



Product Range

Type	Series	Frame Size	kW Range	Poles
Standard TEFC SCR Motors	MA	63 to 355L	0.12 to 355	2P, 4P, 6P, 8P
High Efficiency IE2 Series Motors	2H	71 to 355L	0.37 to 355	2P, 4P, 6P
High Efficiency 8 Pole Motors	MH	90 to 355L	0.37 to 200	8P
Premium Efficiency IE3 Motors	3H	80 to 355	0.75 to 315	2P, 4P, 6P
Large Motors with DCCA	2H/ MH	355LK to 450L	250 to 1250	2P, 4P, 6P, 8P

Reference Standards

Motors comply with following Indian & International standards as applicable.

IS/IEC 60034-1	Three Phase Induction motor specifications ("Rotating Electrical Machines - Part 1: Rating & Performance").
IS : 900	Code of practice for installation & maintenance of induction motors
IS : 1231	Dimensions of foot mounted A.C induction motors
IS : 2223	Dimensions of flange mounted A.C induction motors
IS : 4029	Guide for testing three phase induction motors (For Standard TEFC SCR Motors)
IS : 4889	Methods of determination of efficiency of rotating electric machines (For Standard TEFC SCR Motors)
IS /IEC 60034-5	Degree of protection provided by the integral design of Rotating Electrical Machines (IP code classification)
IS : 6362 / IEC 60034-6	Designation of method of cooling for Rotating Electrical Machines / Method of cooling (IC code)
IS:12065/ IEC 60034-9	Permissible limits of noise level for Rotating Electric Machines
IS:12075 : 2008	Mechanical Vibration of Rotating Electrical Machines
IS:12615: 2011	Energy Efficient Induction Motors Three phase Squirrel Cage (For IE2 Series Motors)

IEC 60034-30	Rotating Electrical Machines - Efficiency classes of line operated AC motors (IE code)
IEC 60072-1	Dimension & Output rating of Rotating Electrical machines
IS:15999 (Part 2 / Sec 1)	Standard Methods for determining Losses and Efficiency from Tests (For IE Series Motors)

CE MARK

All motors have CE mark on the nameplate

ELECTRICAL FEATURES

Standard Operating Conditions

Supply Conditions (Voltage & Frequency)

Voltage : 415 V \pm 10%

Frequency : 50Hz \pm 5%

Combined variation : \pm 10%

(Absolute sum with max frequency variation 5%)

For motors above 710kW the standard supply voltage is 690V \pm 10%.

690V motors wire wound or strip wound can be offered on request.

Ambient

Motors are designed for ambient temperature as mentioned in the performance tables. Higher ambient temperature motors can be offered on request.

Altitude

Motors are designed for an altitude up to 1000m above mean sea level. Motors can be offered for higher altitudes on request.

Re-rating Factors

The re-rating applicable under different conditions of variations in supply voltage, frequency, ambient & altitude are obtained by multiplying following factors.

Variation in Supply Voltage & Frequency

Voltage Variation (%)	Frequency Variation (%)	Combined Voltage & Frequency Variation (%)	Permissible output as % of rated value
\pm 10	\pm 5	\pm 10	100
\pm 12.5	\pm 5	\pm 12.5	95
\pm 15	\pm 5	\pm 15	90

Variation in Ambient & Altitude for all Motors

For motors with Ambient 40° C		For motors with Ambient 50° C	
Amb. Temp. (°C)	Permissible output as % of rated value	Amb. Temp. (°C)	Permissible output as % of rated value
20	107	30	107
21-35	103	30-45	103
40	100	50	100
45	95	55	96
50	91	60	92

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

Method of Starting

Bharat Bijlee motors are suitable for direct on line (DOL) or star/delta starting as shown below. All IE2 series motors and Large LT motors are suitable for inverter duty starting.

kW Rating	Method of Starting	No. of Leads
Up to & including 1.5 kW	DOL	3 (Internal Star connection), for MA series motors
		6 (for 2H series motors)
Above 1.5 kW	DOL or Star/Delta	6

Starting current measurement of BBL Motors

Induction motor starting current is generally 6 to 7 times the full load current of the motor. This is a characteristic feature of the motor and though undesirable, it is inevitable in the design of the motor. Measurement of this starting current at rated voltage becomes difficult since it demands higher capacity of the supply system as well as use of appropriate CTs in the circuit of meters. Generally a fraction of rated starting current is passed in the motor due to capacity constraints. This current is extrapolated to rated voltage. If this measurement is done at higher voltage then the estimated starting current is more accurate. At Bharat Bijlee, starting current measurement is done as per below table

kW Range	Measurement at % of voltage to rated voltage
0.12kW to 90kW	70%
90kW to 200kW	60%
200kW to 355kW	35%
355kW to 560kW	25%
560kW and above (with rated voltage 690V or higher)	25%

Duty, Starting Time & Number of Consecutive Starts

Motors are designed for continuous (S1) Duty. Other types of duty (S2 to S9) can be offered on request. For load $GD^2 \leq \text{Motor } GD^2$, the motors can safely withstand 3 consecutive starts from cold condition & 2 consecutive starts from hot condition. In application where more severe starting conditions are encountered, a special enquiry should be made to our Sales Office. e.g.

- Drives with high inertia e.g flywheel drives, eccentric presses, large fans etc.
- Drives involving intermittent duty of motors with frequent starts e.g. rolling mills, centrifuges and conveyor motors etc.

The enquiry should be accompanied with following information.

- GD^2 and relevant speed of driven equipment
- Duty cycle/sequence of operation/no. starts/ hour
- Speed-Torque diagram of driven equipment
- Method of braking (Electrical or Mechanical)
- Method of starting
- Method of coupling



Insulation and Endurance

The motors are provided with Class F insulation scheme with temperature rise limited to Class B. These motors can be overloaded continuously by 10% (service factor = 1.1). The temperature rise will be still within limits of Class F.

All insulation materials used are adequately resistant to the action of microbes and fungi.

Standard Winding

The stators are wound with modified polyester enamel covered (IS 13730: Part 3, thermal class 155) copper wires and are flood impregnated.

Insulation Scheme for Inverter Duty Motors

- The stators are wound with polyesteramide coated with polyamide-imide top coat, (dual coated) wires as per IS 13730: part 13, thermal class 200 copper wires
- Vacuum Pressure Impregnation (VPI) is provided to windings on request
- Depending on the voltage wave rise time (dv/dt) and the maximum peak to peak voltage at the motor terminals, suitable insulation schemes are provided on request
- On customer's demand, insulated bearings are offered from frame size 160 and onwards on the non driving end side of the motor

For frame size below 160, please contact our sales office.

Options (On request)

- Class 'H' insulation
- VPI for frames 63 to 280
- Winding with dual coated wires

Thermal Protection (for Winding & Bearing)

PTC thermistors / thermostats etc. can be embedded in stator winding on request. All Large Motors with DCCA are provided with 3 numbers of simplex PT 100 platinum RTD's for winding temperature detection. In case of frame sizes 250 & above, Resistance Temperature Detectors (RTD) & Bearing Temperature Detectors (BTD) can be supplied on request.

Earthing Terminals

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

Anti-condensation Method

In order to avoid condensation of water inside the motors, they can be heated up by connecting a 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 of the methods indicated in IS: 900 for heating stator winding can be adopted.

Motors can also be offered with built in space heaters in frame size 90 and above. Built in space

heaters are provided as a standard feature for all Large Motors with DCCA.

Frame Size	Enclosure Materials	Terminals Box Location	
		Standard	Option Available
63-80	Aluminum	TOP	-----
90S-132M	Aluminum	TOP	-----
	Cast Iron (on request)	RHS	TOP & LHS
160M-225M	Cast Iron	RHS	TOP & LHS
250M-355L	Cast Iron	TOP	RHS & LHS
355 L/K	Cast Iron	RHS	LHS/TOP
400L/450M/450L	Fabricated MS with CI E/s	TOP	RHS & LHS

MECHANICAL FEATURES

Enclosures: (Material and Terminal Box Location)

Motors are offered with following enclosure

All foot mounted motors are with integral feet construction. All motors up to 280 frame are with integral bearing covers, and motors in frame 315 & above are with separate bearing covers.

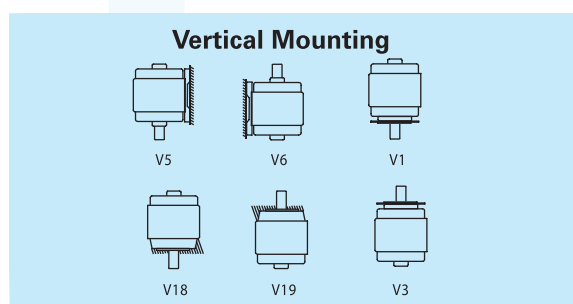
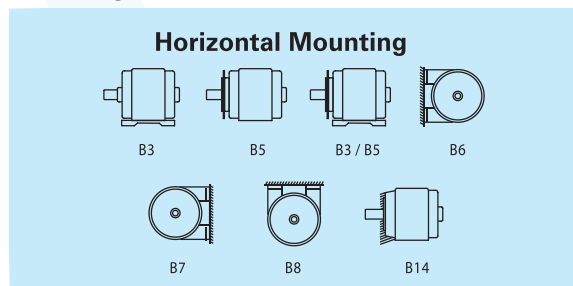
Type of Construction

Standard 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.

Large Motors with DCCA can be supplied in B3, V1 and B35 construction with dimensions as per IEC 60072-1 and IEC 60072-2.

Mounting





Cooling

All motors are Totally Enclosed Fan Cooled (TEFC-IC411 as per IS: 6362, IC4A1A1 as per IEC 60034-6). The cooling is effected by self driven, bi-directional centrifugal fan protected by fan cover. Following cooling types can be provided on request.

- Natural ventilation [TESC or TENV (IC410)]
- Forced cooling for frame sizes 132 and above. (IC 416) Minimum cooling distance, as indicated in the GA drawing has to be provided for effective cooling of the motor.

For Large Motors with DCCA special bearing cooling fan is provided at driving end to reduce bearing temperature and increase bearing life. Minimum cooling distance, as indicated in the GA drawing has to be provided for effective cooling of the motor.

Note: For more details, refer to annexure I.

Bearing and Terminal Box Details

Frame Size	Bearing Nos. C3 clearance		Terminal Box Type/ Location	Terminal		No. & size of Cable entries	Max cond. Cross Sec. area mm ²	
	DE	NDE		No.	Size			
63	6201 ZZ	6201 ZZ	gk030/ TOP	3	M4	1×3/4"	4	
71	6202 ZZ	6202 ZZ						
80	6004 ZZ	6004 ZZ						
90S, 90L	6205 ZZ	6205 ZZ	gk130/TOP	3*	M4	2 × 1"	10	
100L	6206 ZZ	6205ZZ	gk230/TOP					
112M	6206 ZZ	6205 ZZ	gk330/TOP	6	M5	2 × 1"	16	
132S, 132M	6208 ZZ	6208 ZZ						
160M, 160L	6309 ZZ	6209 ZZ	gk330/RHS	6	M6	2 × 1-1/2"	50	
180M, 180L (IE2 4 P)	6310 ZZ	6309 ZZ	gk430/RHS					
180M, 180L (Standard 2P, 4P, 6P, 8P & IE2 2P,6P)	6310 ZZ	6210 ZZ	gk430/RHS	6	M8	2 × 1-1/2"	50	
200L	6312 ZZ	6212 ZZ	TB225/RHS					
225S, 225M	6313	6213	TB280/ TOP	6	M10	2 × 2"	70	
250M	6315	6215						
280 S/M	2P	6316	6316	6	M12	2x2"	150	
	4,6 & 8P	6317						6316
315S/M	6319	6319	TB315/ TOP	6	M16	2x2"	185	
315L						2x2 ½ "	240	
355 L	6322	6322	TB 355/ TOP	6	M16	2 X 3"	300	
355L/K	2P	6322	6322	TB400/RHS	6	M20	2x3"	400
	4P							
	6P							
	8P							
400M/L	2P	6324	6322	TB400/ TOP	6	M20	2x3"	400
	4P							
	6P							
	8P							
450M/L	4P	6326	6326	TB400/ TOP	6	M20	2x3"	400
	6P							
	8P							

*3 Terminals up to and including 1.5kW & 6 terminals for higher kW outputs, except IE2 motors.

Note: L10 bearing life is 50,000 hours for directly coupled loads through flexible couplings only.



Roller Bearing and Insulated Bearing

Motors with insulated bearing on NDE side can be offered from frame size 132 & above on request. Motors can also be offered with cylindrical roller bearing (NU) on DE side for frame sizes 132 and above on request.

Bearing Lubrication

Sealed bearing (2Z) are filled with grease Unirex N3-ESSO. Others are filled with SKF LGMT3 of SKF make. Special high temperature grease can be provided on request.

On line Greasing

On line greasing arrangement is provided in frame sizes 225 and above. For frame sizes 180 and 200 it can be provided on request.

Bearing	Pole	Re-lubrication	
		Quantity (gm)	Interval (Hrs)
6313	2	120	3200
	4		9000
	6		15000
	8		21000
6315	2	150	2800
	4		8200
	6		10000
	8		18000
6316	2	180	2000
6317	4	180	7500
	6		13000
	8		17500
6319	2	220	2000
	4		5000
	6		7500
	8		10000
6322	2	40	1000
	4, 6		3000
	8		6000
6324	2	40	1000
	4, 6		2500
	8		5000
6326	4, 6	40	2000
	8		4000

Degree of Protection

All motors have IP55 degree of protection as per IS/IEC 60034-5. Higher degree of protection such as IP56, IP66 can be provided 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.

Rotor

Entire range of motors is fitted with dynamically balanced aluminum die cast squirrel cage rotors.

Shaft

All motors are provided with single shaft extension in accordance with IS: 1231. The shaft material is C40 (EN8) steel. However, special shaft extension and /or special shaft material e.g. EN24 or stainless steel, is provided on request.

Large Motors with DCCA are provided with single shaft extension in accordance with IS: 8223. Shafts material is EN8 for 355 & 400 frames, and EN19

for 450 frames. Shafts of these frames are ultrasonically tested.

Balancing & Vibration

The balancing grade is G2.5 as per ISO: 1940. Rotors are dynamically balanced with a half key in the shaft extension. All motors have vibration grade A as per IEC 60034 - 14. Other grades as per IEC 60034 - 14 or IS12075 - 2008 can be offered on request.

Note: For more details, refer to annexure IX.

Direction of Rotation

All motors are suitable for bi - directional rotation.

Lifting Arrangement

All motors with frame size 100 and above are provided with lifting hooks. When two or more hooks are provided, all hooks to be used simultaneously for lifting the motor.

Noise Level

Motors are designed for noise level well below the limits specified in IS: 12065 and IEC 60034 - 9.

Note: For more details, refer to annexure IV.

Paint

All motors are painted with acrylic base paint shade RAL 5000. Motors used in corrosive atmosphere are painted with epoxy base paint, any other shade or material (e.g. polyurethane paint) can be offered on request.

Packing

Motors up to 132 frame are packed in thermocol /corrugated boxes. Wooden packing boxes or wooden pallets are provided for higher frame size. sea worthy / Export packing case for home market (without fumigation certificate) is also available on request.

Shipping Dimensions

FRAME	TYPE REF	PACKING BOX DIMENSIONS			MOTOR GROSS WEIGHT IN Kg
		LENGTH	WIDTH	HEIGHT	
63	MA063433G	260	180	240	5.5
71	MA071433G	300	200	260	8
80	2H080453G	320	240	290	13
90S	2H09S423G	390	280	320	16
90L	2H09L473G	390	280	320	20
100L	2H10L473G	455	320	370	28
112M	2H11M473G	555	470	380	38
132S (TOP TB)	2H13S2N3G	600	430	490	70
132S (Side TB)	2H13S2N3G	570	500	400	70
132M	2H13M4T3G	690	410	410	77
160M	2H16M4K3G	660	440	390	155
160L	2H16L4T3G	820	540	440	167
180M	2H18M473G	820	540	440	235
180L	2H18L483G	820	540	440	248
200L	2H20L453G	890	610	560	364
225S	2H22S433G	970	660	610	452
225M	2H22M453G	970	660	610	467
250M	2H25M233G	1050	610	790	646
280SM	2H28M453G	1100	660	820	885
315SM	2H31M653G	1300	720	940	1,179
315L	2H31L693G	1500	720	940	1,400
355L	2H35L453G	1680	840	1050	2,194
400M	MH40M453G	2110	1100	1400	2,915
400L	MH40L6A3G	2110	1100	1400	3,500
450L	MH45L893G	2290	1200	1430	6,350