

Flame Proof Induction Motors

Product Range

Motor type	Series Type	Frame size	kW range
Standard Flame Proof Motors – Ex (d)	Standard (MD)	80 to 280M	0.37 TO 90
High efficiency IE2 series Flame Proof Motors – Ex (d)	IE2 (2J)	80 to 315L	0.37 TO 200

Reference Standards

All motors comply with following Standards, viz.:

IS/IEC 60079-0:2004	Electrical apparatus for Explosive gas atmosphere-Part 0 General Requirements
IS/IEC 60079-1:2007	Electrical apparatus for Explosive gas atmosphere-Equipment protection by flame proof enclosures "d"
IS 5572:2009	Classification of Hazardous areas (other than mining) having flammable gases and vapors for electrical installations.
IS 5571:2009	Guide for selection and installation of electrical equipment for hazardous areas (other than mines)
IS/IEC 60034-1	Three Phase Induction motor specifications ("Rotating Electrical Machines - Part 1 Rating & Performance")
IS 12615:2011	Energy Efficient Induction Motors - Three Phase Squirrel Cage (For IE2 Series 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 15999 - (Part2/Sec 1):2011	Standard Methods for determining Losses and Efficiency from Tests. (For IE Series Motors)
IS/IEC 60034-1	Rotating Electrical Machines - Rating & Performance
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 Electrical Machines
IS 12075	Mechanical Vibration of Rotating Electrical Machines

IEC 60072-1:1991	Dimension & Output rating of Rotating Electrical Machines
IS 900	Code of practice for installation and maintenance of induction motors
IS 1231	Dimensions of Foot Mounted AC Induction motors
IS 2223	Dimensions of Flange mounted AC Induction motors

Hazardous Areas

Hazardous areas are defined as areas where explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment.

The decision as to whether an area is hazardous as per the relevant regulations and specifications rests entirely with the user, or in case of doubt, with the competent inspecting authority.

IS 5572:2009 classifies the hazardous areas into three zones, depending on the frequency and duration for which dangerous concentrations are likely to be present.

Classification of Hazardous Areas (Gases and Vapors) and selection of Electrical Equipment

Classification of these zones and selection of electrical equipment is as under.

Zone	Classification of area as per ref. std. IS 5572:2009	Selection of electrical equipment based on ref. std. IS 5571:2009
Zone '0'	An area in which Hazardous atmosphere is continuously present.	Generally, use of electrical equipment is to be avoided. But when this is not practicable, Intrinsically safe or pressurized electrical equipment to be used.
Zone '1'	Hazardous atmosphere is likely to be present under normal operating conditions.	For this area, electrical equipment used, must be in flame proof enclosure type Ex (d) conforming to IS/IEC 60079-1.
Zone '2'	In this area hazardous atmosphere is likely to be present only under abnormal operating conditions and for a short period.	Apparatus with type of protection Ex (e) in accordance with IS/IEC 60079-7 may be used without any special enclosure. Apparatus having type of protection Ex (nA) in accordance with IS/IEC 60079-15 are also permitted for use.

Note: Zone '21' and Zone '22' motors can be provided on request. Please contact our sales offices.

Temperature Class

The ignition temperature of the gas classified as T1 to T6 is as under:

Temp. Class as required by the area classification	Ignition Temperature of gas or vapor in °C	Allowable temperature classes of equipment
T1	>450	T1 – T6
T2	>300	T2 – T6
T3	>200	T3 – T6
T4	>135	T4 – T6
T5	>100	T5 – T6
T6	>85	T6

The maximum surface temperature under the worst operating condition must not exceed the ignition temperature of gas.

The maximum surface temperature refers to that surface which is coming in contact with the explosive gas.

In case of Flame Proof Ex(d) Motors, this refers to external surface temperature whereas in case of Non sparking Ex (nA) motors, this refers to the internal temperature as well.

Temperature Class of Bharat Bijlee Motors

Frame Size		Temp Class
IEC frame size	BBL frame size	
80	MJ 80	T6
90	MJ 90	T5
100	MJ 100	T5
112	MJ 112	T5
132	MJ 132	T5
160	MJ 160	T5
180	MJ 180	T5
200	MJ 200	T5
225	MJ 225	T5
250	MJ 250	T4
280	MJ 280	T4
315	MJ 315	T4

Classification of Hazardous Gases

Hazardous Gases have been classified in IS/IEC 60079-1 and are associated only with flame proof enclosures.

Bharat Bijlee Flame proof motors are offered suitable for gas Gr. I, IIA and IIB only. Additionally, frame MJ132 is suitable for gas group IIB + H₂ (Hydrogen).

List of hazardous gases, their group specification and ignition temperatures have been specified in IS/IEC 60079-20. Some of the gases are listed in the following table.

Gas Group	Gas or Vapor	Temp. Class
I	Methane (firedamp)	T1
IIA	Industrial Methane*	T1
	Carbon monoxide	T1
	Decane	T3
	Xylene	T1
	Methyl acetate	T1
	Hexane	T3
	Heptane	T3
	Iso-octane	T2
	Propane	T1
	Butane	T2
	Benzene	T1
	Cyclohexane	T2
	Acetone	T1
	Ethyl acetate	T1
Chloroethylene	T1	
IIB	Methanol	T1
	Ethanol	T2
	Butyl acetate	T2
	1,3-Butadiene	T2
	Ethylene	T2
	Diethyl ether	T4
IIC	Ethylene oxide	T2
	Coke-oven Gas	T1
	Hydrogen	T1
	Acetylene	T1

***Note:** Industrial Methane includes Methane mixed with not more than 10% volume of Hydrogen.

Statutory Approvals and Licenses

Motors used in hazardous areas need statutory approvals from various statutory authorities depending upon their area of jurisdiction before marketing. Statutory / Licensing authorities accord their approval / License based on the test reports issued by their recognized test houses such as CIMFR Dhanbad, ERTL (East) Kolkata etc.

Statutory Authority	Scope	Area of Jurisdiction
Central Institute of Mining & Fuel Research CIMFR Dhanbad (formerly CMRI)	Testing & Certification	-
Electronics Regional Test Laboratory ERTL (East) Kolkata	Testing & Certification	-
Directorate General of Mines Safety DGMS Dhanbad	Approving	Coal mines & Oil mines.
Petroleum & Explosives Safety Organization PESO Nagpur (formerly CCOE)	Approving	All areas where explosive liquids/ gases are stored & transported
Directorate General Factory Advice Service and Labour Institutes DGFASLI Mumbai	Approving	All areas where explosive liquids/ gases are Processed.
Bureau of Indian Standards BIS	Licensing	-

All Flame Proof Motors have License mark IS/IEC 60079-1:2007.

DGMS identification mark is mandatory for motors used in coal mines & oil mines.

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%)

Ambient

Motors are designed for ambient temperature of 45°C as mentioned in the performance table.

Higher ambient temperature motors can be offered on request.

Altitude

The motors are designed for an altitude up to 1000m above mean sea level.

Motors suitable for higher altitude can be offered on request.

Re-Rating Factors

The Re-Rating factors applicable under different conditions of supply voltage, frequency, ambient and altitude are obtained by multiplying rated output kW by following factors.

Variation in Supply Voltage & Frequency

Voltage Variation %	Frequency Variation %	Combined Voltage & Frequency (%)	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

Amb. Temp. °C	Permissible output as % of rated value	Altitude above sea level (m)	Permissible output as % of rated value
-	-	1000	100
-	-	1500	97
<30	107	2000	94
30-45	100	2500	90
50	96	3000	86
55	92	3500	82
60	87	4000	77

Method of Starting

Bharat Bijlee Motors are suitable for following methods of starting.

kW rating	Method of starting	No. of Leads
Upto & including 1.5 kW	DOL	3 (Internal star connection)
Above 1.5 kW	DOL or Star/Delta	6

Starting current measurement of Bharat Bijlee 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.

kW Range	Measurement at % of voltage to rated voltage
0.12 kW to 90 kW	70%
90 kW to 200 kW	60%
200 kW to 355 kW	35%
355 kW 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

Motors for Intermittent Duty

Motors required for intermittent duty (S3 or S4) application (crane or hoist) can be supplied in frame sizes MJ80 to MJ132. BBL has acquired necessary statutory certification for this. However please note that efficiency class is not applicable to these motors. Please refer to our sales office for further details.

Insulation and Endurance

The motors are provided with class F Insulation system with temperature rise limited to class B.

All insulating materials used are adequately resistant to the action of microbes and fungi. Gel coat is applied on winding overhangs as an additional protection, against ingress of moisture.

Standard Winding

- Motors are wound with modified polyester enamel covered (IS 13730: Part 3 Thermal class 155) copper wires and are flood impregnated.
- Gel coat is applied on winding overhangs as an additional protection against ingress of moisture.

Insulation for Converter Fed 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.

Options (On request)

- Class 'H' insulation.
- VPI for frame 80 to 280M.
- Winding with dual coated wires.

Thermal Protection for Winding

PTC Thermistors can be embedded in stator winding on request.

Earthing Terminals

Two earthing terminals are provided, one on each motor foot. Also, two earthing terminals are provided in the terminal box.

Anti-condensation Method

Motors can be offered with built in space heaters in frame sizes 90 and above. For 315 frame, space heaters are provided as a standard feature.

Mechanical Features

Enclosure

The motors are offered with totally Enclosed Fan Cooled (TEFC) construction. All foot mounted motors are with integral feet construction.

The frame, end shields, terminals boxes and bearing covers of all motors are made of grey cast iron.

These motors are so designed that the frame temperature will remain below the ignition temperature of gas-air mixture involved.

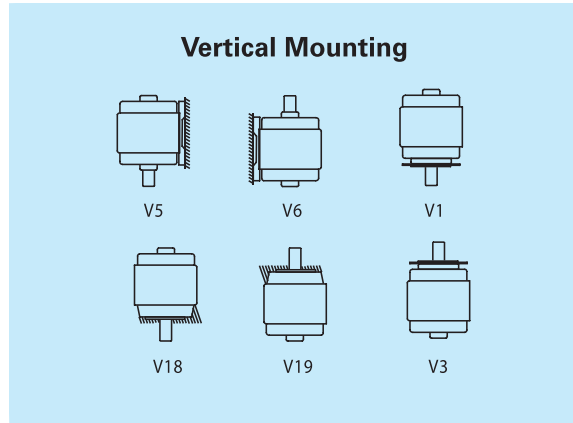
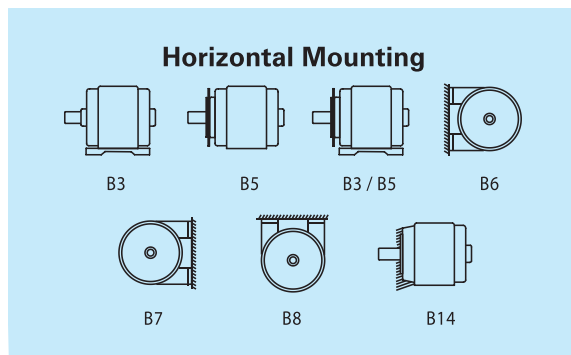
All cast iron parts forming flame proof enclosures are subjected to hydraulic pressure test, after final machining as per IS/IEC 60079-1.

Type of Construction

Standard motors are designed for foot mounting (B3). These are also suitable for B6, B7, B8, V5 and V6 mounting without any change.

Motors can be supplied in Flange mounting (B5). These are also suitable for V1 and V3 mounting without any change.

Mounting



Cooling

All motors are totally Enclosed Fan cooled (TEFC). The cooling is effected by self-driven, bi-directional cast iron or fabricated centrifugal fan protected by fan cover. The type of cooling is IC 411 as per IS 6362/IEC 60034-6.

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.

Degree of Protection

All motors have IP55 Degree of protection as per IS/IEC 60034-5. Higher degree of protection can be provided on request. All flanged motors are additionally provided with oil tight shaft protection on driving end side. A drain plug is not permissible in FLP motors.

Note: For more details, refer to annexure II.

Bearing and Terminal Box Details

Frame Size	Bearing Nos. C3 Clearance		Terminal Box Type/ Location	Terminal		Cable entries No. & size in**	Max cond Cross Sec. area mm ²
	DE	NDE		Nos	Size		
80	6204 2Z	6204 2Z	MJ80/TOP	3	M5	1 x M20	4
90	6205 2Z	6205 2Z	MJ132 /TOP	3/6 *	M6	1 x M25	6
100	6206 2Z	6206 2Z					16
112	6206 2Z	6206 2Z					50
132	6308 2Z	6308 2Z	MJ200/TOP	6	M8	2 x M32	70
160	6209 2Z	6209 2Z				2 x M40	
180	6310 2Z	6310 2Z				150	
200	6212 2Z	6212 2Z	MJ280/TOP	6	M12	2 x M50	240
225	6213	6213					
250	6215	6215					
280	2P	6316	6316	6	M12	2 x M50	150
	4,6 & 8P	6317	6316				
315	6319	6319	MJ315/TOP	6	M16	2 x M63	240

*3 Terminals up to & including 1.5 kW & 6 terminals for higher kW Outputs.

**Cable entries other than those mentioned in the table can be offered subject to availability of statutory approval

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

Shipping Dimension

FRAME	TYPE REF	PACKING BOX DIMENSIONS			MOTOR GROSS WEIGHT IN Kg
		LENGTH	WIDTH	HEIGHT	
80	2J080453G	440	440	310	34
90L	2J09L653G	510	470	340	51
100L	2J10L233G	510	310	510	66
112M	2J11M653G	510	310	510	73
132M	2J13M693G	610	330	550	118
160ML	2J16L293G	790	440	540	216
180L	2J18L633G	790	460	690	267
200L	2J20L253G	940	540	690	408
225SM	2J22M643G	920	540	790	534
250M	2J25M4A3G	1100	660	820	696
280SM	2J28M453G	1220	660	890	860
315SM	2J31M653G	1300	870	1000	1,120
315L	2J31L6B3G	1500	870	1003	1,625

Special Features

- Sturdy housing that prevents an internal explosion from spreading to the external environment and also resists the explosion pressure.
- Robust bearing shields and caps bolted to the frame in a manner where the gaps remain unaffected in the event of an internal explosion.
- Screen on air intake with a mesh size not exceeding 8mm.
- External two earth terminals on motor feet.
- Protective earth conductor terminal in the terminal box.
- Ex (d) mark on the motors.
- CIMFR certificate no, PESO, DGFASLI certificate no. and BIS License mark on the name plate. Special DGMS mark plate is provided with DGMS approval no. in case of motors to be used in coal mines or oil mines.
- Special varnishing and painting treatment to resist highly corrosive atmosphere.
- All vertical mounted motors will be provided with 3 lifting lugs.

Special Maintenance Care During Operation

Each motor must be provided with protective circuit breaker or an equally effective device.

In order to maintain safety protection, the following care must be taken on site during operation;

- The joint faces must not be re-machined nor finished or coated with varnish or paint. The surfaces must be kept metallically clean. A thin film or oil grease must be applied as protection against rust. The use of gaskets at point where there were originally none, is not permitted.
- Defective mounting screws and bolts must be replaced promptly by new ones of a material with at least the same tensile-strength as the original ones.

- Care should be taken to see that all screw, bolts, nuts etc. used for fixing the parts of flame proof enclosure are provided with spring washer wherever originally supplied, to prevent them from getting loose due to shocks and vibration during operation.
- Enough ventilating space must be provided for efficient cooling of the motor. Refer GA drawing given in the catalogue.

Industrial Applications

- Coal Mines
- Petro Chemicals & Chemicals
- Oil Mines & Rigs
- Fertilizers
- Solvent Extraction Plant
- Paints & Varnish Industry
- LPG Bottling Plants
- Agro Chemicals
- Drugs & Pharmaceuticals
- General Industry

Special Design Features Available

- Non standard voltage and frequency variation
- Dual Voltage ($1:\sqrt{3}$ ratio)
- 10,12,16 pole motors
- Special performance requirements
- Class H insulated motors
- Low vibration and noise level
- Special Bearings
- Special Shaft Material
- Canopy
- Flange/Foot cum Flange mounting
- Space Heater, Thermistors
- Multispeed Motors
- Double/ taper/non standard shaft extension
- Non Standard paint Shade
- Motors for use with variable frequency inverter supply

Alternate T. Box Location

Frame Size	T. Box Location
112 & 132	RHS Only
160 to 315	RHS or LHS

Roller Bearing and Insulated Bearing

Motors with insulated bearing on NDE side can be offered from frame size 160 & above on request.

Motors can also be offered with cylindrical roller bearing (NU) on DE side for frame sizes 160 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 200L it can be provided on request.

Bearing	Pole	Re-lubrication	
		Quantity (g)	Interval (Hrs)
6213	2	120	3200
	4		9000
	6		15000
	8		21000
6215	2	150	2800
	4		8200
	6		10000
	8		18000
6316	2	180	2000
6317	4		7500
	6		13000
	8		17500
6319	2	220	2000
	4		5000
	6		7500
	8		10000

Separate T. Box for Thermister / Thermostat / Space Heater

Only one separate T. Box either for Thermister / Thermostat or Space Heater can be offered from frame size 200 to 280. In such cases the Main terminal box location will be either on RHS or LHS only.

In case of 315 frame, separate space heater terminal box will be provided as a standard feature. One separate T. Box for thermister can be offered on request.

Cable Entries

Motors for mining application (i.e. Coal mines and oil mines) are provided with cable entries with compound filling sealing boxes suitable for Paper Insulated Lead Covered Double Wire Armored (PILCDWA) PVC Cables. Cable entries with flame proof glands can also be provided to suit PVC armoured cables (For application in hazardous

area Gas Group IIA and IIB only). A cable sealing box is mandatory for all motors for use in Coal Mines and Oil Mines.

Rotors

All motors are fitted with dynamically balanced aluminum pressure 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.

Balancing and Vibration

Rotors are dynamically balanced with a half key in the shaft extension.

The balancing grade is G2.5 as per ISO:1940.

Vibration grade is 'Normal grade' conforming to IS: 12075:2008. Other grades as per IS 12075:2008 or IEC 60034-14 can be provided 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 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 given a special treatment of primer and paint to internal as well as external surface. All external surfaces are coated with epoxy polyamide base acid/alkali resistant paint of dark Admiralty Grey Shade (No. 632 as per IS: 5).

Name Plate

Stainless steel name plate is provided on each motor. Special data such as efficiency class, starting current, starting torque, gas group, temperature class and statutory approval references are also provided with usual name plate details.

Packing

Motors are packed in wooden packing boxes. Export packing / sea worthy case for home market (without fumigation certificate) is also available on request.

Effect of Converter (VFD) Supply Voltage on Motor Performance

Note : Refer to page no. 6, 7, 8, 9, 10 & 11 of Industrials Motors, Technical Information section.

Statutory Requirement for Flame Proof Induction Motors Fed with VFD Supply

Combined Testing of Flame Proof Motor and Converter:

Bharat Bijlee motors have been tested and approved by statutory authorities for given temperature class with sinusoidal supply. Since VFD supply contains more harmonics, temperature rise of motor increases on VFD supply. This leads to increase in surface temperature. Also, with the VFD, motor speed is varied. When motor speed is reduced, it leads to poor cooling and higher temperature rise. So the new temperature class needs to be verified by statutory authority.

IS 5571 (Guide for selection and installation of electrical equipment for hazardous areas - other than mines) or IEC 60079-14 (Explosive atmospheres - Part 14: Electrical installations design, selection and erection) is the selection guide for the user.

The statutory testing authorities insist that the motors intended for use in hazardous area, which are to be supplied with varying voltage and frequency by converter, shall be tested, certified, and approved in association with the converter to determine the temperature class / maximum surface temperature. The authorities give reference to IS 5571:2009 clause 10.6.1 (a) for this testing.

This is also mentioned in the international standard IEC 60079-14:2007 (Explosive atmospheres - Part 14: Electrical installations design, selection and erection), clause 10.6.1 (a).

Note:

1. Additional factors may also need to be taken into account, which include provision by the user of additional output filters or reactors and the length of cable between converter and motor. Both these affect motor input voltage and cause additional motor heating.
2. High frequency switching in converters can lead to rapid rise time voltage stress in the windings and cable circuits and therefore a further potential source of ignition. It is necessary to consider the effects of this stress according to the type of protection. It will be necessary to add an additional output filter after the converter.

3. Bearing currents require special consideration. Possible solutions include the use of insulated bearings, either alone, or in accordance with a filter that reduces common mode voltages and / or dv/dt.

Cable Length Between Motor and Converter

Whenever flame proof motor is fed through converter supply, converter is placed in safe area and motor is working in hazardous area. Hence the cable length is generally high, i.e. 500 to 800 meters long. For effective and trouble free operation of motor, use of filters (preferably sine wave filter) at converter output terminals is a must, when using such high cable length. The customer and / or his system integrator has to ensure that the voltage appearing at motor terminals is $\leq 1.56kV$.

Warranty clause of motor is applicable only if sine wave filter is provided at converter output terminals by the motor user.

Use of Thermal Protective Devices

Use of thermistors / thermostats is recommended to monitor the temperature rise of stator winding of motor.



Performance table for standard Flame Proof (Ex d) 2 Pole motors TEFC 3 Phase Squirrel Cage Induction Motors - Frame size 80 to 280M

Applicable standard for testing: IS 4029
Applicable standard for efficiency determination: IS 4889

Voltage : 415V+/-10%
Frequency : 50Hz+/-5%
Combined Variation : +/-10%

Ambient : 45°C
Duty : S1 (Continuous)
3000 rpm (2-Pole)

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

Rated Output		Frame size IEC	Frame size BBL	Type ref. B3 construction	Operating characteristics at rated output										With DOL starting		Rotor GD ² kgm ²	Net Weight B3 constr. kg
					Speed RPM	Current Amps.	Rated Torque kg-m	Power Factor			% Efficiency			Starting Current to Rated Current Ratio	Starting Torque to rated torque Ratio	Pullout Torque to Rated Torque Ratio		
KW	HP						FL	3/4L	1/2L	FL	3/4L	1/2L						
*0.37	0.50	80	MJ80	MD0802A3	2880	0.81	0.13	0.85	0.78	0.70	75.00	72.00	67.0	6.0	2.7	3.0	0.0037	31
*0.55	0.75	80	MJ80	MD0802B3	2860	1.24	0.19	0.82	0.74	0.62	75.00	73.00	68.0	5.5	2.7	3.0	0.0037	31
0.75	1.0	80	MJ80	MD080213	2830	1.65	0.26	0.82	0.74	0.62	77.0	76.0	72.0	5.0	2.5	2.8	0.0037	31
1.1	1.5	80	MJ80	MD080233	2840	2.36	0.38	0.82	0.75	0.63	79.0	79.0	76.0	5.9	2.7	3.0	0.0051	32
*1.5	2.0	90L	MJ90	MD09L233	2825	3.01	0.52	0.86	0.83	0.76	80.6	78.0	74.0	5.5	2.7	3.0	0.0071	48
2.2	3.0	90L	MJ90	MD09L253	2830	4.36	0.76	0.85	0.82	0.74	82.5	80.0	76.0	6.0	3.0	3.0	0.0093	50
3.7	5.0	100L	MJ100	MD10L213	2900	7.12	1.24	0.85	0.80	0.70	85.0	83.0	78.0	6.5	2.8	3.0	0.0188	62
5.5	7.5	132S	MJ132	MD13S2B3	2920	10.1	1.83	0.88	0.85	0.77	85.7	85.0	80.0	6.5	2.3	3.0	0.0630	82
7.5	10.0	132S	MJ132	MD13S2E3	2920	13.6	2.50	0.88	0.84	0.76	87.0	86.0	82.0	6.5	2.3	3.0	0.0760	82
9.3	12.5	132M	MJ132	MD13M2N3	2920	16.5	3.10	0.89	0.85	0.76	88.0	86.0	83.0	6.5	2.4	2.9	0.0980	120
11	15	160M	MJ160	MD16M213	2920	19.3	3.67	0.89	0.87	0.83	89.0	88.0	86.0	5.8	2.0	3.0	0.134	145
15	20	160M	MJ160	MD16M253	2920	26.2	5.00	0.89	0.88	0.82	89.5	89.0	87.0	6.0	2.0	3.0	0.171	154
18.5	25	160L	MJ160	MD16L273	2920	31.6	6.17	0.90	0.88	0.86	90.5	90.0	88.0	6.5	2.0	3.0	0.225	168
*22	30	180L	MJ180	MD18L213	2930	37.6	7.31	0.89	0.87	0.80	91.5	90.5	88.0	6.5	2.2	2.7	0.300	220
30	40	200L	MJ200	MD20L233	2950	51.2	9.91	0.88	0.85	0.79	92.6	92.0	89.5	6.5	2.5	2.5	0.520	260
37	50	200L	MJ200	MD20L253	2945	62.9	12.2	0.88	0.85	0.79	93.0	92.5	91.0	6.5	2.5	2.5	0.610	320
45	60	225M	MJ225	MD22M233	2960	74.4	14.8	0.90	0.87	0.83	93.5	93.0	91.0	6.0	2.5	2.5	1.04	420
55	75	250M	MJ250	MD25M213	2960	89.1	18.1	0.92	0.91	0.86	93.3	92.8	91.5	6.0	2.1	2.6	2.11	570
75	100	280S	MJ280	MD28S213	2970	122	24.6	0.91	0.89	0.84	93.7	92.5	90.0	6.0	1.8	2.7	2.63	690
90	120	280M	MJ280	MD28M233	2970	146	29.5	0.91	0.89	0.84	94.0	93.0	91.0	6.0	1.8	2.7	3.01	740

All performance values are subject to tolerance as per IS/IEC 60034-1

* These ratings are offered in higher frame size

STANDARD FLAME PROOF MOTORS

Performance table for standard Flame Proof (Ex d) 4 Pole motors TEFC 3 Phase Squirrel Cage Induction Motors - Frame size 80 to 280M

Applicable standard for testing: IS 4029
Applicable standard for efficiency determination: IS 4889

Voltage : 415V+/-10%

Frequency : 50Hz+/-5%

Combined Variation : +/-10%

Ambient : 45°C

Duty : S1 (Continuous)

1500 rpm (4-Pole)

Ins. Class : F

Temp. Rise : B

Protection : IP55

Rated Output	Frame size IEC	Frame size BBL	Type ref. B3 construction	Operating characteristics at rated output						With DOL starting		Pullout Torque to Rated Torque Ratio	Rotor GD ² kgm ²	Net Weight B3 constr. kg			
				Speed RPM	Current Amps.	Rated Torque kg-m	Power Factor			% Efficiency					Starting Current to Rated Current Ratio	Starting Torque to rated torque Ratio	
KW	HP			FL	3/4L	1/2L	FL	3/4L	1/2L	FL	3/4L	1/2L					
*0.37	0.50	80	MI80	MD0804A3	1415	0.97	0.25	0.76	0.70	0.58	70.0	64.0	4.5	2.4	2.6	0.0061	31
0.55	0.75	80	MI80	MD080413	1405	1.28	0.38	0.81	0.70	0.56	74.0	67.0	4.0	2.4	2.6	0.0061	31
0.75	1.0	80	MI80	MD080433	1405	1.74	0.52	0.78	0.70	0.58	77.0	72.0	4.5	2.8	3.0	0.0072	32
*1.1	1.5	90L	MI90	MD09L433	1410	2.45	0.76	0.80	0.73	0.61	78.0	72.0	4.2	2.3	2.7	0.0120	48
1.5	2.0	90L	MI90	MD09L453	1410	3.26	1.04	0.80	0.72	0.58	80.0	75.0	5.0	2.5	3.0	0.0160	50
2.2	3.0	100L	MI100	MD10L433	1420	4.55	1.51	0.82	0.69	0.53	82.0	76.0	5.5	2.5	3.0	0.0210	60
3.7	5.0	112M	MI112	MD11M433	1430	7.30	2.52	0.83	0.76	0.65	85.0	82.0	6.0	2.6	3.0	0.0530	70
5.5	7.5	132S	MI132	MD13S4B3	1450	10.3	3.69	0.86	0.81	0.70	86.5	84.0	6.0	2.4	3.0	0.104	100
7.5	10.0	132M	MI132	MD13M4K3	1450	13.7	5.04	0.87	0.82	0.72	87.5	85.0	6.0	2.3	3.0	0.126	113
9.3	12.5	160M	MI160	MD16M4A3	1450	17.4	6.25	0.84	0.80	0.72	88.5	87.0	6.0	2.0	2.5	0.141	136
11	15	160M	MI160	MD16M4C3	1450	20.5	7.39	0.84	0.81	0.76	89.0	86.0	6.0	2.1	2.5	0.177	143
15	20	160L	MI160	MD16L4K3	1450	27.5	10.1	0.84	0.83	0.79	90.2	90.0	6.0	2.1	2.5	0.235	156
*18.5	25	180L	MI180	MD18L433	1460	33.2	12.3	0.85	0.82	0.72	91.2	90.0	6.0	2.4	2.5	0.460	215
22	30	180L	MI180	MD18L473	1460	39.2	14.7	0.85	0.82	0.72	91.8	90.0	6.0	2.4	2.5	0.540	230
30	40	200L	MI200	MD20L433	1465	51.6	19.9	0.88	0.84	0.77	92.0	90.0	6.0	2.6	2.6	0.860	305
37	50	225S	MI225	MD22S413	1470	63.6	24.5	0.87	0.83	0.75	93.0	91.0	6.0	2.5	2.5	1.32	380
45	60	225M	MI225	MD22M433	1470	76.3	29.8	0.88	0.84	0.75	93.2	91.0	6.0	2.5	2.5	1.60	430
55	75	250M	MI250	MD25M413	1478	93.8	36.2	0.87	0.84	0.77	93.8	92.0	6.0	2.4	2.5	2.78	590
75	100	280S	MI280	MD28S413	1485	129	49.2	0.86	0.83	0.75	94.2	93.0	6.0	2.1	2.8	5.00	705
90	120	280M	MI280	MD28M433	1485	154	59.0	0.86	0.83	0.75	94.7	93.5	6.0	2.1	2.8	6.00	725

All performance values are subject to tolerance as per IS/IEC 60034-1

* These ratings are offered in higher frame size

Performance table for standard Flame Proof (Ex d) 6 Pole motors TEFC 3 Phase Squirrel Cage Induction Motors - Frame size 80 to 280M

Applicable standard for testing: IS 4029
Applicable standard for efficiency determination: IS 4889

Voltage : 415V+/-10%

Frequency : 50Hz+/-5%

Combined Variation : +/-10%

Ambient : 45°C

Duty : S1 (Continuous)

1000 rpm (6-Pole)

Ins. Class : F

Temp. Rise : B

Protection : IP55

Rated Output		Frame size IEC	Frame size BBL	Type ref. B3 construction	Operating characteristics at rated output										With DOL starting		Pullout Torque to Rated Torque Ratio	Rotor GD ² kgm ²	Net Weight B3 constr. kg
					Speed RPM	Current Amps.	Rated Torque kg-m	Power Factor			% Efficiency			Starting Current to Rated Current Ratio	Starting Torque to rated torque Ratio				
KW	HP							FL	3/4L	1/2L	FL	3/4L	1/2L						
0.37	0.50	80	MJ80	MD080613	910	1.08	0.40	0.70	0.60	0.48	68.0	66.0	61.0	3.0	2.1	2.3	0.0060	31	
0.55	0.75	80	MJ80	MD080633	915	1.56	0.59	0.71	0.62	0.48	69.0	70.0	64.0	4.0	2.2	2.5	0.0084	32	
*0.75	1.0	90L	MJ90	MD09L633	925	1.99	0.79	0.72	0.61	0.50	73.0	70.0	69.0	3.4	2.0	2.5	0.0122	48	
1.1	1.5	90L	MJ90	MD09L653	930	2.80	1.15	0.72	0.61	0.50	76.0	74.0	72.0	4.0	2.1	2.6	0.0160	50	
1.5	2.0	100L	MJ100	MD10L633	935	3.72	1.56	0.72	0.64	0.52	78.0	75.0	72.0	4.0	2.0	2.5	0.0250	60	
2.2	3.0	112M	MJ112	MD11M633	935	4.97	2.29	0.77	0.68	0.55	80.0	80.0	74.0	5.0	2.0	2.5	0.0500	67	
3.7	5.0	132S	MJ132	MD13S6B3	950	8.05	3.79	0.77	0.72	0.60	83.0	83.0	82.0	5.0	2.2	2.8	0.118	100	
5.5	7.5	132M	MJ132	MD13M6N3	950	11.6	5.64	0.78	0.74	0.64	84.5	84.5	83.0	5.5	2.5	3.0	0.172	120	
7.5	10.0	160M	MJ160	MD16M633	960	14.8	7.61	0.80	0.74	0.64	88.0	88.0	86.0	5.4	2.0	2.5	0.276	149	
9.3	12.5	160L	MJ160	MD16L663	960	18.4	9.44	0.80	0.74	0.64	88.0	88.0	87.0	5.5	2.1	2.5	0.340	169	
11	15	160L	MJ160	MD16L673	965	21.6	11.1	0.80	0.77	0.70	88.5	88.0	87.0	6.0	2.0	2.5	0.400	169	
15	20	180L	MJ180	MD18L613	965	29.0	15.1	0.80	0.75	0.62	90.0	90.0	87.0	5.5	2.6	2.3	0.680	210	
18.5	25	200L	MJ200	MD20L613	975	34.0	18.5	0.83	0.78	0.70	91.1	91.0	88.0	5.8	2.6	2.3	1.00	275	
22	30	200L	MJ200	MD20L633	975	40.3	22.0	0.83	0.77	0.68	91.5	91.0	88.0	5.8	2.6	2.3	1.20	290	
30	40	225M	MJ225	MD22M623	975	52.1	30.0	0.87	0.84	0.76	92.0	91.0	88.0	6.0	2.3	2.2	2.10	430	
37	50	250M	MJ250	MD25M603	975	63.2	37.0	0.88	0.85	0.82	92.5	92.5	91.0	6.0	2.5	2.3	3.51	560	
45	60	280S	MJ280	MD28S613	984	80.1	44.5	0.84	0.80	0.72	93.0	92.5	92.0	6.0	2.5	2.4	5.11	615	
55	75	280M	MJ280	MD28M633	984	95.2	54.4	0.86	0.83	0.76	93.5	93.0	92.0	6.0	2.4	2.4	6.16	725	

All performance values are subject to tolerance as per IS/IEC 60034-1

* These ratings are offered in higher frame size

Performance table for standard Flame Proof (Ex d) 8 Pole motors TEFC 3 Phase Squirrel Cage Induction Motors - Frame size 80 to 280M

Applicable standard for testing: IS 4029

Applicable standard for efficiency determination: IS 4889

Voltage : 415V+/-10%

Frequency : 50Hz+/-5%

Combined Variation : +/-10%

Ambient: : 45 °C

Duty : S1 (Continuous)

750 rpm (8-Pole)

Ins. Class : F

Temp. Rise : B

Protection : IP55

Rated Output		Frame size IEC	Frame size BBL	Type ref. B3 construction	Speed RPM	Current Amps.	Rated Torque kg-m	Power Factor				% Efficiency			With DOL starting		Pullout Torque to Rated Torque Ratio	Rotor GD ² kgm ²	Net Weight B3 constr. kg
KW	HP							FL	3/4L	1/2L	FL	3/4L	1/2L	FL	3/4L	1/2L			
*0.37	0.50	90L	MJ90	MD09L833	700	1.32	0.51	0.63	0.52	0.41	62.0	55.0	48.0	2.7	1.8	2.1	0.0110	46	
0.55	0.75	90L	MJ90	MD09L853	690	1.81	0.78	0.63	0.55	0.43	67.0	62.0	58.0	2.9	2.0	2.4	0.0140	46	
0.75	1.0	100L	MJ100	MD10L813	685	2.04	1.07	0.73	0.63	0.50	70.0	70.0	64.0	3.0	1.6	1.8	0.0230	55	
1.1	1.5	100L	MJ100	MD10L833	690	2.91	1.55	0.71	0.62	0.48	74.0	73.0	71.0	3.3	1.9	2.3	0.0270	59	
1.5	2.0	112M	MJ112	MD11M813	705	3.87	2.07	0.70	0.62	0.50	77.0	77.0	75.0	3.8	1.7	2.2	0.0510	70	
2.2	3.0	132S	MJ132	MD13S883	705	5.03	3.04	0.78	0.74	0.64	78.0	78.0	75.0	3.5	1.8	2.3	0.0990	100	
3.7	5.0	160M	MJ160	MD16M813	720	8.05	5.01	0.78	0.74	0.65	82.0	82.0	78.0	4.4	1.8	2.0	0.217	137	
5.5	7.5	160M	MJ160	MD16M833	715	11.6	7.49	0.78	0.74	0.65	84.5	84.5	82.0	4.8	1.9	2.2	0.299	151	
7.5	10.0	160L	MJ160	MD16L873	710	15.6	10.3	0.78	0.74	0.65	86.0	84.0	82.0	5.5	2.1	2.2	0.400	165	
*9.3	12.5	180L	MJ180	MD18L813	715	18.9	12.7	0.79	0.74	0.64	86.5	86.5	85.0	4.5	2.1	2.2	0.620	205	
11	15	180L	MJ180	MD18L833	720	22.1	14.9	0.79	0.74	0.64	87.5	87.5	86.0	4.5	2.1	2.2	0.720	210	
15	20	200L	MJ200	MD20L833	720	28.8	20.3	0.82	0.79	0.71	88.5	88.5	87.0	5.5	2.5	2.3	1.32	305	
18.5	25	225S	MJ225	MD22S813	725	36.6	24.9	0.79	0.77	0.69	89.0	88.0	87.0	5.3	2.1	2.2	1.95	380	
22	30	225M	MJ225	MD22M833	725	43.0	29.6	0.79	0.77	0.69	90.0	89.0	87.0	5.3	2.1	2.2	2.41	430	
30	40	250M	MJ250	MD25M813	730	55.9	40.0	0.82	0.78	0.68	91.0	90.5	89.0	5.5	2.5	2.2	3.72	570	
37	50	280S	MJ280	MD28S823	730	70.8	49.4	0.79	0.75	0.65	92.0	92.0	90.0	5.5	2.2	2.2	5.83	725	
45	60	280M	MJ280	MD28M853	730	86.1	60.0	0.79	0.75	0.65	92.0	92.0	91.0	5.5	2.2	2.2	6.86	725	

All performance values are subject to tolerance as per IS/IEC 60034-1

* These ratings are offered in higher frame size

