



HAVELLS

Energy Efficient 3 Phase LV Induction Motors



Catalogue 2019

CE IE3 & IE2





About us

Havells India Ltd is a billion-dollar-plus organization, and is one of the largest & India's fastest growing electrical and power distribution equipment manufacturer with products ranging from Industrial & Domestic Circuit Protection Switchgear, Cables & Wires, Motors, Fans, Power Capacitors, CFL Lamps, Luminaires for Domestic, Commercial & Industrial applications, Modular Switches, & Bathfittings covering the entire gamut of household, commercial and industrial electrical needs.

Today, Havells owns some of the most prestigious global brands like Havells, Crabtree, Lloyd, Prompetc and Standard.

Its network constitutes of 4000 professionals, over 7575 dealers and 40 branches in the country. Our products are available in 40 countries. Its twelve state-of-the-art manufacturing plants in India located at Haridwar, Baddi, Noida, Sahibabad, Faridabad, Alwar, Neemrana, are manufacturing globally acclaimed products, synonymous with excellence and precision in the electrical industry.

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 land and where we manufacture energy efficient motors ranging from 0.37 kW - 350 kW (0.50 HP - 470 HP).

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 63-355 frame
- Automatic winding lines from 63-250 frame
- Automatic impregnation plant
- Vacuum impregnation plant
- Fully Automated temperature controlled paint stations
- Modern Automatic Type Test Plant
- 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



Shaft Machining



Rotor Run Out



Automatic Winding



Automatic Impregnation Plant



Assembly Line



Testing



Conveyerised Painting



Finished Product

Contents

	Page
Standard product specification	6
Indian & International standards	7
General	
Conditions of installations	8
Material	8
Tolerances (Electrical)	9
Mounting Arrangement	10
Degree of Protection	11
Effect of Variation of Voltage & Frequency	12
Overload	12
Insulation class and temprature rise	12
Installation at higher altitudes	13
Motor for 60 Hz Operation	14
Inverter duty operation	14
Electrical Design	
Connection diagrams	15
Electrical parameters	16
Speed Torque Characteristics	18
Starting methods	19
Thermal protection	20
Space heaters	21
Enclosure details	21
Mechanical Design	
Spare part description	22
Bearing details	23
Pulley diameter	23
Axial force	23
Permissible radial forces	24
Bearing Lubrication and maintenance	25
Permissible operating speed	25
Belt drive	25
Noise level	26
Vibration level	26
Terminal box	27
Cable size	27
Testing	28
Order data	29
Technical Data	30
GA Drawing	37-40
Terminal Box Drawing	41-45
Inverter, Crane & Smoke Motor	46-57

STANDARD PRODUCT SPECIFICATIONS

Motor Type	AC Three Phase Squirrel Cage Induction Motor
Reference Standard	IS:12615: 2014 (IEC 60034-1)
Voltage ± Variation	415 V ± 10%
Frequency ± Variation	50 Hz ± 5%
Combined Variation	10% (Absolute Sum)
Enclosure	TEFC
Mounting	Foot, Flange, Foot cum Flange, face, Foot cum Face
Frame Dimensions	As per IS 1231 & IS 2223
Altitude	Upto 1000 m
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
Connection / No. of Leads	Up to 2 HP - STAR /6 Leads & 3 HP delta / 6 Leads
Direction of Rotation	Bi-directional
Grease Type	Lithium Based Grease
Greasing Arrangements	Online greasing arrangement in 200 and above frame
Cooling	Shaft Mounted Fan
Paint	Smoke Grey
	Range
Output	0.37 kW - 350 kW (0.50 HP - 470 HP)
Voltage	220 V - 660 V
Frequency	25 Hz - 60 Hz
Ambient temperature	20 °C - 50 °C

Indian Standard for Electric Motors

The motors comply with the relevant standards and regulations;

Indian standards

IS 900:	1992	:Code of Practice for installation and maintenance of induction motors
IS 1231:	1974	:Dimensions of three phase foot mounted AC induction motors
IS 2223:	1983	:Dimensions of flange mounted AC induction motors
IS 2253:	1974	:Designations for types of construction and mounting arrangements of rotating electrical machines
IS 2254:	1985	:Dimensions of vertical shaft motors for pumps.
IS 2968:	1968	:Dimensions of slide rails for electric motors
IS4029:	2010	:Guide for testing three phase induction motors
IS 4691:	1985	:Degree of protection provided by enclosures for rotating electrical machinery
IS 4722:	1992	:Rotating electrical machines
IS 4728:	1975	:Terminal Marking and direction of rotation for rotation electrical machinery.
IS4889:	1968/IS 15999-2-1	:Methods of determination of efficiency of rotating electrical machines
IS 6362:	1995	:Designation of methods of cooling for rotating electrical machines
IS 7538:	1996	:Three phase squirrel cage induction motors for centrifugal pumps for agricultural applications
IS 7816:	1975	:Guide for testing insulation resistance of rotating machines
IS 8151:	1976	:Single speed three phase induction motors for driving lifts
IS 8789:	1996	:Value of performance characteristics for three phase induction motors.
IS 12065:	1987	:Permissible limits of noise levels for rotating electrical machines
IS 12075:	1986	:Mechanical vibration of rotating electrical machines, measurement, evaluation and limits of vibration severity
IS 12615:	2014	:Energy efficient three-phase –motors
IS 13529:	1992	:Guide on effects of unbalanced voltage on the performance of three phase induction motors
IS 13555:	1993	:Guide for selection and application of three-phase AC induction motors for different types of driven equipment.

GENERAL

Conditions of installation

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 °C 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.

Material

Motor parts	Frame size	Material
Stator frame	63 - 160	Aluminum alloy
	80 - 355	Cast iron
Endshield	63 - 112	Aluminum alloy
	80 - 355	Cast iron
Flanged endshield	63 - 112	Aluminum alloy
	80 - 355	Cast iron
Fan cover	63 - 71	Industrial nylon grade
	63 - 355	Sheet steel
Fan	63 - 355	Industrial nylon grade
Terminal box	63 - 71	Industrial nylon grade
	63 - 160	Aluminum alloy
	160 - 355	Sheet steel / Cast iron

Tolerances

For industrial motors conforming to IEC 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
Power factor ($\cos \varphi$)	$-\frac{1 - \cos \varphi}{6}$, minimum 0.02, maximum 0.07
Slip (s) (at rated load and at working temperature)	$\pm 20\%$ of the guaranteed slip at $P_N \geq 1$ kW $\pm 30\%$ 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)	$\pm 10\%$ of the guaranteed value

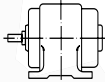
* P_N = Rated Power.

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)



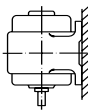
B7 - Horizontal wall mounted (RHS)



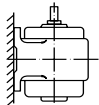
B8 - Horizontal ceiling mounted



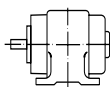
V5 - Wall mounted shaft down wards



V6 - Wall mounted shaft up wards

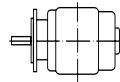


B34 - Horizontal base flange type 'C'

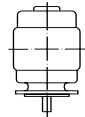


Flange mounting

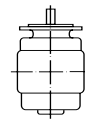
B5 - Flange type 'D'



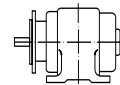
V1 - Vertical down wards flange type 'D'



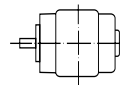
V3 - Vertical up wards flange type 'D'



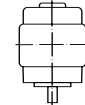
B35 - Horizontal base flange type 'D'



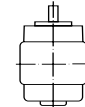
B14 - Horizontal face flange type 'C'



V18 - Vertical face down wards flange type 'C'



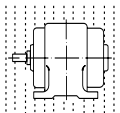
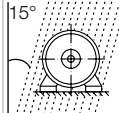
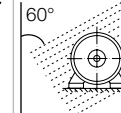
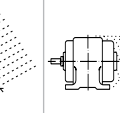
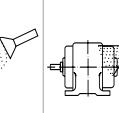
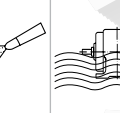


V19 - Vertical face up wards flange type 'C'



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

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 dropping 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

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 1.6 times the rated torque at rated voltage. This overload is according to IEC 60034-1 and will not result in excessive heating.

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 IEC 60034-1.

	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

Motors for 60 Hz operation

Motors wound for a certain voltage at 50 Hz can be operated at 60 Hz, without modification, subject to the following changes in their data.

Motor wound for 50 Hz and	Connected to 60 Hz and	Data at 60 Hz in percentage of values at 50 Hz						
		Output	r/min	I_N	I_S / I_N	T_N	T_S / T_N	T_{MAX} / T_N 1)
220 V	220 v	100	120	98	83	83	70	85
	225 v	115	120	100	100	96	95	98
380 V	380 V	100	120	98	83	83	70	85
	415 V	110	120	98	95	91	85	93
	440 V	115	120	100	100	96	95	98
	460 V	120	120	100	105	100	100	103
400 V	380 V	100	120	100	80	83	66	80
	400 V	100	120	98	83	83	70	85
	415 V	105	120	100	88	86	78	88
	440 V	110	120	100	95	91	85	93
	460 V	115	120	100	100	96	95	98
	480 V	120	120	100	105	100	100	100
415 V	415 V	100	120	98	83	83	70	85
	460 V	110	120	98	95	91	85	94
	480 V	115	120	100	100	96	95	98
500 V	500 V	100	120	98	83	83	70	85
	550 V	110	120	98	95	91	85	94
	575 V	115	120	100	100	96	95	98
	600 V	120	120	100	105	100	100	103

Efficiency, power factor and temperature rise will be approximately the same as at 50 Hz.

- 1)
- I_N = rated current N
 - I_S / I_N = starting current/rated current S N
 - T_N = rated torque N
 - T_S / T_N = maximum torque/rated torque max N
 - T_{MAX} / T_N = starting torque/rated torque

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 500 V at peak voltages \hat{U} 1460 V and du/dt 13 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.
- 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.

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:
 $I_{ph} = I_n$; $U_{ph} = U_n / 1.732$

where I_n is the line current and V_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:

$$I_{ph} = I_n / 1.732 ; U_{ph} = U_n$$

where I_n and U_n are referred to the delta connection.

Star-delta starting

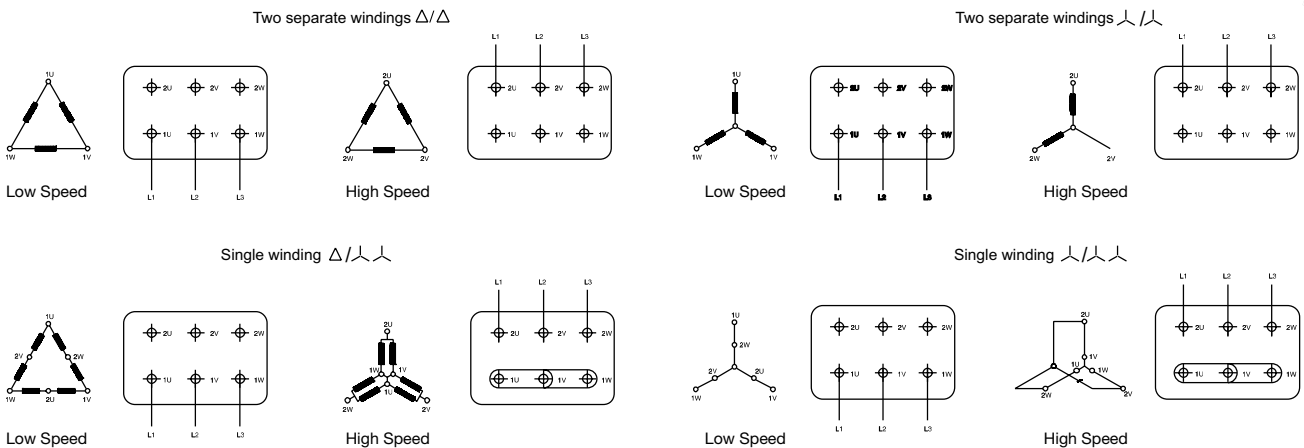
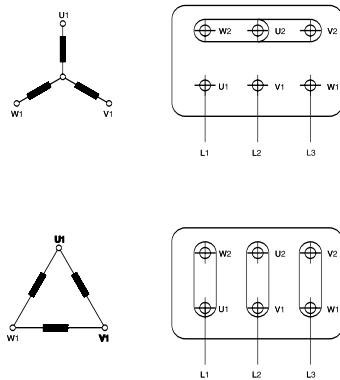
Star-delta starting allows a peak current reduction, ensuring however that the peak torque obtained is bigger than the resistant torque. Actually, it should be noted that the torque of an induction squirrel-cage motor is directly proportional to the square of the voltage. Motors whose rated voltage with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



Electrical Parameter

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 $\pm 10\%$
690 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 IEC 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 I_N

The rated currents listed in the data tables apply to an operating voltage of 415 V. 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

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

Output

The outputs stated in this catalogue are for constant load in continuous running duty S1 according to IEC 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.

Number of poles

Number of poles of the motor determine the basic speed (synchronous speed) of the motor. Standard motors are available in the configuration of 2,4,6 and 8-poles.

5. Power

Rated power is the shaft power of the motor with an ambient temperature not exceeding 50 °C and an altitude not exceeding 1000 m above mean sea level.

6. Rated speed, slip

Rated speed corresponds to the operating speed of the motor at the rated power when it is being fed at rated voltage and frequency.

The synchronous speed of an induction motor depends on the supply frequency and the number of poles of the stator winding.

Thus,

$$\eta_s = f/p \times 120 \text{ (r/min)}$$

where η_s = synchronous speed (r/min) s

f = frequency (Hz)

P = number of poles

note 2 p = number of poles

The rated speed given in the list is for motors operating at rated power under normal voltage and frequency.

The difference between synchronous speed, η_s and rotor speed, η_r ; referred to the synchronous speed, is called slip.

This slip, s, is expressed as a percentage;

$$s = \frac{\eta_s - \eta_r}{\eta_s} \times 100 \text{ (\%)}$$

When the motor is partly loaded the slip varies almost linearly with the load.

Starting current

Usually, given as a percentage or as a multiple of rated current, it is the value of the current drawn by the motor during starting.

The value of the starting current is generally between 500-700% (5-7 per unit) of the rated current.

Torque characteristics

Typical torque/speed characteristics of the motor is shown in figures on page no. 15 along with different relevant parameters.

The nominal torque of the motor T_N is the torque developed by the motor at rated speed, n while delivering rated power P. The relationship between the torque T_N , the power P, and n

the speed n is

$$T_N = 9550 \times P/n \text{ [Nm]}$$

Where P = power (kW)

T_N = motor speed (r/min)

alternatively, torque T, in kgm can be given as

$$T_N = 974 \times P/n \text{ [kgm]}$$

Starting torque of the motor T_s is the torque developed by the motor at zero speed when it is directly switched on.

Value of starting torque is usually given as a percentage or as a multiple of nominal motor torque T_N .

Pull out torque of the motor T_{max} is the maximum torque that the motor can develop when it is operated directly on line.

Value of pull out torque is usually given as a percentage or as a multiple of nominal motor torque T_N .

Moment of Inertia

The moment of inertia J is given in kgm². The moment of inertia is numerically equal to 1/4 GD². The moment of

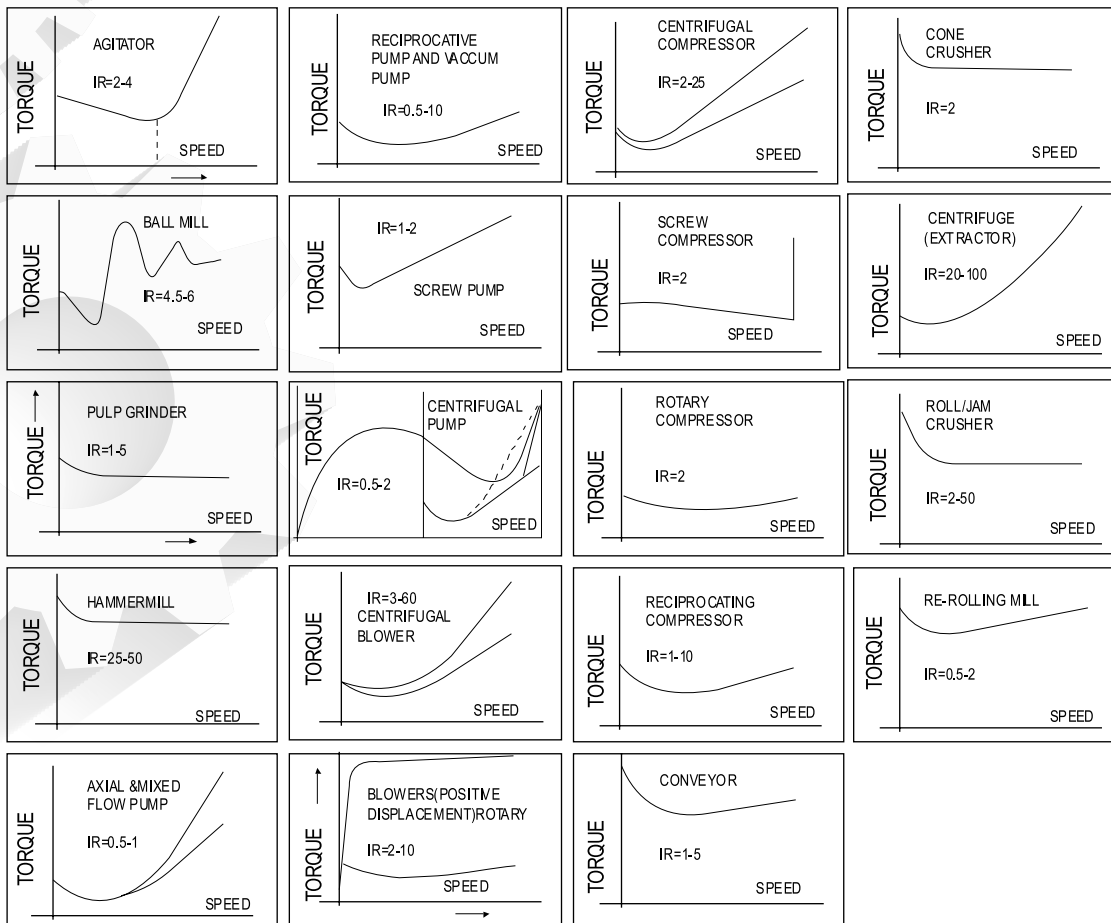
inertia J_L of the driven machine at n_L r/min when referred to motor speed n r/min is given by $J = J_L [n_L/n]^2$.

Overloads

In accordance with IEC 60034-1 Motors are rated to withstand an overload, an excess torque of 60% of their rated torque at rated voltage and frequency for 15 seconds.

Speed Torque Characteristics

Typical Speed Torque characteristics for few applications are shown below:



Note: These characteristics are exemplary and the values of Torque, Inertia Ratio etc. are given based on experience of normal applications. These values should be verified in actual before forming any reference.

Starting methods for AC motors

Reducing electrical and mechanical stress at start-up

The starting current of an AC motor can vary from 3 to 7 times the nominal current. This is because a large amount of energy is required to magnetise the motor enough to overcome the inertia the system has at standstill. The high current drawn from the network can cause problems such as voltage drop, high transients and in some cases, uncontrolled shutdown. High starting current also causes great mechanical stress on the motor's rotor bars and windings and can affect the driven equipment and the foundations. Several starting methods exist, all aiming to reduce these stresses. The load, the motor and the supply network determine the most appropriate starting method. When selecting and dimensioning the starting equipment and any protective devices, the following factors must be taken into account:

- The voltage drop in the supply network when starting the motor
- The required load torque during start
- The required starting time

Direct-on-line (DOL) start:

Direct on line starting is suitable for stable supplies and mechanically stiff and well dimensioned systems. It is the simplest, cheapest and most common starting method. Starting equipment for small motors that do not start and stop frequently is simple, often consisting of a hand operated motor protection circuit breaker. Larger motors and motors that start and stop frequently, or have some kind of control system, normally use a direct-on-line starter which can consist of a contactor plus overload protection, such as a thermal relay.

Star-Delta (Y/D) starting:

Most low voltage motors can be connected to run at either 400 V with delta connection or at 690 V with star connection. This flexibility can also be used to start the motor with a lower voltage. Star/delta connection gives a low starting current of only about one third of that during direct-online starting, although this also reduces the starting torque to about 25%. The motor is started with Y-connection and accelerated as far as possible, then switched to D-connection. This method can only be used with induction motors delta connected for the supply voltage.

Soft starters

Soft starters are based on semiconductors, which, via a power circuit and a control circuit, initially reduce the motor voltage, resulting in lower motor torque. During the starting process, the soft starter progressively increases the motor voltage so that the motor becomes strong enough to accelerate the load to rated speed without causing torque or current peaks. Soft starters can also be used to control the stopping of a process. Soft starters are less costly than frequency converters but like frequency converters, they may inject harmonic currents into the grid, disrupting other processes.

Frequency converter start

Although a frequency converter is designed for continuous feeding of motors, can also be used exclusively for start-up only. The frequency converter enables low starting current because the motor can produce rated torque at rated current from zero to full speed. As the price of frequency converters continues to drop, they are increasingly replacing soft starters. However in most cases they are still more expensive than soft starters, and like these, they inject harmonic currents into the network.

Thermal protection

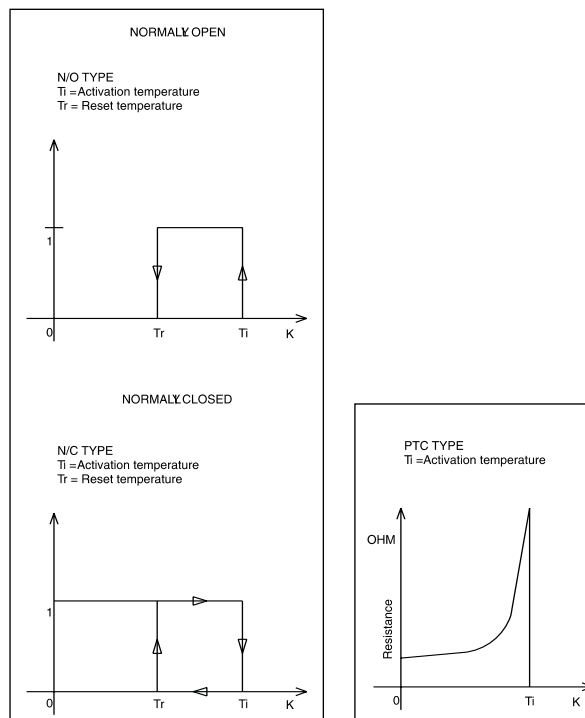
The decision on a particular type of thermal protection should be taken according to the actual operating conditions. Motors may be protected by means of current-dependent thermal protection switches, over current relays and temperature detectors.

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.



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) r/min
Temperature range	-20 °C to + 85 °C
Degree of protection	IP 55

Enclosure

Frames 56 to 112 M are of diecast aluminum. Foot mounted stators have integral feet. TEFC & TE motors have integral longitudinal ribs for effective heat transfer.

The stator & end shields are machined to close tolerances for providing perfect alignment & fits.

Terminal boxes of frames up to 132 M are of diecast aluminum alloy. Frame 160 & above have sheet metal/cast iron terminal box. All joints in terminal box are sealed with gaskets. Motors above frame 160 have drain holes at their lowest position as a standard features.

Core

Both stator and rotor cores are made of high quality magnetic steel.

Windings

Stator windings consists of modified polyester enamel covered copper wire. Motor with higher temperature windings wires can also be supplied as per customer requirement.

Insulation

All motors are made with class F insulation as a standard feature.

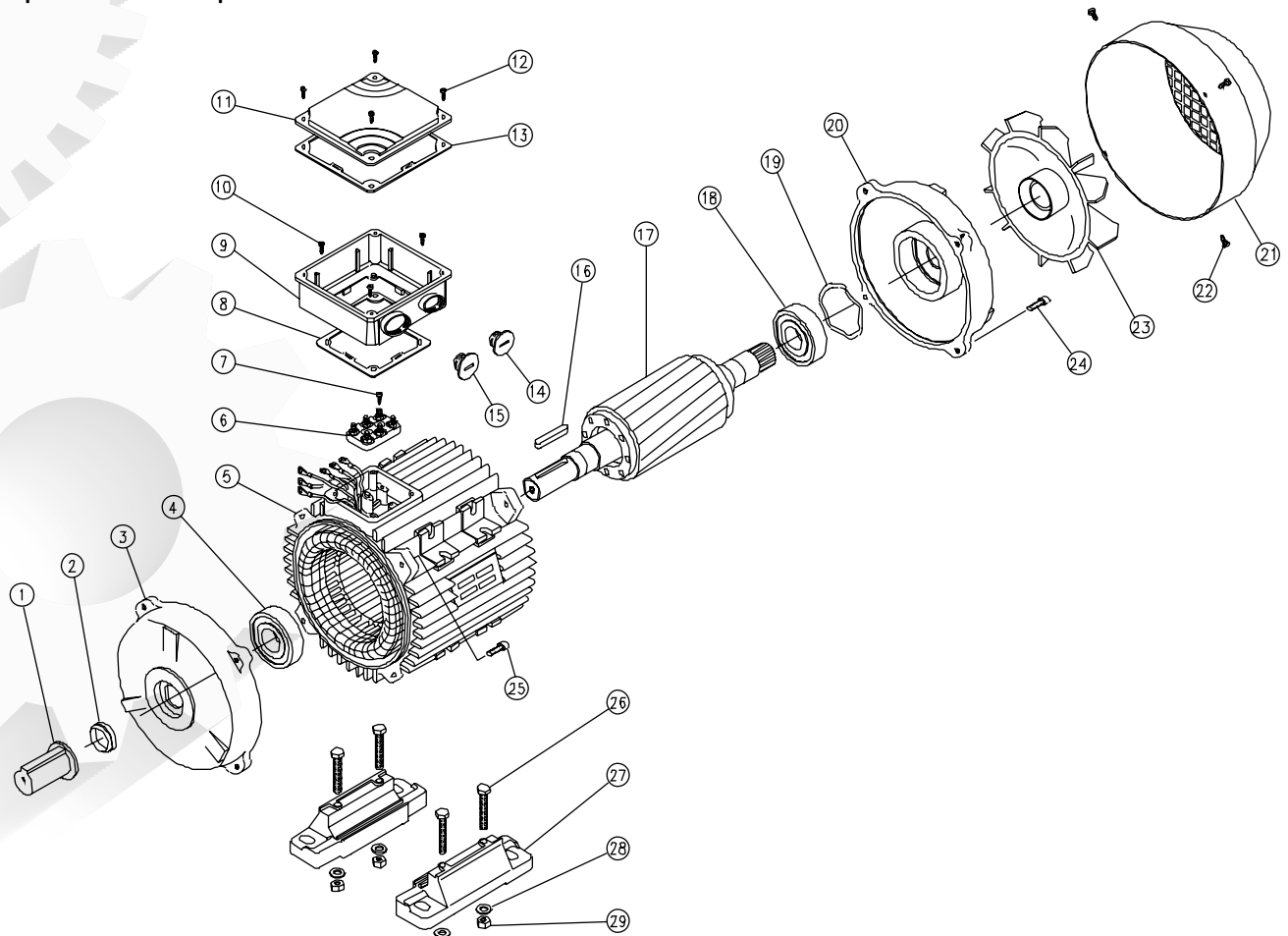
The slot liners are either provided with double cuffing or edge binding at the slot mouth portion to strengthen the insulation. For frame 160 & above class F varnish is used for impregnating the winding. Epoxy gel coat can be provided as per requirement to withstand the electrical and mechanical stresses. Surge testing is carried out on all windings in addition to all other tests ensuring healthiness of windings.

Rotor

The rotor of SCR motors are made of pressure diecast aluminum (or alloy in case of special designs) up to frame 355 L.

MECHANICAL DESIGN

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)

Bearing details

Classification of bearings (standard design)

Frame size	No. of poles	Drive end	Non-drive end
56	2 & 4	6201-2Z	6201-2Z
63	2 & 4	6202-2Z	6202-2Z
71	2 - 8	6203-2Z	6203-2Z
80	2 - 8	6204-2Z C3	6204-2Z C3
90	2 - 8	6205-2Z C3	6205-2Z C3
100	2 - 8	6206-2Z C3	6206-2Z C3
112	2 - 8	6206-2Z C3	6206-2Z C3
132	2 - 8	6208-2Z C3	6208-2Z C3

Frame size	No. of poles	Drive end	Non-drive end
160	2 - 8	6309-2Z C3	6209-2Z C3
180	2 - 8	6310-2Z C3	6310-2Z C3
200	2 - 8	6312-C3	6312-C3
225	2 - 8	6313-C3	6313-C3
250	2 - 8	6314 C3	6314 C3
280	2	6314 C3	6314 C3
280	4 - 8	6317 C3	6317 C3
315	2	6317 C3	6317 C3
315	4 - 8	NU319 C3	6319 C3
355	2	6319 C3	6319 C3
355	4 - 8	NU322 C3	6322 C3

Recommended pulley diameters

Sync. r/min	Frame	63	71	80	90	100	112	132	160	180	200	225	250	280	315	355
3000	Pulley Dia (mm)	75	75	75	75	75	100	120	120	125	130	170	180	300	500	600
1500 and below	Pulley Dia (mm)	75	75	75	75	75	100	120	180	200	220	260	220	220	420	450
	Face width (mm)	30	40	50	63	80	100	125	177	203	280	330	380	380	380	400

Maximum permissible axial forces without additional radial forces*

Frame size	3000 r/min kN	Horizontal shaft				Vertical shaft - force upwards				Vertical shaft - force downwards			
		1500 r/min kN	1000 r/min kN	750 r/min kN	3000 r/min kN	1500 r/min kN	1000 r/min kN	750 r/min kN	3000 r/min kN	1500 r/min kN	1000 r/min kN	750 r/min 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

Permissible radial forces

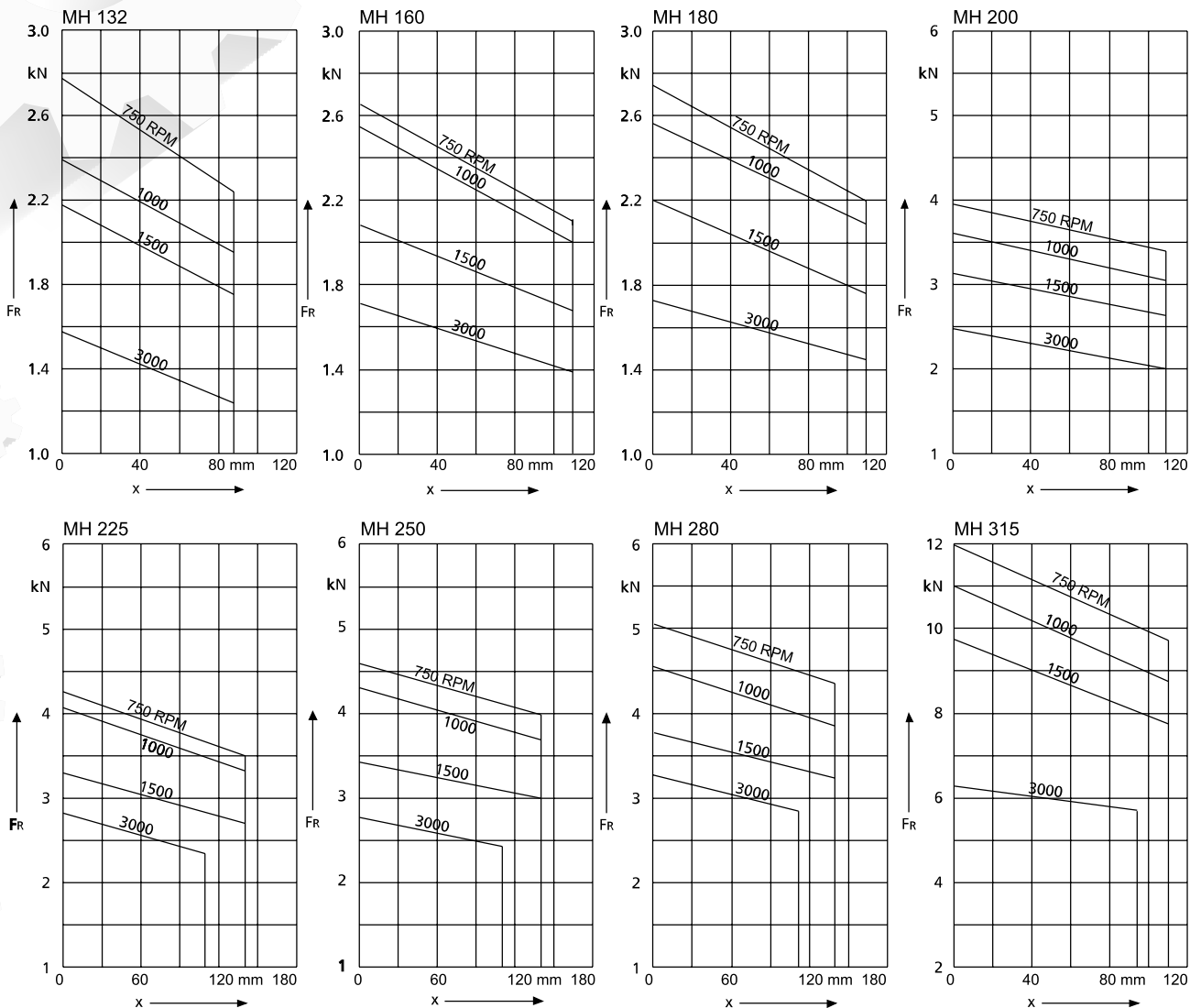
without additional axial force
(Ball bearings)

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



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 r/min	4 - 8 Pole r/min
63-112	3600	1800
132-180	6000	6000
200	5000	5000
225	4500	4500
250	4300	4300
280	3600	2600
315	3600	2300
355	3600	2200

Belt drive

The data apply only to the normal drive end shaft extension of 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.

Noise level

The permitted noise levels of electrical machines are fixed in IS 12065 / IEC 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. 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}
63	80	76		
71	80	76	76	
80	80	76	76	72
90	85	78	76	72
100	89	83	75	72
112	89	83	75	75
132	90	87	80	78
160	98	91	84	80
180	98	93	89	81
200	99	93	89	85
225	101	96	92	86
250	101	96	92	88
280	107	104	97	92
315	110	106	104	96
355	112	109	106	100

Vibration level

The amplitude of vibration in electric motors is governed by IS 12075 / IEC 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.

The maximum level of vibrations measured as per IS 12075-1987 are: max vibration velocity, mm/s rms are:

Pole	Frame 71-132	Frame 160-225	Above Frame 225
2P	1.8	2.8	4.5
4P-8P	1.8	1.8	2.8

If the machine vibrates even after proper alignment on an amply sized foundation, this could be caused by incorrectly balanced pulley, coupling shaft or similar, fitted to the shaft. Other causes could be weak foundation structure generation vibrations.

Terminal box

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 63 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.

Cable size

Frame	Maximum Cable Size		No. of Terminals	Terminal			Cable Entry Size		
	Main DOL	Stud Size Star/Delta		Main	Earth	Nos.			
63 - 71	4Cx4 mm ²	–	6	M4	M4	2	M16	M20	-
80	4Cx4 mm ²	–	6	M4	M4	2	M20	M25	-
90	4Cx10 mm ²	4Cx10 mm ²	6	M5	M4	2	M20	M25	-
100	4Cx10 mm ²	–	6	M5	M4	2	M20	M25	-
112	4Cx10 mm ²	4Cx10 mm ²	6	M5	M4	2	M20	M25	-
132	4Cx10 mm ²	4Cx10 mm ²	6	M5	M4	2	M32	M32	-
160	3Cx50 mm ²	2x3Cx35 mm ²	6	M6	M4	2	M40	M40	-
180	3Cx50 mm ²	2x3Cx35 mm ²	6	M8	M5	2	M40	M40	M20
200	3Cx50 mm ²	2x3Cx35 mm ²	6	M8	M5	2	M50	M50	M25
225	3Cx120 mm ²	2x3Cx95 mm ²	6	M10	M6	2	M50	M50	M25
250	3Cx120 mm ²	2x3Cx95 mm ²	6	M10	M6	2	M50 / M63	M50 / M63	M25
280	3Cx120 mm ²	2x3Cx95 mm ²	6	M10	M6	2	M63	M63	-
315	3Cx400 mm ²	2x3Cx300 mm ²	6	M16	M8	2	M63	M63	-
355	3Cx400 mm ²	2x3Cx300 mm ²	6	M20	M8	2	M63	M63	-

Testing of Motors

All motors are tested in accordance with IEC 60034-1.

Type Tests

The following tests are carried out on one motor in a batch production or on motors specially required to be type tested as per customer's requirement. All tests included in routine tests and following additional tests are carried on the motor.

- a. Measurement of stator resistance
- b. No Load Test
- c. Locked rotor test at reduced voltage and measurement of current, voltage & power input of motors.
- d. Full load reading of voltage, current, power input and slip.
- e. Temperature rise test The temperature rise of the motor after being run on full load till steady state is reached
- f. Resistance method-Momentary overload test
- g. Insulation resistance test
- h. High voltage test

Routine Tests

The following are the routine tests carried out on each and every motor.

- a. Measurement of resistance
- b. Insulation resistance test.
- c. Motors are tested at $1/\sqrt{3}$ times the rated voltage for checking the ability of the motor to run up to the full speed, when switched in either direction.
- d. No load test. This test is carried out at rated voltage and the readings for current, r/min & power input are noted.
- e. Locked rotor test This test is carried at a reduced voltage and the readings for current and power input are noted.
- f. High voltage test

The meters used for noting the above readings have class 0.5 class accuracy.

Other Tests

Apart from the above tests mentioned in the Indian Standards, following additional tests can be offered.

- a. Over speed test Running of motor at 1.2 times the maximum rated speed for 2 Mins at no load.
- b. Vibration test Carried out as per IS :12075
- c. Noise level of the motors measured as per IS:12065

Order Data

Motor Code

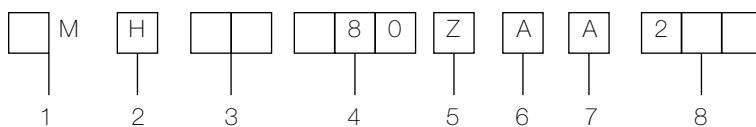
Apart from other information, it is necessary to specify the exact type designation in all enquiries, when ordering spare parts or replacement motors or when asking for documentary information.

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
		H	Three-phase motor, efficiency to EPACT regulations / IE1
		HE	Three-phase motor, efficiency EFF 1 to CEMEP Voluntary Agreement
		EE	Three-phase motor, IE2
		HP	Three-phase motor, IE3
4	Shaft centre height	56, 63, 71, 80, 90, 100, 112, 132, 160, 180, 200, 225, 250, 280, 315, 355	
5	Frame length	Z	Totally enclosed (TE)
		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



Prima Series (Performance Chart)

Efficiency Class: IE3	
Three-Phase Squirrel Cage Induction Motor	
Voltage	415±10%
Frequency	50±5%
Ambient	50 °C
Duty	S1
Class of Insulation	F
Type of enclosure	TEFC(IC411)
Temperature Rise	Limited to Class B

3000 r/min (2 Pole)

Frame Size	Output		Speed r/min	Efficiency			Power Factor (Cos j)			Rated Current A	DIRECT-ON-LINE STARTING			Moment of inertia GD ² (kgm ²)	Net Weight kg (Approx.)
	kW	HP		100%	75%	50%	100%	75%	50%		Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)		
MHHP71ZAA2	0.37	0.5	2830	73.8	73.8	72.6	0.78	0.73	0.66	0.9	550	210	240	0.00232	8
MHHP71ZBA2	0.55	0.75	2830	77.8	77.8	76.7	0.8	0.75	0.68	1.2	550	200	240	0.00255	8.3
MHHP80ZAA2	0.75	1.0	2840	80.7	80.7	79.6	0.82	0.78	0.72	1.6	650	220	240	0.0042	16
MHHP80ZBA2	1.1	1.5	2850	82.7	82.7	81.7	0.82	0.78	0.72	2.3	650	230	260	0.00462	16.4
MHHP90SAA2	1.5	2.0	2860	84.2	84.2	83.1	0.85	0.81	0.75	2.9	700	220	250	0.0115	22
MHHP90LCA2	2.2	3.0	2860	85.9	85.9	84.8	0.88	0.84	0.78	4.0	750	220	250	0.0123	23
MHHP100LBA2	3.7	5.0	2920	87.8	87.8	86.8	0.86	0.83	0.77	6.8	750	220	250	0.018	32
MHHP132SZA2	5.5	7.5	2900	89.2	89.2	88.3	0.89	0.86	0.81	9.6	750	220	250	0.0684	58
MHHP132STA2	7.5	10	2900	90.1	90.1	89.2	0.90	0.87	0.82	12.9	750	230	250	0.0714	65
MHHP160MYA2	11	15	2930	91.2	91.2	90.3	0.88	0.85	0.80	19.1	750	220	250	0.246	115
MHHP160MZA2	15	20	2930	91.9	91.9	91	0.89	0.86	0.81	25.5	750	220	250	0.284	135
MHHP160LZA2	18.5	25	2930	92.4	92.4	91.5	0.9	0.87	0.82	31.0	750	220	240	0.359	138
MHHP180MZA2	22	30	2935	92.7	92.7	91.8	0.9	0.87	0.82	36.7	750	220	250	0.414	172
MHHP200LPG2	30	40	2950	93.3	93.3	92.4	0.9	0.87	0.82	49.7	750	200	245	0.775	243
MHHP200LRG2	37	50	2950	93.7	93.7	92.8	0.88	0.85	0.80	62.4	750	220	250	0.99	256
MHHP225MP2	45	60	2950	94	94	93.1	0.9	0.88	0.84	74.0	750	220	250	1.78	330
MHHP250MP2	55	75	2950	94.3	94.3	93.4	0.90	0.88	0.84	90.2	750	200	240	2.145	421
MHHP280SV2	75	100	2975	94.7	94.7	93.8	0.92	0.90	0.86	119.8	750	210	250	4.635	656
MHHP280MV2	90	120	2975	95	95	94.1	0.91	0.89	0.85	144.8	750	220	250	5.319	660
MHHP315SYE2	110	150	2985	95.2	95.2	94.3	0.91	0.90	0.87	176.7	750	180	220	6.59	990
MHHP315MZE2	132	180	2980	95.4	95.4	94.5	0.91	0.90	0.87	211.5	750	200	230	7.644	1060
MHEE315LYE2	160	220	2980	95.6	95.6	94.5	0.92	0.91	0.88	253.1	750	200	245	8.736	1214
MHHP315LZE2	200	270	2985	95.8	95.8	94.7	0.92	0.91	0.88	315.7	750	180	220	11.32	1280
MHHP355MB2	250	340	2985	95.8	95.8	94.9	0.92	0.91	0.89	394.6	750	180	220	19.4	1700
MHHP355LB2	315	430	2985	95.8	95.8	94.9	0.92	0.91	0.89	497.2	750	180	220	26.77	2260

Note: All performance figures are in accordance with IEC 60034-30-1:2014

Prima Series (Performance Chart)

Efficiency Class: IE3	
Three-Phase Squirrel Cage Induction Motor	
Voltage	415±10%
Frequency	50±5%
Ambient	50 °C
Duty	S1
Class of Insulation	F
Type of enclosure	TEFC(IC411)
Temperature Rise	Limited to Class B

1500 r/min (4 Pole)

Frame Size	Output		Speed r/min	Efficiency			Power Factor (Cos j)			Rated Current A	DIRECT-ON-LINE STARTING			Moment of inertia GD ² (kgm ²)	Net Weight kg (Approx.)
	kW	HP		100%	75%	50%	100%	75%	50%		Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)		
MHHP71ZAA4	0.37	0.5	1385	77.3	77.3	74.3	0.73	0.67	0.58	0.91	650	200	240	0.00392	8
MHHP80ZAA4	0.55	0.75	1400	80.8	80.8	79.9	0.75	0.69	0.60	1.3	600	220	240	0.00964	15
MHHP80ZBA4	0.75	1.0	1420	82.5	82.5	81.5	0.74	0.69	0.61	1.7	650	220	260	0.0108	16.5
MHHP90SAA4	1.1	1.5	1430	84.1	84.1	83.1	0.79	0.74	0.67	2.3	650	220	250	0.022	24
MHHP90LBA4	1.5	2	1430	85.3	85.3	84.4	0.83	0.79	0.71	2.9	650	210	250	0.025	26
MHHP100LAA4	2.2	3	1455	86.7	86.7	85.8	0.78	0.74	0.66	4.5	700	210	240	0.0462	33
MHHP112MAA4	3.7	5	1450	88.4	88.4	87.5	0.82	0.78	0.71	7.1	700	220	250	0.0608	42
MHHP132SZA4	5.5	7.5	1450	89.6	89.6	88.7	0.81	0.77	0.70	10.5	700	230	260	0.148	64
MHHP132MZA4	7.5	10	1450	90.4	90.4	89.5	0.82	0.78	0.71	14.1	700	220	250	0.1628	77
MHHP160MZA4	11	15	1460	91.4	91.4	90.5	0.85	0.81	0.74	19.7	720	210	260	0.456	117
MHHP160LZA4	15	20	1465	92.1	92.1	91.2	0.85	0.81	0.74	26.7	720	210	250	0.501	139
MHHP180MZA4	18.5	25	1465	92.6	92.6	91.7	0.83	0.79	0.72	33.5	650	215	250	0.68	170
MHHP180LZA4	22	30	1465	93	93	92.1	0.85	0.81	0.75	38.7	700	200	250	0.742	173
MHHP200LRG4	30	40	1465	93.6	93.6	92.7	0.83	0.80	0.73	53.7	700	210	250	1.6	262
MHHP225SP4	37	50	1475	93.9	93.9	93	0.85	0.82	0.75	64.5	700	220	260	1.84	297
MHHP225MP4	45	60	1475	94.2	94.2	93.3	0.86	0.83	0.77	77.3	700	220	250	2.112	334
MHHP250MP4	55	75	1475	94.6	94.6	93.9	0.86	0.83	0.77	94.1	700	240	265	3.85	440
MHHP280SV4	75	100	1485	95	95	94.1	0.87	0.84	0.78	126	750	220	250	4.928	650
MHHP280MG4	90	120	1485	95.2	95.2	94.3	0.88	0.85	0.80	149.5	750	220	250	6.424	668
MHHP315SYE4	110	150	1490	95.4	95.4	94.5	0.88	0.86	0.81	182.3	750	220	250	13.68	980
MHHP315MYE4	132	180	1490	95.6	95.6	94.7	0.88	0.86	0.81	218.3	750	200	230	15.92	1328
MHHP315LYE4	160	220	1490	95.8	95.8	94.9	0.89	0.87	0.82	261	750	220	250	18.17	1510
MHHP315LZE4	200	270	1490	96	96	95.1	0.89	0.88	0.83	326	750	220	250	20.812	1618
MHHP355MB4	250	340	1490	96	96	95.1	0.90	0.89	0.85	402.6	750	220	250	30.58	1810
MHHP355LA4	315	425	1490	96	96	95.1	0.90	0.89	0.85	507.2	750	220	250	38.28	1817

Note: All performance figures are in accordance with IEC 60034-30-1:2014



Prima Series (Performance Chart)

Efficiency Class: IE3	
Three-Phase Squirrel Cage Induction Motor	
Voltage	415±10%
Frequency	50±5%
Ambient	50 °C
Duty	S1
Class of Insulation	F
Type of enclosure	TEFC(IC411)
Temperature Rise	Limited to Class B

1000 r/min (6 Pole)

Frame Size	Output		Speed r/min	Efficiency			Power Factor (Cos j)			Rated Current A	DIRECT-ON-LINE STARTING			Moment of inertia GD ² (kgm ²)	Net Weight kg (Approx.)
	kW	HP		100%	75%	50%	100%	75%	50%		Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)		
MHHP80ZAA6	0.37	0.5	920	73.5	73.3	72.3	0.7	0.64	0.54	1.0	400	170	210	0.00988	14
MHHP80ZBA6	0.55	0.75	920	77.2	77	76	0.71	0.66	0.57	1.4	450	180	220	0.01086	18
MHHP90SAA6	0.75	1.0	920	78.9	78.9	78	0.72	0.67	0.59	1.8	650	180	220	0.023	23
MHHP90LAA6	1.1	1.5	915	81	81	80.1	0.75	0.70	0.62	2.5	650	180	220	0.0253	26
MHHP100LAA6	1.5	2	935	82.5	82.5	81.7	0.75	0.70	0.62	3.4	650	190	210	0.0517	31
MHHP112MAA6	2.2	3	950	84.3	84.3	83.4	0.75	0.70	0.63	4.8	600	210	240	0.0748	48
MHHP132SYA6	3.7	5	960	86.5	86.5	85.6	0.74	0.70	0.62	8.0	650	200	240	0.22	66
MHHP132MZA6	5.5	7.5	975	88	88	87.1	0.75	0.71	0.63	11.6	600	200	240	0.242	77
MHHP160MZA6	7.5	10	975	89.1	89.1	88.2	0.8	0.76	0.68	14.6	700	200	240	0.45	131
MHHP160LZA6	11	15	965	90.3	90.3	89.4	0.79	0.75	0.68	21.5	700	200	280	0.472	134
MHHP180LZG6	15	20	975	91.2	91.2	90.3	0.82	0.78	0.71	28.0	720	200	250	0.99	171
MHHP200LPG6	18.5	25	975	91.7	91.7	90.8	0.8	0.76	0.69	35.0	700	200	230	2.05	230
MHHP200LRG6	22	30	980	92.2	92.2	91.3	0.83	0.79	0.72	40.0	750	200	230	2.26	231
MHHP225MP6	30	40	980	92.9	92.9	92	0.83	0.79	0.72	54.1	750	200	250	3.52	339
MHHP250MP6	37	50	980	93.3	93.3	92.6	0.83	0.80	0.73	67.0	750	200	240	5.75	419
MHHP280SV6	45	60	985	93.7	93.7	92.8	0.85	0.82	0.75	78.6	750	200	240	8.1	698
MHHP280MV6	55	75	985	94.1	94.1	93.2	0.84	0.81	0.74	96.8	750	200	240	8.51	740
MHHP315SYE6	75	100	990	94.6	94.6	93.7	0.86	0.83	0.77	129.0	750	200	240	20.78	1038
MHHP315MYE6	90	120	990	94.9	94.9	94	0.86	0.84	0.78	153.4	750	200	240	21.8	1180
MHHP315MZE6	110	150	990	95.1	95.1	94.2	0.84	0.82	0.76	192	750	200	240	23.98	1210
MHHP315LZE6	132	180	990	95.4	95.4	94.5	0.87	0.85	0.79	221.3	750	200	240	28.52	1440
MHHP355MA6	160	220	990	95.6	95.6	94.7	0.86	0.84	0.79	271.0	750	200	240	45.83	1828
MHHP355MC6	200	270	995	95.8	95.8	94.9	0.86	0.84	0.80	338	750	200	240	56.7	2038
MHHP355LA6	250	340	995	95.8	95.8	94.9	0.86	0.85	0.80	422.2	750	200	240	59.53	2237

Note: All performance figures are in accordance with IEC 60034-30-1:2014

Prima Series (Performance Chart)

Efficiency Class: IE3	
Three-Phase Squirrel Cage Induction Motor	
Voltage	415±10%
Frequency	50±5%
Ambient	50 °C
Duty	S1
Class of Insulation	F
Type of enclosure	TEFC(IC411)
Temperature Rise	Limited to Class B

750 r/min (8 Pole)

Frame Size	Output		Speed r/min	Efficiency			Power Factor (Cos ϕ)	Rated Current A	DIRECT-ON-LINE STARTING			Moment of inertia GD ² (kgm ²)	Net Weight kg (Approx.)
	kW	HP		100%	75%	50%			100%	Starting Current (%)	Breakaway Torque (%)		
MHHP80ZAA8	0.25	0.33	670	64.1	64.1	62.7	0.62	0.88	500	165	220	0.009	11
MHHP90SAA8	0.37	0.5	670	69.3	69.3	68.4	0.54	1.4	500	175	240	0.016	14
MHHP90LBA8	0.55	0.75	670	73	73	72.4	0.51	2.1	500	200	240	0.022	19
MHHP100LAA8	0.75	1.0	680	75	75	74	0.6	2.4	500	195	245	0.032	22
MHHP100LBA8	1.1	1.5	680	77.7	77.7	77	0.6	3.3	500	190	245	0.076	28
MHHP112MAA8	1.5	2.0	685	79.7	79.7	78.6	0.64	4.1	500	185	245	0.080	43
MHHP132SZA8	2.2	3.0	700	81.9	81.9	81.2	0.68	5.5	500	195	250	0.15	73
MHHP160MYA8	3.7	5.0	710	84.5	84.5	83.7	0.63	9.7	550	210	250	0.57	112
MHHP160MZA8	5.5	7.5	715	86.2	86.2	85.4	0.75	11.9	550	200	250	0.57	149
MHHP160LZA8	7.5	10	705	87.3	87.3	86.5	0.77	15.6	570	210	250	0.72	155
MHHP180LZG8	11	15	720	88.6	88.6	87.7	0.77	22.5	570	210	250	1.03	211
MHHP200LRG8	15	20	720	89.6	89.6	88.7	0.78	29.9	570	210	250	1.37	264
MHHP225SP8	18.5	25	725	90.1	90.1	89.3	0.8	35.8	650	210	250	2.09	303
MHHP225MP8	22	30	725	90.6	90.6	89.8	0.79	42.8	650	210	250	2.58	344
MHHP250MP8	30	40	725	91.3	91.3	90.5	0.8	57.2	700	210	250	5.17	462
MHHP280SV8	37	50	730	91.8	91.8	91	0.79	71.0	700	210	250	9.25	561
MHHP280MV8	45	60	730	92.2	92.2	91.5	0.79	86.0	700	200	240	17.49	639
MHHP315SYE8	55	75	730	92.5	92.5	91.8	0.8	103.5	700	190	230	22.96	1040
MHHP315MYE8	75	100	730	93.1	93.1	92.5	0.81	138.4	700	190	220	26.75	1155
MHHP315MZE8	90	120	730	93.4	93.4	92.7	0.82	163.5	700	190	220	30.53	1218
MHHP315LZE8	110	150	730	93.7	93.7	93.1	0.82	199.2	700	190	220	34.65	1287
MHHP355MA8	132	180	735	94	94	93.3	0.82	238.3	700	190	220	37.87	2310
MHHP355MC8	160	220	735	94.3	94.3	93.5	0.82	287.9	700	190	220	49.37	2464
MHHP355LB8	200	270	735	94.6	94.6	93.8	0.82	358.7	700	190	220	58.96	2596

Note: All performance figures are in accordance with IEC 60034-30-1:2014



Prima Series (Performance Chart)

Efficiency Class: IE2	
Three-Phase Squirrel Cage Induction Motor	
Voltage	415±10%
Frequency	50±5%
Ambient	50 °C
Duty	S1
Class of Insulation	F
Type of enclosure	TEFC(IC411)
Temperature Rise	Limited to Class B

3000 r/min (2 Pole)

Frame Size	Output		Speed r/min	Efficiency			Power Factor (Cos j)			Rated Current A	DIRECT-ON-LINE STARTING			Moment of inertia GD ² (kgm ²)	Net Weight kg (Approx.)
	kW	HP		100%	75%	50%	100%	75%	50%		Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)		
MHEE71ZAA2	0.37	0.5	2800	69.5	69.5	68.4	0.78	0.73	0.65	0.94	500	220	245	0.00184	7
MHEE71ZBA2	0.55	0.75	2800	74.1	74.1	73.1	0.79	0.74	0.66	1.3	500	210	240	0.00232	7.2
MHEE80ZAA2	0.75	1.0	2830	77.4	77.4	74.5	0.80	0.76	0.69	1.7	600	240	270	0.00356	15
MHEE80ZBA2	1.1	1.5	2840	79.6	79.6	78.2	0.80	0.76	0.69	2.4	600	250	280	0.0042	15.4
MHEE90SAA2	1.5	2.0	2850	81.3	81.3	80.1	0.85	0.81	0.74	3.0	650	230	250	0.0102	21
MHEE90LCA2	2.2	3.0	2840	83.2	83.2	82.1	0.88	0.84	0.77	4.2	700	220	250	0.0115	22
MHEE100LBA2	3.7	5.0	2920	85.5	85.5	84.8	0.86	0.83	0.76	7.0	700	240	270	0.0134	31
MHEE132SZA2	5.5	7.5	2890	87	87	86.1	0.89	0.86	0.80	9.9	700	240	270	0.056	57
MHEE132STA2	7.5	10	2890	88.1	88.1	86.9	0.90	0.87	0.81	13.2	700	250	290	0.0684	64
MHEE160MYA2	11	15	2920	89.4	89.4	88.5	0.88	0.85	0.79	19.5	700	230	260	0.226	113
MHEE160MZA2	15	20	2920	90.3	90.3	89.4	0.89	0.86	0.80	26.0	700	230	250	0.256	134
MHEE160LZA2	18.5	25	2920	90.9	90.9	90	0.89	0.86	0.81	31.8	750	225	245	0.284	137
MHEE180MZA2	22	30	2930	91.3	91.3	90.4	0.9	0.87	0.82	37.2	700	220	250	0.2982	171
MHEE200LPG2	30	40	2945	92	92	91.1	0.9	0.87	0.82	50.4	700	210	255	0.7	238
MHEE200LRG2	37	50	2945	92.5	92.5	91.6	0.88	0.85	0.80	63.2	700	220	260	0.9	253
MHEE225MP2	45	60	2945	92.9	92.9	92	0.9	0.88	0.83	75	700	225	250	1.3	324
MHEE250MP2	55	75	2945	93.2	93.2	92.3	0.90	0.88	0.83	91.2	700	220	260	1.95	429
MHEE280SV2	75	100	2970	93.8	93.8	92.9	0.92	0.90	0.85	121	700	210	250	4.56	604
MHEE280MV2	90	120	2970	94.1	94.1	93.2	0.91	0.89	0.84	146.2	700	230	275	5.1	626
MHEE315SYE2	110	150	2980	94.3	94.3	93.4	0.91	0.90	0.86	178.3	700	200	235	6.5	811
MHEE315MZE2	132	180	2980	94.6	94.6	93.7	0.91	0.90	0.86	213.3	700	200	230	7.28	891
MHEE315LYE2	160	220	2980	94.8	94.8	93.9	0.92	0.91	0.87	255.2	700	200	245	8.32	1018
MHEE315LZE2	200	270	2980	95	95	94.1	0.92	0.91	0.87	318.4	700	200	235	11.24	1026
MHEE355MB2	250	340	2980	95	95	94.1	0.92	0.91	0.88	398.0	700	200	240	18.5	1828
MHEE355LB2	315	430	2980	95	95	94.1	0.92	0.91	0.88	501.4	700	200	240	25.5	1839

Note: All performance figures are in accordance with IEC 60034-30-1:2014

Prima Series (Performance Chart)

Efficiency Class: IE2	
Three-Phase Squirrel Cage Induction Motor	
Voltage	415±10%
Frequency	50±5%
Ambient	50 °C
Duty	S1
Class of Insulation	F
Type of enclosure	TEFC(IC411)
Temperature Rise	Limited to Class B

1500 r/min (4 Pole)

Frame Size	Output		Speed r/min	Efficiency			Power Factor (Cos ϕ)			Rated Current A	DIRECT-ON-LINE STARTING			Moment of inertia GD ² (kgm ²)	Net Weight kg (Approx.)
	kW	HP		100%	75%	50%	100%	75%	50%		Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)		
MHEE71ZAA4	0.37	0.5	1380	72.7	72.7	71.5	0.71	0.65	0.55	1.0	500	220	250	0.00304	7.5
MHEE80ZAA4	0.55	0.75	1400	77.1	77.1	73.9	0.73	0.67	0.57	1.4	500	260	280	0.008	14
MHEE80ZBA4	0.75	1.0	1410	79.6	79.6	76.4	0.75	0.70	0.61	1.7	500	240	280	0.00964	16
MHEE90SAA4	1.1	1.5	1420	81.4	81.4	80.5	0.79	0.74	0.66	2.4	600	240	270	0.0185	21
MHEE90LBA4	1.5	2	1420	82.8	82.8	81.2	0.83	0.78	0.70	3.0	600	250	280	0.022	24
MHEE100LAA4	2.2	3	1450	84.3	84.3	82.8	0.78	0.73	0.66	4.7	600	240	270	0.0352	32
MHEE112MAA4	3.7	5	1450	86.3	86.3	85.4	0.81	0.76	0.69	7.4	650	240	290	0.0521	41
MHEE132SZA4	5.5	7.5	1450	87.7	87.7	86.8	0.8	0.76	0.68	10.9	650	250	280	0.135	62
MHEE132MZA4	7.5	10	1450	88.7	88.7	87.2	0.82	0.78	0.70	14.3	650	240	275	0.148	69
MHEE160MYA4	9.3	12.5	1460	89.39	89.39	88.7	0.85	0.81	0.73	17.0	650	220	260	0.42	114
MHEE160MZA4	11	15	1460	89.8	89.8	89	0.85	0.80	0.73	20.0	650	220	260	0.42	115
MHEE160LZA4	15	20	1460	90.6	90.6	89.8	0.84	0.78	0.71	27.4	650	230	270	0.456	137
MHEE180MZA4	18.5	25	1460	91.2	91.2	90.3	0.82	0.80	0.73	34.4	650	230	250	0.6	155
MHEE180LZA4	22	30	1465	91.6	91.6	90.7	0.84	0.79	0.72	39.8	650	230	280	0.68	171
MHEE200LRG4	30	40	1460	92.3	92.3	91.4	0.83	0.81	0.74	54.5	650	220	250	1.45	244
MHEE225SP4	37	50	1475	92.7	92.7	91.8	0.85	0.83	0.76	65.3	650	225	260	1.65	294
MHEE225MP4	45	60	1475	93.1	93.1	92.2	0.86	0.83	0.76	78.2	650	220	250	1.84	328
MHEE250MP4	55	75	1470	93.5	93.5	92.9	0.86	0.84	0.77	95.2	650	230	250	3.5	438
MHEE280SV4	75	100	1480	94	94	93.1	0.87	0.84	0.78	128	700	230	260	4.48	625
MHEE280MG4	90	120	1485	94.2	94.2	93.3	0.87	0.86	0.80	153	700	230	260	5.84	648
MHEE315SYE4	110	150	1490	94.5	94.5	93.6	0.88	0.86	0.80	184	700	220	250	12.44	811
MHEE315MYE4	132	180	1490	94.7	94.7	93.8	0.88	0.87	0.81	220	700	230	260	14.48	918
MHEE315LYE4	160	220	1490	94.9	94.9	94	0.89	0.87	0.82	264	700	230	260	16.52	1082
MHEE315LZE4	200	270	1490	95.1	95.1	94.2	0.89	0.89	0.83	329	700	230	260	18.92	1151
MHEE355MB4	250	340	1490	95.1	95.1	94.2	0.90	0.89	0.83	406.3	700	230	260	27.8	1650
MHEE355LA4	315	425	1490	95.1	95.1	94.2	0.90	0.89	0.83	512	700	230	260	34.8	1670

Note: All performance figures are in accordance with IEC 60034-30-1:2014

Prima Series (Performance Chart)

Efficiency Class: IE2	
Three-Phase Squirrel Cage Induction Motor	
Voltage	415±10%
Frequency	50±5%
Ambient	50 °C
Duty	S1
Class of Insulation	F
Type of enclosure	TEFC(IC411)
Temperature Rise	Limited to Class B

1000 r/min (6 Pole)

Frame Size	Output		Speed r/min	Efficiency			Power Factor (Cos j)			Rated Current A	DIRECT-ON-LINE STARTING			Moment of inertia GD ² (kgm ²)	Net Weight kg (Approx.)
	kW	HP		100%	75%	50%	100%	75%	50%		Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)		
MHEE80ZAA6	0.37	0.5	910	67.6	67.4	65.2	0.70	0.63	0.54	1.1	378	180	210	0.00788	13
MHEE80ZBA6	0.55	0.75	910	73.1	72.9	70	0.71	0.65	0.57	1.5	400	180	220	0.00988	15
MHEE90SAA6	0.75	1.0	910	75.9	75.9	74.7	0.66	0.60	0.52	2.1	600	220	230	0.0178	22
MHEE90LAA6	1.1	1.5	910	78.1	78.1	76.9	0.71	0.66	0.58	2.8	600	200	220	0.023	22
MHEE100LAA6	1.5	2	930	79.8	79.8	77.8	0.72	0.67	0.59	3.6	600	190	220	0.045	30
MHEE112MAA6	2.2	3	940	81.8	81.8	79.6	0.72	0.67	0.59	5.2	600	230	260	0.0567	39
MHEE132SYA6	3.7	5	950	84.3	84.3	82.8	0.72	0.67	0.60	8.5	600	220	250	0.216	65
MHEE132MZA6	5.5	7.5	970	86	86	85.1	0.73	0.68	0.61	12.2	600	230	260	0.22	66
MHEE160MZA6	7.5	10	970	87.2	87.2	86.3	0.77	0.72	0.65	15.5	650	220	250	0.354	106
MHEE160LZA6	11	15	960	88.7	88.7	87.8	0.77	0.73	0.65	22.4	650	245	300	0.45	133
MHEE180LZG6	15	20	970	89.7	89.7	89	0.80	0.76	0.68	29.1	670	240	280	0.82	152
MHEE200LPG6	18.5	25	970	90.4	90.4	89.2	0.78	0.73	0.66	36.5	650	230	260	1.79	228
MHEE200LRG6	22	30	975	90.9	90.9	89.5	0.79	0.75	0.68	42.6	680	210	230	1.88	230
MHEE225MP6	30	40	975	91.7	91.7	90.8	0.82	0.78	0.71	55.5	700	220	250	3.22	338
MHEE250MP6	37	50	975	92.2	92.2	91.2	0.82	0.78	0.72	68.1	700	230	260	5.2	377
MHEE280SV6	45	60	980	92.7	92.7	91.3	0.85	0.81	0.75	79.5	700	210	250	7.5	575
MHEE280MV6	55	75	980	93.1	93.1	91.5	0.84	0.80	0.74	97.8	700	220	250	8.7	510
MHEE315SYE6	75	100	985	93.7	93.7	92	0.85	0.81	0.75	131	700	220	250	16.5	860
MHEE315MYE6	90	120	985	94	94	92.2	0.85	0.82	0.77	156.7	700	210	240	20.78	991
MHEE315MZE6	110	150	985	94.3	94.3	92.5	0.85	0.82	0.77	191.0	700	220	250	21.8	976
MHEE315LZE6	132	180	985	94.6	94.6	92.8	0.86	0.83	0.78	226	700	220	250	28.1	1130
MHEE355MA6	160	220	985	94.8	94.8	93	0.86	0.83	0.78	273	700	220	250	44.5	1575
MHEE355MC6	200	270	990	95	95	93.2	0.86	0.84	0.80	341	700	220	250	52.8	1614
MHEE355LA6	250	340	990	95	95	93.2	0.86	0.84	0.80	426	700	220	250	56.7	1650

Note: All performance figures are in accordance with IEC 60034-30-1:2014

Prima Series (Performance Chart)

Efficiency Class: IE2	
Three-Phase Squirrel Cage Induction Motor	
Voltage	415±10%
Frequency	50±5%
Ambient	50 °C
Duty	S1
Class of Insulation	F
Type of enclosure	TEFC(IC411)
Temperature Rise	Limited to Class B

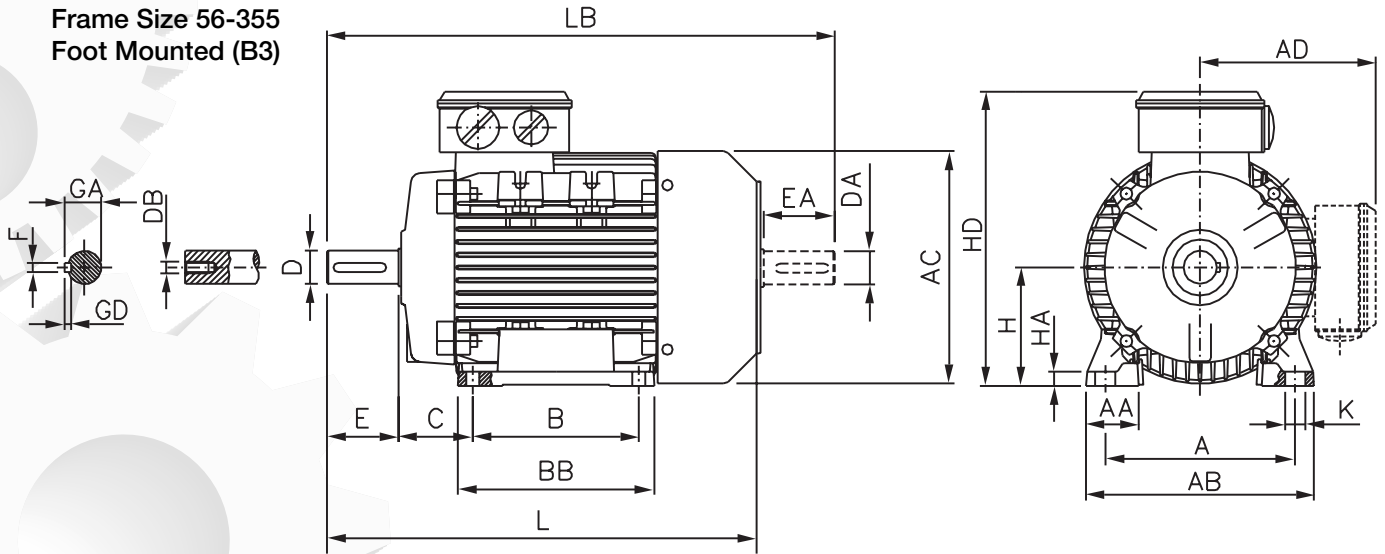
750 r/min (8 Pole)

Frame Size	Output		Speed r/min	Efficiency			Power Factor Cos j	Rated Current A	DIRECT-ON-LINE STARTING			Moment of inertia GD ² (kgm ²)	Net Weight kg (Approx.)
	kW	HP		100%	75%	50%			Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)		
MHEE71ZAA8	0.12	0.16	650	39.8	39.8	39	0.54	0.8	350	160	210	0.004	8
MHEE80ZAA8	0.25	0.33	670	50.6	50.6	49.2	0.62	1.1	400	160	210	0.008	14
MHEE90SAA8	0.37	0.5	670	56.1	56.1	55.2	0.54	1.7	400	170	230	0.014	21
MHEE90LBA8	0.55	0.75	670	61.7	61.7	61.1	0.51	2.4	430	200	230	0.020	22
MHEE100LAA8	0.75	1.0	680	66.2	66.2	65.2	0.6	2.6	450	190	240	0.029	30
MHEE100LBA8	1.1	1.5	680	70.8	70.8	70.1	0.6	3.6	450	180	240	0.068	30
MHEE112MAA8	1.5	2.0	685	74.1	74.1	73	0.64	4.4	450	180	240	0.071	39
MHEE132SZA8	2.2	3.0	700	77.6	77.6	76.9	0.68	5.8	450	190	250	0.13	58
MHEE132MZA8	3	4.0	700	80	80	79.2	0.67	7.8	450	190	255	0.16	63
MHEE160MYA8	3.7	5.0	710	81.4	81.4	80.6	0.63	10.0	480	190	255	0.51	98
MHEE160MZA8	5.5	7.5	715	83.8	83.8	83	0.75	12.2	480	190	250	0.51	112
MHEE160LZA8	7.5	10	705	85.3	85.3	84.5	0.77	15.9	500	210	255	0.64	133
MHEE180LZG8	11	15	720	86.9	86.9	86	0.77	22.9	500	220	260	0.92	153
MHEE200LRG8	15	20	720	88	88	87.1	0.78	30.4	500	220	260	1.22	230
MHEE225SP8	18.5	25	725	88.6	88.6	87.8	0.8	36.3	550	230	260	1.87	325
MHEE225MP8	22	30	725	89.1	89.1	88.3	0.79	43.5	600	230	260	2.30	334
MHEE250MP8	30	40	725	89.8	89.8	89	0.8	58.1	650	230	255	4.62	382
MHEE280SV8	37	50	730	90.3	90.3	89.5	0.79	72.2	650	200	240	8.26	565
MHEE280MV8	45	60	730	90.7	90.7	90	0.79	87.4	650	190	220	15.62	578
MHEE315SYE8	55	75	730	91	91	90.3	0.8	105.1	650	190	220	20.50	860
MHEE315MYE8	75	100	730	91.6	91.6	91	0.81	141	650	190	210	23.88	996
MHEE315MZE8	90	120	730	91.9	91.9	91.2	0.82	166.2	650	190	210	27.26	1026
MHEE315LZE8	110	150	730	92.3	92.3	91.7	0.82	202.2	650	190	210	30.94	1126
MHEE355MA8	132	180	735	92.6	92.6	91.9	0.82	242	650	190	210	33.81	1917
MHEE355MC8	160	220	735	93	93	92.2	0.82	292	650	190	210	44.08	2160
MHEE355LB8	200	270	735	93.5	93.5	92.7	0.82	363	650	190	210	52.64	2178

Note: All performance figures are in accordance with IEC 60034-30-1:2014

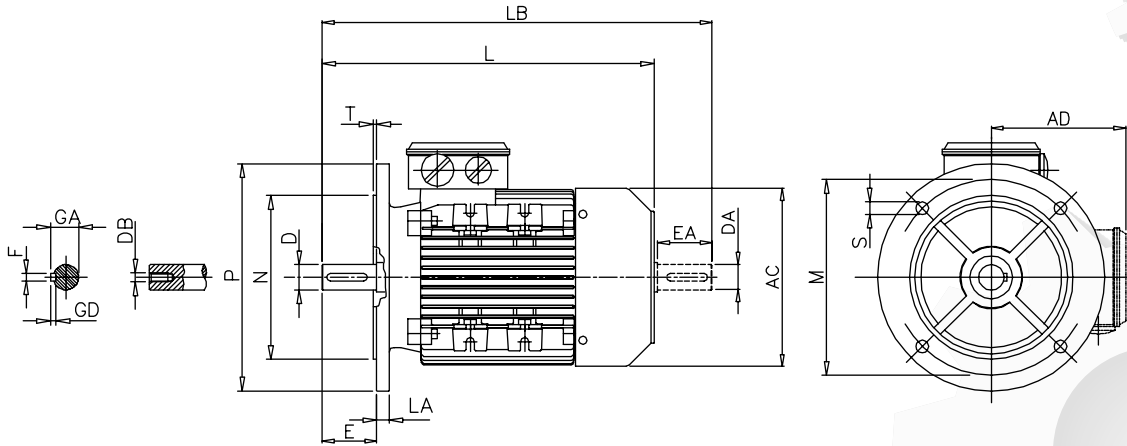
GA DRAWING

Frame Size 56-355
Foot Mounted (B3)



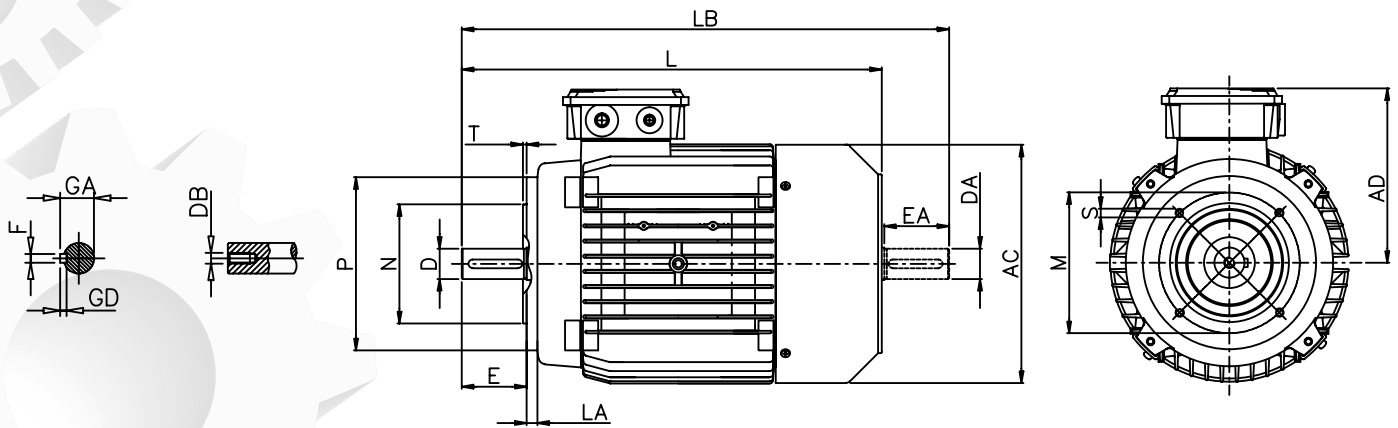
FRAME	NO OF POLES	H	A	B	C	K	AB	BB	AD	HD	AC	HA	L	LB	AA	D/DA	E/EA	F	GD	GA	DB
63	2-4	63	100	80	40	7	119	100	98	160	123	8	211	237	30	11	23	4	4	12.5	M4
71	2-8	71	112	90	45	8	135	110	111	182	140	8	246	279	31	14	30	5	5	16	M5
80	2-8	80	125	100	50	10	153	125	139	219	156	9.5	273	320	35	19	40	6	6	21.5	M6
90S	2-8	90	140	100	56	10	170	150	150	240	177	12	318	371	36	24	50	8	7	27	M8
90L	2-8	90	140	125	56	10	170	150	150	240	177	12	318	371	36	24	50	8	7	27	M8
100L	2-8	100	160	140	63	12	192	166	155	255	195	14	367	433	40	28	60	8	7	31	M10
112M	2-8	112	190	140	70	12	220	175	171	283	221	15	387	456	45	28	60	8	7	31	M10
132S	2-8	132	216	140	89	12	256	218	195	327	248	18	444	527	55	38	80	10	8	41	M12
132M	2-8	132	216	178	89	12	256	218	195	327	248	18	483	565	55	38	80	10	8	41	M12
160M	2-8	160	254	210	108	15	308	260	250	410	317	20	590	700	65	42	110	12	8	45	M16
160L	2-8	160	254	254	108	15	308	300	250	410	317	22	630	743	65	42	110	12	8	45	M16
180M	2-8	180	279	241	121	15	330	316	265	445	355	22	712	838	66	48	110	14	9	51.5	M16
180L	2-8	180	279	279	121	15	330	316	265	445	355	22	712	838	66	48	110	14	9	51.5	M16
200L	2-8	200	318	305	133	19	380	360	300	500	379	25	779	895	79	55	110	16	10	59	M20
225S	2	225	356	286	149	18.5	420	375	360	585	445	30	860	973	90	55	110	16	10	59	M20
	4,6,8	225	356	286	149	18.5	435	375	360	585	445	30	890	1033	90	60	140	18	11	64	M20
225M	2	225	356	311	149	18.5	435	375	360	585	445	30	860	973	90	55	110	16	10	59	M20
	4,6,8	225	356	311	149	18.5	435	375	360	585	445	30	890	1033	90	60	140	18	11	64	M20
250M	2	250	406	349	168	24	500	425	390	640	494	30	970	1118	135	60	140	18	11	64	M20
	4,6,8	250	406	349	168	24	500	425	390	640	494	30	970	1118	135	65	140	18	11	69	M20
280S	2	280	457	368	190	24	550	485	410	680	580	35	985	1128	129	65	140	18	11	69	M20
	4,6,8	280	457	368	190	24	550	485	410	680	580	35	985	1128	129	75	140	20	12	79.5	M20
280M	2	280	457	419	190	24	550	536	410	680	580	35	1035	1178	129	65	140	18	11	69	M20
	4,6,8	280	457	419	190	24	550	536	410	680	580	35	1035	1178	129	75	140	20	12	79.5	M20
315S	2	315	508	406	216	28	635	570	530	845	645	45	1180	1330	120	65	140	18	11	69	M20
	4,6,8,10	315	508	406	216	28	635	570	530	845	645	45	1290	1470	120	80	170	22	14	85	M20
315M	2	315	508	457	216	28	635	680	530	845	645	45	1210	1360	120	65	140	18	11	69	M20
	4,6,8,10	315	508	457	216	28	635	680	530	845	645	45	1320	1500	120	80	170	22	14	85	M20
315L	2	315	508	508	216	28	635	680	530	845	645	45	1210	1360	120	65	140	18	11	69	M20
	4,6,8,10	315	508	508	216	28	635	680	530	845	645	45	1320	1500	120	80	170	22	14	85	M20
355M	2	355	610	560	254	28	730	750	655	1010	710	52	1500	1650	116	75	140	20	12	79.5	M20
	4,6,8,10	355	610	560	254	28	730	750	655	1010	710	52	1570	1790	116	100	210	28	14	100	M24
355L	2	355	610	630	254	28	730	750	655	1010	710	52	1500	1650	116	75	140	20	12	79.5	M20
	4,6,8,10	355	610	630	254	28	730	750	655	1010	710	52	1570	1790	116	100	210	28	14	100	M24

Frame Size 56-355
Flange Mounted (B5)



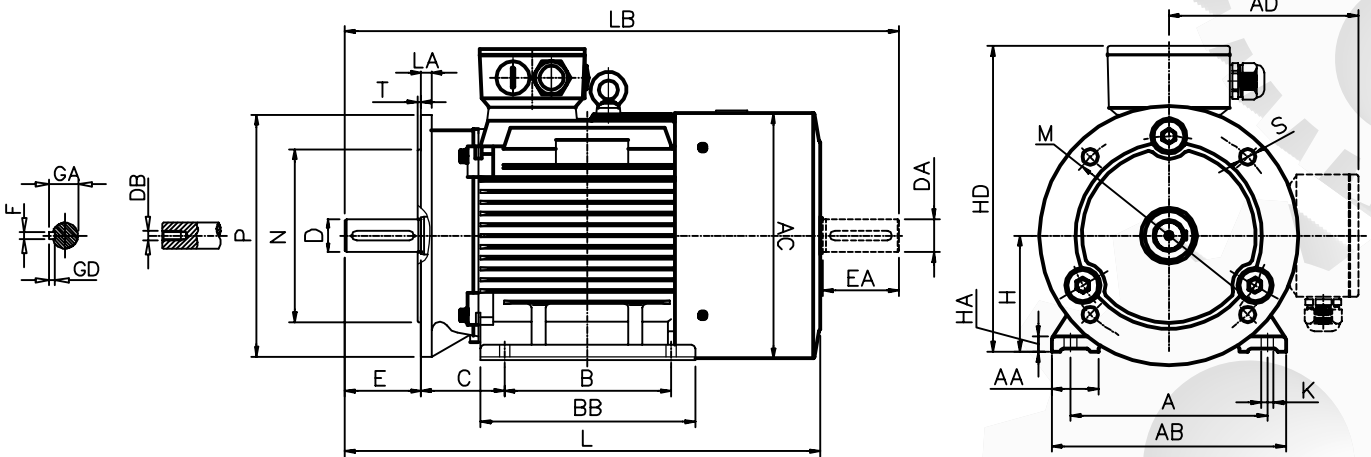
FRAME	NO OF POLES	P	N	M	LA	T	S	No. of Holes	AD	AC	L	LB	D/DA	E/EA	F	GD	GA	DB
63	2-4	140	95	115	8	3	9.5	4	98	123	211	237	11	23	4	4	12.5	M4
71	2-8	160	110	130	10	3.5	9.5	4	111	140	246	279	14	30	5	5	16	M5
80	2-8	200	130	165	10	3.5	11.5	4	139	156	273	320	19	40	6	6	21.5	M6
90S	2-8	200	130	165	12	3.5	12	4	150	177	318	371	24	50	8	7	27	M8
90L	2-8	200	130	165	12	3.5	12	4	150	177	318	371	24	50	8	7	27	M8
100L	2-8	250	180	215	14	4	15	4	155	195	367	433	28	60	8	7	31	M10
112M	2-8	250	180	215	14	4	15	4	171	221	387	456	28	60	8	7	31	M10
132S	2-8	300	230	265	14	4	15	4	195	248	444	527	38	80	10	8	41	M12
132M	2-8	300	230	265	14	4	15	4	195	248	483	565	38	80	10	8	41	M12
160M	2-8	350	250	300	15	5	18	4	250	317	590	700	42	110	12	8	45	M16
160L	2-8	350	250	300	15	5	18	4	250	317	630	743	42	110	12	8	45	M16
180M	2-8	350	250	300	13	5	18	4	265	355	712	838	48	110	14	9	51.5	M16
180L	2-8	350	250	300	13	5	18	4	265	355	712	838	48	110	14	9	51.5	M16
200L	2-8	400	300	350	15	5	18	8	300	379	779	895	55	110	16	10	59	M20
225S	2	450	350	400	16	5	18	8	360	445	860	973	55	110	16	10	59	M20
	4,6,8	450	350	400	16	5	18	8	360	445	890	1033	60	140	18	11	64	M20
225M	2	450	350	400	16	5	18	8	360	445	860	973	55	110	16	10	59	M20
	4,6,8	450	350	400	16	5	18	8	360	445	890	1033	60	140	18	11	64	M20
250M	2	550	450	500	18	5	18	8	390	494	970	1118	60	140	18	11	64	M20
	4,6,8	550	450	500	18	5	18	8	390	494	970	1118	65	140	18	11	69	M20
280S	2	550	450	500	22	5	19	8	410	580	985	1128	65	140	18	11	69	M20
	4,6,8	550	450	500	22	5	19	8	410	580	985	1128	75	140	20	12	79.5	M20
280M	2	550	450	500	22	5	19	8	410	580	1035	1178	65	140	18	11	69	M20
	4,6,8	550	450	500	22	5	19	8	410	580	1035	1178	75	140	20	12	79.5	M20
315S	2	660	550	600	22	6	24	8	530	645	1180	1330	65	140	18	11	69	M20
	4,6,8,10	660	550	600	22	6	24	8	530	645	1290	1470	80	170	22	14	85	M20
315M	2	660	550	600	22	6	24	8	530	645	1210	1360	65	140	18	11	69	M20
	4,6,8,10	660	550	600	22	6	24	8	530	645	1320	1500	80	170	22	14	85	M20
315L	2	660	550	600	22	6	24	8	530	645	1210	1360	65	140	18	11	69	M20
	4,6,8,10	660	550	600	22	6	24	8	530	645	1320	1500	80	170	22	14	85	M20
355M	2	800	680	740	25	6	24	8	655	710	1500	1650	75	140	20	12	79.5	M20
	4,6,8,10	800	680	740	25	6	24	8	655	710	1570	1790	100	210	28	14	100	M24
355L	2	800	680	740	25	6	24	8	655	710	1500	1650	75	140	20	12	79.5	M20
	4,6,8,10	800	680	740	25	6	24	8	655	710	1570	1790	100	210	28	14	100	M24

Frame Size 56-160
Face Mounted (B14)



FRAME	NO OF POLES	P	N	LA	M	T	S	D/DA	E/EA	F	GD	GA	DB	AC	L	LB	AD
63	2-4	90	60	8.5	75	2.5	M5	11	23	4	4	12.5	M4	123	211	237	98
71	2-8	105	70	7.6	85	2.5	M6	14	30	5	5	16	M5	140	246	279	111
80	2-8	120	80	9.5	100	3	M6	19	40	6	6	21.5	M6	156	273	320	139
90S	2-8	140	95	9	115	3	M8	24	50	8	7	27	M8	177	318	371	148
90L	2-8	140	95	9	115	3	M8	24	50	8	7	27	M8	177	318	371	148
100L	2-8	160	110	10	130	3.5	M8	28	60	8	7	31	M10	195	367	433	155
112M	2-8	160	110	10	130	3.5	M8	28	60	8	7	31	M10	221	387	456	171
132S	2-8	200	130	23	165	3.5	M10	38	80	10	8	41	M12	248	444	527	195
132M	2-8	200	130	23	165	3.5	M10	38	80	10	8	41	M12	248	483	565	195
160M	2-8	250	180	20	215	4	M12	42	110	12	8	45	M16	317	590	700	250
160L	2-8	250	180	20	215	4	M12	42	110	12	8	45	M16	317	630	743	250

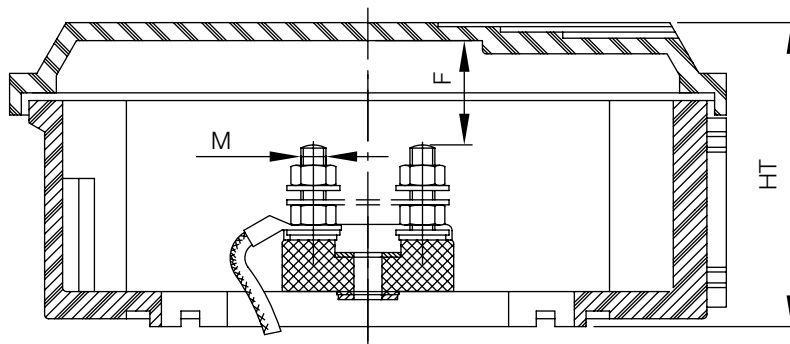
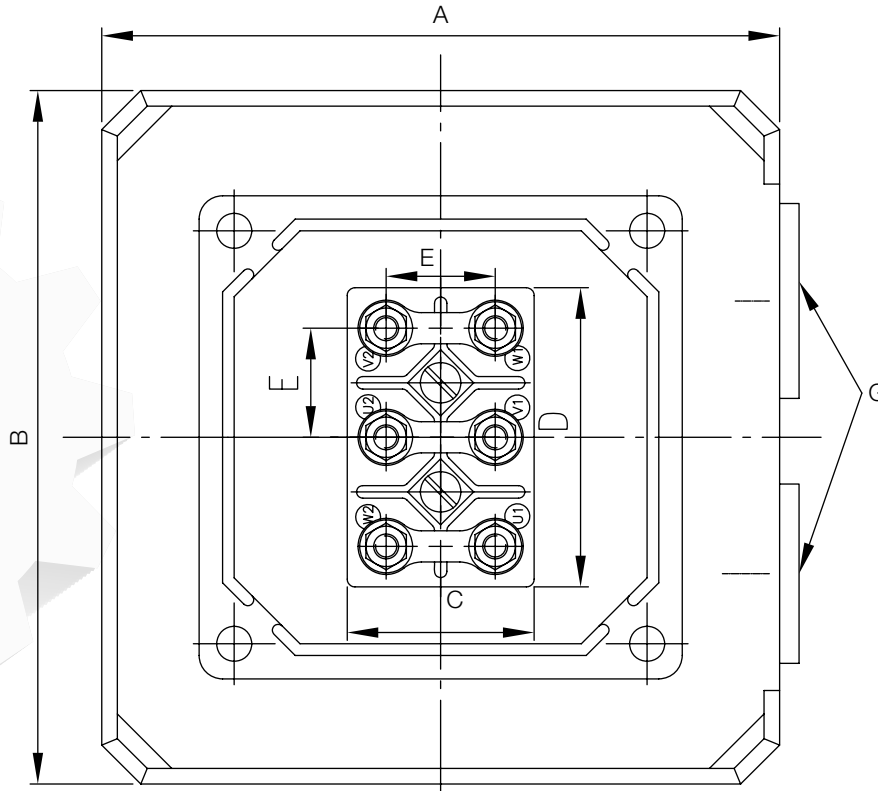
Frame Size 56-355
Foot Cum Flange Mounted (B35)



FRAME	NO OF POLES	P	N	M	LA	T	S	No. of Holes	H	A	B	C	K	AB	BB	AD	HD	AC	HA	L	LB	AA	D/DA	E/EA	F	GD	GA	DB
63	2-4	140	95	115	8	3	9.5	4	63	100	80	40	7	119	100	98	160	123	8	211	237	30	11	23	4	4	12.5	M4
71	2-8	160	110	130	10	3.5	9.5	4	71	112	90	45	8	135	110	111	182	140	8	246	279	31	14	30	5	5	16	M5
80	2-8	200	130	165	10	3.5	11.5	4	80	125	100	50	10	153	125	139	219	156	9.5	273	320	35	19	40	6	6	21.5	M6
90S	2-8	200	130	165	12	3.5	12	4	90	140	100	56	10	170	150	150	240	177	12	318	371	36	24	50	8	7	27	M8
90L	2-8	200	130	165	12	3.5	12	4	90	140	125	56	10	170	150	150	240	177	12	318	371	36	24	50	8	7	27	M8
100L	2-8	250	180	215	14	4	15	4	100	160	140	63	12	192	166	155	255	195	14	367	433	40	28	60	8	7	31	M10
112M	2-8	250	180	215	14	4	15	4	112	190	140	70	12	220	175	171	283	221	15	387	456	45	28	60	8	7	31	M10
132S	2-8	300	230	265	14	4	15	4	132	216	140	89	12	256	218	195	327	248	18	444	527	55	38	80	10	8	41	M12
132M	2-8	300	230	265	14	4	15	4	132	216	178	89	12	256	218	195	327	248	18	483	565	55	38	80	10	8	41	M12
160M	2-8	350	250	300	15	5	18	4	160	254	210	108	15	308	260	250	410	317	20	590	700	65	42	110	12	8	45	M16
160L	2-8	350	250	300	15	5	18	4	160	254	254	108	15	308	300	250	410	317	22	630	743	65	42	110	12	8	45	M16
180M	2-8	350	250	300	13	5	18	4	180	279	241	121	15	330	316	265	445	355	22	712	838	66	48	110	14	9	51.5	M16
180L	2-8	350	250	300	13	5	18	4	180	279	279	121	15	330	316	265	445	355	22	712	838	66	48	110	14	9	51.5	M16
200L	2-8	400	300	350	15	5	18	8	200	318	305	133	19	380	360	300	500	379	25	779	895	79	55	110	16	10	59	M20
225S	2	450	350	400	16	5	18	8	225	356	286	149	18.5	420	375	360	585	445	30	860	973	90	55	110	16	10	59	M20
	4,6,8	450	350	400	16	5	18	8	225	356	286	149	18.5	435	375	360	585	445	30	890	1033	90	60	140	18	11	64	M20
225M	2	450	350	400	16	5	18	8	225	356	311	149	18.5	435	375	360	585	445	30	860	973	90	55	110	16	10	59	M20
	4,6,8	450	350	400	16	5	18	8	225	356	311	149	18.5	435	375	360	585	445	30	890	1033	90	60	140	18	11	64	M20
250M	2	550	450	500	18	5	18	8	250	406	349	168	24	500	425	390	640	494	30	970	1118	135	60	140	18	11	64	M20
	4,6,8	550	450	500	18	5	18	8	250	406	349	168	24	500	425	390	640	494	30	970	1118	135	65	140	18	11	69	M20
280S	2	550	450	500	22	5	19	8	280	457	368	190	24	550	485	410	680	580	35	985	1128	129	65	140	18	11	69	M20
	4,6,8	550	450	500	22	5	19	8	280	457	368	190	24	550	485	410	680	580	35	985	1128	129	75	140	20	12	79.5	M20
280M	2	550	450	500	22	5	19	8	280	457	419	190	24	550	536	410	680	580	35	1035	1178	129	65	140	18	11	69	M20
	4,6,8	550	450	500	22	5	19	8	280	457	419	190	24	550	536	410	680	580	35	1035	1178	129	75	140	20	12	79.5	M20
315S	2	660	550	600	22	6	24	8	315	508	406	216	28	635	570	530	845	645	45	1180	1330	120	65	140	18	11	69	M20
	4,6,8,10	660	550	600	22	6	24	8	315	508	406	216	28	635	570	530	845	645	45	1290	1470	120	80	170	22	14	85	M20
315M	2	660	550	600	22	6	24	8	315	508	457	216	28	635	680	530	845	645	45	1210	1360	120	65	140	18	11	69	M20
	4,6,8,10	660	550	600	22	6	24	8	315	508	457	216	28	635	680	530	845	645	45	1320	1500	120	80	170	22	14	85	M20
315L	2	660	550	600	22	6	24	8	315	508	508	216	28	635	680	530	845	645	45	1210	1360	120	65	140	18	11	69	M20
	4,6,8,10	660	550	600	22	6	24	8	315	508	508	216	28	635	680	530	845	645	45	1320	1500	120	80	170	22	14	85	M20

TERMINAL BOX DRAWING

Frame 56-71 (Nylon)

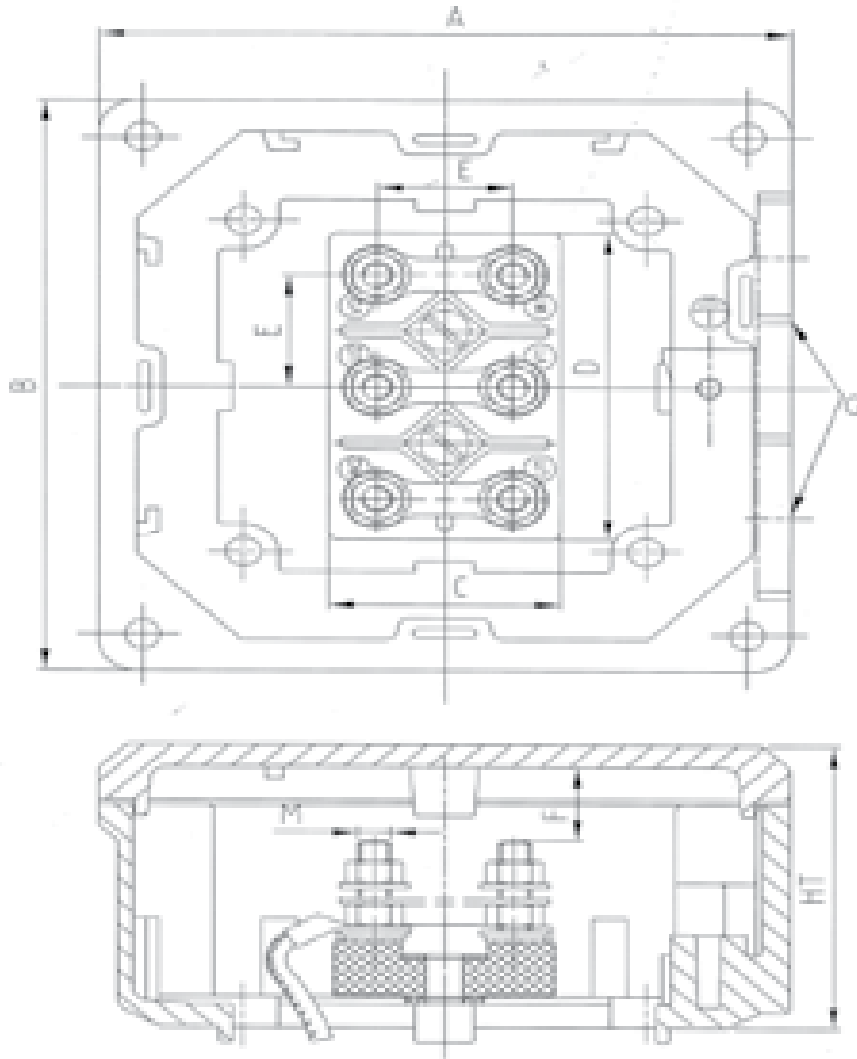


Frame	A	B	C	D	E	F	G	HT	M
56(AL)	90	92	25	40	15	10	M16, M20	40	M4
63(AL)	90	92	25	40	15	10	M16, M20	40	M4
71(AL)	90	92	25	40	15	10	M16, M20	40	M4

1. All Dimensions are in mm 2. Degree of Protection IP55

TERMINAL BOX DRAWING

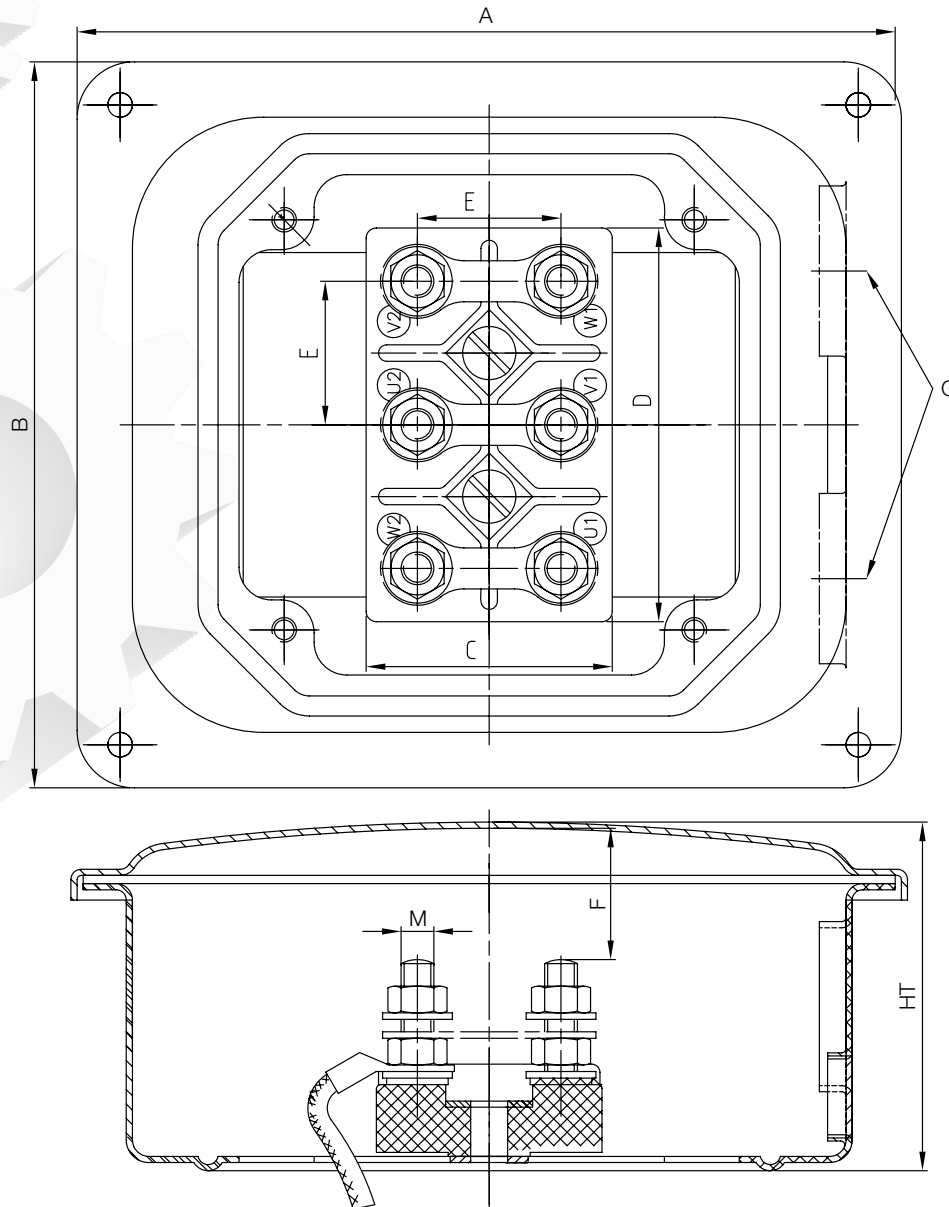
T-BOX DIMENSIONS(80-160 FRAME) Aluminium



FRAME	A	B	C	D	E	F	G	HT	M
80	111	116	25	40	15	20	M20, M25	55	M4
90	101	101	36	56	25	10	M25	59	M5
100	108	101	36	56	25	12	M32, M32	59	M5
112	116	108	36	56	25	15	M32, M32	64	M5
132	116	108	40	64	25	15	M32, M32	64	M5
160	159	149	50	85	30	12	M40, M40	78	M6

TERMINAL BOX DRAWING

Frame 160-250 (Sheet Metal)

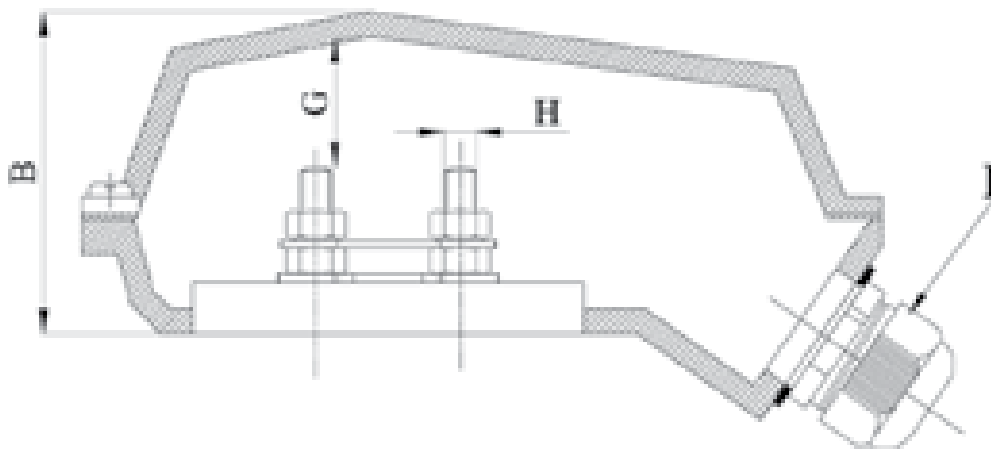
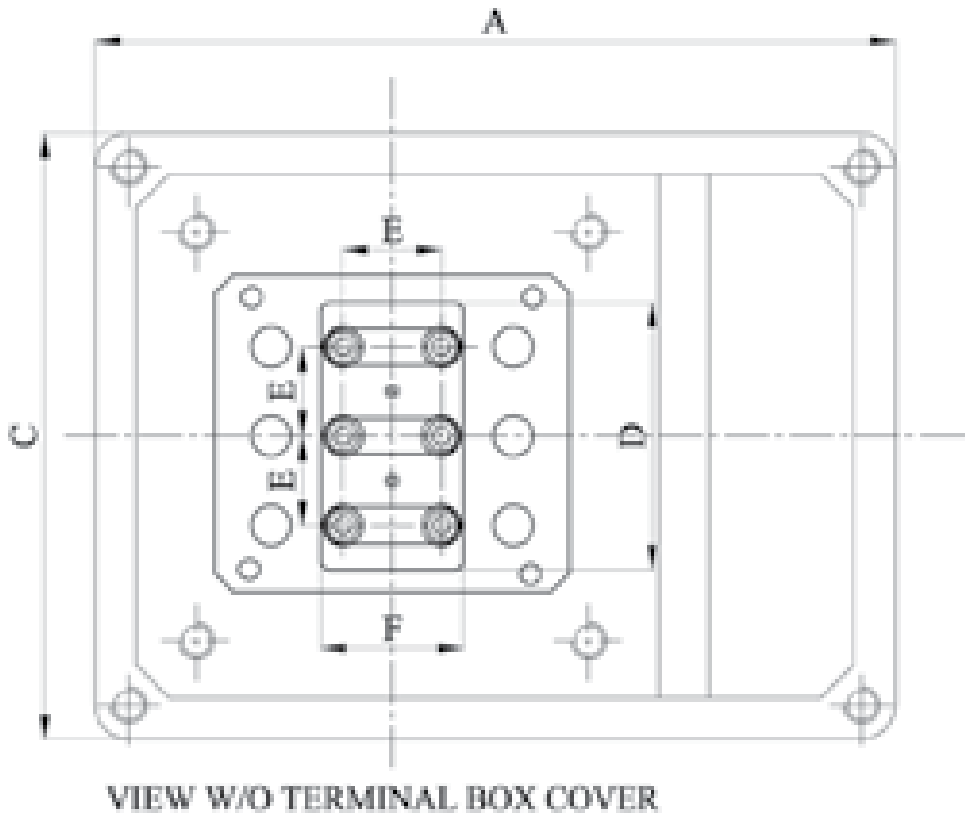


Frame	A	B	C	D	E	F	G	HT	M
160 (CI)	204	180	52	82	30	30	M40, M40	85	M6
180 (CI)	204	180	60	96	35	30	M40, M40	85	M8
200 (CI)	258	265	60	96	35	70	M50, M50	132	M8
225 (CI)	258	265	75	120	45	70	M50, M50	132	M10
250 (CI)	258	265	75	120	45	70	M50/M63, M50/M63	132	M10

1. All Dimensions are in mm 2. Degree of Protection IP55

TERMINAL BOX DRAWING

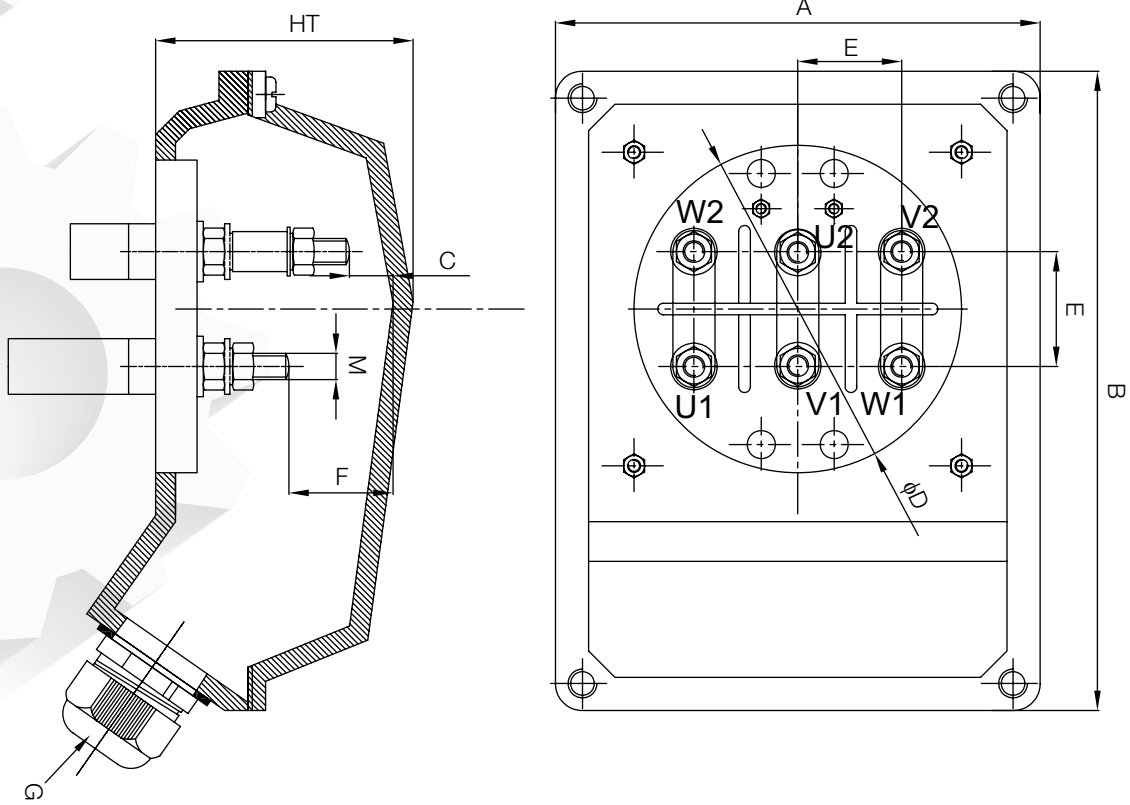
Frame 250-280 (Cast Iron)



Frame	A	B	C	D	E	F	G	H	I
250	342	135	230	140	50	85	40	M10	M63, M63
280	342	165	230	140	50	85	40	M10	M63, M63

TERMINAL BOX DRAWING

Frame 315 - 355 Cast / Iron



Frame	A	B	C	D	E	F	G	HT	M
315	280	390	25	φ210	70	45	2 X M63 X 1.5	140	M16
355	374	484	30	φ260	90	75	2 X M63 X 1.5	195	M20



Drive away smoke

With the new Smoke Extractor Motor from Havells.



Wide range from 0.5 HP to 470 HP (0.37 kW to 350 kW)

Presenting Smoke motor from Havells (as per IS 12111:2) - a highly specialized motor which powers the ventilator to pump-out smoke and harmful gases from the basement. These motors have been tested to operate at 400°C for 120 minutes for up to 015 Phase (203-PS).

The other benefits include:

- Normal inflow and outflow of air in case of no fire
- In case of fire, helps in removal of smoke from escape air access routes
- Supports fire fighting by creating a smoke-free zone
- Reduces the heat stress of components during a fire
- Reduces secondary damage due to thermal oil products and hot gases

Inverter / Crane / Brake Motors

**Inverter Duty Motors
(With Forced Cooling)**



Havells manufactures squirrel cage inverter duty motors which are specially designed for operations requiring wide speed variation through variable speed drives. These motors are generally used when the motor is running for longer duration at speeds below 70% of rated name plate speed.

Inverter duty motors operate at constant torque upto rated design frequency when connected with variable frequency drives.

The motors are fitted with separate cooling arrangement which ensures that the motors perform successfully at lower speeds without over-heating of the motor. This also ensures that the loading capacity of the motor is not reduced in this range.

All external cooling fans are rated at 3000 r/min which provide excellent cooling to the motors even at lower speed of operation.

Features

Voltage	:	3 Ph., 415 V Other voltage as per requirement
Frequency	:	50 Hz Other frequency as per requirement
Ambient	:	50 °C
Ins. Class	:	F (Temp. rise Class B)
Range	:	0.37 kW to 55 kW
Pole	:	2, 4, 6 and 8 Pole
Frame	:	80 to 250
Frequency Range	:	20 Hz to 75 Hz
Mounting	:	B3, B5, B14 and combination
Cooling	:	IC 416

Enclosure	:	Totally Enclosed Separately Cooled
Protection	:	IP 55
Standards	:	IS: 325, IS: 1231, IS: 2223 IS: 4722

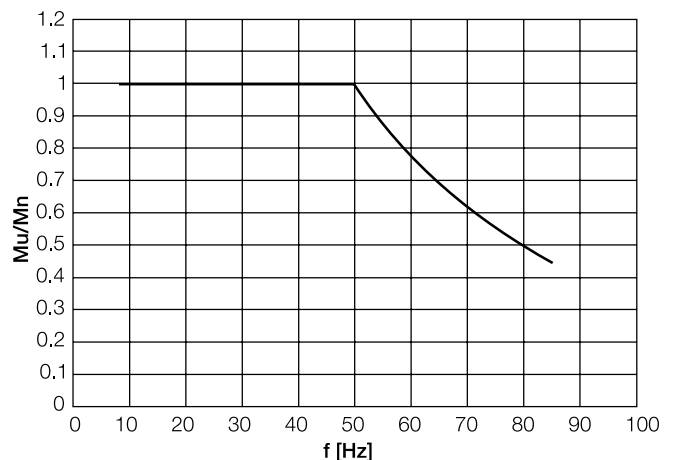
Deration Factor for Higher Ambient

Ambient temp.	Deration Factor
55 °C	0.94
60 °C	0.88

Encoder Mounting

The motors are provided with encoder mounting arrangement as a standard feature which is required by customers for motor control.

The loadability curve of the motor is as shown below:



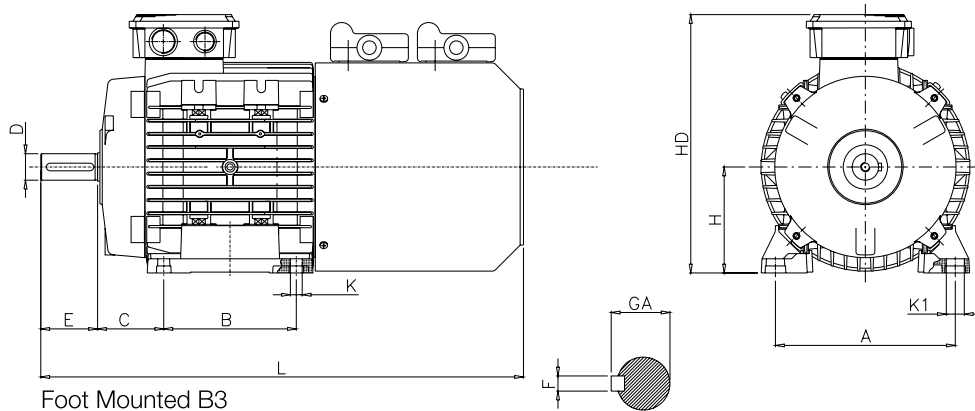
Torque Characteristics of motor driven with frequency converter

While selecting the motor, maximum allowed speed of the motor is also to be considered. For 2 pole motors, the maximum allowed speed is 4000 r/min and for 4 pole motors, it is 3600 r/min.

When the nominal supply voltage of the converter is more than 500 V, it is recommended to use du/dt filters which reduce voltage stresses in the winding by reducing the rate of change of phase and main voltages.

The use of converters with motors also demands extra requirements in terms of cabling and grounding of the drive system. Although asymmetrical cables can be used for the cabling but it is recommended to use shielded symmetrical cables along with EMC glands.

Frame	Pole	General Dimensions										
		D	E	F	L	GA	H	A	B	C	K	HD
80	2-8	19 j6	40	6	347	21.5	80	125	100	50	10	219
90S	2-8	24 j6	50	8	440	27	90	140	100	56	10	238
90L	2-8	24 j6	50	8	440	27	90	140	125	56	10	238
100L	2-8	28 j6	60	8	479	31	100	160	140	63	11	255
112M	2-8	28 j6	60	8	500	31	112	190	140	70	12.5	283
132S	2-8	38 k6	80	10	560	41	132	216	140	89	12	327
132M	2-8	38 k6	80	10	600	41	132	216	178	89	12	327
160M	2-8	42 k6	110	12	675	45	160	254	210	108	14	400.5
160L	2-8	42 k6	110	12	730	45	160	254	254	108	14	400.5
180M	2-8	48 k6	110	14	782	51.5	180	279	241	121	14	470
180L	2-8	48 k6	110	14	782	51.5	180	279	279	121	14	470
200L	2-8	55 m6	110	16	894	59	200	318	305	133	18	541
225S	2	55 m6	110	16	957	59	225	356	286	149	18.5	585
	4	60 m6	140	18	1000	64	225	356	286	149	18.5	585
225M	2	55 m6	110	16	957	59	225	356	311	149	18.5	585
	4	60 m6	140	18	1000	64	225	356	286	149	18.5	585
250M	2	60 m6	140	18	970	64	250	406	349	168	22	640
	4	65 m6	140	18	970	69	250	406	349	168	22	640



Foot Mounted B3

Crane Duty Motors



Havells India Ltd. Crane Duty Motors have been suitably designed for arduous applications for short and intermittent duties involving starts, stops and reversals.

These motors are used on applications like cranes, lifts, material handling, weirs and sluices and auxiliary motors in rolling mills.

Crane Duty motors are designed to have high starting torque with low starting currents. These characteristics ensure that the motors have high acceleration torques that are required in frequent start/ stop applications.

Product Range

Frame	:	71- 160
kW / HP	:	0.37 – 15 / 0.5 - 20
Pole	:	4-8 Pole
Mounting	:	Foot, Flange, Face and combination

CE Marking

All motors have CE Marking.

Operating Conditions

The standard operating conditions for the crane duty motors are:

Voltage	:	415 ± 10% V
Frequency	:	50 ± 5 % Hz
Combined	:	± 10 %
Ambient Temperature	:	45 °C
Altitude	:	Upto 1000 m above mean sea level

In case any operating conditions are different than above, please contact nearest branch office of Havells India Ltd.

Standards

The motors conform to the following standards

- IS: 12615 Energy efficient three-phase –motors
- IS: 1231 Dimensions of Three Phase Foot Mounted Induction Motors

- IS: 2223 Dimensions of Flange Mounted Induction Motors
- IS: 4722 Rotating Electrical Machines- Specification
- IS: 4691 Degree of Protection For Rotating Electrical Machines
- IS: 6362 Designation of Methods of Cooling of Rotating Electrical Machines

Electrical Design

Winding

All crane duty motors are manufactured using dual coat class F copper wire (with temperature withstand up to 155°C) as standard.

Insulation

The motors are having class F insulation with temperature rise limited to Class B. The motors are impregnated in a computerized impregnation plant that ensures high quality of impregnation with high varnish retention.

Deration for Higher Ambient & Altitude

For selection of motors for higher ambient and altitude, the rated kW should be reduced by the following factors for the frame selection.

Ambient	45 °C	50 °C	55 °C	60 °C	
Factor	100%	95%	90%	80%	
Altitude	1000 m	1500 m	2000 m	2500 m	3000 m
Factor	100%	95%	92%	88%	84%

Intermittent Duty Application

The motors are designed for intermittent duty operations and different starts/stops per hour as shown in the rating charts.

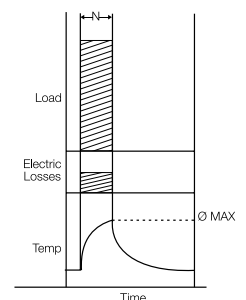
The frame selections are based considering load GD2 values referred to motor shaft are less than or equal to motor GD2 values. Various intermittent duty types are explained below.

Short Time Duty - S2 Duty

The motor operates at constant load for a given duration which is less than that required to reach thermal equilibrium and is followed by a rest or de-energized period such that the motor cools down to close to ambient temperature.

The recommended values for the short time duty are 10, 30, 60 and 90 minutes.

- N = Operation at constant load
- Ømax = Maximum temperature attained during the duty cycle

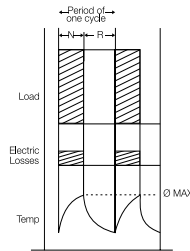


Intermittent Periodic Duty with Starting- S3 Duty

The operation cycle consists of operation at constant load followed by a rest and de-energized period. The duty cycle is such that thermal equilibrium is not reached during one periodic cycle.

- N = Operation at constant load
- R = At rest and de-energized
- Ømax = Maximum temperature attained during the duty cycle

$$\text{Cycle duration factor} = \frac{N}{N + R} \cdot 100\%$$

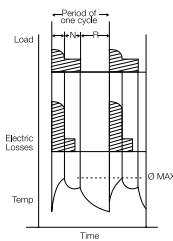


Intermittent Periodic Duty with Starting- S4 Duty

In this duty cycle, each cycle consist of a period of starting, a period of operation at constant load followed by a rest and de-energized period. The duration of one cycle is so short that thermal equilibrium is not reached during one duty cycle.

- D = Starting
- N = Operation at constant load
- R = At rest and de-energized
- Ømax = Maximum temperature attained during the duty cycle

$$\text{Cycle duration factor} = \frac{D + N}{D + N + R} \cdot 100\%$$



Mechanical Design

Construction

Crane Duty Motors are available in Aluminum/ Cast Iron frames as per table below:

Frame	Body	End-Shield
71-80	Aluminum	Aluminum
90-160	Cast Iron	Cast Iron

Frames 80 shall also be available in Cast Iron on request.
For higher frames, kindly refer to nearest branch office.

Enclosure

All motors are Totally Enclosed Fan Cooled (TEFC) as per IS 4691 and are suitable to operate in both outdoor and indoor applications.

Cooling

The motors are designed with IC0141 method of cooling as per IS 6362 which provides excellent heat dissipation of the motors and ensures longer life of the motor.

Degree of Protection

Degree of protection for machines are designated in accordance with IS 4691 by letter IP followed by two characteristic numerals corresponding to protection from dust and water. All motors are provided with IP55 degree of protection as a standard and are suitable for operation in dusty and humid environment conditions.

Bearing Details

All motors are fitted with deep groove ball bearings with C3 clearance and greased for life ensuring longer trouble free operation. The details of bearings used are given in the table.

Frame	Bearing DE/ NDE
71	6203- 2Z / 6203- 2Z
80	6204-2Z C3 / 6204-2Z C3
90	6205-2Z C3 / 6205-2Z C3
100	6206-2Z C3 / 6206-2Z C3
112	6206-2Z C3 / 6206-2Z C3
132	6208-2Z C3 / 6208-2Z C3
160	6309-2Z C3 / 6209-2Z C3

Terminal Box

Terminal box is provided on top as a standard.

The details of Terminal Box and maximum cable size are shown in the table.

Frame	Max. Cable Size	No. of Terminals	Terminal Stud Size	Cable Entry	
				Nos.	Size
71	4C x 4 mm ²	6	M4	2	M16 M20
80	4C x 4 mm ²	6	M4	2	M20 M25
90	4C x 10 mm ²	6	M5	2	M20 M25
100	4C x 10 mm ²	6	M5	2	M20 M25
112	4C x 10 mm ²	6	M5	2	M20 M25
132	4C x 10 mm ²	6	M5	2	M32 M32
160	3C x 50 mm ²	6	M6	2	M40 M40

Information required at the time of enquiry

The following information should be provided at the time of enquiry.

1. Motor kW and Pole
2. Application
3. Supply voltage and frequency with variation
4. Ambient Temperature
5. Duty Type, CDF and number of starts/ stops per hour
6. Mounting arrangement
7. Load GD2 referred to motor shaft (If more than Motor GD2)
8. Degree of protection
9. Shaft extension, If other than standard
10. Any other relevant information

Selection Chart

Crane Duty Motors (S2 / S3 / S4 Duty)

4 Pole (Speed 1500 r/min)

Frame	60 Starts / per hour			90 Starts / per hour			Motor GD ² kgm ² x10 ⁻³
	25% CDF	40% CDF	60% CDF	25% CDF	40% CDF	60% CDF	
	kW	kW	kW	kW	kW	kW	
71ZCA4	0.55	0.55	0.55	0.55	0.55	0.55	3.92
80ZAA4	0.55	0.55	0.55	0.55	0.55	0.55	6.32
80ZBA4	0.75	0.75	0.75	0.75	0.75	0.75	8.0
80ZCA4	1.1	1.1	1.1	1.1	1.1	1.1	9.64
90SAA4	1.1	1.1	1.1	1.1	1.1	1.1	10.0
90LBA4	1.5	1.5	1.5	1.5	1.5	1.5	12.52
90LDA4	2.2	2.2	2.2	2.2	2.2	2.2	16.2
100LAA4	2.2	2.2	2.2	2.2	2.2	2.2	18.4
100LBA4	3.0	3.0	3.0	3.0	3.0	3.0	22.32
100LCA4	3.7	3.7	3.3	3.7	3.7	3.3	24.2
112MAA4	3.7	3.7	3.7	3.7	3.7	3.7	48.8
112MBA4	5.5	5.5	5.0	5.5	5.5	5.0	60.8
132SZA4	5.5	5.5	5.5	5.5	5.5	5.5	88.0
132MZA4	7.5	7.5	7.5	7.5	7.5	7.5	120
132MRA4	9.3	9.3	9.3	9.3	9.3	8.5	148.8
160MXA4	11	11	11	11	11	9.9	324.8
160LXA4	15	15	15	15	15	15	422.8

4 Pole (Speed 1500 r/min)

Frame	150 Starts / per hour			300 Starts / per hour			Motor GD ² kgm ² x10 ⁻³
	25% CDF	40% CDF	60% CDF	25% CDF	40% CDF	60% CDF	
	kW	kW	kW	kW	kW	kW	
71ZCA4	0.55	0.55	0.5	0.5	0.45	0.4	3.92
80ZAA4	0.55	0.55	0.55	0.55	0.5	0.45	6.32
80ZBA4	0.75	0.75	0.75	0.67	0.6	0.6	8.0
80ZCA4	1.1	1.1	1.0	1.0	1.0	0.8	9.64
90SAA4	1.1	1.1	1.1	1.1	1.1	1.0	10.0
90LBA4	1.5	1.5	1.5	1.5	1.5	1.3	12.52
90LDA4	2.2	2.2	2.2	2.2	2.0	2.0	16.2
100LAA4	2.2	2.2	2.2	2.2	2.2	2.0	18.4
100LBA4	3.0	3.0	3.0	2.8	2.8	2.5	22.32
100LCA4	3.7	3.3	3.0	3.0	3.0	2.5	24.2
112MAA4	3.7	3.7	3.7	3.7	3.3	3.0	48.8
112MBA4	5.5	5.5	4.5	4.5	4.0	3.5	60.8
132SZA4	5.5	5.5	5.5	5.5	5.0	4.0	88.0
132MZA4	7.5	7.5	7.5	7.5	7.0	6	120
132MRA4	9.3	8.5	8.0	7.7	7.2	6.8	148.8
160MXA4	11	11	9.3	8.0	7.5	7.0	324.8
160LXA4	15	15	13.5	13.5	11	9.3	422.8

Note: 1. Load GD² value should not be more than motor GD² value. 2. All motors suitable for an Ambient Temperature of 45 °C.

Selection Chart

Crane Duty Motors (S2 / S3 / S4 Duty)

6 Pole (Speed 1000 r/min)

Frame	60 Starts / per hour			90 Starts / per hour			Motor GD ² kgm ² x10 ⁻³
	25% CDF	40% CDF	60% CDF	25% CDF	40% CDF	60% CDF	
	kW	kW	kW	kW	kW	kW	
80ZAA6	0.37	0.37	0.37	0.37	0.37	0.37	7.88
80ZBA6	0.55	0.55	0.55	0.55	0.55	0.55	9.88
90SAA6	0.75	0.75	0.75	0.75	0.75	0.75	12.72
90LBA6	1.1	1.1	1.1	1.1	1.1	1.1	19.12
100LAA6	1.5	1.5	1.5	1.5	1.5	1.5	26.92
100LBA6	1.8	1.8	1.8	1.8	1.8	1.8	37.72
112MAA6	2.2	2.2	2.2	2.2	2.2	2.2	56.72
112MBA6	3.0	3.0	3.0	3.0	3.0	2.7	74.8
132SZA6	3.0	3.0	3.0	3.0	3.0	3.0	94.0
132MYA6	3.7	3.7	3.7	3.7	3.7	3.7	118.0
132MZA6	5.5	5.5	5.5	5.5	5.5	5.5	149.2
132MTA6	7.5	7.5	7.0	7.5	7.0	6.5	216.4
160MZA6	7.5	7.5	7.0	7.5	7.0	6.3	324.8
160LYA6	9.3	9.3	9.3	9.3	9.3	9.3	422.8
160LZA6	11	11	11	11	11	11	422.8

6 Pole (Speed 1000 r/min)

Frame	150 Starts / per hour			300 Starts / per hour			Motor GD ² kgm ² x10 ⁻³
	25% CDF	40% CDF	60% CDF	25% CDF	40% CDF	60% CDF	
	kW	kW	kW	kW	kW	kW	
80ZAA6	0.37	0.37	0.33	0.33	0.33	0.3	7.88
80ZBA6	0.55	0.55	0.5	0.5	0.5	0.45	9.88
90SAA6	0.75	0.75	0.7	0.7	0.7	0.65	12.72
90LBA6	1.1	1.1	0.9	0.9	0.9	0.8	19.12
100LAA6	1.5	1.5	1.3	1.3	1.1	1.1	26.92
100LBA6	1.8	1.8	1.6	1.8	1.5	1.3	37.72
112MAA6	2.2	2.2	2.0	2.0	2.0	1.8	56.72
112MBA6	3.0	3.0	2.7	2.7	2.2	2.0	74.8
132SZA6	3.0	3.0	2.7	2.7	2.7	2.2	94.0
132MYA6	3.7	3.7	3.3	3.3	3.3	3.0	118.0
132MZA6	5.5	5.5	5.0	5.0	5.0	4.5	149.2
132MTA6	7.5	7.0	6.3	6.5	6	5.5	216.4
160MZA6	5.8	5.3	5.0	-	-	-	324.8
160LYA6	9.3	9.3	9.3	9.3	8.2	7.8	422.8
160LZA6	11	11	9.8	9.8	8.5	8.0	422.8

Note: 1. Load GD² value should not be more than motor GD² value. 2. All motors suitable for an Ambient Temperature of 45 °C.

Selection Chart

Crane Duty Motors (S2 / S3 / S4 Duty)

8 Pole (Speed 750 r/min)

Frame	60 Starts / per hour			90 Starts / per hour			Motor GD ² kgm ² x10 ⁻³
	25% CDF	40% CDF	60% CDF	25% CDF	40% CDF	60% CDF	
	kW	kW	kW	kW	kW	kW	
90SAA8	0.37	0.37	0.37	0.37	0.37	0.37	12.72
90LBA8	0.55	0.55	0.55	0.55	0.55	0.55	19.12
100LAA8	0.75	0.75	0.75	0.75	0.75	0.68	26.88
100LBA8	1.1	1.1	1.1	1.1	1.1	1.0	63.72
112MAA8	1.5	1.5	1.5	1.5	1.5	1.2	66.8
132SZA8	2.2	2.2	2.2	2.2	2.2	2.2	118.0
132MZA8	3.0	3.0	3.0	3.0	3.0	3.0	150.8
160MYA8	3.7	3.7	3.7	3.7	3.7	3.3	358.0
160MZA8	5.5	5.5	5.5	5.5	5.5	5.0	478.0
160LZA8	7.5	7.5	7.5	7.5	7.5	7.0	600.8

8 Pole (Speed 750 r/min)

Frame	150 Starts / per hour			300 Starts / per hour			Motor GD ² kgm ² x10 ⁻³
	25% CDF	40% CDF	60% CDF	25% CDF	40% CDF	60% CDF	
	kW	kW	kW	kW	kW	kW	
90SAA8	0.37	0.37	0.37	0.37	0.37	0.33	12.72
90LBA8	0.55	0.55	0.50	0.55	0.50	0.45	19.12
100LAA8	0.75	0.75	0.66	0.68	0.66	0.58	26.88
100LBA8	1.1	1.1	1.0	1.0	0.8	0.7	63.72
112MAA8	1.5	1.5	1.2	1.5	1.2	1.0	66.8
132SZA8	2.2	2.2	2.0	2.0	1.8	1.5	118.0
132MZA8	3	3	2.6	2.8	2.2	1.8	150.8
160MYA8	3.3	3.3	3.0	3.0	2.5	2.0	358.0
160MZA8	5.0	5.0	4.5	4.0	3.5	3.0	478.0
160LZA8	7.5	7.0	6.5	6.0	5.5	5.0	600.8

Note: 1. Load GD² value should not be more than motor GD² value. 2. All motors suitable for an Ambient Temperature of 45 °C.

Brake Motors



Introduction

Brake Motor is combination of an AC Induction Motor and Electromagnetic DC brake. DC supply is fed to the brake from a rectifier unit installed in the motor terminal box.

The brake is disc type and is mounted on the motor shaft. The brake is 'Fail proof Type' i.e. brake comes into action and stops the driven equipment instantly when the power to the motor is switched off or / if power fails.

The supply to the rectifier is fed from any two terminals of the main terminal box. Havells with its AEG technology, state-of-art plant and automatic processing can offer zero-defect Brake Motors in frames 63 to 160, in 2P, 4P, 6P and 8P versions.

Operation

Under 'OFF' power condition Brake springs keep the Brake Liner pressed against the mounting flange thus preventing the rotation of the motor shaft. When power is switched on, the Brake coil gets energized through the Rectifier unit. It instantly attracts the armature disc by overcoming the spring force. This results in releasing of the brake rotor allowing the motor to rotate.

In the event of power failure / switch of mode, the brake coil gets de-energised. This results in the springs pressing the brake liner against mounting flange, i.e. returning armature disc to its original position. This results in instantaneous braking of rotor. Fail safe condition is thus ensured.

Applicable Standard

IS 325
IEC 34
BS 4999
IS 1231
IS 2223

Special Features

- The brake motors are simple, rugged & easy for maintenance.
- No separate DC supply is required as the rectifier is provided, which gives the required DC voltage for energisation of the brake.
- The rectifier is mounted inside the main terminal box so no separate terminal box required.
- Special brake liner is used which ensures, the braking torque value remains quite stable through out the use.

General guidelines for selection of suitable brake model:

The brakes are rated by torque & selection of suitable model can be made by calculating the required torque, rating or the brake & then matching it with static torque.

Torque (Nm) = 9550 x (kW/r/min) x Safety Factor (SF) where
kW-Kilowatts of motor,
r/min-Speed of motor,
SF-Safety Factor

Applications

Brake Motors are used for numerous applications. A few of them are listed below:

- Textile machinery
- Machine Tools
- Printing Machine
- Cranes and Hoists
- Material Handling Equipments
- Leather Processing Machines
- Cable Reeling Drums
- Rolling Mills
- Elevators
- Conveyers, etc.

Bearing Details

Frame Size	Bearing Sizes (C3 Clearance)	
	DE	NDE
63	6202 - 2Z	6202 - 2Z
71	6203 - 2Z	6203 - 2Z
80	6204 - 2Z C3	6204 - 2Z C3
90S, 90L	6205 - 2Z C3	6205 - 2Z C3
100L	6206 - 2Z C3	6206 - 2Z C3
112M	6206 - 2Z C3	6206 - 2Z C3
132S, 132M	6208 - 2Z C3	6208 - 2Z C3
160M, 160L	6309 - 2Z C3	6209 - 2Z C3

Terms to be incorporated while placing an enquiry:

- Application detail
- Motor power & speed
- Brake size / required braking torque
- Mounting
- No. of start/stops per hour
- Duty cycle

DC Brake Motors:

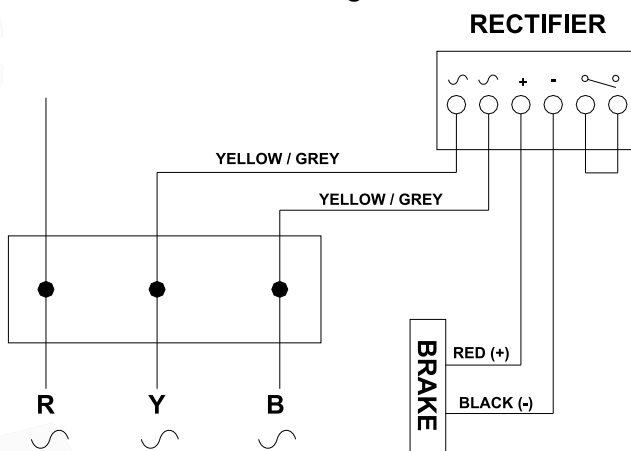
Voltage	: 415 V +/-10%
Frequency	: 50 Hz +/-5%
Combined Variation	: +/-10%
Ambient Temp.	: 50 °C
Duty	: S1
Mounting	: B3, B5, B14 & B35
Ins. Class	: F
Temp. Rise	: B
Protection	: IP55

Performance Table - For Brake Part

Selection Chart

kW	HP	Type	Rated	Torque	Brake	Safety	kW	HP	Type	Rated	Torque	Brake	Safety
			Speed	Mn	Torque	Factor				Speed	Mn	Torque	Factor
			r/min	Nm	Nm	SF				r/min	Nm	Nm	SF
0.12	0.16	MHBY63ZAA4	1350	0.85	5	5.9	2.2	3	MHBY90LCA2	2860	7.35	16	2.2
		MHBY71ZAA8	670	1.71	5	2.9			MHBY100LAA4	1435	14.64	35	2.4
0.18	0.25	MHBY63ZAA2	2790	0.62	5	8.1			MHBY112MAA6	940	22.35	60	2.7
		MHBY63ZBA4	1330	1.29	5	3.9			MHBY132SZA8	710	29.59	60	2
		MHBY71ZAA6	850	2.02	5	2.5	3	4	MHBY100LAA2	2860	10.02	35	3.5
		MHBY80ZAA8	680	2.53	10	4			MHBY100LBA4	1425	20.11	60	3
0.25	0.33	MHBY63ZBA2	2790	0.86	5	5.8			MHBY132SZA6	950	30.16	80	2.7
		MHBY71ZAA4	1340	1.78	5	2.8			MHBY132MZA8	710	40.35	80	2
		MHBY71ZBA6	870	2.74	5	1.8	3.7	5	MHBY100LCA2	2865	12.33	35	2.8
		MHBY80ZAA8	680	3.51	10	2.8			MHBY112MAA4	1430	24.71	60	2.4
0.37	0.5	MHBY71ZAA2	2820	1.25	5	4			MHBY132SYA6	950	37.19	80	2.2
		MHBY71ZBA4	1370	2.58	5	1.9			MHBY160MYA8	700	50.48	150	3
		MHBY80ZAA6	910	3.88	10	2.6	5.5	7.5	MHBY132SYA2	2890	18.17	60	3.3
		MHBY90SAA8	680	5.2	16	3.1			MHBY132SZA4	1430	36.73	80	2.2
0.55	0.75	MHBY71ZBA2	2830	1.86	10	5.4			MHBY132MZA6	950	55.29	150	2.7
		MHBY80ZAA4	1400	3.75	10	2.7			MHBY160MZA8	720	72.95	150	2.1
		MHBY80ZBA6	910	5.77	10	1.7	7.5	10	MHBY132SZA2	2880	24.87	60	2.4
		MHBY90LBA8	680	7.72	16	2.1			MHBY132MZA4	1440	49.74	150	3
0.75	1	MHBY80ZAA2	2840	2.52	10	4			MHBY160MZA6	970	73.84	150	2
		MHBY80ZBA4	1410	5.08	10	2			MHBY160LZA8	710	100.88	260	2.6
		MHBY90SAA6	910	7.87	16	2	9.3	12.5	MHBY132MRA2	2880	30.84	80	2.6
		MHBY100LAA8	690	10.38	35	3.4			MHBY160MYA4	1460	60.83	150	2.5
1.1	1.5	MHBY80ZBA2	2810	3.74	10	2.7			MHBY160LYA6	960	92.52	260	2.8
		MHBY90SAA4	1400	7.5	16	2.1	11	15	MHBY160MVA2	2940	35.73	80	2.2
		MHBY90LBA6	908	11.57	35	3			MHBY160MXA4	1460	71.95	150	2.1
		MHBY100LBA8	690	15.22	35	2.3			MHBY160LZA6	960	109.43	260	2.4
1.5	2	MHBY90SAA2	2830	5.06	16	3.2	15	20	MHBY160MXA2	2940	48.72	150	3.1
		MHBY90LBA4	1400	10.23	35	3.4			MHBY160LXA4	1460	98.12	260	2.6
		MHBY100LAA6	930	15.4	35	2.3	18.5	25	MHBY160LXA2	2950	59.89	150	2.5
		MHBY112MAA8	696	20.58	60	2.9							

Break Coil Connection Diagram:

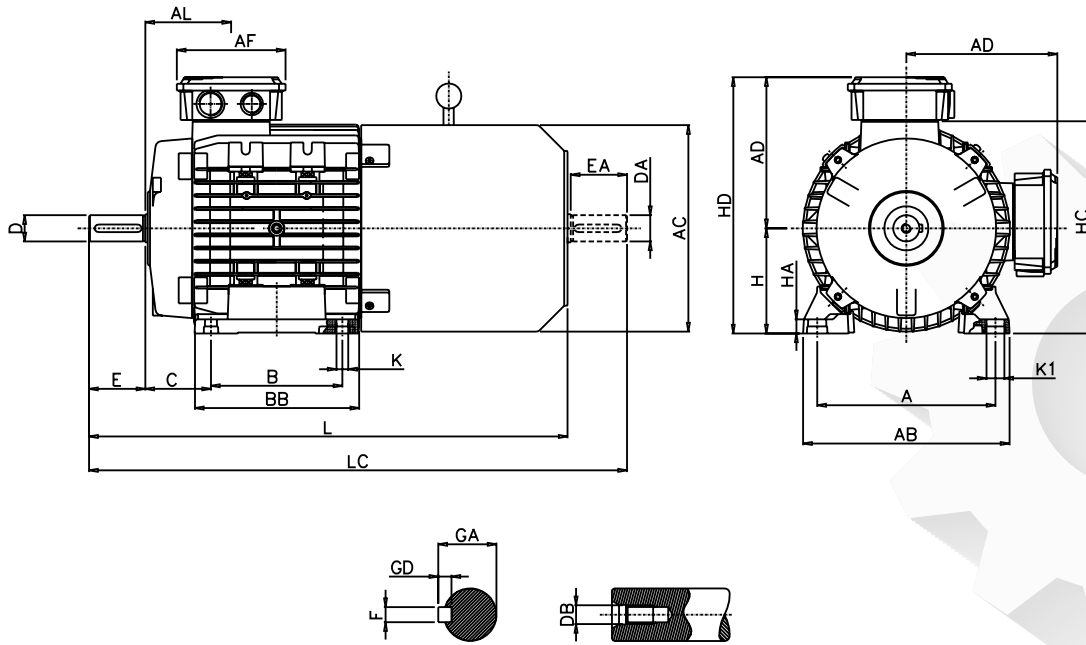


The Motor must never be switched ON unless the brake is energized and the brake should never be De-energised when the motor is ON. The interlocking of two contactors is Absolutely Necessary.

Note:

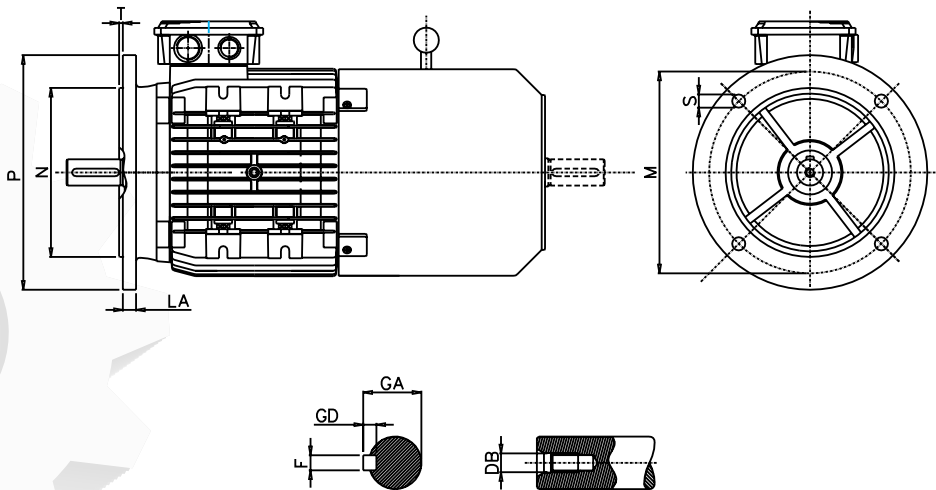
1. Other higher braking torque values can be given for special applications.
2. For performance details of motor part, please refer latest standard motor catalogue.

General Arrangement / Dimensional Drawing - Foot Mounted (B3) Brake Motor



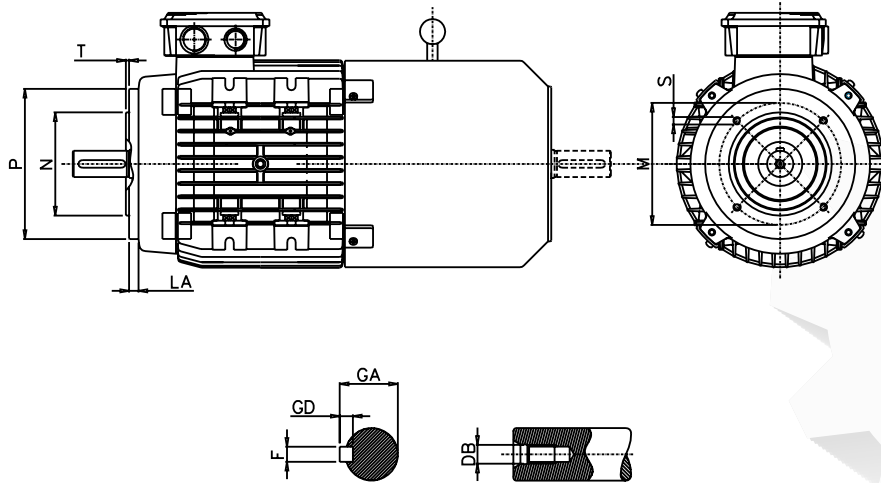
Frame	D/DA	E/EA	AD (2)	AL	AF	F/FA h10	GD	L	LC	GA/GC	DB (3)	AC	H	A	B	C	K(1)	AB	BB	HD (2)	HC	HA	K1	BA	AA
63	11 j6	23	96.5	66	92	4	4	290	310	12.5	M4	123	63	100	80	40	7	119	100	159.5	119.5	8	11	29	30
71	14 j6	30	111	69	92	5	5	331	358	16	M5	139	71	112	90	45	8	135	109	182	142	8	11	29	31
80	19 j6	40	139	79	110	6	6	377	419	21.5	M6	155.6	80	125	100	50	10	153	125	219	162	9.5	14	28.5	35
90S	24 j6	50	148	84.5	110	8	7	421	472	27	M8	176.6	90	140	100	56	10	170	150	238	181	11	15	28/53	37
90L	24 j6	50	148	84.5	110	8	7	421	472	27	M8	176.6	90	140	125	56	10	170	150	238	181	11	15	28/53	37
100L	28 j6	60	155	91	110	8	7	484	546	31	M10	192	100	160	140	63	11	192	166	255	198	12	17	38	44
112M	28 j6	60	171	91.5	110	8	7	512	575	31	M10	221	112	190	140	70	12.5	220	175	283	226	15	19	46	48.5
132S	38 k6	80	195	100	133	10	8	567	642	41	M12	248	132	216	140	89	12	256	180	327	261	17	20	45	59
132M	38 k6	80	195	120	133	10	8	622	698	41	M12	248	132	216	178	89	12	256	218	327	261	17	20	45	59
132M	38 k6	80	195	120	133	10	8	640	733	41	M12	248	132	216	178	89	12	256	218	327	261	17	20	45	59
160M	42 k6	110	240.5	146	150	12	8	750	853	45	M16	317	160	254	210	108	14	320	270	400.5	317	23	18	65	76
160L	42 k6	110	240.5	168	150	12	8	810	913	45	M16	317	160	254	254	108	14	320	310	400.5	317	23	18	65	76

General Arrangement / Dimensional Drawing - Flange Mounted (B5) Brake Motor



Frame	D/DA	E/EA	AD (2)	AL	AF	F/FA h10	GD	L	LC	GA/GC	DB (3)	AC	P	N	LA	M	T	S
63	11 j6	23	96.5	66	92	4	4	290	310	12.5	M4	123	140	95	3	9.5	115	8
71	14 j6	30	111	69	92	5	5	331	358	16	M5	139	160	110	3.5	9.5	130	10
80	19 j6	40	139	79	110	6	6	377	419	21.5	M6	155.6	200	130	3.5	11.5	165	10
90S	24 j6	50	148	84.5	110	8	7	421	472	27	M8	176.6	200	130	3.5	11.5	165	12
90L	24 j6	50	148	84.5	110	8	7	421	472	27	M8	176.6	200	130	3.5	11.5	165	12
100L	28 j6	60	155	91	110	8	7	484	546	31	M10	192	250	180	4	14	215	14
112M	28 j6	60	171	91.5	110	8	7	512	575	31	M10	221	250	180	4	14	215	14
132S	38 k6	80	195	100	133	10	8	567	642	41	M12	248	300	230	4	14	265	14
132M	38 k6	80	195	120	133	10	8	622	698	41	M12	248	300	230	4	14	265	14
132M	38 k6	80	195	120	133	10	8	640	733	41	M12	248	300	230	4	14	265	14
160M	42 k6	110	240.5	146	150	12	8	750	853	45	M16	317	350	250	5	18	300	15
160L	42 k6	110	240.5	168	150	12	8	810	913	45	M16	317	350	250	5	18	300	15

General Arrangement / Dimensional Drawing - Face Mounted (B14) Brake Motor



Frame	D/DA	E/EA	AD (2)	AL	AF	F/FA h10	GD	L	LC	GA/GC	DB (3)	AC	P	N	LA	M	T	S
63	11 j6	23	96.5	66	92	4	4	290	310	12.5	M4	123	90	60	8.5	75	2.5	M5
71	14 j6	30	111	69	92	5	5	331	358	16	M5	139	105	70	7.6	85	2.5	M6
80	19 j6	40	139	79	110	6	6	377	419	21.5	M6	155.6	120	80	9.5	100	3	M6
90S	24 j6	50	148	84.5	110	8	7	421	472	27	M8	176.6	140	95	9	115	3	M8
90L	24 j6	50	148	84.5	110	8	7	421	472	27	M8	176.6	140	95	9	115	3	M8
100L	28 j6	60	155	91	110	8	7	484	546	31	M10	192	160	110	10	130	3.5	M8
112M	28 j6	60	171	91.5	110	8	7	512	575	31	M10	221	160	110	10	130	3.5	M8
132S	38 k6	80	195	100	133	10	8	567	642	41	M12	248	200	130	23	165	3.5	M10
132M	38 k6	80	195	120	133	10	8	622	698	41	M12	248	200	130	23	165	3.5	M10
132M	38 k6	80	195	120	133	10	8	640	733	41	M12	248	200	130	23	165	3.5	M10
160M	42 k6	110	240.5	146	150	12	8	750	853	45	M16	317	250	180	20	215	4	M12
160L	42 k6	110	240.5	168	150	12	8	810	913	45	M16	317	250	180	20	215	4	M12



ZHMMIC00001/ Jan 18 / Sep 19

REGIONAL & BRANCH OFFICES:

NORTH - REGIONAL OFFICE: Corporate Office: QRG Towers, 2D, Sector-126, Expressway, Noida-201304, Tel: 0120-3331000, **Delhi:** Tel: 011-47676700, 23888200, **Chandigarh:** Tel: 0172-4232400-401, **Dehradun:** Tel: 0135-6670202, **Noida / Haryana:** Tel: 0120-3331000, **Ludhiana:** Tel: 0161-4676000 / 24, **Jammu:** Tel: 0191-2478330, 2479330, **Sri Nagar:** Tel: 0194-2490431, **Jaipur:** Tel: 0141-3914645, 3988210 **Jodhpur:** Tel: 0291-9214201640 / 45, **Lucknow:** Tel: 0522-6672100, **Kanpur:** Tel: 0512-6710400, 6710409

EAST - REGIONAL OFFICE: Kolkata: ICC Tower, 5th Floor, 4 India Exchange Place, Kolkata-700001, Tel: 033-40129851/ 52, **Bhubaneswar:** Tel: 0674-6668101/102/103/104, **Guwahati:** Tel: 0361-2134521, 2458923, 2460355, **Siliguri:** Tel: 0353-2525907, **Ranchi:** 0651-2244861, 2244862, 2244864, 2244868, 2244869, **Jamshedpur:** Tel: 0657-6542492, 09234369436, **Patna:** Tel: 0612-2207221, 2207222, 2207223, 2655518

WEST - REGIONAL OFFICE: Mumbai: 1271, Solitaire Corporate Park, Bldg. No. 12, 7th Floor, Andheri - Ghatkopar Link Road, Chakala, Andheri (East), Mumbai- 400093. Ph.: 022 - 67298600-602, **Ahmedabad:** Tel: 079-40061111, 40060738-740, **Indore:** Tel: 0731-2572340-41, 4009998 (Airtel), **Rajkot:** Tel: 0281-2481112, 2921212, **Nagpur:** Tel: 0712-2240932, 2242692, 2242699 **Pune:** Tel: 020-64016413 / 14, **Raipur:** Tel: 0771-4243400 / 01, **Surat:** Tel: 0261-2350137, 9979890137, **Jabalpur:** Tel: 0761-4064491

SOUTH - REGIONAL OFFICE: Chennai: Sigapi Achi Building, No. 18 / 3, 6th Floor, Rukmani Lakshmi Pathy Road, Egmore, Chennai-600008, Tel: 044-42280600, 605, **Bangalore:** Tel: 080-49075000, **Coimbatore:** Tel: 0422-4550200, 2305199, 2306199, **Hyderabad:** Tel: 040-27533372, 27533355, 27533632, 66320407/0408/6401/6402, **Kochi:** Tel: 0484-4099000, **Vishakapatnam:** Tel: 0891-6514339, **Vizag:** Tel: 0891-6514339, **Vijayawada:** Tel: 91+9247058847/57, **Calicut:** 0495-4019194, **Madurai:** 0452-4267022, **Trivandrum:** 0471-4015323, **Hubli:** 09448146028, **Trichy:** 09944460160

Representative Offices: • Goa • Solapur • Gwalior • Kathmandu • Bhopal

"COPYRIGHT SUBSISTS. IMITATION OF TRADE DRESS, GRAPHICS AND COLOR SCHEME OF THIS DOCUMENT IS A PUNISHABLE OFFENCE."

Scan the QR Code
to download
Havells mCatalogue



Havells India Ltd.

QRG Towers, 2D, Sector -126, Expressway, Noida - 201 304 (UP), Ph. +91-120-3331000,

E-mail: marketing@havells.com, www.havells.com

Consumer Care No.: 1800 11 0303, 1800 103 1313 (All Connections), 011-4166 0303 (Landline)

Join us on Facebook at www.facebook.com/havells and share your ways to save the planet!

CIN - L31900DL1983PLC016304.



HAVELLS