Powered by Trust™

Bharat Bijlee

LOW VOLTAGE MOTORS

0.12kW to 1250kW

Crane & Hoist Duty Motors

Over the last 67 years, we have become a reflection of the strength and purpose that today represent Indian Industry and its growing power internationally. Bharat Bijlee has evolved from a pioneer of electrical engineering in India to one of the most trusted names in the industry. Our portfolio of products and services includes Power Transformers, Projects, Motors, Drives and Elevator Systems and caters to a spectrum of industries and the builders of the nation's infrastructure: Power, Refineries, Steel, Cement, Railways, Machinery, Construction and Textiles.

Our products must perform faultlessly and we must fulfill the most demanding delivery schedules. We value innovation and are proud of the customer - centric outlook that enables us to develop specialised solutions for a wide range of utility and industrial markets. Our plant near Mumbai & our extensive network of Sales and Service offices are integrated by enterprise - wise management and information systems. Technology and innovation coverage to offer our customers integrated solutions that meet their specific needs. We are growing; expanding both our manufacturing range and capacities, venturing into related diversifications and exploring new markets with new partners.

Transformers

Projects

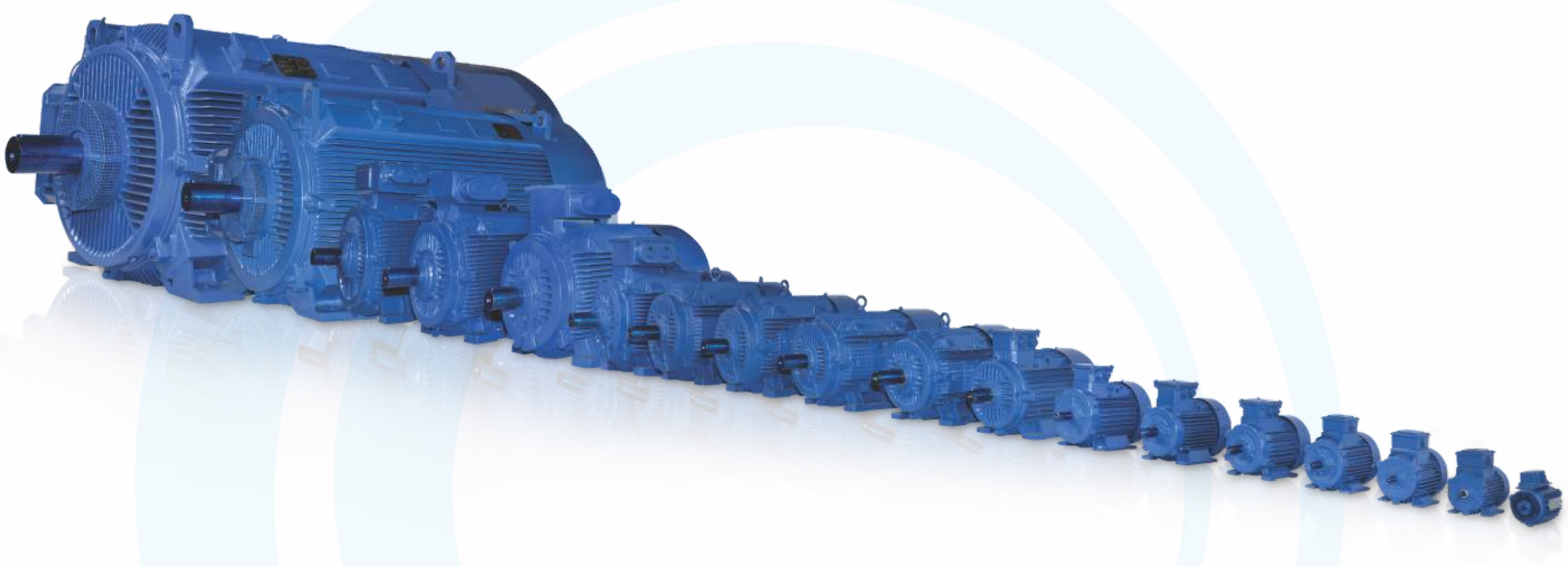
LT Motors
0.12kW to 1250 kW, up to 690V

MV Motors
160kW to 1000kW, up to 6.6kV

Drives

Elevator Systems

Complete range of BBL motors from frame 56 to 450
(0.12kW to 1250kW) suitable for all applications across industries.

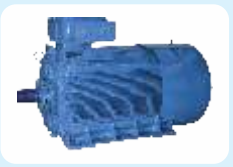


C. CRANE AND HOIST DUTY MOTORS

Technical Information

PRODUCT RANGE

Bharat Bijlee manufactures a complete range of three phase squirrel cage induction motors.

Motor Type	Frame	Power (kW)	Polarity	
Standard Motors	63 to 355	0.18 to 315	2, 4, 6, 8	
IE2 Motors	71 to 355	0.37 to 375	2,4,6	
Large LT Motors(DCCA)	355 to 450	280 to 1250	2, 4, 6, 8	
Standard Flame Proof Motors	80 to 280	0.37 to 90	2, 4, 6, 8	
IE2 Flame Proof Motors	80 to 315	0.37 to 200	2, 4, 6	
Non - Sparking Motors	63 to 400	0.12 to 560	2, 4, 6, 8	
Increased Safety Motors (For details, please contact our Sales Office)	63 to 450		2, 4, 6, 8	
Crane & Hoist Duty Motors	71 to 355	0.37 to 400	4, 6, 8	
Brake Motors	71 to 132	0.25 to 9.3	2, 4, 6, 8	
Slip ring Motors	100 to 160	1.1 to 10	4,6	
Textile Motors - Ring Frame	100 to 160	1.1 to 15	4	
Cane Unloader Motors	160 to 225	11 to 30	6	
Marine Duty Motors	63 to 450	----	----	
Roller Table Motors	As per requirement	----	----	
Railway Auxilliary Motors	As per requirement	----	----	
Medium Voltage Motors	355 to 450	160 to 1000	2,4,6,8	

TECHNICAL INFORMATION

Bharat Bijlee make crane and hoist duty motors are ideally suitable for short time and intermittent duties. These motors are specially designed for frequent starts/stops and reversals.

Major Application

These motors are widely used in following applications:

- Crane duty and Hoist duty application including LT & CT drives
- Material Handling
- Weirs and Sluices
- Lift Duty
- Auxiliary motors in rolling mills

Product Range

Frame Size	kW Range
71 to 355L	0.37 to 400

Standards

In general these motors conform to following standards

IS : 325	Three Phase Induction motors specification
IS : 1231	Dimensions of foot mounted A.C induction motors
IS : 2223	Dimensions of flange mounted A.C Induction motors

CE Marks

All motors have CE marking on the nameplate.

ELECTRICAL FEATURES

Operating Conditions

Supply conditions (Voltage & Frequency)

Voltage : 415V ± 10%

Frequency : 50Hz ± 5%

Combined Variation : ± 10%

*Other voltage / Frequency on request.

Ambient

Motors are designed for ambient temperature of 45°C.

Altitude

Motors are designed for altitude up to 1000m above mean sea level.

Re-rating Factors

The re-rating applicable under different conditions of ambient and altitude are obtained by multiplying following factors.

Variation in Ambient & Altitude

Amb. Temp. (°C)	Permissible output as % of rated value
⩽ 30	107
30-45	100
50	96
55	92
60	87

Altitude above sea level (meters)	Permissible output as % of rated value
1000	100
1500	97
2000	94
2500	90
3000	86
3500	82
4000	77

Table 1

Insulation

The motors are provided with class F insulation scheme with temperature rise limited to class B limits.

Winding

The stators are wound with modified polyester enamel covered (Temp class 155°C) copper wires as per IS 13730:3 and impregnated with class F varnish. However motors wound with dual coated copper wires and VPI can be provided on request.

All Motors in 315S frame & above are wound with dual coated winding wire (thermal class 200°C) as per IS 13730:13 and all are impregnated with VPI process.

Thermal Protection (for Winding & Bearing)

PTC thermistors / thermostats/ RTDs etc. can be embedded in stator winding on request.

In case of frame sizes 250M & above bearing temperature detectors (BTD) can be supplied on request.

Earthing Terminals

Two earthing terminals are provided, one on the body and other in the terminal box.

Anti- condensation Method

In order to avoid condensation of water inside the motors they can be heated up by connecting voltage 4% to 10% of rated voltage to the motor terminals. Adequate heating is obtained with current equal to 20-25% of rated motor current. Alternatively any method as indicated in IS: 900 for heating the stator winding could be adopted. Motors can also be offered with built in space heaters in frame sizes 90S and above.

MECHANICAL FEATURES

Enclosures: (Material & T Box Location)

Frame Size	Enclosure Materials	Terminal Box Location	
		Standard	Option available
63-80	Aluminum	TOP	----
90S-112M	Aluminum	TOP	----
	Cast Iron	RHS	TOP & LHS
132S-132M	Aluminum	TOP	-
132S-225M	Cast Iron	RHS	TOP & LHS
250M-355L	Cast Iron	TOP	RHS & LHS

Table 2

Degree of Protection

All motors have IP55 degree of protection as per IS:4691. Higher degree of protection such as IP56, IP66 can be offered on request. All flange mounted motors are additionally provided with oil tight shaft protection on driving end side.

Note: For more details, refer to annexure II on page no. 121.

Cooling

All motors are totally enclosed Fan Cooled (TEFC). The cooling is effected by self driven, bi-directional centrifugal fan protected by fan cover. The Type of cooling is IC411 as per IS: 6362-Motors with natural ventilation(TENV) or with forced cooing arrangement can be offered on request.
Minimum cooling distance as indicated in GA Drawing has to be provided for effective cooling of the motor.
Note: For more details, refer to annexure I on page no. 120.

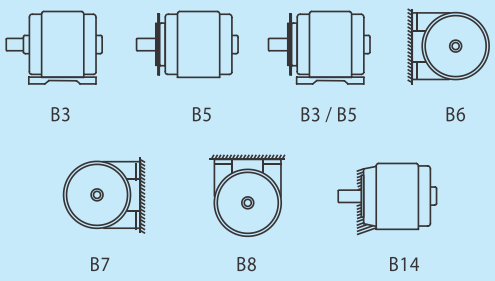
Type of Construction

Standards motors are designed for foot mounting (B3). Motors up to frame 355 are also suitable for B6, B7, B8, V5 and V6 mounting.

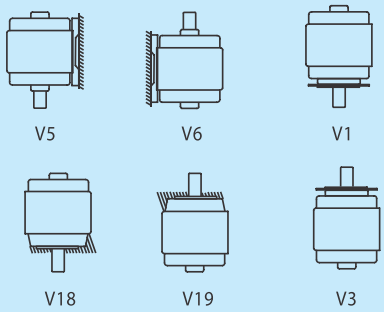
Motors can be supplied in Flange mounting (B5). Flange mounted motors up to frame 355 are also suitable for V1 and V3 mounting.

Mounting

Horizontal Mounting



Vertical Mounting



Frame Size	Bearing Nos. C3 clearance		Termin-al Box Type/ Location	Terminal		No. & size of Cable entries	Max cond. Cross Sec. area (mm^2)
	DE	NDE		No.	Size		
63	6201 2Z	6201 2Z	gk030/ Top	3	M4	1×3/4"	4
71	6202 2Z	6202 2Z					
80	6004 2Z	6004 2Z					
90S, 90L	6205 2Z	6205 2Z	gk130/ TOP	3*			6
100L	6206 2Z	6205 2Z	gk230/ TOP	3*		2 × 1"	10
112M	6206 2Z	6205 2Z					
132S, 132M	6208 2Z	6208 2Z	gk330/ TOP	6	M5		
160M, 160L	6309 2Z	6209 2Z	gk330/ RHS				16
180M, 180L	6310 2Z	6210 2Z	gk430/ RHS	6	M6	2 × 1 1/2"	50
200L	6312 2Z	6212 2Z	TB225/ RHS	6	M8	2 × 2"	70
225S, 225M	6313	6213					
250M	6315	6215	TB280/ Top	6	M10		150
280 S/M	2P: 6316	6316					
	4,6 & 8P: 6317	6316					
315S, 315M	6319	6319	TB315/ Top	6	M12	2 × 2"	240
315L						2 × 2 1/2"	
355L	6322	6322	TB355/ Top	6	M16	2 × 3"	300

Table 3

*3 Terminals up to and including 1.5kW & 6 terminals for higher outputs

Special Design Features

- Increased air gap between stator and rotor
- Special rotor design

Types of Duties

The various operating cycles of driven machines can be classified into nine basic duties, ranging from S1 to S9 They are as follows:

S_1	Continuous duty
S_2	Short time duty
S_3	Intermittent periodic duty
S_4	Intermittent periodic duty with starting
S_5	Intermittent periodic duty with starting and electric braking
S_6	Continuous duty with Intermittent periodic loading
S_7	Continuous duty with starting and electric braking
S_8	Continuous duty with periodic speed changes

Table 4

Duties S2, S3, S4 and S5 explained with graphs

A) S2-Short Time Duty

This includes a period of operation at constant load which are too short to attain thermal equilibrium, followed by rest period of sufficient duration to re-establish equality of temperature with cooling medium in one cycle.

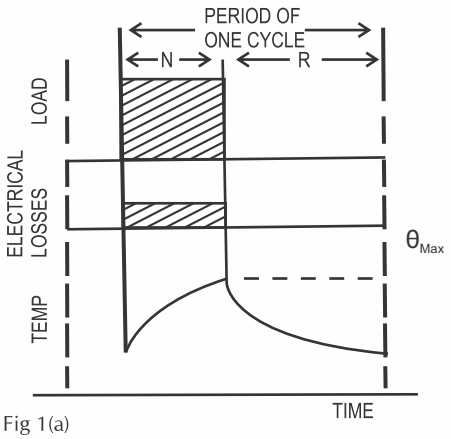


Fig 1(a)

N = Operation under rated conditions.

R = At rest de-energized

θ_{Max} = Maximum temperature attained during the duty cycle.

B) S3- Intermittent Period Duty

This includes a period of operation at constant load and a de-energized period, which are too short to attain thermal equilibrium during one cycle. The starting current does not significantly affect the temperature rise for this type of duty.

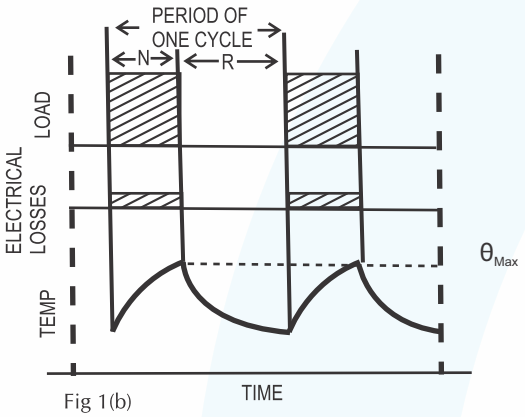


Fig 1(b)

$$\text{Cyclic duration factor} = \frac{N}{N + R}$$

C) S4- Intermittent Periodic Duty with Starting

This includes a period of starting, a period of operation at constant load and a de-energized period, which is too short to attain thermal equilibrium during one cycle. The starting affects temperature rise, as load GD^2 is higher than rotor GD^2 and/ or no. of start/hour is high, for this type of duty. The motor is stopped after switching off either by natural deceleration, or by a mechanical Brake, without additional heating of the windings

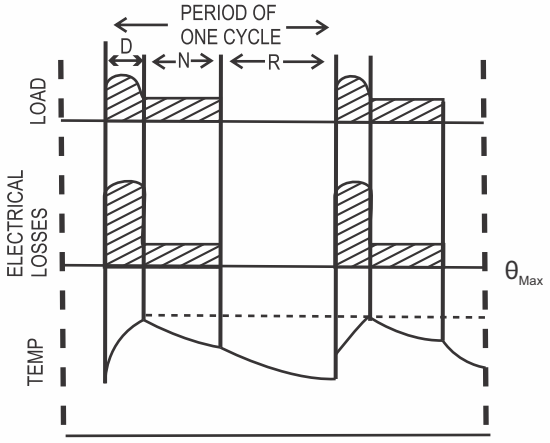


Fig 1(c)

$$\text{Cyclic duration factor} = \frac{D + N}{D + N + R}$$

Where D = Starting

D) S5- Intermittent Periodic Duty with Starting and Electrical Braking

This includes a period of starting, a period of operation at constant load, a period of electrical braking, and de-energized period which are too short to attain thermal equilibrium during one duty cycle. It is understood that the starting affect temperature rise, as in (c) above, and the stopping also affects temperature rise as braking is carried out electrically.

We also supply motors for special types of duties, on enquiry including multi-speed motors with squirrel cage rotors.

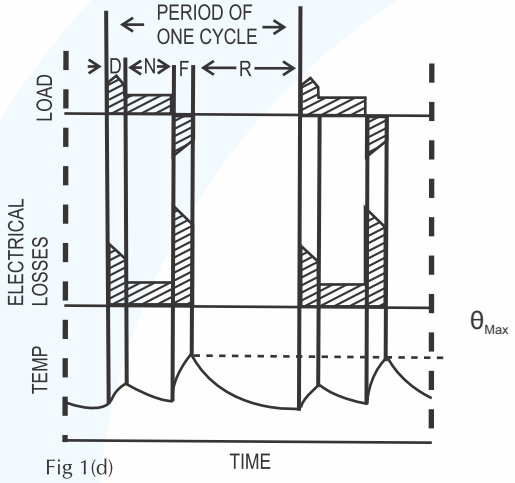


Fig 1(d)

$$\text{Cyclic duration factor} = \frac{D + N + F}{D + N + F + R}$$

Where F = Electric breaking

The common Cyclic Duration Factors (CDF) for the above duties are 25%, 40% and 60%. We also supply, on enquiry, motors for other CDF's. The CDF calculations are shown in figures 1(a), 1(b), 1(c), 1(d).

Examples of typical Starting Duties

Starting Duties					Starting Class
Duty Cycle	St/hr	Jogs/hr	Breaking to Stop/hr	Complete plug reversal/hr	No. of Starts/hr thermal Equivalent
S3	60	0	0	0	60
	40	80	0	0	
	20	80	20	0	
S4	150	0	0	0	150
	100	200	0	0	
S5	80	0	80	0	150
	65	130	65	0	
	30	160	30	30	
S4	300	0	0	0	300
	200	400	0	0	
S5	160	0	180	0	300
	130	260	130	0	
	60	320	60	60	

Table 5

Refer above table for example of typical starting duties and selection of starting class. Table given here are for load $GD^2 \leq$ rotor GD^2. For cases where load GD^2 >rotor GD^2 the motor should be selected from the table with a higher no. of starts/hr. as per the formula.

No. of starts allowed =No. of starts as per table $\times 2 \times GD^2$ of rotor/ (GD^2 of rotor + GD^2 of load).

Selection of motors for hoist motions

For hoisting motor, the power required shall not be less than that computed from the following:

$$kW = \frac{MVC_v CDF}{6.12E} \times \frac{1}{C_{amb}}$$

Where, derating factor will be taken as 12%,

kW = One hour power rating for DC motors & power rating at (S-40%) cyclic duration factor for AC motors

M = Mass of rated load on hook plus weight of hook block & wire ropes in tones

V = Specified hoisting speed in m/min

E = Combined efficiency of gears & sheaves
= $(0.93)^n \times (0.98)^m$ for sleeve bearings
= $(0.95)^n \times (0.99)^m$ for antifriction bearings
= $(0.985)^n \times (0.99)^m$ for hardened profile ground & oil splashed lubricator, where

n = Number of pairs of gears

m = Total number rotating sheaves passed over by each part of the moving rope attached to the drum

C_v = Service factor for vertical motion depending on type of motors,
= 0.67 for AC motors,
= 0.5 for DC motors

CDF = Cyclic duration factor

C_{amb} = Derating factor for ambient temperature as per table 1.

For an AC hoist motor, the specified full load hoist speed must be obtained at not more than rated

$$\frac{(100 - \text{rated slip\%})}{(100 \text{ total ohms at full speed\%})}$$

Where sufficient information is not available values given in table 6 below for duty cycles, cyclic duration factor & starting corresponding to mechanism class shall be used. The values given are based on the following formula:

$$CDF = \frac{\text{Operating time X 100}}{\text{Operating time + Idle time}}$$

Recommended Cyclic Duration Factor & starting class:

Mechanism Class	Duty cycle No. of cyclic class (c) Cycles/hr (%)	Recommended CDF (%)	Starting class (c) Equivalent starts/hr
M1	Up to 5 Cycles 25	25	90
M2	Up to 5 Cycles 25	25	90
M3	10 to 15 Cycles 40	40	150
M4	16 to 20 Cycles 40	40	150
M5	21 to 30 Cycles 60	60	300
M6	31 to 40 Cycles 60	60	300
M7	41 to 50 Cycles 100	100	600
M8	51 to 60 Cycles 100	100	600

Table 6

Selection of Motors for Crane Travel or Trolley Traverse

It is assumed that the drive mechanism from the motor to the track wheels will use enclosed gearings mounted on anti-friction bearings. The actual efficiency of the drive will be adopted in making calculations. Where actual efficiency values are not available, the efficiency of the drive shall be taken in the range of 0.85 to 0.9.

For the track wheel with anti-friction bearings the rolling friction at these bearings plus the friction between the track wheels with an average drive efficiency of 0.875 will give an overall friction factor of 8.0 kgf per tonne of the mass moved for calculation of the motor horse power or torque. In the case of wheels with the plain bearings an overall friction of 13.0 kgf per tonne of the mass moved may be used.

Selection of Motors for Crane Travel or Trolley Traverse:

For bridge travel or trolley traverse the power of the motor required shall not be less than that computed from the following:

For indoor cranes

$$kW = \frac{MVSCDF}{6117T} \times \frac{(F+1100a)}{981N}$$

For outdoor cranes

$$kW = \frac{MVSCDF}{6117T} \times \frac{(F+1100a)}{981N} + \frac{R_w V}{6117T}$$

where,

kW = One hour power rating for DC motors & power rating at 40 percent cyclic duration factor for AC motors.

M = Mass of crane or trolley plus mass of max rated load in tonnes.

V = Specified free running speed m/min.

N = Mechanical efficiency of gearing. For spur & helical gears it can be taken as 0.95 per reduction.

T = Factor introduced by the permissible motor torque during acceleration exceeding the motor rated torque. As a general guidance value of T may be taken as 1.7 for motor having pull out torque of 275 percent full load torque. Lower value of T should be taken for corresponding lower value of pull out torque.

= 1.3 of d.c motor pull out torque *100

= 1.6 for a.c motor 160*full load torque

F = Overall friction factor

= 8kgf per tonne for wheel on anti friction bearing.

= 13 kgf per tonne for wheels on plane bearings

CDF = Cyclic duration factor

R_w = Load due to service wind acting horizontally, which can be obtained by multiplying the horizontal exposed area by the service wind by taking drag co-efficient into consideration.

A = Average linear acceleration of the crane of the trolley in cm/s^2 till the mechanism reaches 90% of free running speed for the value of average linear acceleration refer table 7

S = Service factor aimed at providing adequate motor heat dissipation capacity as given in table 7

Acceleration values

Speed to be reached m/min	Acceleration in cm/s^2 Low & Moderate speed with Long Travel	Acceleration in cm/s^2 for Moderate & High speed (Normal Application)	Acceleration in cm/s^2 for High speed with High Acceleration
240	-	50	67
190	-	44	58
150	-	39	52
120	22	35	47
100	19	32	43
60	15	25	33
40	12	19	-
25	10	16	-
15	8	-	-
10	7	-	-

Table 7

VFD Crane Duty Motors

The growing need for energy saving and accurate control has resulted in increased demand for VFD operated Crane Duty Motors. It has advantage over traditional Slipring Motor on speed range with low maintenance leading to reduced Life Cycle Cost. Current control of VFD Driven motors is better than Standard TEFC SCR Motors. Crane / Hoist Duty Motors call for the Constant Torque application and the speed range varies from 10% to 100% of the synchronous speed.

Bharat Bijlee Inverter Duty Crane and Hoist Motors are provided with special insulation system suitable to withstand voltage spikes when run on VFD. The selection of frame size for various duty type and starts shall be as per the selection table enclosed. These motors have following special features:

- Dual Coated Winding Wire
- Vacuum Pressure Impregnation

Standard Features:

Voltage: 220 to 690 Volts
Frequency: 50 / 60 Hz
Ambient: 45^{0}C
Altitude: 1000 meters above mean sea level.
Insulation: Class F / H (Temperature rise limited to Class B)
Bharat Bijlee Motors are suitable for the following IGBT Drive output

- High Frequency in the range of 3kHz – 6kHz
- Voltage rise time > 0.1 sec
- Voltage spikes up to 1600V and rise time of 0.1 sec
- THD < 3%

Bharat Bijlee motors from 315 frame and above are inherently suitable for VFD operation.

Optional: Insulated bearing (Recommended for 250 Frame onwards) Thermister /RTD / BTD.

Motors with Integral Brakes

These motors can be supplied with integral fail safe D.C. brake in frame sizes up to 132, with built in rectifiers (so that no separate DC supply is required for brake part).For more details refer brake motors section of the catalogue.

Flame-proof Crane Duty Motors

Motors suitable for intermittent duty operation can be offered in frame sizes MJ80, MJ 90, MJ 100, MJ 112 and MJ 132. for enquiry please refer to our sales office.

Enquiries

When making an enquiry or placing an order for crane duty motor, please furnish the following information. This will enable us to supply most suitable motor for your cranes and hoists.

1. Details of Crane:

a. Class of crane
b. Type of crane
c. Tonnage of crane
d. Operating speed
e. Type of motion: Hoisting, Travelling or Traversing

2. Electrical Features:

a. Motor Outpt (kW) and Polarity
b. Supply voltage and frequency with variations
c. Type of Rotor: Squirrel Cage / Slipring
d. Class of Insulation and ambient temperature
e. Method of starting
f. Requirement of starting torque, pull out torque, starting current
g. Load torque of the driven equipment
h. In case of Slipring motors rotor voltage and rotor current is to be specified

3. Operational Details:

a. Duty type : S2,S3,S4 or S5
b. Duty cycle details preferably with a sketch if different from S2, S3, S4 or S5.
c. No. of starts per hour
d. Method of braking: plugging, DC injection/ mechanical brake
e. No. of reversals per hour
f. Cyclic duration factor (CDF)
g. Load inertia referred to motor speed (GD^2)

4. Mechanical Features:

a. Enclosure
b. Degree of protection
c. Mounting
d. Fixing dimensions

(If Bharat Bijlee standard motor fixing dimensions are not applicable, please let us know your specific requirements, preferably with a drawing)

e. Shaft extension: Requirement of shaft extension if any, needs to be mentioned
f. Any other relevant data

Note: For more details, refer to page 6, 7, 8, 9, 10 and 11 of Industrial Motors Technical Information section.

Performance table for 4-Pole motors

TEFC 3 Phase Squirrel Cage Induction Motors Crane & Hoist duty with DOL Starting Fr. 71 to 355L

Voltage : 415V ± 10%
Frequency : 50Hz ± 5%
Combined Variation : ± 10%

Ambient : 45°C
Duty : S3 / S4

Ins. Class : F
Temp. Rise : B
Protection : IP55

1500 rpm (4-Pole)

Frame size IEC	Type Ref. B3 Construction	60 Starts/ hr.						150 Starts/ hr.						300 Starts/ hr.						Rated Speed RPM	With DOL Starting		Pullout Torque to Rated Torque Ratio	Rotor GD² kgm²	Net Wt. B3 Const. kg
		40 % CDF			60 % CDF			40 % CDF			60 % CDF			40 % CDF			60 % CDF				Starting Current to Rated Current Ratio	Starting Torque to Rated Torque Ratio			
		kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m						
71	MC071433	0.55	1.56	0.41	0.55	1.56	0.41	0.55	1.56	0.41	0.55	1.56	0.41	0.55	1.56	0.41	0.55	1.56	0.41	1310	3.7	2.25	2.75	0.0033	7
80	MC080413	0.75	1.8	0.55	0.75	1.8	0.55	0.75	1.8	0.55	0.75	1.8	0.55	0.75	1.8	0.55	0.75	1.8	0.55	1340	4.5	2.30	2.75	0.0061	10
80	MC080433	1.1	3.1	0.80	1.1	3.1	0.80	1.1	3.1	0.80	1.1	3.1	0.80	1.1	3.1	0.80	1.1	3.1	0.80	1365	5.0	2.30	2.80	0.0072	11
90S	MC09S433	1.5	3.9	1.1	1.5	3.9	1.1	1.5	3.9	1.1	1.5	3.9	1.1	1.5	3.9	1.1	1.5	3.9	1.1	1385	5.0	2.25	2.75	0.0120	14
90L	MC09L453	2.2	5	1.6	2.2	5	1.6	2.2	5	1.6	2.2	5	1.6	2.2	5	1.6	2.2	5	1.6	1380	4.8	2.30	2.80	0.0160	17
100L	MC10L453	3.7	8	2.6	3.7	8	2.6	3.7	8	2.6	3.7	8	2.6	3.7	8	2.6	3.7	8	2.6	1380	6.0	2.30	3.00	0.0260	27
112M	MC11M453	5.5	12.4	3.8	5.5	12.4	3.8	5.5	12.4	3.8	5.5	12.4	3.8	5.5	12.4	3.8	5.5	12.4	3.8	1400	6.0	2.50	2.80	0.058	35
132S	MC13S4G3	7.5	14.8	5.1	7.5	14.8	5.1	7.5	14.8	5.1	7.5	14.8	5.1	7.5	14.8	5.1	7.5	14.8	5.1	1440	6.5	2.25	2.90	0.127	56
132M	MC13M4P3	9.3	18.1	6.3	9.3	18.1	6.3	9.3	18.1	6.3	9.3	18.1	6.3	9.3	18.1	6.3	9.3	18.1	6.3	1440	6.5	2.30	2.90	0.143	68
160M	MC16M4A3	11	22	7.4	11	22	7.4	11	22	7.4	11	22	7.4	11	22	7.4	11	22	7.4	1440	6.5	2.25	2.80	0.141	93
160M	MC16M4C3	13.2	25	8.9	12.1	23	8.2	13.2	25	8.9	12.1	23	8.2	13.2	25	8.9	12.1	23	8.2	1440	6.5	2.25	2.80	0.177	103
160M	MC16M4F3	15	30	10.1	15	30	10.1	15	30	10.1	15	30	10.1	13.8	27	9.3	13.8	27	9.3	1440	6.5	2.25	2.80	0.193	107
160L	MC16L4P3	18.5	36	12.5	18.5	36	12.5	18.5	36	12.5	18.5	36	12.5	17	33	11.5	17	33	11.5	1445	6.5	2.10	2.50	0.265	132
180L	MC18L473	22	39	14.7	22	39	14.7	22	39	14.7	22	39	14.7	22	39	14.7	20	35.5	13.3	1460	6.5	2.40	2.60	0.540	188
200L	MC20L433	30	52	19.9	30	52	19.9	30	52	19.9	30	52	19.9	28	49	18.6	26	45	17.3	1465	6.5	2.60	2.60	0.860	270
225S	MC22S413	37	64	24.5	37	64	24.5	37	64	24.5	34	59	22.5	32	57	21.2	30	54	19.9	1470	6.5	2.50	2.60	1.32	328
225M	MC22M433	45	78	29.8	45	78	29.8	45	78	29.8	40	69	26.5	37	66	24.5	34	61	22.5	1470	6.5	2.50	2.50	1.60	362
250M	MC25M413	55	97	36.3	55	97	36.3	55	97	36.3	52	92	34.3	48	84	31.7	45	78	29.7	1475	6.5	2.50	2.60	2.83	475
280S	MC28S413	75	130	49.4	75	130	49.4	75	130	49.4	70	121	46	67	116	44.1	65	112	42.8	1480	6.5	2.30	2.60	5.00	653
280M	MC28M433	90	156	59.2	90	156	59.2	90	156	59.2	84	146	55.3	80	139	52.6	75	130	49.4	1480	6.5	2.30	2.60	6.00	713
315S	MC31S413	110	190	72.1	110	190	72.1	110	190	72.1	102	176	67	95	164	62.3	90	155	59.0	1485	6.5	2.30	2.60	8.7	902
315M	MC31M433	132	225	86.5	132	225	86.5	132	225	86.5	125	213	81.9	115	196	75.4	110	188	72.1	1486	6.5	2.30	2.60	10.2	1010
315L	MC31L453	160	270	104.8	160	270	104.8	160	270	104.8	150	253	98.3	138	233	90.4	132	223	86.5	1487	6.5	2.30	2.60	12.2	1185
315L	MC31L463	180	305	117.9	180	305	117.9	180	305	117.9	168	285	110.0	158	268	103.5	150	254	98.3	1487	6.5	2.30	2.60	13.4	1262
315L	MC31L473	200	342	131.0	200	342	131.0	200	342	131.0	185	316	121.2	180	308	117.9	175	299	114.6	1487	6.5	2.30	2.60	14.6	1305
355L	MC35L413	250	410	163.6	250	410	163.6	250	410	163.6	232	380	151.9	220	361	144.0	210	344	137.5	1488	6.5	2.25	2.60	17.76	1290
355L	MC35L433	315	517	206.2	315	517	206.2	315	517	206.2	295	484	193.1	280	460	183.3	270	443	176.7	1488	6.5	2.25	2.60	32.70	1855
355L	MC35L453	355	586	232.8	355	586	232.8	355	586	232.4	330	545	216.0	310	512	202.9	300	495	196.4	1488	6.5	2.20	2.50	38.20	2050

Note: Derating factors of motor ratings for higher ambient temperatures are as given in the catalogue for Crane & Hoist Duty - CCB1/A

Performance table for 6-Pole motors

TEFC 3 Phase Squirrel Cage Induction Motors Crane & Hoist duty with DOL Starting Fr. 71 to 355L

Voltage : 415V ± 10%
Frequency : 50Hz ± 5%
Combined Variation : ± 10%

Ambient : 45°C
Duty : S3 / S4

Ins. Class : F
Temp. Rise : B
Protection : IP55

1000 rpm (6-Pole)

Frame size IEC	Type Ref. B3 Construction	150 Starts/ hr.						300 Starts/ hr.						Rated Speed RPM	With DOL Starting		Pullout Torque to Rated Torque Ratio	Rotor GD² kgm²	Net Wt. B3 Const. kg
		40 % CDF			60 % CDF			40 % CDF			60 % CDF				Starting Current to Rated Current Ratio	Starting Torque to Rated Torque Ratio			
		kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m						
71	MC071633	0.37	1.43	0.45	0.37	1.43	0.45	0.37	1.43	0.45	0.37	1.43	0.45	800	3.0	1.70	1.90	0.0038	7
80	MC080613	0.55	2	0.65	0.55	2	0.65	0.55	2	0.65	0.55	2	0.65	830	3.5	1.90	2.20	0.0060	10
80	MC080633	0.75	2.7	0.85	0.75	2.7	0.85	0.75	2.7	0.85	0.75	2.7	0.85	860	3.5	2.25	2.50	0.0084	11
90L	MC09L6A3	1.1	3	1.2	1.1	3	1.2	1.1	3	1.2	1.1	3	1.2	900	4.0	2.30	2.60	0.0160	17
90L	MC09L653	1.5	4.2	1.6	1.5	4.2	1.6	1.5	4.2	1.6	1.5	4.2	1.62	900	4.0	2.30	2.75	0.0160	17
100L	MC10L653	2.2	6.5	2.3	2.2	6.5	2.3	2.2	6.5	2.3	2.2	6.5	2.3	920	4.5	2.25	2.75	0.029	27
112M	MC11M653	3.7	9.1	3.9	3.7	9.1	3.9	3.7	9.1	3.9	3.7	9.1	3.92	920	5.0	2.25	2.75	0.065	33
132S	MC13S6G3	5.5	13.5	5.7	5.5	13.5	5.7	5.5	13.5	5.7	5.5	13.5	5.73	935	5.5	2.30	2.75	0.130	52
132M	MC13M6T3	7.5	18.8	7.8	7.5	18.8	7.8	6.5	16.3	6.8	6.5	16.3	6.8	935	5.5	2.30	2.75	0.193	71
160M	MC16M633	9.3	21	9.7	8	18	8.3	9.3	21	9.7	8	18.1	8.3	935	6.0	2.30	2.75	0.276	103
160L	MC16L663	11	24	11.5	10.2	22.3	10.6	11	24	11.5	10.2	22.3	10.6	935	6.0	2.30	2.75	0.34	113
160L	MC16L673	13	29	13.5	12	27	12.5	13	29	13.5	12	27	12.5	935	6.0	2.25	2.75	0.40	123
180L	MC18L633	17	35	17.2	16	33	16.2	16	33	16.2	15	31	15.2	960	6.0	2.30	2.60	0.82	190
200L	MC20L633	22	42	22.1	20	38	20.1	20	38	20.1	18.5	35.1	18.6	970	6.0	2.30	2.50	1.20	254
225M	MC22M623	30	55	30.1	28	51	30.1	28	51.3	28.1	26	47.7	26.1	970	6.0	2.30	2.50	2.10	336
250M	MC25M603	37	66	37.0	34	60	34.0	34	60.2	34.0	30	53.1	30.0	975	6.0	2.30	2.50	3.51	458
280S	MC28S613	45	82	45.0	40	73	40.0	40	70.2	40.0	37	65.0	37.0	975	6.0	2.30	2.50	5.11	573
280M	MC28M633	52	93	51.7	48	86	47.7	48	85.5	47.7	45	80	44.7	980	6.0	2.30	2.50	6.16	620
315S	MC31S613	70	123	69.2	65	114	64.3	65	115	64.3	60	106	59.3	985	6.0	2.30	2.50	10.7	830
315M	MC31M633	85	151	84.1	80	142	79.1	80	142	79.1	75	133	74.2	985	6.0	2.30	2.50	12.4	912
315M	MC31M653	102	178	100.6	95	166	93.7	95	166	93.7	90	157	88.7	988	6.0	2.30	2.50	15.5	1010
315L	MC31L673	125	217	123.2	120	208	118.3	120	208	118.3	110	191	108.4	988	6.0	2.30	2.50	18.0	1175
315L	MA31L693	150	260	147.9	142	246	140.0	142	246	140.0	132	229	130.1	988	6.0	2.30	2.50	21.5	1231
355L	MC35L6A3	168	294	165.3	160	280	157.4	160	280	157.4	150	263	147.6	990	6.0	2.20	2.50	28.7	1670
355L	MC35L613	185	326	182.0	175	308	172.2	175	308	172.2	160	282	157.4	990	6.0	2.20	2.50	28.7	1670
355L	MC35L633	235	414	231.2	225	396	221.4	225	396	221.4	210	370	206.6	990	6.0	2.20	2.50	35.5	1780
355L	MC35L653	280	493	275.5	265	466	260.7	265	466	260.7	240	422	236.1	990	6.0	2.20	2.50	43.3	2000

Note: Derating factors of motor ratings for higher ambient temperatures are as given in the catalogue for Crane & Hoist Duty - CCB1/A

Performance table for 8-Pole motors

TEFC 3 Phase Squirrel Cage Induction Motors Crane & Hoist Duty with DOL Starting Fr. 71 to 355L

Voltage : 415V ±10%
Frequency : 50Hz ±5%
Combined Variation : ± 10%

Ambient : 45°C
Duty : S3 / S4

Ins. Class : F
Temp. Rise : B
Protection : IP55

750 rpm (8-Pole)

Frame size IEC	Type Ref. B3 Construction	150 Starts/ hr.						300 Starts/ hr.						Rated Speed RPM	With DOL Starting		Pullout Torque to Rated Torque Ratio	Rotor GD² kgm²	Net Wt. B3 Const. kg
		40 % CDF			60 % CDF			40 % CDF			60 % CDF				Starting Current to Rated Current Ratio	Starting Torque to Rated Torque Ratio			
		kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m						
90S	MC09S8A3	0.37	1.43	0.5	0.37	1.43	0.5	0.37	1.43	0.5	0.37	1.43	0.5	700	3.0	2.00	2.30	0.011	13
90S	MC09S813	0.55	2.15	0.8	0.45	1.76	0.6	0.55	2.15	0.8	0.45	1.76	0.6	680	3.0	1.80	2.10	0.011	13
90L	MC09L853	0.75	2.76	1.1	0.75	2.76	1.1	0.75	2.76	1.1	0.65	2.39	0.9	680	3.0	2.00	2.40	0.014	14
100L	MC10L813	1.1	3.4	1.6	1.1	3.4	1.6	1.1	3.4	1.6	0.9	2.78	1.3	655	3.5	1.80	2.00	0.023	18
100L	MC10L833	1.5	4.95	2.1	1.5	4.95	2.1	1.5	4.95	2.1	1.1	3.63	1.6	680	3.5	2.00	2.30	0.027	22
112M	MC11M833	2.2	6.8	3.1	2.2	6.8	3.1	2.2	6.8	3.1	1.5	4.64	2.1	700	4.0	2.00	2.30	0.06	32
132S	MC13S8G3	3.7	8.8	5.1	3.7	8.8	5.1	3.7	8.8	5.1	3	7.14	4.1	710	4.0	2.00	2.30	0.133	69
160M	MC16M833	5.5	12	7.5	5.5	12	7.5	5.5	12	7.5	4.5	9.82	6.2	710	5.0	2.10	2.40	0.299	106
160L	MC16L873	7.5	16	10.3	6.5	13.9	8.9	6.5	13.9	8.9	6	12.8	8.2	710	5.5	2.25	2.50	0.40	119
180M	MC18M813	9.3	20	12.8	8.5	18.5	11.7	8.5	18.5	11.7	7.5	16.5	10.3	710	5.5	2.25	2.50	0.62	177
180L	MC18L833	11	23	15.1	9.3	19.4	12.8	9.3	19.5	12.8	8.5	17.8	11.7	710	5.5	2.25	2.50	0.72	182
200L	MC20L833	15	28.8	20.3	13	25	17.6	13	25.0	17.6	11	21.1	14.9	720	5.5	2.30	2.30	1.32	282
225S	MC22S813	18.5	37.5	25.0	17	34.5	23.0	17	34.5	23.0	15	30.4	20.3	720	5.5	2.25	2.50	1.95	329
225M	MC22M833	22	44.5	29.8	20	40.5	27.1	20	40.5	27.1	18.5	37.4	25.0	720	5.5	2.25	2.50	2.41	369
250M	MC25M813	30	56	40.0	26	48.5	34.7	26	48.5	34.7	22	41.1	29.4	730	5.5	2.30	2.50	3.72	472
280S	MC28S823	37	71	49.4	34	65.2	45.4	34	65.0	45.4	30	57.6	40.0	730	5.5	2.25	2.40	5.83	615
280M	MC28M853	45	86	60.0	40	76.4	53.4	40	76	53.4	37	71	49.4	730	5.5	2.25	2.40	6.86	665
315S	MC31S813	55	108	72.9	50	98.2	66.3	50	98	66.3	45	88	59.6	735	6.0	2.25	2.40	10.7	833
315M	MC31M833	75	148	99.4	67	132	88.8	67	132	88.8	60	118	79.5	735	6.0	2.25	2.40	12.4	912
315M	MC31M853	90	175	119.3	80	156	106.0	80	156	106.0	75	146	99.4	735	6.0	2.25	2.40	15.5	1010
315L	MC31L873	110	214	145.8	100	195	132.5	100	195	132.5	90	175	119.3	735	6.0	2.25	2.40	18.0	1170
315L	MC31L893	132	257	174.9	125	243	165.6	125	244	165.6	115	224	152.4	735	6.0	2.25	2.40	21.5	1340
355L	MC35L813	160	300	210.6	150	281	197.4	150	281	197.4	140	263	184.3	740	6.0	2.00	2.30	28.7	1670
355L	MC35L8B3	180	337	236.9	170	318	223.8	170	318	223.8	155	290	204.0	740	6.0	2.20	2.40	35.5	1780
355L	MC35L833	185	347	243.5	175	328	230.3	175	328	230.3	160	300	210.6	740	6.0	2.00	2.30	35.5	1780
355L	MC35L853	210	394	276.4	200	375	263.2	200	375	263.2	180	338	236.9	740	6.0	2.00	2.30	35.5	1780

Note: Derating factors of motor ratings for higher ambient temperatures are as given in the catalogue for Crane & Hoist Duty - CCB1/A

Performance table for 4-Pole motors

TEFC 3 Phase Squirrel Cage Induction Motors Crane & Hoist Duty with Inverter (VVVF) Drive Fr. 71 to 355L

Voltage : 415V ± 10%
Frequency : 50Hz ±5%
Combined Variation : ± 10%

Ambient : 45° C
Duty : S3 / S4

Ins. Class : F
Temp. Rise : B
Protection : IP55

1500 rpm (4-Pole)

Frame size IEC	Type Ref. B3 Construction	150 Starts/ hr.						300 Starts/ hr.						Rated Speed RPM	With DOL Starting			Rotor GD² kgm²	Net Wt. B3 Const. kg
		40 % CDF			60 % CDF			40 % CDF			60 % CDF				Starting Current to Rated Current Ratio	Starting Torque to Rated Torque Ratio	Pullout Torque to Rated Torque Ratio		
		kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m						
71	MC071433	0.55	1.56	0.41	0.55	1.56	0.41	0.55	1.56	0.41	0.55	1.56	0.41	1310	3.7	2.25	2.75	0.0033	7
80	MC080413	0.75	1.8	0.55	0.75	1.8	0.55	0.75	1.8	0.55	0.75	1.8	0.55	1340	4.5	2.30	2.75	0.0061	10
80	MC080433	1.1	3.1	0.80	1.1	3.1	0.80	1.1	3.1	0.80	1.1	3.1	0.80	1365	5.0	2.30	2.80	0.0072	11
90S	MC09S433	1.5	3.9	1.1	1.5	3.9	1.1	1.5	3.9	1.1	1.5	3.9	1.1	1385	5.0	2.25	2.75	0.0120	14
90L	MC09L453	2.2	5	1.6	2.2	5	1.6	2.2	5	1.6	2.2	5	1.6	1380	4.8	2.30	2.80	0.0160	17
100L	MC10L453	3.7	8	2.6	3.7	8	2.6	3.7	8	2.6	3.7	8	2.6	1380	6.0	2.30	3.00	0.0260	27
112M	MC11M453	5.5	12.4	3.8	5.5	12.4	3.8	5.5	12.4	3.8	5.5	12.4	3.8	1400	6.0	2.50	2.80	0.058	35
132S	MC13S4G3	7.5	14.8	5.2	7.5	14.8	5.2	7.5	14.8	5.2	7.5	14.8	5.2	1410	6.5	2.25	2.90	0.127	56
132M	MC13M4P3	9.3	18.1	6.4	9.3	18.1	6.4	9.3	18.1	6.4	9.3	18.1	6.4	1420	6.5	2.30	2.90	0.143	68
160M	MC16M4A3	11	22	7.4	11	22	7.4	11	22	7.4	11	22	7.4	1440	6.5	2.25	2.80	0.141	93
160M	MC16M4C3	13	25	8.8	13	25	8.8	13	25	8.8	13	25	8.8	1440	6.5	2.25	2.80	0.177	103
160M	MC16M4F3	15	30	10.1	15	30	10.1	13.8	27	9.3	13.8	27	9.3	1440	6.5	2.25	2.80	0.193	107
160L	MC16L4P3	18.5	36	12.5	18.5	36	12.5	17	33	11.5	17	33	11.5	1445	6.5	2.10	2.50	0.265	132
180M	MC18M433	22	41	14.8	20.5	38	13.8	22	41	14.8	20.5	38	13.8	1450	6.5	2.25	2.50	0.460	160
180L	MC18L473	26	46	17.5	24	42.5	16.1	24	42.5	16.1	22	39	14.8	1450	6.5	2.25	2.50	0.540	188
200L	MC20L433	35	62	23.4	33	59	22.1	33	59	22.1	31	56	20.8	1455	6.5	2.30	2.60	0.860	270
225S	MC22S413	43	77	28.7	41	74	27.4	41	74	27.4	39	72	26.0	1460	6.5	2.30	2.60	1.32	328
225M	MC22M433	53	96	35.4	50	91	33.4	50	91	33.4	48	88	32.0	1460	6.5	2.30	2.50	1.60	362
250M	MC25M413	64	113	42.6	61	108	40.6	61	108	40.6	58	103	38.6	1465	6.5	2.30	2.60	2.83	475
280S	MC28S413	88	152	58.3	85	147	56.3	85	146	56.3	82	141	54.3	1470	6.5	2.30	2.60	5.00	653
280M	MC28M453	110	190	72.9	102	177	67.6	102	177	67.6	97	169	64.3	1470	6.5	2.30	2.60	6.35	730
315S	MC31S413	132	228	87	125	216	82.5	125	216	82.5	120	208	79.2	1475	6.5	2.30	2.60	8.70	902
315M	MC31M433	160	274	105.7	150	256	99.1	150	256	99.1	145	248	95.7	1475	6.5	2.30	2.60	10.2	1010
315L	MC31L453	185	317	121.8	178	305	117.1	178	305	117.1	170	292	111.9	1480	6.5	2.30	2.60	12.2	1185
315L	MC31L463	205	350	134.9	192	328	126.4	192	328	126.4	180	307	118.5	1480	6.5	2.30	2.60	13.4	1262
315L	MC31L473	230	390	151.4	210	356	138.2	210	356	138.2	200	340	131.6	1480	6.5	2.30	2.60	14.6	1305
355L	MC35L413	285	480	186.9	270	455	177.1	270	455	177.1	260	438	170.5	1485	6.5	2.25	2.60	23.3	1680
355L	MC35L433	350	590	229.6	335	565	219.7	335	565	219.7	315	531	206.6	1485	6.5	2.25	2.60	32.7	1855
355L	MC35L453	400	660	262.4	380	630	249.2	380	630	249.2	355	588	232.8	1485	6.5	2.20	2.50	38.2	2050

Note: Derating factors of motor ratings for higher ambient temperatures are as given in the catalogue for Crane & Hoist Duty - CCB1/A

Performance table for 6-Pole motors

TEFC 3 Phase Squirrel Cage Induction Motors Crane & Hoist Duty with Inverter (VVVF) Drive Fr. 71 to 355L

Voltage : 415V ± 10%
Frequency : 50Hz ±5%
Combined Variation : ± 10%

Ambient : 45°C
Duty : S3 / S4

Ins. Class : F
Temp. Rise : B
Protection : IP55

1000 rpm (6-Pole)

Frame size IEC	Type Ref. B3 Construction	150 Starts/ hr.						300 Starts/ hr.						Rated Speed RPM	With DOL Starting		Pullout Torque to Rated Torque Ratio	Rotor GD² kgm²	Net Wt. B3 Const. kg
		40 % CDF			60 % CDF			40 % CDF			60 % CDF				Starting Current to Rated Current Ratio	Starting Torque to Rated Torque Ratio			
		kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque Kg.m	kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m						
71	MC071633	0.37	1.43	0.5	0.37	1.43	0.5	0.37	1.43	0.5	0.37	1.43	0.5	800	3.0	1.70	1.90	0.0038	7
80	MC080613	0.55	2	0.6	0.55	2	0.6	0.55	2	0.6	0.55	2	0.6	830	3.5	1.90	2.20	0.006	10
80	MC080633	0.75	2.7	0.9	0.75	2.7	0.9	0.75	2.7	0.9	0.75	2.7	0.9	860	3.5	2.25	2.50	0.0084	11
90L	MC09L6A3	1.1	3.0	1.2	1.1	3	1.2	1.1	3	1.2	1.1	3	1.2	900	4.0	2.30	2.60	0.016	17
90L	MC09L653	1.5	4.2	1.6	1.5	4.2	1.6	1.5	4.2	1.6	1.5	4.2	1.6	900	4.0	2.30	2.75	0.016	17
100L	MC10L653	2.2	6.5	2.3	2.2	6.5	2.3	2.2	6.5	2.3	2.2	6.5	2.3	920	4.5	2.25	2.75	0.029	27
112M	MC11M653	3.7	9.1	3.9	3.7	9.1	3.9	3.7	9.1	3.9	3.7	9.1	3.9	920	5.0	2.25	2.75	0.065	33
132S	MC13S6G3	5.5	13.5	5.8	5.5	13.5	5.8	5.5	13.5	5.8	5.5	13.5	5.8	925	5.5	2.30	2.75	0.130	52
132M	MC13M6T3	7.5	18.8	7.9	6.8	17	7.2	7.5	18.8	7.9	6.8	17.0	7.2	925	5.5	2.30	2.75	0.193	71
160M	MC16M633	9.3	21	9.7	8	18.1	8.3	9.3	21	9.7	8	18.0	8.3	935	6.0	2.30	2.60	0.28	103
160L	MC16L663	11	24	11.5	10.2	22.3	10.6	11	24	11.5	10.2	22.3	10.6	935	6.0	2.30	2.60	0.34	113
160L	MC16L673	13	29	13.5	12	27	12.5	13	29	13.5	12	27	12.5	935	6.0	2.25	2.60	0.40	123
180L	MC18L613	18	37	18.7	16.7	35	17.3	18	37	18.7	16.7	35	17.3	940	6.0	2.30	2.60	0.68	175
180L	MC18L633	21	43	21.8	19	39	19.7	21	43	21.8	19	39	19.7	940	6.0	2.30	2.60	0.82	190
200L	MC20L633	26	50	26.7	24	47	24.6	24	47	24.6	22	43	22.6	950	6.0	2.30	2.50	1.20	254
225M	MC22M623	34.5	64	35.0	32	60	32.5	32	60	32.5	30	57	30.4	960	6.0	2.30	2.50	2.10	336
225M	MC22M643	39	73	39.6	35	66	35.5	35	66	35.5	33	63	33.5	960	6.0	2.30	2.50	2.42	360
250M	MC25M633	46	83	46.0	42	76	42.4	42	76	42.4	40	73	40.4	965	6.0	2.30	2.50	3.72	528
280S	MC28S613	52	93	52.2	49	88	49.2	49	88	49.2	45	81	45.2	970	6.0	2.30	2.50	5.11	573
280M	MC28M633	65	117	65.3	61	110	61.3	61	110	61.3	58	105	58.2	970	6.0	2.30	2.50	6.16	620
315S	MC31S613	90	158	89.4	85	150	84.5	85	150	84.5	80	142	79.5	980	6.0	2.30	2.50	10.7	830
315M	MC31M633	105	184	104.4	100	175	99.4	100	175	99.4	95	166	94.4	980	6.0	2.30	2.50	12.4	912
315M	MC31M653	125	219	124.2	120	210	119.3	120	210	119.3	115	201	114.3	980	6.0	2.30	2.50	15.5	1010
315L	MC31L673	150	263	148.8	142	249	140.8	142	249	140.8	136	138	134.9	982	6.0	2.30	2.50	18.0	1175
315L	MC31L693	180	316	178.5	170	300	168.6	170	300	168.6	160	282	158.7	982	6.0	2.30	2.50	21.5	1231
355L	MC35L613	220	383	217.5	210	366	207.7	210	366	207.7	200	349	197.8	985	6.0	2.20	2.50	28.7	1670
355L	MC35L633	275	479	271.9	262	456	259.1	262	456	259.1	250	435	247.2	985	6.0	2.20	2.5	35.5	1780
355L	MC35L653	325	566	321.4	310	540	306.5	310	540	306.5	300	523	296.6	985	6.0	2.20	2.50	43.30	2000

Note: Derating factors of motor ratings for higher ambient temperatures are as given in the catalogue for Crane & Hoist Duty - CCB1/A

Performance table for 8-Pole motors

TEFC 3 Phase Squirrel Cage Induction Motors Crane & Hoist Duty with Inverter (VVVF) Drive Fr. 90S to 355L

Voltage : 415V ±10%
Frequency : 50Hz ±5%
Combined Variation : ± 10%

Ambient : 45°C
Duty : S3 / S4

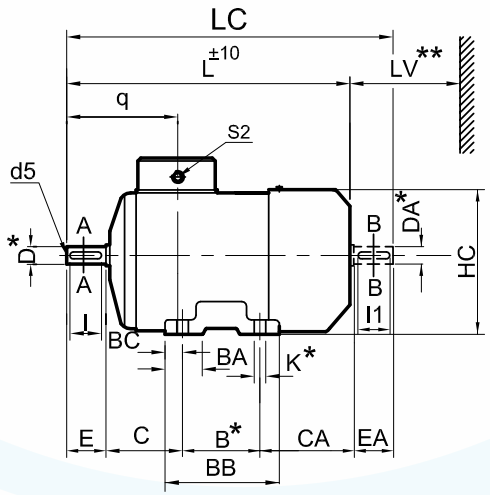
Ins. Class : F
Temp. Rise : B
Protection : IP55

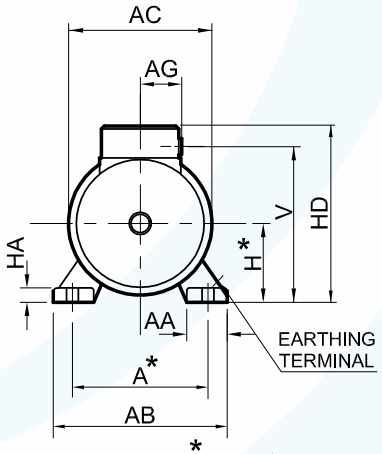
750 rpm (8-Pole)

Frame size IEC	Type Ref. B3 Construction	150 Starts/ hr.						300 Starts/ hr.						Rated Speed RPM	With DOL Starting		Pullout Torque to Rated Torque Ratio	Rotor GD² kgm²	Net Wt. B3 Const. kg
		40 % CDF			60 % CDF			40 % CDF			60 % CDF				Starting Current to Rated Current Ratio	Starting Torque to Rated Torque Ratio			
		kW	Rated Current Amps.	Rated Torque Kg.m	kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque kg.m	kW	Rated Current Amps.	Rated Torque Kg.m						
90S	MC09S8A3	0.37	1.43	0.5	0.37	1.43	0.5	0.37	1.43	0.5	0.37	1.43	0.5	700	3.0	2.00	2.30	0.011	13
90S	MC09S813	0.55	2.15	0.8	0.45	1.76	0.6	0.55	2.15	0.8	0.45	1.76	0.6	680	3.0	1.80	2.10	0.011	13
90L	MC09L853	0.75	2.76	1.1	0.75	2.76	1.1	0.75	2.76	1.1	0.65	2.39	0.9	680	3.0	2.00	2.40	0.014	14
100L	MC10L813	1.1	3.4	1.6	1.1	3.4	1.6	1.1	3.4	1.6	0.9	2.78	1.3	655	3.5	1.80	2.00	0.023	18
100L	MC10L833	1.5	4.95	2.1	1.5	4.95	2.1	1.5	4.95	2.1	1.1	3.63	1.6	680	3.5	2.00	2.30	0.027	22
112M	MC11M833	2.2	6.8	3.1	2.2	6.8	3.1	2.2	6.8	3.1	1.5	4.64	2.1	700	4.0	2.00	2.30	0.06	32
132S	MC13S8G3	3.7	8.8	5.1	3.7	8.8	5.1	3.7	8.8	5.1	3	7.14	4.1	710	4.0	2.00	2.30	0.133	69
160M	MC16M833	6	13	8.2	5.5	12	7.5	5.5	12	7.5	5	11	6.9	710	5.0	2.10	2.40	0.299	106
160M	MC16M853	7	15.5	9.6	6.5	14.4	8.9	6.5	14.4	8.9	6	13.3	8.2	710	5.0	2.10	2.40	0.344	110
160L	MC16L873	8.3	18.5	11.4	7.8	17.4	10.7	7.8	17.4	10.7	7	15.6	9.6	710	5.5	2.00	2.30	0.40	119
180M	MC18M813	10.6	22.5	14.5	10	21	13.7	10	21	13.7	9.3	20	12.8	710	5.5	2.10	2.50	0.62	177
180L	MC18L833	12.5	26.5	17.1	11.5	24.5	15.8	11.5	24.5	15.8	11	23.4	15.1	710	5.5	2.10	2.50	0.72	182
200L	MC20L833	17	28.8	35.0	16	33	21.8	16	33	21.8	15	31	20.4	715	5.5	2.20	2.50	1.32	282
225S	MC22S813	20.5	41.5	27.7	19.4	39.3	26.2	19.4	39.3	26.2	18.5	37.5	25.0	720	5.5	2.10	2.20	1.95	329
225M	MC22M833	24.5	50	33.1	23	47	31.1	23	47	31.1	22	45	29.8	720	5.5	2.10	2.20	2.41	369
250M	MC25M813	34	67	45.7	32	63	43.0	32	63	43.0	30	59	40.3	725	5.5	2.20	2.50	3.72	472
280S	MC28S823	42	82	56.0	39	76	52.0	39	76	52.0	37	72	49.4	730	5.5	2.20	2.20	5.83	615
280M	MC28M853	52	101	69.4	48	93	64.0	48	93	64.0	45	87.5	60.0	730	5.5	2.20	2.20	6.86	665
315S	MC31S813	62	120	82.2	58	113	76.9	58	113	76.9	55	107	72.9	735	6.0	2.10	2.40	10.7	833
315M	MC31M833	85	165	112.6	80	155	106.0	80	155	106.0	75	145	99.4	735	6.0	2.10	2.40	12.4	912
315M	MC31M853	100	193	132.5	95	184	125.9	95	184	125.9	90	175	119.3	735	6.0	2.10	2.40	15.5	1010
315L	MC31L873	122	234	161.7	116	222	153.7	116	223	153.7	110	211	145.8	735	6.0	2.10	2.40	18.0	1170
315L	MC31L893	145	278	192.1	138	265	182.9	138	265	182.9	132	254	174.9	735	6.0	2.10	2.40	21.5	1340
355L	MC35L813	175	332	230.3	168	319.0	221.1	168	319	221.1	160	304	210.6	740	6.0	2.10	2.40	28.7	1670
355L	MC35L833	220	417	289.6	210	398.0	276.4	210	398	276.4	200	380	263.2	740	6.0	2.00	2.30	35.5	1780
355L	MC35L853	250	480	329.1	235	452.0	309.3	235	452	309.3	225	433	296.1	740	6.0	2.20	2.40	43.3	2000

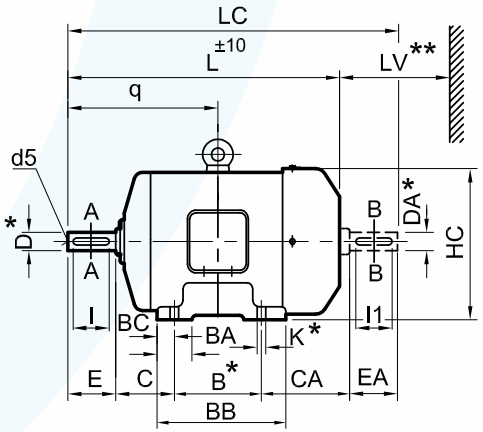
Note: Derating factors of motor ratings for higher ambient temperatures are as given in the catalogue for Crane & Hoist Duty - CCB1/A

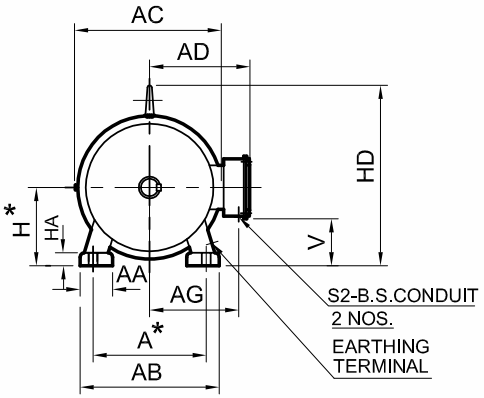
Dimensional Drawing: Crane and Hoist Duty Motors Type MC Foot Mounted (B3) TEFC series Frame 63-355L



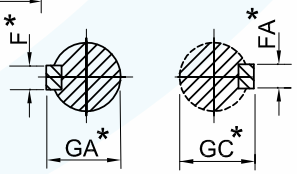


FRAME SIZE 63 TO 80

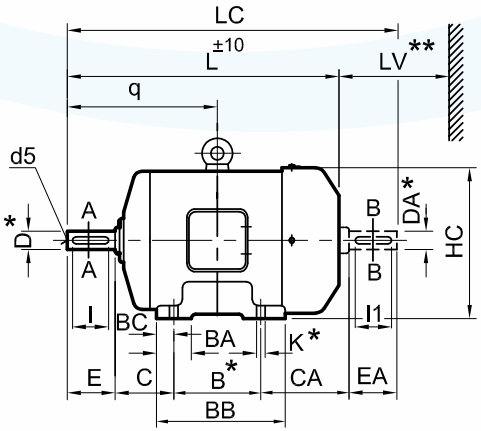


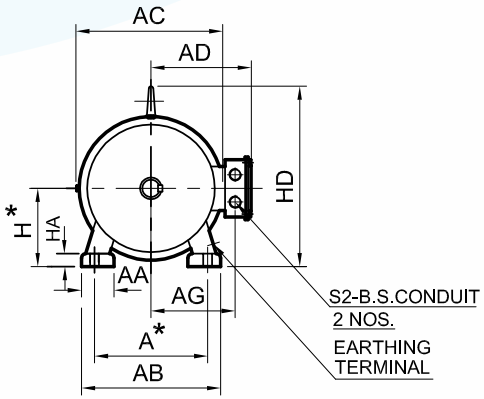


FRAME SIZE 160M TO 180L



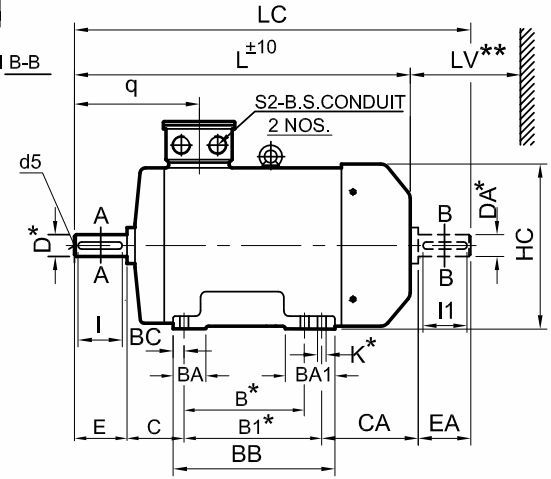
SECTION A-A SECTION B-B

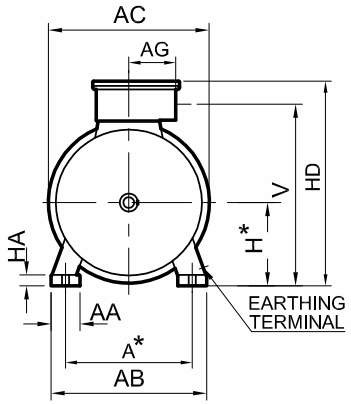




FRAME SIZE 200L TO 225M

* Refer TABLE A for tolerances





FRAME SIZE 90S TO 132M
FRAME SIZE 250M TO 355L

CAT-C-6335-3-1

Dimensional Drawing: Crane and Hoist Duty Motors Type MC Foot Mounted (B3) TEFC series Frame 63-355L

		FIXING						GENERAL														TERMINAL BOX				SHAFT					
IEC Fr. size	Pole	A*	B*	B1*	C	H*	K*	AB	BB	AA	BA	BA1	BC	HA	HC	HD	AD	L	LC	CA	AC	LV**	V	q	AG	S2 B.S.C.	D,DA**	E EA	F* FA*	GA* GC*	I I1	d5
63	4	100	80	—	40	63	7	126	100	28	30	—	13	7	125	179	—	206	241	75	124	30	149	104	40	3/4"	11	23	4	12.5	18	M4
71	4 & 6	112	90	—	45	71	7	135	110	31	30	—	13	7	141	195	—	234	278	83	140	30	166	102	40	3/4"	14	30	5	16	25	M5
80	4 & 6	125	100	—	50	80	10	150	124	31	35	—	15	9	159	214	—	267	324	94	157	30	185	112	40	3/4"	19	40	6	21.5	35	M6
90S	4,6 & 8	140	100	—	56	90	10	168	125	34	31.5	—	18	12	177	230	-	302	374	118	174	35	199	139	52	3/4"	24	50	8	27	45	M8
90L	4,6 & 8		125						150									327	399					153								
100L	4,6 & 8	160	140	—	63	100	12	190	174	43.5	36	—	21	12	198	257	-	366	448	125	192	40	225	152	56	1"	28	60	8	31	55	M10
112M	4,6 & 8	190	140	—	70	112	12	220	174	47	36	—	21	12	222	282	-	388	471	141	220	45	249	157	56	1"	28	60	8	31	55	M10
132S	4,6 & 8	216	140	—	89	132	12	256	180	64	50	—	23	17	262	338	-	459	561	172	260	50	299	196	63	1"	38	80	10	41	70	M12
132M	4,6		178						218		54							497	599	172				215								
160M	4,6 & 8	254	210	—	108	160	15	310	250	58	70	—	23	20	318	366	226	585	721	183	316	60	98	323	186	1"	42	110	12	45	105	M16
160L	4,6 & 8		254						294									629	765	183				345								
180M	4,6 & 8	279	241	—	121	180	15	344	281	65	70	—	23	26	357	412	265	679	799	217	354	70	83	352	216	1 1/2"	48	110	14	51.5	100	M16
180L	4,6 & 8		279						319									717	838	218				371								
200L	4,6 & 8	318	305	—	133	200	19	398	355	85	85	—	28	32	397	462	319	772	897	239	394	80	—	396	249	2"	55	110	16	59	100	M20
225S	4,6 & 8	356	286	—	149	225	19	436	336	85	85	—	28	34	450	509	344	842	966	257	450	90	—	432.5	273	2"	60	140	18	64	130	M20
225M	4,6 & 8		311						361									857	991	257				445								
250M	4,6 & 8	406	349	—	168	250	24	506	425	100	115	—	49	42	495	665	—	914	1065	268	489	100	578	352	243	2"	65	140	18	69	130	M20
280S/M	4,6 & 8	457	368	419	190	280	24	540	490	100	110	149	40	42	552	725	—	1010	1160	271	544	115	638	360	243	2"	75	140	20	79.5	130	M20
315S/M	4,6 & 8	508	406	457	216	315	28	625	540	120	120	155	46	45	615	830	—	1167	1353	240	600	130	728	416	278	2"	80	170	22	85	160	M20
315L	4,6 & 8		508	—					593	120	120	—	46					1332	1518	454						2 1/2"	80	170	22	85	160	
355L	4,6 & 8	610	630	—	254	355	28	710	770	110	170	—	73	45	693	939	—	1491	1682	458	685	145	850	464	403	3"	95	170	25	100	160	M24

TABLE A

Dimension	Tolerance		Specification
A,B	±0.75		
H	-0.5	UPTO 280	IS : 1231
	-1	OVER 280	
K	+0.360	7,10Ø	
	+0.430	12,15Ø	
	+0.520	19,24,28Ø	

Dimension	Tolerance		Specification
D,DA	j6	11,14,19,24,28Ø	IS : 1231
	k6	38,42,48Ø	
	m6	55,60,65,75,80,95Ø	
GA,GC,F,FA			IS : 2048
d5(centering)			IS : 2540

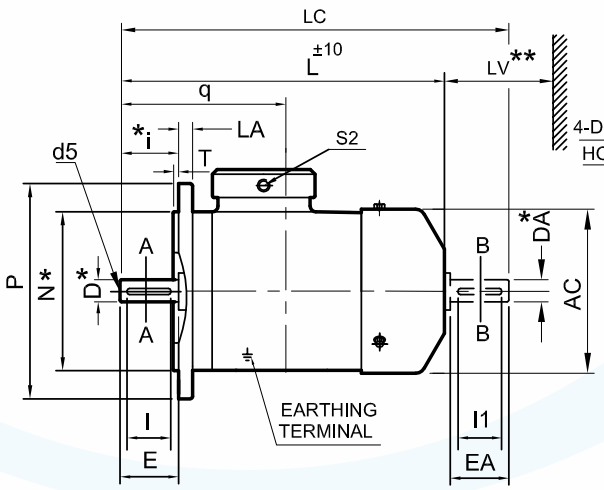
① Without Eye bolt

- Key / key way fit : h9 / N9
- Double shaft extension can be provided with shaft dimension identical to DE shaft.
- Also suitable for B6,B7,B8,V5 & V6 mounting as per IS 2253.

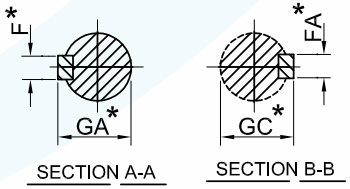
** Minimum distance for efficient cooling of motor to be maintained by user

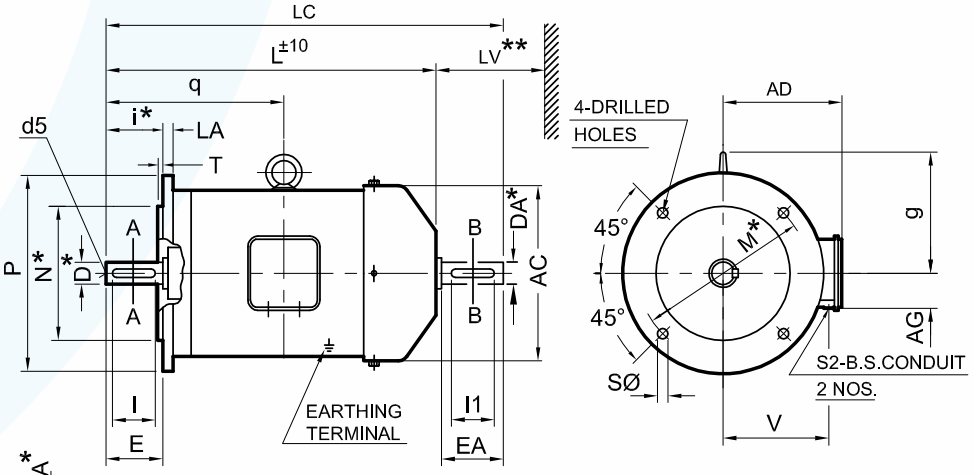
All Dimensions are in mm unless otherwise specified.

Dimensional Drawing: Crane and Hoist Duty Motors Type MC Flange Mounted (B5) TEFC series Frame 63-355L

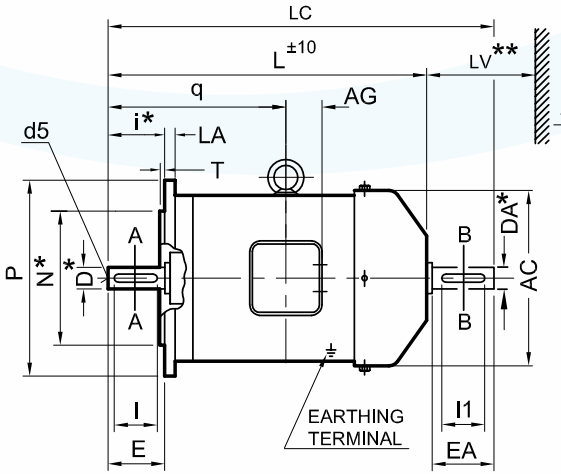


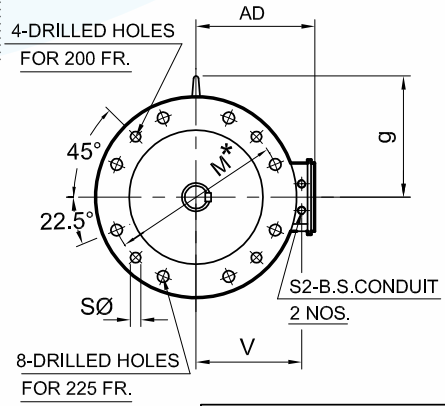
FRAME SIZE 63 TO 80



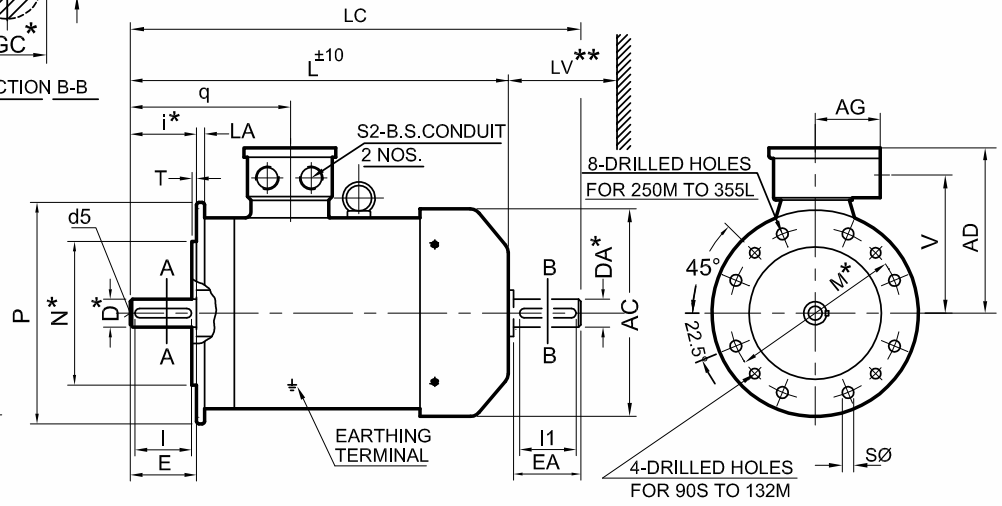


FRAME SIZE 160M TO 180L





FRAME SIZE 200L TO 225M



FRAME SIZE 90S TO 132M
FRAME SIZE 250M TO 355L

* Refer TABLE A for tolerances

CAT-C-6335-5-1

Dimensional Drawing: Crane and Hoist Duty Motors Type MC Flange Mounted (B5) TEFC series Frame 63-355L

		FIXING					GENERAL								TERMINAL BOX				SHAFT					
IEC Fr. size	Pole	P	N*	M*	i*	S	T	LA	AD	AC	L	LC	LV**	g	V	q	AG	S2 B.S.C.	D,DA**	E EA	F* FA*	GA* GC*	I I1	d5
63	4	140	95	115	23	10	3	9	116	124	225	260	30	—	86	109	40	3/4"	11	23	4	12.5	18	M4
71	4 & 6	160	110	130	30	10	3.5	9	124	140	261	305	30	—	95	127	40	3/4"	14	30	5	16	25	M5
80	4 & 6	200	130	165	40	12	3.5	10	134	157	267	324	30	—	105	112	40	3/4"	19	40	6	21.5	35	M6
90S	4,6 & 8	200	130	165	50	12	3.5	10	140	174	302	374	35	①	109	139	52	3/4"	24	50	8	27	45	M8
90L	4,6 & 8										327	399				153								
100L	4,6 & 8	250	180	215	60	15	4	11	157	195	366	448	40	-	125	152	56	1"	28	60	8	31	55	M10
112M	4,6 & 8	250	180	215	60	15	4	11	170	220	388	471	45	-	137	157	56	1"	28	60	8	31	55	M10
132S	4,6 & 8	300	230	265	80	15	4	12	206	260	459	561	50	-	167	196	63	1"	38	80	10	41	70	M12
132M	4,6										497	599				215								
160M	4,6 & 8	350	250	300	110	19	5	13	226	316	585	721	60	206	186	323	63	1"	42	110	12	45	105	M16
160L	4,6 & 8										629	765				345								
180M	4,6 & 8	350	250	300	110	19	5	13	265	354	679	799	70	232	216	352	97	1 1/2"	48	110	14	51.5	100	M16
180L	4,6 & 8										717	838				371								
200L	4,6 & 8	400	300	350	110	19	5	15	319	394	772	897	80	262	249	396	172	2"	55	110	16	59	100	M20
225S	4,6 & 8	450	350	400	140	19	5	16	344	450	842	966	90	284	273	432.5	172	2"	60	140	18	64	130	M20
225M	4,6 & 8										857	991				445								
250M	4,6 & 8	550	450	500	140	19	5	18	415	489	914	1065	100	—	328	352	243	2"	65	140	18	69	130	M20
280S/M	4,6 & 8	550	450	500	140	19	5	18	445	544	1010	1160	115	—	358	360	243	2"	75	140	20	79.5	130	M20
315S/M	4,6 & 8	660	550	600	170	24	6	22	515	600	1167	1353	130	—	413	416	278	2"	80	170	22	85	160	M20
315L	4,6 & 8										1332	1518				416		2 1/2"	80	170	22	85	160	
355L	4,6 & 8	800	680	740	170	24	6	25	584	685	1491	1682	145	—	495	464	403	3"	95	170	25	100	160	M24

TABLE A

Dimension	Tolerance		Specification
N	j6	UPTO 450	IS : 2223
	js6	OVER 450	
M	±0.3	UPTO 265	
	±0.5	OVER 265	
i	±1	UPTO 85	
	±1.5	OVER 85	

Dimension	Tolerance		Specification
D,DA	j6	11,14,19,24,28Ø	IS : 1231
	k6	38,42,48Ø	
	m6	55,60,65,75,80,95Ø	
GA,GC,F,FA			IS : 2048
d5(centering)			IS : 2540

① Without Eye bolt

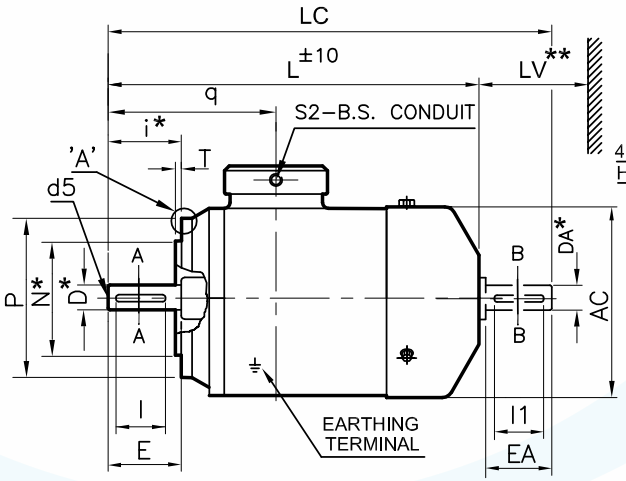
- Key / key way fit : h9 / N9
- 8 Nos. Fixing Holes from 225S/M frame onwards
- Double shaft extension can be provided with shaft dimension identical to D.E.shaft
- Also suitable for V1 & V3 mounting as per IS 2253

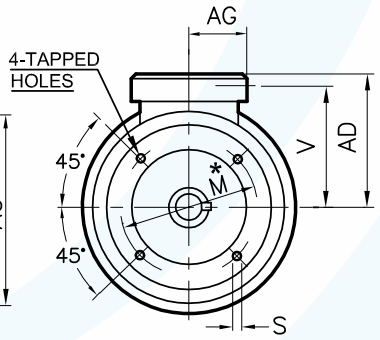
** Minimum distance for efficient cooling of motor to be maintained by user

All Dimensions are in mm unless otherwise specified.

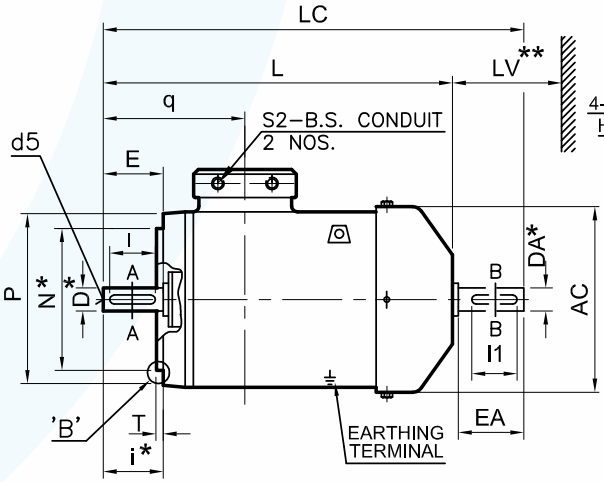
CAT-C-6335-5-2

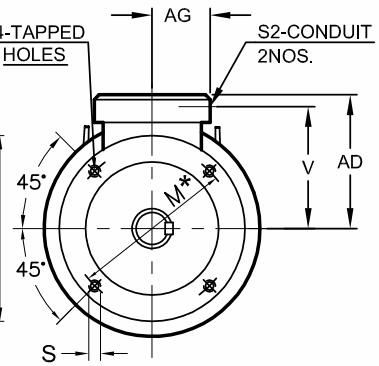
Dimensional Details: Crane and Hoist Duty Motors Type MC Face Mounted (B14) TEFC series Frame 63-132M



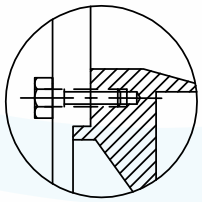


FRAME SIZE 63 TO 80



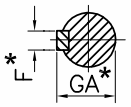


FRAME SIZE 90S TO 132M

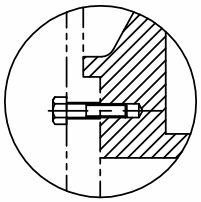


ENLARGEMENT OF CIRCLE 'A'

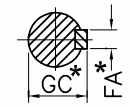
		FIXING					GENERAL						TERMINAL BOX				SHAFT					
IEC Fr. size	Pole	P	N*	M*	i*	S	T	AD	AC	L	LC	LV**	g	V	q	AG	S2 B.S.C.	D* DA*	E EA	F* FA*	GA* GC*	l l1	d5
63	4	90	60	75	23	M5X10	2.5	116	124	206	241	30	—	86	104	40	3/4"	11	23	4	12.5	18	M4
71	4 & 6	105	70	85	30	M6X10	2.5	124	140	234	278	30	—	95	102	40	3/4"	14	30	5	16	25	M5
80	4 & 6	120	80	100	40	M6X13	3	134	157	267	324	30	—	105	112	40	3/4"	19	40	6	21.5	35	M6
90S	4,6 & 8	140	95	115	50	M8X12	3	140	174	302	374	35	①	109	139	52	3/4"	24	50	8	27	45	M8
90L	4,6 & 8									327	399				153								
100L	4,6 & 8	160	110	130	60	M8X12	3.5	157	195	366	448	40	-	125	152	56	1"	28	60	8	31	55	M10
112M	4,6 & 8	160	110	130	60	M8X12	3.5	170	220	388	471	45	-	137	157	56	1"	28	60	8	31	55	M10
132S	4,6 & 8	250	180	215	80	M12X20	4	206	260	459	561	50	-	167	196	63	1"	38	80	10	41	70	M12
132M	4 & 6									497	599				215								



SECTION A–A



ENLARGEMENT OF CIRCLE 'B'



SECTION B–B

TABLE A

Dimension	Tolerance	Specification
N	j6	IS : 2223
M	±0.3	
i	±1	

Dimension	Tolerance		Specification
D,DA	j6	11,14,19,24,28Ø	IS : 1231
	k6	38Ø	
GA,GC,F,FA			IS : 2048
d5(centering)			IS : 2540

*Refer TABLE A for tolerances

① Without Eye bolt

- Also suitable for V19 & V18 mounting as per IS 2253
- Key / key way fit : h9 / N9
- Double shaft extension can be provided with shaft dimension identical to D.E. shaft

** Minimum distance for efficient cooling of motor to be maintained by user

All Dimensions are in mm unless otherwise specified.

Application

Slipring induction motors are used for systems specifying limitations on starting current, for high inertia drives and for frequent starting. The motors are eminently suitable for high mechanical and electrical stresses encountered under heavy duty conditions such as excavating machines, stone crushers, main and auxiliary drives in rolling mills etc. These motors are well suited for smooth starting by using the resistance bank. These motors can also be used for variable speed drives, particularly for short periods and within a small speed range.

Insulation

The motors are provided with class F insulation scheme with temperature rise for stator windings limited to class B limits and rotor winding limited to class F limits.

Enclosures: (Material & T-Box Location)

Frame Size	Enclosure Materials	Terminals Box Location	
		Standards	Options Available
100 to 160	Cast Iron	Top	----

Degree of Protection

All motors have IP55 degree of protection as per IS/IEC 60034-5. Higher degree of protection such as IP 56, IP 65 and IP 66 can be offered on request. All flange mounted motors are additionally provided with oil tight shaft protection on driving end side.

Note: For more details, refer to annexure II on page no. 121.

Mounting

Standard mounting is B3. In case B5 mounting is required, please refer to our sales office.

Additional Mechanical Features

The Slipring's at the drive end are accessible through hinged brushes on the top after opening the T-Box cover. The brush block assembly can hence easily be replaced as a whole unit without dismantling the motor. Terminals box of the motor contains 3 terminals for stator and 3 for rotor and 2 cable entries.

Starting and Speed Control

The maximum torque (which is approx. the pull-out torque) can be obtained for starting by correct selection of the resistance of the controller. By appropriately switching the resistance as the motor picks up speed, the mean torque during starting can be as high as 2.25 times the rated full load torque.

The values of rated current and voltage required for selecting the starting resistors are listed in the performance table of Slipring motors.

For reduced load, the rotor current reduces and is given by rated current × (reduced load/rated load)

The rotor current while starting is proportional to the motor torque and determines the size of the starting resistance.

Fine speed variation is possible by inserting resistance in the rotor circuit calculated per phase as:

$$R_c = \frac{V_r \times (N_s - N) \times M_n}{3 \times I_r \times N_s \times M} - R_r$$

Where V_r, I_r and R_r are the open circuit voltage, rated current and resistance of the rotor, M_n and M are the rated and required torque values, and N_s and N are the synchronous and required speed respectively.

Since the cooling is reduced at lower speed, torque and output must be reduced as per the following table, otherwise a larger motor should be selected.

Speed %	100	90	80	70	60	50
Torque %	100	96	91	85	80	72
Output %	100	86	73	60	48	36

At lower speeds the torque speed characteristic is such that the speed varies inversely with the load. Below 50% rated speed, satisfactory operating characteristics may not be obtained even if the load torque remains constant.

If sufficiently ventilated by using a separate fan etc. the motor can provide the full load torque at reduced speed.

Performance table for 6-Pole motors

TEFC 3 Phase Slipring Induction Motors Crane & Hoist Duty Fr. 100L To 160L

Voltage : 415V ± 10%
Frequency : 50Hz ± 5%
Combined Variation : ± 10%

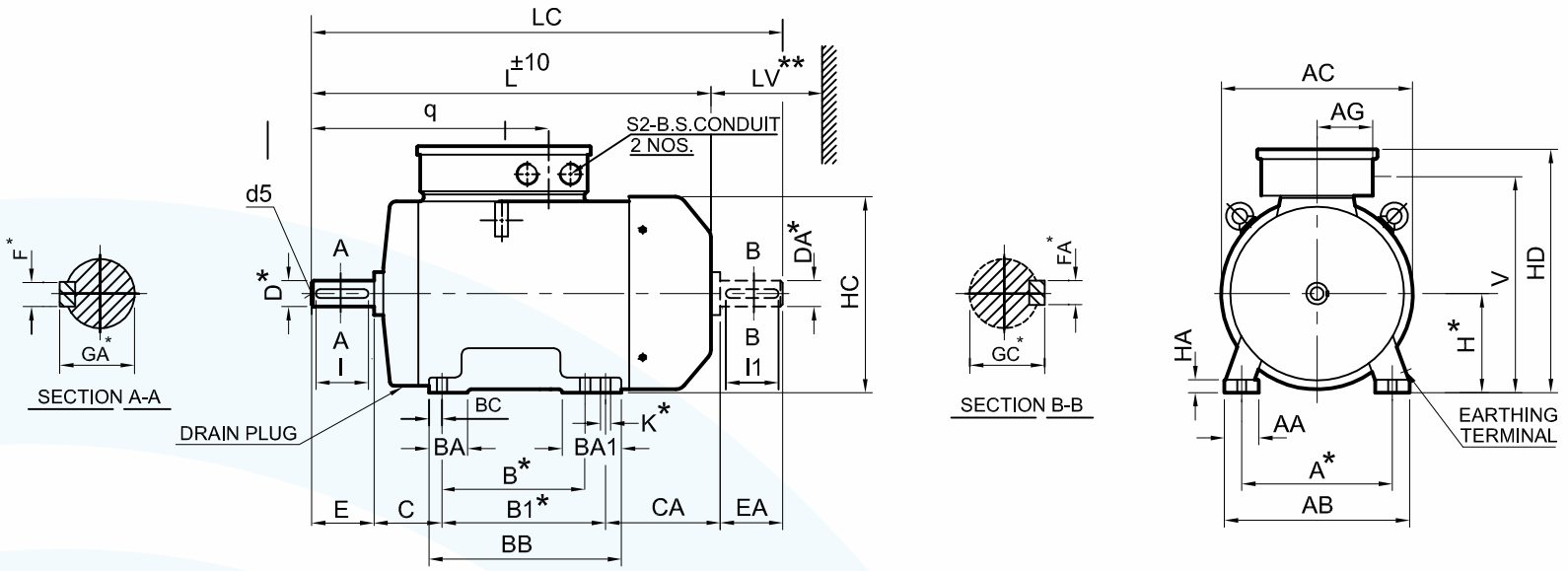
Ambient : 45°C
Duty : S3/S4/S5

Ins. Class Stator/Rotor : F/F
Temp. Rise Stator/Rotor : B/F
Protection : IP55

1000 rpm (6-Pole)

	Frame Size IEC	Type Ref. B3 Construction	25%CDF					40 % CDF					60 % CDF								
			kW	Rated RPM	Pullout Torque to Rated Torque Ratio	Line Amps		kW	Rated RPM	Pullout Torque to Rated Torque Ratio	Line Amps		kW	Rated RPM	Pullout Torque to Rated Torque Ratio	Line Amps		Rotor O.C.V.	GD² Rotor	kgm² Load	Wt. of motor kg.
						Sator	Rotor				Sator	Rotor				Sator	Rotor				
60 stars per hour	100L	MP10L613	1.3	800	1.75	3.8	17	1.1	850	2.2	3.5	13	1	870	2.50	3.4	12	65	0.034	0.09	37
	100L	MP10L623	1.9	785	2.00	5.4	18.5	1.5	870	2.8	5	13	1.3	890	3.30	4.7	11	80	0.038	0.10	40
	112M	MP11M623	2.6	820	2.20	9.8	22.5	2.4	840	2.2	6.4	20.5	2.1	870	2.70	6	17.1	90	0.068	0.17	58
	112M	MP11M643	3.8	830	2.00	9.6	23.5	3.3	850	2.3	8.6	20.5	2.8	880	2.80	8.2	17	115	0.076	0.19	61
	132M	MP13M613	4.8	860	2.10	12.5	32.5	4	890	2.6	11	26	3.4	910	3.00	9.7	21	110	0.153	0.38	90
	132M	MP13M663	6.6	870	1.90	16	35	5.5	895	2.5	13.3	26.5	4.8	915	2.90	12.4	23	140	0.180	0.45	94
	160L	MP16L613	8	900	2.00	18.1	33	7	920	2.1	15.8	31.3	6.5	930	2.50	14.7	27.2	165	0.310	0.77	129
	160L	MP16L653	11.5	890	1.60	25.3	46.2	10	915	1.8	21	28	9	920	2.10	19.8	25.2	240	0.378	0.94	139
150 stars per hour	100L	MP10L613	1.3	800	1.75	3.8	17	1.1	850	2.2	3.5	13	1	870	2.50	3.4	12	65	0.034	0.09	37
	100L	MP10L623	1.8	810	2.20	5.3	17	1.5	870	2.8	5	13	1.3	890	3.30	4.7	11	80	0.038	0.10	40
	112M	MP11M623	2.6	820	2.00	6.8	22.5	2.3	850	2.4	6.2	19.5	2	875	2.80	5.9	16	90	0.068	0.17	58
	112M	MP11M643	3.8	830	2.00	9.6	23.5	3.2	855	2.4	8.5	20	2.7	885	3.00	8.1	16.5	115	0.076	0.19	61
	132M	MP13M613	4.5	865	2.20	11.9	30	3.7	895	2.8	10.4	23.5	3.2	915	3.30	9.4	19.5	110	0.153	0.38	90
	132M	MP13M663	6.5	870	2.00	15.1	34	5.4	895	2.7	13.2	25	4.6	920	3.00	12	22	140	0.180	0.45	94
	160M	MP16M613	8	900	2.00	18.1	33	7	920	2.3	15.8	29	6	930	2.70	13.4	25	165	0.310	0.77	129
	160L	MP16L653	10.5	900	1.80	23.1	29.4	9.5	915	1.9	21	28	8.6	930	2.25	18.5	24	240	0.378	0.94	139
300 stars per hour	100L	MP10L613	1.3	800	1.75	3.8	17	1.1	850	2.2	3.5	13	0.9	890	2.80	3.3	10.5	65	0.034	0.09	37
	100L	MP10L623	1.8	810	2.20	5.3	17	1.5	870	2.8	5	13	1.3	890	3.30	4.7	11	80	0.038	0.10	40
	112M	MP11M623	2.6	820	2.00	6.8	22.5	2.3	850	2.4	6.2	19.5	1.9	880	3.00	5.7	15	90	0.068	0.17	58
	112M	MP11M643	3.6	840	2.10	9.2	22	3	870	2.6	8.3	18.5	2.6	890	3.10	8	16	115	0.076	0.19	61
	132M	MP13M613	4	890	2.60	11	26	3.4	905	3.0	9.7	21	3	920	3.50	9	18	110	0.153	0.38	90
	132M	MP13M663	6.1	875	2.20	14.6	30	5.1	900	2.7	12.5	24	4.4	930	3.20	11.5	20.5	140	0.180	0.45	94
	160M	MP16M613	6.7	920	2.40	15.2	28	5.5	940	2.9	12.3	23	5	945	3.20	11.2	21	165	0.310	0.77	129
	160L	MP16L653	9	920	2.10	19.8	25.2	8	935	2.4	17.4	22.6	7.5	940	2.50	16.5	21	240	0.378	0.94	139

Dimensional Details: Slip Ring Motor Type MP Foot Mounted (B3) TEFC Frame 100L-160 M/L



		FIXING						GENERAL													TERMINAL BOX				SHAFT					
IEC Fr. size	Pole	A*	B*	B1*	C	H*	K*	AB	BB	AA	BA	BA1	BC	HA	HC	HD	L	LC	CA	AC	LV**	V	q	AG	S2 B.S.C.	D,DA*	E EA	F* FA*	GA* GC*	I I1	d5
100L	4 , 6	160	140	—	63	100	12	200	176	54	50	__	18	14	198	252	488	570	247	195	40	210	295	61	3/4"	28	60	8	31	55	M10
112M	4 , 6	190	140	__	70	112	12	230	176	62	50	__	18	15	222	281	537	620	290	220	45	230	316	63	3/4"	28	60	8	31	55	M10
132S/M	4 , 6	216	140	178	89	132	12	256	218	64	54	__	20	17	262	317	612	715	288	260	50	266	364	74	3/4"	38	80	10	41	70	M12
160M/L	4 , 6	254	210	254	105	160	15	314	294	60	70	115	20	20	318	366	730	866	287	316	60	315	434	88	1"	42	110	12	45	105	M16

TABLE A

Dimension	Tolerance		Specification
A,B	±0.75		IS : 1231
H	-0.5		
K	+0.430	12,15Ø	

Dimension	Tolerance		Specification
D,DA	j6	28Ø	IS : 1231
	k6	38,42Ø	
GA,GC,F,FA			IS : 2048
d5(centerlng)			IS : 2540

*Refer TABLE A for tolerances

- Key / key way fit : h9 / N9
- Double shaft extension can be provided with shaft dimension identical to D.E.shaft
- Also suitable for B6,B7,B8,V5 & V6 mounting as per IS 2253

**Minimum distance for efficient cooling of motor to be maintained by user

All dimensions are in mm unless otherwise specified.
CAT-P-1016-3-1

CANE UNLOADER MOTORS

Bharat Bijlee has developed a special series of Cane un-loader motors for unloading cane at sugar mills. These motors are designed after thorough study of the Cane un-loader application in sugar mills.

Application

These motors are primarily crane duty motors suitable for very high no. of switching per hour. These motors can be used for lifting applications where high switching frequencies lead to overheating and burnouts. These motors are developed with specially designed squirrel cage rotor and they readily replace Slipring induction motors.

Salient Features

Very high no. of switching: These motors are suitable for very high no. of switching i.e. 900 starts/stop per hour which includes inching and plugging.

Special winding & impregnation: The stators are wound with dual coated (DC) winding wires as per IS13730 part 13 and winding is impregnated with VPI process. This improves the thermal withstand capacity of the motor.

Robust construction: Shaft material is given special heat treatment to withstand high intermittent load. These motors have special squirrel cage die cast rotors which ensure minimum maintenance and trouble free operation.

Forced cooling: This ensures continuous cooling of the motor.

Built in thermal protection: Built in thermal protection is provided by embedding thermostats in the winding. This ensures protection of the motor against failure due to excessive heating caused by severe starting duty, single phasing, overloading, low voltage etc.

Compact design: Compact in size as the auxiliary fan motor used for forced Cooling is an integral part of the main motor.

Product Range

Frame Size	kW range
160L to 225M	11 to 30

Electrical Features

Operating Conditions:

Supply Voltage : 415V ± 10%
Frequency : 50Hz ± 5%
Combined Variation : ± 10%
Duty : S5, 50% CDF, 900 Switching per hour.

Ambient

Motors are designed for ambient temperature of 45°C.

Altitude

Motor are designed for altitude up to 1000m above mean sea level.

Insulation

The motors are provided with class F insulation scheme with temperature limited to class B limits.

Mechanical Features

Construction:

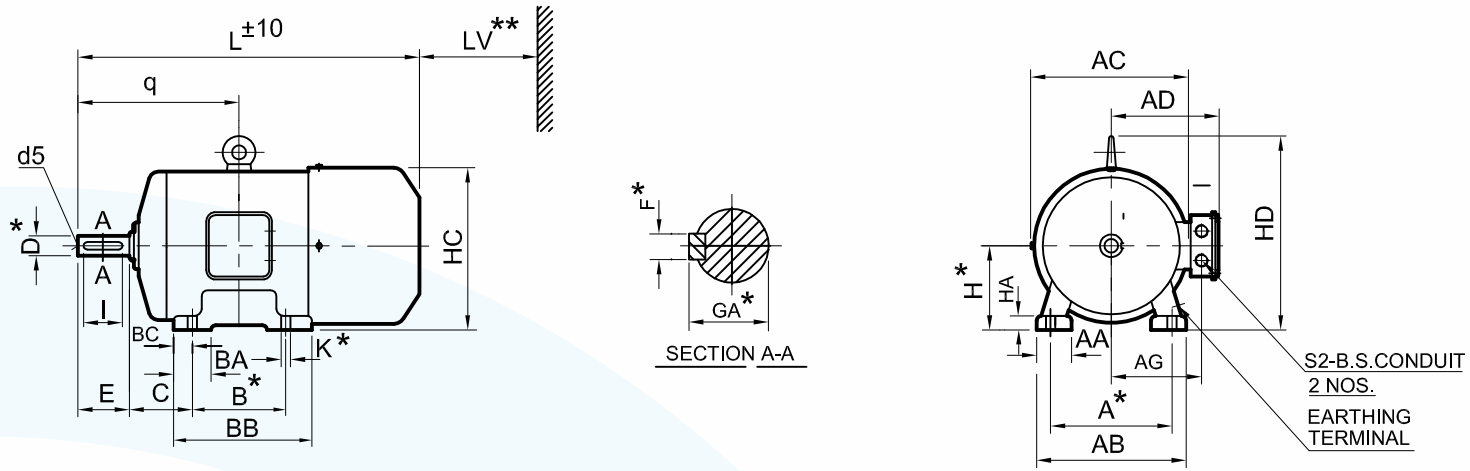
TEFC Horizontal foot mounting (B3) as per IS 1231. TEFC Horizontal flange mounting (B5) as per IS 2223.

Terminals Box Location

As standard practice terminal box will be located on RHS when viewed from DE side. However motors can be offered with Terminal Box location on LHS when viewed from DE side or top on request.

Rated Output		Frame Size IEC	Type Ref. B3 Construction	Operating Characteristic at Rated output			Starting Current to rated current Ratio	Starting Current to rated Torque Ratio	Pullout torque to rated torque Ratio	Rotor GD^2 kgm^2	Net Weight B3 Constrn. kg
kW	HP			Rated Speed RPM	Rated Current Amps	Rated Torque kg.m					
11	15	160L	MF16L673	965	21.6	11.1	5.5	2.25	2.30	0.4	140
15	20	180M	MF18L613	940	29	15.5	5.5	2.25	2.30	0.68	190
18.5	25	180L	MF18L633	950	36.9	19.0	5.5	2.25	2.30	0.82	220
22	30	200L	MF20L633	955	43	22.4	5.5	2.25	2.30	1.2	260
30	40	225M	MF22M643	975	54	30.0	5.5	2.25	2.30	2.42	395

Dimensional Details: Cane Unloader Motor Type MF Foot Mounted (B3) TEFC Frame 160L-225 M



		FIXING					GENERAL											T. BOX			SHAFT					
IEC Fr. size	Pole	A*	B*	C	H*	K*	AB	BB	AA	BA	BC	HA	HC	HD	AD	L	AC	LV**	q	AG	S2 B.S.C.	D*	E	F*	GA*	I	d5
160L	6	254	254	108	160	15	310	294	58	70	23	20	318	366	246	779	316	60	345	204	1"	42	110	12	45	105	M16
180L	6	279	279	121	180	15	344	319	65	70	23	26	357	412	280	922	354	70	371	225	1 1/2"	48	110	14	51.5	100	M16
200L	6	318	305	133	200	19	398	355	85	85	28	32	397	462	319	965	394	80	396	249	2"	55	110	16	59	100	M20
225M	6	356	311	149	225	19	436	361	85	85	28	34	450	509	344	1037	450	90	445	273	2"	60	140	18	64	130	M20

*Refer TABLE A for tolerances

TABLE A

Dimension	Tolerance		Specification
A,B	±0.75		
H	-0.5		IS : 1231
K	+0.430	15 Ø	
	+0.520	19 Ø	

Dimension	Tolerance		Specification
D	k6	42,48 Ø	IS : 1231
	m6	55,60 Ø	
GA,F			IS : 2540
d5(centering)			IS : 2540

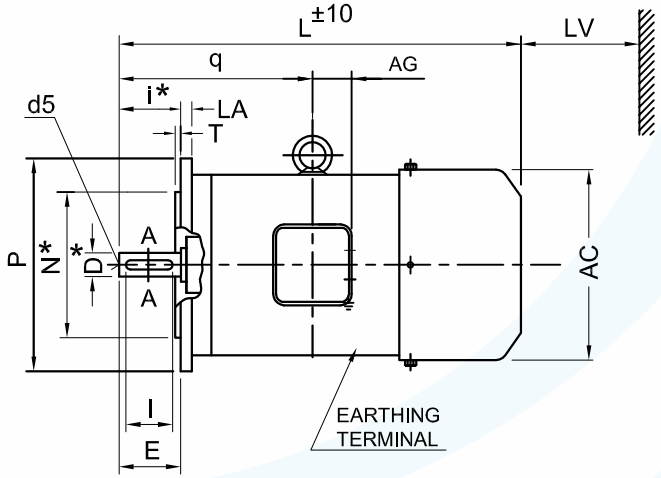
- Online re-greasing arrangement is provided in frame sizes 225M
- Also suitable for B6,B7,B8,V5 & V6 mounting as per IS 2253
- Key / key way fit : h9/N9

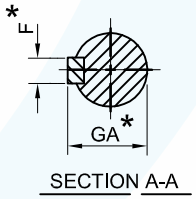
** Minimum distance for efficient cooling of motor to be maintained by user

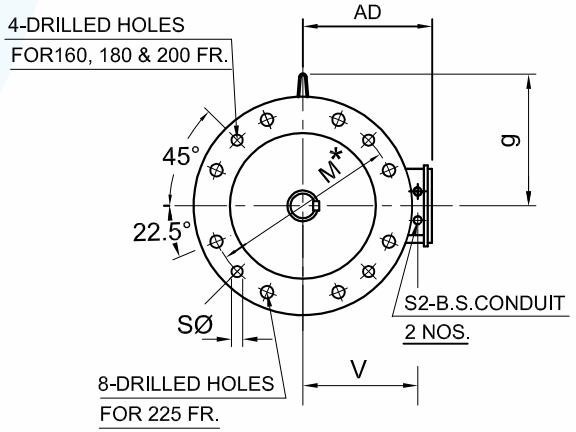
All dimensions are in mm unless otherwise specified.

CAT-F-1622-3-1

Dimensional Details: Cane Unloader Motor Type MF Flange Mounted (B5) TEFC Frame 160L-225 M







		FIXING					GENERAL							T. BOX				SHAFT					
IEC Fr. size	Pole	P	N*	M*	i*	S	T	LA	AD	AC	L	LV**	g	V	q	AG	S2 B.S.C.	D*	E	F*	GA*	I	d5
160L	6	350	250	300	110	19	5	13	246	316	779	60	206	204	345	63	1"	42	110	12	45	105	M16
180L	6	350	250	300	110	19	5	13	280	354	922	70	232	225	371	97	1 1/2"	48	110	14	51.5	100	M16
200L	6	400	300	350	110	19	5	15	319	394	965	80	262	249	396	172	2"	55	110	16	59	100	M20
225M	6	450	350	400	140	19	5	16	344	450	1037	90	284	273	445	172	2"	60	140	18	64	130	M20

*Refer TABLE A for tolerances

TABLE A

Dimension	Tolerance		Specification
N	j6	OVER 450	IS : 2223
M	±0.5	OVER 265	
i	±1.5	OVER 85	

Dimension	Tolerance		Specification
D	k6	42,48 Ø	IS : 1231
	m6	55,60 Ø	
GA,F			IS : 2048
d5(centering)			IS : 2540

- Online re-greasing arrangement is provided in frame sizes 225M
- Also suitable for V1 & V3 mounting as per IS 2253
- Key / key way fit : h9 / N9

** Minimum distance for efficient cooling of motor to be maintained by user

All dimensions are in mm unless otherwise specified.

CAT-F-1622-5-1

Brake motors are offered for various application requiring almost instantaneous stopping if driven with load. These motors are offered in frame size 71 to 132. Their operation is of "fail safe" type, i.e., the brake applied when, power to the motor is switched off, or, if power failure occurs.

Enclosures: (Material & T-Box location)

Frame Sizes	Enclosure Materials	Terminal Box Location	
		Standard	Option Available
71-80	Aluminum	Top	---
90S-132M	Cast Iron	RHS	LHS
			TOP

Construction

A Brake motor is an integral combination of an A.C induction motor and a disc type, fail safe, electromagnetic Brake unit. It consists of following:

I) A.C. induction motor.
II) Encapsulated brake coil housed in the non driving side end-cover.
III) Brake liner attached to the armature disc at its interface with the cooling fan.
IV) Cooling fan.
V) The rectifier unit is provided inside the terminal box. It converts A.C. supply into D.C. supply for the brake coil.

Operation

Under no power condition brake springs keep the brake liner pressed against the cooling fan. This prevents rotor shaft rotation, because, the fan is keyed to it. 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 action results in releasing of the fan allowing the rotor to rotate freely.

When the power fails or when it is switched off, the brake coil gets de-energized. This results in the springs pressing the brake liner against cooling fan, i.e. returning armature disc to its original position. This causes almost instantaneous braking of rotor. Fail safe condition is thus ensured.

For applications, where total load stopping time is not very critical, A.C. side interruption can be used.

However for application where faster braking is required, D.C. side interruption should be used. An additional contactor interlocked with main contactor should be used.

Special Features

a) Being simple and rugged in construction these motors need very little maintenance.

b) No separate DC supply is necessary for brake coil energisation, because a rectifier unit is provided. The rectifier is open type and fixed between the two terminals inside the terminals box. Being open type, it ensures good heat dissipation and is very easy to replace. Varistor is provided across the DC terminals to protect the brake coil and rectifier against line and switching surges.

c) Special brake liner is used, which ensures that, the braking torque value remains quite stable throughout the use. Compensation for liner wear is done by advancing the position of the fan by tightening the castle nut at the non-drive end. The design of brake motor facilitates a very easy replacement of armature disc and brake liner assembly.

d) Since the fan serves as a braking surface (unlike some other designs), it also serves to cool the brake coil and the motor. These brake motors being fan-cooled are available in smaller frame size than other Brake motors which are surface cooled. Therefore, these motor are more compact and economical for a given application.

e) For Crane and Hoist duty application Brake motors are offered with special rotors to suit their respective duties. These rotors are specially suited for S3 and S4 duty normally encountered in Crane and Hoist application.

f) Mechanical manual release of the brake as an optional feature is available from 90 to 132 frames. In case of power failure, the brake can be released manually with a lever.

g) The working of the rectifier unit has been successfully type tested for one million operations.

Bearing Details

Frame Size	Bearing Nos. C3 Clearance	
	DE	NDE
71	6202 2Z	6203 2Z
80	6004 2Z	6204 2Z
90S, 90L	6205 2Z	6305 2Z
100L	6206 2Z	6307 2Z
112M	6206 2Z	6308 2Z
132S, 132M	6208 2Z	6308 2Z

Applications

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

- Textile Machinery
- Machine Tools
- Printing Machine
- Crane and Hoists
- Material Handling Equipments
- Leather Processing Machines
- Geared Motors
- Cable Reeling Drums
- Rolling Mills

Enquiry Details

When placing an enquiry kindly furnish the following information.

1. Application details
2. Output and speed
3. Duty cycle with number of starts/stops per hour
4. Ambient temperature and special environmental factors likely to affect the motor, if any
5. Method of mounting
6. Load GD^2 referred to motor shaft *
7. Braking torque required *
8. Maximum permissible stopping time
9. Any other special features required

* These are inter-related parameters and related by following formula:

$$\text{Total Stopping time } T_s = \frac{GD^2 \times N}{375 \times T} + t_{app}$$

Where

T = Braking torque in kgm

GD^2 = load GD^2 + rotor GD^2

N = Speed of rotation in r.p.m.

t_{app} = brake application time

Voltage	: 415V ± 10%	Ambient	: 50°C	Ins. Class	:	F
Frequency	: 50Hz ± 5%	Duty	: S1	Temp. Rise	:	B
Combined Variation	: ± 10%			Protection	:	IP55

Performance Table - For Brake Part

Frame Size	Outputs (kW)				*Brake release time (ms)	**Brake Application time (ms)		Braking Torque (kgm)
	2P	4P	6P	8P		AC Side Interruption	DC Side Interruption	
71	0.37	0.25	0.25	-	50	135	25	0.5
	0.55	0.37	-	-	50	135	25	0.5
80	0.75	0.55	0.37	-	55	225	45	1.0
	1.1	0.75	0.55	-	55	225	45	1.0
90S	1.5	1.1	0.75	0.37	100	260	50	2.0
90L	2.2	1.5	1.1	0.55	100	260	50	2.0
100L	3.7	2.2	1.5	0.75	135	270	50	4.0
	-	-		1.1	135	270	50	4.0
112M	-	3.7	2.2	1.5	145	290	60	5.0
132M	5.5,7.5	5.5	3.7	2.2	145	270	60	5.0
132M	9.3	7.5	5.5	-	145	270	60	5.0

1. Other Braking torque values up to 40% higher can be given for special applications.
2. Other output can be offered on request where feasible.

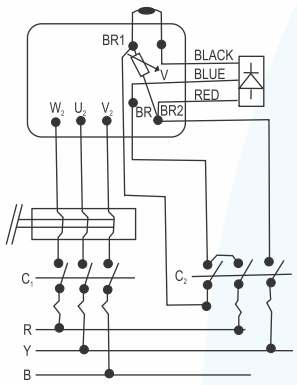
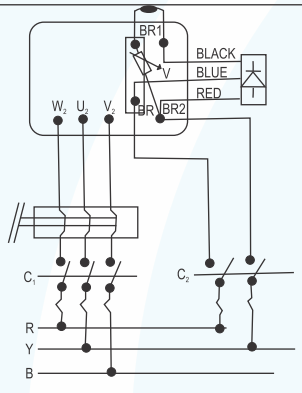
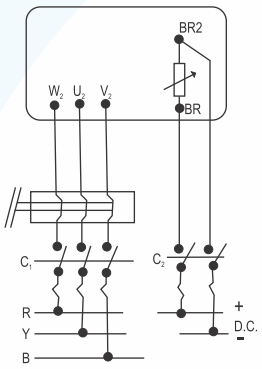
*Brake release time: The time interval between the instant the supply to the brake coil is switched on, to the instant the brake is released.

**Brake application time: The time interval between the instant the supply to the brake coil is interrupted to the instant the brake is applied.

The value depends on whether the circuit is interrupted on AC side or DC side.

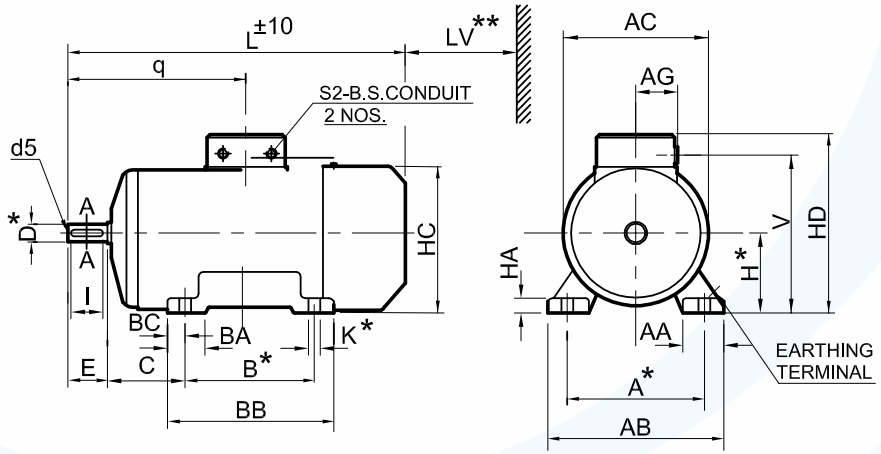
For performance details of motor parts, please refer Industrial Motor section of this catalogue.

Brake Coil Connections

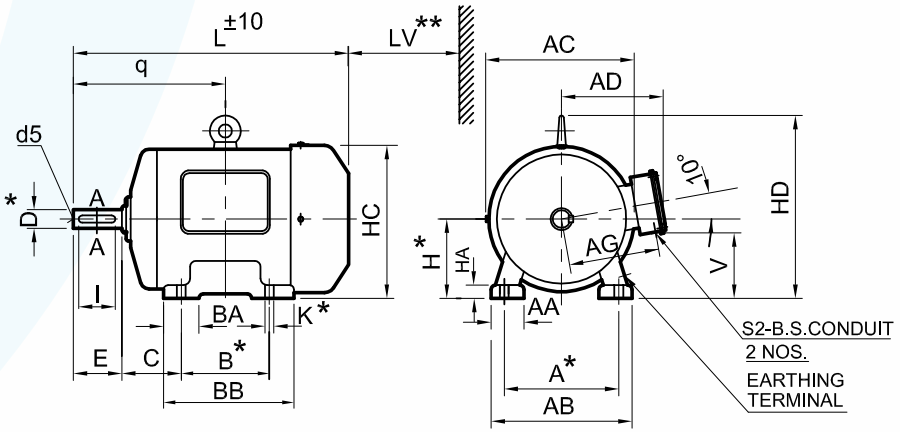
Type 1 BRAKE COIL SWITCHED OFF ON D.C. SIDE	Type 2 BRAKE COIL SWITCHED OFF ON A.C. SIDE	Type 3 BRAKE COIL CONECTION WITH SEPARATE D.C. SUPPLY TO BRAKE
		

THE MOTOR MUST NEVER BE SWITCHED ON UNLESS THE BRAKE IS ENERGISED AND BRAKE SHOULD NEVER BE DE-ENERGISED WHEN THE MOTOR IS ON, THE INTERLOCKING OF TWO CONTACTS IS ABSOLUTELY NECESSARY.

Dimensional Details: Brake Motors Type MB Foot Mounted (B3) TEFC Series Frame 71-132M



FRAME SIZE 71 TO 80



FRAME SIZE 90S TO 132M

		FIXING					GENERAL												TERMINAL BOX				SHAFT					
IEC Fr. size	Pole	A*	B*	C*	H*	K*	AB	BB	AA	BA	BC	HA	HC	HD	AD	L	AC	LV**	V	q	AG	S2 B.S.C.	D*	E	F*	GA*	I	d5
71	2,4 & 6	112	90	45	71	7	135	110	31	30	13	7	141	216	—	279	140	30	175	141	53	3/4"	14	30	5	16	25	M5
80	2,4 & 6	125	100	50	80	10	150	124	31	35	15	9	159	235	—	331	157	30	194	170	53	3/4"	19	40	6	21.5	35	M6
90S	2,4,6 & 8	140	100	56	90	10	180	130	50	43	18	13	177	①	172	355	174	35	59	156	124	3/4"	24	50	8	27	45	M8
90L	2,4,6 & 8		125					155								380				169								
100L	2,4,6 & 8	160	140	63	100	12	200	176	54	50	21	14	198	235	198	439	195	40	66	193	143	1"	28	60	8	31	55	M10
112M	4,6 & 8	190	140	70	112	12	230	176	62	51	21	15	222	260	200	456	220	45	80	200	156	1"	28	60	8	31	55	M10
132S	2,4,6 & 8	216	140	89	132	12	256	180	64	50	23	17	262	308	231	512	260	50	104	239	178	1"	38	80	10	41	70	M12
132M	2,4,6 & 8		178					218		54						550				258								

*Refer TABLE A for tolerances

TABLE A

Dimension	Tolerance		Specification
A,B	±0.75		
H	-0.5		IS : 1231
K	+0.360	7,10Ø	
	+0.430	12Ø	

Dimension	Tolerance		Specification
D	j6	14,19,24,28Ø	IS : 1231
	k6	38Ø	
GA,F			IS : 2048
d5(centering)			IS : 2540

① Without Eye bolt

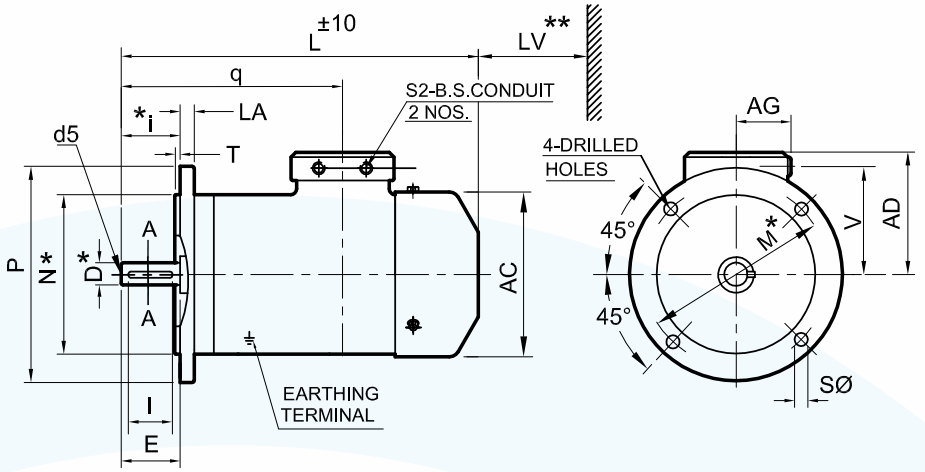
- Key / key way fit : h9/N9
- Also suitable for B6,B7,B8,V5 & V6 mounting as per IS 2253

** Minimum distance for efficient cooling of motor to be maintained by user

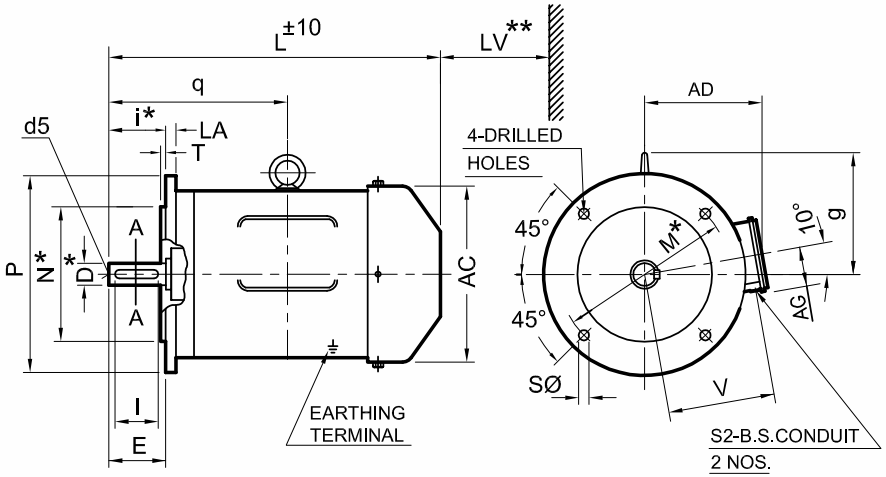
All dimensions are in mm unless otherwise specified.

CAT-B-7113-3-1

Dimensional Details: Brake Motors Type MB Flange Mounted (B5) TEFC Series Frame 71-132M



FRAME SIZE 71 TO 80



FRAME SIZE 90S TO 132M

		FIXING					GENERAL							TERMINAL BOX				SHAFT					
IEC Fr. size	Pole	P	N*	M*	i*	S	T	LA	AD	AC	L	g	LV**	V	q	AG	S2 B.S.C.	D*	E	F*	GA*	I	d5
71	2,4 & 6	160	110	130	30	10	3.5	9	145	140	306	—	30	104	168	53	3/4"	14	30	5	16	25	M5
80	2,4 & 6	200	130	165	40	12	3.5	10	155	157	331	—	30	114	170	53	3/4"	19	40	6	21.5	35	M6
90S	2,4,6 & 8	200	130	165	50	12	3.5	10	172	174	355	①	35	124	156	53	3/4"	24	50	8	27	45	M8
90L	2,4,6 & 8										380				169								
100L	2,4,6 & 8	250	180	215	60	15	4	11	198	195	439	135	40	143	193	60	1"	28	60	8	31	55	M10
112M	4,6 & 8	250	180	215	60	15	4	11	211	220	456	148	45	156	200	60	1"	28	60	8	31	55	M10
132S	2,4,6 & 8	300	230	265	80	15	4	12	232	260	512	176	50	178	239	60	1"	38	80	10	41	70	M12
132M	2,4,6 & 8										550				258								

* Refer TABLE A for tolerances

TABLE A

Dimension	Tolerance	Specification
N	j6	IS : 2223
M	±0.3	
i	±1	

Dimension	Tolerance		Specification
D	j6	14,19,24,28Ø	IS : 1231
	k6	38Ø	
GA,F			IS : 2048
d5(centering)			IS : 2540

① Without Eye bolt

□ Also suitable for V19 & v18 mounting as per IS 2253

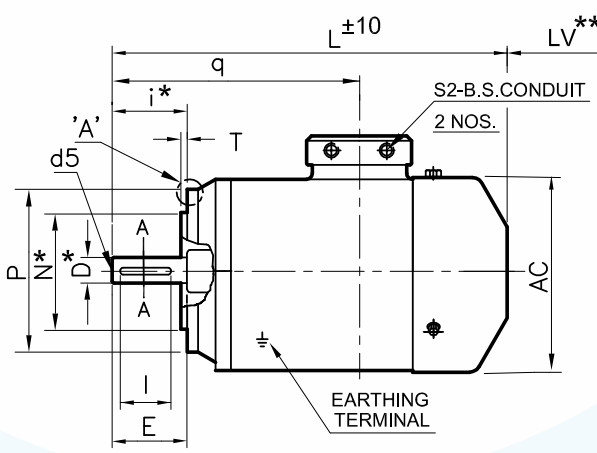
□ Key / key way fit : h9 / N9

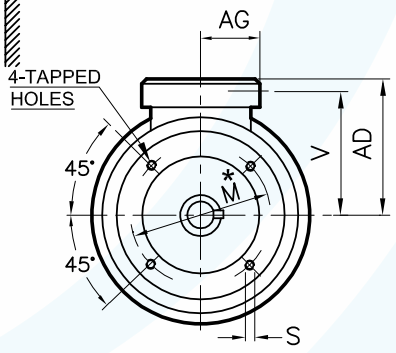
** Minimum distance for efficient cooling of motor to be maintained by user

All Dimensions are in mm unless otherwise specified.

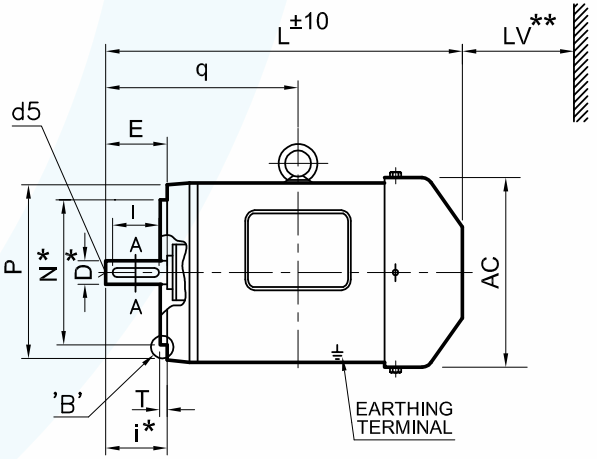
CAT-B-7113-5-1

Dimensional Details: Brake Motors Type MB Face Mounted (B14) TEFC Series Frame 71-132M

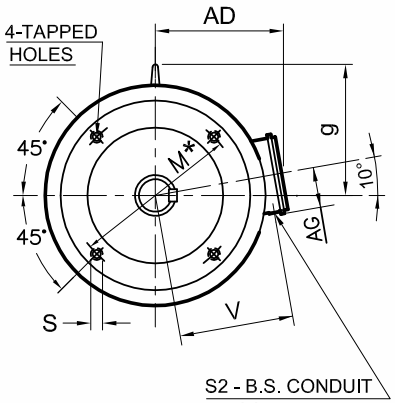




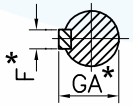
FRAME SIZE 71 TO 80



FRAME SIZE 90S TO 132M

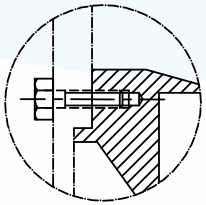


S2 - B.S. CONDUIT
2 NOS.

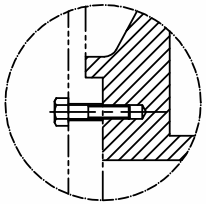


SECTION A—A

		FIXING					GENERAL						TERMINAL BOX				SHAFT					
IEC Fr. size	Pole	P	N*	M*	i*	S	T	AD	AC	L	g	LV**	V	q	AG	S2 B.S.C.	D*	E	F*	GA*	l	d5
71	2,4 & 6	105	70	85	30	M6X10	2.5	145	140	279	—	30	104	143	53	3/4"	14	30	5	16	25	M5
80	2,4 & 6	120	80	100	40	M6X13	3	155	157	331	—	30	114	170	53	3/4"	19	40	6	21.5	35	M6
90S	2,4,6 & 8	140	95	115	50	M8X12	3	172	174	355	①	35	124	156	53	3/4"	24	50	8	27	45	M8
90L	2,4,6 & 8									380				169								
100L	2,4,6 & 8	160	110	130	60	M8X12	3.5	198	195	439	135	40	143	193	60	1"	28	60	8	31	55	M10
112M	4,6 & 8	160	110	130	60	M8X12	3.5	211	220	456	148	45	156	200	60	1"	28	60	8	31	55	M10
132S	2,4,6 & 8	250	180	215	80	M12X20	4	232	260	512	176	50	178	239	60	1"	38	80	10	41	70	M12
132M	2,4,6 & 8									550				258								



ENLARGEMENT OF CIRCLE 'A'



ENLARGEMENT OF CIRCLE 'B'

* Refer TABLE A for tolerances

TABLE A

Dimension	Tolerance	Specification
N	j6	IS : 2223
M	±0.3	
i	±1	

Dimension	Tolerance		Specification
D	j6	14,19,24,28Ø	IS : 1231
	k6	38Ø	
GA,F			IS : 2048
d5(centering)			IS : 2540

① Without Eye bolt
□ Also suitable for V19 & v18 mounting as per IS 2253
□ Key / key way fit : h9 / N9
** Minimum distance for efficient cooling of motor to be maintained by user

All Dimensions are in mm unless otherwise specified.

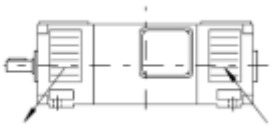
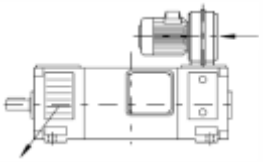
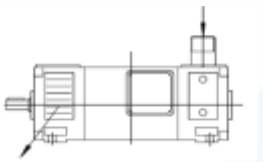
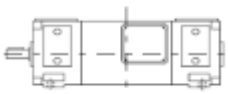
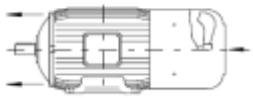
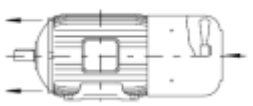
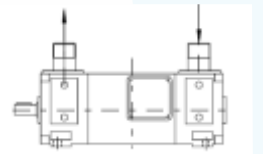
CAT-B-7113-4-1

Methods of Cooling

Designation system concerning methods of cooling refers to standard IEC 60034-6.

Explanation of the product code

International Cooling	Circuit arrangement	Primary coolant	Method of movement of primary coolant	Secondary coolant	Method of movement of secondary coolant
(IC)	4	(A)	1	(A)	6
	1	2	3	4	5
Position 1			Position 4		
0 :	Free circulation (open circuit)		A:	For air (omitted for simplified designation)	
4 :	Frame surface cooled		W:	For water	
Position 2			Position 5		
A:	For air (omitted for simplified designation)		0	Free convection	
Position 3			1	Self-circulation	
0 :	Free convection		6	Machine-mounted independent component	
1 :	Self-circulation		8	Relative displacement	
6 :	Machine-mounted independent component				

IC 01		Enclosure IP 21 - IP 23 (type G...) **Self-ventilated with integral fan cooling (DP)** Cooling air is blown through the motor by a fan mounted on the shaft.
IC 06		Enclosure IP 21 - IP 23 (type G...I) **Separate ventilation with radial fitted fan unit (FV)** Cooling air is blown through the motor by a separately excited fan motor. The inlet side may be equipped with an air filter.
IC 17		Enclosure IP 21 - IP 23 (type G..) **Single pipe ventilated (FV)** Cooling air is blown across the motor through the pipe connection with a separate customer provided external blower fan and discharges on the other side to open space.
IC 410		Enclosure IP 44 - IP 55 (type G..Z) **Totally-enclosed non ventilated (TENV)** Cooling without using a fan, only by nature ventilation and radiation on the totally enclosed motor surface.
IC 411		Enclosure IP 44 - IP 55 (type G..ZE) **Totally-enclosed fan-cooled (TEFC)** Cooling air is blown over the totally enclosed motor surface by a fan mounted an the shaft.
IC 416		Enclosure IP 44 - IP 55 (type G..ZO) **External surface cooling (TEFV)** Cooling air is blown over the totally enclosed motor surface by an separately excited fan motor.
IC 37		Enclosure IP 44 - IP 55 (type G..Z) **Double pipe ventilated (TEPV)** Cooling air is blown across the motor through a pipe connecting by means of a separate customer provided external blower fan and discharges on the other side's pipe connecting.

Degree of Protection

Degree of protection for rotating machines are indicated according to IS/IEC 60034-5 using the characteristic letters 'IP' followed by two characteristic numerals for the degree of protection.

The first numeral indicates protection against contact and ingress of foreign bodies.

The second numeral indicates protection against ingress of water.

First characteristic numeral

IP2X Protected against solid objects greater than 12mm

IP5X Dust protected motors, Ingress of dust is not fully protected ,but dust can not enter in an amount sufficient to interface with satisfactory operations of the motor.

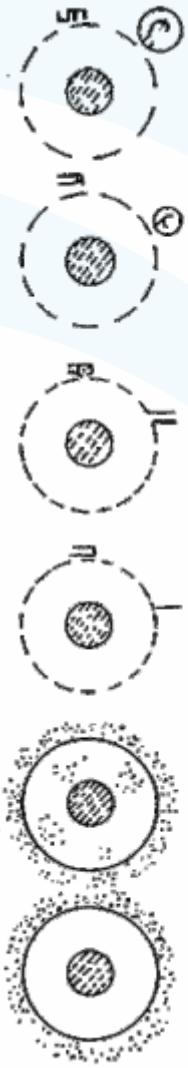
Second characteristic numeral

IPX3 Protected against spraying water, sprayed up to angle of 60^{o} from vertical shall have no harmful effect.

IPX5 Protected against water, jets by a nozzle from any direction shall have no harmful effect.

IPX6 Protected against heavy seas, powerful jets from all direction shall have no harmful effect.

Degree of protection Schematic

1st Numeric		
	0	No protection
	1	Protected against solid objects greater that 50mm (e.g. hand)
	2	Protected against solid objects greater that 12mm (e.g. fingers)
	3	Protected against solid objects greater that 2.5mm (e.g. tools, wires)
	4	Protected against solid objects greater that 1mm (e.g. wire or strips)
	5	Ingress of dust is not totally protected, but does not enter in sufficient quantities to harm equipment
	6	No ingress of dust

2nd Numeric		
	0	No protection
	1	Dripping water shall have no harmful effect.
	2	Protected against dripping water when enclosure is titled 15^{0}
	3	Protected against spraying water up to 60^{0}
	4	Water splashed from any direction shall have no harmful effect
	5	Water hosed against the enclosure shall have no harmful effect (water jets)
	6	Water from powerful jets of heavy seas shall have no harmful effects

Tolerances (Reference IS/IEC 60034-1)

Unless stated otherwise, tolerances on declared values are applicable as given in the table below:

Schedule of tolerances on values of quantities

Quantity	Tolerance
Efficiency ŋ -Machines up to and including 150 kW (or kVA) -Machines above 150 kW (or kVA)	 -15 % of (1 - ŋ) -10 % of (1 - ŋ)
Power-factor, cosΦ, for induction machines	-1/6 (1 -cosΦ) Minimum absolute value 0.02 Maximum absolute value 0.07
Slip of induction motors (at full load and at working temperature) *PN* < 1 kW *PN* 1 kW	 ± 30 % of the slip ± 20 % of the slip
Locked rotor current of cage induction motors with any specified starting apparatus	+20 % of the current
Locked rotor torque of cage induction motors	+25 -15 % of the torque. (+25 % may be exceeded by agreement)
Breakdown torque of induction motors	-10% of the torque except that after allowing for this tolerance the torque shall be not less than 1.6 or 1.5 times the rated torque

Note: When tolerance is stated in only direction, the value is not limited in the other direction.

Limiting Mean Sound Power Level Lw in dB(A) for Airborne Noise Emitted by Rotating Electrical Machines

IS: 12065 - 1987

Protective Enclosure		IP22	IP44	IP22	IP44	IP22	IP44	IP22	IP44	IP22	IP44	IP22	IP44
Rating kV(or kVA)		Rated Speed (rpm)											
		960 and below		961 to 1320		1321 to 1900		1901 to 2360		2361 to 3150		3151 to 3750	
Above	Up to	Sound Power Level dB(A)											
-	1.1	-	76	-	79	-	80	-	83	-	84	-	88
1.1	2.2	-	79	-	80	-	83	-	87	-	89	-	91
2.2	5.5	-	82	-	84	-	87	-	92	-	93	-	95
5.5	11	82	85	85	88	88	91	91	96	94	97	97	100
11	22	86	89	89	93	92	96	94	98	97	101	100	103
22	37	89	91	92	95	94	97	96	100	99	103	102	105
37	55	90	92	94	97	97	99	99	103	101	105	104	107
55	110	94	96	97	101	100	104	102	105	104	107	106	109
110	220	98	100	100	104	103	106	105	108	107	110	108	112
220	630	100	102	104	106	106	109	107	111	108	112	110	114
660	1100	102	104	106	107	107	111	108	111	108	112	110	114
1100	2500	105	107	109	110	109	113	109	113	109	113	110	114
2500	6300	106	108	110	112	111	115	111	115	111	115	111	115
6300	16000	108	110	111	113	113	116	113	116	113	116	113	116

Note 1: IP22 corresponds generally to drip-proof, ventilated and similar enclosures.

IP44 corresponds generally to totally enclosed fan-cooled, closed air circuit air-cooled, and similar enclosures (See IS: 4691-1985*).

Note 2: No positive tolerance is allowed on the above sound power levels.

Storage and Handling Instructions for Motors

Introduction

The purpose of this write-up is to offer some short, easy to follow recommendations to our customers, users and dealers for the proper care of electric motors in storage.

For practical purposes, such equipment is considered to be in storage not only when it is in the store room but also when:

It has been delivered to the jobsite and is awaiting installation;
or, It has been installed but regular operation is delayed / pending completion of plant construction;
or, there are 3 months or more, idle periods between operating cycles;
or, the plant or department is shut down.

The recommendations given here apply to conditions commonly found in indoor storage. Personnel responsible for care of the equipment should use good discretion in adapting these recommendations to the particular situation. Common sense and sound safety rules need to be followed.

SAFETY PROCEDURE

WARNING

Dangerous voltages are present in the motor components which can cause serious injury, electrocution and equipment damage. To avoid serious injury and/or equipment damage before any adjustments, servicing, wiring, parts replacement or any other act requiring physical contact with the electrical or mechanical working components of this equipment is performed, all equipment must be de-energized, disconnected and isolated to prevent accidental contact with live or rotating parts.

The success and safe operation of motors is dependent upon proper handling, installation, operation and maintenance, as well as upon proper design and manufacture. Failure to follow certain fundamental installation and maintenance requirements may lead to personal injury and the failure and loss of the motor as well as damage to other property.

Only qualified personnel should be involved in the inspection, maintenance and repair procedure and all plant safety procedures must be observed.

A qualified person is one who is familiar with the installation, construction and operation of the equipment, and the hazards involved. In addition, he has the following qualifications:

- Is trained and authorized to energize, de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices.

- Is trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing etc. in accordance with established safety practices.

- Is trained in rendering first aid.

Motor should be installed and grounded as per local and national codes.

Storage Instructions For Motors

Indoor storage

Wholly controlled atmosphere or partially controlled atmosphere

- Storage room must be clean, dust free and dry
- Maintain temperature in the range 20 deg to 50 deg in the storage room
- Maintain uniform temperature throughout the room
- Relative humidity to be 50% or less
- Ensure absence of harmful fumes
- Vibration free area
- Space heater must be energized if temperature falls below 10 deg.C or humidity is more than 50% to prevent harmful effects of moisture condensation.
- Ensure that no water drips on motor and no water accumulates under the motor.
- Ensure that all plugs originally provided are in place. (e.g. cable entry hole plugs, drain plugs and plug in fan cowl for greasing. If plugs are missing, all the openings to be covered with an adhesive plastic cloth.
- The enclosing structure should be designed to protect the motor from flying debris or other damage from high winds.

Cover the motor completely in a strong, transparent plastic bag to exclude dirt, dust, moisture, and other foreign materials. Before sealing this bag, small bags of silica-gel desiccant should be put inside the bag, around the motor.

Rodents and other animals like to house inside motors in search of warm surroundings or food. Some of them attack the insulating materials. Their access to the motor should be restricted.

Outdoor storage

Dry climate (Conditions usually found) - Dust, sand, heat from the sun, and occasional rain or snow.

Humid climate (Conditions usually found) - Dust, rain and snow, organic (fungus) growth

Salty and industrial atmospheres (Conditions usually found) - Moisture impregnated with salts or other acidic / alkaline chemicals, salty dust, sand, rain or snow, fungus growth, fumes, coal and chemical dust soot. All precautions indicated in indoor storage to be taken.

In addition, after the unit is covered as explained in these instructions, a shed should be erected to protect it from direct rain, snow, and excessive direct sun heat. At a bare minimum, a heavy water-proofed cover should be slipped over it.

Bearings:
Special precautions need to be taken when the machine is idle for a period of 3 moths or more to avoid corrosion of the bearings and loss of grease. It is advisable to rotate the shaft periodically (once in a week @ 30 rpm for minimum 15 sec.) as the grease tends to settle at the bottom of the housings. Before a machine is started after a long idle period, the bearing covers should be removed and grease in the housing pressed with thumbs between the races of the bearing. If any deterioration of grease is apparent, the old grease should be removed and new grease pressed in the bearing housings.

If the machine is idle for four months or more, change the grease completely.

Shaft extensions, machines surfaces or flanges:
The machined parts have a protective coat of anti-rust preservative which should not be taken off during normal storage periods. In case of long storage, periodic examination should be carried out and fresh preservation should be applied, if required, after any rust or moisture has been removed. Preservation can be easily taken off by using paraffin or other petroleum solvents.

Complete motor:
When storage may last over one year, repaint all surfaces previously painted, before putting motor into service.

Handling instructions for motors

- For lifting the motor, only the lifting hook provided with motor, are to be used.
- Use all lifting hooks that are provided simultaneously. (If motor is provided with two hooks, use both hooks and not one)
- Do not use any other part of the motor for lifting.
- Do not use shaft projections for dragging the motor.
- Do not roll or drag the motor on the floor.
- Motors must not be kept in vertical position with external fan cowls as base.
- Jerks and jolts must be avoided to increase the bearing life.
- In vertical lifting, uncontrolled rotation of the motor must be prevented.
- Do not lift other equipments with motor lifting points only.

Recommended Maintenance Schedule

1. DAILY MAINTENANCE

1.1 Examine visually earth connections. Check motor leads and cable connections are fully tight and not loose.
1.2 Check motor windings for overheating (the permissible maximum temperature is above that which can be comfortably felt by hand).
1.3 Examine control equipments.
1.4 Check body and bearing temperature
1.5 Check voltage and current in all three phases. Check voltage variation and unbalance.
1.6 Check vibrations at bearings.
1.7 Check if motor rotation is free and measure speed.
1.8 Check for any abnormal noise.

Note: In order to avoid opening up motors, a good indication is to observe the shell temperature under normal working conditions. Any increase not accounted for, for example by seasonal increase in ambient temperature, should be suspected.

2. WEEKLY MAINTENANCE

2.1 Check belt tension. In cases where this is excessive, it should immediately be reduced. Check motor pulley seat location. Pulley has to rest on shaft shoulder.
2.2 Check coupling condition.
2.3 Blow out windings of protected type motors situated in dusty locations. Check for any accumulation of dirt, sand or fine dust.
2.4 Examine starting equipment for burnt contacts where motor is started and stopped frequently.
2.5 For outdoor motors, check if canopy is at proper place.

3. MONTHLY MAINTENANCE

3.1 Overhaul Controllers.
3.2 Inspect and clean oil circuit breakers.
3.3 Wipe brush holders and check bedding of brushes of slip-ring motors.

4. HALF YEARLY MAINTENANCE

4.1 Clean windings of motors subjected to corrosive or other elements; also bake and varnish, if necessary.
4.2 In the case of slip-ring motors, check sliprings for grooving or unusual wear.
4.3 Check grease in ball and roller bearings and make it up where necessary taking care to avoid overfilling.

5. ANNUAL MAINTENANCE

5.1 Check all high speed bearings and renew, if necessary.
5.2 Blow out all motor winding thoroughly with clean dry air. Make sure that the pressure is not so high as to damage the insulation.
5.3 Clean and varnish dirty and oily windings.
5.4 Overhaul motors which have been subjected to severe operating conditions.
5.5 Renew switch and fuse contacts, if damaged. Check oil.
5.6 There can be cement dust / saw dust / rock dust / coal dust / grain dust on motor body. Blow out compressed air over motor body to clean this accumulated dust at the time of monthly maintenance. See to it that all ventilation paths are absolutely free.
5.7 Paint the motor if required.
5.8 Check insulation resistance to earth and between phases of motor winding, control gear and wiring.
5.9 Check resistance of earth connections.
5.10 Check air gaps.
5.11 Test the motor overload relays and breakers.

6. RECORDS

6.1 Maintain a register giving one or more pages for each motor and record therein all important inspection and maintenance works carried out from time to time. These records should show past performance, normal insulation resistance level, air gap measurements, nature of repairs and time between previous repairs and other important information which would be of help for good performance and maintenance. Sample format is attached.

Trouble Shooting Chart

TROUBLE	CAUSE	WHAT TO DO
Motor fails to start	Blown fuses	Replace fuses with proper type and rating.
	Overload trips	Check and reset overload in starter
	Improper power supply	Check to see that power supply agrees with Motor name plate and load factor
	Improper line connection	Check connections with diagram supplied with motor
	Open circuit in winding or control switch	Indicated by humming sound when switch is closed. Check for loose wiring connections. Also, ensure that all control contacts are closing
	Mechanical failure	Check to see if motor and drive turn freely. Check bearings and lubrication
	Short circuited stator	Indicated by blown fuses. Motor must be rewound
	Poor stator coil connection	Remove end shields, locate with test lamps
	Rotor defective	Look for broken bar sand/or end rings
	Motors may be over loaded	Reduce Load
Motor stalls	One phase may be open	Check lines for open phase
	Wrong application	Change type or size. Consult manufacturer
	Over Load	Reduce Load
	Low Voltage	Ensure the name plate voltage is maintained. Check connection
	Open circuit	Fuses blown, check overload relay, stator and push buttons
Motor runs and then dies down	Power failure	Check for loose connections to line, fuses and control
Motor does not come up to speed	Voltage too low at motor terminals because of line drop	Use higher voltage or transformer terminals or reduce load. Check connections. Check conductors for proper size
	Starting load too high	Check load motor is supposed to carry at start
	Broken rotor bars or loose rotor	Look for cracks near the rings. A new rotor may be required, as repairs are usually temporary
	Open primary circuit	Locate fault with testing device and repair

Motor takes too long to accelerate and/or draws high amp	Excessive load	Reduce load
	Low voltage during start	Check for high resistance. Adequate wire size
	Defective squirrel cage rotor	Replace with new rotor
	Applied voltage too low	Increase power tap
Wrong rotation	Wrong sequence of phases	Reverse connections at motor or at switchboard
Motor overheats while running under load	Overload	Reduce Load
	Frame vents may be clogged with dirt and prevent proper ventilation of motor	Open vent holes and check for a continuous stream of air from the motor
	Motor may have one phase open	Check to make sure that all leads are well connected
	Grounded coil	Locate and repair
	Unbalanced terminal voltage	Check for faulty leads, connections and transformers
Motor vibrates	Motor misaligned	Realign
	Weak support	Strengthen base
	Coupling out of balance	Balance coupling
	Driven equipment unbalanced	Rebalance driven equipment
	Defective bearings	Replace bearings
	Bearings not in line	Line up properly
	Balancing weights shifted	Rebalance motor.
	Contradiction between balancing of rotor and coupling (half key - full key)	Rebalance coupling or motor
	Polyphase motor running single phase	Check for open circuit
	Excessive end play	Adjust bearing or add shim
Scraping noise	Fan rubbing fan cover	Remove interference
	Fan striking insulation	Clear fan
	Loose on bed plate	Tighten holding bolts

Noisy operation	Rotor unbalance	Rebalance
Hot bearings general	Bent or sprung shaft	Straighten shaft
	Excessive belt pull	Decrease belt tension.
	Pulleys too far away	Move pulley closer to motor bearing
	Pulley diameter too small	Use larger pulleys
	Misalignment	Correct by realignment of drive
Hot bearings ball	Insufficient grease	Maintain proper quality of grease in bearing
	Deterioration of grease of lubricant contaminated	Remove old grease, wash bearings thoroughly in kerosene and replace with new grease
	Excess lubricant	Reduce quantity of grease, bearing should not be more than 1/2 filled
	Overload bearing	Check alignment, side and end thrust.
	Broken ball or rough races	Replace bearing, first clean housing thoroughly

MOTOR SERVICE RECORD

Serial No. _____ kW _____ Type _____

Speed _____ Volts _____ Amperes _____ Phase _____ Frequency _____

Insulation Class _____ Temperature Rise _____ °C Frame Size _____

Connection Diagram-Rotor _____ Stator _____

Owner Order No. _____ Item No. _____ Date Purchased _____

MACHINE TYPE	WEATHER PROTECTED	LUBRICATION
- Horizontal - Vertical - Totally-Enclosed - Explosion-Proof	**Bearings** - Ball - Roller -Sleeve Size : Drive End _____ Non Drive End _____	**Shaft Extension** Length _____

Date Installed	Location	Application	Dist. kept for cooling

Date Repaired or Replaced	Repairs or Parts Replaced	Fault	Repaired by	Total Cost

Name of Part	No. Per Machine	Manufacturer's No.	Date	Qty. Repl.	Cost	Date	Qty. Repl.	Cost	Date	Qty. Repl.	Cost
Rotor											
Stator Coils											
Bearing, DE											
NDE											
Cooling fan											
Others											

INSPECTION

Date													
Bearings													
Lubrication													
Excess Heat													
Excess Noise													
Speed													
Voltage in 3 ph													
Voltage Variation													
Voltage Unbalance													
Current in 3 ph													
Current Variation													
Current Unbalance													
Insulation Resistance													
Clean & clear air passages													
Alignment													
Vibration													
Body Temp.													
Abnormal noise													

Table 1 Derived Values of Limits of Vibration Severity in Rotating Electrical Machines measured in State of Free suspension (Velocity Mode)

IS 12075 : 2008

Sl.No	Shaft Height mm	56 < H ≤132		132 < H ≤225		225 < H ≤400		H > 400	
i	Range of Speed, rpm	500 to 1500	> 1500 and up to 3000	500 to 1500	> 1500 and up to 3000	500 to 1500	> 1500 and up to 3000	500 to 1500	> 1500 and up to 3000
rms value of vibration velocity in mm/s for the shaft height H in mm									
ii	N(Normal)	1.8	18	1.8	2.8	2.8	4.5	2.8	4.5
iii	R(Reduced)	0.71	0.71	0.71	1.12	1.8	2.8	----	----
iv	S(Special)	0.45	0.45	0.45	0.71	1.12	1.8	----	----

Table 2 Derived Values of Limits of Vibration Severity in Rotating Electrical Machines measured in State of Free suspension (Displacement Mode)

Shaft Height	56 < H ≤132						132 < H ≤225						225 < H ≤400						H > 400					
Speed, rpm	500	600	750	1000	1500	3000	500	600	750	1000	1500	3000	500	600	750	1000	1500	3000	500	600	750	1000	1500	3000
Vibration limit in maximum displacement amplitude, in µm																								
N(Normal)	96	80	64	48	32	16	96	80	64	48	32	25	150	125	100	75	50	42	150	125	100	75	50	40
R(Reduced)	36	30	24	18	12	6	36	30	24	18	12	10	96	80	64	48	32	26	---	---	---	---	---	---
S(Special)	24	20	16	12	8	4	24	20	16	12	8	6	50	60	40	30	20	17	---	---	---	---	---	---

Note: For the purpose of Table 2 f is assumed as frequency corresponding to rotor rpm. But for evaluation the dominant frequency should be determined by spectrum analysis and only that frequency should be used for calculation.

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