

Energy Efficient Electric Motors

3 Phase LV Induction Motors (56-315 Frames)



Technical Catalogue '08



HAVELLS



About us

Havells India Ltd, a US\$1.3bn company, and one of the largest & India's fastest growing electrical and power distribution equipment companies, manufacturing products ranging from Building Circuit Protection, Industrial & Domestic Switchgear, Cables, Energy Meters, Fans, CFL Lamps, Luminaires for Domestic, Commercial & Industrial application and Modular Switches.

Havells owns some of the prestigious global brands like Crabtree, Sylvania, Concord, Lumiance, Claude, Linolite, SLI Lighting & Zenith.

With 91 branches / representative offices and over 8000 professionals spread over 50 countries across the globe, the group has achieved rapid success in the past few years. Its 20 state-of-the-art manufacturing plants spread over India, Europe, Latin America & Africa churn out globally acclaimed products.

To add to the existing state-of-the-art manufacturing plants, Havells has now started a world class Motor Plant at Neemrana (Rajasthan). It is one of the largest LV Motor Plant in Asia spread over 42 acres and will manufacture energy efficient motors ranging from 0.12HP to 300HP.

The plant has a capacity of manufacturing over 20000 motors per month. The state-of-the-art plant and machinery has been imported from AEG Spain.

The Manufacturing Strengths of the Plant are :

- In house manufacturing of complete range of motors from 56-315 frame
- Automatic winding lines from 56-250 frame
- Automatic impregnation plant
- Ultra-violet impregnation plant
- Fully automated temperature controlled paint stations
- Modern Test Plant having 9 test beds with Power Analyzers
- Mechanical Test Lab

Havells is committed to manufacturing excellence and providing world class quality products at affordable prices. Havells offers a complete solution which is not only safe and reliable but also saves energy. We will continue the same tradition with our motors also.



Manufacturing Process



CNC Machine



Rotor Balancing



Automatic Winding



Automatic Impregnation Plant



Assembly Line



Testing



Conveyerised Painting





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STANDARD PRODUCT SPECIFICATIONS

Motor Type	AC Three Phase Squirrel Cage Induction Motor
Reference Standard	IS: 325 / IS:12615
Voltage \pm Variation	415 Volts \pm 10%
Frequency \pm Variation	50 Hz \pm 5%
Combined Variation	10% (Absolute Sum)
Enclosure	TEFC
Mounting	Foot, Flange, Foot cum Flange
Frame Dimensions	As per IS 1231 & IS 2223
Altitude	Upto 1000M
Relative Humidity	Upto 100%
Degree of Protection	IP 55 (As per IS 4691)
Class of Insulation	Class 'F'
Ambient Temp / Temp Rise	50°C / 70°C
Duty / Rating	S1 / Continuous
Position of Terminal Box	Top
Direction of Rotation	Bi-directional
Grease Type	Lithium Based
Cooling	Shaft Mounted Fan
Paint	RAL 9005



Indian Standard for Electric Motors

The motors comply with the relevant standards and regulations;

Indian standards

IS : 325	:	Three phase induction motors
IS : 1231	:	Dimensions of three phase foot mounted AC induction motors
IS : 2223	:	Dimensions of flange mounted AC induction motors
IS : 2253	:	Designations for types of construction and mounting arrangements of rotating electrical machines
IS : 4029	:	Guide for testing three phase induction motors
IS : 4691	:	Degree of protection provided by enclosures for rotating electrical machinery
IS : 4722	:	Rotating electrical machines
IS : 4889	:	Methods of determination of efficiency of rotating electrical machines
IS : 6362	:	Designation of methods of cooling for rotating electrical machines
IS : 7538	:	Three phase squirrel cage induction motors for centrifugal pumps for agricultural applications
IS : 8151	:	Single speed three phase induction motors for driving lifts
IS : 8789	:	Value of performance characteristics for three phase induction motors.
IS : 12065	:	Permissible limits of noise levels for rotating electrical machines
IS : 12075	:	Mechanical vibration of rotating electrical machines, measurement, evaluation and limits of vibration severity
IS : 12615	:	Energy efficient motors

International standards & (IEC & EU)

IEC	EU	:
60034-1	EN 60034-1	: General stipulation for electrical machines
60034-2	HD 532 DIN	: Rotating electrical machines methods for determining losses & efficiency using tests
60034-8	HD 53854	: Terminal markings and direction of rotation of rotating electrical machines
60034-12	EN 60034-12	: Starting performance
60038	HD 47251	: Standard voltages
60085	-	: Insulating materials
60072	-	: Dimensions and output ratings
60072	-	: Mounting dimensions and relationship frames sizes - output ratings, IM B3
60072	-	: Mounting dimensions and relationship frame sizes - output ratings, IM B5
60072	-	: Mounting dimensions and relationship frame sizes - output ratings, IM B14
60072	HD 231	: Cylindrical shaft ends for electric motors
60034-5	EN 60034-5	: Degree of protection
60034-6	EN 60034-6	: Methods of cooling
60034-7	EN 60034-7	: Mounting arrangements
60034-9	EN 60034-9	: Noise limits
60034-14	EN 60034-14	: Mechanical vibration
600721-2-1	-	: Classification of environmental conditions

The motors conform to degree of protection IP 55 as per IS 4691 / IEC 60034-5. Higher protection on request.

The standard design for horizontal mounting is suitable for indoor and protected outdoor installation (temperature of coolant -20° to + 50°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 conforming to IS 325 / 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.

Electrical Tolerances

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 ($\cos \phi$)	$\frac{1 - \cos \phi}{6}$, 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 (MA)	- 15 % and + 25 % of the guaranteed breakaway torque (+ 25 % may be exceeded by agreement)
Pull-up torque (MS)	- 15 % of the guaranteed value
Pull-out torque (MK)	- 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

* P_N = Rated Power.

Mechanical Tolerances

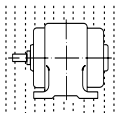
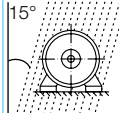
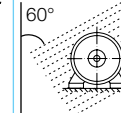
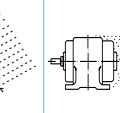
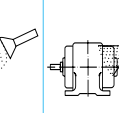
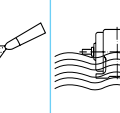
According to IEC 72-1, the following tolerances on mechanical dimensions of electric motors are permitted:

Parameter	Code	Tolerances	
Shaft centre height	H	- up to 250 Frame	-0.5 mm
		- over 250 Frame	-1 mm
		- from 11 to 28 mm	j6
Diameter of shaft end	D-DA	- from 38 to 48 mm	k6
		- from 55 to 100 mm	m6
Hub key width	F-FA	h9	
Flange spigot	N	- up to 132 Frame	j6
		- over size 132 Frame	h6

MECHANICAL DESIGN

Degree of protection

Degrees of protection for mechanical machines are designated in accordance with IS 4691 / IEC 60034-5 by the letters IP and two characteristic numerals.

							
First numeral: Protection against contact and ingress of foreign bodies	No. special protection	Protection against vertically falling water drops	Protection against dripping water when inclined by up to 15 degrees	Protection against water spray when inclined by up to 60 degrees from vertical	Protection against water splashed from any direction	Protection against water projected by nozzle from any direction	Protection against heavy seas
↓ Second Numeral : Protection against ingress of water →	0	1	2	3	4	5	6
0	No special protection						
1	Protection against solid foreign bodies > 50 mm (Example: inadvertent contact with hand)						
2	Protection against solid foreign bodies > 12 mm (Example: inadvertent contact with the fingers)	IP 21	IP 22	IP 23			
3	Protection against solid foreign bodies > 2.5 mm (Example: Inadvertent contact with wire & tools)						
4	Protection against solid foreign bodies > 1 mm (Example: Inadvertent contact with wire, bands)				IP 44		
5	Protection against dust (Harmful deposits of dust)				IP 54	IP 55	IP 56



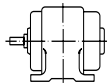
MECHANICAL DESIGN

Mounting arrangements

Mounting arrangements for rotating electrical machines are designated according to IS 2253 / IEC 60034-7. Our motors are available with the mounting arrangements listed below, depending on design and frame size. Motors with aluminium frame are equipped with detachable feet that allow easy change of mounting arrangement.

Foot mounting

B3 - Horizontal foot mounted



B6 - Horizontal wall mounted (LHS)



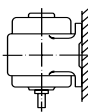
B7 - Horizontal wall mounted (RHS)



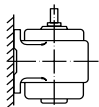
B8 - Horizontal ceiling mounted



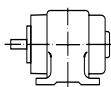
V5 - Wall mounted shaft down wards



V6 - Wall mounted shaft up wards

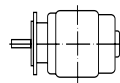


B34 - Horizontal base flange type 'C'

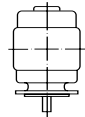


Flange mounting

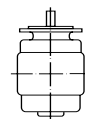
B5 - Flange type 'D'



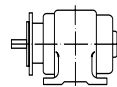
V1 - Vertical down wards flange type 'D'



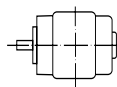
V3 - Vertical up wards flange type 'D'



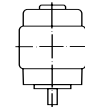
B35 - Horizontal base flange type 'D'



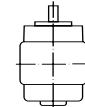
B14 - Horizontal face flange type 'C'



V18 - Vertical face down wards flange type 'C'



V19 - Vertical face up wards flange type 'C'



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

MECHANICAL DESIGN

Terminal boxes

Terminal box is provided on top as a standard practice. However, terminal box on either side is also available on request.

The terminal boxes are of industrial nylon grade for frame sizes 56 to 71. For frame sizes 80 to 160, the terminal boxes are die cast aluminum alloy and from 180 frame onwards the terminal boxes are of sheet metal / cast iron.

All motors are provided with six terminals as a standard practice. The markings U1 V1 W1 and U2 V2 W2 are provided on the terminal blocks.

Frame	Maximum Cable Size		No. of Main Terminals	Terminal Stud Size		Cable Entry		
	DOL	Star/Delta		Main	Earth	Nos.	Size	
56 - 71	4Cx4mm ²	–	6	M4	M4	2	M16	M20
80	4Cx4mm ²	–	6	M4	M4	2	M20	M25
90	4Cx10mm ²	4Cx10mm ²	6	M5	M4	2	M20	M25
100	4Cx10mm ²	–	6	M5	M4	2	M20	M25
112	4Cx10mm ²	4Cx10mm ²	6	M5	M4	2	M20	M25
132	4Cx10mm ²	4Cx10mm ²	6	M5	M4	2	M32	M32
160	3Cx50mm ²	2x3Cx35mm ²	6	M6	M4	2	M40	M40
180	3Cx50mm ²	2x3Cx35mm ²	6	M8	M5	2	M40	M40
200	3Cx50mm ²	2x3Cx35mm ²	6	M8	M5	2	M50	M50
225	3Cx120mm ²	2x3Cx95mm ²	6	M10	M6	2	M50	M50
250	3Cx120mm ²	2x3Cx95mm ²	6	M10	M6	2	M50 / M63	M50 / M63
280	3Cx120mm ²	2x3Cx95mm ²	6	M10	M6	2	M50 / M63	M50 / M63
315	3Cx400mm ²	2x3Cx300mm ²	6	M12	M8	2	M63	M63



MECHANICAL DESIGN

Bearings

Classification of bearings (standard design)

Frame size	No. of poles	Drive end	Non-drive end	Frame size	No. of poles	Drive end	Non-drive end
56	2 & 4	6201-2Z	6201-2Z	160	2 - 8	6309-2Z C3	6309-2Z C3
63	2 & 4	6202-2Z	6202-2Z	180	2 - 8	6310-2Z C3	6310-2Z C3
71	2 - 8	6203-2Z	6203-2Z	200	2 - 8	6312-C3	6312-C3
80	2 - 8	6204-2Z C3	6204-2Z C3	225	2 - 8	6313-C3	6313-C3
90	2 - 8	6205-2Z C3	6205-2Z C3	250	2 - 8	6314 C3	6314 C3
100	2 - 8	6206-2Z C3	6206-2Z C3	280 S/M	2	6316 C3	6316 C3
112	2 - 8	6306-2Z C3	6306-2Z C3	280 S/M	4 - 8	6319 C3	6319 C3
132	2 - 8	6208-2Z C3	6208-2Z C3	315 S/M	2 - 8	6319 C3	6318 C3
				315 L	4 - 8	6319 C3	6319 C3

Recommended pulley diameters

Sync. RPM	Frame	63	71	80	90	100	112	132	160	180	200	225	250	280	315
3000	Pulley Dia (mm)	75	75	75	75	75	100	120	120	125	130	170	180	300	500
1500 and below	Pulley Dia (mm)	75	75	75	75	75	100	120	180	200	220	260	220	220	420
	Face width (mm)	30	40	50	63	80	100	125	177	203	280	330	380	380	380

Maximum permissible axial forces without additional radial forces*

Frame size	3000 RPM kN	Horizontal shaft				Vertical shaft - force upwards				Vertical shaft - force downwards			
		1500 RPM kN	1000 RPM kN	750 RPM kN	3000 RPM kN	1500 RPM kN	1000 RPM kN	750 RPM kN	3000 RPM kN	1500 RPM kN	1000 RPM kN	750 RPM 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	
160	0.5	0.8	1.2	1.5	1	1.4	1.8	2	0.2	0.4	0.6	0.9	
180	0.5	0.8	1.2	1.5	1.1	1.4	1.8	2.1	0.2	0.4	0.6	0.9	
200	0.8	1.3	1.5	1.8	1.8	2.3	2.5	2.8	0.2	0.7	0.9	1.1	
225	1.0	1.6	1.9	2.4	2.1	2.6	2.9	3.4	0.3	0.70	1.0	1.5	
250	1.1	1.6	2.0	2.5	2.3	2.7	3.2	3.7	0.2	0.60	1.1	1.5	
280	1.7	1.9	2.4	2.9	2.9	3.1	3.6	3.7	0.15	0.3	0.8	1.0	
315	3.5	4.0	4.5	5.0	6.0	7.0	7.5	8.0	1.0	1.9	2.4	2.9	

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

* Consult according to direction of force

MECHANICAL DESIGN

Lubrication and maintenance of bearings

Maintenance-free life for motors with permanent lubrication upto frame 180 at ambient temperature of 50° C and service at 50 Hz:

2 and 4/2 pole motors 10,000 h

4 and more pole motors 20,000 h, but not more than 4 years.

From frame size 200 upwards the motors are equipped with regreasing device and grease slinger.

For motors with regreasing device, regreasing interval and required quantity of grease is indicated on the nameplate.

For regreasing please observe the Operating Instructions.

Where unfavourable conditions prevail (e.g. high ambient temperature, dusty conditions, corrosive atmosphere, operation by frequency converter), relubrication should be carried out more frequently.

Permissible operating speed

For motors of standard design, the following maximum operating speeds are permitted:

Frame size	2 Pole RPM	4 - 8 Pole RPM
56-112	3600	1800
132-180	6000	6000
200	5000	5000
225	4500	4500
250	4300	4300
280, 315S YE	4300	3800
315S / M ZE	3600	3600
315 L	3600	3000

Belt drive

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

Calculation of belt drive:

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

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.



MECHANICAL DESIGN

Permissible radial forces

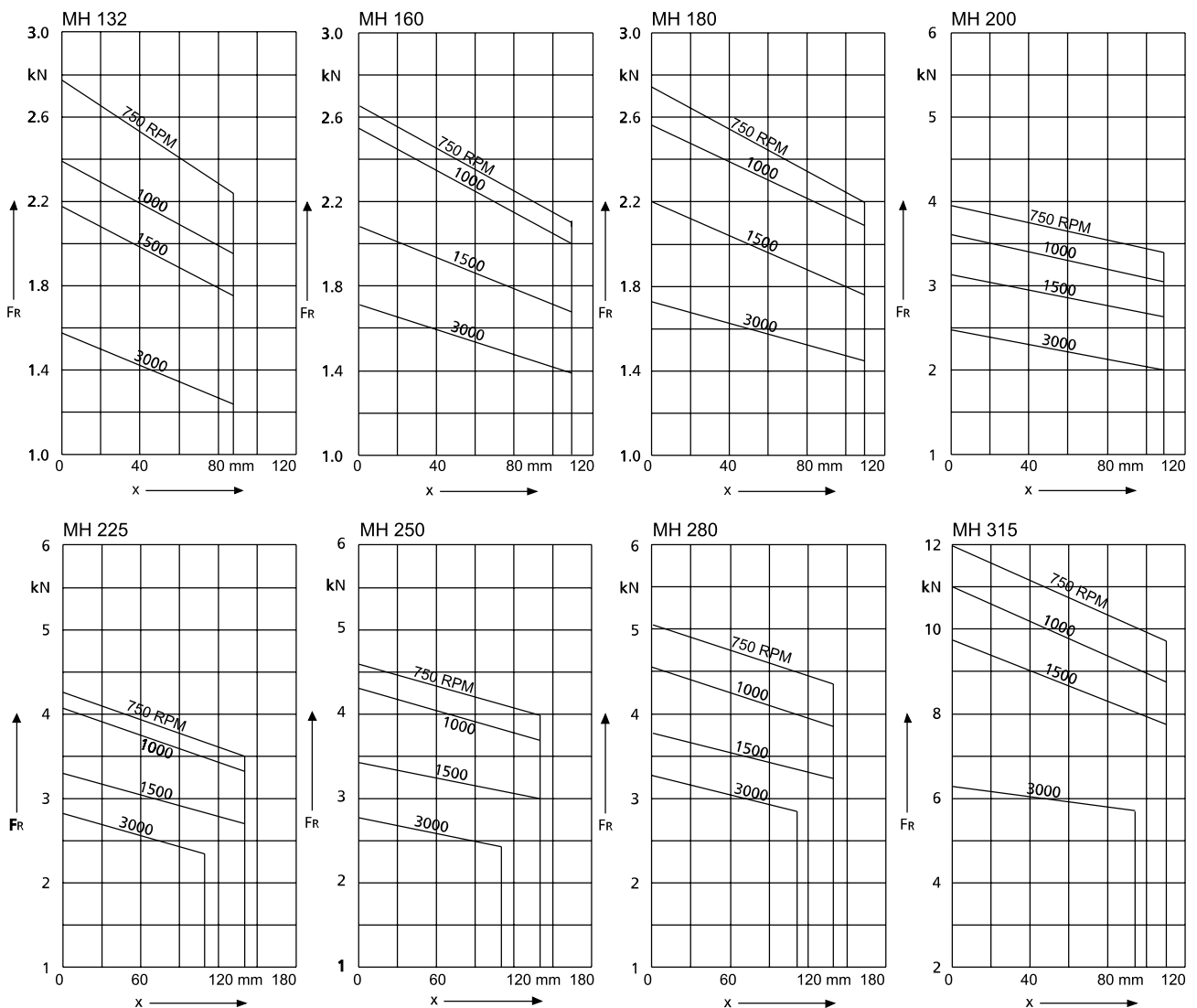
without additional axial force
(Ball bearings)

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)

Frame size	F_R in kN			
	2 Pole	4 Pole	6 Pole	8 Pole
56	340	428	-	-
63	385	485	-	-
71	463	583	668	735
80	590	830	860	945
90SL	675	940	975	1070
100L	925	1295	1335	1470
112M	930	1300	1340	1476



MECHANICAL DESIGN

Noise level

The permitted noise levels of electrical machines are fixed in IS 12065 / EN 60034 - 9 (IEC 34 - 9). The noise level of our motors is well below these limit values.

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 power level L_{WA} for three-phase single-speed motors are given below

Frame size	2 Pole L_{WA}	4 Pole L_{WA}	6 Pole L_{WA}	8 Pole L_{WA}
56	57	47		
63	58	47		
71	61	51	49	
80	72	60	52	47
90	74	61	58	54
100	78	62	62	58
112	80	65	65	58
132	81	71	69	64
160	87	75	71	69
180	87	77	72	71
200	87	78	73	72
225	88	79	75	73
250	90	81	77	74
280	92	83	80	75
315	93	85	82	79

Vibration

The amplitude of vibration in electric motors is governed by IS 12075 / 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 grade A (normal). Vibration grade B are available at extra cost.

Rotors are at present dynamically balanced with half key fitted as per IS 12075. Other balancing can be offered on request.



MECHANICAL DESIGN

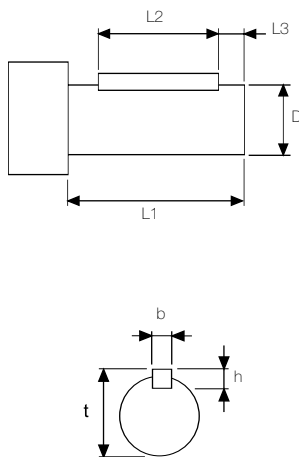
Vibration contd...

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	6	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	6	41
160	42 x 110	12 x 8	100	6	45
180	48 x 110	14 x 9	100	5	51.5
200	55 x 110	16 x 10	100	5	59
225 2 pole	55 x 110	16 x 10	100	5	59
225 4 pole	60 x 140	16 x 10	110	10	59
250 2 pole	60 x 140	18 x 11	110	10	64
250 4 pole	65 x 140	18 x 11	110	10	69
280 2 pole	65 x 140	18 x 11	100	10	69
280 4 pole	75 x 140	20 x 12	100	10	79.5
315 2 pole	65 x 140	18 x 11	125	7.5	69
315 4 pole	80 x 170	22 x 14	140	10	85

Dimensions in mm

For larger shafts in special design the dimensions L2 and L3 are maintained. L2 d1/3 b h t Position and dimensions of key



Materials

Motor parts	Frame size	Material
Stator frame	56 - 160	Aluminium alloy
	132 - 315	Cast iron
Endshield	56 - 112	Aluminium alloy
	100 - 315	Cast iron
Flanged endshield	56 - 112	Aluminium alloy
	100 - 315	Cast iron
Fan cover	56 - 71	Industrial nylon grade
	80 - 315	Sheet steel
Fan	56 - 315	Industrial nylon grade
Terminal box	56 - 71	Industrial nylon grade
	80 - 160	Aluminium alloy
	180 - 315	Sheet steel / Cast iron

MECHANICAL DESIGN

Anti-condensation heater / space heaters

Space heaters are generally provided on the winding of motor to heat the windings when motor is kept in idle condition in order to prevent moisture or due settling over the windings and reducing insulation resistance.

Frame size	Supply voltage (V) (Single Phase)	Heater rating per motor (W)
112 - 160	240	25
180 - 225	240	40
250 - 280	240	60
315	240	60

During operation of the motor, the heating must be switched off.

Other accessories

Motors can be supplied with the following accessory:

- Encoder with internal or external cooling

Encoder (standard design)

Supply voltage U_B	5 V
Pulses per revolution	500-2048
Outputs	2 signals with rectangular pulses A, B 2 signals with inverted rectangular pulses A, B zero pulse and inverted zero pulse
Maximum frequency	100 kHz
Maximum speed	3,000 (6,000) RPM
Temperature range	-20°C to + 85°C
Degree of protection	IP 55

Paint finish

Normal finish

Suitable for climate group **Moderate** e.g. indoor and outdoor installation for short periods: up to 100 % relative humidity at temperatures up to +50°C continuously.

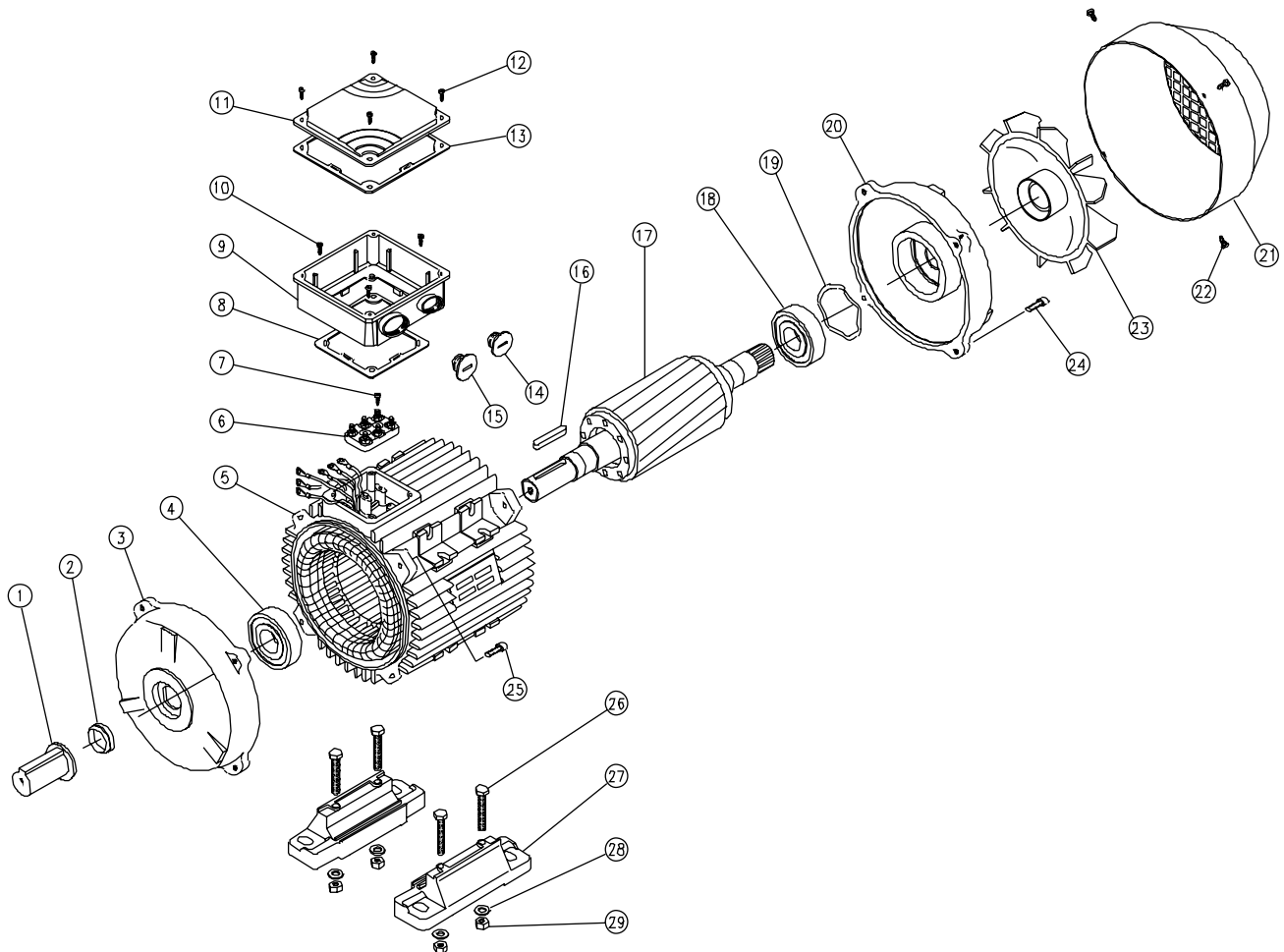
Special finish K1

Suitable for climate group **Worldwide** e.g. outdoor installation in corrosive chemical and marine atmospheres for short periods: up to 100 % relative humidity at temperatures up to +50°C continuously.

Special finishes (on request)

- Special finish K2 (additional treatment of internal motor parts)
- Special paint for exposure to the action of alkalis
- Special finishes to customers' requirements

EXPLODED VIEW FOR ELECTRIC MOTOR



Spare part description

1	Shaft protection	16	Key
2	Dust seal drive end	17	Rotor complete
3	Endshield drive end	18	Bearing non-drive end
4	Bearing drive end	19	Pre-load washer
5	Stator frame	20	Endshield non-drive end
6	Terminal board	21	Fan cover
7	Fixing screw terminal board	22	Fixing screw fan cover
8	Gasket terminal box	23	Fan
9	Terminal box	24	Fixing bolt endshield non-drive end
10	Fixing screw terminal box	25	Fixing bolt endshield drive end
11	Terminal box lid	26	Fixing bolt motor feet
12	Fixing screw terminal box lid	27	Motor feet
13	Gasket terminal box lid	28	Fixing washer motor feet
14	Blank gland plug	29	Fixing nut motor feet
15	Blank gland plug		

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.
 Multimounting facility from 71-160 frame (for aluminium motors)

ELECTRICAL DESIGN

Rated voltage

Motors are suitable for variation of $\pm 10\%$ of the rated voltage. Therefore the motors are designed for the following rated voltage ranges (exceptions are shown in the data tables):

Rated voltage

230 V $\pm 10\%$

415 V $\pm 10\%$

715 V $\pm 10\%$

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 over temperature of the stator winding may be exceeded by 10 °C.

For motors in 500 V, 50 Hz design, as well as all abnormal voltages, no voltage range is marked. The voltage tolerances to IS 325 / EN 60034-1 apply.

Rated frequency

Motors are suitable for 50 Hz with a variation 5%. 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 Frame.

Rated current

The rated currents listed in the data tables apply to an operating voltage of 415V. The conversion to other operating voltages, with output and frequency remaining unchanged, is to be made as follows:

Nominal voltage (V)	230	380	415	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

$$\text{Rated torque in Nm} = 9550 \times \frac{\text{Rated power in kW}}{\text{Rated speed in RPM}}$$

Output

The outputs stated in this catalogue are for constant load in continuous running duty S1 according to IS 325 / EN 60034-1, based on an ambient temperature of 50° 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.



ELECTRICAL DESIGN

Effect of variation of voltage and frequency on the characteristics of motor

Characteristics	Voltage		Frequency	
	110%	90%	105%	95%
Torque Starting & Maximum	Increase 21%	Decrease 19%	Decrease 10%	Increase 11%
Speed Synchronous Full Load	No Change Increase 1%	No Change Decrease 1.5%	Increase 5% Increase 5%	Decrease 5% Decrease 5%
Current No Load Starting Full Load Temp. Rise Overload Capacity Magnetic Noise	Increase 10-15% Increase 10-12% Decrease 7% Decrease 3-4% Increase 21% Slight Increase	Decrease 10-12% Decrease 10-12% Increase 11% Increase 6-7% Decrease 19% Slight Decrease	Decrease 5-6% Decrease 5-6% Slight Decrease Slight Decrease Slight Decrease Slight Decrease	Increase 5-6% Increase 5-6% Slight Increase Slight Increase Slight Increase Slight Increase
Efficiency Full Load	Increase 0.5-1.0%	Decrease 2%	Slight Increase	Slight Decrease
Power Factor	Decrease 3%	Increase 1%	Slight Increase	Slight Decrease

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 IS 325 / 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.

Connection

Motor output at 50 Hz	230 V Δ 415 V Y	415 V Δ 715 V Y	500 V Y	500 V Δ	690 V Δ
under 1.5 kW	standard	on request	on request	on request	-
1.5 to 4 kW	standard	standard	on request	on request	-
5.5 to 90 kW	standard	standard	on request	standard	standard
≥110 kW	on request	standard	on request	standard	standard

ELECTRICAL DESIGN

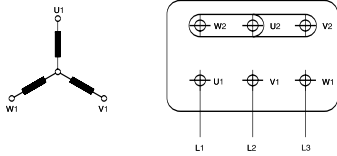
Connection diagrams

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 each other and the U1, V1, W1 terminals to the mains. The phase current and voltage are: $I_{ph} = I_n$; $U_{ph} = U_n / \sqrt{3}$

where I_n is the line current and U_n the line voltage referred to the star connection.



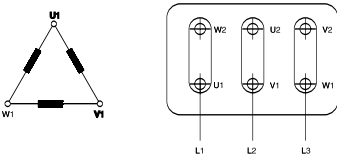
Delta connection

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

The phase current I_{ph} and the phase voltage U_{ph} are:

$$I_{ph} = I_n / \sqrt{3} ; U_{ph} = U_n$$

where I_n and U_n 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.

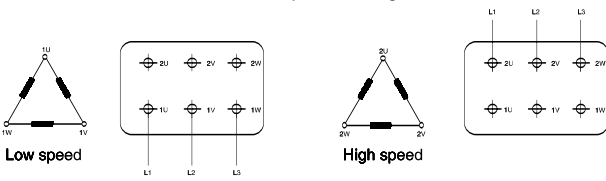
All motors can be supplied with windings designed for star-delta starting (for example: 415 V Δ / 715 V Y).

Pole-changing motors

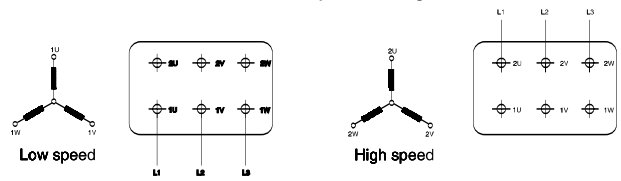
Standard pole-changing motors are designed for single voltage and direct-on-line starting (special design for Y- Δ -connection on request).

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.

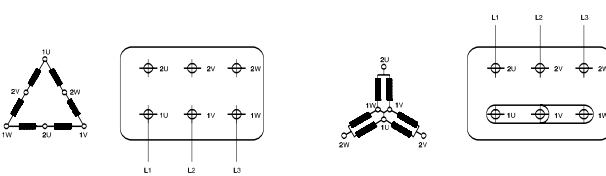
MH/MHV - two separate windings Δ/Δ



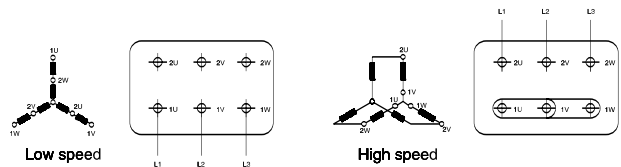
MH/MHV - two separate windings

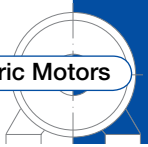


MH - Dahlander connection Δ/Y



MHV - Dahlander connection





ELECTRICAL DESIGN

Insulation and temperature rise

Motors are manufactured with class 'F' insulation as a standard and temperature rise limited to class 'B'.

The motors are suitable for an ambient temperature of 50°C and temperature rise limited to 70°C.

Temperature rise (ΔT^*) and maximum temperatures at the hottest points of the winding (T_{max}) according to the temperature classes of EN 60034-1 / IS 325.

	ΔT^*	T_{max}
Class B	70°C	130°C
Class F	95°C	155°C
Class H	115°C	180°C

*Measurement by resistance method.

Output reduction at ambient temperatures over 50°C

Ambient temperature	50°C	55°C	60°C
Reduction of nominal output to approx.	100%	95%	90%

Installation at altitudes of more than 1000 m above sea level

Altitude of installation	2000 m	3000 m	4000 m
At 50°C ambient temperature and thermal class B Rated output reduced to approx.	92%	84%	76%
At 50°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 \leq moment of inertia of the rotor: load torque rising with the square of the speed up to nominal torque;
starts at even intervals.

Frame size	Permissible No. of cold starts per hour		
	2 Pole	4 Pole	6 & 8 Pole
56 - 71	100	250	350
80 - 100	60	140	160
112 - 132	30	60	80
160 - 180	15	30	50
200 - 225	8	15	30
250 - 315	4	8	12

For permissible number of starts for larger motors please consult us, indicating the complete operating conditions.

ELECTRICAL DESIGN

Thermal protection

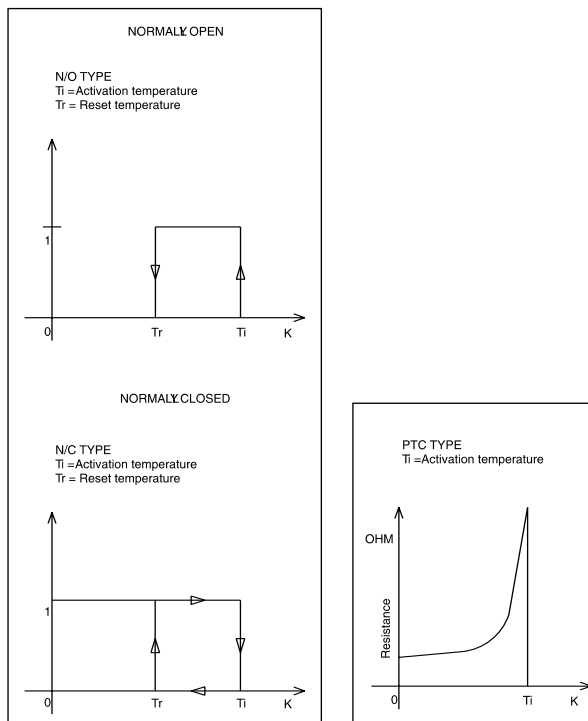
The decision on a particular type of thermal protection should be taken according to the actual operating conditions. Motors may be protected by means of current-dependent thermal protection switches, over current relays and temperature detectors.

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 .

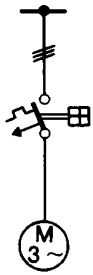
Although there are motors available from stock with built-in semiconductor temperature detector, a special remark has to be made in the enquiry or order when motor protection is required.





ELECTRICAL DESIGN

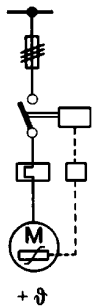
Examples of connection



Protection method
 Motor protection switch with thermal and electromagnetic over current release

Protection against:

- Overload in continuous service
- Locked rotor



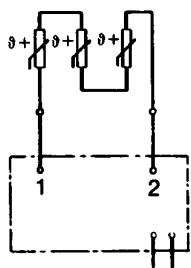
Contactor with over current relay
 Thermistor protection and fuse

in service against:

- Overload in continuous 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 continuous 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

ELECTRICAL DESIGN

Motors for inverter duty operation (frequency converter)

The motors frame sizes 90 upwards in standard design are suitable for operation on static frequency converters, taking into account the following remarks:

- Maximum converter output voltage 500V at peak voltages $\hat{U} \leq 1460V$ and $du/dt \leq 13 \text{ kV/us}$. For higher converter output voltages or stresses, a special insulation is required.
- With square characteristic of the load torque, motors can be driven with their rated torque.
- For constant torque, the rated torque of motors with internal cooling must be reduced due to reduced cooling air inlet. Depending on the control range, the use of an external fan would be advisable.
- The motors frame sizes 90 – 112 are suitable for a maximum output frequency of the converter of 60 Hz (e.g. applications with square torque, control range 1 : 10, such as pumps and fans). For higher frequencies, a special range with type designation AMI is available on request. From frame size 132 upwards, motors designed Δ/Y 230/400 V, 50 Hz can be operated in delta with a maximum frequency of 87 Hz (observe mechanical limit speed).
- Insulated or hybride bearings may be necessary on critical applications. We generally recommend the use of insulated bearings for motors frame size 280 upwards.
- The motors of frame size 56 – 80 can be operated on single-phase converters up to maximum 60 Hz.
- Depending on the operating point and converter type, converter-fed motors produce between approx. 4 - 10 dB(A) higher noise values than when supplied from the mains. For motors driven with a frequency over 50 Hz, more fan noise is produced. We recommend the use of an external fan.



ORDER DATA

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

Quotation (if submitted)	No./Date
Quantity	Units
Designation	Type
Output	kW
Speed	RPM
Direction of rotation (viewed on shaft extension)	
Mounting arrangement	
Degree of protection	
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 50°C, or when aluminium conductors are used. It should be stated when parallel connected conductors are used.

Additional information for special designs

Non-standard shaft extension
Paint coating
Corrosive protection
Vibration level
Anti-condensation heating
Temperature detectors
Noise requirements
Mechanical or electrical brake

ORDER DATA

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.)



TYPE DESIGNATION

Motor Code

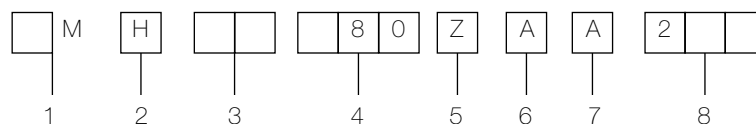
Apart from other information, it is necessary to specify the exact type designation in all enquiries, when ordering spare parts or replacement motors or when asking for documentary information.

The type designation of our motors comprises 8 points of reference, each of which may consist of several letters and/or numerals. The meaning of each symbol can be seen from the following table. For motors not included in our standard range, special symbols may be used which are not listed here.

Meaning of the symbols

Ref. point	Meaning	Description of symbols used for our motors	
1	Product	M	Motor
2	Brand	H	Havells
3	Type of motor	blank	Three-phase motor
		V	Three-phase pole-changing motor for driving fan
		H	Three-phase motor, efficiency to EPACK regulations
		HE	Three-phase motor, efficiency EFF 1 to CEMEP Voluntary Agreement
		I	Special design for three-phase motor driven with frequency converter
4	Shaft centre height	56, 63, 71, 80, 90, 100, 112, 132, 160, 180, 200, 225, 250, 280, 315	
5	Frame length	Z	
		S	Mechanical dimension (short)
		M	Mechanical dimension (medium)
		L	Mechanical dimension (long)
6	Mechanical design and output value	A	For Internal use
		B	
		...	
		Z	
7	Frame material and/or stage of development	A	Aluminium frame
		G	Cast iron frame
		E	Stage of development
8	Number of poles	2	4/2
		4	8/4
		6	4/6
		8	6/8

Example





Three - phase motors designed
for range of rated voltage
415 V ± 10% - 50 Hz ± 5%

Insulation class F with
temperature rise limited to class B

Type	Rated output		Rated speed RPM	Efficiency			Power factor cos φ	Rated current at 415 V I _N	Direct-on-line starting			Pull-out torque ratio M _K /M _N	Moment of inertia J 10 ⁻³ kgm ²	Weight kg	
	kW	HP		50%	75%	100%			starting current ratio I _s /I _N	Breakaway torque ratio M _s /M _N	Pull-up torque ratio M _u /M _N				
3000 RPM (2 Pole)															
MHHE 80Z BA	2	1.1	1.5	2880	83.2	85.2	85.0	0.81	2.22	4.8	3.6	3.4	3.6	0.89	9.5
MHHE 90S AA	2	1.5	2.0	2880	84.2	84.6	85.3	0.83	2.95	7.0	3.0	3.1	4.0	1.56	14
MHHE 90L CA	2	2.2	3.0	2860	85.1	86.9	86.7	0.88	4.01	7.0	3.0	3.2	3.7	1.8	16
MHHE 100L AA	2	3	4.0	2920	86.1	86.8	87.7	0.87	5.47	7.0	3.0	4.7	6.3	4.05	22.8
MHHE 112M AA	2	3.7	5.0	2940	87.9	90.1	90.7	0.88	6.45	7.0	3.0	2.2	4.5	8.58	33.6
MHHE 112M BA	2	5.5	7.5	2920	86.6	88.4	89.5	0.90	9.50	7.0	2.5	2.1	3.2	8.58	34
MHHE 132S ZA	2	5.5	7.5	2900	86.4	87.5	89.5	0.92	9.29	7.0	2.5	2.3	3.3	14	46
MHHE 132S TA	2	7.5	10	2900	87.3	90.3	90.3	0.92	12.56	7.0	2.5	2.5	3.5	20.5	53
MHHE 160M YA	2	11	15	2930	90.2	91.4	91.4	0.88	19.03	7.0	2.4	2.2	3.1	51.7	87.8
MHHE 160M ZA	2	15	20	2930	90.8	92.2	92.2	0.88	25.72	7.0	2.5	2.3	3.1	64	104
MHHE 160L ZA	2	18.5	25	2930	90.8	92.4	92.6	0.88	31.59	7.0	2.5	2.6	3.4	64	105
MHHE 180M ZA	2	22	30	2930	92.4	93.1	93.1	0.89	36.9	7.0	2.5	2.3	3.2	70	135
MHHE 200L PG	2	30	40	2945	92.4	93.6	93.6	0.911	48.9	7.0	2.0	1.9	2.8	130	220
MHHE 200L RG	2	37	50	2950	92.6	93.9	94.1	0.91	60.1	7.0	2.2	2.0	2.8	156	240
MHHE 225M P	2	45	60	2950	93.4	94.5	94.6	0.9	73.5	7.0	2.3	1.9	2.9	270	315
MHHE 250M P	2	55	75	2955	93.5	94.5	94.6	0.91	88.9	7.0	2.3	1.8	3.0	424	410
MHHE 280S V	2	75	100	2975	93.3	94.7	95.2	0.92	119.1	7.0	1.9	1.5	3.2	816	560
MHHE 280M V	2	90	125	2975	93.8	95	95.4	0.91	144.2	7.0	1.9	1.5	3.2	957	620
1500 RPM (4 Pole)															
MHHE 90S AA	4	1.1	1.5	1430	85.2	86.2	86.2	0.80	2.22	6.1	4.0	3.9	4.1	3.73	16.4
MHHE 90L BA	4	1.5	2.0	1430	87.1	87.6	87.3	0.80	2.99	6.4	3.9	3.8	4.0	3.73	16.4
MHHE 100L AA	4	2.2	3.0	1450	87.5	88.1	88.4	0.76	4.56	6.0	3.2	3.0	3.4	5.58	22.4
MHHE 100L BA	4	3.0	4.0	1440	88.7	89.7	89.3	0.81	5.77	6.3	3.4	3.1	3.6	7.3	26.5
MHHE 112M AA	4	3.7	5.0	1450	89.3	90.4	90.1	0.81	7.05	6.1	3.1	2.8	3.3	13.3	30.4
MHHE 132S RA	4	5.5	7.5	1450	89.5	90.8	90.8	0.87	9.69	6.5	2.6	2.4	3.3	30	55
MHHE 132M TA	4	7.5	10	1450	90.3	91.6	91.6	0.87	13.09	6.5	2.6	2.4	3.3	36	65
MHHE 160M ZA	4	11	15	1460	91.4	92.4	92.4	0.85	19.49	6.5	2.0	2.1	2.9	105	105
MHHE 160L ZA	4	15	20	1460	91.9	93	93.0	0.87	25.79	6.5	2.0	2.2	3.1	120	114
MHHE 180M ZA	4	18.5	25	1460	92.8	93.5	93.5	0.87	31.6	6.5	2.2	2.3	3.1	112	130
MHHE 180L ZA	4	22	30	1465	92.9	93.7	93.7	0.88	37.1	6.5	2.5	2.4	3.2	132	140
MHHE 200L RG	4	30	40	1465	93.5	94.3	94.2	0.87	50.9	6.5	2.1	1.8	2.6	206	230
MHHE 225S P	4	37	50	1475	93.2	94.5	94.7	0.87	62.5	6.5	2.0	2.0	2.9	356	290
MHHE 225M P	4	45	60	1475	93.4	94.8	94.9	0.88	75.0	6.5	2.0	2.0	2.9	461	330
MHHE 250M P	4	55	75	1475	93.8	95	95.0	0.85	94.8	6.5	2.5	2.3	2.6	677	400
MHHE 280S V	4	75	100	1485	94.4	95.2	95.3	0.88	124.4	6.5	2.0	1.8	2.7	1060	530
MHHE 280M V	4	90	125	1480	94.6	95.5	95.7	0.88	148.7	6.5	2.0	1.8	2.7	1260	565

Note : Performance figures are subject to IS tolerance



ELECTRICAL DATA

Three - phase motors designed
for range of rated voltage
415 V \pm 10% - 50 Hz \pm 5%



Insulation class F with
temperature rise limited to class B

Type	Rated output		Rated speed RPM	Efficiency			Power factor cos ϕ	Rated current at 415 V I_N	Direct-on-line starting			Pull-out torque ratio M_x/M_N	Moment of inertia J 10 ⁻³ kgm ²	Weight kg	
	kW	HP		50%	75%	100%			starting current ratio I_s/I_N	Breakaway torque ratio M_x/M_N	Pull-up torque ratio M_s/M_N				
3000 RPM (2 Pole)															
Aluminium Frame															
MH 56Z AA	2	0.09	0.12	2810	52.1	56.1	61.4	0.66	0.31	3.9	3.8	3.8	3.9	0.09	3.4
MH 56Z BA	2	0.12	0.16	2800	53.9	58.9	64.5	0.70	0.37	3.9	3.8	3.8	3.9	0.1	3.5
MH 63Z AA	2	0.18	0.25	2790	56.8	60.8	65.8	0.79	0.48	4.2	3.0	3.1	3.2	0.13	4.1
MH 63Z BA	2	0.25	0.33	2790	61.6	66.4	70.5	0.72	0.69	4.5	3.2	3.2	3.3	0.19	4.6
MH 63Z CA	2*	0.37 ⁽¹⁾	0.50 ⁽¹⁾	2800	59.6	63.6	68.6	0.75	1.00	4.6	3.4	3.3	3.4	0.20	4.7
MH 71Z AA	2	0.37	0.50	2820	56.6	63.1	68.6	0.75	1.00	4.7	3.6	3.4	3.6	0.36	5.7
MH 71Z BA	2	0.55	0.75	2830	61.4	68.4	75.2	0.75	1.36	4.8	3.2	3.1	3.3	0.46	6.3
MH 71Z CA	2*	0.75 ⁽¹⁾	1.0 ⁽¹⁾	2800	62.4	68.7	75.4	0.79	1.75	5.2	3.1	3.2	3.1	0.58	6.9
MH 80Z AA	2	0.75	1.0	2840	71.2	76.5	78	0.82	1.63	5.0	2.8	2.8	2.9	0.75	8.4
MH 80Z BA	2	1.1	1.5	2810	76	79	79.3	0.85	2.27	4.6	2.4	2.8	2.9	0.89	9.5
MH 80Z CA	2*	1.5 ⁽¹⁾	2.0 ⁽¹⁾	2825	78.1	81	80.7	0.86	3.01	5.0	2.9	3.0	3.3	1.05	11.1
MH 90S AA	2	1.5	2.0	2830	77	80	80.2	0.85	3.06	5.0	3.1	2.9	3.0	1.37	12.7
MH 90S BA	2*	1.8	2.5	2805	76.7	79.9	80.1	0.83	3.77	4.5	2.6	2.4	2.5	1.37	12.7
MH 90L CA	2	2.2	3.0	2860	79.3	82.1	82.5	0.84	4.42	6.8	4.1	3.6	4.0	1.8	16
MH 90L DA	2*	3 ⁽¹⁾	4.0 ⁽¹⁾	2860	80.1	83.2	83.6	0.83	6.02	6.8	3.9	3.4	3.8	2.09	18.7
MH 100L AA	2	3	4.0	2860	83	84.1	83.9	0.88	5.65	6.0	3.1	3.1	3.3	2.8	19.3
MH 100L BA	2*	3.7	5.0	2835	83.4	84.8	84	0.90	6.81	6.2	2.9	2.5	2.9	3.35	19.7
MH 100L CA	2*	5.5 ⁽¹⁾	7.5 ⁽¹⁾	2865	84.6	86.9	86.1	0.88	10.10	6.5	2.7	3.4	4.1	4.5	25.9
MH 112M AA	2	3.7	5.0	2880	82	85.3	86.9	0.87	6.81	6.5	2.8	3.6	3.6	5.2	24.3
MH 112M BA	2*	5.5	7.5	2900	85.9	87	86.5	0.88	10.05	6.5	2.8	3.4	3.6	6.48	27.4
MH 132S YA	2	5.5	7.5	2890	85	86.5	86	0.88	10.11	6.0	2.2	2.1	2.3	10.0	37
MH 132S ZA	2	7.5	10	2880	86.5	87.6	87	0.91	13.18	6.4	2.9	2.7	3.0	14	42.5
MH 132M ZA	2*	9.3 ⁽¹⁾	12.5 ⁽¹⁾	2890	85.3	87.4	88	0.86	17.10	6.5	2.6	2.8	3.5	17.1	51.4
MH 132M RA	2*	11	15	2880	88.5	89.5	89	0.89	19.32	6.5	2.6	2.8	3.8	17.1	53
MH 132M TA	2*	15 ⁽¹⁾	20 ⁽¹⁾	2920	87.3	88.3	88.8	0.90	26.11	6.5	2.6	2.8	3.7	20.3	59
MH 160M VA	2	11	15	2940	87	88.9	89.1	0.87	19.74	6.5	2.0	2.2	3.0	40	77
MH 160M XA	2	15	20	2940	88.8	90.4	90.5	0.88	26.20	6.5	2.6	2.6	3.7	51.7	93
MH 160L XA	2	18.5	25	2950	89.5	91	91.1	0.88	32.11	6.5	2.8	3.0	4.2	64	107.8
MH 160L RA	2*	22 ⁽¹⁾	30 ⁽¹⁾	2940	89.7	91.5	91.5	0.89	37.59	6.5	2.5	2.5	3.7	64	108.7
3000 RPM (2 Pole)															
Cast Iron Frame															
MH 180M XG	2	22	30	2925	89.8	91.4	91.5	0.88	38.0	6.5	2.0	2.3	3.2	65	155
MH 180M RG	2*	30 ⁽¹⁾	40 ⁽¹⁾	2925	89.9	92	92.1	0.88	51.5	6.5	2.3	2.5	3.4	88	175
MH 200L LG	2	30	40	2945	89.8	91.7	92.2	0.88	51.4	6.5	2.0	2.0	3.0	120	212
MH 200L NG	2	37	50	2950	90.6	92.4	92.8	0.88	63.0	6.5	2.0	2.0	3.0	145	230
MH 225M N	2	45	60	2945	91.5	93	93.2	0.91	73.8	6.5	2.0	1.9	2.8	270	310
MH 250M N	2	55	75	2950	91.2	93	93.4	0.91	90.0	6.5	2.0	1.8	3.0	424	410
MH 280S T	2	75	100	2975	91.2	93.2	94	0.89	124.7	6.5	1.8	1.5	3.2	770	540
MH 280M T	2	90	125	2975	93.9	95.1	94.4	0.91	145.8	6.5	1.8	1.5	3.2	957	615
MH 315S YE	2	110	150	2975	93.1	94.7	95.3	0.89	180.4	6.5	1.8	1.5	3.2	1000	650
MH 315M ZE	2	132	180	2980	94	95.1	95.4	0.90	213.9	6.5	2.0	1.3	2.6	1200	810
MH 315L YE	2	160	220	2980	94.4	95.4	95.6	0.92	253.1	6.5	2.0	1.3	2.6	1400	900
MH 315L ZE	2	200 ⁽¹⁾	270 ⁽¹⁾	2980	94.6	95.5	95.7	0.93	312.6	6.5	2.0	1.3	2.7	1600	1000

1) Temperature rise to class F

* Higher output (progressive motor)

Note : Performance figures are subject to IS tolerance



Three - phase motors designed
for range of rated voltage
415 V ± 10% - 50 Hz ± 5%

Insulation class F with
temperature rise limited to class B

Type	Rated output		Rated speed RPM	Efficiency			Power factor cos φ	Rated current at 415 V I_N	Direct-on-line starting				Moment of inertia J 10 ⁻³ kgm ²	Weight kg	
	kW	HP		50%	75%	100%			starting current ratio I_s/I_N	Breakaway torque ratio M_A/M_N	Pull-up torque ratio M_S/M_N	Pull-out torque ratio M_K/M_N			
1500 RPM (4 Pole)															
Aluminium Frame															
MH 56Z AA	4	0.06	0.08	1300	45.9	47.9	51.9	0.58	0.28	2.6	2.1	2.0	2.1	0.14	3.2
MH 56Z BA	4*	0.09	0.12	1330	46.7	50.7	54.7	0.66	0.35	2.5	2.2	2.1	2.2	0.14	3.3
MH 63Z AA	4	0.12	0.16	1350	49.5	53.5	57.5	0.63	0.46	2.4	2.0	1.9	2.0	0.25	4.1
MH 63Z BA	4	0.18	0.25	1330	55.2	58.2	64.2	0.7	0.56	2.3	1.9	1.8	1.9	0.27	4.6
MH 63Z CA	4*	0.25	0.33	1360	55.3	58.8	64.3	0.76	0.71	2.7	2.2	2.0	2.1	0.30	4.9
MH 71Z AA	4	0.25	0.33	1340	57.7	61.7	66.7	0.65	0.80	3.2	1.9	1.8	2.0	0.63	5.2
MH 71Z BA	4	0.37	0.5	1370	65	68	72	0.71	1.01	3.3	2.2	2.1	2.2	0.76	5.4
MH 71Z CA	4*	0.55 ⁽¹⁾	0.75 ⁽¹⁾	1380	65.8	68.8	72.8	0.75	1.40	3.6	2.4	2.3	2.4	0.98	6.3
MH 80Z AA	4	0.55	0.75	1400	71.5	73.5	74.5	0.78	1.32	3.6	2.6	2.5	2.6	1.58	8.2
MH 80Z BA	4	0.75	1.0	1410	66.9	73.4	75	0.73	1.91	4.4	2.8	2.3	2.8	2.00	9.3
MH 80Z CA	4*	1.1 ⁽¹⁾	1.5 ⁽¹⁾	1385	75.9	78.2	77.7	0.81	2.43	4.4	2.5	2.5	2.6	2.41	10.6
MH 90S AA	4	1.1	1.5	1400	71.4	77.2	78.3	0.82	2.38	5.2	2.5	2.4	2.8	2.5	12.5
MH 90L BA	4	1.5	2.0	1400	77.2	80.3	80.2	0.81	3.21	5.7	2.8	2.6	3.0	3.13	14.5
MH 90L CA	4*	1.8 ⁽¹⁾	2.5 ⁽¹⁾	1380	78.5	81.2	80.7	0.83	3.74	5.5	2.7	2.5	2.9	3.13	14.5
MH 90L DA	4*	2.2 ⁽¹⁾	3.0 ⁽¹⁾	1400	79.4	82.4	82.4	0.82	4.53	4.8	2.9	2.8	3.2	4.05	17
MH 100L AA	4	2.2	3.0	1435	79.5	82.2	83	0.78	4.73	5.3	2.5	2.4	2.7	4.6	19.5
MH 100L BA	4	3	4.0	1425	83	84.7	84.1	0.8	6.20	4.6	2.4	2.3	2.5	5.58	22.5
MH 100L CA	4*	3.7	5.0 ⁽¹⁾	1400	83.5	84.4	83	0.82	7.56	6.0	2.6	2.4	2.9	6.05	25
MH 112M AA	4	3.7	5.0	1430	85.7	86.4	85.4	0.84	7.18	6.0	2.0	2.0	2.8	12.2	29.5
MH 112M BA	4*	5.5 ⁽¹⁾	7.5 ⁽¹⁾	1430	87	87.3	86.3	0.86	10.31	6.0	2.0	2.0	2.9	15.2	34
MH 132S ZA	4	5.5	7.5	1430	86.7	87.7	86.8	0.86	10.25	5.8	3.0	2.7	2.9	22	41.9
MH 132M ZA	4	7.5	10	1440	88.7	89.1	88	0.88	13.47	6.0	2.6	2.7	2.9	30	51
MH 132M RA	4*	9.3	12.5 ⁽¹⁾	1440	88.3	89.1	88.2	0.88	16.67	6.0	2.75	3.0	3.5	37.2	65
MH 132M TA	4*	11 ⁽¹⁾	15 ⁽¹⁾	1440	88.4	88.8	89.4	0.88	19.45	6.0	3.0	3.3	3.5	37.2	65
MH 160M XA	4	11	15	1460	89.3	90.1	89.5	0.83	20.60	6.0	2.1	2.2	2.9	81.2	88.5
MH 160L XA	4	15	20	1460	90.4	91.1	90.4	0.88	26.23	6.0	2.1	2.2	3.5	105.7	106.5
1500 RPM (4 Pole)															
Cast Iron Frame															
MH 180M XG	4	18.5	25	1460	91.7	92.5	92	0.87	32.2	6.0	2.2	2.2	3.0	105	150
MH 180L XG	4	22	30	1460	91.9	92.6	92	0.87	38.2	6.0	2.2	2.2	3.0	118	160
MH 180L RG	4*	30 ⁽¹⁾	40 ⁽¹⁾	1455	91.7	92.7	92.7	0.85	52.9	6.0	2.5	2.4	3.2	150	175
MH 200L NG	4	30	40	1465	91.8	92.9	92.8	0.87	51.7	6.0	2.0	1.8	2.6	195	225
MH 200L FG	4*	37 ⁽¹⁾	50 ⁽¹⁾	1465	92.5	93.2	93.2	0.86	64.2	6.0	2.2	2.0	2.8	248	255
MH 225S N	4	37	50	1475	91.4	92.7	92.8	0.87	63.8	5.9	2.75	2.1	2.9	356	290
MH 225M N	4	45	60	1475	92.3	93.3	93.2	0.88	76.3	6.0	2.0	2.0	2.9	461	330
MH 250M N	4	55	75	1475	93.3	94	93.8	0.87	93.8	6.0	2.0	2.1	2.4	640	385
MH 250M K	4*	75	100	1470	92.6	93.7	93.9	0.85	130.7	6.0	3.0	2.3	2.7	812	440
MH 280S T	4	75	100	1480	92.7	93.9	94	0.87	127.6	6.0	1.8	1.8	2.7	990	510
MH 280M T	4	90	125	1480	93.5	94.6	94.7	0.87	152.0	6.0	1.8	1.8	2.7	1260	565
MH 315S YE	4	110	150	1480	94.1	95	95	0.87	185.2	6.0	2.0	1.8	2.8	1400	620
MH 315M YE	4	132	180	1485	94.3	95.4	95.7	0.88	218.1	6.0	1.8	1.6	2.8	2200	860
MH 315M ZE	4	160	220	1485	94.8	95.7	95.9	0.9	257.9	6.0	1.8	1.5	2.8	2500	940
MH 315L ZE	4	200 ⁽¹⁾	270 ⁽¹⁾	1485	95.2	96	96.2	0.91	317.8	6.0	2.0	1.6	2.8	3100	1120

1) Temperature rise to class F

* Higher output (progressive motor)

Note : Performance figures are subject to IS tolerance



Three - phase motors designed
for range of rated voltage
415 V \pm 10% - 50 Hz \pm 5%

EFF 2

Insulation class F with
temperature rise limited to class B

Type	Rated output		Rated speed RPM	Efficiency			Power factor cos ϕ	Rated current at 415 V I_N	Direct-on-line starting			Moment of inertia J 10 ⁻³ kgm ²	Weight kg		
	kW	HP		50%	75%	100%			starting current ratio I_s/I_N	Breakaway torque ratio M_s/M_N	Pull-up torque ratio M_u/M_N			Pull-out torque ratio M_o/M_N	
1000 RPM (6 Pole)														Aluminium Frame	
MH 71Z AA	6	0.18	0.25	850	53	56	52	0.72	0.67	2.2	1.6	1.5	1.6	0.6	5.7
MH 71Z BA	6	0.25 ⁽¹⁾	0.33 ⁽¹⁾	870	54	58	60	0.7	0.83	2.5	1.7	1.6	1.7	0.9	6.3
MH 80Z AA	6	0.37	0.50	910	55	66	64	0.73	1.10	2.7	1.6	1.6	2.1	1.97	8
MH 80Z BA	6	0.55	0.75	910	63	67	70	0.72	1.52	2.9	2.2	2.1	2.1	2.47	9.4
MH 90S AA	6	0.75	1.0	910	73	75	73	0.72	1.99	2.9	1.7	1.5	1.7	3.18	11.6
MH 90L BA	6	1.1	1.5	908	74	76	75	0.72	2.83	3.0	1.7	1.5	1.7	4.78	15
MH 100L AA	6	1.5	2.0	930	74.5	79.5	76	0.73	3.76	3.7	1.8	1.8	2.3	6.73	17.5
MH 100L BA	6*	1.8	2.5	940	73	77	78	0.70	4.59	4.2	2.4	2.4	2.8	9.43	22
MH 112M AA	6	2.2	3.0	940	82.4	84.4	83.4	0.76	4.83	4.4	2.4	2.4	2.6	14.18	26
MH 112M BA	6*	3	4.0	940	84.2	85.2	85.2	0.77	6.36	5.3	2.9	2.9	2.9	18.7	39
MH 132S ZA	6	3	4.0	950	82.8	84.9	84.6	0.73	6.76	4.9	2.1	1.8	2.4	23.5	36.7
MH 132M YA	6	3.7	5.0	950	84.4	86.1	85.7	0.76	7.90	4.5	2.3	2.0	2.5	29.5	42.5
MH 132M ZA	6	5.5	7.5	950	85	86.4	85.8	0.76	11.73	4.1	2.3	1.9	2.2	37.3	55.5
MH 132M TA	6*	7.5 ⁽¹⁾	10 ⁽¹⁾	950	86.1	86.8	86.1	0.76	15.95	5.0	2.3	1.9	2.8	54.1	64.1
MH 160M ZA	6	7.5	10	970	87.8	88.7	88	0.76	15.60	3.9	1.9	1.8	1.6	81.2	99
MH 160L ZA	6	11	15	960	89.5	89.9	89	0.84	20.47	6.0	2.5	2.2	3.5	105.7	113.6
1000 RPM (6 Pole)														Cast Iron Frame	
MH 180L ZG	6	15	20	970	91.3	91.6	90.8	0.84	27.4	6.7	2.2	1.8	2.8	169	155
MH 200L PG	6	18.5	25	970	90.8	91.9	91.7	0.84	33.4	5.3	2.2	1.8	2.3	260	210
MH 200L RG	6	22	30	975	91.3	92.4	92.2	0.84	39.5	5.7	2.2	1.8	2.3	285	220
MH 225M P	6	30	40	975	92	93	92.8	0.84	53.5	5.7	2.3	1.6	2.3	536	290
MH 250M P	6	37	50	975	92	93.1	93	0.85	65.1	6.0	2.8	2.5	2.6	880	380
MH 280S V	6	45	60	985	92.5	93.6	93.5	0.87	77.0	5.6	1.8	1.5	2.4	1350	460
MH 280M V	6	55	75	985	92.5	93.7	93.6	0.87	94.0	5.6	1.8	1.5	2.4	1640	515
MH 315S YE	6	75	100	985	93.5	94.3	94.3	0.87	127.2	6.0	1.8	1.7	2.6	2200	620
MH 315M YE	6	90	125	988	94.5	95.1	94.8	0.88	150.1	6.0	2.0	2.0	2.6	3100	790
MH 315M ZE	6	110	150	987	94.8	95.3	95	0.88	183.1	6.0	2.0	2.0	2.6	3600	860
MH 315L ZE	6	132 ⁽¹⁾	180 ⁽¹⁾	987	95.3	95.6	95.2	0.89	216.7	6.0	2.0	2.0	2.5	4300	990

¹⁾ Temperature rise to class F

* Higher output (progressive motor)

Note : Performance figures are subject to IS tolerance



Three - phase motors designed
for range of rated voltage
415 V ± 10% - 50 Hz ± 5%

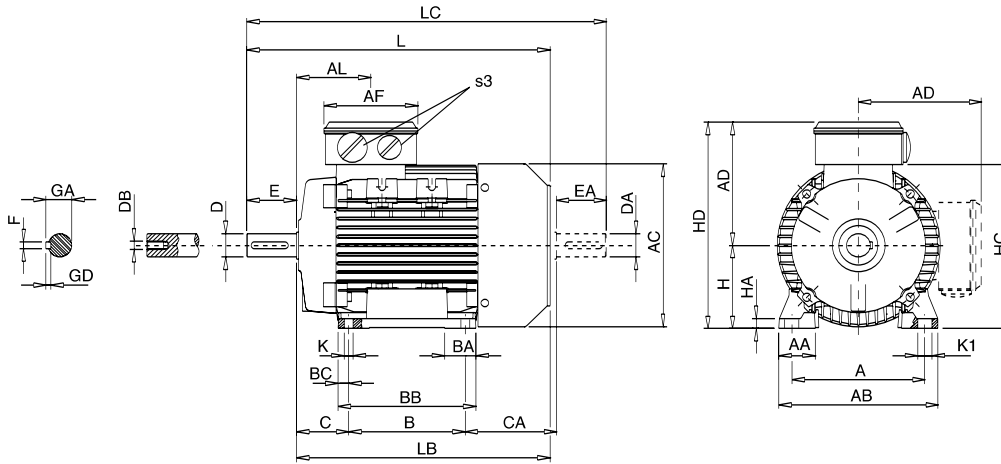
Insulation class F with
temperature rise limited to class B

Type	Rated output		Rated speed RPM	Efficiency			Power factor cos φ	Rated current at 415 V I _N	Direct-on-line starting			Moment of inertia J 10 ⁻³ kgm ²	Weight kg		
	kW	HP		50%	75%	100%			starting current ratio I _s /I _N	Breakaway torque ratio M _b /M _N	Pull-up torque ratio M _g /M _N			Pull-out torque ratio M _x /M _N	
750 RPM (8 Pole)														Aluminium Frame	
MH 71Z AA	8	0.12	0.16	670	47.7	51.7	52	0.55	0.58	2.4	2.5	2.4	2.5	0.90	6.3
MH 80Z AA	8	0.25	0.33	680	51.4	54.4	55	0.65	0.97	2.2	1.8	1.9	2.0	1.97	8.0
MH 90S AA	8	0.37	0.50	680	58.2	64.2	62.1	0.57	1.45	2.1	1.4	1.3	1.6	3.18	11.4
MH 90L BA	8	0.55	0.75	680	58.2	64.2	62.1	0.58	2.12	2.1	1.4	1.3	1.6	4.78	15.0
MH 100L AA	8	0.75	1.0	690	64.3	69.3	70.3	0.68	2.18	3.0	1.6	1.5	1.7	6.72	17.6
MH 100L BA	8	1.1	1.5	690	63.8	71.8	72	0.68	3.13	3.0	1.9	1.3	1.4	15.93	22.6
MH 112M AA	8	1.5	2.0	696	70.5	73.5	74.5	0.69	4.06	4.0	1.8	2.0	2.4	16.7	35
MH 132S ZA	8	2.2	3.0	710	82.5	83.7	82.2	0.69	5.40	3.4	1.7	1.6	1.7	29.5	45.5
MH 132M ZA	8	3	4.0	710	84.3	85.2	83.4	0.73	6.86	3.6	1.7	1.6	2.1	37.7	54.4
MH 160M YA	8	3.7	5.0	700	86.2	86.1	85.7	0.77	7.80	4.5	1.8	1.6	2.3	89.5	79.5
MH 160M ZA	8	5.5	7.5	720	86.7	86.7	86.3	0.77	11.52	4.0	1.8	1.6	2.3	119.5	90.5
MH 160L ZA	8	7.5	10	710	87.4	86.1	86.9	0.78	15.39	4.0	1.8	1.6	2.3	150.2	98
750 RPM (8 Pole)														Cast Iron Frame	
MH 180L ZG	8	11	15	725	87.7	88.8	87.9	0.78	22.3	4.6	2.1	1.4	1.9	215	175
MH 200L RG	8	15	20	730	88.1	89.7	89.4	0.78	29.9	5.3	2.3	1.9	2.5	285	220
MH 225S P	8	18.5	25	730	89.4	90.6	90.3	0.79	36.1	5.2	2.3	1.9	2.2	438	255
MH 225M P	8	22	30	730	89.5	90.7	90.3	0.79	42.9	5.6	2.5	2.0	2.3	538	285
MH 250M P	8	30	40	730	89.4	90.9	90.9	0.80	57.4	6.0	2.8	2.5	2.6	1080	400
MH 280S V	8	37	50	740	91.7	92.9	92.8	0.83	66.8	6.0	2.1	1.7	2.3	1520	480
MH 280M V	8	45	60	740	91.7	93	92.9	0.83	81.2	6.0	2.1	1.7	2.3	1860	500
MH 315S YE	8	55	75	738	92.6	93.4	93.1	0.84	97.8	6.0	2.1	1.7	2.3	2200	620
MH 315M YE	8	75	100	738	93.5	94.3	94.1	0.84	132.0	6.0	2.1	1.8	2.1	3100	790
MH 315M ZE	8	90	125	738	93.7	94.5	94.3	0.84	158.1	6.0	2.2	1.8	2.1	3600	900
MH 315L ZE	8	110 ⁽¹⁾	150	738	93.8	94.6	94.4	0.84	193.0	6.0	2.5	1.8	2.1	4300	990

¹⁾ Temperature rise to class F
Note : Performance figures are subject to IS tolerance

DIMENSIONS

Frame size 56 - 160
(Foot Mounted)

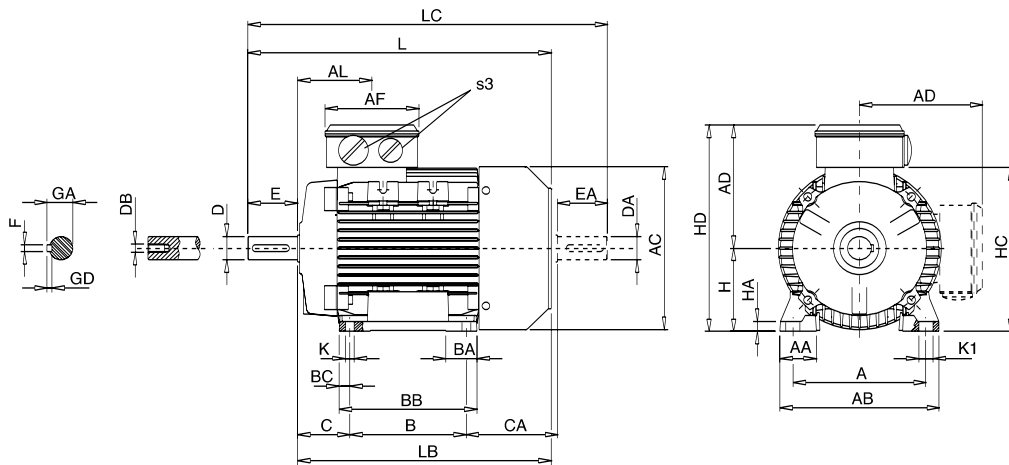


	H	A	B	C	K ⁽¹⁾	AB	BB	CA	AD ⁽²⁾	HD ⁽²⁾	AC	HC	HA	K ₁
56	56	90	71	36	6.5	107	86	65	92.3	148.3	110	108.8	8	9
63	63	100	80	40	7	119	100	72	96.5	159.5	123	119.5	8	11
71	71	112	90	45	8	135	109	83	111	182	139	142	8	11
80	80	125	100	50	10	153	125	89	139	219	155.6	162	9.5	14
90S	90	140	100	56	10	170	150	116	148	238	176.6	181	11	15
90L	90	140	125	56	10	170	150	88	148	238	176.6	181	11	15
100L	100	160	140	63	11	192	166	110	155	255	192	198	12	17
112M	112	190	140	70	12.5	220	175	126	171	283	221	226	15	19
132S	132	216	140	89	12	256	180	134	195	327	248	261	17	20
132M	132	216	178	89	12	256	218	136	195	327	248	261	17	20
132M	132	216	178	89	12	256	218	166	195	327	248	261	17	20
160M	160	254	210	108	14	320	270	180	240.5	400.5	317	317	23	18
160L	160	254	254	108	14	320	310	180	240.5	400.5	317	317	23	18

	L	LB	LC	AL	AF	BA	AA	D/DA	E/EA	F/FA	GD	GA/GC	DB ⁽³⁾
56	188	168	211	62	92	27	27	9	20	3	3	10.2	M3
63	211	188	238	66	92	29	30	11	23	4	4	12.5	M4
71	246	216	278	69	92	29	31	14	30	5	5	16	M5
80	273	233	319	79	110	28.5	35	19	40	6	6	21.5	M6
90S	317.5	267.5	372	84.5	110	28/53	37	24	50	8	7	27	M8
90L	317.5	267.5	372	84.5	110	28/53	37	24	50	8	7	27	M8
100L	366.5	306.5	433	91	110	38	44	28	60	8	7	31	M10
112M	387	327	456	91.5	110	46	48.5	28	60	8	7	31	M10
132S	443.5	363.5	523	100	133	45	59	38	80	10	8	41	M12
132M	483	403	563	120	133	45	59	38	80	10	8	41	M12
132M	500	420	593	120	133	45	59	38	80	10	8	41	M12
160M	610	500	718	146	150	65	76	42	110	12	8	45	M16
160L	654	544	762	168	150	65	76	42	110	12	8	45	M16

1) Clearance hole for screw
2) Maximum dimension
3) Centering holes in shaft extensions to DIN 332 part 2

Frame size 180 - 200
(Foot Mounted)



Cast iron frame

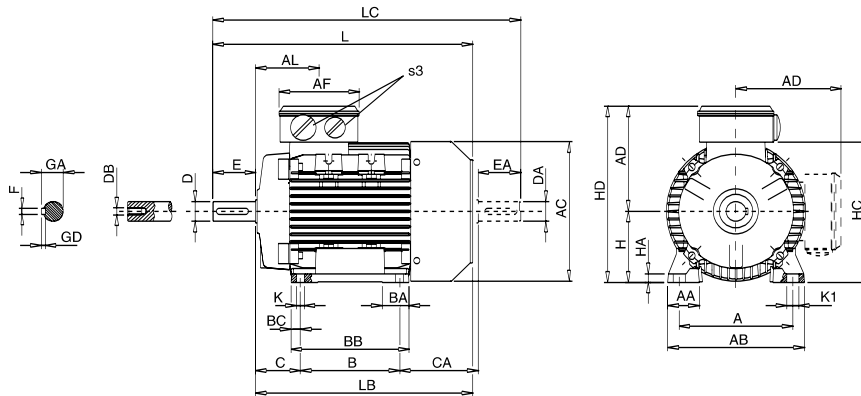
	H	A	B	C	K ⁽¹⁾	AB	BB	CA	AD ⁽²⁾	HD ⁽²⁾	AC	HC	HA	K _f
180M	180	279	241	121	14	330	316	256	290	470	355	360	15	18
180L	180	279	279	121	14	330	316	218	290	470	355	360	15	18
200L	200	318	305	133	18	380	360	237	341	541	379	400	18	18

	L	LB	LC	AL	AF	BA	AA	D/DA	E/EA	F/FA	GD	GA/GC	DB ⁽³⁾
180M	712	602	838	260.5	180	91	66	48	110	14	9	51.5	M16
180L	712	602	838	260.5	180	91	66	48	110	14	9	51.5	M16
200L	779	669	895	285.5	265	90	79	55	110	16	10	59	M20

1) Clearance hole for screw
 2) Maximum dimension
 3) Centering holes in shaft extensions to DIN 332 part 2



Frame size 225 - 315
(Foot Mounted)



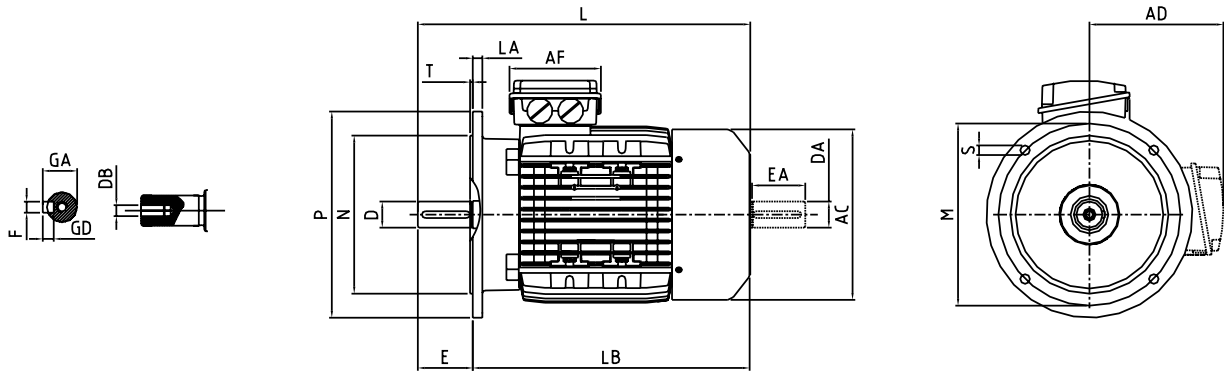
Cast Iron frame

	No. of	H	A	B	C	K ⁽¹⁾	AB	BB	CA	AD ⁽²⁾	HD ⁽²⁾	AC	HC	HA	K ₁	L
225S	2-4/2	225	356	286	149	18.5	420	375	318	360	585	443	450	22	18.5	857.5
	≥4	225	356	286	149	18.5	420	375	318	360	585	443	450	22	18.5	887.5
225M	2-4/2	225	356	311	149	18.5	420	375	318	360	585	443	450	22	18.5	857.5
	≥4	225	356	286	149	18.5	420	375	318	360	585	443	450	22	18.5	887.5
250M	2-4/2	250	406	349	168	22	500	425	321	390	640	494	500	45	28	970
	≥4	250	406	349	168	22	500	425	321	390	640	494	500	45	28	970
280S	2-4/2	280	457	368	190	22	560	450	325	423	703	494	564	50	28	1035.5
	≥4	280	457	368	190	22	560	450	325	423	703	494	564	50	28	1035.5
280M	2-4/2	280	457	419	190	22	560	500	325	423	703	494	564	50	28	1086.5
	≥4	280	457	419	190	22	560	500	325	423	703	494	564	50	28	1086.5
315S	2-4/2	315	508	406	216	28	630	547	365	423	738	506	599	50	35	1117
	≥4	315	508	406	216	28	630	547	315	423	738	506	599	50	35	1097
315S	2-4/2	315	508	406	216	28	630	547	342	515	830	620	660	55	35	1094
	≥4	315	508	406	216	28	630	547	342	515	830	620	660	55	35	1124
315M	2-4/2	315	508	457	216	28	630	547	291	515	830	620	660	55	35	1094
	≥4	315	508	457	216	28	630	547	291	515	830	620	660	55	35	1124
315L	2-4/2	315	508	508	216	28	630	598	360	515	830	620	660	55	35	1214
	≥4	315	508	508	216	28	630	598	360	515	830	620	660	55	35	1244

	No. of	LB	LC	AL ⁴	AF	BA	AA	D	DA	E	EA	F	FA	GD	GA	GC	DB ⁽³⁾
225S	2-4/2	747.5	973	304.5	265	95	90	55	55	110	110	16	16	10	59	59	M20
	≥4	747.5	1033	304.5	265	95	90	60	60	140	140	18	18	11	64	64	M20
225M	2-4/2	747.5	973	304.5	265	95	90	55	55	110	110	16	16	10	59	59	M20
	≥4	747.5	1033	304.5	265	95	90	60	60	140	140	18	18	11	64	64	M20
250M	2-4/2	830	1118	342.5	265	120	135	60	60	140	140	18	18	11	64	64	M20
	≥4	830	1118	342.5	265	120	135	65	65	140	140	18	18	11	69	69	M20
280S	2-4/2	895.5	1163	374	265	135	122	65	65	140	140	18	18	11	69	69	M20
	≥4	895.5	1163	374	265	135	122	75	75	140	140	20	20	12	79.5	79.5	M20
280M	2-4/2	946.5	1214	399.5	265	135	122	65	65	140	140	18	18	11	69	69	M20
	≥4	946.5	1214	399.5	265	135	122	75	75	140	140	20	20	12	79.5	79.5	M20
315S	2-4/2	977	1267	399.5	265	135	122	65	60	140	140	18	18	11	69	64	M20
	≥4	927	1247	399.5	265	135	122	80	70	170	140	22	20	14	85	74.5	M20
315S	2-4/2	954	1244	218	285	100	120	65	60	140	140	18	18	11	69	64	M20
	≥4	954	1274	218	285	100	120	80	70	170	140	22	20	14	85	74.5	M20
315M	2-4/2	954	1244	218	285	100	120	65	60	140	140	18	18	11	69	64	M20
	≥4	954	1274	218	285	100	120	80	70	170	140	22	20	14	85	74.5	M20
315L	2-4/2	1074	1364	218	285	100	120	65	60	140	140	18	18	11	69	64	M20
	≥4	1074	1364	218	285	100	120	80	70	170	140	22	20	14	85	74.5	M20

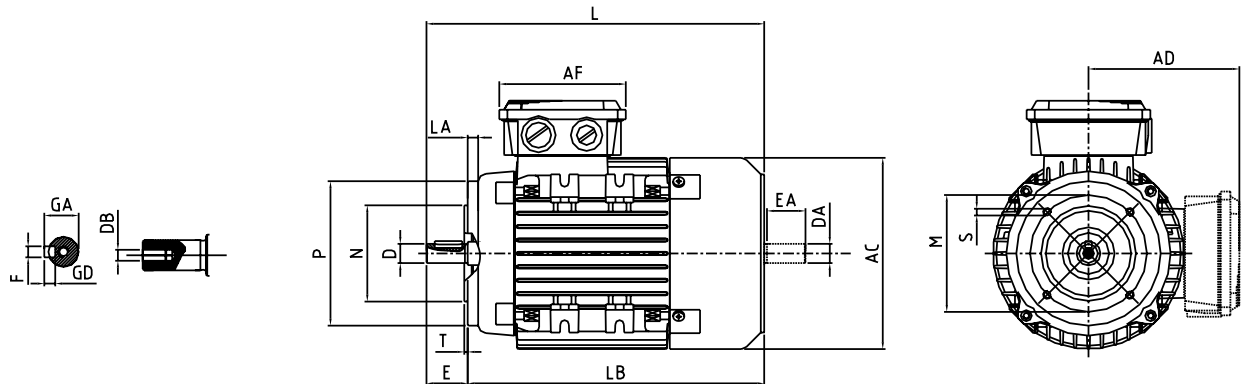
1) Clearance hole for screw
2) Maximum dimension
3) Centering holes in shaft extensions to DIN 332 part 2

Frame size 56-160
(Flange Mounted-B5)



Frame	Flange Dimensions						Shaft and Key						Overall Dimensions			
	P	N	LA	M	T	S	D/DA	E/EA	F h9	GD	GA	DB	AC	L	LB	AD
56	120	80	6.9	100	2.5	M6	9 j6	20	3	3	10.2	M3	110	188	168	92.3
63	140	95	8	115	3	M8	11 j6	23	4	4	12.5	M4	123	211	188	96.5
71	160	110	10	130	3.5	M8	14 j6	30	5	5	16	M5	139	246	216	111
80	200	130	10	165	3.5	M10	19 j6	40	6	6	21.5	M6	155.6	273	233	139
90S	200	130	12	165	3.5	M10	24 j6	50	8	7	27	M8	176.6	317.5	267.5	148
90L	200	130	12	165	3.5	M10	24 j6	50	8	7	27	M8	176.6	317.5	267.5	148
100L	250	180	14	215	4	M12	28 j6	60	8	7	31	M10	192	366.5	306.5	155
112M	250	180	14	215	4	M12	28 j6	60	8	7	31	M10	221	387	327	171
132S	300	230	14	265	4	M12	38 k6	80	10	8	41	M12	248	443.5	363.5	195
132M	300	230	14	265	4	M12	38 k6	80	10	8	41	M12	248	483	403	195
132M	300	230	14	265	4	M12	38 k6	80	10	8	41	M12	248	500	420	195
160M	350	250	15	300	5	M16	42 k6	110	12	8	45	M16	317	610	500	240.5
160L	350	250	15	300	5	M16	42 k6	110	12	8	45	M16	317	654	544	240.5

Frame size 56-160
(Face Mounted-B14)

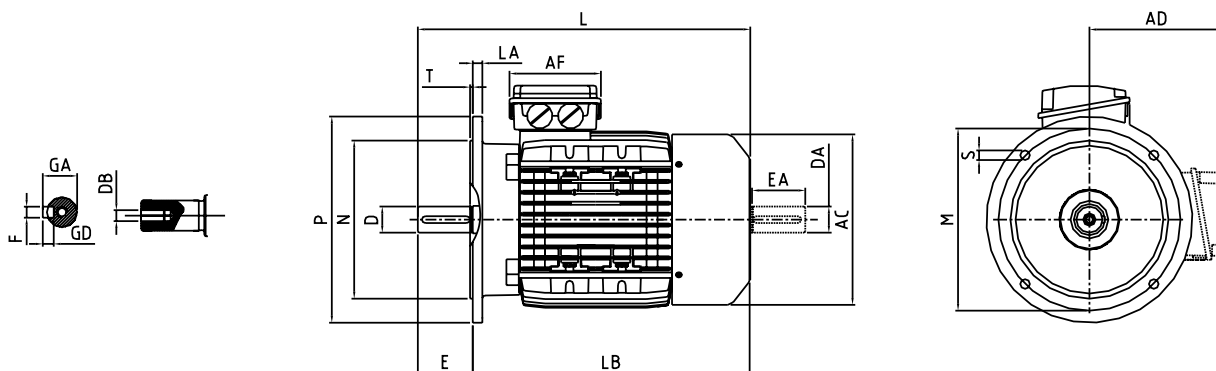


Frame	Flange Dimensions						Shaft and Key						Overall Dimensions			
	P	N	LA	M	T	S	D/DA	E/EA	F h9	GD	GA	DB	AC	L	LB	AD
56	80	50	8	65	2.5	M5	9 j6	20	3	3	10.2	M3	110	188	168	92.3
63	90	60	8.5	75	2.5	M5	11 j6	23	4	4	12.5	M4	123	211	188	96.5
71	105	70	7.6	85	2.5	M6	14 j6	30	5	5	16	M5	139	246	216	111
80	120	80	9.5	100	3	M6	19 j6	40	6	6	21.5	M6	155.6	273	233	139
90S	140	95	9	115	3	M8	24 j6	50	8	7	27	M8	176.6	317.5	267.5	148
90L	140	95	9	115	3	M8	24 j6	50	8	7	27	M8	176.6	317.5	267.5	148
100L	160	110	10	130	3.5	M8	28 j6	60	8	7	31	M10	192	366.5	306.5	155
112M	160	110	10	130	3.5	M8	28 j6	60	8	7	31	M10	221	387	327	171
132S	200	130	23	165	3.5	M10	38 k6	80	10	8	41	M12	248	443.5	363.5	195
132M	200	130	23	165	3.5	M10	38 k6	80	10	8	41	M12	248	483	403	195
132M	200	130	23	165	3.5	M10	38 k6	80	10	8	41	M12	248	500	420	195
160M	250	180	20	215	4	M12	42 k6	110	12	8	45	M16	317	610	500	240.5
160L	250	180	20	215	4	M12	42 k6	110	12	8	45	M16	317	654	544	240.5

1) Centering holes in shaft extension to DIN 332 part 2

Note : The overall dimensions (L) will remain similar to the foot (B3) mounted motors.

Frame size 180-315
(Flange Mounted)



Frame	Pole	Flange Dimensions						Shaft and Key						Overall Dimensions			
		P	N	LA	M	T	S	D/DA	E/EA	F h9	GD	GA	DB	AC	L	LB	AD
180M	-	350	250	13	300	5	M16	48 k6	110	14	9	51.5	M16	355	712	60	290
180L	-	350	250	13	300	5	M16	48 k6	110	14	9	51.5	M16	355	712	62	290
200L	-	400	300	15	350	5	M16	55 m6	110	16	10	59	M20	379	779	669	341
225S	2	450	350	16	400	5	M16	55 m6	110	16	10	59	M20	443	857.5	747.5	360
	≥4	450	350	16	400	5	M16	60 m6	140	18	11	64	M20	443	887.5	747.5	360
225M	2	450	350	16	400	5	M16	55 m6	110	16	10	59	M20	443	857.5	747.5	360
	≥4	450	350	16	400	5	M16	60 m6	140	18	11	64	M20	443	887.5	747.5	360
250M	2	550	450	18	500	5	M16	60 m6	140	18	11	64	M20	494	970	830	390
	≥4	550	450	18	500	5	M16	65 m6	140	18	11	69	M20	494	970	830	390
280S	2	550	450	18	500	5	M16	65 m6	140	18	11	69	M20	494	1035.5	895.5	423
	≥4	550	450	18	500	5	M16	75 m6	140	20	12	79.5	M20	494	1035.5	895.5	423
280M	2	550	450	18	500	5	M16	65 m6	140	18	11	69	M20	494	1086.5	946.5	423
	≥4	550	450	18	500	5	M16	75 m6	140	20	12	79.5	M20	494	1086.5	946.5	423
315S	2	660	550	22	600	6	M20	65 m6	140	18	11	69	M20	506	1117	977	423
	≥4	660	550	22	600	6	M20	80 m6	170	20	14	85	M20	506	1097	927	423
315S	2	660	550	22	600	6	M20	65 m6	140	18	11	69	M20	620	1094	954	515
	≥4	660	550	22	600	6	M20	80 m6	170	22	14	85	M20	620	1124	954	515
315M	2	660	550	22	600	6	M20	65 m6	140	18	11	69	M20	620	1094	954	515
	≥4	660	550	22	600	6	M20	80 m6	170	22	14	85	M20	620	1124	954	515
315M	2	660	550	22	600	6	M20	65 m6	140	18	11	69	M20	620	1214	1074	515
	≥4	660	550	22	600	6	M20	80 m6	170	22	14	85	M20	620	1244	1074	515

Note : The overall dimensions (L) will remain similar to the foot (B3) mounted motors.



Shipping Dimensions

Frame	Length (mm)	Width (mm)	Height (mm)	Volume per Pkg. (in Cu. Meter).	Gross Weight approx. (Kg)
56	235	150	185	0.007	6
63	260	210	200	0.011	8
71	280	220	240	0.015	10
80	300	245	250	0.018	15
90	370	280	250	0.026	22
100	410	280	295	0.034	32
112	450	320	300	0.043	45
132	530	310	385	0.063	72
160	790	385	520	0.158	120
180	820	500	520	0.213	225
200	895	575	610	0.314	320
225	1020	645	670	0.441	420
250	100	725	750	0.054	520
280	1250	795	805	0.800	750
315	1430	965	980	1.352	1300

Other Products

Building Circuit Protection



Compact Fluorescent Lamp (CFL)



Luminaires



Fans



Power & Flexible Cables



Energy Meters



Switches



Branch Offices :

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