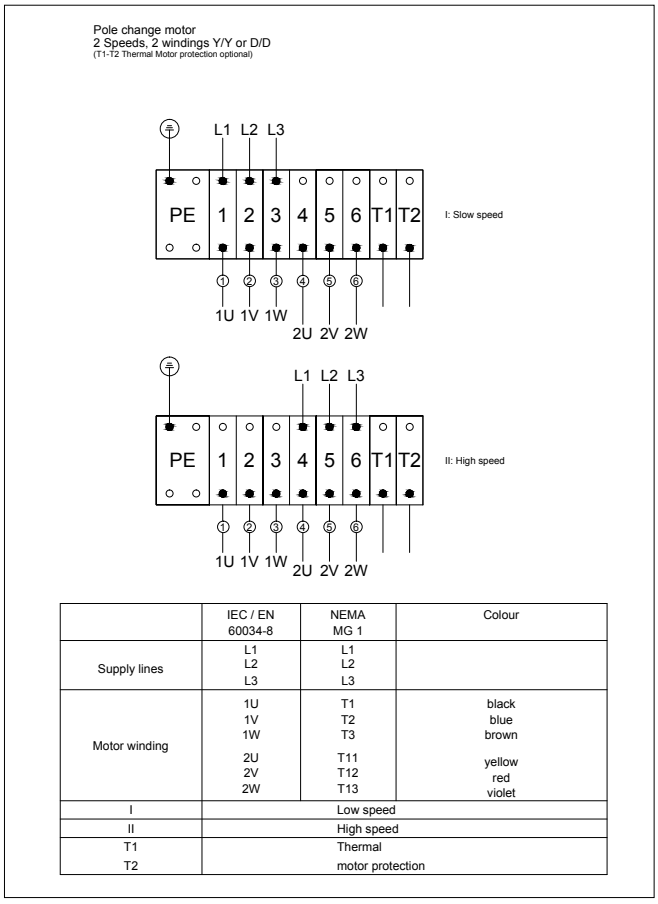


	IEC / EN 60034-8	NEMA MG 1	Colour
Supply lines	L1 L2 L3	L1 L2 L3	
Motor winding	1U 1V 1W 2U 2V 2W	T1 T2 T3 T4 T5 T6	black blue brown yellow red violet
I	Low speed		
II	High speed		
ZK	Optional additional connection		
*	Star point over Dahlander Relay		

General

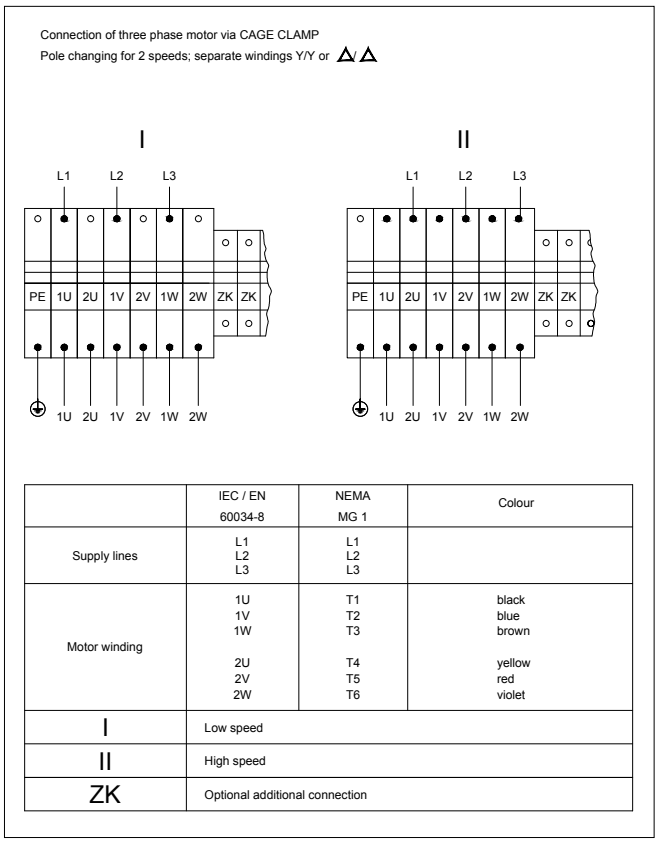
Terminal connections for pole changing motors with two separate windings (Y/Y or Δ/Δ)

Standard connection of three phase motors with motor protection via CAGE CLAMP®.
D04 ... D..09



	IEC / EN 60034-8	NEMA MG 1	Colour
Supply lines	L1 L2 L3	L1 L2 L3	
Motor winding	1U 1V 1W 2U 2V 2W	T1 T2 T3 T11 T12 T13	black blue brown yellow red violet
I	Low speed		
II	High speed		
T1 T2	Thermal motor protection		

D..11 ... D..18



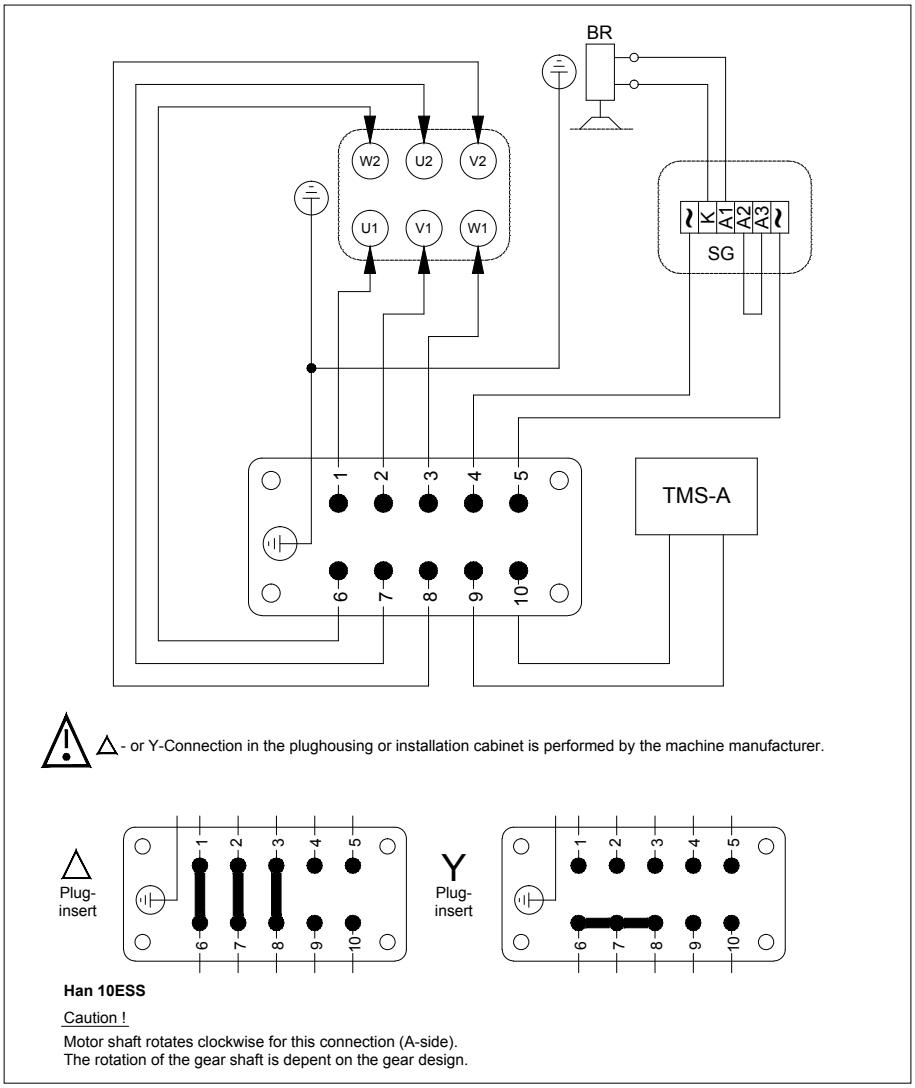
	IEC / EN 60034-8	NEMA MG 1	Colour
Supply lines	L1 L2 L3	L1 L2 L3	
Motor winding	1U 1V 1W 2U 2V 2W	T1 T2 T3 T4 T5 T6	black blue brown yellow red violet
I	Low speed		
II	High speed		
ZK	Optional additional connection		

General

Plug-and-socket connection

D06 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 minimises 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.



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 D08 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.

General

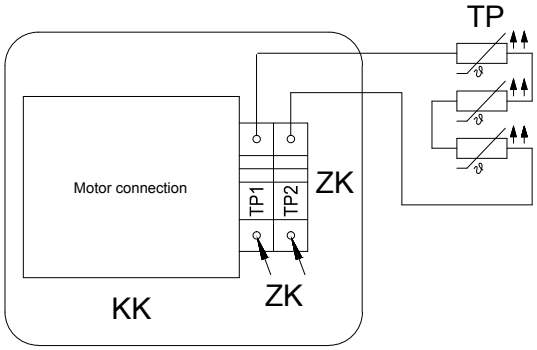
Motor protection

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. Thermal 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.

Thermal motor protection with PTC-thermistors



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

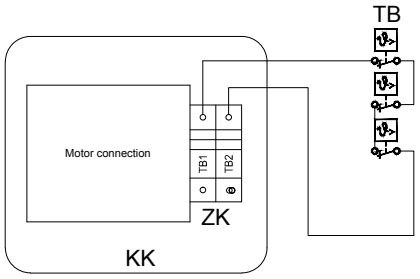
The location of the additional terminals in the drawing is not necessarily identical with the actual arrangement.

General

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).

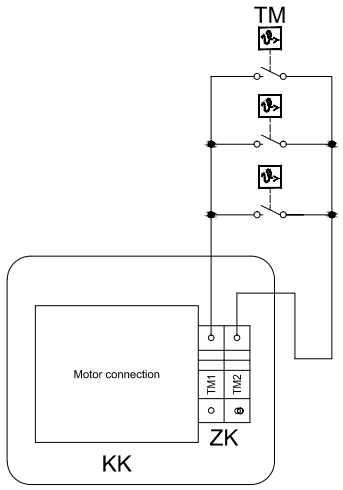
Thermal motor protection with thermostats
(with normally closed contacts)



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.

General

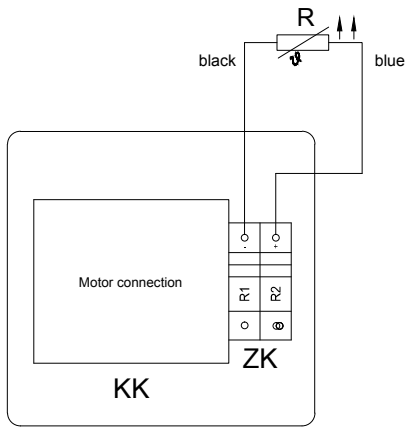
KTY sensors

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
R	Resistance temperature sensor

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

General

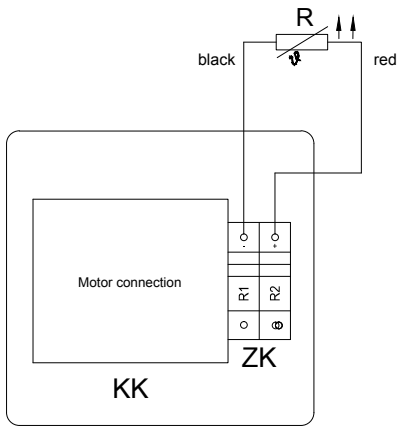
PT100 sensors

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
R	Resistance temperature sensor

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

General

Insulation

The gearmotors described in the selection tables of this catalogue with the motor sizes D04, D05, D06, D08, D..09S and D..09L are executed in insulation class B. Temperature class F is available on request at extra cost.
4-pole motors D07 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.

Degree of protection

Bauer motors from motor size D06 are manufactured to IP65 degree of protection as standard. Motor sizes D04 and D05 have smooth housings, degree of protection IP54, on request in IP65 at extra cost. The motor terminal box is always IP65.

Special corrosion protection

If high requirements for corrosion resistance are required, the geared motors are available with three levels of enhanced corrosion protection:

CORO1: Finished with two-component paint to protect against chemically aggressive gases and vapours.

CORO2: External paint as CORO1. In addition, sheet steel fan cowl with coating. The screws for the terminal-box cover are non-rusting steel.

CORO3 with IP 66: Available from motor size D06. Corrosion protection as CORO2. All motors manufactured within Temperature Class F. Terminal box compartment separated from motor interior by cast resin. Threaded cable entries and mating faces have special seals. See Bauer special imprint SD1 for more information.

Speed of output shaft

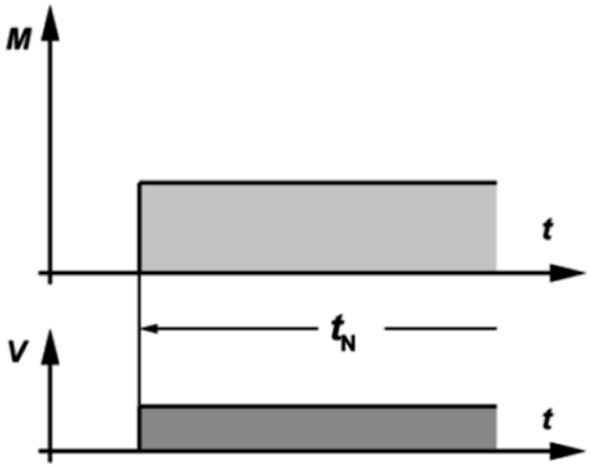
The rated speeds in the selection tables are guidelines for load at rated power. Speed can vary depending on degree of load and temperature (particularly in the case of relatively small motors). Combination gear units for lower speeds are available on request.

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.

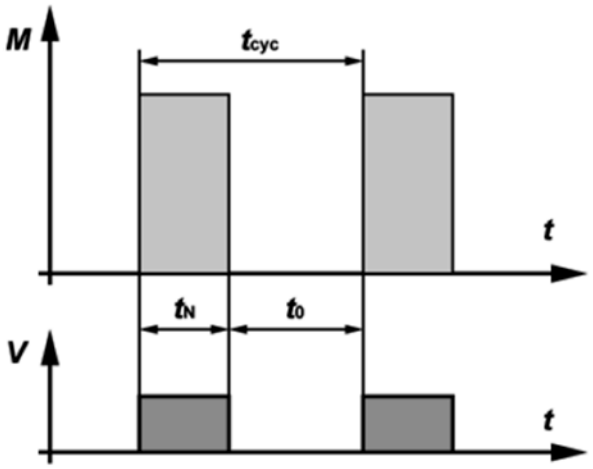
Short-time duty (S2)

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

Duty types as defined by EN 60034

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-energised. 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 standardised duty cycles are 15, 25, 40 and 60 %. The cycle duration is 10 minutes unless otherwise specified.

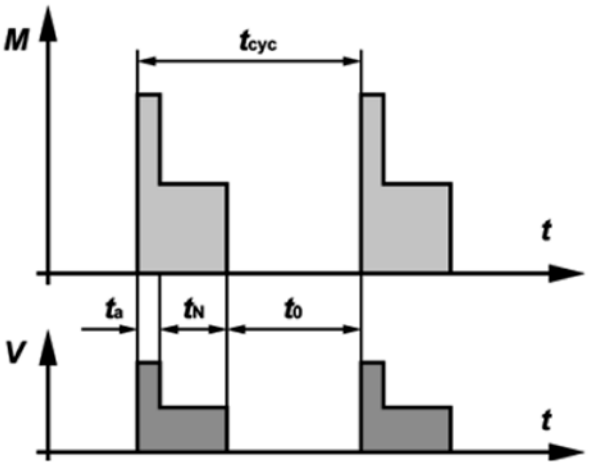
Intermittent periodic duty means that a state of thermal equilibrium is not reached during the load interval.

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%

Intermittent periodic duty with starting (S4)



Duty types as defined by EN 60034

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-energised.

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

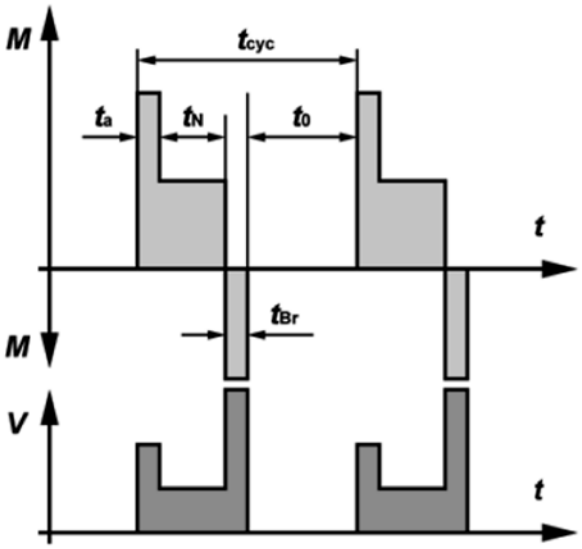
The load cycle corresponds to mode S3, but with additional heating during the starting time that must be taken into account.

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-energised.
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 standardised 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.

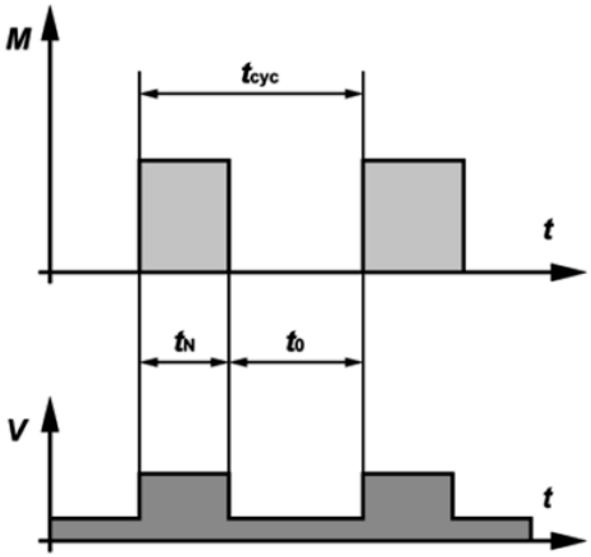
The duty cycle can be determined as follows:

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

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)



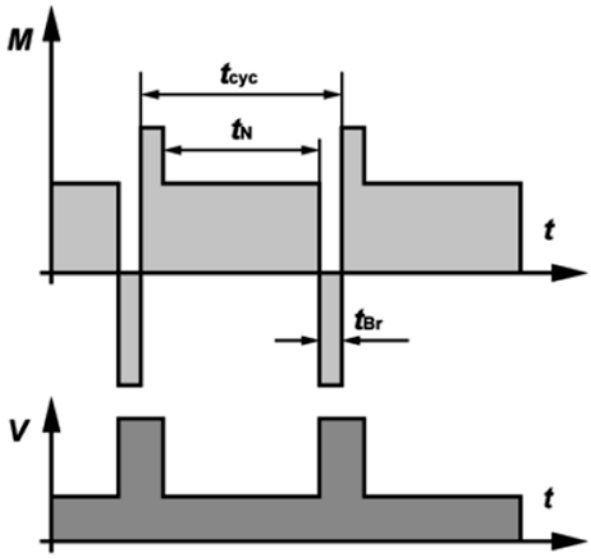
This type of duty corresponds to S3, with the exception that the equipment remains energised during the rest periods. In other words, it operates with no load during these periods. The duty cycle and cycle duration are specified the same way as for S3 duty.

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)

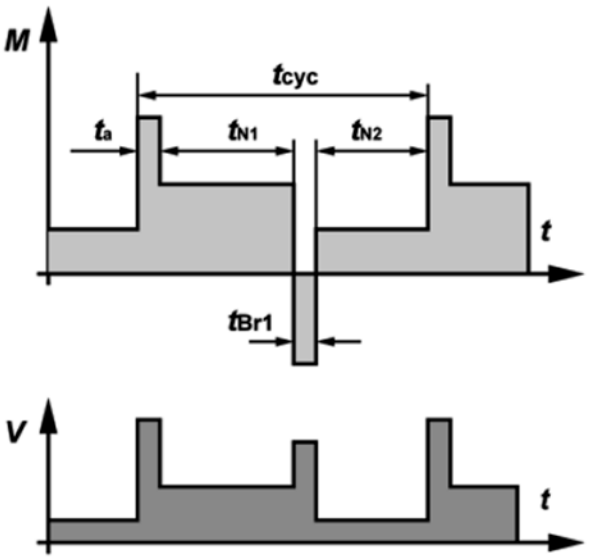


The machine starts up, operates under load, and then is braked electrically, for example by feeding it from a DC power source. Following this, it starts up again immediately. The machine can operate continuously in this manner if the specified moments of inertia of the motor J_M and of the load J_{Ext} 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

Duty types as defined by EN 60034

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



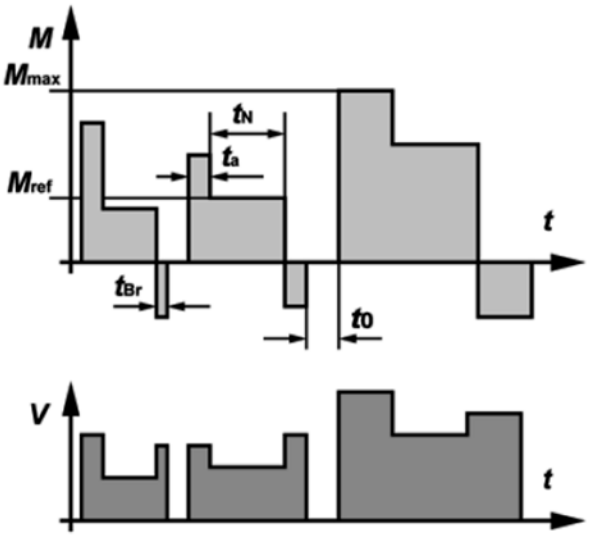
The machine runs continuously under variable load with frequent speed variations. The machine can operate continuously in this manner if at each speed the specified values are not exceeded (moments of inertia J_M and J_{Ext} cycle duration (if other than 10 minutes), rated output and duty cycle. With 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

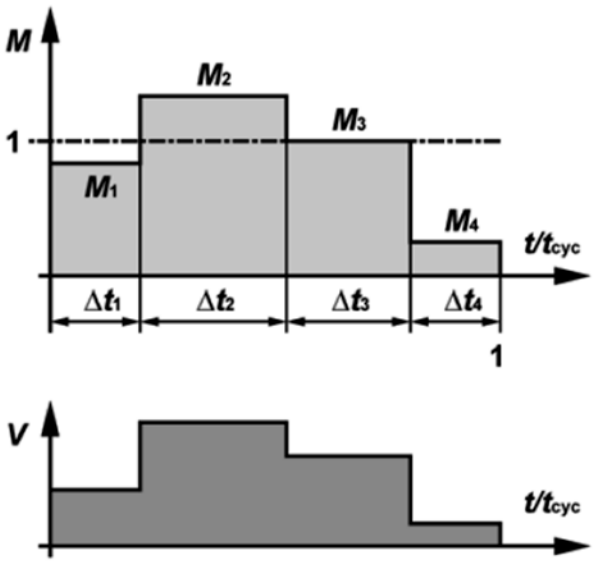
Duty with non-periodic load and speed variations (S9)



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-energised).
The appropriate abbreviation is S10 followed by the per unit quantities $p/\Delta t$ 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 $p/\Delta t$ = 1.1/0.4, 1/0.3, 0.9/0.2, *r*/0.1; *TL* = 0.6

4-pole IE3 motors for continuous operation S1, line frequency 50 Hz

P_N kW	Type	n_N 1/min	M_N Nm	I_N (400 V) A	Connection	cosφ	η (100% - Last) %	η (75% - Last) %	η (50% - Last) %	I_A/I_N	M_A/M_N	M_S/M_N	M_K/M_N	Jrot kgm^2	Brake
0,12	**DPE05LA4**	1380	0,83	0,42	Y	0,61	67,9	66,0	59,4	3,5	3,0	2,9	3,0	0,000295	E003
0,12	**DPE06LA4**	1380	0,83	0,42	Y	0,61	68,4	66,4	60,4	3,5	3,0	2,9	3,0	0,000295	E003
0,18	**DPE07LA4**	1380	1,25	0,55	Y	0,68	70,4	69,8	63,6	3,0	2,8	2,7	2,8	0,000385	E003, E004
0,25	**DPE08MA4**	1420	1,68	0,75	Y	0,66	74,5	73,9	69,9	5,2	2,3	2,2	2,6	0,00115	
0,37	**DPE08LA4**	1420	2,5	0,97	Y	0,69	79,0	79,5	77,3	5,0	2,8	2,5	3,0	0,0015	ES(X)010
0,55	**DPE08XA4**	1420	3,7	1,4	Y	0,69	81,8	81,2	78,1	5,6	3,1	2,9	3,4	0,0017	EH(X)027
0,75	**DPE08XB4**	1420	5,0	1,85	Y	0,71	82,7	83,3	81,7	5,2	3,0	2,8	3,2	0,0020	
0,75	**DPE09LA4**	1450	4,9	1,68	Y	0,76	84,0	82,9	79,5	6,6	3,3	2,7	3,7	0,0032	
1,1	**DPE09XA4**	1440	7,3	2,4	Y	0,76	85,0	84,1	81,2	7,1	3,6	3,2	4,0	0,0038	ES(X)010/027
1,5	**DPE09XB4**	1440	9,9	3,1	Y	0,83	85,4	85,7	83,9	6,9	3,1	2,7	3,5	0,0049	EH(X)040
2,2	**DPE09XB4C**	1450	14,5	4,6	Y	0,80	86,8	87,3	86,1	7,0	2,4	2,1	3,5	0,0069	
2,2	**DPE11MA4**	1450	14,5	4,5	Y	0,81	87,0	86,5	84,6	7,8	3,7	3,0	4,0	0,0105	
3	**DPE11LA4**	1450	20	6	D	0,81	87,7	87,9	86,2	8,5	3,7	3,1	4,3	0,0140	ES(X)027/040/070
4	**DPE11LB4**	1450	26	7,9	D	0,83	89,4	90,1	89,4	8,0	3,5	2,9	4,0	0,0170	EH(X)125
5,5	**DPE11LB4C**	1460	36	11	D	0,80	89,6	89,8	88,7	7,6	2,8	2,4	4,0	0,022	
7,5	**DPE13XA4**	1460	49	14,8	D	0,81	90,4	90,0	89,3	8,5	3,3	2,9	3,5	0,040	ES(X)040/070/125 EH(X)200
9,5	**DPE16LB4**	1470	62	19	D	0,79	91,6	91,8	90,9	8,3	3,5	2,8	3,7	0,076	ES(X)125/200
11	**DPE16LB4**	1470	71	22	D	0,79	91,4	91,6	90,8	7,8	3,3	2,7	3,5	0,076	EH(X)400
15	**DPE16XB4**	1470	97	28,8	D	0,82	92,1	92,7	92,6	7,6	3,2	2,5	3,3	0,097	ZS(X)300
18,5	**DPE18LB4**	1470	120	36	D	0,80	92,8	93,1	92,6	8,8	4,3	3,5	3,9	0,170	ES(X)250, EH(X)400
22	**DPE18XB4**	1470	143	41,5	D	0,82	93,0	93,4	93,1	8,5	4,0	3,2	3,6	0,195	ZS(X)500
30	**DPE20LA4**	1480	194	54	D	0,86	93,6	93,6	93,2	8,3	2,9	2,5	3,4	0,352	ES(X)250 ZS(X)500/800
37	**DPE22SA4**	1480	239	65	D	0,88	93,9	94,1	94,0	7,9	2,9	2,5	3,3	0,389	ES(X)250
45	**DPE22MA4**	1480	290	81	D	0,85	94,2	94,1	93,9	9,2	3,1	2,2	3,9	0,432	ZS(X)500/800

P	Rated power at 50 Hz line frequency
n	Guideline value for rated speed at the rotor shaft at 50 Hz line frequency
M_N	Rated torque at the rotor shaft
I_N	Rated current at 400 V (the current can be converted as inverse ratios of voltages from 400 V to the desired special voltage)
cos φ	Power factor
I_A/I_N	Relative starting current
M_A/M_N	Relative breakaway torque
M_S/M_N	Relative pull-up torque
M_K/M_N	Relative breakdown torque
J_{rot}	Mass moment of inertia of the rotor
Brake	recommended standard brake for normal requirements (see chapter 16)

Winding configuration for standard motors for 400 V / 50 Hz.

All motors are suitable for the voltage range 380…420 V or 400 V +/- 10 % if executed in insulation class F.

Important: Current, power factor and torque change as voltage deviates from 400 V.

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

4-pole IE3 motors for continuous operation S1, line frequency 60 Hz

P_N kW	Type	n_N 1/min	M_N Nm	I_N (400 V) A	Connection	cosφ	η (100% - Last) %	η (75% - Last) %	η (50% - Last) %	I_A/I_N	M_A/M_N	M_S/M_N	M_K/M_N	J_{rot} kgm²	Brake
0,12 0,18 0,25 0,37 0,55 0,75	on application														
0,55	**DPE08XA4**	1740	3,0	1,25	Y	0,66	83,3	81,9	77,8	6,1	3,5	3,2	4,0	0,0017	
0,75	**DPE08XB4**	1740	4,1	1,65	Y	0,68	84,8	84,5	82,0	6,4	3,6	3,1	3,8	0,0020	ES(X)010
0,75	**DPE09LA4**	1750	4,1	1,5	Y	0,73	85,8	84,4	81,3	7,2	3,6	3,2	4,2	0,0032	
1,1	**DPE09XA4**	1750	6,0	2,1	Y	0,73	86,7	84,8	81,5	8,0	4,2	3,7	4,5	0,0038	ES(X)010/027
1,5	**DPE09XB4**	1750	8,2	2,7	Y	0,81	86,7	86,4	83,9	7,9	3,4	3,0	4,2	0,0049	EH(X)040
2,2	**DPE09XB4C**	1760	11,9	4	Y	0,77	89,5	89,1	86,8	8,2	2,7	2,3	4,1	0,0069	
2,2	**DPE11MA4**	1760	11,9	4	Y	0,78	89,5	89,0	86,5	8,5	4,5	3,6	4,9	0,0105	
3	**DPE11LA4**	1760	16,3	5,4	D	0,78	89,5	89,3	87,1	9,9	4,3	3,7	5,2	0,0140	ES(X)027/040/070
4	**DPE11LB4**	1760	22	6,9	D	0,81	90,7	90,6	89,3	9,4	3,6	3,1	4,6	0,0170	EH(X)125
5,5	**DPE11LB4C**	1760	30	9,7	D	0,78	91,7	91,5	89,9	9,0	3,0	2,6	4,8	0,022	
7,5	**DPE13XA4**	1760	41	12,9	D	0,80	91,7	91,7	90,3	9,3	3,9	3,5	4,2	0,040	ES(X)040/070/125 EH(X)200
9,5	**DPE16LB4**	1770	51	16,6	D	0,78	92,4	91,8	90,2	9,1	3,8	3,1	4,1	0,076	ES(X)125/200
11	**DPE16LB4**	1770	59	19,2	D	0,78	92,4	92,2	90,6	9,0	3,6	3,0	3,8	0,076	EH(X)400
15	**DPE16XB4**	1770	81	25,1	D	0,81	93,0	93,0	92,6	8,8	3,7	3,0	3,8	0,097	ZS(X)300
18,5	**DPE18LB4**	1770	100	31,5	D	0,79	93,6	93,5	92,1	9,6	4,7	3,8	4,3	0,170	ES(X)250, EH(X)400
22	**DPE18XB4**	1770	119	36	D	0,82	93,6	93,6	92,8	9,7	4,8	3,9	4,4	0,195	ZS(X)500
30	**DPE20LA4**	1780	161	47	D	0,85	94,1	93,7	93,6	9,5	3,5	3,1	4,1	0,352	ES(X)250 ZS(X)500/800
37	**DPE22SA4**	1780	199	56	D	0,87	94,6	94,7	94,2	9,4	3,5	2,3	4,1	0,389	ES(X)250
45	**DPE22MA4**	1780	241	71	D	0,84	95,0	95,0	94,5	9,8	3,5	2,4	4,4	0,432	ZS(X)500/800

P	Rated power at 60 Hz line frequency
n	Guideline value for rated speed at the rotor shaft at 60 Hz line frequency
M_N	Rated torque at the rotor shaft
I_N	Rated current at 460 V (the current can be converted as inverse ratios of voltages from 460 V to the desired special voltage)
cos φ	Power factor
I_A/I_N	Relative starting current
M_A/M_N	Relative breakaway torque
M_S/M_N	Relative pull-up torque
M_K/M_N	Relative breakdown torque
J_{rot}	Mass moment of inertia of the rotor
Brake	recommended standard brake for normal requirements (see chapter 16)

Winding configuration for standard motors for 460 V / 60 Hz.

All motors are suitable for the voltage range 440…480 V or 460 V +/- 10 % if executed in insulation class F.

Important: Current, power factor and torque change as voltage deviates from 460 V.

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

4-pole IE2 motors for continuous operation S1, line frequency 50 Hz

P_N	Type	n_N	M_N	I_N	Connection	cosφ	η	η	η	I_A/I_N	M_A/M_N	M_S/M_N	M_K/M_N	J_{rot}	Brake
kW		1/min	Nm	(400 V) A			(100% - Last) %	(75% - Last) %	(50% - Last) %					kgm^2	
0,12	**DHE05LA4**	1350	0,85	0,42	Y	0,61	67,9	66		3,5	3	2,9	3	0,000295	E003
0,18	**DHE05LA4**	1350	1,28	0,6	Y	0,66	65,8	64,5		3,2	2,5	2,5	2,5	0,000295	
0,12	**DHE06LA4**	1350	0,85	0,42	Y	0,61	68,4	66,4		3,5	3	2,9	3	0,000295	E003
0,18	**DHE06LA4**	1350	1,28	0,59	Y	0,66	67,2	66,5		3,2	2,5	2,5	2,5	0,000295	
0,25	**DHE07LA4**	1350	1,75	0,78	Y	0,67	69,5	68		3,3	2,5	2,4	2,5	0,000385	E003, E004
0,37	**DHE08MA4**	1420	2,4	1,1	Y	0,66	75,2	73,9		5,2	2,3	2,2	2,6	0,00115	ES(X)010
0,55	**DHE08LA4**	1420	3,7	1,36	Y	0,74	78,4	78,8		4,3	2,1	2	2,4	0,0015	EH(X)027

4-pole IE2 motors for continuous operation S1, line frequency 60 Hz

P_N	Type	n_N	M_N	I_N	Connection	cosφ	η	η	η	I_A/I_N	M_A/M_N	M_S/M_N	M_K/M_N	J_{rot}	Brake
kW		1/min	Nm	(400 V) A			(100% - Last) %	(75% - Last) %	(50% - Last) %					kgm^2	
0,12	**DHE05LA4**	1660	0,7	0,37	Y	0,59	69	67		3,8	3,3	3,2	3,3	0,000295	E003
0,18	**DHE05LA4**	1660	1,06	0,52	Y	0,64	68	67,2		3,5	2,8	2,8	2,8	0,000295	
0,12	**DHE06LA4**	1660	0,7	0,37	Y	0,59	69,3	67		3,8	3,3	3,2	3,3	0,000295	E003
0,18	**DHE06LA4**	1660	1,06	0,52	Y	0,64	68,2	67,4		3,5	2,8	2,8	2,8	0,000295	
0,25	**DHE07LA4**	1660	1,47	0,7	Y	0,64	70,5	70		3,6	2,8	2,7	2,8	0,000385	E003, E004
0,37	**DHE08MA4**	1720	2	0,96	Y	0,66	75,2	73,9		5,7	2,8	2,7	3,2	0,00115	ES(X)010
0,55	**DHE08LA4**	1720	3	1,2	Y	0,74	77,5	77,8		4,7	2,3	2,2	2,7	0,0015	EH(X)027

P	Rated power at 50 Hz/60 Hz line frequency
n	Guideline value for rated speed at the rotor shaft at 50 Hz/60 Hz line frequency
M_N	Rated torque at the rotor shaft
I_N	(the current can be converted as inverse ratios of voltages to the desired special voltage)
cos φ	Power factor
I_A/I_N	Relative starting current
M_A/M_N	Relative breakaway torque
M_S/M_N	Relative pull-up torque
M_K/M_N	Relative breakdown torque
J_{rot}	Mass moment of inertia of the rotor
Brake	recommended standard brake for normal requirements (see chapter 16)

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

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 %).

IE3 Motor torques for frequency-converter range 5 Hz - 70 Hz, line frequency 50 Hz

P kW	**Type**	Connec-tion	5 Hz M Nm	10 Hz M Nm	20 Hz M Nm	30 Hz M Nm	50 Hz M Nm	60 Hz M Nm	70 Hz M Nm	5 Hz I A	10 Hz I A	20 Hz I A	30 Hz I A	50 Hz I A	60 Hz I A	70 Hz I A
0,12	**DPE05LA4**	Y	0,51	0,63	0,76	0,83	0,85	0,85	0,72	0,39	0,4	0,415	0,42	0,42	0,475	0,475
0,12	**DPE06LA4**	Y	0,51	0,63	0,76	0,83	0,85	0,85	0,72	0,39	0,4	0,415	0,42	0,42	0,475	0,475
0,18	**DPE07LA4**	Y	0,76	0,95	1,14	1,25	1,27	1,27	1,08	0,54	0,55	0,55	0,55	0,55	0,63	0,63
0,25	**DPE08MA4**	Y	0,99	1,23	1,48	1,62	1,65	1,65	1,36	0,68	0,71	0,73	0,75	0,75	0,85	0,83
0,37	**DPE08LA4**	Y	1,5	1,87	2,2	2,4	2,5	2,5	2,1	0,88	0,91	0,95	0,97	0,97	1,1	1,1
0,55	**DPE08XA4**	Y	2,1	2,7	3,2	3,6	3,6	3,6	3,1	1,19	1,26	1,35	1,4	1,4	1,58	1,59
0,75	**DPE08XB4**	Y	3	3,8	4,5	4,9	5	5	4,2	1,56	1,66	1,77	1,84	1,85	2,1	2,1
0,75	**DPE09LA4**	Y	2,9	3,6	4,4	4,8	4,9	4,9	4,2	1,35	1,47	1,59	1,67	1,68	1,9	1,9
1,1	**DPE09XA4**	Y	4,3	5,4	6,5	7,1	7,2	7,2	6,2	1,97	2,2	2,4	2,5	2,5	2,8	2,8
1,5	**DPE09XB4**	Y	6	7,5	9	9,8	10	10	8,5	2,3	2,6	2,9	3,1	3,1	3,5	3,6
2,2	**DPE09XB4C**	Y	8,7	10,8	13	14,3	14,5	14,5	12,4	3,6	4	4,4	4,6	4,6	5,2	5,3
2,2	**DPE11MA4**	Y	8,7	10,8	13	14,3	14,5	14,5	12,4	3,5	3,8	4,2	4,5	4,5	5,1	5,1
3	**DPE11LA4**	Y	11,8	14,7	17,7	19,4	19,7	19,7	16,8	4,6	5,1	5,7	6	6	6,8	6,8
4	**DPE11LB4**	Y	15,9	19,8	23,5	26	26,5	26,5	22,5	5,9	6,6	7,4	7,9	7,9	9	9
5,5	**DPE11LB4C**	Y	21,5	27	32	35,5	36	36	30,5	8,5	9,4	10,3	11	11	12,5	12,5
7,5	**DPE13XA4**	Y	29	36,5	44	48	49	49	42	10,9	12,3	13,8	14,7	14,8	16,7	16,8
9,5	**DPE16LB4**	Y	36,5	45,5	54	60	61	61	52	14,2	15,9	17,7	18,9	19	21,5	21,5
11	**DPE16LB4**	Y	42,5	53	64	70	71	71	61	16,7	18,5	21	22	22	25	25
15	**DPE16XB4**	Y	58	73	87	96	97	97	83	20,5	23,5	26,5	29	29	32,5	33
18,5	**DPE18LB4**	Y	72	90	108	118	120	120	102	26,5	30	33,5	36	36	41	41
22	**DPE18XB4**	Y	85	106	127	140	142	142	121	29,5	34	38,5	41,5	41,5	47	47
30	**DPE20LA4**	Y	117	146	175	192	195	195	167	37,5	43	49,5	54	54	61	62
37	**DPE22SA4**	Y	144	180	215	235	240	240	205	43,5	51	60	65	65	74	74
45	**DPE22MA4**	Y	169	210	250	275	280	280	240	56	65	74	81	81	92	92

Field weakening for frequencies above 50 Hz, winding for standard voltage **400 V Y / 50 Hz**, Temperature Class F.

P Rated output
n Guideline value for rated speed at the rotor shaft
M Permissible load torque (S1-100 %) for operation with frequency inverter
M_N Rated torque at the rotor shaft
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.

Operation with frequency converter

IE3 Motor torques for frequency-converter range 5 Hz - 100 Hz, line frequency 50 Hz

P KW	**Type**	Connec-tion	M5 Hz Nm	M8,7 Hz Nm	M10 Hz Nm	M20 Hz Nm	M87 Hz Nm	M100 Hz Nm	M120 Hz Nm	I5 Hz A	I8,7 Hz A	I10 Hz A	I20 Hz A	I87 Hz A	I100 Hz A	I120 Hz A
0,12	**DPE05LA4**	D	0,51	0,61	0,63	0,76	0,85	0,85	0,73	0,68	0,69	0,7	0,72	0,73	0,8	0,83
0,12	**DPE06LA4**	D	0,51	0,61	0,63	0,76	0,85	0,85	0,73	0,68	0,69	0,7	0,72	0,73	0,8	0,83
0,18	**DPE07LA4**	D	0,76	0,91	0,95	1,14	1,27	1,27	1,1	0,94	0,94	0,95	0,95	0,96	1,05	1,08
0,25	**DPE08MA4**	D	0,99	1,18	1,23	1,48	1,65	1,65	1,4	1,17	1,21	1,22	1,27	1,3	1,43	1,45
0,37	**DPE08LA4**	D	1,5	1,79	1,87	2,2	2,5	2,5	2,1	1,52	1,56	1,58	1,64	1,69	1,85	1,9
0,55	**DPE08XA4**	D	2,1	2,6	2,7	3,2	3,6	3,6	3,1	2,1	2,2	2,2	2,4	2,5	2,7	2,8
0,75	**DPE08XB4**	D	3	3,6	3,8	4,5	5	5	4,3	2,7	2,8	2,9	3,1	3,2	3,6	3,7
0,75	**DPE09LA4**	D	2,9	3,5	3,6	4,4	4,9	4,9	4,2	2,4	2,5	2,6	2,8	3	3,2	3,3
1,1	**DPE09XA4**	D	4,3	5,2	5,4	6,5	7,2	7,2	6,3	3,5	3,7	3,7	4	4,2	4,7	4,8
1,5	**DPE09XB4**	D	6	7,1	7,5	9	10	10	8,7	4	4,4	4,5	5	5,4	5,9	6,1
2,2	**DPE09XB4C**	D	8,7	10,4	10,8	13	14,5	14,5	12,6	6,3	6,7	6,9	7,5	8	8,8	9,1
2,2	**DPE11MA4**	D	8,7	10,4	10,8	13	14,5	14,5	12,6	6,1	6,6	6,7	7,4	7,8	8,6	8,9
3	**DPE11LA4**	D	11,8	14,1	14,7	17,7	19,7	19,7	17,1	7,9	8,6	8,8	9,8	10,4	11,4	11,8
4	**DPE11LB4**	D	15,9	19	19,8	23,5	26,5	26,5	23	10,1	11,1	11,4	12,7	13,7	15,1	15,5
5,5	**DPE11LB4C**	D	21,5	25,5	27	32	36	36	31	14,7	15,9	16,2	17,9	19,1	21	22
7,5	**DPE13XA4**	D	29	35	36,5	44	49	49	42,5	18,9	21	21,5	24	26	28,5	29
9,5	**DPE16LB4**	D	36,5	43,5	45,5	54	61	61	53	25	27	27,5	31	33	36,5	37,5
11	**DPE16LB4**	D	42,5	51	53	64	71	71	62	29	31,5	32,5	36	38,5	42	43,5
15	**DPE16XB4**	D	58	70	73	87	97	97	84	35,5	39,5	40,5	46	50	55	57
18,5	**DPE18LB4**	D	72	86	90	108	120	120	104	46	51	52	58	63	69	71
22	**DPE18XB4**	D	85	102	106	127	142	142	123	52	57	59	67	72	79	82
30	**DPE20LA4**	D	117	140	146	175	195	195	169	65	73	75	86	94	103	106
37	**DPE22SA4**	D	144	172	180	215	240	240	205	76	86	88	103	113	124	128
45	**DPE22MA4**	D	169	200	210	250	280	280	245	96	108	112	129	141	154	159

Field weakening for frequencies above 87 Hz, winding for standard voltage **230 V Y / 50 Hz** (Umax = 400 V Δ /87 Hz), Temperature Class F.

P	Rated output
n	Guideline value for rated speed at the rotor shaft
M	Permissible load torque (S1-100 %) for operation with frequency inverter
M_N	Rated torque at the rotor shaft
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

IE3 Motor torques for frequency-converter range 5 Hz - 80 Hz, line frequency 60 Hz

P	**Type**	Connec-tion	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
kW			Nm	Nm	Nm	Nm	Nm	Nm	Nm	A	A	A	A	A	A	A
0,55	**DPE08XA4**	Y	1,8	2,2	2,7	2,9	3	3	2,7	1,08	1,14	1,21	1,25	1,25	1,39	1,42
0,75	**DPE08XB4**	Y	2,4	3,1	3,7	4,1	4,1	4,1	3,7	1,41	1,5	1,59	1,65	1,65	1,83	1,87
0,75	**DPE09LA4**	Y	2,4	3	3,6	4	4,1	4,1	3,6	1,24	1,33	1,43	1,5	1,5	1,67	1,7
1,1	**DPE09XA4**	Y	3,6	4,5	5,4	5,9	6	6	5,4	1,81	1,93	2,1	2,2	2,2	2,4	2,5
1,5	**DPE09XB4**	Y	5	6,2	7,4	8,1	8,3	8,3	7,4	2,1	2,3	2,6	2,7	2,7	3	3,1
2,2	**DPE09XB4C**	Y	7,2	9	10,8	11,8	12	12	10,8	3,2	3,5	3,8	4	4	4,5	4,5
2,2	**DPE11MA4**	Y	7,2	9	10,8	11,8	12	12	10,8	3,4	3,6	3,8	4	4	4,5	4,5
3	**DPE11LA4**	Y	9,7	12,2	14,6	16,1	16,3	16,3	14,6	4,2	4,6	5,1	5,4	5,4	6	6,2
3,7	**DPE11LA4**	Y	12	15	18	19,7	20	20	18	5,3	5,8	6,4	6,7	6,7	7,5	7,6
4	**DPE11LB4**	Y	13,2	16,5	19,8	21,5	22	22	19,8	5,2	5,8	6,5	6,9	6,9	7,7	7,8
5,5	**DPE11LB4C**	Y	18	22,5	27	29,5	30	30	27	7,6	8,3	9,2	9,7	9,7	10,8	11
7,5	**DPE13XA4**	Y	24	30	36,5	40	40,5	40,5	36,5	9,8	10,9	12,1	12,8	12,9	14,3	14,6
9,5	**DPE16LB4**	Y	30	37,5	45	49	50	50	45	12,7	14,1	15,6	16,5	16,6	18,4	18,8
11	**DPE16LB4**	Y	35	44	53	58	59	59	53	14,6	16,2	18	19,1	19,2	21,5	22
15	**DPE16XB4**	Y	48,5	60	72	80	81	81	72	17,9	20,5	23,5	25	25,5	28	28,5
18,5	**DPE18LB4**	Y	60	75	90	98	100	100	90	23,5	26,5	29,5	31,5	31,5	35	36
22	**DPE18XB4**	Y	70	88	106	116	118	118	106	26,5	30	33,5	36	36	40	41
30	**DPE20LA4**	Y	96	120	144	158	160	160	144	33,5	38	43,5	47	47	53	54
37	**DPE22SA4**	Y	120	150	180	197	200	200	180	39	45	52	56	57	63	64
45	**DPE22MA4**	Y	140	175	210	230	230	230	210	49	57	65	71	71	79	81

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

P	Rated output
n	Guideline value for rated speed at the rotor shaft
M	Permissible load torque (S1-100 %) for operation with frequency inverter
M_N	Rated torque at the rotor shaft
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 36-84 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

IE3 Motor torques for frequency-converter range 5 Hz - 120 Hz, line frequency 60 Hz

P KW	**Type**	Connection	5 Hz M Nm	10 Hz M Nm	20 Hz M Nm	30 Hz M Nm	104 Hz M Nm	120 Hz M Nm	5 Hz I A	10 Hz I A	20 Hz I A	30 Hz I A	104 Hz I A	120 Hz I A
0,55	**DPE08XA4**	D	1,8	2,2	2,7	2,9	3	3	1,86	1,97	2,1	2,2	2,2	2,4
0,75	**DPE08XB4**	D	2,4	3,1	3,7	4,1	4,1	4,1	2,5	2,6	2,8	2,8	2,9	3,2
0,75	**DPE09LA4**	D	2,4	3	3,6	4	4,1	4,1	2,2	2,3	2,5	2,6	2,6	2,9
1,1	**DPE09XA4**	D	3,6	4,5	5,4	5,9	6	6	3,2	3,4	3,6	3,8	3,8	4,1
1,5	**DPE09XB4**	D	5	6,2	7,4	8,1	8,3	8,3	3,6	4	4,4	4,7	4,7	5,2
2,2	**DPE09XB4C**	D	7,2	9	10,8	11,8	12	12	5,6	6,1	6,6	6,9	7	7,7
2,2	**DPE11MA4**	D	7,2	9	10,8	11,8	12	12	5,8	6,2	6,6	6,9	7	7,7
3	**DPE11LA4**	D	9,7	12,2	14,6	16,1	16,3	16,3	7,3	8	8,8	9,3	9,4	10,3
3,7	**DPE11LA4**	D	12	15	18	19,7	20	20	9,2	10	11	11,6	11,7	12,8
4	**DPE11LB4**	D	13,2	16,5	19,8	21,5	22	22	8,9	10	11,2	11,9	12	13,2
4,5	**DPE11LB4**	D	14,3	17,9	21,5	23,5	23,5	23,5	9,5	10,8	12,2	13,1	13,2	14,5
5,5	**DPE11LB4C**	D	18	22,5	27	29,5	30	30	13,1	14,4	15,8	16,7	16,9	18,5
7,5	**DPE13XA4**	D	24	30	36,5	40	40,5	40,5	16,9	18,8	21	22,5	22,5	25
9,5	**DPE16LB4**	D	30	37,5	45	49	50	50	22	24,5	27	29	29	32
11	**DPE16LB4**	D	35	44	53	58	59	59	25,5	28	31,5	33	33,5	37
15	**DPE16XB4**	D	48,5	60	72	80	81	81	31	35,5	40,5	43,5	43,5	48
18,5	**DPE18LB4**	D	60	75	90	98	100	100	41	45,5	51	55	55	60
22	**DPE18XB4**	D	70	88	106	116	118	118	45,5	52	58	62	63	69
30	**DPE20LA4**	D	96	120	144	158	160	160	58	66	75	81	82	90
37	**DPE22SA4**	D	120	150	180	197	200	200	67	78	90	97	98	108
45	**DPE22MA4**	D	140	175	210	230	230	230	85	98	113	122	123	136

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

P	Rated output
n	Guideline value for rated speed at the rotor shaft
M	Permissible load torque (S1-100 %) for operation with frequency inverter
M_N	Rated torque at the rotor shaft
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 36-120 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

IE3 Motor torques for frequency-converter range 5 Hz - 70 Hz, line frequency 50 Hz

P	**Type**	Connec-tion	5 Hz	10 Hz	20 Hz	30 Hz	50 Hz	60 Hz	70 Hz	5 Hz	10 Hz	20 Hz	30 Hz	50 Hz	60 Hz	70 Hz
			M	M	M	M	M	M	M	I	I	I	I	I	I	I
kW			Nm	Nm	Nm	Nm	Nm	Nm	Nm	A	A	A	A	A	A	A
0,12	**DHE05LA4**	Y	0,51	0,63	0,76	0,83	0,85	0,85	0,72	0,39	0,4	0,415	0,42	0,42	0,475	0,475
0,18	**DHE05LA4**	Y	0,76	0,96	1,15	1,26	1,28	1,28	1,02	0,55	0,57	0,59	0,6	0,6	0,68	0,64
0,12	**DHE06LA4**	Y	0,51	0,63	0,76	0,83	0,85	0,85	0,72	0,39	0,4	0,415	0,42	0,42	0,475	0,475
0,18	**DHE06LA4**	Y	0,76	0,96	1,15	1,26	1,28	1,28	1,02	0,55	0,56	0,58	0,59	0,59	0,67	0,63
0,25	**DHE07LA4**	Y	1,05	1,31	1,57	1,72	1,75	1,75	1,39	0,7	0,73	0,76	0,78	0,78	0,88	0,83
0,37	**DHE08MA4**	Y	1,47	1,83	2,2	2,4	2,4	2,4	2	1	1,03	1,08	1,1	1,1	1,25	1,21
0,55	**DHE08LA4**	Y	2,2	2,8	3,3	3,6	3,7	3,7	2,8	1,13	1,21	1,3	1,36	1,36	1,54	1,38
0,75	**DHE08XA4**	Y	3	3,8	4,5	4,9	5	5	4,2	1,6	1,7	1,81	1,88	1,88	2,2	2,2
0,75	**DHE09SA4**	Y	3	3,8	4,5	4,9	5	5	4,2	1,54	1,63	1,73	1,8	1,8	2,1	2,1
1,1	**DHE09LA4**	Y	4,3	5,4	6,5	7,2	7,3	7,3	6,2	2,1	2,2	2,5	2,6	2,6	2,9	2,9
1,5	**DHE09XA4**	Y	5,9	7,4	8,9	9,8	9,9	9,9	8,5	2,7	2,9	3,2	3,4	3,4	3,8	3,8
2,2	**DHE09XB4**	Y	8,8	11,1	13,3	14,6	14,8	14,8	12,6	3,7	4	4,5	4,7	4,7	5,4	5,4
2,2	**DHE11SA4**	Y	8,7	10,8	13	14,3	14,5	14,5	12,4	3,6	3,9	4,4	4,6	4,6	5,2	5,3
3	**DHE11MA4**	Y	12	15	18	19,7	20	20	17,1	4,9	5,4	5,9	6,3	6,3	7,2	7,2
4	**DHE11LA4**	Y	15,9	19,8	23,5	26	26,5	26,5	22,5	6,9	7,4	8	8,4	8,4	9,5	9,5
5,5	**DHE11LA4C**	Y	21,5	27	32	35,5	36	36	30,5	8,2	9,2	10,3	11	11	12,5	12,5
5,5	**DHE11LB4**	Y	21,5	27	32	35,5	36	36	30,5	8,3	9,2	10,3	11	11	12,5	12,5
5,5	**DHE13MA4**	Y	21,5	27	32	35,5	36	36	30,5	8,2	9,2	10,3	11	11	12,5	12,5
7,5	**DHE13LA4**	Y	29	36,5	44	48	49	49	42	11,2	12,6	14,1	15	15,1	17,1	17,1
9,5	**DHE16MB4**	Y	37	46,5	55	61	62	62	53	14,8	16,5	18,4	19,6	19,7	22,5	22,5
11	**DHE16LB4**	Y	42,5	53	64	70	71	71	61	17,2	19	21,5	22,5	22,5	25,5	25,5
15	**DHE16XB4**	Y	58	73	87	96	97	97	83	24	26,5	29,5	31	31	35	35,5
18,5	**DHE18LB4**	Y	72	90	108	118	120	120	102	25	28,5	32,5	35	35	39,5	40
22	**DHE18XB4**	Y	85	106	127	140	142	142	121	33,5	37	41	43,5	43,5	49,5	49,5
30	**DNFHE20LA4**	Y	117	146	175	192	195	195	167	37,5	43,5	50	54	55	62	62
37	**DNFHE22SA4**	Y	144	180	215	235	240	240	205	46	53	62	67	67	76	76
45	**DNFHE22MA4**	Y	174	215	260	285	290	290	245	55	64	73	80	80	91	91

Field weakening for frequencies above 50 Hz, winding for standard voltage **400 V Y / 50 Hz**, Temperature Class F.

P	Rated output
n	Guideline value for rated speed at the rotor shaft
M	Permissible load torque (S1-100 %) for operation with frequency inverter
M_N	Rated torque at the rotor shaft
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.

Operation with frequency converter

IE2 Motor torques for frequency-converter range 5 Hz - 120 Hz, line frequency 50 Hz

P kW	**Type**	Connec-tion	M5 Hz Nm	M8,7 Hz Nm	M10 Hz Nm	M20 Hz Nm	M87 Hz Nm	M100 Hz Nm	M120 Hz Nm	I5 Hz A	I8,7 Hz A	I10 Hz A	I20 Hz A	I87 Hz A	I100 Hz A	I120 Hz A
0,12	**DHE05LA4**	D	0,51	0,61	0,63	0,76	0,85	0,85	0,73	0,68	0,69	0,7	0,72	0,73	0,8	0,83
0,18	**DHE05LA4**	D	0,76	0,92	0,96	1,15	1,28	1,28	1,05	0,95	0,98	0,98	1,02	1,04	1,14	1,11
0,12	**DHE06LA4**	D	0,51	0,61	0,63	0,76	0,85	0,85	0,73	0,68	0,69	0,7	0,72	0,73	0,8	0,83
0,18	**DHE06LA4**	D	0,76	0,92	0,96	1,15	1,28	1,28	1,05	0,94	0,97	0,97	1	1,03	1,13	1,1
0,25	**DHE07LA4**	D	1,05	1,25	1,31	1,57	1,75	1,75	1,43	1,22	1,25	1,26	1,32	1,36	1,49	1,45
0,37	**DHE08MA4**	D	1,47	1,76	1,83	2,2	2,4	2,4	2	1,72	1,78	1,79	1,86	1,91	2,1	2,2
0,55	**DHE08LA4**	D	2,2	2,6	2,8	3,3	3,7	3,7	2,9	1,95	2,1	2,1	2,2	2,4	2,6	2,5
0,75	**DHE08XA4**	D	3	3,6	3,8	4,5	5	5	4,3	2,8	2,9	3	3,2	3,3	3,6	3,7
0,75	**DHE09SA4**	D	3	3,6	3,8	4,5	5	5	4,3	2,7	2,8	2,8	3	3,2	3,5	3,6
1,1	**DHE09LA4**	D	4,3	5,2	5,4	6,5	7,3	7,3	6,3	3,6	3,8	3,9	4,2	4,5	4,9	5
1,5	**DHE09XA4**	D	5,9	7,1	7,4	8,9	9,9	9,9	8,6	4,6	5	5,1	5,5	5,9	6,4	6,6
2,2	**DHE09XB4**	D	8,8	10,6	11,1	13,3	14,8	14,8	12,8	6,4	6,9	7	7,7	8,2	9	9,3
2,2	**DHE11SA4**	D	8,7	10,4	10,8	13	14,5	14,5	12,6	6,2	6,7	6,8	7,5	8	8,8	9,1
3	**DHE11MA4**	D	12	14,3	15	18	20	20	17,4	8,4	9,1	9,3	10,3	11	12	12,4
4	**DHE11LA4**	D	15,9	19	19,8	23,5	26,5	26,5	23	11,9	12,6	12,8	13,9	14,6	16	16,5
5,5	**DHE11LA4C**	D	21,5	25,5	27	32	36	36	31	14,2	15,6	15,9	17,8	19,1	21	22
5,5	**DHE11LB4**	D	21,5	25,5	27	32	36	36	31	14,3	15,6	15,9	17,8	19,1	21	22
5,5	**DHE13MA4**	D	21,5	25,5	27	32	36	36	31	14,1	15,5	15,8	17,7	19,1	21	22
7,5	**DHE13LA4**	D	29	35	36,5	44	49	49	42,5	19,3	21,5	22	24,5	26,5	29	30
9,5	**DHE16MB4**	D	37	44,5	46,5	55	62	62	53	26	28	29	32	34,5	37,5	39
11	**DHE16LB4**	D	42,5	51	53	64	71	71	62	30	32,5	33	36,5	39	43	44,5
15	**DHE16XB4**	D	58	70	73	87	97	97	84	41,5	45	46	51	54	59	61
18,5	**DHE18LB4**	D	72	86	90	108	120	120	104	43,5	48	49,5	56	61	67	69
22	**DHE18XB4**	D	85	102	106	127	142	142	123	58	63	64	71	76	83	86
30	**DNFHE20LA4**	D	117	140	146	175	195	195	169	65	73	75	87	95	104	107
37	**DNFHE22SA4**	D	144	172	180	215	240	240	205	79	90	92	106	117	128	132
45	**DNFHE22MA4**	D	174	205	215	260	290	290	250	94	106	110	127	139	152	157

Field weakening for frequencies above 87 Hz, winding for
230 V Δ/ 50 Hz (U_{max} = 400 V Δ/87 Hz), Temperature Class F.

P	Rated output
n	Guideline value for rated speed at the rotor shaft
M	P0ermissible load torque (S1-100%) for operation with frequency inverter
M_N	Rated torque at the rotor shaft
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

IE2 Motor torques for frequency-converter range 5 Hz - 80 Hz, line frequency 60 Hz

P	**Type**	Connec-tion	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
kW			Nm	Nm	Nm	Nm	Nm	Nm	Nm	A	A	A	A	A	A	A
0,12	**DHE05LA4**	Y	0,42	0,52	0,63	0,69	0,7	0,7	0,63	0,34	0,35	0,365	0,37	0,37	0,41	0,42
0,18	**DHE05LA4**	Y	0,63	0,79	0,95	1,04	1,06	1,06	0,95	0,485	0,5	0,51	0,52	0,52	0,58	0,59
0,12	**DHE06LA4**	Y	0,42	0,52	0,63	0,69	0,7	0,7	0,63	0,34	0,35	0,365	0,37	0,37	0,41	0,42
0,18	**DHE06LA4**	Y	0,63	0,79	0,95	1,04	1,06	1,06	0,95	0,485	0,5	0,51	0,52	0,52	0,58	0,59
0,25	**DHE07LA4**	Y	0,88	1,1	1,32	1,45	1,47	1,47	1,32	0,63	0,66	0,68	0,7	0,7	0,78	0,8
0,37	**DHE08MA4**	Y	1,2	1,5	1,8	1,97	2	2	1,8	0,96	0,96	0,96	0,96	0,96	1,07	1,09
0,55	**DHE08LA4**	Y	1,83	2,2	2,7	3	3	3	2,7	1	1,07	1,15	1,2	1,2	1,33	1,36
0,75	**DHE08XA4**	Y	2,4	3,1	3,7	4,1	4,1	4,1	3,7	1,45	1,5	1,56	1,6	1,6	1,78	1,81
0,75	**DHE09SA4**	Y	2,4	3,1	3,7	4,1	4,1	4,1	3,7	1,34	1,43	1,53	1,6	1,6	1,78	1,81
1,1	**DHE09LA4**	Y	3,6	4,5	5,4	5,9	6	6	5,4	1,85	1,99	2,2	2,2	2,2	2,5	2,6
1,5	**DHE09XA4**	Y	4,9	6,1	7,3	8,1	8,2	8,2	7,3	2,4	2,6	2,8	3	3	3,3	3,4
2,2	**DHE09XB4**	Y	7,2	9	10,8	11,9	12,1	12,1	10,8	3,2	3,6	3,9	4,1	4,1	4,5	4,7
2,2	**DHE11SA4**	Y	7,2	9	10,8	11,8	12	12	10,8	3,1	3,5	3,8	4	4	4,5	4,5
3	**DHE11MA4**	Y	9,9	12,3	14,8	16,2	16,5	16,5	14,8	4,2	4,7	5,2	5,5	5,5	6,1	6,3
4	**DHE11LA4**	Y	13	16,2	19,5	21	21,5	21,5	19,5	6,2	6,6	7	7,3	7,3	8,1	8,3
5,5	**DHE11LB4**	Y	18	22,5	27	29,5	30	30	27	7,5	8,2	9,1	9,6	9,6	10,7	10,9
5,5	**DHE13MA4**	Y	18	22,5	27	29,5	30	30	27	7,3	8,1	9,1	9,7	9,7	10,8	11
7,5	**DHE13LA4**	Y	24	30	36	40	40,5	40,5	36	9,9	11	12,3	13,1	13,2	14,7	15
9,5	**DHE16LB4**	Y	30,5	38	45,5	50	51	51	45,5	12,4	13,9	15,4	16,4	16,5	18,3	18,7
11	**DHE16LB4**	Y	35	44	53	58	59	59	53	15	16,6	18,4	19,5	19,6	22	22,5
15	**DHE16XB4**	Y	48,5	60	72	80	81	81	72	21	23	25,5	27	27	30	31
18,5	**DHE18LB4**	Y	60	75	90	98	100	100	90	22	25,5	29	31	31	34,5	35,5
22	**DHE18XB4**	Y	70	88	106	116	118	118	106	29,5	32,5	36	38,5	38,5	43	43,5

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

P	Rated output
n	Guideline value for rated speed at the rotor shaft
M	permissible load torque (S1-100 %) for operation with frequency inverter
M_N	Rated torque at the rotor shaft
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 converter. Load current is lower if the load torque is below the values permitted for 36-84 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

IE2 Motor torques for frequency-converter range 5 Hz - 120 Hz, line frequency 60 Hz

P kW	**Type**	Connec-tion	6 Hz M Nm	12 Hz M Nm	24 Hz M Nm	36 Hz M Nm	104 Hz M Nm	120 Hz M Nm	6 Hz I A	12 Hz I A	24 Hz I A	36 Hz I A	104 Hz I A	120 Hz I A
0,12	**DHE05LA4**	D	0,42	0,52	0,63	0,69	0,7	0,7	0,59	0,61	0,63	0,64	0,65	0,71
0,18	**DHE05LA4**	D	0,63	0,79	0,95	1,04	1,06	1,06	0,84	0,86	0,89	0,9	0,91	0,99
0,12	**DHE06LA4**	D	0,42	0,52	0,63	0,69	0,7	0,7	0,59	0,61	0,63	0,64	0,65	0,71
0,18	**DHE06LA4**	D	0,63	0,79	0,95	1,04	1,06	1,06	0,84	0,86	0,89	0,9	0,91	0,99
0,25	**DHE07LA4**	D	0,88	1,1	1,32	1,45	1,47	1,47	1,09	1,13	1,18	1,21	1,22	1,34
0,37	**DHE08MA4**	D	1,2	1,5	1,8	1,97	2	2	1,67	1,67	1,67	1,67	1,67	1,83
0,55	**DHE08LA4**	D	1,83	2,2	2,7	3	3	3	1,73	1,85	1,99	2,1	2,1	2,3
0,75	**DHE08XA4**	D	2,4	3,1	3,7	4,1	4,1	4,1	2,6	2,6	2,7	2,8	2,8	3,1
0,75	**DHE09SA4**	D	2,4	3,1	3,7	4,1	4,1	4,1	2,4	2,5	2,7	2,8	2,8	3,1
1,1	**DHE09LA4**	D	3,6	4,5	5,4	5,9	6	6	3,2	3,5	3,8	3,9	3,9	4,3
1,5	**DHE09XA4**	D	4,9	6,1	7,3	8,1	8,2	8,2	4,2	4,5	4,9	5,1	5,2	5,7
2,2	**DHE09XB4**	D	7,2	9	10,8	11,9	12,1	12,1	5,7	6,2	6,7	7,1	7,2	7,9
2,2	**DHE11SA4**	D	7,2	9	10,8	11,8	12	12	5,4	5,9	6,5	6,9	7	7,7
3	**DHE11MA4**	D	9,9	12,3	14,8	16,2	16,5	16,5	7,4	8,1	9	9,5	9,6	10,5
4	**DHE11LA4**	D	13	16,2	19,5	21	21,5	21,5	10,7	11,4	12,2	12,6	12,7	13,9
5,5	**DHE11LB4**	D	18	22,5	27	29,5	30	30	12,9	14,2	15,6	16,5	16,7	18,3
5,5	**DHE13MA4**	D	18	22,5	27	29,5	30	30	12,6	14,1	15,7	16,7	16,9	18,5
7,5	**DHE13LA4**	D	24	30	36	40	40,5	40,5	17,1	19,1	21,5	23	23	25,5
9,5	**DHE16LB4**	D	30,5	38	45,5	50	51	51	21,5	24	27	28,5	29	31,5
11	**DHE16LB4**	D	35	44	53	58	59	59	26	29	32	34	34	37,5
15	**DHE16XB4**	D	48,5	60	72	80	81	81	36,5	40	44	46,5	47	52
18,5	**DHE18LB4**	D	60	75	90	98	100	100	38	43,5	49,5	54	54	60
22	**DHE18XB4**	D	70	88	106	116	118	118	51	56	63	67	67	74

Field weakening for frequencies above 87 Hz, winding for standard voltage **265 V Δ / 60 Hz** (Umax = 460 V Δ / 104 Hz), Temperature Class F.

P	Rated output
n	Guideline value for rated speed at the rotor shaft
M	permissible load torque (S1-100%) for operation with frequency inverter
M_N	Rated torque at the rotor shaft
I	Load current for operation with frequency inverter

The load currents in the table are guideline values for selecting the size of frequency converter. Load current is lower if the load torque is below the values permitted for 36-120 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 requiremen-tapproximate
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 D08 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.

Operation with frequency converter

Energy-saving function

High quality frequency inverters reduce voltage in part-load operation to lower the motor current and thus improve efficiency. This converter function emulates the method of operation of commercially available "energy-saving devices".

Regeneration

Regenerative torques (braking torques) are required for motors used in lifting gear, for example. In conjunction with high quality frequency inverters, the motor torques listed in the table can also be applied as regenerative torques. As with motor torque, an increase in regenerative torque with reduced duty factor is permissible.

Notes on operation with other-make frequency inverters

The precondition is that the motor current generated by the frequency converter is largely free of harmonics. The harmonics generated in the motor by some old-style frequency inverters result in additional losses and cut available torque by some 10 % across the entire frequency range. There is also a risk of oscillation causing damage to the gear unit.

At frequencies below approximately 5 Hz, operation without pulse generators is possible only using a frequency inverter with state-of- the-art control. If frequency inverters are used that do not feature load-dependent frequency and current adjustment, the increase in the motor's current consumption means that, particularly in the case of small motors (D04-D..09), torque has to be reduced at frequencies below approximately 10 Hz even if an external fan is used or the duty factor is reduced. Regenerative operation is possible only under certain circumstances.