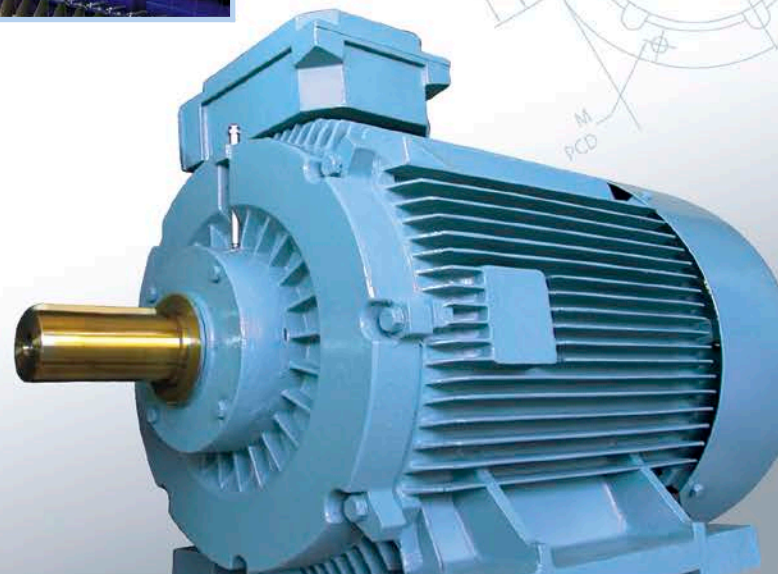
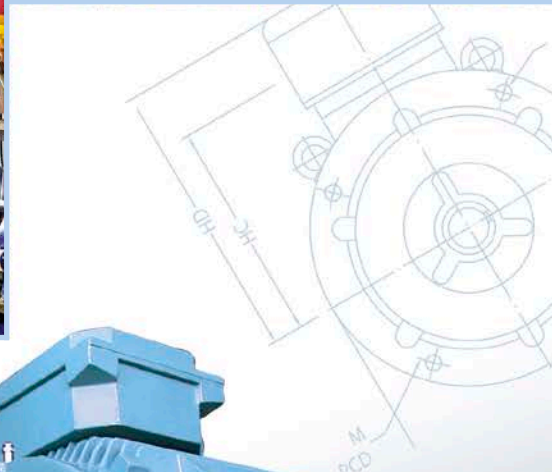




TECHNICAL
SPECIFICATIONS



motoring the wheels of success

hindustan
ELECTRIC MOTORS

India's Foremost Manufacturer of Motors

Establishing strengthening and sustaining the development of a strong company not only means deploying resources, expertise and knowhow but also great determination and confidence in the future. Through all these years of intensive activity and quick expansions, the action towards common goal to stand out as a strong consistent group, constantly striving for improvement have driven HINDUSTAN ELECTRIC MOTOR attain and achieve a leading position in the Indian Motor industry.

Hindustan Electric Motor, an ISO 9001: 2015 company is the leading Electric Motor Manufacturer in India with a proven track record of over four decades.

From a modest beginning with an electric motor unit in Mumbai, Hindustan Electric Motor has set up state of art manufacturing facilities at Daman & Vapi. The last four decades have seen the core business develop along with different product lines; Flameproof motors, Crane duty motors, Cooling tower motors, Textile motors, Inverter duty motors, Brake motors & other motors for customer specific application. In the manufacture of motor, a competitive edge lies in providing consistent quality, high reliability with innovative products. Our expansion in Daman & Vapi was to address these key market determinants. The manufacturing set up is sourced out from the world renowned machinery and technology suppliers with constant up-gradations and expansions.

Our primary focusCustomer Satisfaction

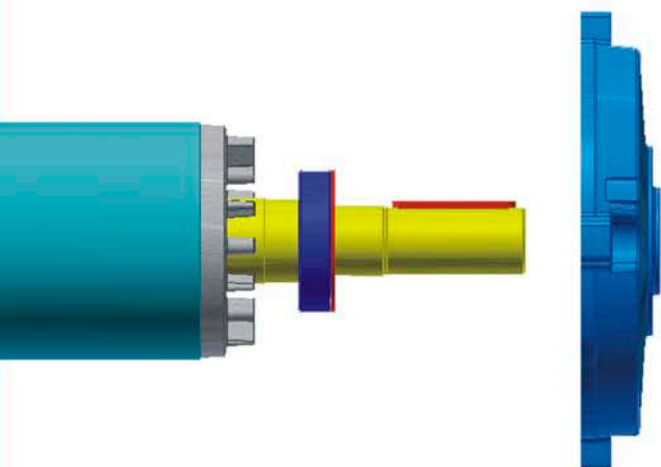
Hindustan Electric Motor derives its strength from its customers. The growth of the latter is the prerequisite to the growth of the company and hence customers' satisfaction is its prime objective. In an ongoing process to improve customer satisfaction, Hindustan Electric Motor offers a variety of Services:

- Competitive prices
- Consistent quality
- Timely delivery
- Product development for a changing Market
- A targeted stocking policy
- Technical support for applications / projects

Hindustan Electric Motor has highly experienced qualified and dedicated professionals with strong adherence to the quality management system. Hindustan Electric Motor has offices all over the country and also has a wide network of authorised distributors, dealers and service centers to cater to all the customer segments in India and abroad.

Hindustan Electric Motor has earned the trust and reputation in India and abroad by winning the customers' confidence. Millions of motors have been manufactured and are in operation in India & abroad.

Hindustan brand motors are preferred choice in OEM, end users, heavy industries, cooling tower application and various diverse application and industries. The titans of Indian industry & consultants / specifiers are now referring Hindustan Electric Motor for most critical and specific applications.



PRODUCT RANGE

IE2 High Efficiency Motors

Frames : 63 to 355LX
 Rating (kW) : 0.12 to 315.0
 Poles : 2, 4, 6, 8
 Mountings : B3, B5, B14 & combinations
 Protection : IP55
 Enclosure : TEFC



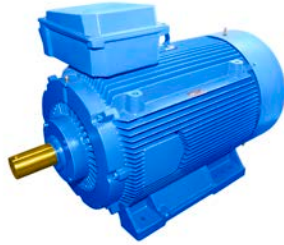
Cooling Tower Motors

Frames : 71 to 315LX
 Rating (kW) : 0.37 to 45.0
 Poles : 4, 6, 8, 10, 12 & others
 Mountings : B3 or B5
 Protection : IP55
 Enclosure : TE, TEFC



IE3 Premium Efficiency Motors

Frames : 63 to 355LX
 Rating (kW) : 0.12 to 315.0
 Poles : 2, 4, 6, 8
 Mountings : B3, B5, B14 & combinations
 Protection : IP55
 Enclosure : TEFC



Torque Motors

Frames : 63 to 160L
 Rating (kW) : 0.037 to 5.5
 Poles : 4, 6, 8
 Mountings : B3, B5, B14 or special
 Protection : IP55
 Enclosure : TE or Force Cooled



Multi Speed Motors

Frames : 71 to 355LX
 Rating (kW) : 0.12 to 150.0
 Poles : 4/2, 8/4, 6/4, 8/6 & others
 Mountings : B3, B5, B14 & combinations
 Protection : IP55
 Enclosure : TEFC



Brake Motors

Frames : 63 to 250MX
 Rating (kW) : 0.18 to 55.0
 Poles : 2, 4, 6, 8
 Mountings : B3, B5, B14 & combinations
 Protection : IP54
 Enclosure : TEFC



Standard Flameproof Motors

Frames : 63 to 315LX
 Rating (kW) : 0.12 to 200.0
 Poles : 2, 4, 6, 8
 Mountings : B3, B5, B14 & combinations
 Protection : IP55
 Enclosure : TEFC



Inverter Duty Motors

Frames : 90S to 355LX
 Rating (kW) : 0.37 to 315.0
 Poles : 2, 4, 6, 8
 Mountings : B3, B5, B14 & combinations
 Protection : IP55
 Enclosure : Force Cooled



IE2 High Efficiency Flameproof Motors

Frames : 63 to 315LX
 Rating (kW) : 0.12 to 200.0
 Poles : 2, 4, 6, 8
 Mountings : B3, B5, B14 & combinations
 Protection : IP55
 Enclosure : TEFC



Roller Table Motors

Frames : 112M to 160L
 Rating (kW) : 0.75 to 7.5
 Poles : 4, 6, 8
 Mountings : B5
 Protection : IP55
 Enclosure : TE, TEFC



IE3 Premium Efficiency Flameproof Motors

Frames : 63 to 315LX
 Rating (kW) : 0.12 to 200.0
 Poles : 2, 4, 6, 8
 Mountings : B3, B5, B14 & combinations
 Protection : IP55
 Enclosure : TEFC



Crane Duty Motors

Frames : 71 to 315LX
 Rating (kW) : 0.18 to 200.0
 Poles : 4, 6, 8
 Mountings : B3, B5, B14 & combinations
 Protection : IP55
 Enclosure : TEFC



Multi Speed Flameproof Motors

Frames : 71 to 315LX
 Rating (kW) : 0.12 to 120.0
 Poles : 4/2, 8/4, 6/4, 8/6 & others
 Mountings : B3, B5, B14 & combinations
 Protection : IP55
 Enclosure : TEFC



Textile Motors

Frames : 100L to 180L
 Rating (kW) : 0.55 to 15.0
 Poles : 4, 6, 8
 Mountings : B3, B5, B14 & Pad
 Protection : IP55
 Enclosure : TENV, TEFC with clean flow



Special Application Motors : Dual Voltage / Dual Frequency motors • Low Vibration motors for machine tools • Motors for Extreme Climatic Conditions • Motor for Import Substitute

STANDARDS & REFERENCES

HINDUSTAN motors are manufactured according to Indian & International standards.

Description	IS
3 phase induction motors - Efficiency & Performance specification	IS 12615
Code of practice for installation & maintenance of induction motor	IS 900
Dimensions & output series for rotating electrical machines	IS 1231, IS 2223, IS 8223
Symbols of construction & mounting arrangement	IS 2253
Guide for testing 3 ph induction motor (For standard TEFC motors)	IS 4029
Classification of degrees of protection	IS/IEC 60034-5
Terminal marking & direction of rotation	IS/IEC 60034-8
Methods of determination of efficiency of rotating electrical machines (For standard TEFC motors)	IS 15999-2-1
Methods of cooling	IS 6362
Permissible limits of noise levels for rotating electrical machines	IS 12065
Mechanical vibration of rotating electrical machines	IS 12075

Additional standards for hazardous area motors

Electrical apparatus for explosive atmospheres - General requirements	IS/IEC 60079-0
Electrical apparatus for explosive atmospheres - Equipment protection by flameproof enclosures "d"	IS/IEC 60079-1
Classification of hazardous areas (other than mines) having flammable gases & vapours for electrical installation	IS 5572
Guide for selection & installation of electrical equipment in hazardous areas (other than mines)	IS 5571

Other Specifications: Inter plant standard for steel industries: IPSS-1-03-007





All the motors are manufactured in Quality Assurance System compliant with ISO 9000.

The motors covered by the present catalogue comply with the regulations & standards consistent with IS & IEC standards.

Glossary:

IS - Indian standards published by Bureau of Indian Standard (BIS)

RATING PLATE

		3~Ind. Motor		IE3	CE	IS 12615	
Amb. 50 °C	Duty S1	Encl. TEFC		CM/L-78XXXXXXXX			
Type 2HE3	096-0403-A00001		Wt. 25 kg				
Brg 6205ZZ/6205ZZ	In.Cl. F						
Fr 90L/B3							
SN  1119 M 12345678	IP  55						
Hz ±5%	V ±10%	kW/HP	A	RPM	%Eff	PF	
50	240D	1.5/2.0	5.4	1435	85.3	0.79	
50	415Y	1.5/2.0	3.1	1435	85.3	0.79	
MADE IN INDIA							

AMBIENT TEMPERATURE

HMM Motors are designed for 50°C ambient temperature.

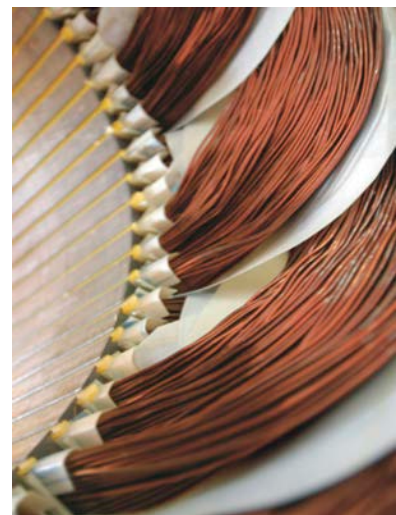
Permitted output (% of rated output)

≤ 30° C	107 %
30° C - 45° C	103 %
50° C	100 %
55° C	96 %
60° C	92 %

TOLERANCE ON PERFORMANCE PARAMETERS & DIMENSIONS

Performance Parameter	Tolerances
1 Efficiency (η) – motors up to and including 150 kW – motors above 150 kW	- 15 % of (1 - η) - 10 % of (1 - η)
2 Total losses (applicable to motors with ratings >150 kW)	+10 % of the total losses
3 Power factor ($\cos \phi$)	- 1/6 of (1 - $\cos \phi$); min 0.02, max 0.07
4 Slip at full load and at working temperature – For motors having output < 1 kW – For motors having output \geq 1 kW	\pm 30 % of the slip \pm 20 % of the slip
5 Locked rotor current (I_{ST}) with any specified starting apparatus	+ 20 % of the current
6 Locked rotor torque (T_{ST})	- 15 % to + 25 % of the torque (+25 % may be exceeded by agreement between manufacturer & purchaser)
7 Pull out torque (T_{PO})	- 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
8 Moment of inertia	\pm 10 % of the value

Dimension	Tolerances
Frame Size $H \leq 250$	0, - 0.5 mm
≥ 250	0, - 1.0mm
Diameter D of shaft extension:	
• 11 to 28 mm	j6
• 32 to 48 mm	k6
• 55mm and above	m6
Diameter N of flange spigot:	
Up to F 500 B	j6
Above F 500 B	js6
Key width	h9
Width of drive shaft keyway (normal keying)	P9
Key depth:	
• Square section	h9
• Rectangular section	h11
Runout of shaft in flanged motors (normal class):	
D \leq 10 mm	0.030 mm
10 mm < D \leq 18 mm	0.035 mm
18 mm < D \leq 30 mm	0.040 mm
30 mm < D \leq 50 mm	0.050 mm
50 mm < D \leq 80 mm	0.060 mm
80 mm < D \leq 120 mm	0.070 mm
Concentricity of spigot diameter and perpendicularity of mating surface of flange to shaft (normal class)	
Flange:	
F65 to F 115	0.080 mm
F130 to F 265	0.100 mm
F300 to F 500	0.125 mm
F600 to F740	0.160 mm



TERMINAL BOX DATA

Frame Size	Cable Entry size		Max. Cable Size DOL starting	Max. Cable Size Star-Delta starting	Terminal Stud size
	Safe Area	Hazardous Area			
63-90	1 x 3/4" BSC	1 x M20x1.5P	3C x 4mm ²	-	M4
100-132	2 x 1" BSC	2 x M25x1.5P	3C x 10mm ²	2 x 3C x 10mm ²	M5
160-180	2 x 1" BSC	2 x M25x1.5P	3C x 35mm ²	2 x 3C x 25mm ²	M6
200	2 x 2" BSC	2 x M40x1.5P	3C x 120mm ²	2 x 3C x 70mm ²	M8
225-250		2 x M50x1.5P			
280-315	2 x 2 1/2" BSC	2 x M63x1.5P	3C x 240mm ²	2 x 3C x 150mm ²	M12
355	2 x 3" BSC	-	3C x 400mm ²	2 x 3C x 300mm ²	M16

Equivalent metric & Pg threadings can also be provided on request.

EFFECT OF VARIATION OF VOLTAGE & FREQUENCY ON MOTOR PERFORMANCE

Characteristics		Voltage		Frequency	
		110%	90%	105%	95%
Torque	Starting & Maximum	Increase 21%	Decrease 19%	Decrease 10%	Increase 11%
Speed	Synchronous	No Change	No Change	Increase 5%	Decrease 5%
	Full Load	Increase 1%	Decrease 1.5%	Increase 5%	Decrease 5%
Current	No Load	Increase 10-15%	Decrease 10-12%	Decrease 5-6%	Increase 5-6%
	Starting	Increase 10-12%	Decrease 10-12%	Decrease 5-6%	Increase 5-6%
	Full Load	Decrease 7%	Increase 11%	Slight Decrease	Slight Increase
	Temp. Rise	Decrease 3-4°C	Increase 6-7°C	Slight Decrease	Slight Decrease
	Overload	Increase 21%	Decrease 19%	Slight Decrease	Slight Decrease
	Magnetic Noise	Slight Increase	Slight Decrease	Slight Decrease	Slight Increase
Efficiency	Full Load	Increase 0.5-1.0%	Decrease 2%	Slight Increase	Slight Decrease
Power Factor	Full Load	Decrease 3%	Increase 1%	Slight Increase	Slight Decrease

BEARING ARRANGEMENT

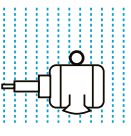
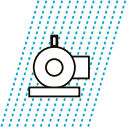
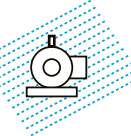
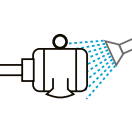
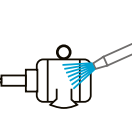
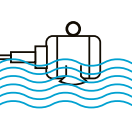
Frames upto 180 have sealed bearings which are lubricated for life. Frames 200 & above have regreasing arrangement as a standard feature.

Frame Size	Safe Area Motors		Hazardous Area Motors		Regreasing Time (Hrs.)	
	DE side	NDE side	DE side	NDE side	2 pole	4, 6, 8 pole
63	6201ZZ	6201ZZ	6201ZZ	6201ZZ	-	-
71	6202ZZ	6202ZZ	6202ZZ	6202ZZ	-	-
80	6204ZZ	6204ZZ	6204ZZ	6204ZZ	-	-
90S/L	6205ZZ	6205ZZ	6205ZZ	6205ZZ	-	-
100L	6206ZZ	6206ZZ	6206ZZ	6206ZZ	-	-
112M	6206ZZ	6206ZZ	6306ZZ	6206ZZ	-	-
132S/M	6208ZZ	6208ZZ	6308ZZ	6208ZZ	-	-
160M/L	6309ZZ	6209ZZ	6309ZZ	6309ZZ	-	-
180M/L	6310ZZ	6210ZZ	6310ZZ	6310ZZ	-	-
200L	6312 #	6312 #	6312ZZ	6312ZZ	# 3,500	# 8,000
225S/M	6313	6313	6313	6313	3,500	8,000
250M	6315	6315	6315	6315	2,500	6,000
280S/M - 2P	6315	6315	6317	6317	2,000	-
280S/M - 4-8P	6317	6317			-	5,000
315S/M/L - 2P	6316	6316	6319	6319	2,000	-
315S/M/L - 4-8P	6319	6319			-	4,000
355S/M/L - 2P	6317	6317	-	-	2,000	-
355S/M/L - 4-8P	6322	6322	-	-	-	3,000

The regreasing time mentioned is for horizontal mounted motors. For vertical mounted motors, it should be reduced by half.

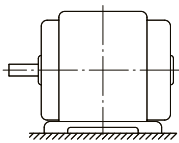
DEGREE OF PROTECTION

The degree of protection as classified in IS/IEC 60034-5 is given below. It is denoted by 2 digits. The first digit denotes protection against solid bodies or particles and the second digit denotes protection against liquid. All our standard TEFC motors are having IP55 degree of protection, unless otherwise specified.

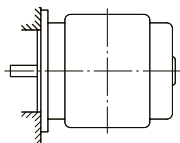
Second Characteristic Numeral								
First Characteristic Numeral		No Protection	Dripping water from top shall not harm	Dripping water up to 15° from vertical shall not harm	Dripping water up to 60° from vertical shall not harm	Water splashes shall not harm	Water projected by nozzle shall not harm	Water from heavy seas shall not harm
		0	1	2	3	4	5	6
0	No Protection							
1	Machine protected against bodies > 50mm dia							
2	Machine protected against bodies > 12mm dia		IP 21	IP 22	IP 23			
3	Machine protected against bodies > 2.5mm dia							
4	Machine protected against bodies > 1mm dia					IP 44		
5	Dust-protected machine					IP 54	IP 55	IP 56
6	No ingress of dust						IP 65	

MOUNTING POSITIONS

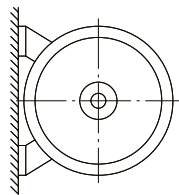
HORIZONTAL MOUNTING



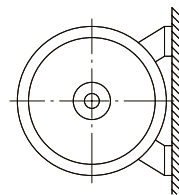
IM B3



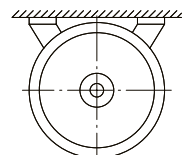
IM B5



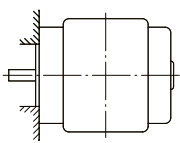
IM B6



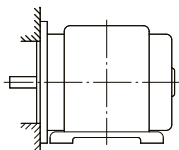
IM B7



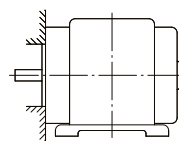
IM B8



IM B14

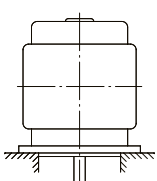


IM B35

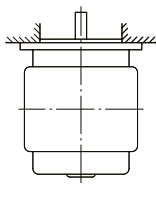


IM B34

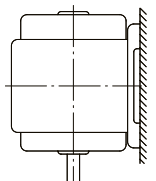
VERTICAL MOUNTING



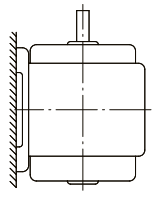
IM V1



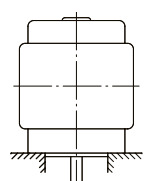
IM V3



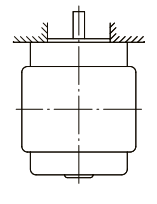
IM V5



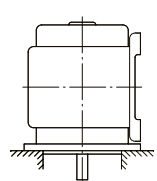
IM V6



IM V18



IM V19



IM V15

DUTY CLASSES

The various operating cycles of driven machines can be classified into nine basic duties, ranging from S1 to S9 separately indicated below. Suitable motors can be offered to match the duty cycles of the driven machines.

CLASSES OF DUTY

The following are the duty types:

Duty	Type	Description	Application
S1	Continuous duty	Operation at constant load maintained for sufficient time to allow the machine to reach thermal equilibrium. These are our standard motors.	Pumps, Blowers, Fan Compressors
S2	Short time duty	Operation at constant load for a given time, less than that required to reach thermal equilibrium, followed by a time de-energized and at rest of sufficient duration to re-establish machine temperatures within 2K of the coolant temperature. The recommended values for the short-time duty are 10, 30, 60 and 90 minutes.	Operation of gates of dams, siren, Capstan, Valve Actuators, Mixers etc.
S3	Intermittent periodic duty	A sequence of identical duty cycles, each including a time of operation at constant load and a time de-energized and at rest. In this duty, the cycle is such that the starting current does not significantly affect the temperature rise. Unless otherwise specified, the duration of the cycle is 10 minutes. The recommended values for the load factor are 15, 25, 40 and 60 percent. These motors also come in crane duty applications and the duty cycle is designated as S3-40%, S3-60%. The no. of starts are also less; either 45 or 60 st/hr.	Valve actuators, Wire drawing machines
S4	Intermittent periodic duty with starting	A sequence of identical duty cycles each consisting of a period of starting, a period of operation at constant load and a rest period, the operating, rest & de-energized being too short to attain thermal equilibrium during one duty cycle. In this duty the stopping of the motor is obtained either by natural deceleration after disconnection of the electricity supply or by means of braking such as mechanical brake which does not cause additional heating of the windings. These are generally suitable for crane duty / lift duty applications. The duty is mentioned as S4-60% CDF, 150 st/hr etc.	Hoists, cranes, lifts
S5	Intermittent periodic duty with starting and braking	A sequence identical duty cycles each consisting of a period of starting, a period of operation at constant load, a period of braking and a rest period. The operating and de-energized periods being too short to attain thermal equilibrium. In this duty braking is rapid and is carried out electrically through electromagnetic DC brakes or by injection of DC voltage in the rotor. Since the braking is done electrically, the braking losses are also added to the starting losses, thus making this duty most stringent and heavy. The duty is mentioned as S5-60% CDF, 300 st/hr etc.	Hoists, Cranes, Rolling Mills
S6	Continuous duty with intermittent periodic loading	A sequence of identical duty cycles each consisting of a period of operation at constant load & a period of operation at no-load, The operation and no-load periods are too short to attain thermal equilibrium during one duty cycle. Unless otherwise specified the duration of the duty cycle is 10 minutes. The recommended values of CDF are 15, 25, 40 and 60 percent. This duty is different from S2 duty, as in S2 Duty there is a period of rest after the load operation. Normal S1 duty motors are suitable to operate on S6 duty provided the load Inertia is maximum equal to motor inertia.	Conveyors, Machine Tools
S7	Continuous duty with starting and braking	A sequence of identical duty cycles each consisting of a period of starting, a period of operation at constant load & a period of electrical braking. There is no rest and de-energized period. This is also a very stringent duty application similar to S5 duty, except in this case there is no rest period.	Machine Tools, Balancing machines, Tapping machines
S8	Continuous duty with periodic speed changes	A sequence of identical duty cycles each consisting of a period of operation at constant load corresponding to a determined speed of rotation, followed immediately by a period of operation at another load corresponding to a different speed of rotation (carried out, for example, by means of change of the number of poles in the case of induction motors), the operating periods being too short to attain equilibrium during one duty cycle. There is no rest and de-energized period. These motors are always Multi-speed Motors for e.g. 4P/2P, 8P/4P, 6P/4P etc. Here the Speed change is done by Pole Changing method. This is achieved by connecting the motor terminals in two different ways to achieve 2 different speeds.	Special applications where the motor is required to run at different speeds and different loads

Duty	Type	Description	Application
S9	Duty with non periodic load and speed variations	A duty in which generally load and speed are varying non-periodically within the permissible operating range. This duty includes frequently applied overloads that may greatly exceed the full loads. For this duty type, suitable load values should be taken as the basis of the overload concept.	Special applications where the motor is required to run at different speeds and different loads

DESIGNATION

A duty type is designated by means of the abbreviation given below. For the duty type S2 the abbreviation is followed an indication of the duration of the duty. For duty type S3 and S6 the abbreviations are followed by an indication of the cyclic duration factor.

Examples: S2 60 minutes • S3 25 percent • S6 40 percent

For the duty types S4 and S5 the abbreviation are followed by the indication of the cyclic duration factor, the number of starts per hour (st/hr) and the factor of inertia (FI)

Examples: S4-25%, 120 st/hr, load factor = 2 (load factor = load inertia/motor inertia)

For the duty type S7 the abbreviation is followed by the indication of the number of cycles per hour and the factor of inertia.

Examples: S7-500 st/hr, load factor = 2

For the duty type S8 and S9 the abbreviation is followed by the indication of the number of duty cycles per hour and the factor of inertia together with the load. In addition, the cyclic duration factor should be indicated for each speed.

Examples: S8 or S9 30 st/hr, load factor = 3

S2/S3 RATED MOTOR OUTPUTS

Standard motors can be used for S2 and S3 duties with increased outputs. However, the starting torque and pullout torque as percentage of full load torque would be reduced. The ratings indicated in the table are with minimum 200% pull out torque.

SPARES

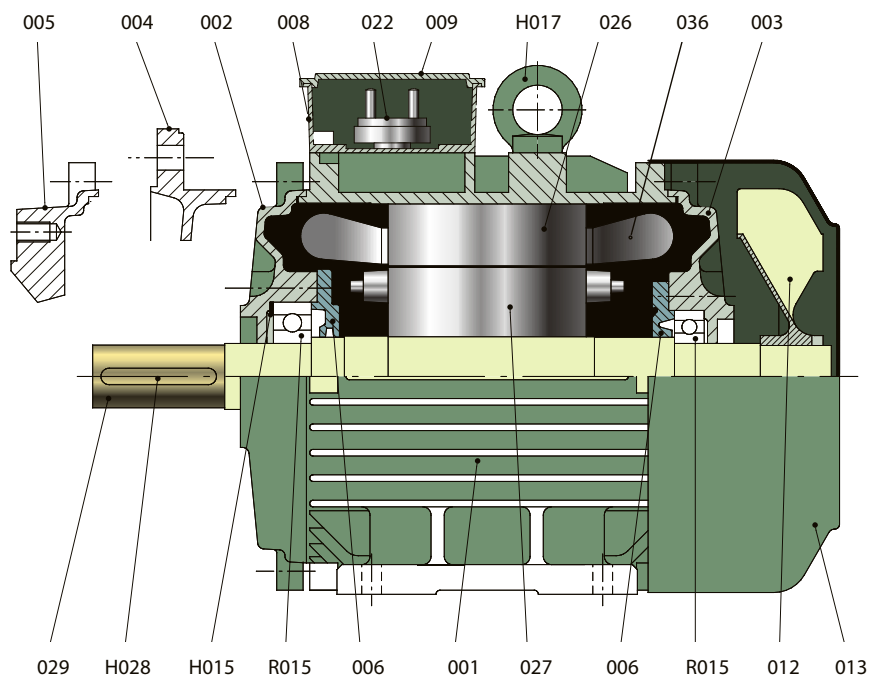


Table of Components

005 - Endshield DE B14	H017 - Eye bolt	H015 - Wavy washer	R015 - Bearing NDE
004 - Endshield DE B5	026 - Stator packet	R015 - Bearing DE	012 - Fan
002 - Endshield DE B3	036 - Stator winding	006 - Bearing cover DE	013 - Fan cover
008 - Terminal box	003 - Endshield NDE	001 - Stator body	
022 - Terminal block	029 - Shaft	027 - Rotor packet	
009 - Terminal box cover	H028 - Shaft key	006 - Bearing cover NDE	

MECHANICAL VIBRATION

Limits of vibration of rotating electrical machines is defined in IS: 12075. This is applicable for machines with shaft height 56mm and higher having a nominal speed from 500 rpm up to and including 3000 rpm.

The measurements are carried out under no load, uncoupled condition in a state of free suspension (suspension by resilient means such as rope, V-belt, spring or freely placed on test bed) or Rigid mounting (for motors with shaft height greater than 400mm).

The measurements are to be carried out with half key in its shaft extension keyway.

Shaft Height (mm)	56 < H ≤ 132		132 < H ≤ 225		225 < H ≤ 400		H > 400	
	500 -1500	> 1500 & up to 3000	500 -1500	> 1500 & up to 3000	500 -1500	> 1500 & up to 3000	500 -1500	> 1500 & up to 3000
rms values of vibration velocity in mm/s for the shaft height H								
N (normal)	1.8	1.8	1.8	2.8	2.8	4.5	2.8	4.5
R (reduced)	0.71	0.71	0.71	1.12	1.8	2.8	-	-
S (special)	0.45	0.45	0.45	0.71	1.12	1.8	-	-

NOISE LEVEL

Permissible limits of noise levels for rotating electrical machines are defined in IS: 12065. Machines are to run at no load, uncoupled condition. Measurements are carried out at a distance of 1m in the horizontal and vertical planes of the machine.

LIMITING MEAN SOUND POWER LEVEL L_w IN dB (A) FOR AIRBORNE NOISE EMITTED BY ROTATING ELECTRICAL MACHINES													
Protective Enclosure		IP 22	IP 44	IP 22	IP 44	IP 22	IP 44	IP 22	IP 44	IP 22	IP 44	IP 22	IP 44
Rating kW (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
630	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

INVERTER DUTY MOTORS

Introduction:

These motors are fed with variable voltage & variable frequency from inverter supply to achieve speed variation required by the process / application & also to gain energy savings related with speeds. Typical VFDs have a very high switching frequencies which results in generating very high dV/dt (up to $1.2kV/\mu s$). Such high pulses impress severe stresses on the windings. If the motors with standard insulation systems are fed from inverters, the repeated pulses of such surge waves reduces the insulation strength & the life of the motor unpredictably. "HINDUSTAN" Inverter duty motors are wound with special insulation system viz. dual coated class H wires, special vacuum pressure impregnation (VPI).

Unless specified, following details are assumed for motors with drives;

- Rated Voltage - 415V
- Rated Frequency - 50Hz
- Ratio V/f - 8.3
- V/f - Constant for frequency in the range 0-50Hz
- V - Constant for frequency > 50Hz

Separate Cooling:

When the motor is run from 5Hz to 50Hz & expected to deliver the rated torque, the motor will draw the rated current. The heating due to the rated current will be equal to the rated heating. At lower speeds, the cooling of the motor is reduced significantly resulting in increased temperature rise. To control this, inverter duty motors are fitted with separate cooling fans. This ensures that the rated cooling is maintained even at reduced speeds.

Insulated Bearing:

It is also suggested to protect motors of 315 frame & above with insulated bearing preferably at non-drive end due to high shaft currents induced, which are detrimental to bearing life. In smaller motors, shaft currents are less which are taken care of by grease film in the bearing.

Operation at higher speeds:

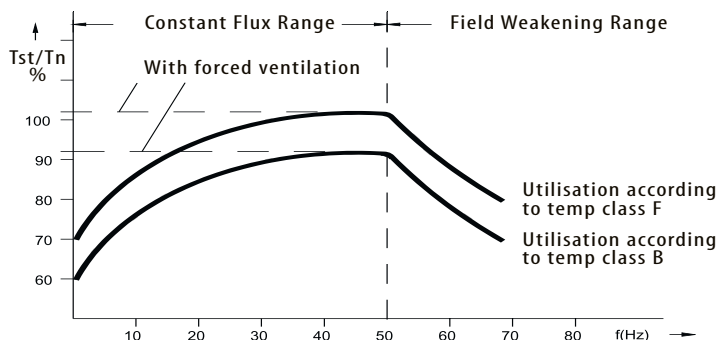
At frequencies above 50Hz, voltage is maintained constant & only the frequency is increased. This results in reduced V/f ratio resulting in weakened magnetic flux in the motor. Following care should be taken in this operation mode;

1. The mechanical speed of the motor should never exceed as below.

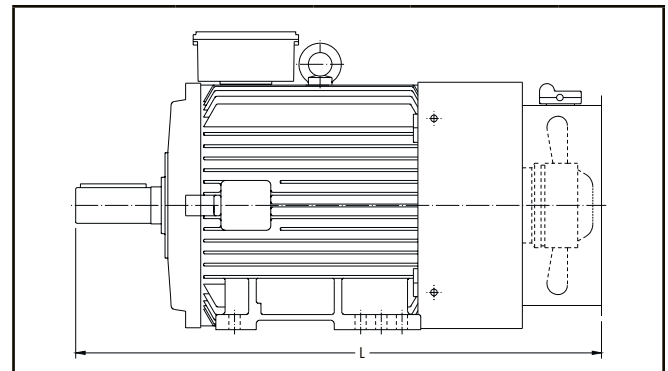
Safe Maximum Speed for Motors				
Frame Size	2P	4P	6P	8P
≤100	5200	3600	2400	1800
112	5200	3600	2400	1800
132	4500	2700	2400	1800
160	4500	2700	2400	1800
180	4500	2700	2400	1800
200	4500	2300	1800	1500
225	3600	2300	1800	1500
250	3600	2300	1800	1500
280	3600	2300	1800	1500
315	3600	2300	1800	1500
355	3600	2300	1800	1500

2. The output torque reduces greatly with increase in frequency. This results in constant power output.

3. The maximum speed & the maximum operating torque possible at any speed should be chosen ensuring the above.



Mechanical Dimensions:



Frame Size	IE2		IE3	
	No. of Poles	L	No. of Poles	L
90S	2,4,6,8	424	2,4,6,8	449
90L	2,8	449	2,4,6,8	480
	4,6	480		
100L	2	523	2,4	523
	4,6,8	489	6,8	489
112M	4,6,8	503	8	503
			4,6	545
132S	2	606	2,6	606
	4,6,8	568	4,8	568
132M	4,6	606	4	606
			6	646
160M	2,4,6,8	704	2,4,6 ³⁾	783
160L		748		
180M	2,4,8	770	2,4,8	770
180L	4,6,8	808	4,6,8	808
200L	2	915	2	932
	4,6,8		4,6(22kW)	
			6,8	915
225M	2	1005	2	1005
225SX/MX	4,6,8	1035	4,6,8	1035
250M	2	1085	2	1085
250MX	4,6,8		4,6,8	
280S/M	2	1195	2	1195
280SX/MX	4,6,8		4,6,8	
315S/M	2	1310	2	1310
315L		1473		1473
315SX/MX	4,6,8	1340	4,6,8	1340
315LX		1503		1503
355S/M/L	2	1647	2	1647
355SX/MX/LX	4,6,8	1717	4,6,8	1717

Note:

- 1) Suffix "X" denotes motors other than 2 pole motors.
- 2) For other dimensions, refer to page nos. 23 & 25.
- 3) For frame 160/8P, refer to dimension of IE2 motors.

INTRODUCTION

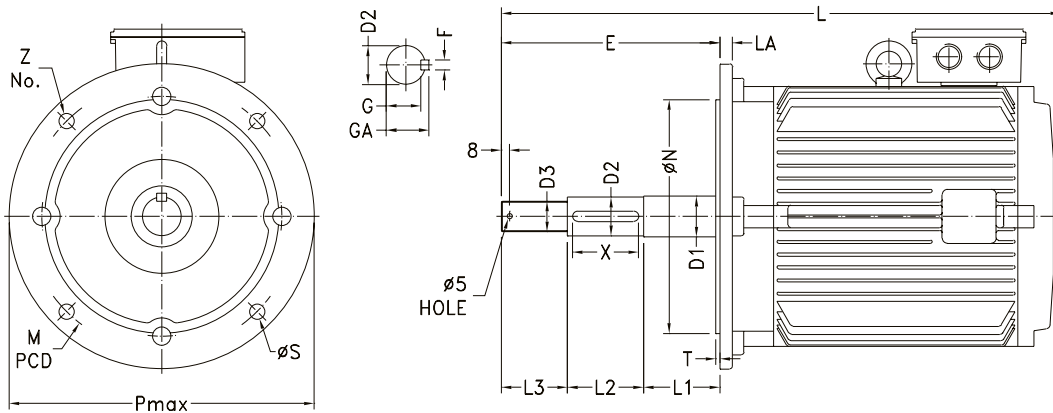
Cooling tower motors are specially designed flange mounted motors in totally enclosed construction to suit air conditioning & refrigeration industries. They are provided with special long shaft construction with external threaded end to directly mount the fan blades. This also helps in the better cooling of the motor. Motors are compact in design & less in weight to facilitate easy maintenance. They are available as standard catalogue designs or as custom built.



RANGE

Power	: 0.37 to 45.0 kW
Polarity	: 4P, 6P, 8P, 10P & 12P
Mounting	: B5 flange mounted
Frame size	: 71 to 315
Voltage	: 415V ± 10% or as required
Frequency	: 50Hz ± 5% or as required
Ambient	: 45°C
Altitude	: up to 1000m above msl
Enclosure	: Totally Enclosed Non Ventilated (TENV)
Protection	: IP55
Ins. class	: Class F with temp. rise limited to class B.
Duty	: S1

MECHANICAL DIMENSIONS



Frame	D1	D2	D3	F	GA	G	L1	L2	L3	E	P max	M PCD	øN	øS	Z No.	T	LA	X	L
71	15	14	M12	5	16	11	50	40		155	160	130	110	10		3.5	9	35	331
80	20	19	M16	6	21.5	15.5	50	55	65	170	200	165	130	12	4	4	10	45	408
90S	25	24		8	27	20													442
90L			30				28	M24	31	24	250	215	180	15	4	11	65	446	
100L	40	38		M30	10	41												33	75
112M			45				42	12	45	37	350	300	250	300	350	400	350		
132S	50	48		M36	14	51.5												42.5	100
160M			60				55	16	59	49	305	550	500	450	600	600	550		
160L	65	60		18	64	53												375	660
180M			75				65	M36	69	58	85	305	550	500	450	600	550		
180L	85	75		20	79.5	67.5												305	550
200L			95				80	22	85	71	120	170	85	305	550	500	450		
225SX	22	85		71	120	170												85	305
225MX			75				65	M36	69	58	85	305	550	500	450	600	550		
250MX	85	75		20	79.5	67.5												85	305
280SX			95				80	22	85	71	120	170	85	305	550	500	450		
280MX	22	85		71	120	170												85	305
315SX			95				80	22	85	71	120	170	85	305	550	500	450		
315MX																			

Note: 1) Suffix "X" denotes motors other than 2 pole motors. 2) All flange dimensions are conforming to IS: 2223.

ELECTRICAL PERFORMANCE - IE2 (Upto 8P) COOLING TOWER MOTOR

Output		Frame Size	Type Designation	Speed (rpm)	Current (A)	Torque (kgm)	Efficiency %			Power Factor			I _{ST} /I _N	T _{ST} /T _N	T _{PO} /T _N	GD ² (kgm ²)
KW	HP						FL	3/4L	1/2L	FL	3/4L	1/2L				
4 POLE																
0.37	0.50	71	2KL2 073-04	1390	1.00	0.26	72.7	72.7	65.0	0.71	0.67	0.58	6.0	1.9	2.3	0.0024
0.75	1.0	80	2KL2 083-04	1415	1.70	0.52	79.6	79.6	75.0	0.77	0.70	0.63	6.0	2.5	3.0	0.0062
1.1	1.5	90S	2KL2 090-04	1430	2.4	0.75	81.4	81.4	80.0	0.78	0.73	0.65	6.0	2.5	3.0	0.0093
1.5	2.0	90L	2KL2 096-04	1430	3.2	1.02	82.8	82.8	81.0	0.79	0.74	0.65	6.0	2.4	2.8	0.0134
6 POLE																
0.75	1.0	90S	2KL2 090-06	935	2.0	0.78	75.9	75.9	73.0	0.69	0.63	0.52	5.0	2.1	2.5	0.0122
1.1	1.5	90L	2KL2 096-06	935	2.7	1.15	78.1	78.1	74.0	0.73	0.68	0.54	5.0	2.1	2.5	0.0176
1.5	2.0	100L	2KL2 106-06	945	3.4	1.55	79.8	79.8	77.0	0.77	0.70	0.56	5.5	2.1	2.5	0.0269
2.2	3.0	112M	2KL2 123-06	950	4.8	2.26	81.8	81.8	78.5	0.78	0.71	0.58	6.0	2.1	2.5	0.0467
3.7	5.0	132S	2KL2 130-06	950	7.6	3.79	84.3	84.3	80.0	0.80	0.74	0.62	6.0	2.2	2.6	0.0991
5.5	7.5	132M	2KL2 133-06	955	11.0	5.61	86.0	86.0	83.0	0.81	0.76	0.62	6.5	2.2	2.6	0.1321
7.5	10.0	160M	2KL2 163-06	970	14.6	7.53	87.2	87.2	84.0	0.82	0.77	0.65	7.0	2.2	2.6	0.2625
9.3	12.5	160L	2KL2 166-06	970	18.0	9.34	88.1	88.1	85.0	0.82	0.77	0.65	7.0	2.1	2.5	0.3440
11.0	15.0	160L	2KL2 167-06	970	21.0	11.05	88.7	88.7	86.0	0.82	0.77	0.65	7.0	2.1	2.5	0.4164
8 POLE																
1.1	1.5	100L	2KL2 107-08	700	3.0	1.53	70.8	70.8	65.0	0.72	0.62	0.48	5.0	1.9	2.1	0.0296
1.5	2.0	112M	2KL2 123-08	710	3.9	2.06	77.0	74.1	73.0	0.69	0.63	0.51	5.5	1.8	2.3	0.0467
2.2	3.0	132S	2KL2 130-08	715	5.3	3.00	77.6	77.6	75.0	0.74	0.66	0.53	5.0	2.2	2.4	0.0826
3.7	5.0	160M	2KL2 163-08	722	8.2	4.99	81.4	81.4	79.5	0.77	0.71	0.59	6.0	2.2	2.4	0.2625
5.5	7.5	160M	2KL2 164-08	720	11.8	7.44	83.8	83.8	82.0	0.77	0.72	0.60	6.0	2.0	2.2	0.2625
7.5	10.0	160L	2KL2 166-08	723	15.8	10.10	85.3	85.3	83.0	0.77	0.72	0.60	6.0	2.0	2.2	0.3440
9.3	12.5	180M	2KL2 183-08	725	19.5	12.49	86.3	86.3	83.5	0.77	0.72	0.60	6.0	2.1	2.3	0.5057
11.0	15.0	180L	2KL2 186-08	727	23.0	14.74	86.9	86.9	84.0	0.77	0.68	0.55	6.0	2.2	2.4	0.5949
15.0	20.0	200L	2KL2 206-08	730	31.0	20.01	88.0	88.0	85.0	0.76	0.68	0.56	6.0	2.0	2.2	1.1136
10 POLE																
1.5	2.0	132S	2HL1 130-10	555	4.5	2.63	74.0	74.0	71.0	0.63	0.55	0.43	4.5	2.0	2.2	0.0826
2.2	3.0	132M	2HL1 133-10	555	5.7	3.86	78.0	78.0	76.0	0.69	0.61	0.49	4.5	2.0	2.2	0.1198
3.7	5.0	160M	2HL1 164-10	560	9.0	6.44	81.0	81.0	79.0	0.71	0.62	0.50	5.0	2.1	2.3	0.2072
5.5	7.5	180M	2HL1 183-10	560	14.0	9.57	82.0	81.5	80.0	0.67	0.58	0.45	5.0	2.0	2.2	0.5057
7.5	10.0	180L	2HL1 186-10	565	18.0	12.93	83.0	82.5	80.0	0.70	0.62	0.48	5.0	2.0	2.2	0.5949
9.3	12.5	180L	2HL1 187-10	570	22.0	15.89	84.0	83.5	81.0	0.70	0.62	0.49	5.0	2.0	2.2	0.6544
11.0	15.0	180L	2HL1 188-10	570	25.0	18.80	85.0	85.0	83.0	0.72	0.64	0.50	5.0	2.0	2.2	0.7734
15.0	20.0	200L	2HL1 206-10	575	34.0	25.41	86.5	86.0	84.0	0.71	0.63	0.52	4.5	2.0	2.2	1.2654
18.5	25.0	225MX	2HL1 223-10	575	43.0	31.34	89.0	89.0	87.0	0.67	0.60	0.50	4.0	2.0	2.2	1.8378
12 POLE																
1.1	1.5	132S	2HL1 130-12	460	3.8	2.33	70.0	68.0	64.0	0.58	0.50	0.40	3.5	1.7	1.9	0.0826
1.5	2.0	132M	2HL1 133-12	460	4.9	3.18	71.0	70.0	66.0	0.60	0.52	0.42	3.5	1.7	1.9	0.1198
2.2	3.0	160M	2HL1 164-12	465	6.0	4.61	79.0	79.0	75.0	0.65	0.54	0.45	4.5	2.0	2.2	0.2072
3.7	5.0	160L	2HL1 166-12	465	10.0	7.75	80.0	80.0	77.0	0.64	0.55	0.42	4.5	2.0	2.2	0.2857
5.5	7.5	180M	2HL1 183-12	470	15.0	11.40	82.0	82.0	80.0	0.62	0.54	0.42	4.5	1.9	2.1	0.5949
7.5	10.0	180L	2HL1 186-12	470	20.0	15.54	82.0	82.0	80.0	0.64	0.55	0.43	4.5	1.9	2.1	0.6544
9.3	12.5	180L	2HL1 187-12	470	23.0	19.27	84.0	84.0	82.0	0.67	0.59	0.46	4.5	1.9	2.1	0.7734
11.0	15.0	200L	2HL1 206-12	485	33.0	22.09	84.5	84.0	81.0	0.55	0.47	0.38	4.5	1.9	2.1	1.2654
15.0	20.0	225MX	2HL1 223-12	480	40.0	30.44	85.5	85.5	83.5	0.61	0.54	0.43	4.0	1.8	2.0	1.8378
18.5	25.0	250MX	2HL1 253-12	485	54.0	37.15	86.5	86.0	82.0	0.55	0.48	0.37	4.0	1.9	2.1	2.5127
22.0	30.0	280SX	2HL1 280-12	485	56.0	44.18	89.0	89.0	87.0	0.61	0.54	0.44	4.0	1.8	2.0	4.8613
30.0	40.0	280MX	2HL1 283-12	485	77.0	60.25	89.3	89.3	87.2	0.61	0.55	0.44	4.0	1.9	2.1	5.8335
37.0	50.0	315SX	2HL1 310-12	488	103.0	73.85	89.3	89.3	86.0	0.56	0.49	0.39	4.0	2.0	2.1	7.2611
45.0	60.0	315MX	2HL1 314-12	488	125.0	89.82	90.0	90.0	87.0	0.56	0.49	0.39	4.0	2.0	2.1	10.3731

- Note : 1) All the above ratings can be offered in flameproof enclosure wherever applicable.
2) All the above ratings can be offered in totally enclosed fan cooled (TEFC) construction as well.

TESTING

The standard test programmes are divided into three parts; routine tests, type tests & optional tests. The routine tests are done to every machine & are included in the price of the machine. Type tests are performed in addition to routine tests normally to one of the machines of a series of similar machine or by request of the customer. Optional tests are additional tests subject to mutual agreement between purchaser & manufacturer.

Contents of test programmes:

Routing tests	Type tests
<ol style="list-style-type: none"> 1. Insulation resistance test 2. Measurement of stator resistance 3. No load test 4. Locked rotor test 5. Reduced voltage running up test (up to 37kW) 6. High voltage test 	<ol style="list-style-type: none"> 1. Dimensions 2. Measurement of stator resistance 3. No load test 4. Reduced voltage running up test (up to 37kW) 5. Locked rotor test 6. Full load test 7. Temperature rise test 8. Momentary overload test 9. Insulation resistance test 10. High voltage test
Optional tests	
<ol style="list-style-type: none"> 1. Vibration severity test 2. Noise level measurement 3. Degree of protection test 4. Overspeed test 5. Temp. rise test at limiting values of voltage and frequency variation 	

SPECIAL CUSTOMISED DESIGNS

Frames	63	71	80	90	100	112	132	160	180	200	225	250	280	315	355
Electrical															
Non std voltage &/or frequency	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Gelcoat on winding overhang	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Vacuum pressure impregnation	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Insulation class H	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Two speed motors	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
High torque motors	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Special performance requirements	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Mechanical															
Second std shaft end	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Non std shaft end	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
B6, B7, B8, V5, V6 mtg.	□	□	□	□	□	□	□	□	□	□	□	□	N	N	N
V1 mtg.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
B5, V3 mtg.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	N
B35, V15 mtg.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
B14, V18, V19 mtg.	■	■	■	■	■	■	■	■	-	-	-	-	-	-	-
B34 mtg.	■	■	■	■	■	■	■	■	-	-	-	-	-	-	-
Non std flange	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Spl. vibration level	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Epoxy paint	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Thermistors, RTD	N	N	■	■	■	■	■	■	■	■	■	■	■	■	■
Anti condensation heater	N	N	N	■	■	■	■	■	■	■	■	■	■	■	■
Regreasing arrangement	N	N	N	N	N	N	N	N	N	□	□	□	□	□	□
Colours other than RAL 6011	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Special shaft material	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Cast iron cooling fan	■	■	■	■	■	■	■	■	■	■	■	■	■	■	□
IP 56 protection	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Special bearings	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Encoder mounting arrangement	N	N	N	■	■	■	■	■	■	■	■	■	■	■	■
Force cooling arrangement	N	N	N	■	■	■	■	■	■	■	■	■	■	■	■
Larger terminal box	■	■	■	■	■	■	■	■	■	■	■	■	■	■	N
Cast iron terminal box	■	■	■	■	■	■	■	■	■	■	■	■	□	□	□
Motors with service factor	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Extremely high & low ambient temp.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

N Cannot be supplied □ No extra cost ■ Extra cost