HAVELLS

Energy Efficient 3 Phase
LV Induction Motors

Catalogue 2018

CE IE3 & IE2

QRG GROUP


HAVELLS-LAFERT

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 0.25HP to 470HP.

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 Automatc 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

STANDARD PRODUCT SPECIFICATIONS

Motor Type	AC Three Phase Squirrel Cage Induction Motor
Reference Standard	IS:12615: 2014 (IEC 60034-1)
Voltage ± Variation	415 Volts ± 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 1000M
Relative Humidity	Upto 100%
Degree of Protection	IP 55 (As per IS 4691)
Class of Insulation	Class 'F'
Ambient Temp / Temp Rise	50°C / 70°C
Duty / Rating	S1 / Continuous
Position of Terminal Box	Top
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	0.25-470 HP
Voltage	220-660V
Frequency	25-60Hz
Ambient temperature	20^0 C - 50^0 C

CE IE3 & IE2

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° 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 φ)	$-\frac{1 - \cos \varphi}{6}$, minimum 0.02, maximum 0.07
Slip (s) (at rated load and at working temperature)	±20 % of the guaranteed slip at $P_N \geq 1$ kW ±30 % of the guaranteed slip at $P_N < 1$ kW
Breakaway starting current (I_A) (in the starting circuit envisaged)	+ 20 % of the guaranteed starting current (no lower limit)
Breakaway torque (MA)	- 15 % and + 25 % of the guaranteed breakaway torque (+ 25 % may be exceeded by agreement)
Pull-up torque (MS)	- 15 % of the guaranteed value
Pull-out torque (MK)	- 10 % of the guaranteed value (after allowing for this tolerance, M_K/M_N not less than 1.6)
Moment of inertia (J)	±10 % of the guaranteed value

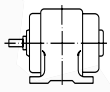
* P_N = Rated Pawer.

Mounting arrangements

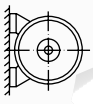
Mounting arrangements for rotating electrical machines are designated according to IS 2253 / IEC 60034-7. Our motors are available with the mounting arrangements listed below, depending on design and frame size. Motors with aluminium frame are equipped with detachable feet that allow easy change of mounting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

Foot mounting

B3 - Horizontal foot mounted



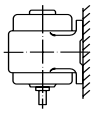
B6 - Horizontal wall mounted (LHS)



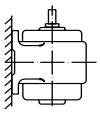
B7 - Horizontal wall mounted (RHS)

B8 - Horizontal ceiling mounted

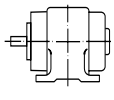
V5 - Wall mounted shaft down wards



V6 - Wall mounted shaft up wards

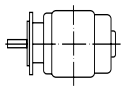


B34 - Horizontal base flange type 'C'

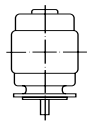


Flange mounting

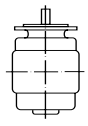
B5 - Flange type 'D'



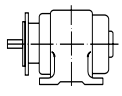
V1 - Vertical down wards flange type 'D'



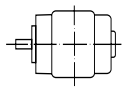
V3 - Vertical up wards flange type 'D'



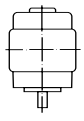
B35 - Horizontal base flange type 'D'



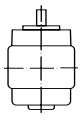
B14 - Horizontal face flange type 'C'



V18 - Vertical face down wards flange type 'C'



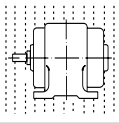
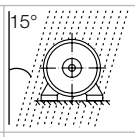
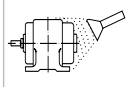
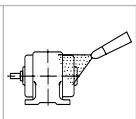
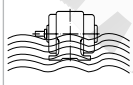
V19 - Vertical face up wards flange type 'C'



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 noozle 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 (Tmax) 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 50Hz						
		Output	rpm	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:

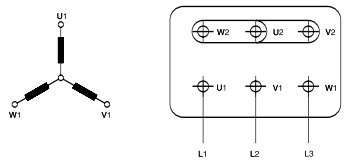
- Maximum converter output voltage 500V at peak voltages Û 1460V and du/dt 13 kV/us. For higher converter output voltages or stresses, a special insulation is required.
- With square characteristic of the load torque, motors can be driven with their rated torque.
- For constant torque, the rated torque 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.

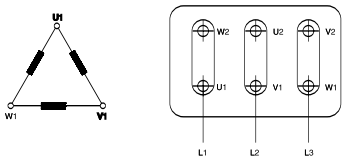
Star connection



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: Iph = In ; Uph = Un / 1.732

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

Delta connection



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

The phase current Iph and the phase voltage Uph are:

Iph = In / 1.732 ; Uph = Un

where In and Un are referred to the delta connection.

Star-delta starting

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

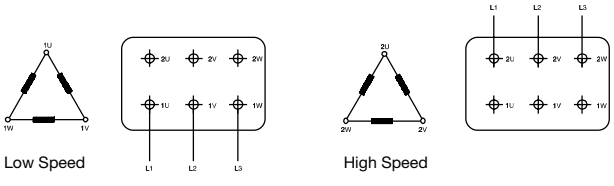
All motors can be supplied with windings designed for star-delta starting (for example: 415 V Δ / 690 Volts Y).

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).

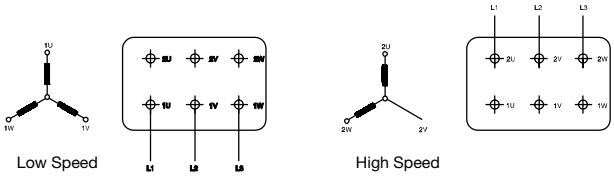
When the ratio between the two speeds is from 1 to 2, the standard motors have one single winding (Dahlander connection). For the other speeds, the motors have two separate windings.

Two separate windings Δ/Δ



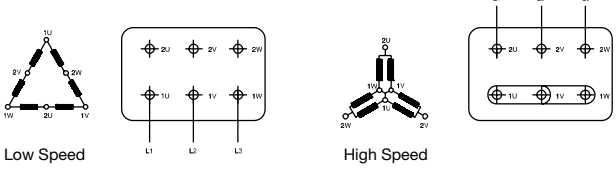
Low Speed High Speed

Two separate windings 人/人



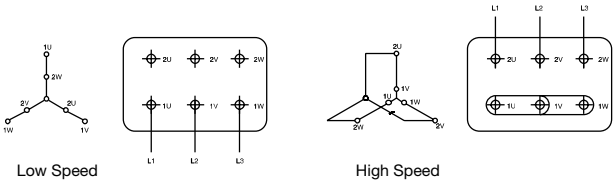
Low Speed High Speed

Single winding Δ/人人



Low Speed High Speed

Single winding 人/人人



Low Speed High Speed

Electrical Parameter

Rated voltage

Motors are suitable for variation of ± 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 ±10%
415 V ±10%
690 V ±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 415V. The conversion to other operating voltages, with output and frequency remaining unchanged, is to be made as follows:

Nominal voltage (V)	230	380	415	440	500	660	690
Conversion factor x I_N	1.74	1.05	1.0	0.91	0.80	0.61	0.58

Rated torque

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

Output

The outputs stated in this catalogue are for constant load in continuous running duty S1 according to 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 1000m 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,
$\eta s = f/p \times 120$(rpm)
where η= synchronous speed (rpm) s
f = frequency (Hz)
P = number of poles
note 2p = 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, $\eta$and rotor speed, η; referred to the synchronous speed, is called slip.
This slip, s, is expressed as a percentage;
$s = \eta s - \eta / \eta s \times 100$ (%)
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
$T_N = 9550 \times 415.I / Ux$ [Nm]
Where P = power (kW)
T_N = motor speed (rpm)
alternatively, torque T, in kgm can be given as
$T_N = 974 \times P/n$ [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

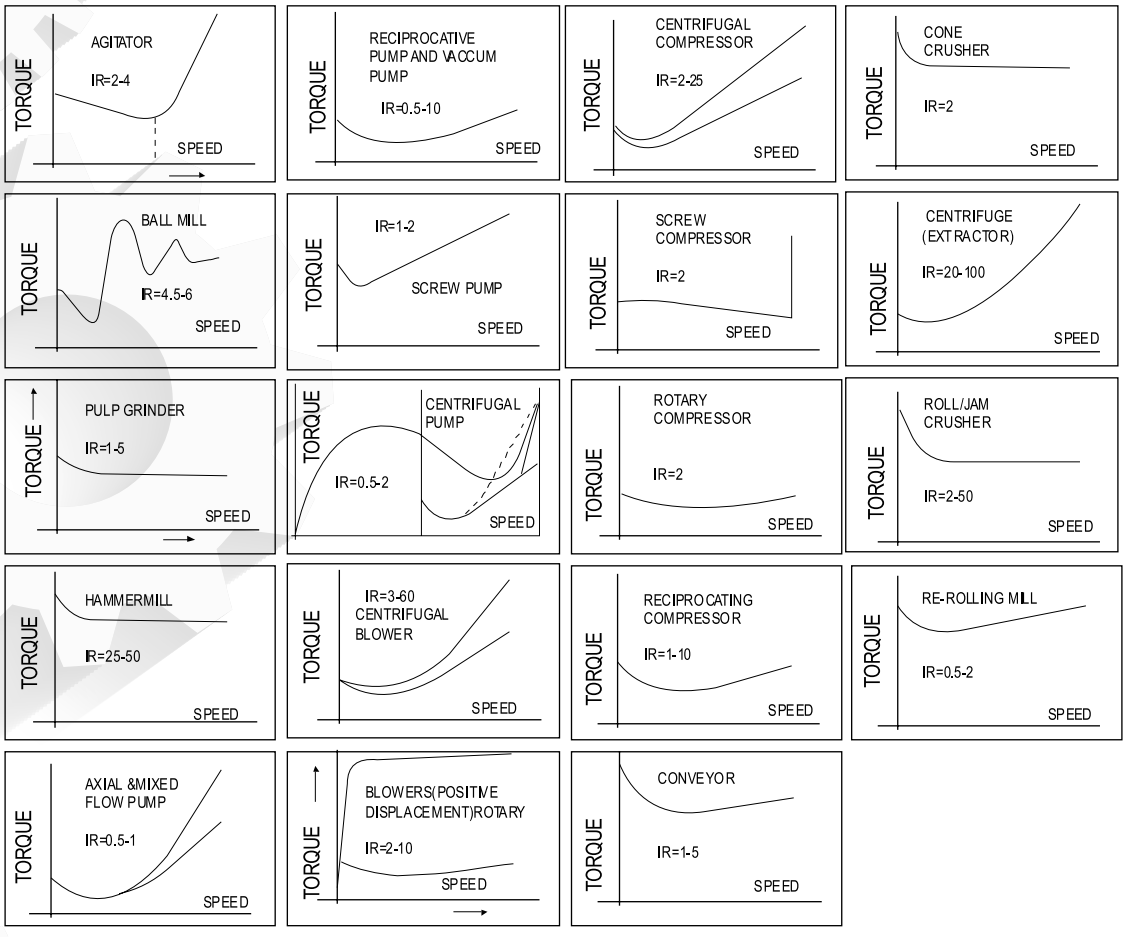
The moment of inertia J is given in Kgm^2. The moment of inertia is numerically equal to 1/4 GD^2. The moment of inertia J_L of the driven machine at n_L rpm when referred to motor speed n rpm is given by $J = J_L [n_L/n]^2$.

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, Inerti a Ratio etc. are given based on experience of normal applications. Theses values should be verified in actual before farming 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 400V with delta connection or at 690V 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

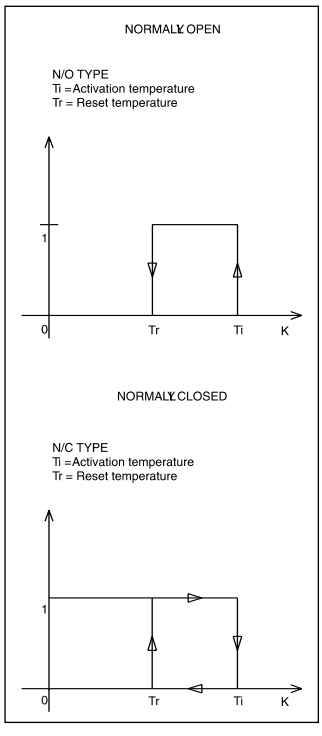
The decision on a particular type of thermal protection should be taken according to the actual operating conditions. Motors may be protected by means of current-dependent thermal protection switches, over current relays and temperature detectors.

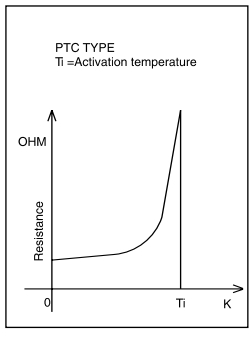
Thermal protection is possible as follows:

- 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) RPM
Temperature range	-20ºC to + 85ºC
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 132M 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.

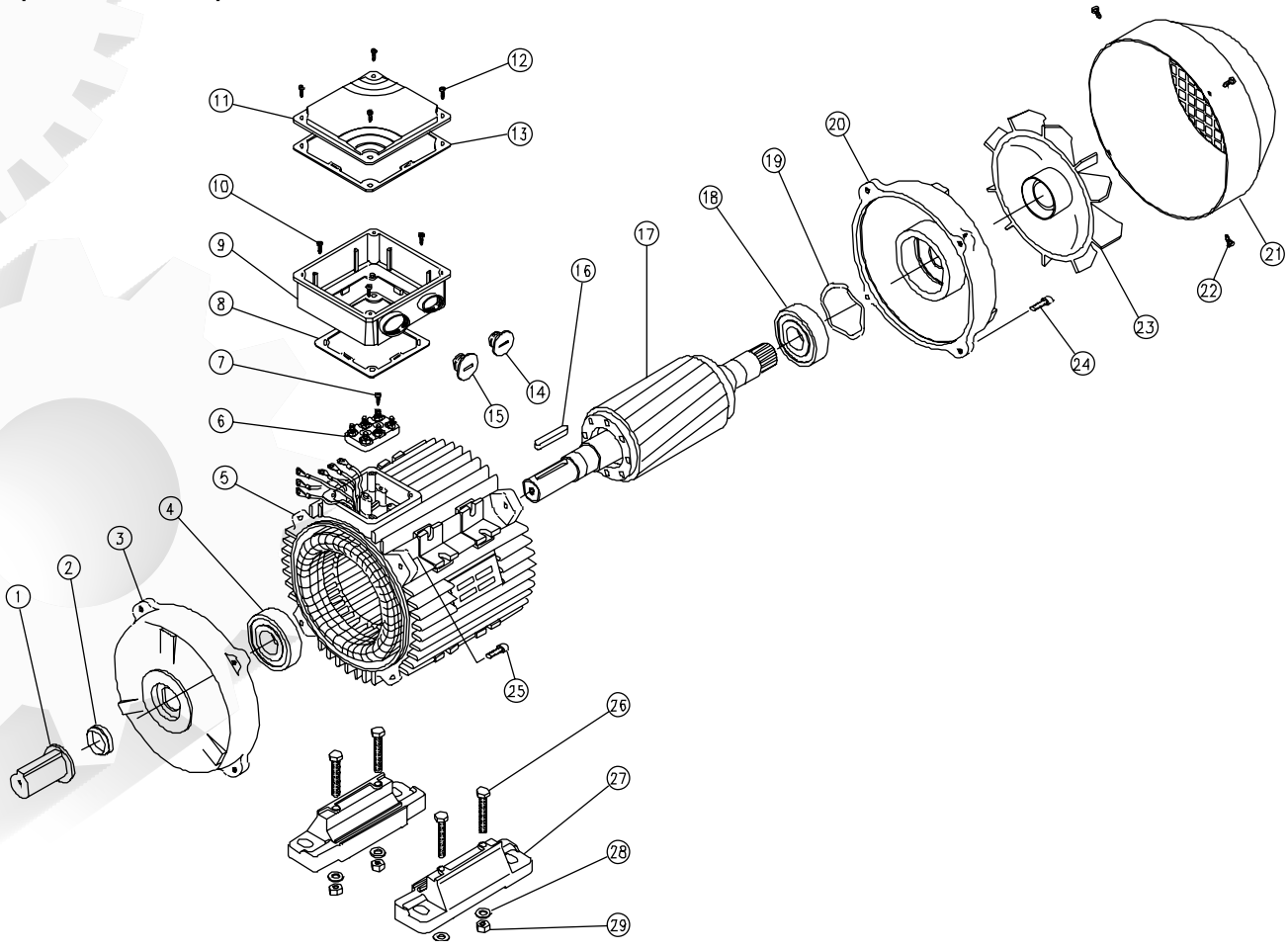
The slot liners are either provided with double cuffing or edge binding at the slot mouth portion to strengthen the insulation. For frame 160 & above class F varnish is used for impregnating the winding. Epoxy gel coat can be provided as per requirement to withstand the electrical and mechinical stresses. 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 355L.

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. RPM	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	Horizontal shaft				Vertical shaft - force upwards				Vertical shaft - force downwards			
	3000 RPM kN	1500 RPM kN	1000 RPM kN	750 RPM kN	3000 RPM kN	1500 RPM kN	1000 RPM kN	750 RPM kN	3000 RPM kN	1500 RPM kN	1000 RPM kN	750 RPM kN
56	0.16	0.21	-	-	0.18	0.22	-	-	0.15	0.19	-	-
63	0.19	0.26	-	-	0.21	0.28	-	-	0.17	0.24	-	-
71	0.23	0.33	0.33	0.37	0.26	0.35	0.36	0.39	0.21	0.30	0.31	0.34
80	0.32	0.44	0.46	0.50	0.34	0.47	0.48	0.53	0.29	0.41	0.43	0.47
90	0.34	0.48	0.49	0.54	0.38	0.47	0.53	0.58	0.31	0.44	0.46	0.51
100	0.48	0.68	0.70	0.77	0.54	0.74	0.76	0.83	0.43	0.62	0.64	0.71
112	0.48	0.68	0.70	0.77	0.56	0.75	0.77	0.84	0.40	0.60	0.62	0.69
132	0.6	0.9	1.1	1.3	1.0	1.3	1.5	1.9	0.5	0.75	0.75	1.05
160	0.5	0.8	1.2	1.5	1	1.4	1.8	2	0.2	0.4	0.6	0.9
180	0.5	0.8	1.2	1.5	1.1	1.4	1.8	2.1	0.2	0.4	0.6	0.9
200	0.8	1.3	1.5	1.8	1.8	2.3	2.5	2.8	0.2	0.7	0.9	1.1
225	1.0	1.6	1.9	2.4	2.1	2.6	2.9	3.4	0.3	0.70	1.0	1.5
250	1.1	1.6	2.0	2.5	2.3	2.7	3.2	3.7	0.2	0.60	1.1	1.5
280	1.7	1.9	2.4	2.9	2.9	3.1	3.6	3.7	0.15	0.3	0.8	1.0
315	3.5	4.0	4.5	5.0	6.0	7.0	7.5	8.0	1.0	1.9	2.4	2.9

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

* Consult according to direction of force

Permissible radial forces

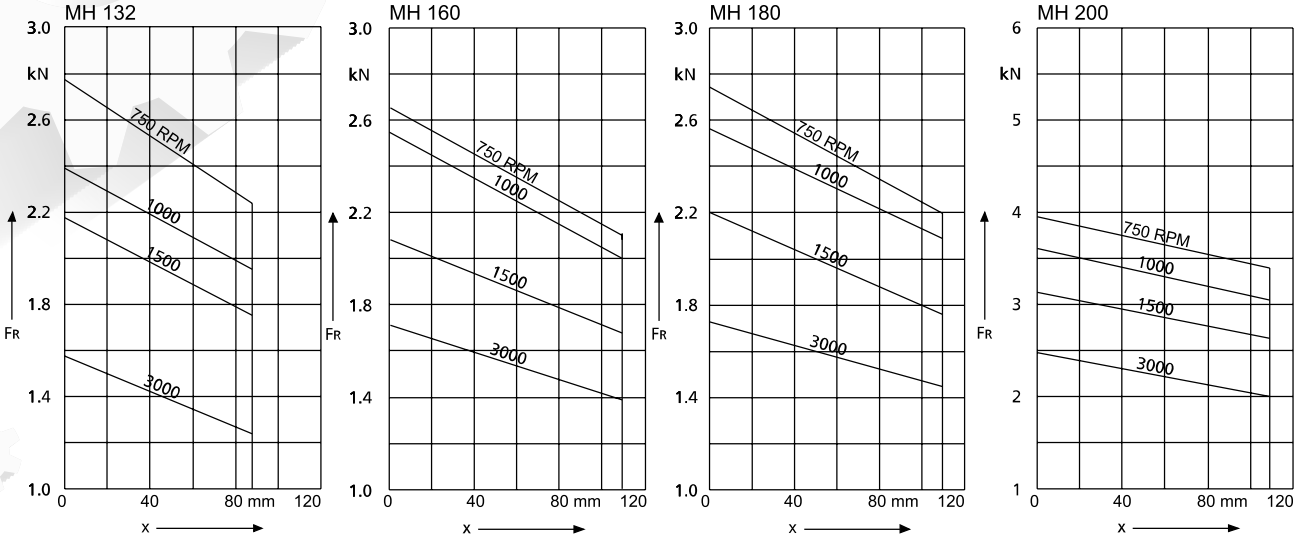
without additional axial force
(Ball bearings)

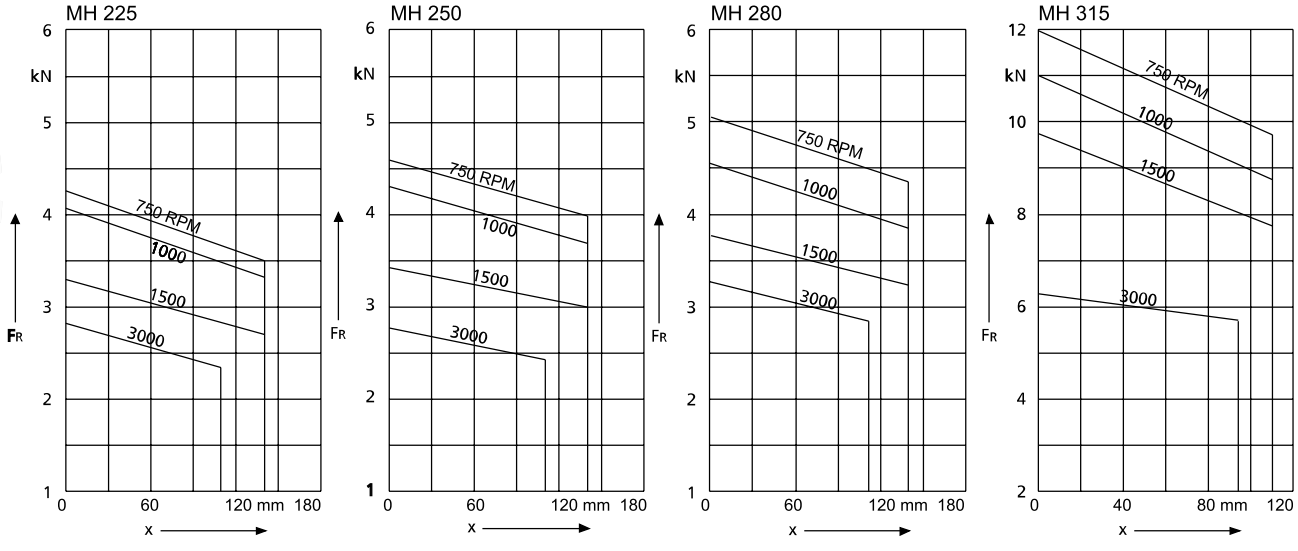
Nominal life = 20.000 h (Lh10)

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 RPM	4 - 8 Pole RPM
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	Terminal			Cable Entry Size		
	Main DOL	Stud Size Star/Delta	Terminals	Main	Earth	Nos.			
63 - 71	4Cx4mm^2	–	6	M4	M4	2	M16	M20	-
80	4Cx4mm^2	–	6	M4	M4	2	M20	M25	-
90	4Cx10mm^2	4Cx10mm^2	6	M5	M4	2	M20	M25	-
100	4Cx10mm^2	–	6	M5	M4	2	M20	M25	-
112	4Cx10mm^2	4Cx10mm^2	6	M5	M4	2	M20	M25	-
132	4Cx10mm^2	4Cx10mm^2	6	M5	M4	2	M32	M32	-
160	3Cx50mm^2	2x3Cx35mm^2	6	M6	M4	2	M40	M40	-
180	3Cx50mm^2	2x3Cx35mm^2	6	M8	M5	2	M40	M40	M20
200	3Cx50mm^2	2x3Cx35mm^2	6	M8	M5	2	M50	M50	M25
225	3Cx120mm^2	2x3Cx95mm^2	6	M10	M6	2	M50	M50	M25
250	3Cx120mm^2	2x3Cx95mm^2	6	M10	M6	2	M50 / M63	M50 / M63	M25
280	3Cx120mm^2	2x3Cx95mm^2	6	M10	M6	2	M63	M63	-
315	3Cx400mm^2	2x3Cx300mm^2	6	M16	M8	2	M63	M63	-
355	3Cx400mm^2	2x3Cx300mm^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, rpm & 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

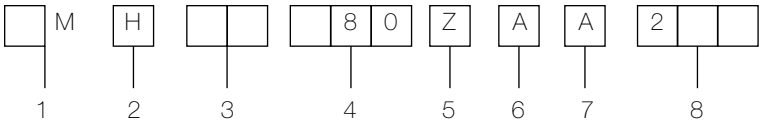
Apart from other information, it is necessary to specify the exact type designation in all enquiries, when ordering spare parts or replacement motors or when asking for documentary information.

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 H HE EE HP	Three-phase motor Three-phase motor, efficiency to EPACT regulations / IE1 Three-phase motor, efficiency EFF 1 to CEMEP Voluntary Agreement Three-phase motor, IE2 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 S M L	Totally enclosed (TE) Mechanical dimension (short) Mechanical dimension (medium) Mechanical dimension (long)
6	Mechanical design and output value	A B ... Z	For Internal use
7	Frame material and/or stage of development	A G E	Aluminium frame Cast iron frame Stage of development
8	Number of poles	2 4 6 8	4/2 8/4 4/6 6/8

Example



IE3

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 RPM (2 Pole)

Frame Size	Output		Speed	Efficiency			Power Factor (Cos j)			Rated Current	DIRECT-ON-LINE STARTING			Moment of inertia	Weight
	kW	HP	Rpm	100%	75%	50%	100%	75%	50%	(Amps.)	Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)	GD^2 (Kgm^2)	Kg (Approx.)
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	12
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	14
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	17
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	19
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	26
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	31
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	43
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	85
MHHP132STA2	7.5	10	2900	90.1	90.1	89.2	0.90	0.87	0.82	12.9	750	230	250	0.0714	90
MHHP160MYA2	11	15	2930	91.2	91.2	90.3	0.88	0.85	0.80	19.1	750	220	250	0.246	134
MHHP160MZA2	15	20	2930	91.9	91.9	91	0.89	0.86	0.81	25.5	750	220	250	0.284	150
MHHP160LZA2	18.5	25	2930	92.4	92.4	91.5	0.9	0.87	0.82	31.0	750	220	240	0.359	190
MHHP180MZA2	22	30	2935	92.7	92.7	91.8	0.9	0.87	0.82	36.7	750	220	250	0.414	220
MHHP200LPG2	30	40	2950	93.3	93.3	92.4	0.9	0.87	0.82	49.7	750	200	245	0.775	235
MHHP200LRG2	37	50	2950	93.7	93.7	92.8	0.88	0.85	0.80	62.4	750	220	250	0.99	264
MHHP225MP2	45	60	2950	94	94	93.1	0.9	0.88	0.84	74.0	750	220	250	1.78	425
MHHP250MP2	55	75	2950	94.3	94.3	93.4	0.90	0.88	0.84	90.2	750	200	240	2.145	451
MHHP280SV2	75	100	2975	94.7	94.7	93.8	0.92	0.90	0.86	119.8	750	210	250	4.635	720
MHHP280MV2	90	125	2975	95	95	94.1	0.91	0.89	0.85	144.8	750	220	250	5.319	750
MHHP315SYE2	110	150	2985	95.2	95.2	94.3	0.91	0.90	0.87	176.7	750	180	220	6.59	995
MHHP315MZE2	132	180	2980	95.4	95.4	94.5	0.91	0.90	0.87	211.5	750	200	230	7.644	1075
MHEE315LYE2	160	220	2980	95.6	95.6	94.5	0.92	0.91	0.88	253.1	750	200	245	8.736	1215
MHHP315LZE2	200	270	2985	95.8	95.8	94.7	0.92	0.91	0.88	315.7	750	180	220	11.32	1290
MHHP355MB2	250	340	2985	95.8	95.8	94.9	0.92	0.91	0.89	394.6	750	180	220	19.4	2050
MHHP355LB2	315	430	2985	95.8	95.8	94.9	0.92	0.91	0.89	497.2	750	180	220	26.77	2415

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

IE3

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 RPM (4 Pole)

Frame Size	Output		Speed	Efficiency			Power Factor (Cos j)			Rated Current	DIRECT-ON-LINE STARTING			Moment of inertia	Weight
	kW	HP	Rpm	100%	75%	50%	100%	75%	50%	(Amps.)	Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)	GD^2 (Kgm^2)	Kg (Approx.)
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	13
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	19
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	21
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	28
MHHP90LBA4	1.5	2	1430	85.3	85.3	84.4	0.83	0.79	0.71	2.9	650	210	250	0.025	33
MHHP100LAA4	2.2	3	1455	86.7	86.7	85.8	0.78	0.74	0.66	4.5	700	210	240	0.0462	42
MHHP112MAA4	3.7	5	1450	88.4	88.4	87.5	0.82	0.78	0.71	7.1	700	220	250	0.0608	50
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	80
MHHP132MZA4	7.5	10	1450	90.4	90.4	89.5	0.82	0.78	0.71	14.1	700	220	250	0.1628	100
MHHP160MZA4	11	15	1460	91.4	91.4	90.5	0.85	0.81	0.74	19.7	720	210	260	0.456	144
MHHP160LZA4	15	20	1465	92.1	92.1	91.2	0.85	0.81	0.74	26.7	720	210	250	0.501	180
MHHP180MZA4	18.5	25	1465	92.6	92.6	91.7	0.83	0.79	0.72	33.5	650	215	250	0.68	230
MHHP180LZA4	22	30	1465	93	93	92.1	0.85	0.81	0.75	38.7	700	200	250	0.742	250
MHHP200LRG4	30	40	1465	93.6	93.6	92.7	0.83	0.80	0.73	53.7	700	210	250	1.6	330
MHHP225SP4	37	50	1475	93.9	93.9	93	0.85	0.82	0.75	64.5	700	220	260	1.84	410
MHHP225MP4	45	60	1475	94.2	94.2	93.3	0.86	0.83	0.77	77.3	700	220	250	2.112	440
MHHP250MP4	55	75	1475	94.6	94.6	93.9	0.86	0.83	0.77	94.1	700	240	265	3.85	480
MHHP280SV4	75	100	1485	95	95	94.1	0.87	0.84	0.78	126	750	220	250	4.928	730
MHHP280MG4	90	125	1485	95.2	95.2	94.3	0.88	0.85	0.80	149.5	750	220	250	6.424	840
MHHP315SYE4	110	150	1490	95.4	95.4	94.5	0.88	0.86	0.81	182.3	750	220	250	13.68	1200
MHHP315MYE4	132	180	1490	95.6	95.6	94.7	0.88	0.86	0.81	218.3	750	200	230	15.92	1330
MHHP315LYE4	160	220	1490	95.8	95.8	94.9	0.89	0.87	0.82	261	750	220	250	18.17	1500
MHHP315LZE4	200	270	1490	96	96	95.1	0.89	0.88	0.83	326	750	220	250	20.812	1640
MHHP355MB4	250	340	1490	96	96	95.1	0.90	0.89	0.85	402.6	750	220	250	30.58	1870
MHHP355LA4	315	425	1490	96	96	95.1	0.90	0.89	0.85	507.2	750	220	250	38.28	2090

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

IE3

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 RPM (6 Pole)

Frame Size	Output		Speed	Efficiency			Power Factor (Cos j)			Rated Current	DIRECT-ON-LINE STARTING			Moment of inertia	Weight
	kW	HP	Rpm	100%	75%	50%	100%	75%	50%	(Amps.)	Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)	GD² (Kgm²)	Kg (Approx.)
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	18
MHHP80ZBA6	0.55	0.75	920	77.2	77	76	0.71	0.66	0.57	1.4	450	180	220	0.01086	20
MHHP90SAA6	0.75	1.0	920	78.9	78.9	78	0.72	0.67	0.59	1.8	650	180	220	0.023	29
MHHP90LAA6	1.1	1.5	915	81	81	80.1	0.75	0.70	0.62	2.5	650	180	220	0.0253	35
MHHP100LAA6	1.5	2	935	82.5	82.5	81.7	0.75	0.70	0.62	3.4	650	190	210	0.0517	46
MHHP112MAA6	2.2	3	950	84.3	84.3	83.4	0.75	0.70	0.63	4.8	600	210	240	0.0748	66
MHHP132SYA6	3.7	5	960	86.5	86.5	85.6	0.74	0.70	0.62	8.0	650	200	240	0.22	85
MHHP132MZA6	5.5	7.5	975	88	88	87.1	0.75	0.71	0.63	11.6	600	200	240	0.242	93
MHHP160MZA6	7.5	10	975	89.1	89.1	88.2	0.8	0.76	0.68	14.6	700	200	240	0.45	145
MHHP160LZA6	11	15	965	90.3	90.3	89.4	0.79	0.75	0.68	21.5	700	200	280	0.472	151
MHHP180LZG6	15	20	975	91.2	91.2	90.3	0.82	0.78	0.71	28.0	720	200	250	0.99	230
MHHP200LPG6	18.5	25	975	91.7	91.7	90.8	0.8	0.76	0.69	35.0	700	200	230	2.05	240
MHHP200LRG6	22	30	980	92.2	92.2	91.3	0.83	0.79	0.72	40.0	750	200	230	2.26	270
MHHP225MP6	30	40	980	92.9	92.9	92	0.83	0.79	0.72	54.1	750	200	250	3.52	350
MHHP250MP6	37	50	980	93.3	93.3	92.6	0.83	0.80	0.73	67.0	750	200	240	5.75	470
MHHP280SV6	45	60	985	93.7	93.7	92.8	0.85	0.82	0.75	78.6	750	200	240	8.1	650
MHHP280MV6	55	75	985	94.1	94.1	93.2	0.84	0.81	0.74	96.8	750	200	240	8.51	680
MHHP315SYE6	75	100	990	94.6	94.6	93.7	0.86	0.83	0.77	129.0	750	200	240	20.78	1030
MHHP315MYE6	90	125	990	94.9	94.9	94	0.86	0.84	0.78	153.4	750	200	240	21.8	1170
MHHP315MZE6	110	150	990	95.1	95.1	94.2	0.84	0.82	0.76	192	750	200	240	23.98	1200
MHHP315LZE6	132	180	990	95.4	95.4	94.5	0.87	0.85	0.79	221.3	750	200	240	28.52	1450
MHHP355MA6	160	220	990	95.6	95.6	94.7	0.86	0.84	0.79	271.0	750	200	240	45.83	1820
MHHP355MC6	200	270	995	95.8	95.8	94.9	0.86	0.84	0.80	338	750	200	240	56.7	2050
MHHP355LA6	250	340	995	95.8	95.8	94.9	0.86	0.85	0.80	422.2	750	200	240	59.53	2240

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

IE2

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 RPM (2 Pole)

Frame Size	Output		Speed	Efficiency			Power Factor (Cos j)			Rated Current	DIRECT-ON-LINE STARTING			Moment of inertia	Weight
	kW	HP	Rpm	100%	75%	50%	100%	75%	50%	(Amps.)	Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)	GD^2 (Kgm^2)	Kg (Approx.)
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	11
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	12
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	17
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	25
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	26
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	32
MHEE132SZA2	5.5	7.5	2890	87	87	86.1	0.89	0.86	0.80	9.9	700	240	270	0.056	70
MHEE132STA2	7.5	10	2890	88.1	88.1	86.9	0.90	0.87	0.81	13.2	700	250	290	0.0684	85
MHEE160MYA2	11	15	2920	89.4	89.4	88.5	0.88	0.85	0.79	19.5	700	230	260	0.226	125
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	150
MHEE180MZA2	22	30	2930	91.3	91.3	90.4	0.9	0.87	0.82	37.2	700	220	250	0.2982	158
MHEE200LPG2	30	40	2945	92	92	91.1	0.9	0.87	0.82	50.4	700	210	255	0.7	212
MHEE200LRG2	37	50	2945	92.5	92.5	91.6	0.88	0.85	0.80	63.2	700	220	260	0.9	240
MHEE225MP2	45	60	2945	92.9	92.9	92	0.9	0.88	0.83	75	700	225	250	1.3	310
MHEE250MP2	55	75	2945	93.2	93.2	92.3	0.90	0.88	0.83	91.2	700	220	260	1.95	410
MHEE280SV2	75	100	2970	93.8	93.8	92.9	0.92	0.90	0.85	121	700	210	250	4.56	700
MHEE280MV2	90	125	2970	94.1	94.1	93.2	0.91	0.89	0.84	146.2	700	230	275	5.1	720
MHEE315SYE2	110	150	2980	94.3	94.3	93.4	0.91	0.90	0.86	178.3	700	200	235	6.5	980
MHEE315MZE2	132	180	2980	94.6	94.6	93.7	0.91	0.90	0.86	213.3	700	200	230	7.28	1023
MHEE315LYE2	160	220	2980	94.8	94.8	93.9	0.92	0.91	0.87	255.2	700	200	245	8.32	1155
MHEE315LZE2	200	270	2980	95	95	94.1	0.92	0.91	0.87	318.4	700	200	235	11.24	1280
MHEE355MB2	250	340	2980	95	95	94.1	0.92	0.91	0.88	398.0	700	200	240	18.5	1950
MHEE355LB2	315	430	2980	95	95	94.1	0.92	0.91	0.88	501.4	700	200	240	25.5	2300

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

IE2

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 RPM (4 Pole)

Frame Size	Output		Speed	Efficiency			Power Factor (Cos j)			Rated Current	DIRECT-ON-LINE STARTING			Moment of inertia	Weight
	kW	HP	Rpm	100%	75%	50%	100%	75%	50%	(Amps.)	Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)	GD² (Kgm²)	Kg (Approx.)
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	10
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	16
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	19
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	27
MHEE90LBA4	1.5	2	1420	82.8	82.8	81.2	0.83	0.78	0.70	3.0	600	250	280	0.022	28
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	46
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	69
MHEE132MZA4	7.5	10	1450	88.7	88.7	87.2	0.82	0.78	0.70	14.3	650	240	275	0.148	80
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	135
MHEE160MZA4	11	15	1460	89.8	89.8	89	0.85	0.80	0.73	20.0	650	220	260	0.42	135
MHEE160LZA4	15	20	1460	90.6	90.6	89.8	0.84	0.78	0.71	27.4	650	230	270	0.456	144
MHEE180MZA4	18.5	25	1460	91.2	91.2	90.3	0.82	0.80	0.73	34.4	650	230	250	0.6	190
MHEE180LZA4	22	30	1465	91.6	91.6	90.7	0.84	0.79	0.72	39.8	650	230	280	0.68	210
MHEE200LRG4	30	40	1460	92.3	92.3	91.4	0.83	0.81	0.74	54.5	650	220	250	1.45	260
MHEE225SP4	37	50	1475	92.7	92.7	91.8	0.85	0.83	0.76	65.3	650	225	260	1.65	330
MHEE225MP4	45	60	1475	93.1	93.1	92.2	0.86	0.83	0.76	78.2	650	220	250	1.84	360
MHEE250MP4	55	75	1470	93.5	93.5	92.9	0.86	0.84	0.77	95.2	650	230	250	3.5	470
MHEE280SV4	75	100	1480	94	94	93.1	0.87	0.84	0.78	128	700	230	260	4.48	675
MHEE280MG4	90	125	1485	94.2	94.2	93.3	0.87	0.86	0.80	153	700	230	260	5.84	750
MHEE315SYE4	110	150	1490	94.5	94.5	93.6	0.88	0.86	0.80	184	700	220	250	12.44	965
MHEE315MYE4	132	180	1490	94.7	94.7	93.8	0.88	0.87	0.81	220	700	230	260	14.48	1017
MHEE315LYE4	160	220	1490	94.9	94.9	94	0.89	0.87	0.82	264	700	230	260	16.52	1130
MHEE315LZE4	200	270	1490	95.1	95.1	94.2	0.89	0.89	0.83	329	700	230	260	18.92	1270
MHEE355MB4	250	340	1490	95.1	95.1	94.2	0.90	0.89	0.83	406.3	700	230	260	27.8	1700
MHEE355LA4	315	425	1490	95.1	95.1	94.2	0.90	0.89	0.83	512	700	230	260	34.8	1900

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

IE2

Prima Series (Performance Chart)

Efficiency Class: IE2	
Three-Phase Squirrel Cage Induction Motor	
Voltage	415±10%
Frequency	50±5%
Ambient	50^{0}C
Duty	S1
Class of Insulation	F
Type of enclosure	TEFC(IC411)
Temperature Rise	Limited to Class B

1000 RPM (6 Pole)

Frame Size	Output		Speed	Efficiency			Power Factor (Cos j)			Rated Current	DIRECT-ON-LINE STARTING			Moment of inertia	Weight
	kW	HP	Rpm	100%	75%	50%	100%	75%	50%	(Amps.)	Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)	GD^2 (Kgm^2)	Kg (Approx.)
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	16
MHEE80ZBA6	0.55	0.75	910	73.1	72.9	70	0.71	0.65	0.57	1.5	400	180	220	0.00988	18
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	26
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	29
MHEE100LAA6	1.5	2	930	79.8	79.8	77.8	0.72	0.67	0.59	3.6	600	190	220	0.045	40
MHEE112MAA6	2.2	3	940	81.8	81.8	79.6	0.72	0.67	0.59	5.2	600	230	260	0.0567	50
MHEE132SYA6	3.7	5	950	84.3	84.3	82.8	0.72	0.67	0.60	8.5	600	220	250	0.216	80
MHEE132MZA6	5.5	7.5	970	86	86	85.1	0.73	0.68	0.61	12.2	600	230	260	0.22	85
MHEE160MZA6	7.5	10	970	87.2	87.2	86.3	0.77	0.72	0.65	15.5	650	220	250	0.354	129
MHEE160LZA6	11	15	960	88.7	88.7	87.8	0.77	0.73	0.65	22.4	650	245	300	0.45	145
MHEE180LZG6	15	20	970	89.7	89.7	89	0.80	0.76	0.68	29.1	670	240	280	0.82	190
MHEE200LPG6	18.5	25	970	90.4	90.4	89.2	0.78	0.73	0.66	36.5	650	230	260	1.79	210
MHEE200LRG6	22	30	975	90.9	90.9	89.5	0.79	0.75	0.68	42.6	680	210	230	1.88	220
MHEE225MP6	30	40	975	91.7	91.7	90.8	0.82	0.78	0.71	55.5	700	220	250	3.22	320
MHEE250MP6	37	50	975	92.2	92.2	91.2	0.82	0.78	0.72	68.1	700	230	260	5.2	425
MHEE280SV6	45	60	980	92.7	92.7	91.3	0.85	0.81	0.75	79.5	700	210	250	7.5	600
MHEE280MV6	55	75	980	93.1	93.1	91.5	0.84	0.80	0.74	97.8	700	220	250	8.7	615
MHEE315SYE6	75	100	985	93.7	93.7	92	0.85	0.81	0.75	131	700	220	250	16.5	945
MHEE315MYE6	90	125	985	94	94	92.2	0.85	0.82	0.77	156.7	700	210	240	20.78	1030
MHEE315MZE6	110	150	985	94.3	94.3	92.5	0.85	0.82	0.77	191.0	700	220	250	21.8	1070
MHEE315LZE6	132	180	985	94.6	94.6	92.8	0.86	0.83	0.78	226	700	220	250	28.1	1300
MHEE355MA6	160	220	985	94.8	94.8	93	0.86	0.83	0.78	273	700	220	250	44.5	1710
MHEE355MC6	200	270	990	95	95	93.2	0.86	0.84	0.80	341	700	220	250	52.8	1805
MHEE355LA6	250	340	990	95	95	93.2	0.86	0.84	0.80	426	700	220	250	56.7	1950

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

IE2

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

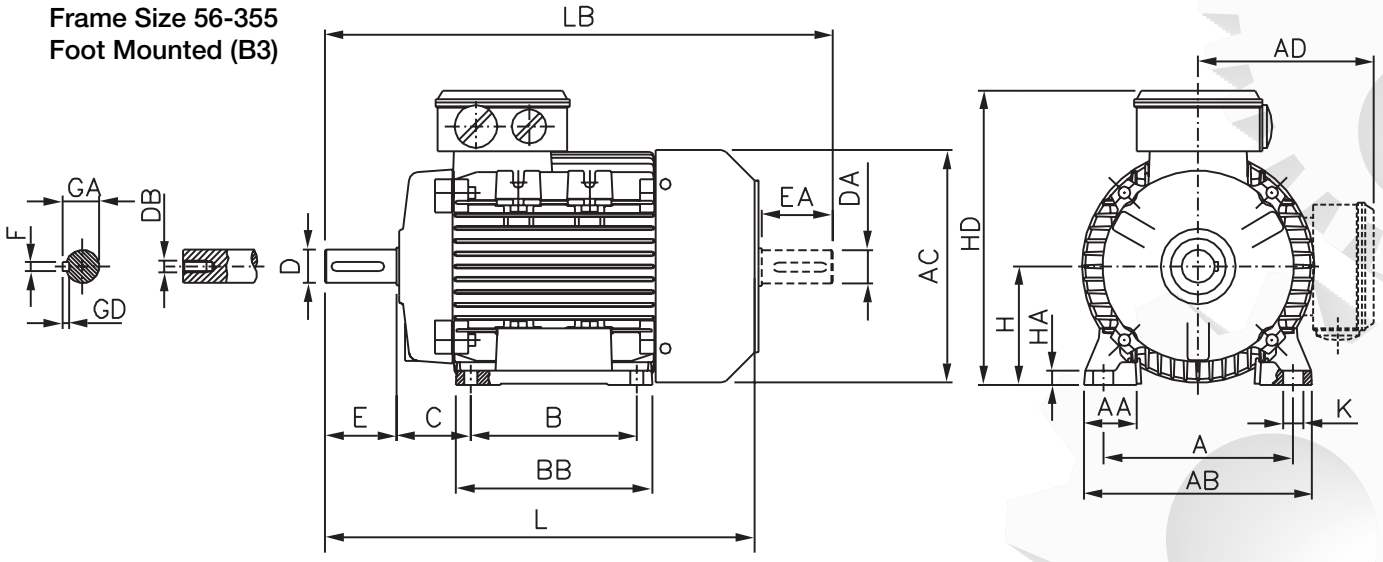
750 RPM (8 Pole)

Frame Size	Output		Speed	Efficiency			Power Factor	Rated Current	DIRECT-ON-LINE STARTING			Moment of inertia	Weight
	kW	HP	Rpm	100%	75%	50%	Cos j	(Amps.)	Starting Current (%)	Breakaway Torque (%)	Pull-Out Torque (%)	GD^2 (Kgm^2)	Kg (Approx.)
MHEE71ZAA8	0.12	0.16	650	39.8	39.8	39	0.54	0.8	350	160	210	0.004	7
MHEE80ZAA8	0.25	0.33	670	50.6	50.6	49.2	0.62	1.1	400	160	210	0.008	10
MHEE90SAA8	0.37	0.5	670	56.1	56.1	55.2	0.54	1.7	400	170	230	0.014	13
MHEE90LBA8	0.55	0.75	670	61.7	61.7	61.1	0.51	2.4	430	200	230	0.020	17
MHEE100LAA8	0.75	1.0	680	66.2	66.2	65.2	0.6	2.6	450	190	240	0.029	20
MHEE100LBA8	1.1	1.5	680	70.8	70.8	70.1	0.6	3.6	450	180	240	0.068	25
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	66
MHEE132MZA8	3	4.0	700	80	80	79.2	0.67	7.8	450	190	255	0.16	77
MHEE160MYA8	3.7	5.0	710	81.4	81.4	80.6	0.63	10.0	480	190	255	0.51	102
MHEE160MZA8	5.5	7.5	715	83.8	83.8	83	0.75	12.2	480	190	250	0.51	135
MHEE160LZA8	7.5	10	705	85.3	85.3	84.5	0.77	15.9	500	210	255	0.64	141
MHEE180LZG8	11	15	720	86.9	86.9	86	0.77	22.9	500	220	260	0.92	192
MHEE200LRG8	15	20	720	88	88	87.1	0.78	30.4	500	220	260	1.22	240
MHEE225SP8	18.5	25	725	88.6	88.6	87.8	0.8	36.3	550	230	260	1.87	275
MHEE225MP8	22	30	725	89.1	89.1	88.3	0.79	43.5	600	230	260	2.30	313
MHEE250MP8	30	40	725	89.8	89.8	89	0.8	58.1	650	230	255	4.62	420
MHEE280SV8	37	50	730	90.3	90.3	89.5	0.79	72.2	650	200	240	8.26	510
MHEE280MV8	45	60	730	90.7	90.7	90	0.79	87.4	650	190	220	15.62	581
MHEE315SYE8	55	75	730	91	91	90.3	0.8	105.1	650	190	220	20.50	945
MHEE315MYE8	75	100	730	91.6	91.6	91	0.81	141	650	190	210	23.88	1050
MHEE315MZE8	90	125	730	91.9	91.9	91.2	0.82	166.2	650	190	210	27.26	1107
MHEE315LZE8	110	150	730	92.3	92.3	91.7	0.82	202.2	650	190	210	30.94	1170
MHEE355MA8	132	180	735	92.6	92.6	91.9	0.82	242	650	190	210	33.81	2100
MHEE355MC8	160	220	735	93	93	92.2	0.82	292	650	190	210	44.08	2240
MHEE355LB8	200	270	735	93.5	93.5	92.7	0.82	363	650	190	210	52.64	2360

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

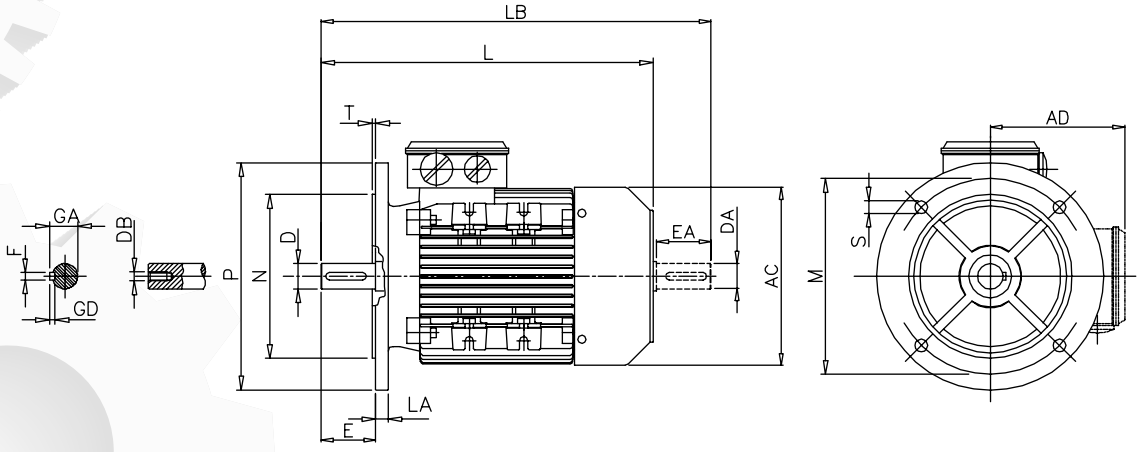
GA DRAWING

Frame Size 56-355
Foot Mounted (B3)



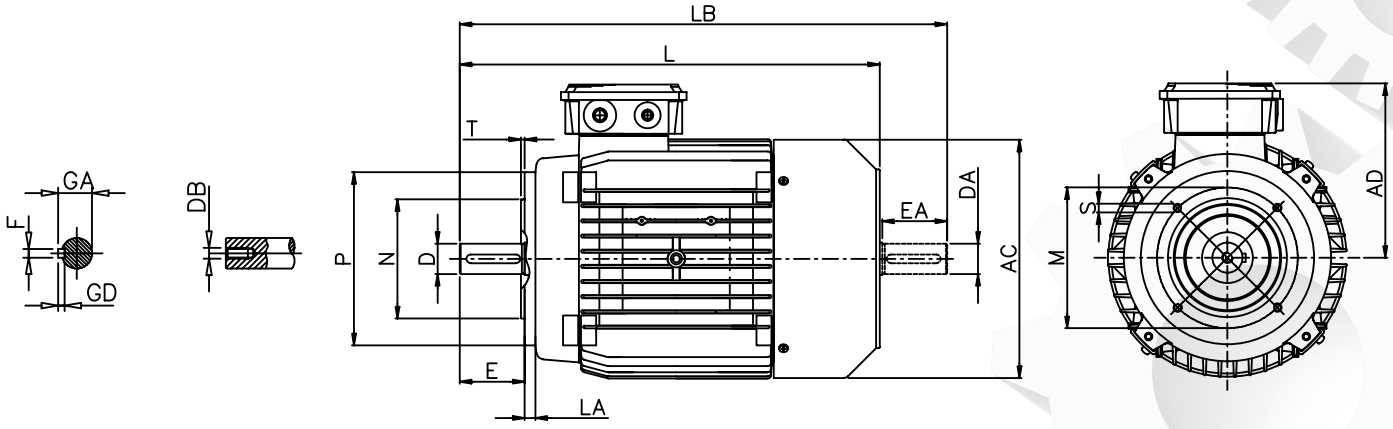
FRAME	NO OF POLES	H	A	B	C	K	AB	BB	AD	HD	AC	HA	L	LB	AA	D/DA	E/EA	F	GD	GA	DB
63	2-4	63	100	80	40	7	119	100	98	160	123	8	211	237	30	11	23	4	4	12.5	M4
71	2-8	71	112	90	45	8	135	110	111	182	140	8	246	279	31	14	30	5	5	16	M5
80	2-8	80	125	100	50	10	153	125	139	219	156	9.5	273	320	35	19	40	6	6	21.5	M6
90S	2-8	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)



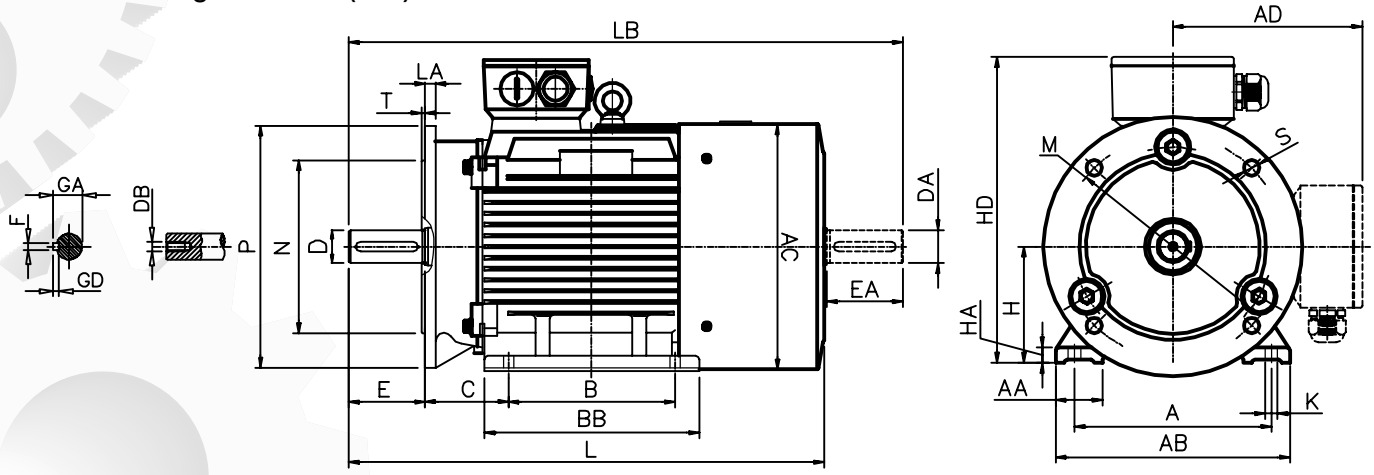
FRAME	NO OF POLES	P	N	M	LA	T	S	No. of Holes	AD	AC	L	LB	D/DA	E/EA	F	GD	GA	DB
63	2-4	140	95	115	8	3	9.5	4	98	123	211	237	11	23	4	4	12.5	M4
71	2-8	160	110	130	10	3.5	9.5	4	111	140	246	279	14	30	5	5	16	M5
80	2-8	200	130	165	10	3.5	11.5	4	139	156	273	320	19	40	6	6	21.5	M6
90S	2-8	200	130	165	12	3.5	12	4	150	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

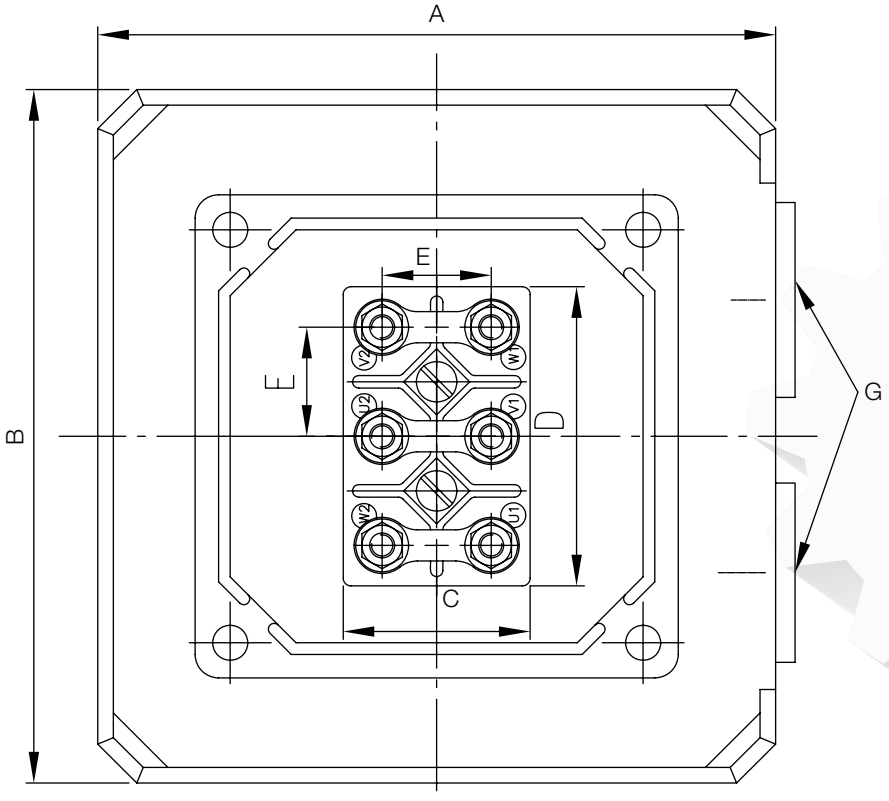
Frame Size 56-355
Foot Cum Flange Mounted (B35)

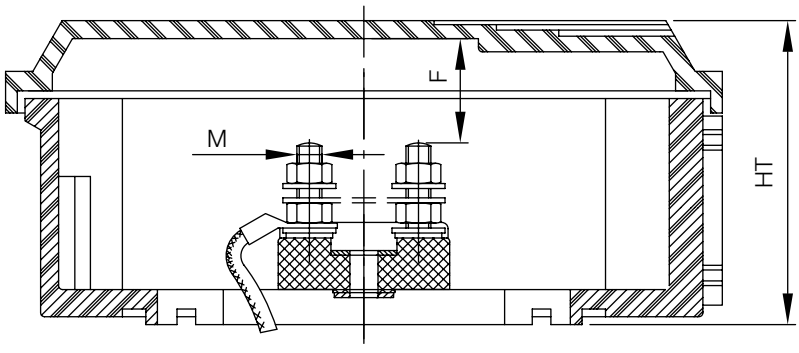


FRAME	NO OF POLES	P	N	M	LA	T	S	No. of Holes	H	A	B	C	K	AB	BB	AD	HD	AC	HA	L	LB	AA	D/ DA	E/EA	F	GD	GA	DB
63	2-4	140	95	115	8	3	9.5	4	63	100	80	40	7	119	100	98	160	123	8	211	237	30	11	23	4	4	12.5	M4
71	2-8	160	110	130	10	3.5	9.5	4	71	112	90	45	8	135	110	111	182	140	8	246	279	31	14	30	5	5	16	M5
80	2-8	200	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)



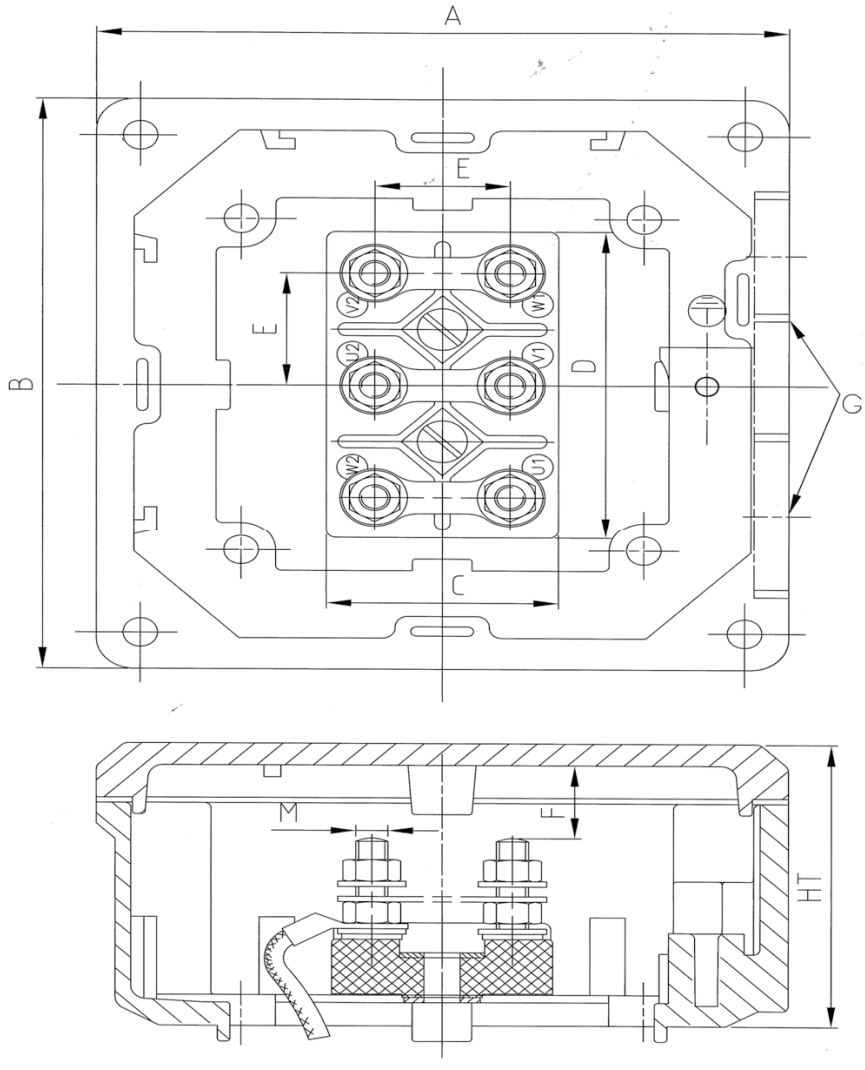


Frame	A	B	C	D	E	F	G	HT	M
56(AL)	90	92	25	40	15	10	M16, M20	40	M4
63(AL)	90	92	25	40	15	10	M16, M20	40	M4
71(AL)	90	92	25	40	15	10	M16, M20	40	M4

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

TERMINAL BOX DRAWING

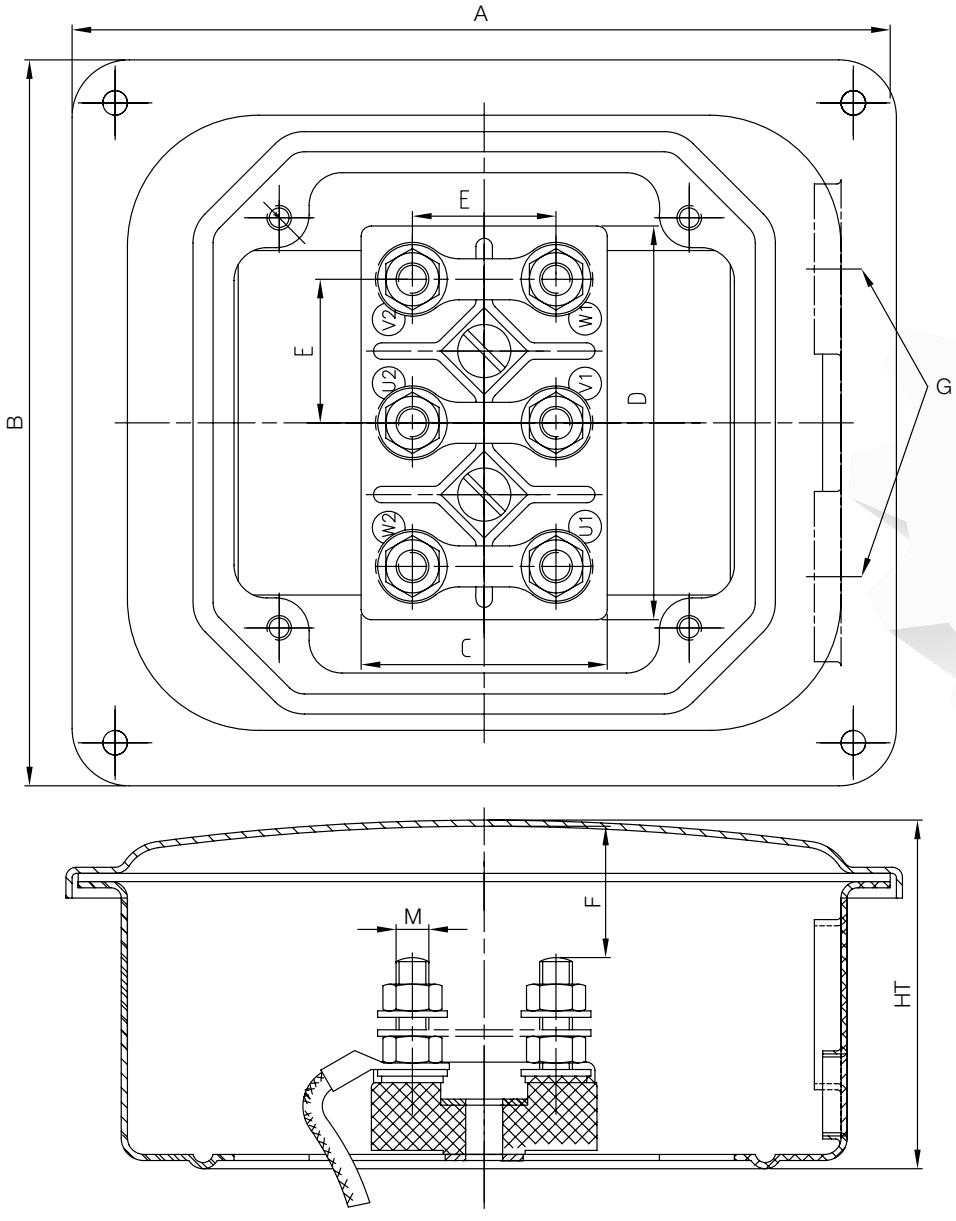
T-BOX DIMENSONS(80-160 FRAME) Aluminium



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)

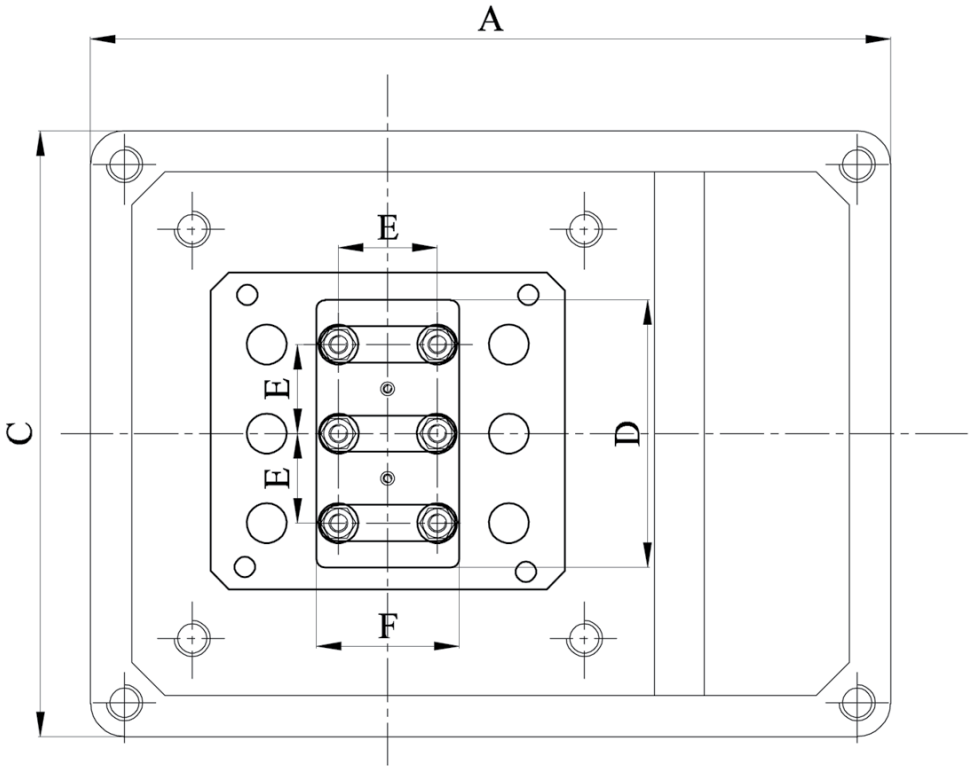


Frame	A	B	C	D	E	F	G	HT	M
160 (CI)	204	180	52	82	30	30	M40, M40	85	M6
180 (CI)	204	180	60	96	35	30	M40, M40	85	M8
200 (CI)	258	265	60	96	35	70	M50, M50	132	M8
225 (CI)	258	265	75	120	45	70	M50, M50	132	M10
250 (CI)	258	265	75	120	45	70	M50/M63, M50/M63	132	M10

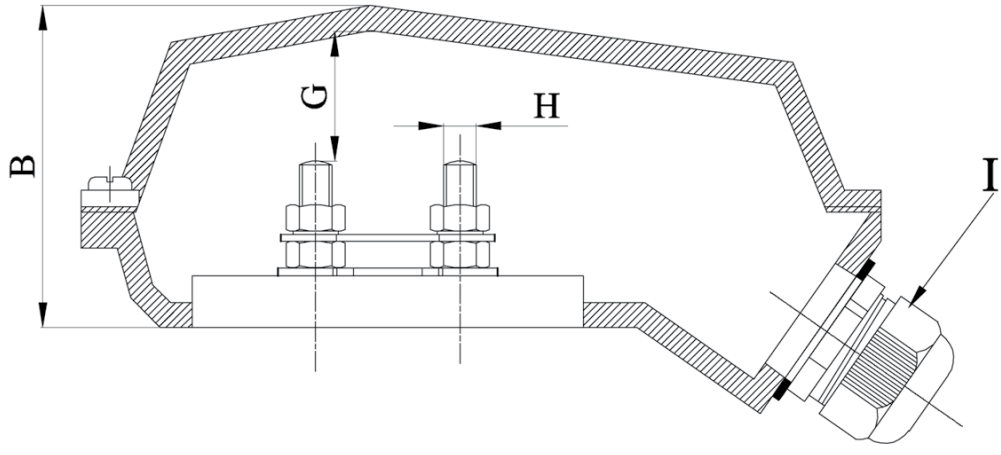
1. All Dimensions are in mm 2. Degree of Protection IP55

TERMINAL BOX DRAWING

Frame 250-280 (Cast Iron)



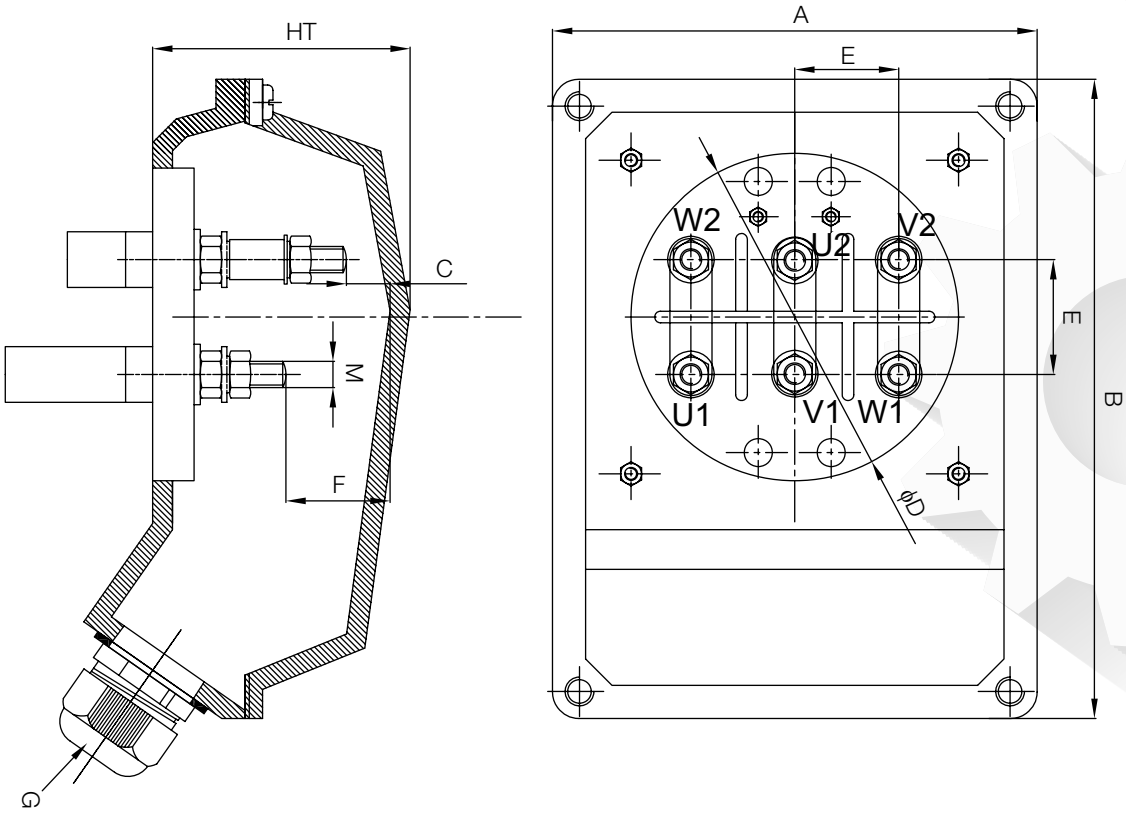
VIEW W/O TERMINAL BOX COVER



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

Other Products

Building Circuit Protection

Compact Fluorescent Lamp (CFL)

Luminiaries

Fans & Domestic Appliances

Power & Flexible Cables

Industrial Circuit Protection

APFC & IPFC

Capacitors

Switches

NOTES

View of Motor Manufacturing Plant

ZHMMC00001/ Nov 17 / Jan 18

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