Technical catalogue

Low-voltage squirrel-cage motors

3.1e

2002

LAFERT GROUP

All technical data, outputs, dimensions and weights stated in this catalogue are subject to change without prior notice.

The illustrations are not binding.

Contents

CE

DECLARATION OF CONFORMITY

The manufacturer

ICME S.p.A.
Via Santa Barbara, 143 – Fusignano, Ravenna, Italy

DECLARES THAT:

The products: Three-phase and single-phase induction motors type:

T, BP, M, ME, FA, FC, FBA, FBC, FS, FMC, FME

comply with the requirements of the following international standard:

IEC 60034

as well as with the requirements of the Low Voltage Directive 73/23 (1973), modified by the Directive 93/68 (1993) and of the EMC-Directive 89/336.

The above named products comply with the requirements of the EC Directive Machines 89/392. In accordance with this Directive induction motors are components and intended solely for integration into other machines. Commissioning is forbidden until conformity of the end product with this Directive is proved!

The CE symbol was applied for the first time in 1996.

When handling the motor, the safety instructions in the Operation Manual of the manufacturer and EN 60204-1 have to be observed.

3nd edition: 24.04.2002

Licio Celsi
Technical Manager and Quality Assurance

CSA Approval Canadien Standards Association

The motors comply with the relevant standards and regulations, especially:

Title	IEC	EU CENELEC	D DIN/VDE	I CEI/UNEL	GB BS	F NFC	E UNE
Electrical							
General stipulations for electrical machines	60034-1	EN 60034-1	DIN EN 60034-1	CEI EN 60034-1	4999-1 4999-69	51-200 51-111	UNE EN 60034-1
Rotating electrical machines: methods for determining losses and efficiency using tests	60034-2	HD 53 2	DIN EN 60034-2	CEI EN 60034-2	4999-34	51-112	UNE EN 60034-2
Terminal markings and direction of rotation of rotating electrical machines	60034-8	HD 53 8 S4	DIN VDE 0530-8	CEI 2-8	4999-3	51-118	20113-8-96
Starting performance	60034-12	EN 60034-12	DIN EN 60034-12	CEI EN 60034-12	4999-112		UNE EN 60034-12
Standard voltages	60038	HD 472 S1	DIN IEC 60038	CEI 8-6			
Insulating materials	60085		DIN IEC 60085	CEI 15-26			
Mechanical							
Dimensions and output ratings	60072			UNEL 13113			
Mounting dimensions and relationship frame sizes-output ratings, IM B3	60072	HD 231	DIN 42673-1	UNEL 13113	4999-10 51-110	51-105 51-104	20106-1/26 1980
Mounting dimensions and relationship frame sizes-output ratings, IM B5	60072	HD 231	DIN 42677-1	UNEL 13117		20106-2-74	
Mounting dimensions and relationship frame sizes-output ratings, IM B14	60072	HD 231	DIN 42677-1	UNEL 13118	4999-10 51-110	51-105 51-104	20106-2-IC-80
Cylindrical shaft ends for electric motors	60072	HD 231	DIN 784-3	UNEL 13502	4999-10	51-111	
Degrees of protection	60034-5	EN 60034-5	DIN IEC60034-5	CEI EN 60034-5	4999-20	EN60034-5	20111-5
Methods of cooling	60034-6	EN 60034-6	DIN EN 60034-6	CEI EN 60034-6	4999-21		EN 60034-6
Mounting arrangements	60034-7	EN 60034-7	DIN EN 60034-7	CEI EN 60034-7	4999-22	51-117	EN 60034-7
Noise limits	60034-9	EN 60034-9	DIN EN 60034-9	CEI EN 60034-9	4999-51	51-119	EN 60034-9
Mechanical vibration	60034-14	EN60034-14	DIN EN 60034-14	CEI EN 60034-14	4999-50	51-111	EN 60034-14
Mounting flanges			DIN 42948	UNEL 13501			
Tolerances of mounting and shaft extensions			DIN 42955	UNEL 13501/ 13502			
Classification of environmental conditions	600721-2-1		DIN IEC 60721-2-1	CEI 75-1			
Mechanical vibration; balancing	ISO 8821		DIN ISO 8821				

The motors are designed for operation at altitudes ≤ 1000 m above sea-level and at ambient temperatures of up to 40° C. Exceptions are indicated on the rating plate.

Permissible temperature rises to various standards

Standard/Regulation	Temperature of coolant	Permissible temperature rise in K (measured by resistance method) Temperature class		
	°C	B	F	H
VDE 0530 part 1	40	80	105	125
International IEC 34-1	40	80	105	125
Britain BS 2613	40	80	105	
Canada CSA	40	80	105	
USA NEMA and ANSI	40	80	105	
Italy CEI	40	80	105	
Sweden SEN	40	80	105	
Norway NEK	40	80	105	
Belgium NBN	40	80	105	
France NF	40	80	105	
Switzerland SEV	40	80	105	
India IS	40	80	-	
Germanischer Lloyd [1]	45	75	90	
American Bureau of Shipping [1]	50	70	95	
Bureau Veritas [1]	45	70	100	
Norske Veritas [1]	45	70	90 [2]	
Lloyds Register [1]	45	70	90	
Registro Italiano Navale [1]	45	70	90	
Korean Register [1]	50	70	90	
China Classification Society [1]	45	75	95	

on request

[1] Classification societies for marine motors

[2] Only with special approval

The motors conform to degree of protection IP 55 to IEC 60034-5. Higher protection on request.

The standard design for horizontal mounting is suitable for indoor and protected outdoor installation, climate group MODERATE (see page 15) (temperature of coolant -20° to +40° C).

For unprotected outdoor installation or severe climatic conditions (moisture category wet, climate group WORLDWIDE, extremely dusty site conditions, aggressive industrial atmosphere, danger of storm rain and coastal climate, danger of attack by termites, etc.), as well as vertical mounting, special protective measures are recommended, such as:

- Protective cowl (for vertical *shaft-down* motors)
- For vertical *shaft-up* motors additional bearing seal and flange drainage
- Special paint finish
- Treatment of winding with protective moisture-proof varnish
- Anti-condensation heating (possibly winding heating)
- Condensation drain holes

The special measures to be applied have to be agreed with the factory once the conditions of installation have been settled.

The corresponding conditions of installation have to be clearly indicated in the order.

Tolerances

For industrial motors to EN 60034-1, certain tolerances must be allowed on guaranteed values, taking into consideration the necessary tolerances for the manufacture of such motors and the materials used. The standard includes the following remarks:

1. It is not intended that guarantees necessarily have to be given for all or any of the items involved. Quotations including guaranteed values subject to tolerances should say so, and the tolerances should be in accordance with the table.
2. Attention is drawn to the different interpretation of the term guarantee. In some countries a distinction is made between guaranteed values and typical or declared values.
3. Where a tolerance is stated in only one direction, the value is not limited in the other direction.

Values for	Tolerance
Efficiency (η) (by indirect determination)	- 0.15 (1 - η) at $P_N \leq 50$ kW - 0.1 (1 - η) at $P_N > 50$ kW
Power factor ($\cos \varphi$)	$\frac{1 - \cos \varphi}{6}$, minimum 0.02, maximum 0.07
Slip (s) (at rated load and at working temperature)	± 20 % of the guaranteed slip at $P_N \geq 1$ kW ± 30 % of the guaranteed slip at $P_N < 1$ kW
Breakaway starting current (I_A) (in the starting circuit envisaged)	+ 20 % of the guaranteed starting current (no lower limit)
Breakaway torque (M_A)	- 15 % and + 25 % of the guaranteed breakaway torque (+ 25 % may be exceeded by agreement)
Pull-up torque (M_S)	- 15 % of the guaranteed value
Pull-out torque (M_K)	- 10 % of the guaranteed value (after allowing for this tolerance, M_K/M_N not less than 1.6)
Moment of inertia (J)	± 10 % of the guaranteed value

Degrees of protection

Degrees of protection for mechanical machines are designated in accordance with IEC 60034-5 by the letters **IP** and two characteristic numerals.

First numeral: Protection against contact and ingress of foreign bodies

IP	Description
0	No special protection
1	Protection against solid foreign bodies larger than 50 mm (Example: inadvertent contact with the hand)
2	Protection against solid foreign bodies larger than 12 mm (Example: inadvertent contact with the fingers)
3	Protection against solid foreign bodies larger than 2.5 mm (Example: Wires, tools)
4	Protection against solid foreign bodies larger than 1 mm (Example: Wires, bands)
5	Protection against dust (harmful deposits of dust)
6	Complete protection against dust. Is not described for electrical machines to IEC 34-5.

Second numeral:
Protection against ingress of water

IP	Description
0	No special protection
1	Protection against vertically falling water drops (condensation)
2	Protection against dropping water when inclined by up to 15°
3	Protection against waterspray at up to 60° from vertical
4	Protection against water splashed from any direction
5	Protection against water projected by a nozzle from any direction
6	Protection against heavy seas or water projected in powerful jets
7	Protection when submerged between 0.15 and 1 m
8	Protection when continuously submerged in water at conditions agreed between the manufacturer and the user.

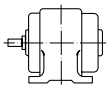
Mounting arrangements

Mounting arrangements for rotating electrical machines are designated according to IEC 60034-7, *Code I* (in brackets Code II).

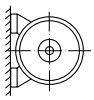
Our motors are available with the mounting arrangements listed below, depending on design and frame size. Motors with aluminium frame are equipped with removable feet that allow easy change of mounting arrangement.

Foot mounting

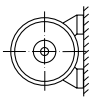
IM B3 (IM 1001)



IM B6 (IM 1051)

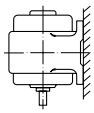


IM B7 (IM 1061)

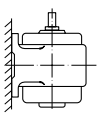


IM B8 (IM 1071)

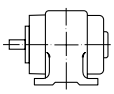
IM V5 (IM 1011)



IM V6 (IM 1031)



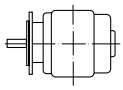
IM B34 (IM 2101)



Flange type C to DIN 42 948 at drive end

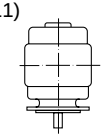
Flange mounting

IM B5 (IM 3001)



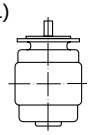
Flange type A to DIN 42 948 at drive end

IM V1 (IM 3011)



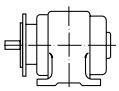
Flange type A to DIN 42 948 at drive end

IM V3 (IM 3031)



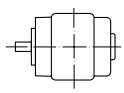
Flange type A to DIN 42 948 at drive end

IM B35 (IM 2001)



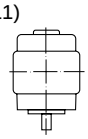
Flange type A to DIN 42 948 at drive end

IM B14 (IM 3601)



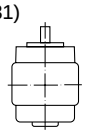
Flange type C to DIN 42 948 at drive end

IM V18 (IM 3611)



Flange type C to DIN 42 948 at drive end

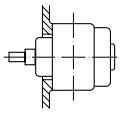
IM V19 (IM 3631)



Flange type C to DIN 42 948 at drive end

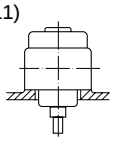
Motors without endshield

IM B9 (IM 9101)



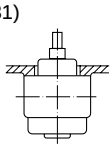
without endshield and without ball bearings on drive end

IM V8 (IM 9111)



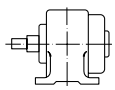
without endshield and without ball bearings on drive end

IM V9 (IM 9131)



without endshield and without ball bearings on drive end

IM B15 (IM 1201)



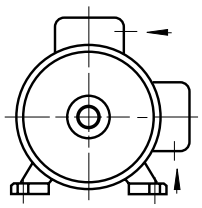
without endshield and without ball bearings on drive end

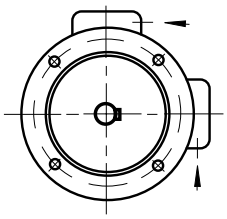
It is essential to state the desired mounting arrangement when ordering, as the constructive design depends partly on the mounting arrangement.

Terminal boxes

The location of the terminal box in standard design is on top; on the right or on the left are possible.

Direction of cable entries





For motors with mountings IM B6, IM B7, IM B8, IM V5, IM V6 the location of the terminal box is related to an IM B3 mounting.

The position of the entry openings can be adjusted to suit the existing connection facilities by turning through 90°. Should special accessories be used (temperature detectors, anti-condensation heating, etc.) please enquire.

For motors in standard design, the cable gland does not belong to our scope of delivery.

For plastic terminal boxes, only plastic glands may be used (shock protection).

When using screened leads, a metal terminal box is required.

Frame size	Degree of protection	Thread for cable entry [1]		Connection for temperature detector		Max. cable section	Terminal thread	Max. external cable diam.
		Pg	Metric [2]	Pg	Metric	mm²		mm
56 - 71	IP 55	2 x Pg 11	1 x M20	-	-	2,5	M4	12
80 - 100	IP 55	1 x Pg 13.5 / 1 x Pg 16	1 x M25	-	-	2,5	M4	16
112	IP 55	1 x Pg 13.5 / 1 x Pg 16	1 x M25	-	-	4	M5	16
132	IP 55	2 x Pg 21	2 x M32	-	-	4	M5	20

[1] Pg thread to DIN 40 430
[2] Pitch 1.5

Bearings

Classification of bearings (standard design)
Ball bearings to ISO15 (DIN 625)

Frame size	Drive end	Non-drive end
56	6201-2Z	6201-2Z
63	6202-2Z	6202-2Z
71	6202-2Z	6202-2Z
80	6204-2Z	6204-2Z
90	6205-2Z	6205-2Z
100	6206-2Z	6206-2Z
112	6206-2Z	6206-2Z
132	6208-2Z C3	6208-2Z C3

Bearing arrangement

Frame size	Bearing drive end	Bearing non-drive end	Spring-loaded
56 - 132	Non-locating bearing	Non-locating bearing	Non-drive end

Maximum permissible axial forces without additional radial forces *

Frame size	Horizontal shaft				Vertical shaft - force upwards				Vertical shaft - force downwards			
	3000 min $^{-1}$ kN	1500 min $^{-1}$ kN	1000 min $^{-1}$ kN	750 min $^{-1}$ kN	3000 min $^{-1}$ kN	1500 min $^{-1}$ kN	1000 min $^{-1}$ kN	750 min $^{-1}$ kN	3000 min $^{-1}$ kN	1500 min $^{-1}$ kN	1000 min $^{-1}$ kN	750 min $^{-1}$ kN
56	0.16	0.21	-	-	0.18	0.22	-	-	0.15	0.19	-	-
63	0.19	0.26	-	-	0.21	0.28	-	-	0.17	0.24	-	-
71	0.23	0.33	0.33	0.37	0.26	0.35	0.36	0.39	0.21	0.30	0.31	0.34
80	0.32	0.44	0.46	0.50	0.34	0.47	0.48	0.53	0.29	0.41	0.43	0.47
90	0.34	0.48	0.49	0.54	0.38	0.47	0.53	0.58	0.31	0.44	0.46	0.51
100	0.48	0.68	0.70	0.77	0.54	0.74	0.76	0.83	0.43	0.62	0.64	0.71
112	0.48	0.68	0.70	0.77	0.56	0.75	0.77	0.84	0.40	0.60	0.62	0.69
132	0.6	0.9	1.1	1.3	1.0	1.3	1.5	1.9	0.5	0.75	0.75	1.05

Values for 50 Hz. For service on 60 Hz, reduce values by 10%

* Consult according to direction of force

Permissible radial forces

without additional axial force

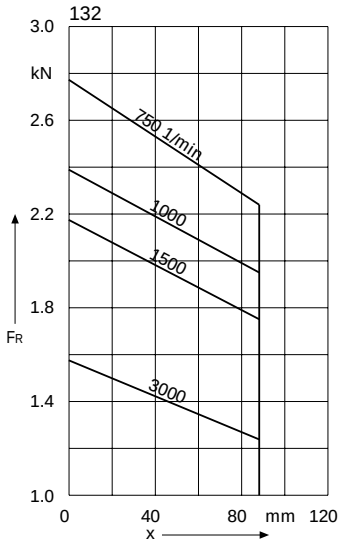
(Ball bearings)

Nominal life = 20.000 h (Lh10)

F_R = permissible radial force in kN

X = Distance between point of application of force and shaft shoulder (e.g. half pulley width)

Size	F_R in N when 2p=			
	2	4	6	8
56	340	428	-	-
63	385	485	-	-
71	463	583	668	735
80	590	830	860	945
90S/L	675	940	975	1070
100L	925	1295	1335	1470
112M	930	1300	1340	1476



Belt drive

The data apply only to the normal drive end shaft extension of IM B3 motors with one speed.

Calculation of belt drive:

$$F_R = \frac{19120 \cdot P \cdot k}{D_1 \cdot n}$$

F_R = Radial shaft load in N
P = Output in kW
n = Speed in min^{-1}
D_1 = Pulley diameter in m
k = Belt tension factor, varying with the type of belt, assumed to be approximately:
3-4 for normal flat belt without idler pulley
2-2.5 for normal flat belt with idler pulley
2.2-2.5 for V-belt
For exact data apply to the belt manufacturer.

Cooling

Surface cooling, independent of the direction of rotation.

Motors type T available without internal fan, e.g. for installation in a directed air stream (outputs on request).

Vibration

The amplitude of vibration in electric motors is governed by EN 60034-14 *Mechanical vibration of rotating electrical machines with shaft heights 56 and larger - methods of measurement and limits.*

Standard motors are designed to vibration class N (normal). Vibration class R (reduced) and vibration class S (special) are available at extra cost.

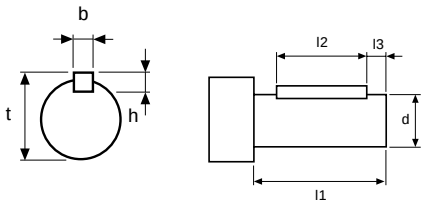
Pole-changing motors in Dahlander connection can only be supplied in vibration class N.

Rotors are at present dynamically balanced with **half** key fitted as per DIN ISO 8821. Other balancing only on request.

The motors are identified as follows:

"H" or "blank" means balanced with *half key*
"F" means balanced with *full key*
"N" means *no key*

Position and dimensions of key



Frame size	d x l1	b x h	l2	l3	t
56	9 x 20	3 x 3	15	2.5	10.2
63	11 x 23	4 x 4	15	4	12.5
71	14 x 30	5 x 5	20	5	16
80	19 x 40	6 x 6	30	6	21.5
90	24 x 50	8 x 7	40	6	27
100	28 x 60	8 x 7	50	6	31
112	28 x 60	8 x 7	50	6	31
132	38 x 80	10 x 8	70	5	41

Dimensions in mm
For larger shafts in special design the dimensions l2 and l3 are maintained.

Noise

The noise level of an electrical machine is determined by measuring the sound pressure level in accordance with curve A of the sound level meter to EN 60651 and is indicated in dB (A).

The permitted noise levels of electrical machines are fixed in EN 60034-9 (IEC 34-9). The noise level of our motors is well below these limit values.

Air-borne sound measurements are carried out in an anechoic testing chamber to EN 21680.

Speed corresponding to a mains frequency of 50 Hz and the number of poles.

Measures for noise reduction

With special measures noise level can be reduced (special fan, noise reducing hood, etc.).

Noise levels

The noise values listed below refer to 50 Hz at rated voltage with a tolerance of up to + 3 dB(A). Values for pole-changing motors on request. For 60 Hz supply values are 3-5 dB(A) higher.

Sound pressure level L_{pA} and sound power level L_{WA} for three-phase squirrel-cage motors

Frame size	2 pole		4 pole		6 pole		8 pole	
	L_{WA}	L_{pA}	L_{WA}	L_{pA}	L_{WA}	L_{pA}	L_{WA}	L_{pA}
56	57	48	47	38				
63	58	49	47	38				
71	61	52	51	42	49	40		
80	70	61	54	45	49	40	44	35
90	72	63	60	51	55	46	51	42
100	76	67	63	54	60	51	54	46
112	79	70	65	56	65	56	54	46
132	77	67	68	58	67	57	68	58

Brake motors

The induction brake is very often the part of the motor that has to bear most of the electrical and mechanical load, since it is affected by the transient dynamics of the brake's mechanical starts and stops. Therefore it is easy to understand why our brake motors are subject to the strictest quality control.
Overall dimensions of our brake motors do not differ from series to series. This allows assembly of an AC or DC supplied brake, with the same performance standards.
Depending on the type of end use, our brake motors are divided into two main groups:

Series FA-FC-FBA-FBC

These series are especially recommended for high braking torque requirements and other heavy-duty applications such as lifting, traversing and transmission in general.

In their standard version the FA and FBA motors are available with three-phase AC coils, while the FC-FBC-FMC-FME motors are equipped with DC coils.

DC brake supply is an ideal choice for applications where a very silent braking is required. This option, combined with the other main specifications of our different brake motors, allows for a large range of application possibilities.

Series FS

These are brake motors with reduced braking torque, especially indicated for machines that require controlled, but not necessarily precision braking (CE Directive Machines 89/392 CEE and Low voltage 93/68). They are suitable for small to medium capacity crane traversing and, using a special brake, in low moment inertia automation.

Protection

The standard mechanical protection of all brake motor series is IP 54. On request, higher degrees of protection can be supplied.

SERIES	Supply, speed and poles	Frame size	Rated output range	Braking range	Brake coils	Supply motor-brake
FA	Three-phase single-speed 2, 4, 6, 8, poles	63-132	0.12-7.5	7.5-100	AC	3~/3~
FBA	Three-phase pole-changing 2/4, 4/8, 4/6, 6/8, 2/8 poles	63-132	0.037-7.5	7.5-100	AC	3~/3~
FC	Three-phase single-speed 2, 4, 6, 8 poles	63-132	0.12-7.5	7.5-100	DC	3~/1~
FBC	Three-phase pole-changing 2/4, 4/8, 4/6, 6/8, 2/8 poles	63-132	0.037-7.5	7.5-100	DC	3~/1~
FMC	Single-phase single-speed 4 poles	63-100	0.12-2.20	7.5-45	DC	1~/1~
FME	Single-phase single-speed 4 poles	63-100	0.12-2.20	7.5-45	DC	1~/1~
FS	Three-phase single-speed 2,4 poles	63-132	0.12-7.5	2.5-25	DC	3~/1~

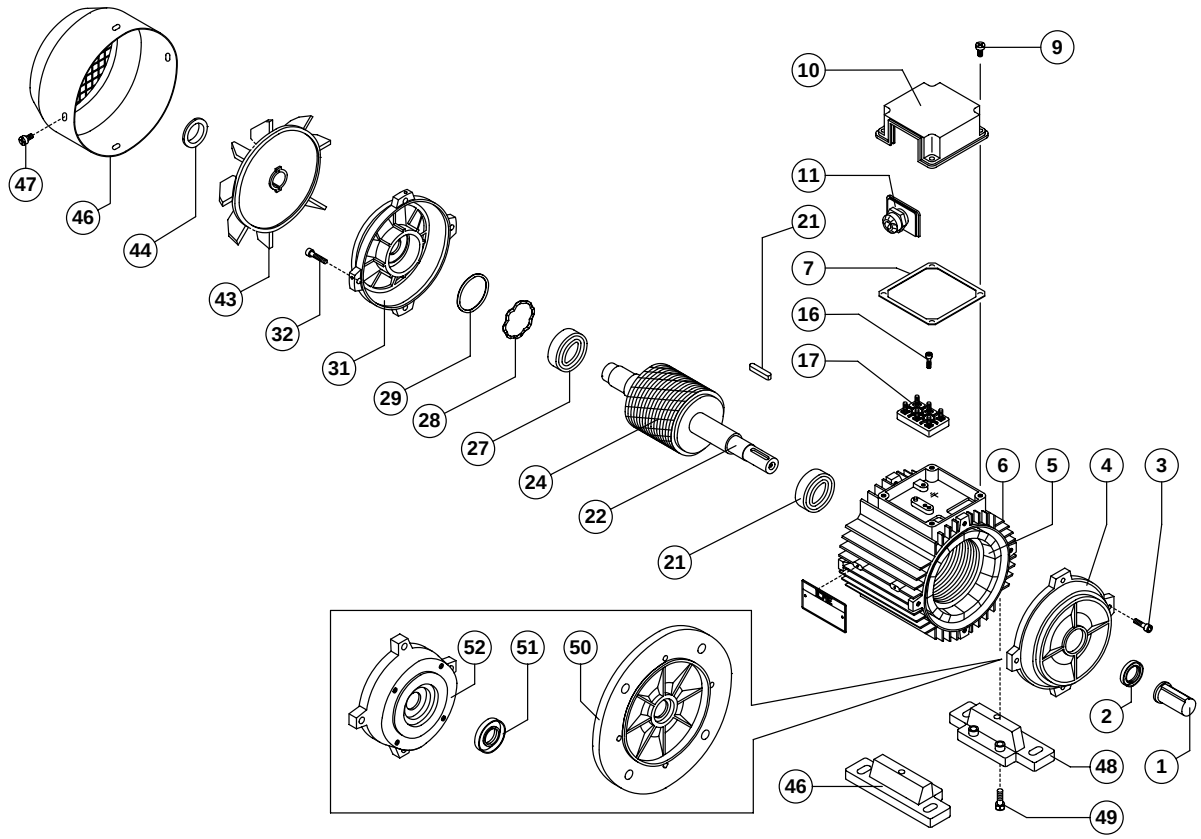
Single-phase motors

Series M and ME

Series M are standard single-phase motors and series ME single-phase motors with high starting torque.
The series ME with high starting torque is electrically and mechanically equivalent to series M, but additionally to the starting and running capacitor, these motors are equipped with an electronic timer. For easy handling and mounting of the motor, these three elements are located all together in one single component.

Spare parts for three-phase motors

Series T and BP



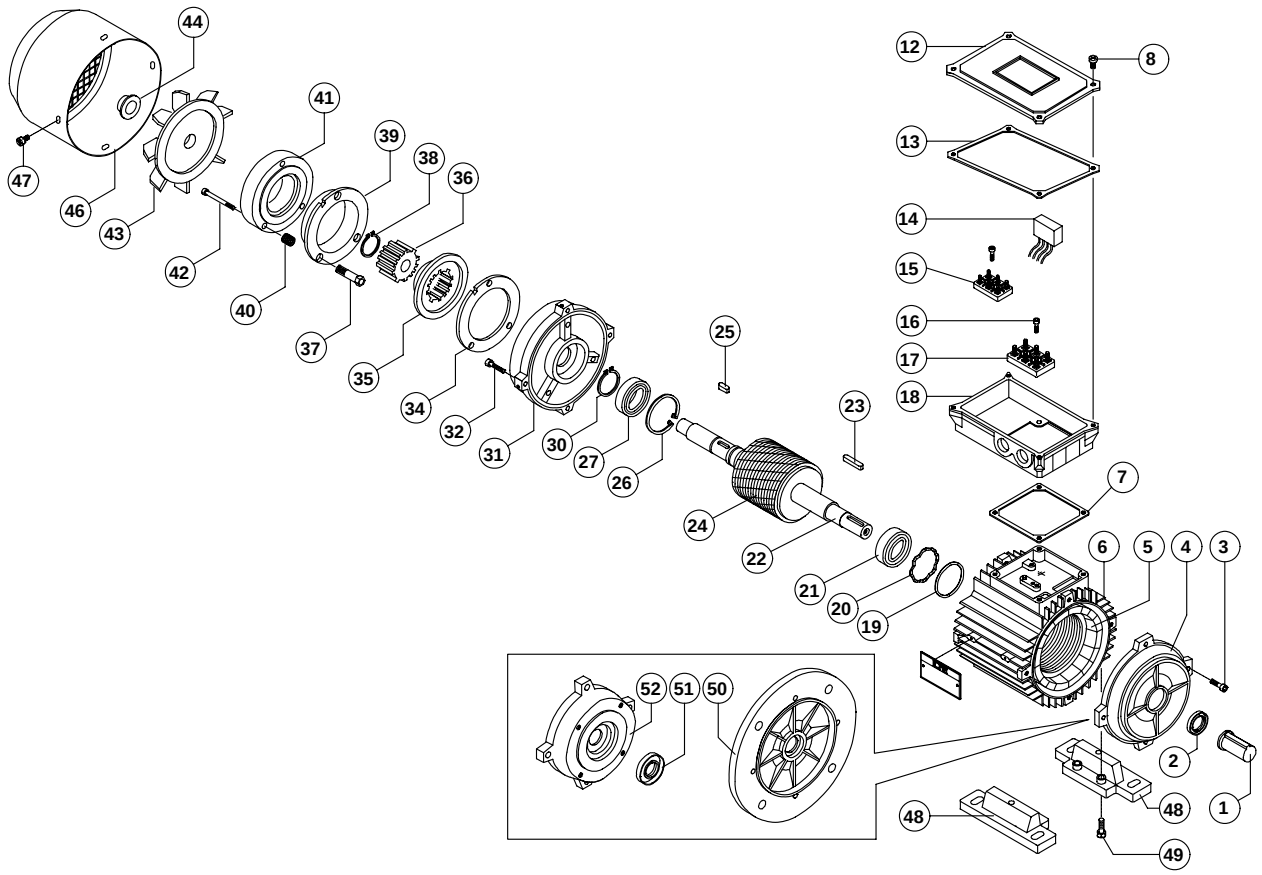
Part description

1	Shaft protection
2	Drive end dust seal
3	Drive end endshield fixing screw
4	Drive end endshield
5	Stator
6	Stator frame
7	Terminal box gasket
9	Terminal box fixing screw
10	Terminal box
11	Cable gland
16	Terminal board fixing screw
17	Terminal board
21	Drive end bearing
22	Motor shaft
23	Hub key
24	Rotor assembly
27	Non-drive end bearing
28	Non-drive end pre-load washer
29	Non-drive end shim ring
31	Non-drive end endshield
32	Non-drive end endshield fixing screw
43	Fan
44	Fan hose clamp
46	Fan cowl
47	Fan cowl fixing screw
48	Feet
49	Feet fixing bolt
50	Flange B5
51	Seal ring
52	Flange B14

In enquires and orders for spare parts please state always:
Designation of spare part, motor type, mounting arrangement, motor serial number (Product No. when available)
Enquires and orders cannot be handled without these data.

Spare parts for brake motors

Series FA, FC, FBA, FBC



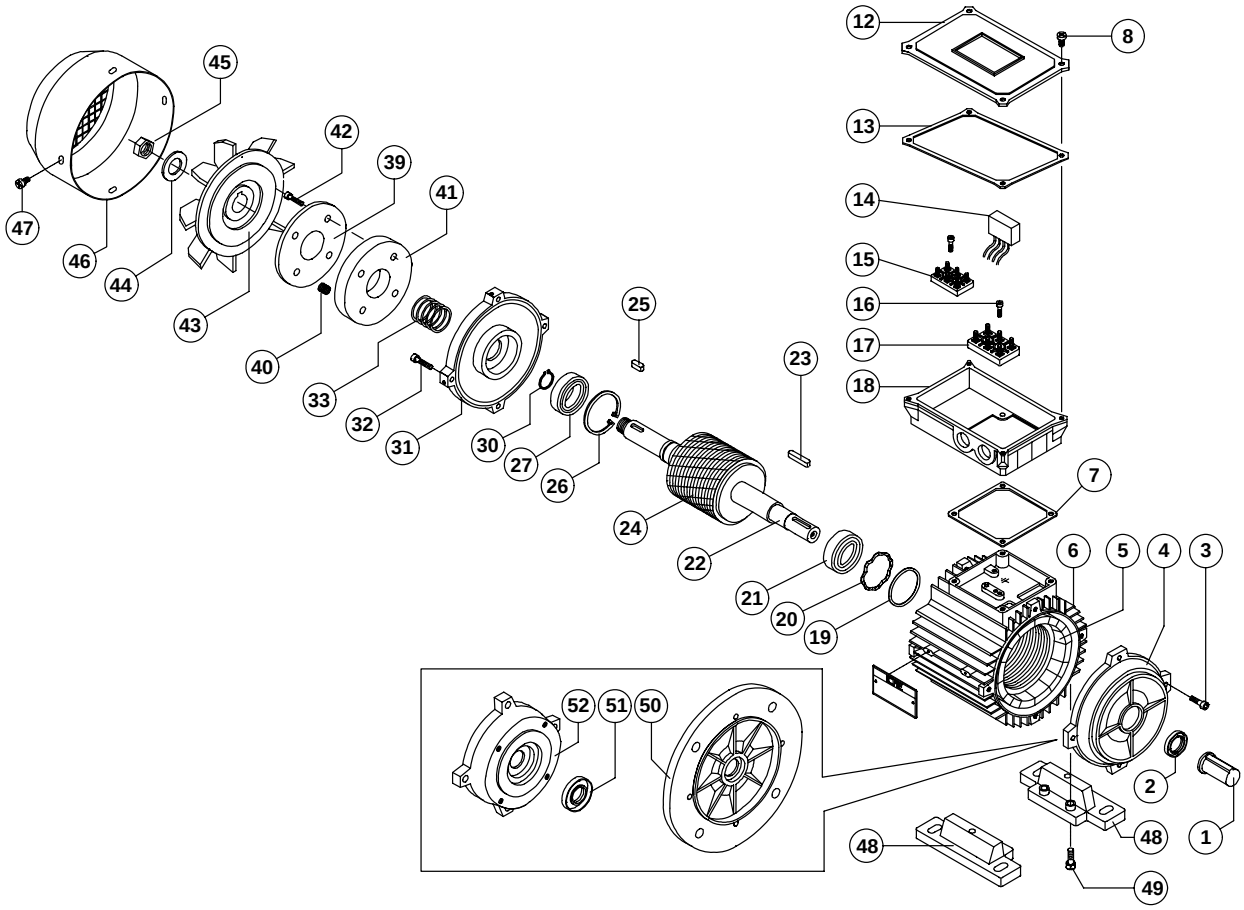
Part description

1	Shaft protection
2	Drive end dust seal
3	Drive end endshield fixing screw
4	Drive end endshield
5	Stator
6	Stator frame
7	Terminal box gasket
8	Terminal box lid fixing screw
12	Terminal box lid
13	Terminal box lid gasket
14	Rectifier
15	Brake terminal board
16	Terminal board fixing screw
17	Terminal board
18	Terminal box bases
19	Drive end shim ring
20	Non-drive end pre-load washer
21	Drive end bearing
22	Motor shaft
23	Hub key
24	Rotor assembly
25	Brake end hub key
26	Seeger ring endshield end
27	Non-drive end bearing
30	Seeger ring for motor shaft
31	Non-drive end endshield
32	Non-drive end endshield fixing screw
34	Counter-disc
35	Brake disc
36	Hub
37	Bushing
38	Seeger ring shaft end
39	Counter-brake coil
40	Brake spring
41	Brake coil
42	Brake screw
43	Fan
44	Fan hose clamp
46	Fan cowl
47	Fan cowl fixing screw
48	Feet
49	Feet fixing bolt
50	Flange B5
51	Seal ring
52	Flange B14

In enquires and orders for spare parts please state always:
Designation of spare part, motor type, mounting arrangement, motor serial number (Product No. when available)
Enquires and orders cannot be handled without these data.

Spare parts for brake motors

Series FS



Part description

1 Shaft protection
2 Drive end dust seal
3 Drive end endshield fixing screw
4 Drive end endshield
5 Stator
6 Stator frame
7 Terminal box gasket
8 Terminal box lid fixing screw
12 Terminal box lid
13 Terminal box lid gasket
14 Rectifier
15 Brake terminal board
16 Terminal board fixing screw
17 Terminal board
18 Terminal box bases
19 Drive end shim ring
20 Non-drive end pre-load washer
21 Drive end bearing
22 Motor shaft
23 Hub key
24 Rotor assembly
25 Brake end hub key
26 Seeger ring endshield end
27 Non-drive end bearing
30 Seeger ring for motor shaft
31 Non-drive end endshield
32 Non-drive end endshield fixing screw
33 Thrust spring
39 Counter-brake coil
40 Brake spring
41 Brake coil
42 Brake screw
43 Fan
44 Fan hose clamp
45 Locknut
46 Fan cowl
47 Fan cowl fixing screw
48 Feet
49 Feet fixing bolt
50 Flange B5
51 Seal ring
52 Flange B14

In enquires and orders for spare parts please state always:
Designation of spare part, motor type, mounting arrangement, motor serial number (Product No. when available)
Enquires and orders cannot be handled without these data.

Rated voltage

For the rated voltage of the motors, EN 60 034-1 allows a tolerance of ± 5 %. According to IEC 60038, the mains voltages may have a tolerance of ± 10 %.

Therefore the motors are designed for the following rated voltage ranges (exceptions are shown in the data tables):

Mains voltage to DIN IEC 38	Rated voltage range of motor
230 V ± 10%	218-242 V ± 5%
400 V ± 10%	380-420 V ± 5%
690 V ± 10%	655-725 V ± 5%

Within the rated motor voltage range, the permissible maximum temperature is not exceeded. When the motors are operated at the limits of the voltage tolerance, the permissible overtemperature of the stator winding may be exceeded by 10 K.

For frame sizes 56 to 132 nameplates are marked with the maximum rated currents within the stated voltage ranges.

Rated frequency

50 Hz motors can also be operated on 60 Hz mains, provided the mains voltage increases proportionally to the frequency. The relative values for starting and breakaway torque remain nearly unchanged and slightly increase for the starting current. The rated speed increases by the factor 1.2 and output by factor 1.15. Should a motor designed for 50 Hz be operated at 60 Hz without the voltage being increased, the rated output of the motor cannot be increased. Under these operating conditions, rated speed increases by factor 1.2. The relative values for starting and breakaway torque are reduced by factor 0.82 and for starting current by factor 0.9.

Rated current

The rated currents listed in the data tables apply to an operating voltage of 400 V. The conversion to other operating voltages, with output and frequency remaining unchanged, is to be made as follows:

Nominal voltage (V)	230	380	**400**	440	500	660	690
Conversion factor x I_N	1.74	1.05	**1.0**	0.91	0.80	0.61	0.58

Rated torque

$$\text{Rated torque in Nm} = 9550 \times \frac{\text{Rated voltage in kW}}{\text{Rated speed in min}^{-1}}$$

Output

The outputs stated in this catalogue are for constant load in continuous running duty S1 according to EN 60034-1, based on an ambient temperature of 40° C and installation at altitudes up to 1000 m above sea level.

For severe operating conditions, e.g. high switching rate, long run-up time or electric braking, a thermal reserve is necessary, which could call for higher thermal class or the use of a motor with a higher rating. In these cases we recommend to enquire with detailed information on the operating conditions.

Overload

At operating temperature three-phase motors are capable of withstanding an overload for 15 seconds at 1.5 times the rated torque at rated voltage. This overload is according to EN 60034-1 and will not result in excessive heating.

Utilizing thermal class F, motors can be operated continuously with an overload of 12 %. Nevertheless this is not valid for motors which to catalogue are utilized to thermal class F.

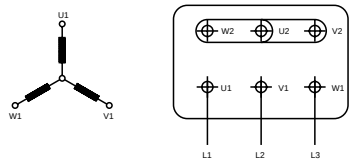
Brake motors

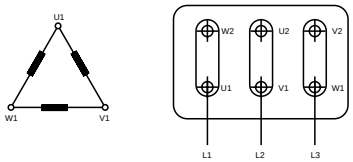
Except for brake motors for special applications, all motors are according to thermal class F. Supply voltage corresponds to Eurovoltage (230-400 V and 400/692 V, 50 Hz). On request, brake motors with special voltage, special duty and for special applications are available.

The windings of the brake coil are adapted to the motor voltage. The three- and single-phase coils are designed for continuous duty with running motor.

Motors with DC brake coil are equipped with the corresponding rectifier. The brake is connected in the terminal box of the motor.

Connection diagrams





Windings of standard three-phase motors can be connected either in star or delta connection.

Star connection

A star connection is obtained by connecting W2, U2, V2 terminals to eachother and the U1, V1, W1 terminals to the mains. The phase current and voltage are:

Iph = In ; Uph = Un / $\sqrt{3}$

where In is the line current and Vn the line voltage referred to the star connection.

Delta connection

A delta connection is obtained by connecting the end of a phase to the beginning of the next phase.

The phase current Iph and the phase voltage Uph are:

Iph = In / $\sqrt{3}$; Uph = Un

where In and Un are referred to the delta connection.

Star-delta starting

Star-delta starting allows a peak current reduction, ensuring however that the peak torque obtained is bigger than the resistant torque. Actually, it should be noted that the torque of an induction squirrel-cage motor is directly proportional to the square of the voltage. Motors whose rated voltage with delta connection corresponds to the mains voltage, can be started with the star-delta method.

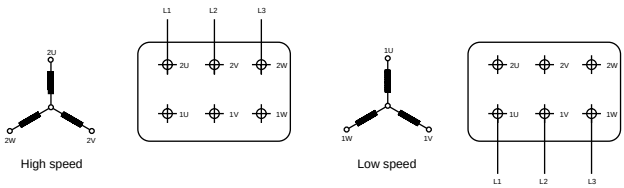
All motors can be supplied with windings designed for star-delta starting (for example: 400 V Δ / 690 V Y).

Pole-changing motors

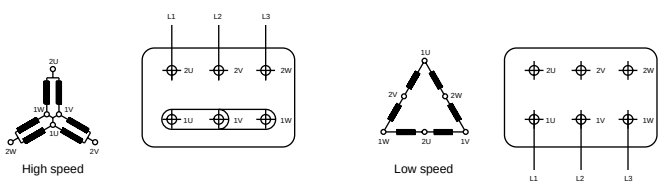
Standard pole-changing motors are designed for single voltage and direct-on-line starting (special design for Y-Δ-connection on request).

When the ratio between the two speeds is from 1 to 2, the standard motors have one single winding (Dahlander connection). For the other speeds, the motors have two separate windings.

BP - two separate windings Y / Y



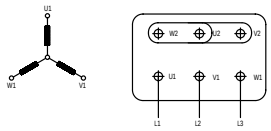
BP – Dahlander connection YY / Δ



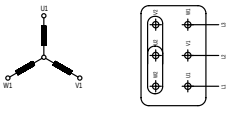
Brake motors

SERIES FA

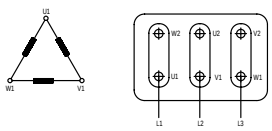
MOTOR



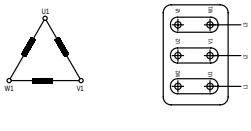
BRAKE



MOTOR

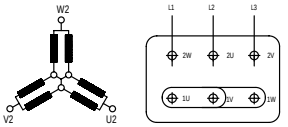


BRAKE



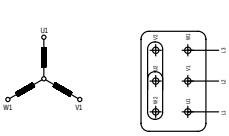
SERIES FBA DAHLANDER ⅄⅄/△

MOTOR

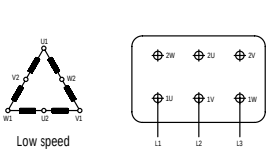


High speed

BRAKE

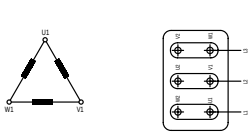


MOTOR



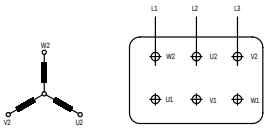
Low speed

BRAKE



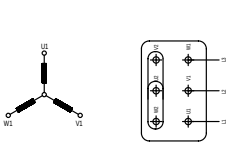
SERIES FBC DUAL-WOUND ⅄⅄

MOTOR

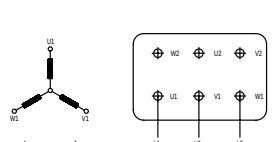


High speed

BRAKE

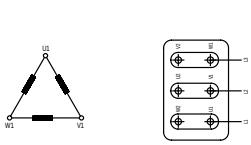


MOTOR

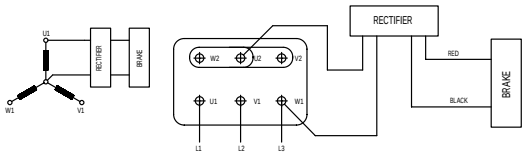


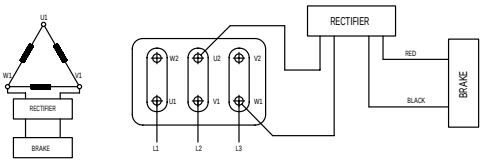
Low speed

BRAKE

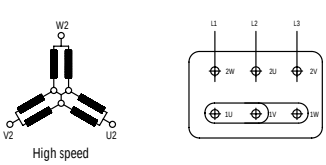


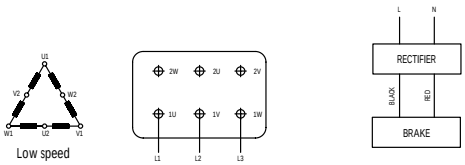
SERIES FC



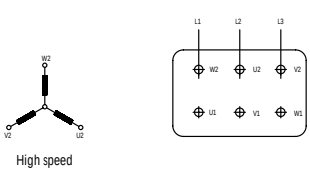


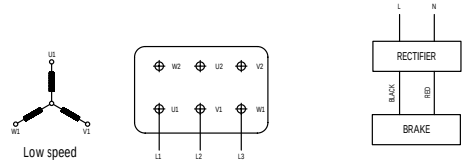
SERIES FBC DAHLANDER ⅄⅄/△





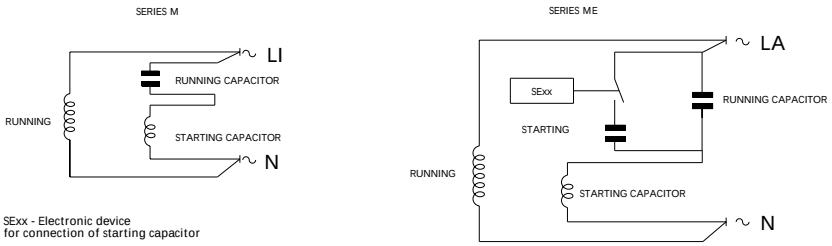
SERIES FBC DUAL-WOUND ⅄⅄





Single-phase motors

Single-phase motors are designed for a single rated voltage. The windings (running and starting winding) are connected to the capacitor supplied with the motor. The direction of rotation can be reversed by inverting the winding ends.



Insulation and temperature rise

Class F insulation to EN 60034-1 is used throughout.

In standard design motors are intended for operation at 40° C ambient temperature with class B temperature rise only, with an overtemperature limit of 80 K. This also applies for the rated voltage range to IEC 60038. Exceptions are shown on the data tables.

Temperature rise (ΔT*) and maximum temperatures at the hottest points of the winding (T_{max}) according to the temperature classes of EN 60034-1.

	ΔT*	T_{max}
Class B	80 K	125° C
Class F	105 K	155° C
Class H	125 K	180° C

*Measurement by resistance method

Output reduction at ambient temperatures over 40° C

Ambient temperature	45° C	50° C	55° C	60° C
Reduction of nominal output to approx.	95 %	90 %	85 %	80 %

When a winding is utilized to temperature class F (105K), no output reduction is required up to an ambient temperature of 60° C. *This does not apply to motors which in their standard design are already utilized to thermal class F.*

Installation at altitudes of more than 1000 m above sea level (see also EN 60034-1)

Altitude of installation	2000 m	3000 m	4000 m
At 40°C ambient temperature and thermal class B Rated output reduced to approx.	92 %	84 %	76 %
At 40°C ambient temperature and thermal class F Rated output reduced to approx.	89 %	79 %	68 %
Full nominal output to data tables with thermal class B and ambient temperature of	32° C	24° C	16° C
Full nominal output to data tables with thermal class F and ambient temperature of	30° C	19° C	9° C

Starting rate

The permissible number of starts per hour can be taken as given in the table below, provided the following conditions are met:

Additional moment of inertia ≤ moment of inertia of the rotor: load torque rising with the square of the speed up to nominal torque; starts at even intervals.

Shaft height	Permissible No. of starts per hour for 2p		
	= 2	= 4	≥ 6
56 - 71	100	250	350
80 - 100	60	140	160
112 - 132	30	60	80

Thermal protection

The decision on a particular type of thermal protection should be taken according to the actual operating conditions. Motors may be protected by means of current-dependent thermal protection switches, overcurrent relays and temperature detectors.

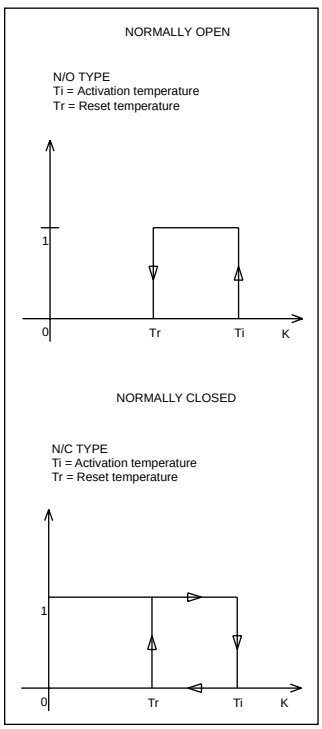
Thermal protection is possible as follows:

- Thermal protection switch with bimetal release
- Thermistor protection with semiconductor temperature detectors (PTC) in the stator winding in connection with release (if required, with additional motor protection switch).
- Bimetal temperature detector as N/C or N/O in the stator winding (if required, with additional motor protection switch).
- Resistance thermometer for monitoring winding and bearing temperature.

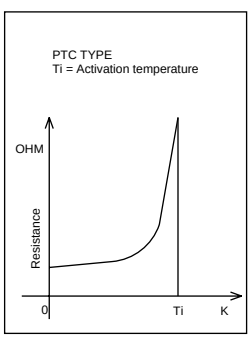
Should protection of the motor be required, we install protection switch with bimetal release up to frame size 112 and semiconductor temperature detectors in motors ≥ 132.

Although there are motors available from stock with built-in semiconductor temperature detector, a special remark has to be made in the enquiry or order when motor protection is required.

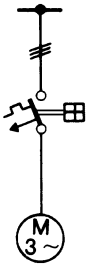
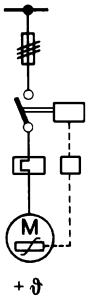
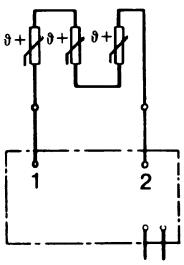
Operating specifications
Thermal cut-out



Operating specifications
of the thermistors



Examples of connection

	Protection method	Protection
	Motor protection switch with thermal and electromagnetic overcurrent release	against: • Overload in continuous service • Locked rotor
	Contactor with overcurrent relay Thermistor protection and fuse	in service against: • Overload in continous service • Long starting and braking periods • High switching rate in case of fault against: • Obstruction of cooling • Increased ambient temperature • Single-phase operation • Frequency fluctuations • Switching against locked rotor
	Semiconductor temperature detector with release	in service against: • Overload in continous service • Long starting and braking periods • High switching rate in case of fault against: • Obstruction of cooling • Increased ambient temperature • Single-phase operation • Frequency fluctuations • Switching against locked rotor

Motors for normal continuous duty (S1) and normal operating conditions

Quotation (if submitted)	No./Date
Quantity	Units
Designation	Type
Output (for pole-changing motors, outputs referred to speeds)	kW
Speed (for pole-changing motors, outputs referred to outputs)	min^{-1}
Direction of rotation (viewed on shaft extension)	
Mounting arrangement (to IEC 60034-7)	
Degree of protection, motor/terminal box (to IEC 60034-5)	
Mains voltage	V
Mains frequency	Hz
Method of starting (direct-on-line or Y-Δ)	
Location of terminal box	
Machine to be driven	

Dimensions of cables, if these differ from those allocated by VDE 0100, referred to an ambient temperature of 40° C, or when aluminium conductors are used. It should be stated when parallel connected conductors are used.

Additional information for special duties and difficult operating conditions

S 2: ... min (short-time duty)

S 3: ... % - ... min (intermittent duty)

S 4: ... % - J_M ... kgm² - J_{ext} ... kgm²
(intermittent duty with starting)

S 5: ... % - J_M ... kgm² - J_{ext} ... kgm²
(intermittent duty with electric braking)

S 6: ... % - min
(continuous-operation periodic duty with intermittent load)

S 7: J_M ... kgm² - J_{ext} ... kgm²
(continuous-operation periodic duty with electric braking)

S 8: J_M ... kgm² - J_{ext} ... kgm²
(continuous-operation periodic duty with speed changes)

S 9: ... kW equ (continuous duty with non-periodic load and speed variations). For this duty type suitable full load values should be taken as the overload concept.

S10: p/Δt .... r .... TL (Duty with discrete constant loads).
Starting conditions (no-load or loaded starting)

Shock loads

Load torque curve during run-up (characteristic)

Moment of inertia (J_{ext}) referred to the motor shaft	kgm²
Description of the type of drive (direct coupling, flat or V-belt, straight or helical gears, sprocket, crank, eccentric cam, etc.)	
Radial force (or diameter of drive element)	N
Direction of force and point of application (distance from shaft shoulder or width of drive element)	mm
Axial force and direction of application (pull/thrust)	N

Ambient conditions (e.g. increased humidity, dust accumulation, corrosive gases or vapours, increased or extremely low ambient temperature, outdoor installation, installation at altitudes over 1000 m above sea level, extraneous vibration, etc.)

Three-phase squirrel cage motors
230-400 V - 50 Hz
Protection IP 55

Series T

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Moment of inertia	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos \varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	J 10^{-3} kgm^2	kg
3000 min^{-1} (2 poles)											
56 B2	0.12	2720	0.40	56	0.77	0.42	2.7	3	3	0.09	3.5
63 A2	0.18	2740	0.60	56	0.78	0.63	2.7	3	3.5	0.13	4.1
63 B2	0.25	2770	0.70	66	0.78	0.86	3.2	3	4.5	0.19	4.6
71 A2	0.37	2820	1.15	68	0.69	1.25	3.6	3.7	4.6	0.36	5.7
71 B2	0.55	2820	1.60	71	0.70	1.86	3.6	3.5	4.7	0.46	6.3
80 A2	0.75	2830	1.90	76	0.75	2.53	3.6	3.6	5.7	0.77	9.0
80 B2	1.10	2840	2.60	77	0.79	3.70	3.7	3.8	6.5	0.91	10.5
90S A2	1.50	2850	3.40	79	0.81	5.03	2.7	3.1	5.8	1.15	13.0
90L B2	2.20	2860	5.00	80	0.79	7.34	3.9	4	6.9	1.80	15.0
100L A2	3.00	2850	6.20	81	0.86	10.00	2.8	3.1	6.2	3.25	19.6
112M A2	4.00	2910	8.20	85	0.83	13.13	2.9	3	7.8	6.20	36.0
132S A2	5.50	2910	12.00	83	0.80	18.04	2.9	3.3	6.5	13.10	45.0
132M B2	7.50	2930	14.80	86	0.85	24.40	3.2	3.4	7	17.50	50.0

Three-phase squirrel cage motors
230-400 V - 50 Hz
Protection IP 55

Series T

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Moment of inertia	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$cos\ \varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	J 10^{-3} kgm^2	kg
1500 min^{-1} (4 poles)											
56 B4	0.09	1360	0.41	53	0.60	0.63	2.6	2.7	2.4	0.14	3.4
63 A4	0.12	1350	0.46	54	0.69	0.85	2	2	2.4	0.25	4.1
63 B4	0.18	1350	0.70	53	0.70	1.27	2	2	2.3	0.31	4.6
71 A4	0.25	1370	0.69	67	0.77	1.74	2	2.1	3.4	0.54	5.1
71 B4	0.37	1380	1.18	68	0.67	2.56	2.2	2.3	4	0.76	6.3
80 A4	0.55	1380	1.38	72	0.80	3.80	1.9	2.2	3.9	1.47	9.0
80 B4	0.75	1390	2.00	72	0.75	5.15	2.6	2.2	3.9	1.90	9.9
90S A4	1.10	1410	2.60	79	0.77	7.45	2.3	2.6	4.6	2.75	11.8
90L B4	1.50	1410	3.60	79	0.76	10.16	2.4	2.6	4.8	3.20	14.3
90L C4	1.80	1410	4.50	79	0.73	12.20	3.1	3.1	5.2	3.72	15.5
100L A4	2.20	1410	5.10	80	0.78	14.90	2.4	2.6	4.8	4.93	18.7
100L B4	3.00	1410	7.10	80	0.80	18.04	2.9	3.3	6.5	5.97	21.0
112M A4	4.00	1430	9.00	84	0.76	26.40	3.1	3.6	6.6	10.56	36.0
132S A4	5.50	1450	11.90	87	0.77	36.20	2.3	2.6	5.4	19.40	45.0
132M B4	7.50	1450	16.00	87	0.78	49.40	2.8	3	6.3	28.60	55.0

Three-phase squirrel cage motors
230-400 V - 50 Hz
Protection IP 55

Series T

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Moment of inertia	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos \varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	J 10^{-3} kgm^2	kg
1000 min^{-1} (6 poles)											
56 B6	0.06	780	0.33	40	0.65	0.73	1.3	1.8	1.3	0.23	3.5
63 A6	0.09	890	0.67	40	0.49	0.96	2.5	2.5	1.7	0.30	4.1
63 B6	0.12	870	0.70	45	0.55	1.32	1.3	2	1.8	0.40	4.6
71 A6	0.18	850	0.70	51	0.73	2.00	1.4	2.1	2.1	0.60	5.7
71 B6	0.25	870	1.00	53	0.68	2.74	2.2	2.1	2.7	0.90	6.3
80 A6	0.37	880	1.35	56	0.71	4.00	2.2	2.1	2.7	1.32	8.8
80 B6	0.55	900	1.74	65	0.70	5.83	2	2.1	3	1.78	10.5
90S A6	0.75	910	2.20	68	0.72	7.87	2.2	2.1	3.7	2.80	13.0
90L B6	1.10	900	3.30	69	0.70	11.67	1.9	2	3.1	3.50	16.5
100L A6	1.50	935	4.10	75	0.70	15.30	2.1	2.5	4.2	6.40	21.0
100L B6	1.80	935	4.90	76	0.70	18.40	2.3	2.5	4.4	7.90	30.2
112M A6	2.20	945	6.30	79	0.64	22.23	2.7	2.7	4.6	11.00	40.0
132S A6	3.00	960	7.70	84	0.67	29.84	2.5	2.4	5.4	20.00	45.0
132M B6	5.50	950	12.97	85	0.72	55.30	2.1	3.1	5.8	35.00	60.0

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Moment of inertia	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos \varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	J 10^{-3} kgm^2	kg
750 min^{-1} (8 poles)											
63 B8	0.08	630	0.48	45	0.53	1.21	1.3	1.8	1.3	0.40	4.6
71 B8	0.12	670	0.69	49	0.51	1.71	2.5	2.9	2.4	0.90	6.3
80 A8	0.18	670	0.92	47	0.60	2.56	1.8	2	2.1	1.32	9.0
80 B8	0.25	680	1.28	50	0.56	3.50	1.9	2.1	2.3	1.78	9.5
90S A8	0.37	670	1.40	61	0.62	5.30	1.7	2.2	2.5	2.80	13.0
90L B8	0.55	670	2.20	62	0.58	7.84	1.6	2.1	2.5	3.50	15.3
100L A8	0.75	690	2.50	67	0.65	10.40	1.7	1.9	2.9	6.40	20.0
100L B8	1.10	690	3.90	68	0.60	15.20	1.8	2	2.9	7.90	22.3
112M B8	1.50	710	4.50	76	0.63	20.20	1.7	2.4	3.9	11.00	36.0
132S A8	2.20	710	6.80	73	0.64	29.60	1.6	2	4.5	20.00	45.0
132M B8	3.00	705	7.70	80	0.70	40.60	1.5	2.2	5.2	35.00	55.0

Pole-changing three-phase motors
400 V - 50 Hz
Protection IP 54

Series BP

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Moment of inertia	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos \varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	J 10^{-3} kgm²	kg
3000/1500 min^{-1} (2/4 poles) - Dahlander connection											
63 A2/4	0.16 0.11	2700 1270	0.56 0.46	57 53	0.72 0.65	0.55 0.83	1.3 1.6	1.7 1.4	2.4 2.6	0.25	4.1
63 B2/4	0.22 0.15	2710 1280	0.70 0.58	58 55	0.78 0.68	0.77 1.12	2.2 2.5	2.5 3.0	3.3 3.5	0.31	4.6
71 A2/4	0.30 0.20	2750 1330	0.90 0.72	60 57	0.80 0.70	1.04 1.43	2.2 2.0	2.4 2.9	3.1 3.3	0.54	5.1
71 B2/4	0.45 0.30	2780 1350	1.30 1.06	63 59	0.79 0.69	1.54 2.12	2.1 2.4	2.3 2.7	3.4 3.3	0.76	6.3
80 A2/4	0.60 0.45	2800 1380	1.78 1.49	64 67	0.76 0.65	2.05 3.11	2.3 2.5	2.2 2.4	3.2 3.4	1.47	9.0
80 B2/4	0.80 0.60	2820 1390	2.22 1.74	65 70	0.80 0.71	2.71 4.12	2.5 2.6	2.6 2.8	3.4 3.6	1.90	9.9
90S A2/4	1.40 1.00	2830 1400	3.66 2.86	68 70	0.81 0.72	4.73 6.82	2.4 2.3	2.7 2.9	3.5 3.6	2.75	11.8
90L B2/4	1.80 1.25	2830 1390	4.57 3.38	71 73	0.80 0.73	6.07 8.58	2.3 2.2	2.7 2.8	3.5 3.4	3.72	15.5
100L A2/4	2.50 1.80	2860 1410	5.95 4.74	73 74	0.83 0.74	8.35 12.19	2.4 2.2	2.6 2.5	4.3 4.2	4.93	18.7
100L B2/4	3.30 2.60	2880 1400	7.74 6.86	75 77	0.82 0.71	10.94 17.73	2.1 2.3	2.7 2.6	4.5 4.4	5.97	21.0
112M A2/4	4.40 3.30	2900 1410	10.08 8.14	75 79	0.84 0.74	14.48 22.35	2.2 2.3	2.8 2.5	5.6 5.5	10.56	36.0
132S A2/4	5.50 4.50	2910 1400	12.57 11.14	77 81	0.82 0.72	18.05 30.69	2.4 2.5	2.6 2.4	6.3 6.5	19.40	45.0
132M B2/4	7.50 6.00	2920 1405	16.32 14.83	78 80	0.85 0.73	24.53 40.78	2.2 2.5	2.8 2.6	6.5 7.0	28.60	55.0

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Moment of inertia	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos \varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	J 10^{-3} kgm²	kg
1500/750 min^{-1} (4/8 poles) - Dahlander connection											
63 A4/8	0.09 0.04	1280 620	0.32 0.24	54 40	0.76 0.60	0.67 0.62	1.3 1.6	1.7 1.4	2.1 2.0	0.31	4.6
71 B4/8	0.15 0.09	1305 610	0.52 0.53	56 40	0.75 0.61	1.09 1.40	2.2 2.5	2.5 3.0	2.4 2.6	0.54	5.1
80 A4/8	0.37 0.20	1320 630	1.20 1.09	59 42	0.76 0.63	2.67 3.03	2.2 2.0	2.4 2.9	2.6 2.7	1.47	9.0
80 B4/8	0.55 0.30	1350 650	1.69 1.50	60 45	0.78 0.64	3.89 4.41	2.1 2.4	2.3 2.7	2.7 2.5	1.90	9.9
90S A4/8	0.75 0.37	1380 670	2.10 1.53	65 53	0.79 0.66	5.19 5.27	2.3 2.5	2.2 2.4	3.0 3.2	2.75	11.8
90L B4/8	0.90 0.50	1400 680	2.39 1.89	68 56	0.80 0.68	6.14 7.02	2.5 2.6	2.6 2.8	3.0 3.3	3.72	15.5
100L A4/8	1.40 0.70	1405 685	3.50 2.59	73 60	0.79 0.65	9.52 9.76	2.4 2.3	2.7 2.9	3.5 3.6	6.40	18.7
100L B4/8	1.60 0.90	1410 690	3.80 2.98	75 64	0.81 0.68	10.84 12.46	2.3 2.2	2.7 2.8	3.5 3.4	7.90	21.0
112M A4/8	1.70 1.00	1420 700	4.03 3.26	77 67	0.79 0.66	11.43 13.64	2.4 2.2	2.6 2.5	3.9 3.6	11.00	36.0
112M A4/8	2.20 1.30	1410 690	5.29 4.25	78 69	0.77 0.64	14.90 18.00	2.1 2.3	2.7 2.6	4.6 4.0	13.54	39.0
132S A4/8	3.70 2.20	1430 690	8.89 7.08	77 66	0.78 0.68	24.70 30.45	2.2 2.3	2.8 2.5	5.0 4.2	20.10	45.0
132M B4/8	4.70 2.80	1445 710	10.34 8.77	80 72	0.82 0.64	31.06 37.66	2.4 2.5	2.6 2.4	5.2 4.4	35.00	55.0

Pole-changing three-phase motors
230/400 V - 50 Hz
Protection IP 54

Series BP

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Moment of inertia	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos\varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	J 10^{-3} kgm^2	kg
1500/1000 min^{-1} (4/6 poles) - Separate windings											
63 A4/6	0.18 0.04	1320 840	0.68 0.17	54 52	0.70 0.64	1.30 0.45	2.4 1.5	2.3 1.6	2.1 1.8	0.31	4.6
71 B4/6	0.22 0.15	1360 860	0.69 0.61	63 55	0.73 0.65	1.54 1.66	2.3 1.6	2.2 1.5	2.3 1.9	0.76	5.1
80 A4/6	0.37 0.26	1380 870	1.05 0.98	67 60	0.76 0.64	2.56 2.85	2.4 1.7	2.5 1.7	2.4 2.0	1.47	9.0
80 B4/6	0.55 0.45	1380 880	1.50 1.56	69 63	0.77 0.66	3.80 4.88	2.5 1.7	2.6 1.8	3.2 2.8	1.90	9.9
90S A4/6	0.75 0.50	1400 905	1.90 1.70	73 65	0.78 0.65	5.12 5.27	2.6 1.7	2.7 2.0	3.4 3.0	2.75	11.8
90L B4/6	1.10 0.75	1410 910	2.65 2.44	75 67	0.80 0.66	7.45 7.87	2.5 1.6	2.8 2.2	3.7 3.2	3.72	15.5
100L A4/6	1.50 0.90	1405 900	3.56 2.73	77 71	0.79 0.67	10.19 9.54	2.7 1.7	2.6 2.3	4.1 3.8	7.90	18.7
112M A4/6	1.80 1.30	1420 910	4.00 3.73	80 74	0.81 0.68	12.10 13.64	2.9 1.8	2.8 2.5	4.4 4.0	11.00	36.0
112M B4/6	2.60 1.80	1430 915	5.86 5.09	81 74	0.79 0.69	17.36 18.78	3.0 2.0	3.0 2.6	5.5 4.4	13.54	39.0
132S A4/6	4.00 2.60	1425 920	9.02 7.36	80 75	0.80 0.68	26.80 26.98	3.2 2.2	3.1 2.7	5.7 4.8	20.00	45.0
132M B4/6	5.50 3.70	1435 930	11.95 10.49	82 76	0.81 0.67	36.60 37.99	3.1 2.1	3.2 2.8	5.6 4.4	35.00	55.0

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Moment of inertia	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos\varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	J 10^{-3} kgm^2	kg
1500/750 min^{-1} (4/8 poles) - Separate windings											
63 A6/8	0.07 0.037	840 600	0.30 0.21	52 46	0.64 0.55	0.79 0.59	2.0 1.5	1.4 1.3	2.1 1.8	0.31	4.6
71 B6/8	0.18 0.09	845 620	0.74 0.48	54 48	0.65 0.56	2.03 1.38	2.1 1.6	1.6 1.5	2.3 1.9	0.76	5.1
80 A6/8	0.25 0.18	860 640	0.94 0.89	58 53	0.66 0.55	2.77 2.68	2.2 1.6	1.7 1.8	2.7 2.5	1.90	9.0
90S A6/8	0.37 0.25	870 660	1.26 1.15	63 56	0.67 0.56	4.06 3.62	2.3 1.7	2.2 .2.1	3.2 2.8	2.75	11.8
90L B6/8	0.55 0.37	890 680	1.77 1.65	67 59	0.67 0.55	5.90 5.20	2.4 1.8	2.3 2.1	3.5 3.1	3.72	15.5
100L B6/8	0.75 0.55	900 670	2.25 2.21	73 63	0.66 0.57	7.96 7.84	2.6 1.9	2.5 2.2	3.8 3.3	7.90	18.7
112M B6/8	1.10 0.75	905 690	3.07 2.88	76 67	0.68 0.56	11.60 10.38	2.4 2.0	2.3 2.5	4.6 4.2	11.00	36.0
132S A6/8	1.50 1.10	910 700	3.92 3.72	79 70	0.70 0.61	15.74 15.00	2.6 2.3	3.0 2.8	5.5 4.4	20.00	45.0
132M B6/8	2.20 1.50	920 700	5.51 4.71	80 73	0.72 0.63	22.84 20.46	2.4 2.1	3.1 2.7	5.5 4.6	35.00	55.0

Pole-changing three-phase motors
230/400 V - 50 Hz
Protection IP 54

Series BP

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Moment of inertia	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos\varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	J 10^{-3} kgm^2	kg
3000/750 min^{-1} (2/8 poles) - Separate windings											
63 A2/8	0.18 0.06	2760 600	0.59 0.36	56 40	0.78 0.60	0.62 0.95	2.4 1.5	2.3 1.6	2.1 1.8	0.31	4.6
71 B2/8	0.30 0.09	2770 620	0.92 0.48	59 43	0.80 0.63	1.03 1.39	2.3 1.6	2.2 1.5	2.3 1.9	0.76	5.1
80 A2/8	0.55 0.12	2800 640	1.53 0.59	64 47	0.81 0.62	1.87 1.79	2.4 1.7	2.5 1.7	2.4 2.0	1.90	9.0
90S A2/8	0.75 0.18	2810 675	1.89 0.76	69 54	0.83 0.63	2.55 2.54	2.5 1.7	2.6 1.8	3.2 2.8	2.75	11.8
90L B2/8	1.10 0.30	2810 680	2.62 1.26	74 56	0.82 0.61	3.74 4.21	2.6 1.7	2.7 2.0	3.4 3.0	3.72	15.5
100L A2/8	1.50 0.37	2815 690	3.30 1.33	78 63	0.84 0.64	5.08 5.12	2.5 1.6	2.8 2.2	3.7 3.2	4.93	18.7
100L B2/8	1.80 0.45	2810 680	3.91 1.59	80 65	0.83 0.63	6.12 6.32	2.7 1.7	2.6 2.3	4.1 3.8	5.97	21.0
112M A2/8	2.20 0.55	2820 700	4.66 1.77	83 70	0.82 0.64	7.45 7.50	2.9 1.8	2.8 2.5	4.4 4.0	10.56	36.0
132S A2/8	3.00 0.75	2825 710	6.06 2.31	84 71	0.85 0.66	10.14 10.09	3.0 2.0	3.0 2.6	5.5 4.4	19.40	45.0
132M B2/8	4.00 1.10	2830 715	8.18 3.25	84 73	0.84 0.67	13.50 14.69	3.2 2.2	3.1 2.7	5.7 4.8	28.60	55.0

Single-phase motors with running capacitor 230 V - 50 Hz Protection IP 54

Series M

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Running capacitor	Moment of inertia	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos\varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	C (μF)	J 10^{-3} kgm^2	kg
3000 min^{-1} (2 poles)												
56 B2	0.12	2600	1.23	47	0.90	1.14	1.3	1.8	1.3	6.3	0.09	3.0
63 A2	0.18	2710	1.47	55.5	0.97	0.63	1.2	1.4	2.7	8.0	0.13	4.1
63 B2	0.25	2730	1.85	64.6	0.91	0.88	1.0	1.3	3.0	10.0	0.19	4.6
71 A2	0.37	2720	2.56	64.4	0.98	1.40	0.8	1.6	2.9	16.0	0.36	5.7
71 B2	0.55	2740	3.75	65.8	0.97	1.92	0.7	1.7	2.7	20.0	0.46	7.0
80 A2	0.75	2790	5.10	70.6	0.90	2.56	0.7	2.0	3.3	20.0	0.77	9.0
80 B2	1.10	2800	7.35	72.6	0.89	3.78	0.8	2.0	3.5	30.0	0.91	9.9
90S A2	1.50	2860	9.60	74	0.92	5.13	0.9	2.1	3.5	45.0	1.15	13.0
90L B2	1.85	2880	11.78	75	0.91	6.13	0.8	2.4	3.8	50.0	1.80	15.3
100L B2	2.20	2910	13.43	77.2	0.93	7.32	0.6	2.1	5.9	60.0	3.25	21.0

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Running capacitor	Moment of inertia	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos\varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	C (μF)	J 10^{-3} kgm^2	kg
1500 min^{-1} (4 poles)												
56 B4	0.09	1100	0.95	45	0.91	0.76	0.7	1.2	1.5	8.0	0.14	3.5
63 A4	0.12	1370	1.32	46	0.85	0.84	1.3	1.4	2.0	8.0	0.25	4.1
63 B4	0.18	1290	2.00	47.4	0.85	1.33	0.8	1.2	1.8	8.0	0.31	4.1
71 A4	0.25	1340	2.26	53.4	0.90	1.78	0.7	1.5	2.2	16.0	0.54	5.5
71 B4	0.37	1370	3.00	60.4	0.87	2.57	0.8	1.6	2.7	16.0	0.76	6.3
80 A4	0.55	1370	3.70	65.9	0.97	3.82	0.8	1.4	3.1	20.0	1.47	9.0
80 B4	0.75	1390	5.40	67.4	0.89	5.14	0.7	1.7	3.2	25.0	1.90	10.3
90S A4	1.10	1353	7.23	67.2	0.95	7.59	0.7	1.6	3.0	35.0	2.75	13.0
90L B4	1.50	1380	10.10	68	0.95	10.44	0.9	1.7	2.7	40.0	3.20	15.5
100L A4	1.80	1380	11.74	71.2	0.95	12.60	0.7	1.8	3.2	50.0	4.93	23.0
100L B4	2.20	1410	15.16	72.6	0.88	15.24	0.6	2.1	3.2	60.0	5.97	24.0

Single-phase motors with running capacitor 230 V - 50 Hz Protection IP 54

Series M

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Running capacitor	Moment of inertia	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos \varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	C (μF)	J 10^{-3} kgm^2	kg
1000 min^{-1} (6 poles)												
71 B6	0.18	840	1.87	48	0.87	2.04	0.8	1.6	2.7	16.0	0.90	6.3
80 A6	0.30	850	2.49	54	0.97	3.37	0.8	1.4	3.1	20.0	1.32	8.8
80 B6	0.37	870	3.23	56	0.89	4.06	0.7	1.7	3.2	25.0	1.78	10.5
90S A6	0.55	890	3.87	65	0.95	5.90	0.7	1.6	3.0	35.0	2.80	13.0
90L B6	0.75	890	5.12	67	0.95	8.05	0.9	1.7	2.7	60.0	3.50	16.5
100L A6	1.10	900	7.09	71	0.95	11.67	0.7	1.8	3.2	60.0	6.40	21.0
100L B6	1.50	910	10.15	73	0.88	15.74	0.6	2.1	3.2	60.0	7.90	30.2

Single-phase motors with high starting torque with starting and running capacitor 230 V - 50 Hz Protection IP 54

Series ME

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Running capacitor	Starting capacitor	Moment of inertia	Weight
	kW	min-1	I_N 400V(A)	η 100%	$\cos \varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	C (µF)	C (µF-0+20%)	J 10^{-3} kgm²	kg
3000 min-1 (2 poles)													
63 A2	0.18	2710	1.47	55.5	0.97	0.63	1.9	1.4	2.2	8.0	20.0	0.13	4.1
63 B2	0.25	2730	1.85	64.6	0.91	0.88	2.5	1.3	3.0	8.0	20.0	0.19	4.6
71 A2	0.37	2720	2.56	64.4	0.98	1.40	2.3	1.6	2.8	16.0	25.0	0.36	5.7
71 B2	0.55	2740	3.75	65.8	0.97	1.92	2.3	1.7	3.2	20.0	45.0	0.46	7.0
80 A2	0.75	2790	5.10	70.6	0.90	2.56	2.5	2.0	3.4	20.0	45.0	0.77	9.0
80 B2	1.10	2800	7.35	72.6	0.89	3.78	2.3	2.0	3.5	25.0	60.0	0.91	9.9
90S A2	1.50	2860	9.60	74	0.92	5.13	2.5	2.1	3.9	35.0	70.0	1.15	13.0
90L B2	1.85	2880	11.78	75	0.91	6.13	2.3	2.4	3.9	35.0	200.0	1.80	15.3
100L B2	2.20	2910	13.43	77.2	0.93	7.32	2.1	2.1	5.9	50.0	250.0	3.25	21.0

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Starting current ratio	Running capacitor	Starting capacitor	Moment of inertia	Weight
	kW	min-1	I_N 400V(A)	η 100%	$\cos \varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	I_A/I_N	C (µF)	C (µF-0+20%)	J 10^{-3} kgm²	kg
1500 min-1 (4 poles)													
63 A4	0.12	1370	1.32	46	0.85	0.84	3.0	1.4	2.5	8.0	20.0	0.25	4.1
63 B4	0.18	1290	2.00	47.4	0.85	1.33	2.6	1.2	2.0	8.0	20.0	0.31	4.1
71 A4	0.25	1340	2.26	53.4	0.90	1.78	2.3	1.5	2.2	8.0	20.0	0.54	5.5
71 B4	0.37	1370	3.00	60.4	0.87	2.57	2.5	1.6	2.7	16.0	25.0	0.76	6.3
80 A4	0.55	1370	3.70	65.9	0.97	3.82	2.5	1.4	3.2	20.0	45.0	1.47	9.0
80 B4	0.75	1390	5.40	67.4	0.89	5.14	2.5	1.7	3.4	25.0	60.0	1.90	10.3
90S A4	1.10	1353	7.23	67.2	0.95	7.59	2.5	1.6	3.1	35.0	70.0	2.75	13.0
90L B4	1.50	1380	10.10	68	0.95	10.44	2.2	1.7	2.7	35.0	200.0	3.20	15.5
100L A4	1.80	1380	11.74	71.2	0.95	12.60	2.2	1.8	4.5	50.0	100.0	4.93	23.0
100L B4	2.20	1410	15.16	72.6	0.88	15.24	2.5	2.1	3.7	50.0	200.0	5.97	24.0

Three-phase brake motors
230/400 V
Protection IP 54

Series FA-FC

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Max. braking torque	Starting current ratio	Moment of inertia	Starts/h	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos \varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	M_f max (Nm)	I_A/I_N	J 10^{-3} kgm²	n* 1/h	kg
3000 min^{-1} (2 poles)													
63 A2	0.18	2740	0.60	56	0.78	0.63	2.7	3	7.5	3.5	0.20	3000	5.1
63 B2	0.25	2770	0.70	66	0.78	0.86	3.2	3	7.5	4.5	0.23	3000	5.6
71 A2	0.37	2820	1.15	68	0.69	1.25	3.6	3.7	7.5	4.6	0.54	2900	7.3
71 B2	0.55	2820	1.60	71	0.70	1.86	3.6	3.5	7.5	4.7	0.69	2300	7.9
80 A2	0.75	2830	1.90	76	0.75	2.53	3.6	3.6	15	5.7	1.15	1500	11.7
80 B2	1.10	2840	2.60	77	0.79	3.70	3.7	3.8	15	6.5	1.37	1400	13.2
90S A2	1.50	2850	3.40	79	0.81	5.03	2.7	3.1	25	5.8	1.73	1200	17.0
90L B2	2.20	2860	5.00	80	0.79	7.34	3.9	4	25	6.9	2.70	1100	19.0
100L A2	3.00	2850	6.20	81	0.86	10.00	2.8	3.1	45	6.2	4.87	950	23.6
112M A2	4.00	2910	8.20	85	0.83	13.13	2.9	3	60	7.8	9.30	820	41.2
132S A2	5.50	2910	12.00	83	0.80	18.04	2.9	3.3	100	6.5	19.65	500	52.0
132M B2	7.50	2930	14.80	86	0.85	24.40	3.2	3.4	100	7	26.25	470	57.0

* Number of starts per hour permitted under no load

Three-phase brake motors
230/400 V - 50 Hz
Protection IP 54

Series FA-FC

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Max. braking torque	Starting current ratio	Moment of inertia	Starts/h	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$cos\ \varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	Mf max (Nm)	I_A/I_N	J 10^{-3} kgm^2	n* 1/h	kg
1500 min^{-1} (4 poles)													
63 A4	0.12	1350	0.46	54	0.69	0.85	2	2	7.5	2.4	0.38	5500	5.1
63 B4	0.18	1350	0.70	53	0.70	1.27	2	2	7.5	2.3	0.47	5500	5.6
71 A4	0.25	1370	0.69	67	0.77	1.74	2	2.1	7.5	3.4	0.81	5000	6.7
71 B4	0.37	1380	1.18	68	0.67	2.56	2.2	2.3	7.5	4	1.14	5000	6.9
80 A4	0.55	1380	1.38	72	0.80	3.80	1.9	2.2	15	3.9	3.35	4700	11.7
80 B4	0.75	1390	2.00	72	0.75	5.15	2.6	2.2	15	3.9	3.68	4500	12.6
90S A4	1.10	1410	2.60	79	0.77	7.45	2.3	2.6	25	4.6	4.13	3900	15.8
90L B4	1.50	1410	3.60	79	0.76	10.16	2.4	2.6	25	4.8	4.80	3800	18.3
90L C4	1.80	1410	4.50	79	0.73	12.20	3.1	3.1	25	5.2	5.58	3700	19.5
100L A4	2.20	1410	5.10	80	0.78	14.90	2.4	2.6	45	4.8	7.40	2500	23.9
100L B4	3.00	1410	7.10	80	0.80	18.04	2.9	3.3	45	6.5	8.85	2400	28.0
112M A4	4.00	1430	9.00	84	0.76	26.40	3.1	3.6	60	6.6	15.85	1800	43.0
132S A4	5.50	1450	11.90	87	0.77	36.20	2.3	2.6	100	5.4	39.10	1200	52.0
132M B4	7.50	1450	16.00	87	0.78	49.40	2.8	3	100	6.3	42.90	1000	62.0

* Number of starts per hour permitted under no load

Three-phase brake motors
230/400 V - 50 Hz
Protection IP 54

Series FA-FC

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Max. braking torque	Starting current ratio	Moment of inertia	Starts/h	Weight
	kW	min-1	I_N 400V(A)	η 100%	cos φ	Mn (Nm)	M_A/M_N	M_M/M_N	Mf max (Nm)	I_A/I_N	J 10^{-3} kgm²	n* 1/h	kg
1000 min-1 (6 poles)													
63 A6	0.09	890	0.67	40	0.49	0.96	2.5	2.5	7.5	1.7	0.45	5700	4.1
63 B6	0.12	870	0.70	45	0.55	1.32	1.3	2	7.5	1.8	0.60	5500	4.6
71 A6	0.18	850	0.70	51	0.73	2.00	1.4	2.1	7.5	2.1	0.90	5500	5.7
71 B6	0.25	870	1.00	53	0.68	2.74	2.2	2.1	7.5	2.7	1.40	5000	6.3
80 A6	0.37	880	1.35	56	0.71	4.00	2.2	2.1	15	2.7	1.98	4700	8.8
80 B6	0.55	900	1.74	65	0.70	5.83	2	2.1	15	3	2.67	4300	10.5
90S A6	0.75	910	2.20	68	0.72	7.87	2.2	2.1	25	3.7	4.20	3800	13.0
90L B6	1.10	900	3.30	69	0.70	11.67	1.9	2	25	3.1	5.25	3600	16.5
100L A6	1.50	935	4.10	75	0.70	15.30	2.1	2.5	45	4.2	9.60	2600	21.0
100L B6	1.80	935	4.90	76	0.70	18.40	2.3	2.5	45	4.4	11.85	2500	30.2
112M A6	2.20	945	6.30	79	0.64	22.23	2.7	2.7	60	4.6	16.50	1700	40.0
132S A6	3.00	960	7.70	84	0.67	29.84	2.5	2.4	100	5.4	41.13	1200	45.0
132M C6	5.50	950	12.97	85	0.72	55.30	2.1	3.1	100	5.8	52.50	800	60.0

* Number of starts per hour permitted under no load

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Max. braking torque	Starting current ratio	Moment of inertia	Starts/h	Weight
	kW	min-1	I_N 400V(A)	η 100%	cos φ	Mn (Nm)	M_A/M_N	M_M/M_N	Mf max (Nm)	I_A/I_N	J 10^{-3} kgm²	n* 1/h	kg
750 min-1 (8 poles)													
63 B8	0.08	630	0.48	45	0.53	1.21	1.3	1.8	7.5	1.3	0.60	6000	5.6
71 B8	0.12	670	0.69	49	0.51	1.71	2.5	2.9	7.5	2.4	1.35	5700	7.9
80 A8	0.18	670	0.92	47	0.60	2.56	1.8	2	15	2.1	1.98	5500	11.7
80 B8	0.25	680	1.28	50	0.56	3.50	1.9	2.1	15	2.3	2.67	5500	12.2
90S A8	0.37	670	1.40	61	0.62	5.30	1.7	2.2	25	2.5	4.20	5000	17.0
90L B8	0.55	670	2.20	62	0.58	7.84	1.6	2.1	25	2.5	5.25	5000	19.3
100L A8	0.75	690	2.50	67	0.65	10.40	1.7	1.9	45	2.9	9.60	4700	27.4
100L B8	1.10	690	3.90	68	0.60	15.20	1.8	2	45	2.9	11.85	4500	30.2
112M B8	1.50	710	4.50	76	0.63	20.20	1.7	2.4	60	3.9	16.50	3900	40.0
132S A8	2.20	710	6.80	73	0.64	29.60	1.6	2	100	3.7	41.13	3800	45.0
132M B8	3.00	705	7.70	80	0.70	40.60	1.5	2.2	100	3.5	52.50	3700	60.0

* Number of starts per hour permitted under no load

Pole-changing brake motors
400 V - 50 Hz
Protection IP 54

Series FBA-FBC

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Max. braking torque	Starting current ratio	Moment of inertia	Starts/h	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos\varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	Mf max (Nm)	I_A/I_N	J 10^{-3} kgm^2	n* 1/h	kg
3000/1500 min^{-1} (2/4 poles) - Dahlander connection													
63 A2/4	0.16 0.11	2700 1270	0.56 0.46	57 53	0.72 0.65	0.55 0.83	1.3 1.6	1.7 1.4	7.5	2.4 2.6	0.38	3000	5.1
63 B2/4	0.22 0.15	2710 1280	0.70 0.58	58 55	0.78 0.68	0.77 1.12	2.2 2.5	2.5 3.0	7.5	3.3 3.5	0.47	3000	5.1
71 A2/4	0.30 0.20	2750 1330	0.90 0.72	60 57	0.80 0.70	1.04 1.43	2.2 2.0	2.4 2.9	7.5	3.1 3.3	0.81	2900	6.7
71 B2/4	0.45 0.30	2780 1350	1.30 1.06	63 59	0.79 0.69	1.54 2.12	2.1 2.4	2.3 2.7	7.5	3.4 3.3	1.14	2300	6.9
80 A2/4	0.60 0.45	2800 1380	1.78 1.49	64 67	0.76 0.65	2.05 3.11	2.3 2.5	2.2 2.4	15	3.2 3.4	3.35	1500	11.7
80 B2/4	0.80 0.60	2820 1390	2.22 1.74	65 70	0.80 0.71	2.71 4.12	2.5 2.6	2.6 2.8	15	3.4 3.6	3.68	1400	12.6
90S A2/4	1.40 1.00	2830 1400	3.66 2.86	68 70	0.81 0.72	4.73 6.82	2.4 2.3	2.7 2.9	25	3.5 3.6	4.13	1200	15.8
90L B2/4	1.80 1.25	2830 1390	4.57 3.38	71 73	0.80 0.73	6.07 8.58	2.3 2.2	2.7 2.8	25	3.5 3.4	5.58	1100	19.5
100L A2/4	2.50 1.80	2860 1410	5.95 4.74	73 74	0.83 0.74	8.35 12.19	2.4 2.2	2.6 2.5	45	4.3 4.2	7.40	950	22.7
100L B2/4	3.30 2.60	2880 1400	7.74 6.86	75 77	0.82 0.71	10.94 17.73	2.1 2.3	2.7 2.6	45	4.5 4.4	8.85	820	25.0
112M A2/4	4.40 3.30	2900 1410	10.08 8.14	75 79	0.84 0.74	14.48 22.35	2.2 2.3	2.8 2.5	60	5.6 5.5	15.85	500	41.2
132S A2/4	5.50 4.50	2910 1400	12.57 11.14	77 81	0.82 0.72	18.05 30.69	2.4 2.5	2.6 2.4	100	6.3 6.5	39.10	470	52.0
132M B2/4	7.50 6.00	2920 1405	16.32 14.83	78 80	0.85 0.73	24.53 40.78	2.2 2.5	2.8 2.6	100	6.5 7.0	42.90	400	62.0

* Number of starts per hour permitted under no load

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Max. braking torque	Starting current ratio	Moment of inertia	Starts/h	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$\cos\varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	Mf max (Nm)	I_A/I_N	J 10^{-3} kgm^2	n* 1/h	kg
1500/750 min^{-1} (4/8 poles) - Dahlander connection													
63 A4/8	0.09 0.04	1280 620	0.32 0.24	54 40	0.76 0.60	0.67 0.62	1.3 1.6	1.7 1.4	7.5	2.1 2.0	0.47	5500	5.6
71 B4/8	0.15 0.09	1305 610	0.52 0.53	56 40	0.75 0.61	1.09 1.40	2.2 2.5	2.5 3.0	7.5	2.4 2.6	1.14	5000	6.9
80 A4/8	0.37 0.20	1320 630	1.20 1.09	59 42	0.76 0.63	2.67 3.03	2.2 2.0	2.4 2.9	15	2.6 2.7	3.35	4700	11.7
80 B4/8	0.55 0.30	1350 650	1.69 1.50	60 45	0.78 0.64	3.89 4.41	2.1 2.4	2.3 2.7	15	2.7 2.5	3.68	4500	12.6
90S A4/8	0.75 0.37	1380 670	2.10 1.53	65 53	0.79 0.66	5.19 5.27	2.3 2.5	2.2 2.4	25	3.0 3.2	4.13	3900	15.8
90L B4/8	0.90 0.50	1400 680	2.39 1.89	68 56	0.80 0.68	6.14 7.02	2.5 2.6	2.6 2.8	25	3.0 3.3	4.80	3800	18.3
100L A4/8	1.40 0.70	1405 685	3.50 2.59	73 60	0.79 0.65	9.52 9.76	2.4 2.3	2.7 2.9	45	3.5 3.6	5.58	2500	23.9
100L B4/8	1.60 0.90	1410 690	3.80 2.98	75 64	0.81 0.68	10.84 12.46	2.3 2.2	2.7 2.8	45	3.5 3.4	9.60	2400	28.0
112M A4/8	1.70 1.00	1420 700	4.03 3.26	77 67	0.79 0.66	11.43 13.64	2.4 2.2	2.6 2.5	60	3.9 3.6	11.85	1800	43.0
112M A4/8	2.20 1.30	1410 690	5.29 4.25	78 69	0.77 0.64	14.90 18.00	2.1 2.3	2.7 2.6	60	4.6 4.0	16.50	1200	47.0
132S A4/8	3.70 2.20	1430 690	8.89 7.08	77 66	0.78 0.68	24.70 30.45	2.2 2.3	2.8 2.5	100	5.0 4.2	41.13	1200	52.0
132M B4/8	4.70 2.80	1445 710	10.34 8.77	80 72	0.82 0.64	31.06 37.66	2.4 2.5	2.6 2.4	100	5.2 4.4	52.50	1000	62.0

* Number of starts per hour permitted under no load

Pole-changing brake motors
230/400 V - 50 Hz
Protection IP 54

Series FBA-FBC

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Max. braking torque	Starting current ratio	Moment of inertia	Starts/h	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	cos φ	Mn (Nm)	M_A/M_N	M_M/M_N	Mf max (Nm)	I_A/I_N	J 10^{-3} kgm^2	n* 1/h	kg
1500/1000 min^{-1} (4/6 poles) - Separate windings													
63 A4/6	0.18 0.04	1320 840	0.68 0.17	54 53	0.70 0.64	1.30 0.45	2.4 1.5	2.3 1.6	7.5	2.1 1.8	0.47	5500	5.6
71 B4/6	0.22 0.15	1360 860	0.69 0.61	63 55	0.73 0.65	1.54 1.66	2.3 1.6	2.2 1.5	7.5	2.3 1.9	1.14	5000	6.9
80 A4/6	0.37 0.26	1380 870	1.05 0.98	67 60	0.76 0.64	2.56 2.85	2.4 1.7	2.5 1.7	15	2.4 2.0	3.35	4700	11.7
80 B4/6	0.55 0.45	1380 880	1.50 1.56	69 63	0.77 0.66	3.80 4.88	2.5 1.7	2.6 1.8	15	3.2 2.8	3.68	4500	12.6
90S A4/6	0.75 0.50	1400 905	1.90 1.70	73 65	0.78 0.65	5.12 5.27	2.6 1.7	2.7 2.0	25	3.4 3.0	4.20	3900	15.8
90L B4/6	1.10 0.75	1410 910	2.65 2.44	75 67	0.80 0.66	7.45 7.87	2.5 1.6	2.8 2.2	25	3.7 3.2	5.25	3800	18.3
100L A4/6	1.50 0.90	1405 900	3.56 2.73	77 71	0.79 0.67	10.19 9.54	2.7 1.7	2.6 2.3	45	4.1 3.8	11.85	2400	28.0
112M A4/6	1.80 1.30	1420 910	4.00 3.73	80 74	0.81 0.68	12.10 13.64	2.9 1.8	2.8 2.5	60	4.4 4.0	16.50	1800	43.0
112M B4/6	2.60 1.80	1430 915	5.86 5.09	81 74	0.79 0.69	17.36 18.78	3.0 2.0	3.0 2.6	60	5.5 4.4	19.50	1200	47.0
132S A4/6	4.00 2.60	1425 920	9.02 7.36	80 75	0.80 0.68	26.80 26.98	3.2 2.2	3.1 2.7	100	5.7 4.8	41.13	1200	52.0
132M B4/6	5.50 3.70	1435 930	11.95 10.49	82 76	0.81 0.67	36.60 37.99	3.1 2.1	3.2 2.8	100	5.6 4.4	52.50	1000	62.0

* Number of starts per hour permitted under no load

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Max. braking torque	Starting current ratio	Moment of inertia	Starts/h	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	cos φ	Mn (Nm)	M_A/M_N	M_M/M_N	Mf max (Nm)	I_A/I_N	J 10^{-3} kgm^2	n* 1/h	kg
1000/750 min^{-1} (6/8 poles) - Separate windings													
63 A6/8	0.07 0.037	840 600	0.30 0.21	52 46	0.64 0.55	0.79 0.59	2.0 1.5	1.4 1.3	7.5	2.1 1.8	0.47	5500	4.6
71 B6/8	0.18 0.09	845 620	0.74 0.48	54 48	0.65 0.56	2.03 1.38	2.1 1.6	1.6 1.5	7.5	2.3 1.9	1.14	5000	6.3
80 A6/8	0.25 0.18	860 640	0.94 0.89	58 53	0.66 0.55	2.77 2.68	2.2 1.6	1.7 1.8	15	2.7 2.5	3.68	4300	10.5
90S A6/8	0.37 0.25	870 660	1.26 1.15	63 56	0.67 0.56	4.06 3.62	2.3 1.7	2.2 2.1	25	3.2 2.8	4.20	3800	13.0
90L B6/8	0.55 0.37	890 680	1.77 1.65	67 59	0.67 0.55	5.90 5.20	2.4 1.8	2.3 2.1	25	3.5 3.1	5.25	3600	16.5
100L B6/8	0.75 0.55	900 670	2.25 2.21	73 63	0.66 0.57	7.96 7.84	2.6 1.9	2.5 2.2	45	3.8 3.3	11.85	2500	30.2
112M B6/8	1.10 0.75	905 690	3.07 2.88	76 67	0.68 0.56	11.60 10.38	2.4 2.0	2.3 2.5	60	4.6 4.2	16.50	1700	40.0
132S A6/8	1.50 1.10	910 700	3.92 3.72	79 70	0.70 0.61	15.74 15.00	2.6 2.3	3.0 2.8	100	5.5 4.4	41.13	1200	45.0
132M B6/8	2.20 1.50	920 700	5.51 4.71	80 73	0.72 0.63	22.84 20.46	2.4 2.1	3.1 2.7	100	5.5 4.6	52.50	800	60.0

* Number of starts per hour permitted under no load

Pole-changing brake motors
400 V - 50 Hz
Protection IP 54

Series FBA-FBC

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Max. braking torque	Starting current ratio	Moment of inertia	Starts/h	Weight
	kW	min^{-1}	I_N 400V(A)	η 100%	$cos\ \varphi$	Mn (Nm)	M_A/M_N	M_M/M_N	Mf max (Nm)	I_A/I_N	J 10^{-3} kgm^2	n* 1/h	kg
3000/750 min^{-1} (2/8 poles) - Separate windings													
63 A2/8	0.18 0.06	2760 600	0.59 0.36	56 40	0.78 0.60	0.62 0.95	2.4 1.5	2.3 1.6	7.5	2.1 1.8	0.47	5500	4.6
71 B2/8	0.30 0.09	2770 620	0.92 0.48	59 43	0.80 0.63	1.03 1.39	2.3 1.6	2.2 1.5	7.5	2.3 1.9	1.14	5000	6.3
80 A2/8	0.55 0.12	2800 640	1.53 0.59	64 47	0.81 0.62	1.87 1.79	2.4 1.7	2.5 1.7	15	2.4 2.0	3.68	4300	10.5
90S A2/8	0.75 0.18	2810 675	1.89 0.76	69 54	0.83 0.63	2.55 2.54	2.5 1.7	2.6 1.8	25	3.2 2.8	3.35	3800	13.0
90L B2/8	1.10 0.30	2810 680	2.62 1.26	74 56	0.82 0.61	3.74 4.21	2.6 1.7	2.7 2.0	25	3.4 3.0	3.68	3600	16.5
100L A2/8	1.50 0.37	2815 690	3.30 1.33	78 63	0.84 0.64	5.08 5.12	2.5 1.6	2.8 2.2	45	3.7 3.2	7.40	2600	21.0
100L B2/8	1.80 0.45	2810 680	3.91 1.59	80 65	0.83 0.63	6.12 6.32	2.7 1.7	2.6 2.3	45	4.1 3.8	8.85	2500	30.2
112M A2/8	2.20 0.55	2820 700	4.66 1.77	83 70	0.82 0.64	7.45 7.50	2.9 1.8	2.8 2.5	60	4.4 4.0	15.58	1700	40.0
132S A2/8	3.00 0.75	2825 710	6.06 2.31	84 71	0.85 0.66	10.14 10.09	3.0 2.0	3.0 2.6	100	5.5 4.4	39.10	1200	45.0
132M B2/8	4.00 1.10	2830 715	8.18 3.25	84 73	0.84 0.67	13.50 14.69	3.2 2.2	3.1 2.7	100	5.7 4.8	42.90	800	60.0

* Number of starts per hour permitted under no load

Smaller-sized brake motors
230/400 V - 50 Hz
Protection IP 54

Series FS

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Max. braking torque	Starting current ratio	Moment of inertia	Weight
	kW	min-1	I_N 400V(A)	η 100%	cos φ	Mn (Nm)	M_A/M_N	M_M/M_N	Mf max (Nm)	I_A/I_N	J 10^{-3} kgm²	kg
3000 min-1 (2 poles)												
63 A2	0.18	2740	0.60	56	0.78	0.63	2.7	3	2.50	3.5	0.18	5.1
63 B2	0.25	2770	0.70	66	0.78	0.86	3.2	3	2.50	4.5	0.21	5.6
71 A2	0.37	2820	1.15	68	0.69	1.25	3.6	3.7	5.50	4.6	0.48	7.0
71 B2	0.55	2820	1.60	71	0.70	1.86	3.6	3.5	5.50	4.7	0.59	7.6
80 A2	0.75	2830	1.90	76	0.75	2.53	3.6	3.6	9.00	5.7	1.02	11.2
80 B2	1.10	2840	2.60	77	0.79	3.70	3.7	3.8	9.00	6.5	1.16	12.7
90S A2	1.50	2850	3.40	79	0.81	5.03	2.7	3.1	9.50	5.8	1.54	15.2
90L B2	2.20	2860	5.00	80	0.79	7.34	3.9	4	9.50	6.9	2.43	17.2
100L A2	3.00	2850	6.20	81	0.86	10.00	2.8	3.1	12.00	6.2	4.12	24.1
112M A2	4.00	2910	8.20	85	0.83	13.13	2.9	3	12.50	7.8	8.57	39.7
132M A2	5.50	2910	12.00	83	0.80	18.04	2.9	3.3	17.00	6.5	18.40	49.5
132M B2	7.50	2930	14.80	86	0.85	24.40	3.2	3.4	17.00	7	22.45	54.5

Type	Rated output	Rated speed	Rated current at	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Max. braking torque	Starting current ratio	Moment of inertia	Weight
	kW	min-1	I_N 400V(A)	η 100%	cos φ	Mn (Nm)	M_A/M_N	M_M/M_N	Mf max (Nm)	I_A/I_N	J 10^{-3} kgm²	kg
1500 min-1 (4 poles)												
63 A4	0.12	1350	0.46	54	0.69	0.85	2	2	2.50	2.4	0.27	5.1
63 B4	0.18	1350	0.70	53	0.70	1.27	2	2	2.50	2.3	0.36	5.6
71 A4	0.25	1370	0.69	67	0.77	1.74	2	2.1	4.00	3.4	0.75	6.4
71 B4	0.37	1380	1.18	68	0.67	2.56	2.2	2.3	4.00	4	0.98	7.6
80 A4	0.55	1380	1.38	72	0.80	3.80	1.9	2.2	9.00	3.9	2.90	11.2
80 B4	0.75	1390	2.00	72	0.75	5.15	2.6	2.2	9.00	3.9	3.35	12.1
90S A4	1.10	1410	2.60	79	0.77	7.45	2.3	2.6	9.50	4.6	3.87	14.0
90L B4	1.50	1410	3.60	79	0.76	10.16	2.4	2.6	9.50	4.8	4.60	16.5
90L C4	1.80	1410	4.50	79	0.73	12.20	3.1	3.1	9.50	5.2	5.23	17.7
100L A4	2.20	1410	5.10	80	0.78	14.90	2.4	2.6	12.00	4.8	6.88	22.2
100L B4	3.00	1410	7.10	80	0.80	18.04	2.9	3.3	12.00	6.5	8.34	24.5
112M A4	4.00	1430	9.00	84	0.76	26.40	3.1	3.6	12.50	6.6	14.56	40.7
132S A4	5.50	1450	11.90	86	0.77	36.20	2.3	2.6	17.00	5.4	33.20	52.0
132M B4	7.50	1450	16.00	87	0.78	49.40	2.8	3	17.00	6.3	40.40	62.0

Single-phase motors with high starting torque with starting and running capacitor 230 V - 50 Hz Protection IP 54

Series FME

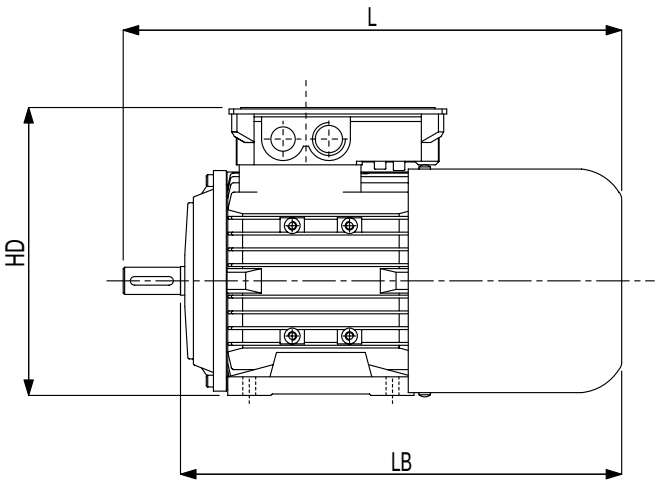
Typ	Rated output	Rated speed	Rated current	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Max. braking torque	Starting current ratio	Running capacitor	Starting capacitor	Moment of inertia	Starts/h	Weight
	kW	min-1	I_N 400V(A)	η 100%	cos φ	Mn (Nm)	M_A/M_N	M_M/M_N	Mf max (Nm)	I_A/I_N	C (µF)	C Start (µF)	J 10^{-3} kgm²	n 1/h	kg
3000 min-1 (2 poles)															
63 A4	0.12	1370	1.32	46	0.85	0.84	3.0	1.4	7.5	2.0	8.0	20.0	0.38	5500	5.1
63 B4	0.18	1290	2.00	47.4	0.85	1.33	2.6	1.2	7.5	1.8	8.0	20.0	0.47	5200	5.1
71 A4	0.25	1340	2.26	53.4	0.90	1.78	2.3	1.5	7.5	2.2	16.0	20.0	0.81	4200	7.1
71 B4	0.37	1370	3.00	60.4	0.87	2.57	2.5	1.6	7.5	2.7	16.0	25.0	1.14	4100	7.9
80 A4	0.55	1370	3.70	65.9	0.97	3.82	2.5	1.4	15	3.1	20.0	45.0	3.35	3600	11.7
80 B4	0.75	1390	5.40	67.4	0.89	5.14	2.5	1.7	15	3.2	25.0	60.0	3.68	3300	13.0
90S A4	1.10	1353	7.23	67.2	0.95	7.59	2.5	1.6	25	3.0	35.0	70.0	4.13	2500	17.0
90L B4	1.50	1380	10.10	68	0.95	10.44	2.2	1.7	25	2.7	60.0	70.0	5.58	2300	19.5
100L A4	1.80	1380	11.74	71.2	0.95	12.60	2.2	1.8	45	3.2	50.0	100.0	7.40	1800	27.0
100L B4	2.20	1410	15.16	72.6	0.88	15.24	2.5	2.1	45	3.2	60.0	180.0	8.85	1800	28.0

Single-phase brake motors with running capacitor 230 V - 50 Hz Protection IP 54

Series FMC

Typ	Rated output	Rated speed	Rated current	Efficiency	Power factor	Breakaway torque	Breakaway torque ratio	Pull-up torque ratio	Max. braking torque	Starting current ratio	Running capacitor	Moment of inertia	Starts/h	Weight
	kW	min-1	I_N 400V(A)	η 100%	cos φ	Mn (Nm)	M_A/M_N	M_M/M_N	Mf max (Nm)	I_A/I_N	C (µF)	J 10^{-3} kgm²	n 1/h	kg
1500 min-1 (4 poles)														
63 A4	0.12	1370	1.32	46	0.85	0.84	1.3	1.4	7.5	2.0	8.0	0.38	5500	5.1
63 B4	0.18	1290	2.00	47.4	0.85	1.33	0.8	1.2	7.5	1.8	8.0	0.47	5200	5.1
71 A4	0.25	1340	2.26	53.4	0.90	1.78	0.7	1.5	7.5	2.2	16.0	0.81	4200	7.1
71 B4	0.37	1370	3.00	60.4	0.87	2.57	0.8	1.6	7.5	2.7	16.0	1.14	4100	7.9
80 A4	0.55	1370	3.70	65.9	0.97	3.82	0.8	1.4	15	3.1	20.0	3.35	3600	11.7
80 B4	0.75	1390	5.40	67.4	0.89	5.14	0.7	1.7	15	3.2	25.0	3.68	3300	13.0
90S A4	1.10	1353	7.23	67.2	0.95	7.59	0.7	1.6	25	3.0	35.0	4.13	2500	17.0
90L B4	1.50	1380	10.10	68	0.95	10.44	0.9	1.7	25	2.7	60.0	5.58	2300	19.5
100L A4	1.80	1380	11.74	71.2	0.95	12.60	0.7	1.8	45	3.2	50.0	7.40	1800	27.0
100L B4	2.20	1410	15.16	72.6	0.88	15.24	0.6	2.1	45	3.2	60.0	8.85	1800	28.0

Forced ventilated motors



Series TSV

Electrical data

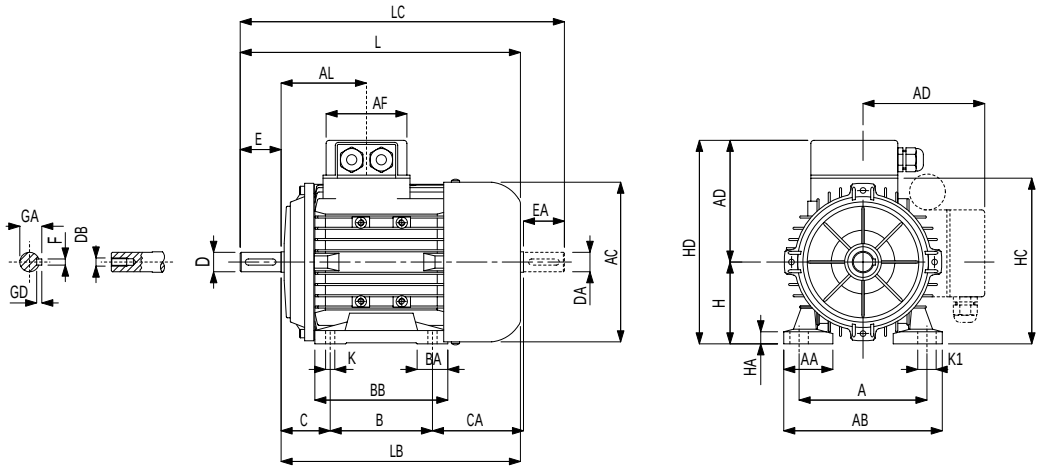
TYPE	Fan	W	V	A	MC/h	dB/A	Hz
71	A2S 107	20	230*	0.12	160	42	50/60
80	A2S 130	40	230*	0.18	360	49	50/60
90 S/L	A2E 170	50	230*	0.22	500	59	50/60
90 S/L	A2D 170	50	230/400	0.2/0.12	500	59	50/60
100 L	A2E 170	50	230*	0.22	500	59	50/60
100 L	A2D 170	50	230/400	0.2/0.12	500	59	50/60
112 M	A2D 200	60	230/400	0.26/0.15	600	67	50/60
132 S/M	A2D 200	60	230/400	0.26/0.15	600	67	50/60

* single-phase supply

Dimensions

TYPE	L	LB
71	305	275
80	350	310
90 S	392	342
90 L	416	366
100 L	452	392
112 M	476	416
132 S	539	459
132 M	577	497

Note
Data omitted are identical to those of the corresponding version (T)
*F: Dimensions of forced ventilated motors, see page 50

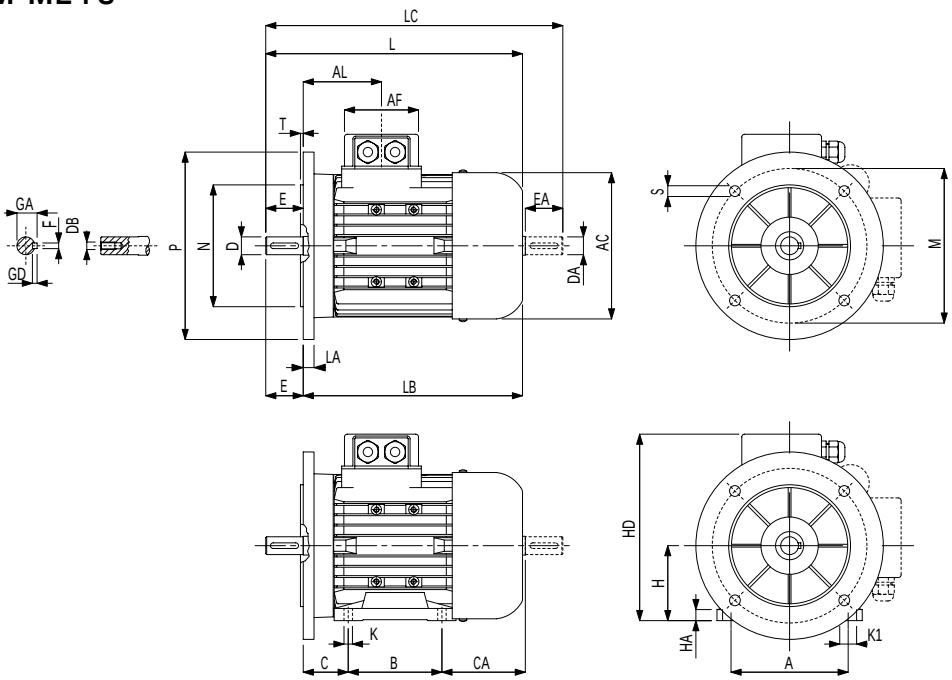


Note: Sectioning refers to capacitors of series M and ME

Type	H	A	B	C	K	AB	BB	CA	AD	HD	AC	HC	HA	K1	L	LB	LC	AL	AF*	BA	AA	D DA	E EA	F	GD	GA	DB
56	56	90	71	36	6	107	90	65	94	150	110	114	8	12	188	168	212	62	70	22	22	9	20	3	3	10.2	M4
63	63	100	80	40	7	126	105	72	98	161	124	126	10	12	211	191	238	66	70	26	26	11	23	4	4	12.5	M4
71	71	112	90	45	7	144	109	86	107	178	137	143	12	17	247	217	281	76	70	22	30	14	30	5	5	16	M5
80	80	125	100	50	9	155	130	85	122	202	156	162	13	18	275	235	315	85	84	31	32	19	40	6	6	21.5	M6
90 S	90	140	100	56	9	184	130	98	129	219	176	182	14	18	302	252	354	86	84	32	39	24	50	8	7	27	M8
90 L	90	140	125	56	9	184	154	98	129	219	176	182	14	18	326	276	378	86	84	32	39	24	50	8	7	27	M8
100 L	100	160	140	63	12	200	176	105	140	240	195	200	14	20	366	306	429	96	84	40	42	28	60	8	7	31	M10
112M	112	190	140	70	12	220	176	118	160	272	219	225	15	21	385	325	448	97	84	38	42	28	60	8	7	31	M10
132S	132	216	140	89	12	260	178	143	177	309	258	261	16	21	449	369	532	117	92	44	58	38	80	10	8	41.5	M12
132M	132	216	178	89	12	260	216	143	177	309	258	261	16	21	487	407	570	117	92	44	58	38	80	10	8	41.5	M12

Note
Series BP frame sizes 63 to 132
Single-phase motors series M frame sizes 56 to 100L
Single-phase motors series ME frame sizes 63 to 100L
Brake motors series FS frame sizes 63 to 132M
*AF: Dimensions for brake motors series FS see page 53

Three-phase and single-phase motors
Series T-BP-M-ME-FS

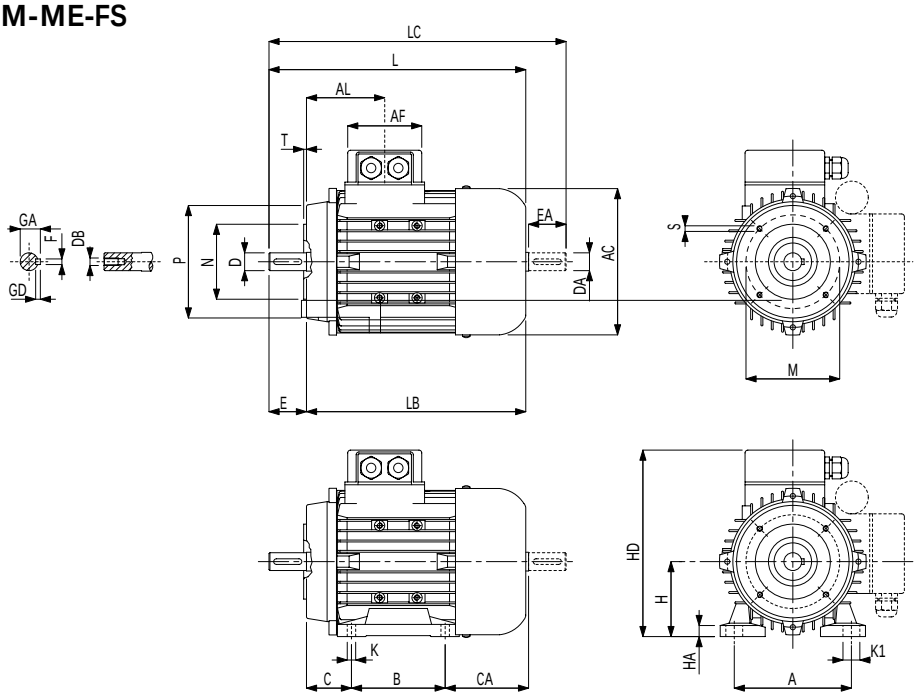


Note: Sectioning refers to capacitors of series M and ME

Type	M	N	P	T	LA	S	H	A	B	C	K	CA	HD	AC	HA	K1	L	LB	LC	AL	AF*	D DA	E EA	F	GD	GA	DB
56	100	80	120	2.5	5.5	7.0	56	90	71	36	6	65	150	110	8	12	188	168	212	62	70	9 20	20 40	3	3	10.2	M4
63	115	95	140	3.0	10	9.5	63	100	80	40	7	72	161	124	10	12	211	191	238	66	70	11 23	23 50	4	4	12.5	M4
71	130	110	160	3.5	10	9.5	71	112	90	45	7	86	178	137	12	17	247	217	281	76	70	14 30	30 60	5	5	16	M5
80	165	130	200	3.5	12	11.5	80	125	100	50	9	85	202	156	13	18	275	235	315	85	84	19 40	40 80	6	6	21.5	M6
90S	165	130	200	3.5	12	11.5	90	140	100	56	9	98	219	176	14	18	302	252	354	86	84	24 50	50 110	8	8	27	M8
90L	165	130	200	3.5	12	11.5	90	140	125	56	9	98	219	176	14	18	326	276	378	86	84	24 50	50 110	8	8	27	M8
100L	215	180	250	4.0	14	14.0	100	160	140	63	12	105	240	195	14	20	366	306	429	96	84	28 60	60 140	8	8	31	M10
112M	215	180	250	4.0	14	14.0	112	190	140	70	12	118	272	219	15	21	385	325	448	97	84	28 60	60 140	8	8	31	M10
132S	265	230	300	4.0	14	14.0	132	216	140	89	12	143	309	258	16	21	449	369	532	117	92	38 80	80 170	8	10	41.5	M12
132M	265	230	300	4.0	14	14.0	132	216	178	89	12	143	309	258	16	21	487	407	570	117	92	38 80	80 170	8	10	41.5	M12

Note
Series BP frame sizes 63 to 132
Single-phase motors series M frame sizes 56 to 100L
Single-phase motors series ME frame sizes 63 to 100L
Brake motors series FS frame sizes 63 to 132M
*AF: Dimensions for brake motors series FS see page 53

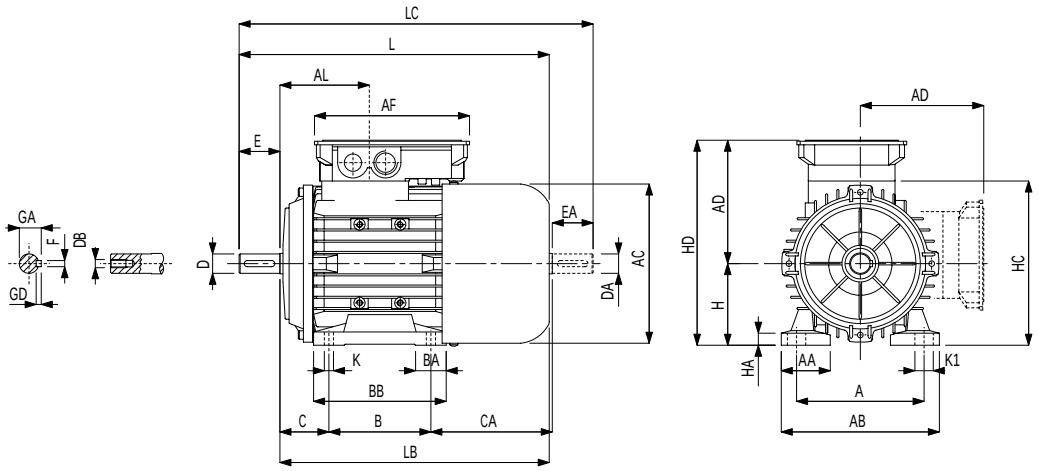
Three-phase and single-phase motors
Series T-BP-M-ME-FS



Note: Sectioning refers to capacitors of series M and ME

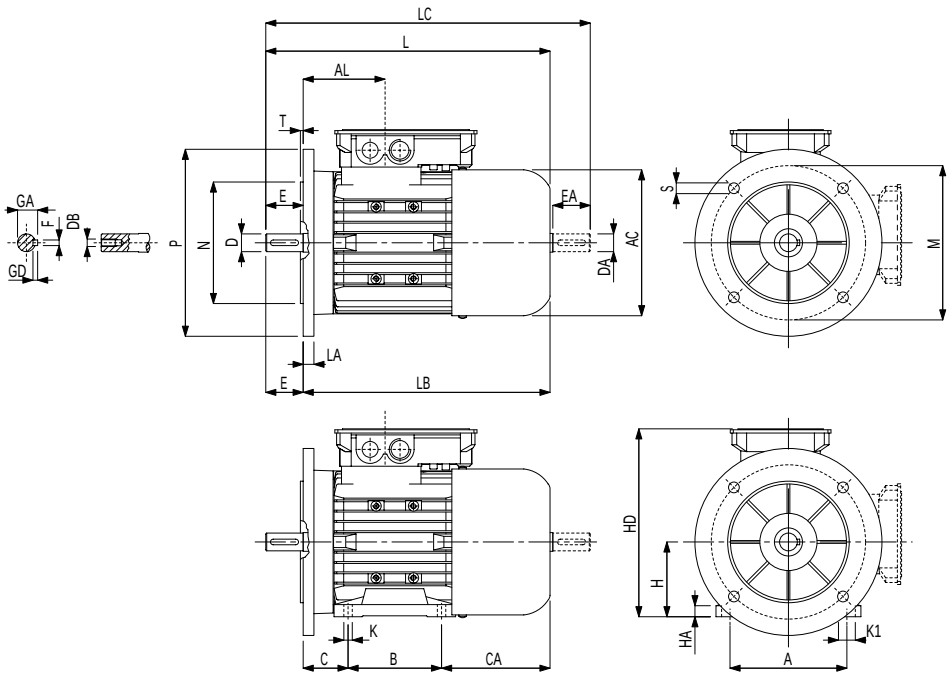
Type	M	N	P	T	S	H	A	B	C	K	CA	HD	AC	HA	K1	L	LB	LC	AL	AF*	D DA	E EA	F	GD	GA	DB
56	65	50	80	2.5	M5	56	90	71	36	6	65	150	110	8	12	188	168	212	62	70	9 20	20 30	3	3	10.2	M4
63	75	60	90	2.5	M5	63	100	80	40	7	72	161	124	10	12	211	191	238	66	70	11 23	23 40	4	4	12.5	M4
71	85	70	105	2.5	M6	71	112	90	45	7	86	178	137	12	17	247	217	281	76	70	14 30	30 50	5	5	16	M5
80	100	80	120	3.0	M6	80	125	100	50	9	85	202	156	13	18	275	235	315	85	84	19 40	40 60	6	6	21.5	M6
90 S	115	95	140	3.0	M8	90	140	100	56	9	98	219	176	14	18	302	252	354	86	84	24 50	50 80	8	8	27	M8
90 L	115	95	140	3.0	M8	90	140	125	56	9	98	219	176	14	18	326	276	378	86	84	24 50	50 80	8	8	27	M8
100 L	130	110	160	3.5	M8	100	160	140	63	12	105	240	195	14	20	366	306	429	96	84	28 60	60 90	8	8	31	M10
112 M	130	110	160	3.5	M8	112	190	140	70	12	118	272	219	15	21	385	325	448	97	84	28 60	60 90	8	8	31	M10
132 S	165	130	200	4.0	M10	132	216	140	89	12	143	309	258	16	21	449	369	532	117	92	38 80	80 110	8	10	41.5	M12
132 M	165	130	200	4.0	M10	132	216	178	89	12	143	309	258	16	21	487	407	570	117	92	38 80	80 110	8	10	41.5	M12

Note
Series BP frame sizes 63 to 132
Single-phase motors series M frame sizes 56 to 100L
Single-phase motors series ME frame sizes 63 to 100L
Brake motors series FS frame sizes 63 to 132M
*AF: Dimensions for brake motors series FS see page 53



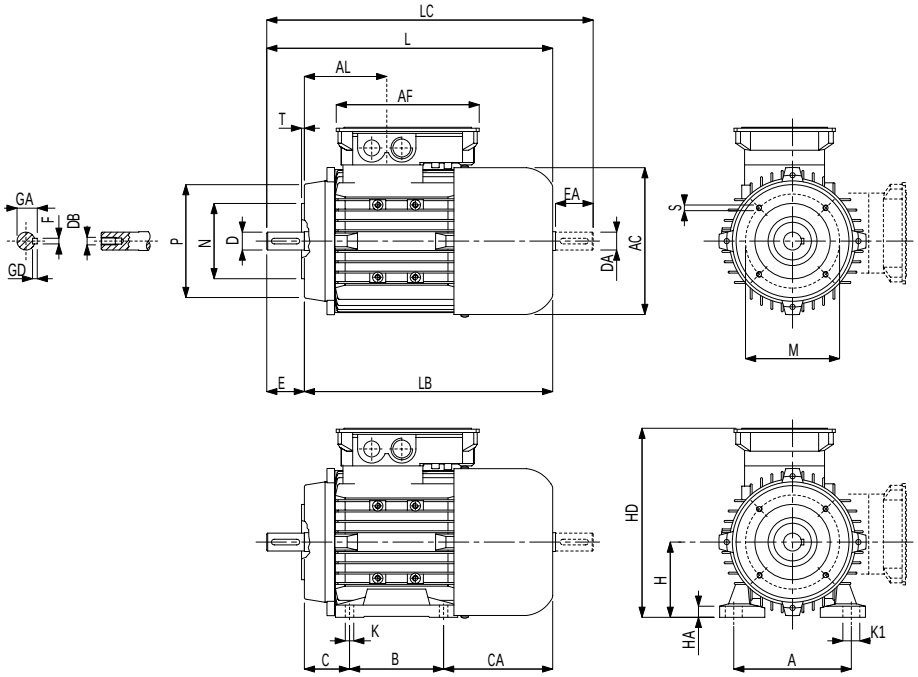
Type	H	A	B	C	K	AB	BB	CA	AD	HD	AC	HC	HA	K1	L	LB	LC	AL	AF	BA	AA	D DA	E EA	F	GD	GA	DB
63	63	100	80	40	7	126	105	127	98	161	124	126	10	12	270	247	295	66	137	26	26	11	23	4	4	12.5	M4
71	71	112	90	45	7	144	109	140	107	178	137	143	12	17	305	275	337	76	152	22	30	14	30	5	5	16	M5
80	80	125	100	50	9	155	130	160	122	202	156	162	13	18	350	310	392	85	152	31	32	19	40	6	6	21.5	M6
90S	90	140	100	56	9	184	130	186	129	219	176	182	14	18	392	342	444	86	152	32	39	24	50	8	7	27	M8
90L	90	140	125	56	9	184	154	185	129	219	176	182	14	18	416	366	468	86	152	32	39	24	50	8	7	27	M8
100L	100	160	140	63	12	200	176	189	140	240	195	200	14	20	452	392	515	96	152	40	42	28	60	8	7	31	M10
112M	112	190	140	70	12	220	176	206	160	272	219	225	15	21	476	416	539	97	152	38	42	28	60	8	7	31	M10
132S	132	216	140	89	12	260	178	230	177	309	258	261	16	21	539	459	622	117	123	44	58	38	80	10	8	41.5	M12
132M	132	216	178	89	12	260	216	230	177	309	258	261	16	21	577	497	660	117	123	44	58	38	80	10	8	41.5	M12

Note
Series FMC frame sizes 56 to 100L
Series FME frame sizes 63 to 100L
Series FBA-FBC frame sizes 63 to 132M



Type	M	N	P	T	LA	S	H	A	B	C	K	CA	HD	AC	HA	K1	L	LB	LC	AL	AF DA	D EA	E	F	GD	GA	DB
63	115	95	140	3.0	10	9.5	63	100	80	40	7	127	161	124	10	12	270	247	295	66	137	11	23	4	4	12.5	M4
71	130	110	160	3.5	10	9.5	71	112	90	45	7	140	178	137	12	17	305	275	337	76	152	14	30	5	5	16	M5
80	165	130	200	3.5	12	11.5	80	125	100	50	9	160	202	156	13	18	350	310	392	85	152	19	40	6	6	21.5	M6
90S	165	130	200	3.5	12	11.5	90	140	100	56	9	186	219	176	14	18	392	342	444	86	152	24	50	8	8	27	M8
90L	165	130	200	3.5	12	11.5	90	140	125	56	9	185	219	176	14	18	416	366	468	86	152	24	50	8	8	27	M8
100L	215	180	250	4.0	14	14.0	100	160	140	63	12	189	240	195	14	20	452	392	515	96	152	28	60	8	8	31	M10
112M	215	180	250	4.0	14	14.0	112	190	140	70	12	206	272	219	15	21	476	416	539	97	152	28	60	8	8	31	M10
132S	265	230	300	4.0	14	14.0	132	216	140	89	12	230	309	258	16	21	539	459	622	117	123	38	80	8	10	41.5	M12
132M	265	230	300	4.0	14	14.0	132	216	178	89	12	230	309	258	16	21	577	497	660	117	123	38	80	8	10	41.5	M12

Note
Series FMC frame sizes 56 to 100L
Series FME frame sizes 63 to 100L
Series FBA-FBC frame sizes 63 to 132M



Type	M	N	P	T	S	H	A	B	C	K	CA	HD	AC	HA	K1	L	LB	LC	AL	AF	D DA	E EA	F	GD	GA	DB
63	75	60	90	2.5	M5	63	100	80	40	7	127	161	124	10	12	270	247	295	66	137	11	23	4	4	12.5	M4
71	85	70	105	2.5	M6	71	112	90	45	7	140	178	137	12	17	305	275	337	76	137	14	30	5	5	16	M5
80	100	80	120	3.0	M6	80	125	100	50	9	160	202	156	13	18	350	310	392	85	152	19	40	6	6	21.5	M6
90S	115	95	140	3.0	M8	90	140	100	56	9	186	219	176	14	18	392	342	444	86	152	24	50	8	8	27	M8
90L	115	95	140	3.0	M8	90	140	125	56	9	185	219	176	14	18	416	366	468	86	152	24	50	8	8	27	M8
100L	130	110	160	3.5	M8	100	160	140	63	12	189	240	195	14	20	452	392	515	96	152	28	60	8	8	31	M10
112M	130	110	160	3.5	M8	112	190	140	70	12	206	272	219	15	21	476	416	539	97	152	28	60	8	8	31	M10
132S	165	130	200	4.0	M10	132	216	140	89	12	230	309	258	16	21	539	459	622	117	123	38	80	8	10	41.5	M12
132M	165	130	200	4.0	M10	132	216	178	89	12	230	309	258	16	21	577	497	660	117	123	38	80	8	10	41.5	M12

Note
Series FMC frame sizes 56 to 100L
Series FME frame sizes 63 to 100L
Series FBA-FBC frame sizes 63 to 132M

Notes

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