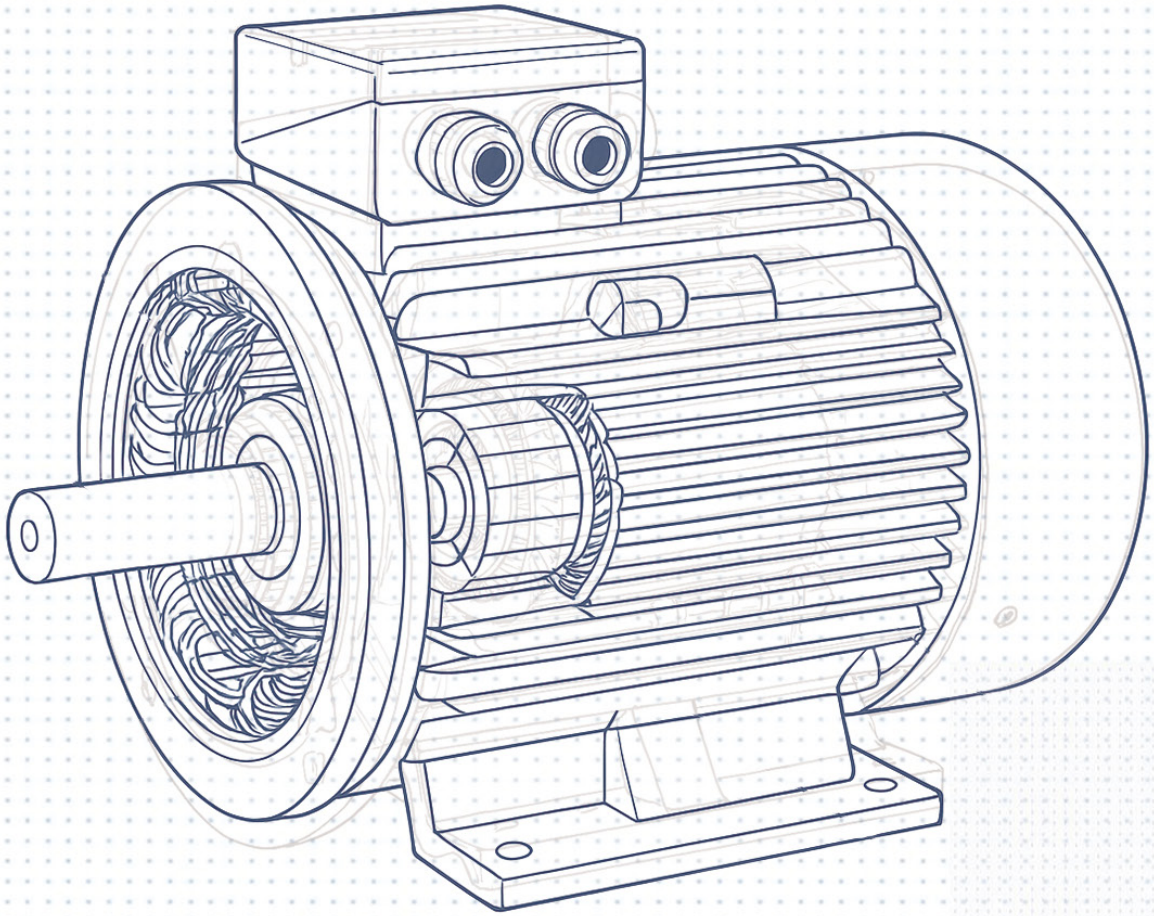
HM3 SERIES MOTORS

Electromote

TECHNICAL INFORMATION CATALOGUE



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Contents

Introduction

This catalogue details the complete range of Electromote HM3 series motors. Standard HM3 motors are three phase squirrel cage TEFC (Totally Enclosed Fan Cooled), with IEC frame sizes from 71 to 400. They combine excellent electrical characteristics with the robust strength of cast iron.

All units are supplied with H Class insulation with temperature rise being limited to less than 80K (unless otherwise marked). This provides the end user with a wide safety margin under general operating conditions.

Additional protection is provided by installation of thermistors in all units from 160 frame upward to continuously protect the winding.

The conservative rating of Electromote type HM3 motors provides additional operation safeguards, ensures long unit life and renders this series inherently suitable for the most arduous mining, industrial or agricultural applications.

EXPLOLABS CERTIFICATION SERVICES (PTY) LTD.

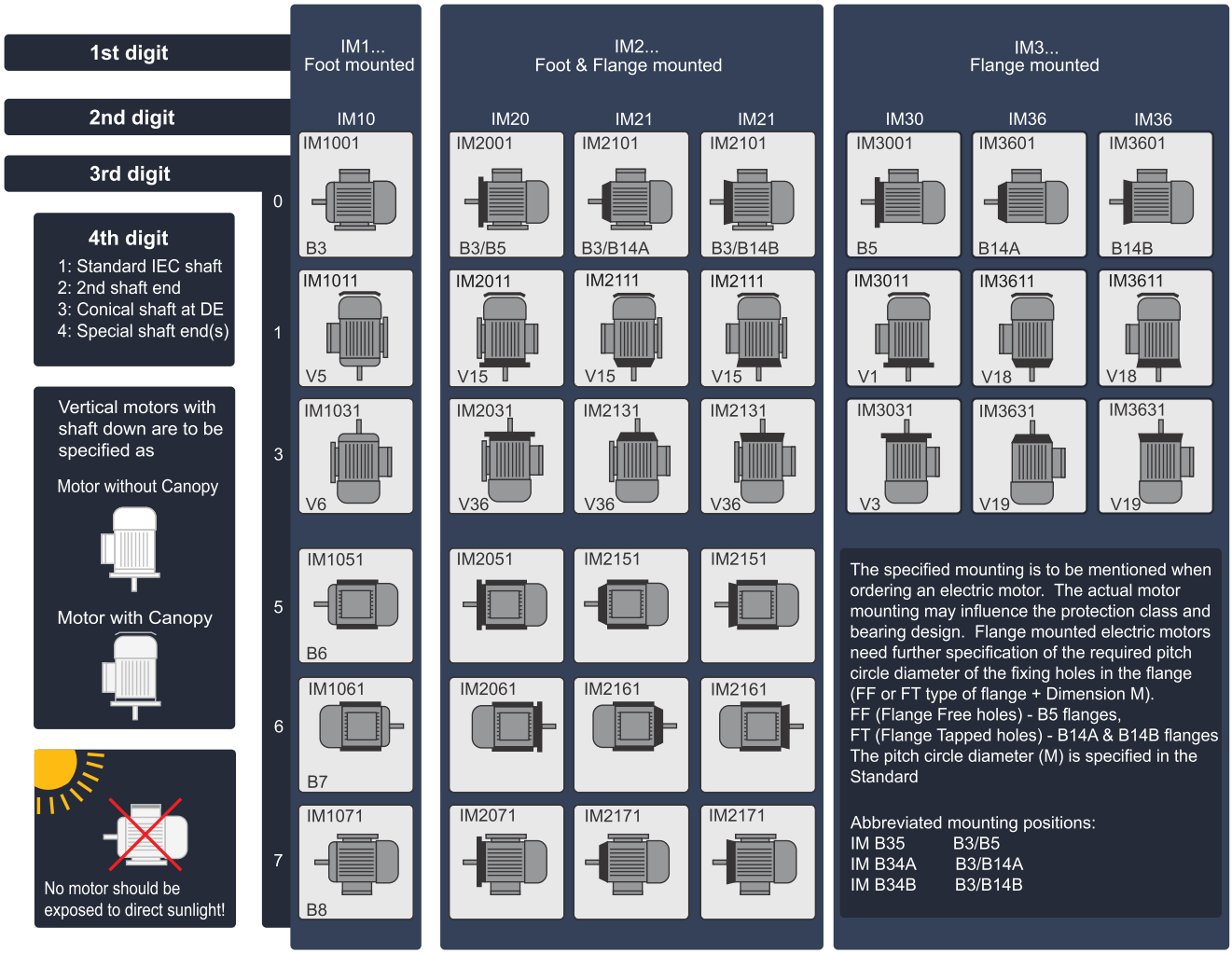
STANDARDS AND SPECIFICATIONS

The main dimensions and rated outputs of Electromote type HM3 series motors conform to IEC 60034 and SANS 1804-1/2.

Mechanical design

MOUNTINGS

Electromote HM3 series motors are available in the mounting arrangements listed in the tables below:



Protection

FOR VERTICALLY MOUNTED MOTORS

Motors to be mounted with the shaft vertically down must be provided with a suitable cover (rain canopy available on request) to ensure foreign particles are prevented from entering the motor

AGAINST SOLAR RADIATION

High solar radiation will result in undue temperature rise. In these circumstances motors should be screened from solar radiation by placement of adequate sunshades which do not inhibit air flow.

DEGREE OF PROTECTION

Standard levels of enclosure protection for all HM3 frame sizes for both motor and terminal box is IP66. Enclosure designations comply with IEC standards.

The enclosure protection required will depend upon the environmental and operational conditions within which the motor is to operate.

IP STANDARDS EXPLANATION

I P	6	6
1-2	3	4

Positions 1 and 2

International protection rating prefix.

Position 3

First characteristic numeral.

Degree of protection of persons against approach to live parts or contact with live moving parts (other than smooth rotating shafts and the like) inside the enclosure, and degree of protection of equipment within the enclosure against ingress of solid foreign bodies.

4 = *Protected against solid object greater than 1.0mm:*
Wires or strips of thickness greater than 1.0mm, solid objects exceeding 1.0mm

5 = *Dust protected:* Ingress of dust is not totally prevented but it does not enter in sufficient quantity to interfere with satisfactory operation of the equipment.

6 = *Dust tight:* No ingress of dust.

Position 4

Second characteristic numeral

4 = *Protected against splashing water:* Water splashed against the enclosure from any direction shall have no harmful effect.

5 = *Protected against water jets:* Water projected by a nozzle against the enclosure from any direct shall have no harmful effect.

6 = *Protected against heavy seas:* Water from heavy seas or water projected in powerful jets (larger nozzle and higher pressure than second numeral 5) shall not enter the enclosure in harmful quantities.

Materials and construction

SHAFT

HM3 series motors have standard shaft extension lengths and are provided with standard key, drilled and tapped hole. Non-standard shaft extensions are available upon special order, with shaft design outlined on a detailed drawing.

Shaft extension run out, concentricity and perpendicularity to face of standard flange mount motors & comply with normal grade tolerance as specified in IEC 60072-1. Precision grade tolerance is available upon special order.

PAINT

Standard HM3 motor color is RAL 7021 Dark Grey, other colors are also available. All castings and steel parts are provided with a prime coat of rust resistant paint.

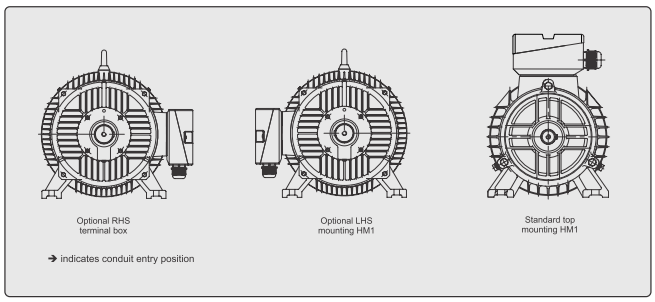
The finishing coat of enamel paint is sufficient for normal conditions, however special paint systems can be provided to accomodate stringent requirements for motors in corrosive environments. Special coatings are needed to resist such substances as acid, salt water and extreme climatic conditions.

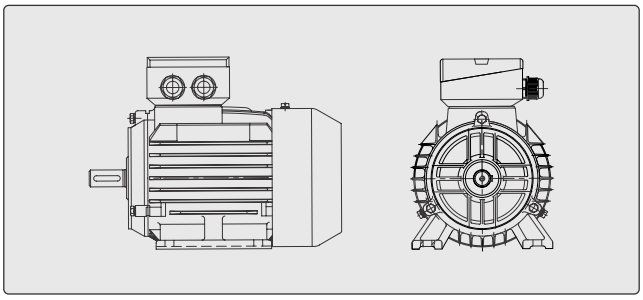
Terminal box

HM3 series motors have a cast iron terminal box with one-piece nitrile rubber barrier gasket between terminal box and motor, and a flat gasket under the terminal box lid. The earthing arrangement is available within the terminal box.

As standard the terminal box is mounted on the top. Motors are also available with terminal boxes on the right-hand side, or left-hand side, when viewed from the drive end.

Conduit entries for motor frame sizes 71 to 355 are provided tapped, with thread details set out below





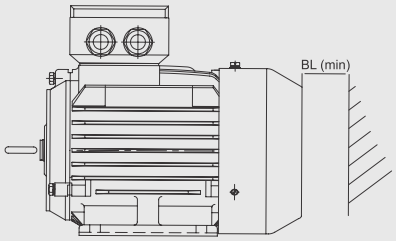
Motor frame	Pitch*	Number of entries	Motor frame	Pitch*	Number of entries
71	M20 x 1.5	2	160M	M25 x 1.5	2
80	M20 x 1.5	2	160L	M25 x 1.5	2
90S	M20 x 1.5	2	180M	M32 x 1.5	2
90L	M20 x 1.5	2	180L	M32 x 1.5	2
100L	M20 x 1.5	2	200	M32 x 1.5	2
112M	M25 x 1.5	2	225	M40 x 1.5	2
132S	M25 x 1.5	2	250	M40 x 1.5	2
132M	M25 x 1.5	2	280	M50 x 1.5	2
			315	M63 x 1.5	2
			355	M63 x 1.5	2

Cooling

HM3 Series motors are totally enclosed fan cooled (TEFC) over a ribbed frame, with free movement of internal air by rotation of rotor blades, which is in accordance with IC0141 of IEC 60034-6.

Cooling air flows from the non drive end to the drive end. The fan is independent of the direction of the motor.

When the motor is installed, care should be taken not to impede the air flow into the motor cowl. As a guide the following minimum dimension BL should be adopted:



Motor frame	Dimension BL [mm]
71-100	15
112-132	30
160-180	40
200-280	50
315-355	65

Bearings

As standard, frame sizes 71 to 280 have high quality deep groove ball bearings. Bearings are prepacked with grease which, under normal operating conditions provide a high degree of operational reliability. Frame sizes 160 to 400 have high quality bearings with vibrolobe re-greasing facility to enable replenishment of the lubricant during operation. The vibrolobe re-greasing facility are fitted to endshields.

The table below sets out the permissible forces that can be applied to the motor shaft. Values assume the occurrence of only radial or axial loading. Point of application of the force is assumed to be at the tip of the shaft. Rotor weights have already been allowed for in the calculation of the radial and axial loads. These loads are applicable for the horizontal mounting only. The values are calculated on on the basis of basic rating life or fatigue life L_{10} of 40,000 hours. Adjusted rating life for specific applications can be calculated if all influencing factors are known.

Greater axial forces can be tolerated if the motors are provided with angular contact ball bearings. Note that in such cases, the axial force must operate in one direction.

HIGH CAPACITY BEARINGS

For frame sizes 160 to 280 in application with increased radial force, cylindrical roller bearings can be substituted for ball bearings at the drive end, according to the accompanying table. When a roller bearing is fitted to the D-end, the N-end ball bearing is locked with a circlip to prevent axial movement. Note that the use of roller bearings is not recommended for 2 pole motors.

Permissible radial force - high capacity

Motor frame	D-end Roller	N-end Ball	Permissible radial force [N]		
			4 pole	6 pole	8 pole
200	NU312	6312	5825	6730	7455
225	NU313	6313	6015	7055	7740
250	NU314	6314	7295	8420	9315
280	NU317	6317	13445	15320	16770

Lubrication

HM3 series motors standard bearings are lubricated with lithium based rolling contact bearing grease suitable for operation within the cooling air temperature range of -20˚ to +55˚. For operation outside this temperature range special lubricants are required.

Special lubricants or additional maintenance may be required in the case of motors exposed to comparatively high degrees of pollution, high humidity, increased or changed bearing loads, or prolonged continuous operation.

Permissible radial and axial forces – standard B3 mounted motors

	Bearing		Permissible radial force [N]				Permissible axial force [N]			
Motor frame	D-end	N-end	2 pole	4 pole	6 pole	8 pole	2 pole	4 pole	6 pole	8 pole
71	6202-2RS	6202-2RS	320	380	-	-	235	320	-	-
80	6204-2RS	6204-2RS	465	595	685	-	395	540	650	-
90	6205-2RS	6205-2RS	490	620	720	-	415	570	685	-
100	6206-2RS	6206-2RS	700	885	1030	1140	570	775	940	1075
112	6306-2RS	6306-2RS	960	1230	1415	1575	785	1080	1305	1515
132	6308-2RS	6308-2RS	1410	1815	2095	2320	1160	1590	1910	2200
160	6309-2RS	6309-2RS	1825	2345	2710	3020	1470	2030	2450	2800
180	6311-2RS	6311-2RS	2495	3200	3765	4200	1985	2700	3265	3755
200	6312	6312	2905	3745	4345	4825	2220	3055	3705	4225
225	6313	6313	3265	4010	4725	5205	2460	3385	4120	4730
250-2	6314	6314	3570	4635	5370	5960	2730	3775	4560	5220
280-2	6314	6314	3455				2605			
280-4,6,8	6317	6317		8170	9360	10270		4560	5580	6365
315-2	6317	6317	3550				2730			
315-4,6,8	NU319	6319		15720	17925	19660		4835	5890	6770
355-2	6319	6319	3760				2875			
355-4,6,8	NU322	6322		22125	25350	27860		6115	7390	8530

Vibration, balancing & noise

VIBRATION

HM3 series motors fall within the limits of vibration severity set out in standard IEC 60034-14 which are listed below. As specified in the standards, these values relate to rotating machinery measured in soft suspension.

Vibration severity limit, level n

Motor frame	Maximum RMS vibration velocity [mm/s]	Motor frame	Maximum RMS vibration velocity [mm/s]
71	1.8	180	2.8
80	1.8	200	2.8
90	1.8	225	2.8
100	1.8	250	3.5
112	1.8	280	3.5
132	1.8	315	3.5
160	2.8	355	3.5

BALANCING

Rotors have been dynamically balanced with a half key. Pulleys or couplings used with motors must also be appropriately balanced.

NOISE

Noise levels for HM3 series motors comply with limits set by IEC 60034-9. HM3 Series sound pressure levels at 1 meter (Data relates to motors tested at no load) are set out in the table below.

Sound pressure level

Output [kW]	Sound pressure level dB(A) at 1 metre			
	3000 r/min	1500 r/min	1000 r/min	750 r/min
0.37	-	61	57	-
0.55	-	61	57	-
0.75	65	61	59	-
1.1	65	61	60	56
1.5	69	61	60	56
2.2	69	63	60	56
3.0	72	63	64	59
4.0	72	67	64	59
5.5	76	68	68	65
7.5	76	71	68	65
11	80	72	70	65
15	80	74	70	67
18.5	80	74	70	67
22	85	74	70	68
30	87	76	73	70
37	87	76	73	70
45	89	76	76	70
55	89	78	76	74
75	91	81	78	76
90	91	81	78	76
110	92	84	79	76
132	92	86	80	77
160	92	87	85	82
200	92	89	85	82
220	95	92	88	-
250	95	92	88	-
250	95	92	88	-
315	95	92	-	-

Electrical design

As standard, HM3 series motors have the following design & operating parameters. Performance data is based on this standard. Any deviation should be examined and performance values altered in accordance with the information provided in this section.

Three phase, 400V / 550V, 50Hz
Ambient cooling air temperature, 40°
Altitude - 1000m
Duty cycle - S1 (continuous)
Rotation - Clockwise viewed from drive end

Connection
- 230V Delta/400V Star (3kW and below)
- 400V Delta/690V Star (4kW and above)
- 550V Delta/950V Star

Voltage and frequency

Standard HM3 series motors are designed for a power supply of three phase 400V or 550V, 50Hz. Motors can be manufactured for any supply between 220V & 1100V & frequencies other than the 50Hz. Standard HM3 Series motors wound for a certain voltage at 50Hz can also operate at other voltages at 50Hz and 60Hz without modification, subject to the changes in their data (see table below)

Motor wound for 50Hz at rated voltage -	Connected to	Data in percentage of values at 50Hz and rated voltage						
		Output	r/min	I_N	I_L/I_N	T_N	T_L/T_N	T_B/T_N
380V	400V 50Hz	100	100	95	110	100	110	110
	380V 60Hz	100	120	98	83	83	70	85
	400V 60Hz	105	120	98	90	87	80	90
	415V 60Hz	110	120	98	95	91	85	93
	440V 60Hz	115	120	100	100	96	95	98
	460V 60Hz	120	120	100	105	100	100	103
400V	380V 50Hz	100	100	105	91	100	90	90
	415V 50Hz	100	100	96	108	100	108	108
	400V 60Hz	100	120	98	83	83	70	85
	415V 60Hz	104	120	98	89	86	75	88
	440V 60Hz	110	120	98	95	91	85	93
	460V 60Hz	115	120	100	100	96	93	98
	480V 60Hz	120	120	100	105	100	100	103
415V	380V 50Hz*	100	100	109	84	100	84	84
	400V 50Hz	100	100	104	93	100	93	93
	440V 50Hz	100	100	94	112	100	112	112
	415V 60Hz	100	120	98	83	83	70	85
	440V 60Hz	105	120	98	90	87	80	90
	460V 60Hz	110	120	98	95	91	85	94
	480V60Hz	115	120	100	100	96	95	98
525V	550V50Hz	100	100	95	110	100	110	110
	525V60Hz	100	120	98	83	83	70	85
	550V60Hz	105	120	98	90	87	80	90
	575V60Hz	110	120	98	95	91	85	94
	600V60Hz	115	120	100	100	96	95	98

* Not applicable for motors with F class temperature rise.

Note: This table is not applicable for hazardous area motors.

[1] I_N = Full load current T_N = Full load torque
I_L/I_N = Locked rotor current/full load current T_L/T_N = Locked rotor torque/full load torque
T_B/T_N = Breakdown torque/full load torque

Standard torque values for alternative supplies are obtainable only with special windings. For these purpose-built motors the performance data is the same as for 415V motors except for the currents which are calculated with the accompanying formula:

$$I_X = \frac{415 \times I_N}{U_X}$$

Where:
I_X = Current
I_N = Full load current at 415 volt
U_X = Design voltage

Temperature and altitude

Rated power specified in the performance data tables apply for standard ambient conditions of 40˚ at 1000m above sea level. Where temperature or altitude differ from the standard, multiplication factors in the table below should be used.

Ambient temperature	Temperature factor	Altitude above sea level	Altitude factor
30°C	1.06	1000m	1.00
35°C	1.03	1500m	0.98
40°C	1.00	2000m	0.94
45°C	0.97	2500m	0.91
50°C	0.93	3000m	0.87
55°C	0.88	3500m	0.82
60°C	0.82	4000m	0.77

$$\text{effective Power} = \text{rated Power} \times \text{temperature factor} \times \text{altitude factor}$$

Example 1

Effective Power required = 15kW
Air temperature = 50°C (factor 0.93)
Altitude = 2500 metres (factor 0.91)

$$\text{Rated power required} = \frac{15}{0.93 \times 0.91} = 17.7\text{kW}$$

The appropriate motor is one with a rated power above the required, being 18.5kW.

Example 2

Rated power = 11kW
Air temperature = 50°C (factor 0.93)
Altitude = 1500 metres (factor 0.98)

$$\text{Effective Power} = 11 \times 0.93 \times 0.98 = 10.0\text{kW}$$

Rotation

For clockwise rotation, viewed from drive end, standard three phase HM3 & HM3T motor terminal marking coincide with the sequence of the phase line conductors.

For counter clock wise rotation, viewed from drive end, two of the line conductors have to be reversed. This is made clear in the accompanying table.

Non-standard HM3L series motors with the terminal box located on the left, viewed from drive end, have a counter-clockwise rotation for corresponding markings. Reversing two of the line conductors will reverse the rotation to clockwise.

Terminal box location (viewed from drive end)	Sequential connection of L1, L2 and L3	Direction of rotation
Right or Top	U1 V1 W1	Clockwise
	V1 U1 W1	Counter-clockwise
Left	V1 U1 W1	Clockwise
	U1 V1 W1	Counter-clockwise

Duty

HM3 series motors are supplied suitable for S1 operation (continuous operation under rated load). When the motor is to operate under any other type of duty the following information should be supplied to determine the correct motor size:

- Type and frequency of switching cycles as per duty factors S3 to S7 and duty cycle factor.
- Load torque variation during motor acceleration and braking (in graphical form).
- Moment of inertia of the load on the motor shaft.
- Type of braking (eg mechanical, electrical through phase reversal or DC injection).

PERMISSIBLE OUTPUT

Apply the factors in the accompanying table to the output rating for motors with duty cycles that are not continuous.

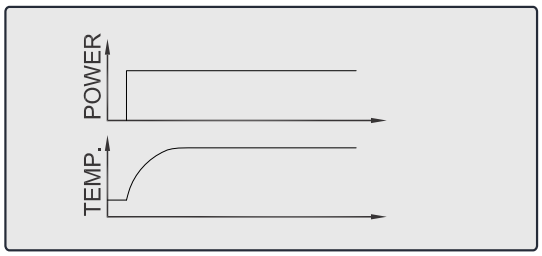
		Duty cycle factor		
	Poles	For frames 80 to 132	For frames 160 to 250	For frames 280 to 355
short-time duty, s2				
30 min	2	1.05	1.20	1.20
	4 to 8	1.10	1.20	1.20
60 min	2 to 8	1.00	1.10	1.10
Intermittent duty, s3				
15%	2	1.15	1.45	1.40
	4 to 8	1.40	1.40	1.40
25%	2	1.10	1.30	1.30
	4 to 8	1.30	1.25	1.30
40%	2	1.10	1.10	1.20
	4 to 8	1.20	1.08	1.20
60%	2	1.05	1.07	1.10
	4 to 8	1.10	1.05	1.10

For other duties (S4, S5, S6 and S7) contact Electromote for appropriate duty cycle factors.

DUTY CYCLES

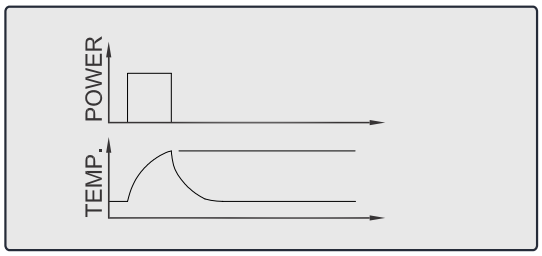
S1 Continuous duty

Operation at constant load of sufficient duration for thermal equilibrium to be reached.



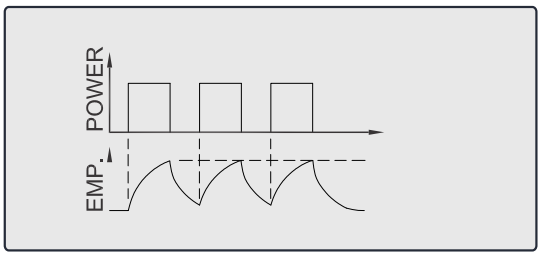
S2 Short –time duty

Operation at constant load during a given time, less than that required to reach thermal equilibrium, followed by a rest (de-energized) period of sufficient duration to allow machine temperatures to reduce to within 2K of the rated inlet coolant temperature.



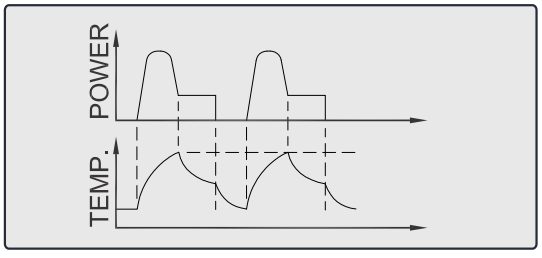
S3 Intermittent periodic duty with insignificant starting time

A sequence of identical duty cycles where each consists of a period of operating at constant load and a period at rest. The cycle is such that the starting current does not significantly affect the temperature rise.



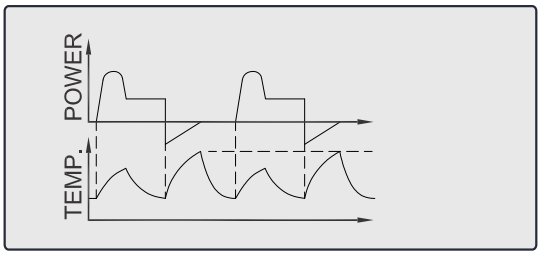
S4 Intermittent periodic duty with significant starting time

Sequence of identical duty cycles where each cycle consists of a significant period of starting, a period of operation at full load and a period of rest.



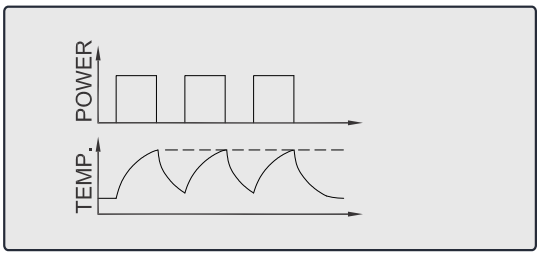
S5 Intermittent periodic duty with influence of running up period and electric braking

As S4, but with each cycle including a period of rapid electric braking.



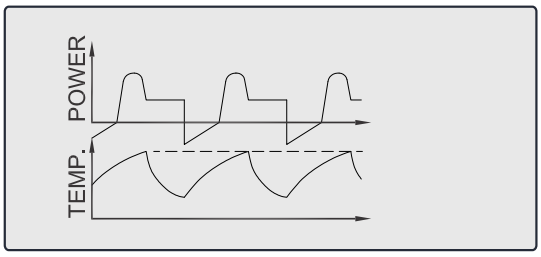
S6 Continuous periodic duty

A sequence of identical duty cycles, each cycle consisting of a period of operation at no-load. There is no rest or de-energized period.



S7 Continuous periodic duty with starting and electric braking

As S6, with each cycle including a period of starting and a period of electric braking.



Connection

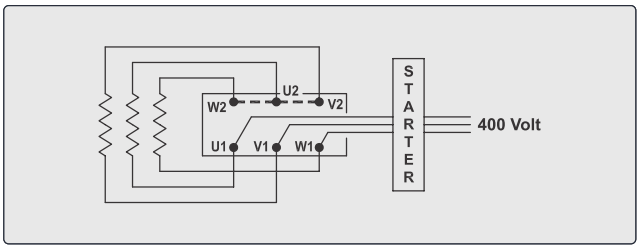
A motor's rated voltage must agree with the power supply line-to-line voltage. Care must therefore be taken to ensure the correct connection to the motor terminals.

INTERNAL CONNECTIONS, VOLTAGES & VF DRIVE SELECTION

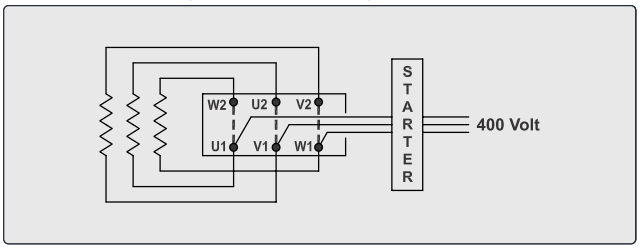
Standard terminal connections for motors 3.0kW and below is 230V delta / 400V star. These motors are designs for 400V. Direct On Line (D.O.L) starting, when connected in the star configuration. They are also suitable for operation with 230V three phase variable frequency drives, when connected in the delta configuration.

Standard terminal connections for motors 4.0kW and above is 400V delta/ 690V star. These motors are designed for 400V Direct On Line (D.O.L) starting, when connected in the delta configuration. They are also suitable for operation with 400V three phase phase variable frequency drives. Alternatively, they can be operated D.O.L in the star configuration from a 690V variable frequency frequency drive. In this case the drive must be supplied with an output reactor to protect the winding insulation. These size motors are also suitable for 400V star-delta starting as described below:

Motor connected for D.O.L starting with bridges in place for star connection (3.0kW and below)



Motor connected for D.O.L starting with bridges in place for delta connection (4.0kW and above)



Starting

All of the following starter options are available through Electromote Drives division, and are best supplied together with the motor.

D.O.L STARTERS

When an electric motor is started by direct connection to the power supply (D.O.L), it draws a high current called the 'starting current' which is approximately equal in magnitude to the locked rotor current I_L. As listed in the performance data, locked rotor current can be up to 8 times the rated current I_N of the motor. In circumstances where the motor starts under no load or where high starting torque is not required, it is preferable to reduce the starting current by one of the following means.

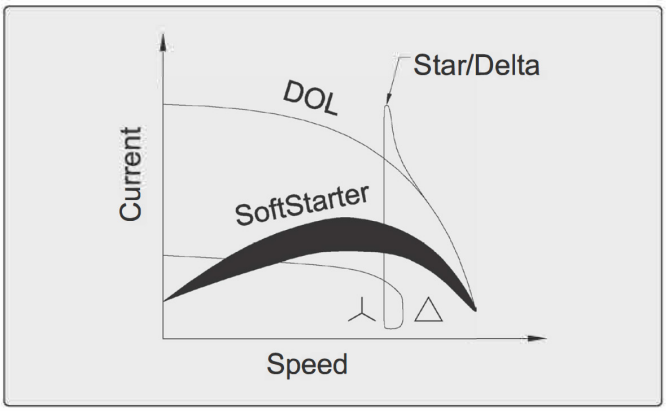
STAR - DELTA STARTING

HM3 series motors 4.0kW and above are suitable for the star-delta starting method. Through the use of a star-delta starter, the motor terminals are connected in the star configuration during starting, and reconnected to the delta configuration when running.

The benefits of this starting method are a significantly lower starting current, to a value about 1/3 of the D.O.L starting current, and a corresponding starting torque also reduced to about 1/3 of its D.O.L value. It should be noted that a second current surge occurs on changeover to the delta connection. The level of this surge will depend on the speed the motor has reached at the moment of changeover.

ELECTRONIC SOFT STARTERS

Through the use of an electronic soft starter, which controls such parameters as current and voltage, the starting sequence can be totally controlled. The starter can be programmed to limit the amount of starting current. By limiting the rate of the current increase the start up time is extended. This starting method is particularly suitable for centrifugal loads (fans and pumps)



VWF DRIVES

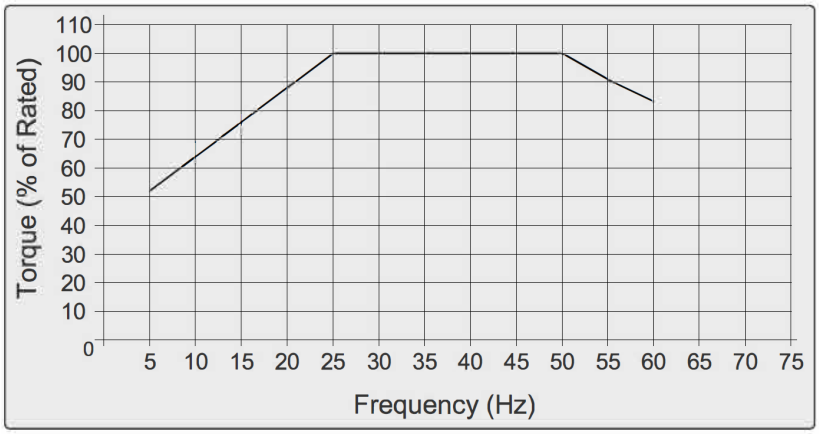
The HM3 series motor performs excellently without cogging at low speed when operating in conjunction with our Electrodrive WVF (Variable Voltage Variable Frequency) drive. Electrodrive VSD's drives are primarily recognized for their ability to manipulate power from a constant 3 phase 50/60Hz supply converting it to variable voltage and variable frequency power. This enables the speed of the motor to be matched to its load in a flexible and energy efficient manner. The only way of producing starting torque equal with full load current is by using Electrodrive drives. The functionality flexible Electrodrive drive is also commonly used to reduce energy consumption on fans, pumps and compressors, and offers a simple and repeatable method of changing speeds or flow rates.

For operation below 25Hz motor cooling fan efficiency drops significantly. Hence, in constant torque applications, a separately driven cooling fan should be fitted to provide sufficient cooling of the motor.

For operation between 25Hz and 50Hz speed range the motor is capable of delivering full rated torque with it standard fan.

For operation above 50Hz, all HM3 series motors are capable of delivering constant rated power up to 60Hz. However, most of these motors are suitable to run and deliver constant power at much higher frequencies than 60Hz to a maximum of 1 00Hz. In the case of applications between 60Hz and 1 00Hz please contact Electromote for advice on suitability.

The HM3 series range of motors will operate without modifications on WVF drives however under certain conditions additional features should be considered (see EDM Concerns). The graph below shows HM series motors loadability with a frequency converter.



EDM CONCERNS

Capacitive voltages in the rotor can be generated due to an affect caused by harmonics in the waveform causing voltage discharge to earth through the bearings. This discharge results in etching of the bearing running surfaces. This effect is known as Electrical Discharge Machining (EDM). It can be controlled with the fitment of Electromote Earthrings.

To further reduce the effect of EDM, an insulated non-drive bearing can be used. Electromote recommends the use of Earthrings for all motors 250 frame and above

Insulation

Standard HM3 series motors are wound with H class insulation and winding designs limit the temperature rise to 80K (unless otherwise noted) for which B Class insulation would normally be sufficient. The use of H Class insulation provides an additional safety margin of 45K, as shown in the accompanying table, together with an extended operating life.

	Insulation class		
	B	F	H
Max. permissible winding temp. (°C)	130	155	180
Less ambient temp. (°C)	-40	-40	-40
Less hotspot allowance (K)	-10	-10	-15
Equals max. permissible temp.rise (K)	80	105	125
Less max. design temp. rise (K)	-80	-80	-80
Equals min. safety margin (K)	-	25	45

Due to their conservative design many sizes in the HM3 series range of motors have temperature rises considerably less than 80K and therefore provide even greater safety margins.

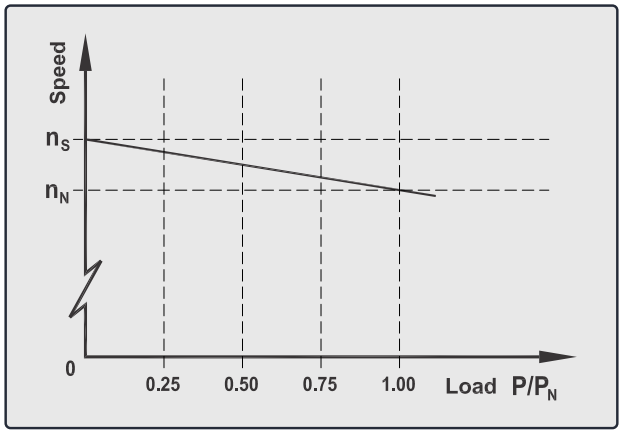
Thermal protection

Motors can be protected against excessive temperature rise by inserting, at various positions within the windings, thermal probes which can either give a warning signal or cut off the supply to the motor in the event of a temperature abnormality.

The units fitted to HM3 series motors, frame sizes 160 and above, are fitted with PTC thermistors. These thermovariable resistors, with positive temperature co-efficient, are fitted one per phase, series connected and are terminated in a terminal strip located in the terminal box. Trip temperature is 140° for HM3 series. Additional 130° thermistors can be fitted as an option for alarm protection.

Speed at partial loads

The relationship between motor speed and degree of loading on an HM3 series motor is approximately linear up to the rated load. This is expressed graphically in the accompanying drawing.



Where:

n_N = full load speed

n_S = synchronous speed

P/P_N = partial load factor

Current at partial loads

Current at partial loads can be calculated using the following formula:

$$I_X = \frac{Pout_X}{\sqrt{3} \times U_N \times \cos\varphi_X \times \eta_X} \times 10^5$$

Where:

I_X = partial load current (amps)

$Pout_X$ = partial load (kW)

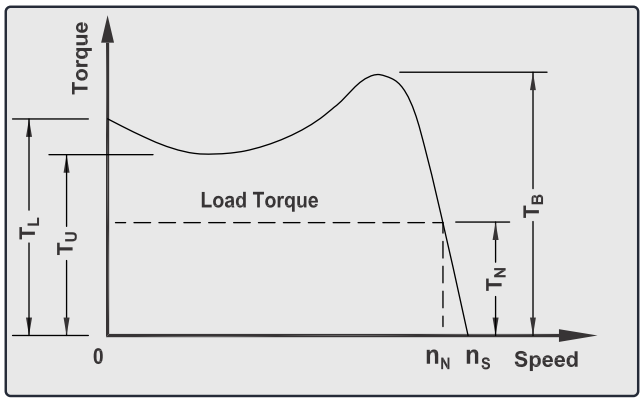
U_N = rated voltage

$\cos\varphi_X$ = partial load power factor

η_X = partial load efficiency (%)

Torque characteristics

Typical characteristics of torque behavior relative to speed are shown in the torque speed curve example below



Where:

T_N = full load torque

T_L = locked rotor torque

T_U = pull-up torque

T_B = break down torque

n_N = full load speed

n_S = synchronous speed

HM3 series motors all exceed the minimum starting torque requirements for Design N (Normal torque) as specified in IEC60034-12, and in most cases meet the requirements of Design H (High torque)

Rated torque can be calculated with the following formula:

$$T_N = \frac{9550 \times P_N}{n_N}$$

Where:

T_N = full load torque (Nm)

P_N = full load output power (kW)

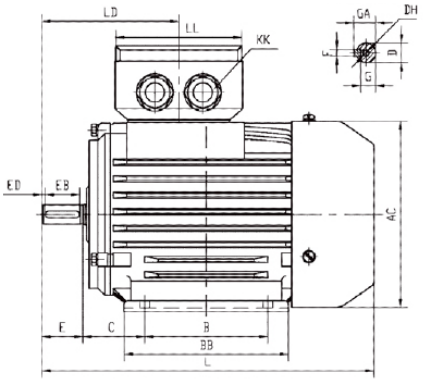
n_N = full load speed (r/min)

Basic Motor Dimensions

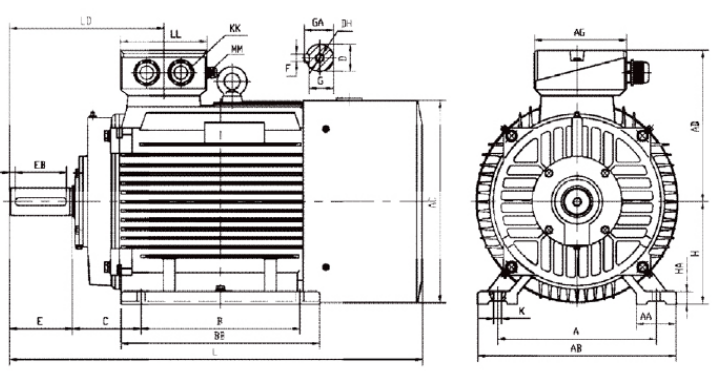
Mounting & Overall Dimensions - Frame 63-355

Type	Pole	A	AA	AB	AC	AD	AG	B	B1	B2	BB	C	D
63	2,4,6	100	30	130	120	119	94	80			110	40	11
71	2,4,6	112	32	144	136	125	94	90			120	45	14
80	2,4,6,8	125	34	160	155,4	137	94	100			130	50	19
90S	2,4,6,8	140	36	180	175,4	150	104	100			140	56	24
90L	2,4,6,8	140	36	180	175,4	150	104	125			165	56	24
100L	2,4,6,8	160	40	200	195,4	164	104	140			176	63	28
112M	2,4,6,8	190	45	226	219,4	192	127	140			180	70	28
132S	2,4,6,8	216	55	262	258,4	212	127	140			186	89	38
132M	4,6,8	216	55	262	258,4	212	127	178			224	89	38
160M	2,4,6,8	254	65	314	314	252	162	210			260	108	42
160L	2,4,6,8	254	65	314	314	252	162	254			304	108	42
180M	2,4,8	279	70	349	355	268	162	241			311	121	48
180L	4,6,8	279	70	349	355	268	162	279			349	121	48
200L	2,4,6,8	318	70	388	397	303	215	305			369	133	55
225S/M	2	356	75	431	446	326	215		286	311	393	149	55
225S/M	4,6,8	356	75	431	446	326	215		286	311	393	149	60
250S/M	2	406	80	484	485	361	243		311	349	445	168	60
250S/M	4,6,8	406	80	484	485	361	243		311	349	445	168	70
280S/M	2	457	85	542	547	390	243		368	419	485	190	65
280S/M	4,6,8	457	85	542	547	390	243		368	419	536	190	80
315S/M	2	508	120	628	620	555	360		406	457	680	216	65
315S/M	2	508	120	628	620	555	360		406	457	680	216	70
315S/M	4,6,8	508	120	628	620	555	360		406	457	680	216	85
315S/M		4	508	120	628	620	555		360	406	457	680	216
355M/L	2	610	116	726	698	642	380		560	630	750	254	90
355M/L	2	610	116	726	698	642	380		560	630	750	254	90
355M/L	4,6,8	610	116	726	698	642	380		560	630	750	254	100

H63-132



H160-200

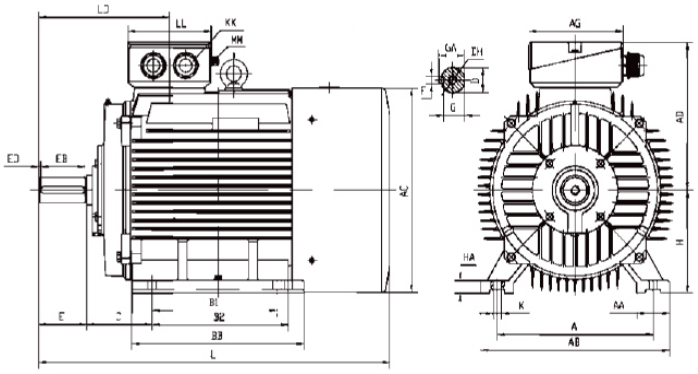


Basic Motor Dimensions

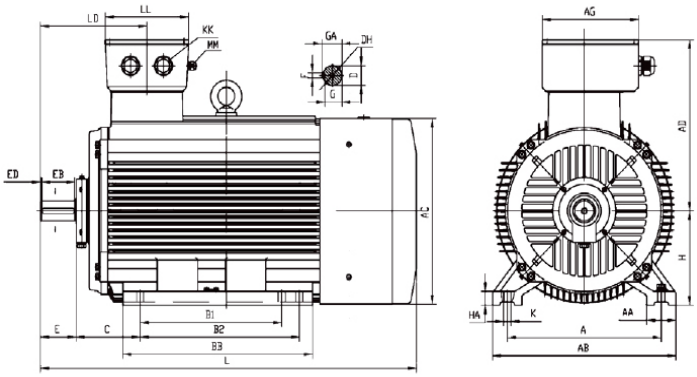
Mounting & Overall Dimensions - Frame 63-355

Type	Pole	DH	E	EB	ED	F	G	GA	H	HA	K	KK	MM	L	LD
63	2,4,6	M4X12	23	16	3,5	4	8,5	12,5	63	8	4-Φ7	2-M20X1.5		217	80,5
71	2,4,6	M5X12	30	25	2,5	4	11	16	71	8	4-Φ7	2-M20X1.5		243	100
80	2,4,6,8	M6X16	40	30	5	10	15,5	21,5	80	10	4-Φ10	2-M20X1.5		284	112
90S	2,4,6,8	M8X19	50	40	5	10	20	27	90	12	4-Φ10	2-M20X1.5		318	130
90L	2,4,6,8	M8X19	50	40	5	10	20	27	90	12	4-Φ10	2-M20X1.5		343	130
100L	2,4,6,8	M10X22	60	50	5	10	24	31	100	14	4-Φ12	2-M20X1.5		370	138
112M	2,4,6,8	M10X22	60	50	5	10	24	31	112	15	4-Φ12	2-M25X1.5		394	147
132S	2,4,6,8	M12X28	80	65	7,5	10	33	41	132	18	4-Φ12	2-M25X1.5		456	172
132M	4,6,8	M12X28	80	65	7,5	10	33	41	132	18	4-Φ12	2-M25X1.5		494	172
160M	2,4,6,8	M16X36	110	90	10	4	37	45	160	8	4-Φ14.5	2-M25X1.5	1-M16X1.5	608	256
160L	2,4,6,8	M16X36	110	90	10	4	37	45	160	8	4-Φ14.5	2-M25X1.5		652	256
180M	2,4,8	M16X36	110	90	10	10	42,5	51,5	180	10	4-Φ14.5	2-M32X1.5	1-M16X1.5	688	271
180L	4,6,8	M16X36	110	90	10	10	42,5	51,5	180	12	4-Φ14.5	2-M32X1.5	1-M16X1.5	726	271
200L	2,4,6,8	M20X42	110	100	5	10	49	59	200	12	4-Φ18.5	2-M32X1.5	1-M16X1.5	771	296
225S/M	2	M20X42	100	100	5	16	49	59	225	28	6-Φ18.5	2-M40X1.5	1-M16X1.5	802	299
225S/M	4,6,8	M20X42	140	125	7,5	18	53	64	225	28	6-Φ18.5	2-M40X1.5	1-M16X1.5	832	329
250S/M	2	M20X42	140	125	7,5	18	53	64	250	30	6-Φ24	2-M40X1.5	1-M25X1.5	910	347
250S/M	4,6,8	M20X42	140	125	7,5	20	62,5	74,5	250	30	6-Φ24	2-M40X1.5	1-M25X1.5	910	347
280S/M	2	M20X42	140	125	7,5	18	58	69	280	35	6-Φ24	2-M50X1.5	1-M25X1.5	1033	355,5
280S/M	4,6,8	M20X42	170	160	5	22	71	85	280	35	6-Φ24	2-M50X1.5	1-M25X1.5	1063	355,5
315S/M	2	M20X42	140	125	7,5	18	58	69	315	45	6-Φ28	2-M63X1.5	1-M25X1.5	1288	397
315S/M	2	M20X42	140	125	7,5	20	62,5	74,5	315	45	6-Φ28	2-M63X1.5	1-M25X1.5	1288	397
315S/M	4,6,8	M20X42	170	160	5	22	76	90	315	45	6-Φ28	2-M63X1.5	1-M25X1.5	1318	427
315S/M		90M20X42	170	160	5	25	81	95	315	45	6-Φ28	2-M63X1.5	1-M25X1.5	1318	427
355M/L	2	M24X50	140	130	5	25	81	95	355	52	6-Φ28	2-M63X1.5	1-M25X1.5	1486	414
355M/L	2	M24X50	170	160	5	25	81	95	355	52	6-Φ28	2-M63X1.5	1-M25X1.5	1516	444
355M/L	4,6,8	M24X56	210	180	15	28	90	106	355	52	6-Φ28	2-M63X1.5	1-M25X1.5	1556	484

H225-315



H355

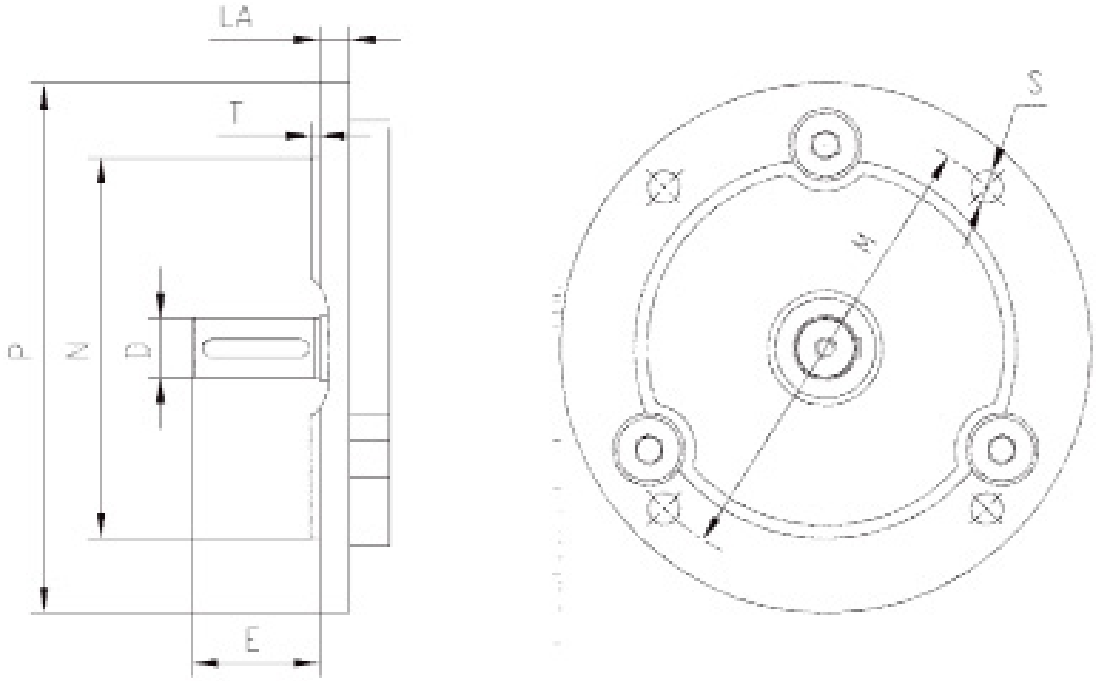


Flange Dimensions

B5

TYPE	M PCD	N SPIGOT	P DIA	S HOLE DIA	T SPIGOT LENGTH	LA FLANGE THICKNESS
63	115	95	140	4-Φ10	3	10
71	130	110	160	4-Φ10	3,5	10
80	165	130	200	4-Φ12	3,5	12
90	165	130	200	4-Φ12	3,5	12
100	215	180	250	4-Φ14.5	4	13
112	215	180	250	4-Φ14.5	4	14
132	265	230	300	4-Φ14.5	5	14
160	300	250	350	4-Φ18.5	5	15
180	300	250	350	4-Φ18.5	5	15
200	350	300	400	4-Φ18.5	5	17
225	400	350	450	8-Φ18.5	5	20
250	500	450	550	8-Φ18.5	5	22
280	500	450	550	8-Φ18.5	5	22
315	600	550	660	8-Φ24	6	22
355	740	680	800	8-Φ24	6	25

B5



Flange Dimensions

B14A

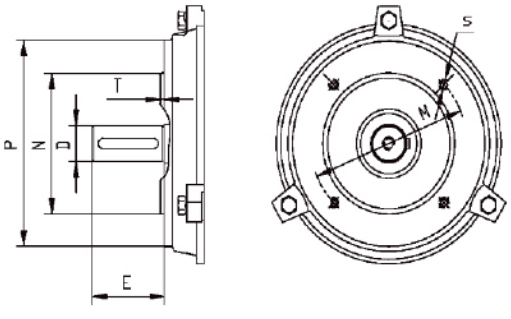
TYPE	M PCD	N SPIGOT	P DIA	S HOLE DIA	T SPIGOT LENGTH
63	75	60	90	4-M5	2,5
71	85	70	105	4-M6	2,5
80	100	80	120	4-M6	3
90	115	95	140	4-M8	3
100	130	110	160	4-M8	3,5
112	130	110	160	4-M8	3,5
132	165	130	200	4-M10	3,5
160	215	180	250	4-M12	4

Flange Dimensions

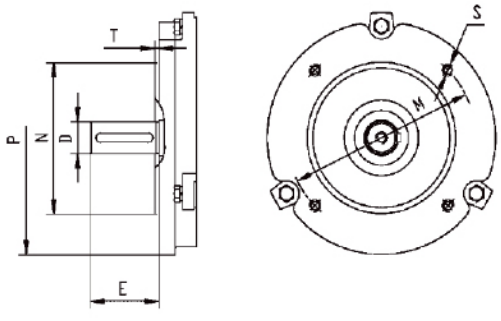
B14B

TYPE	M PCD	N SPIGOT	P DIA	S HOLE DIA	T SPIGOT LENGTH
63	100	80	120	4-M6	3
71	115	95	140	4-M8	3
80	130	110	160	4-M8	3,5
90	130	110	160	4-M8	3,5
100	165	130	200	4-M10	3,5
112	165	130	200	4-M10	3,5
132	215	180	250	4-M12	4
160	265	230	300	4-M12	4

14A



14B



Cast Iron Three Phase Premium IE3 Motors Class H Insulation IP66
2 POLE

Frame	kW	Speed 50Hz	Shaft	Rated Current 50Hz 400V	Rated Current 50Hz 550V	Power Factor cos φ	Efficiency % at 50Hz	Rated Torque Nm	Starting Current	Ratio Starting Torque	B-down Torque	Weight kg
80M	0.75	2880	Ø19	1.64	1.19	0.82	80.7	2.49	7.0	2.3	2.3	18.1
80M	1.1	2880	Ø19	2.34	1.70	0.82	82.7	3.65	7.3	2.2	2.3	19.5
90S	1.5	2895	Ø24	3.10	2.25	0.83	84.2	4.95	7.6	2.2	2.3	23.3
90L	2.2	2895	Ø24	4.40	3.20	0.84	85.9	7.26	7.6	2.2	2.3	27.1
100L	3	2895	Ø28	5.85	4.25	0.85	87.1	9.90	7.8	2.2	2.3	38.8
112M	4	2905	Ø28	7.53	5.48	0.87	88.1	13.15	8.3	2.2	2.3	48.3
132S	5.5	2930	Ø38	10.11	7.36	0.88	89.2	17.93	8.3	2.0	2.3	55.1
132S	7.5	2930	Ø38	13.65	9.93	0.88	90.1	24.45	7.9	2.0	2.3	69.2
160M	11	2945	Ø42	19.78	14.39	0.88	91.2	35.67	8.1	2.0	2.3	113
160M	15	2945	Ø42	26.47	19.25	0.89	91.9	48.64	8.1	2.0	2.3	123
160L	18.5	2940	Ø42	32.47	23.61	0.89	92.4	60.09	8.2	2.0	2.3	142
180M	22	2955	Ø48	38.49	27.99	0.89	92.7	71.10	8.2	2.0	2.3	182
200L	30	2960	Ø55	52.15	37.93	0.89	93.3	96.79	7.6	2.0	2.3	246
200L	37	2960	Ø55	64.40	46.57	0.89	93.7	119.38	7.6	2.0	2.3	265
225SM	45	2965	Ø55	77.64	56.49	0.89	94.0	144.94	7.7	2.0	2.3	323
250SM	55	2970	Ø60	93.54	68.03	0.90	94.3	176.85	7.7	2.0	2.3	413
250SM	75	2975	Ø60	127.01	92.37	0.90	94.7	240.76	7.1	1.8	2.3	546
280SM	90	2975	Ø65	151.93	110.50	0.90	95.0	288.91	7.1	1.8	2.3	569
315SM	110	2978	Ø65	185.31	134.77	0.90	95.2	352.75	7.1	1.8	2.3	897
315SM	132	2978	Ø65	221.90	161.38	0.90	95.4	423.30	7.1	1.8	2.3	1029
315SM	160	2980	Ø65	268.41	195.21	0.90	95.6	512.75	7.2	1.8	2.3	1067
315SM	185	2980	Ø70	306.62	222.76	0.91	95.7	592.90	7.2	1.8	2.2	1300
315SM	200	2980	Ø70	331.13	240.82	0.91	95.8	640.94	7.2	1.8	2.2	1194
315SM	220	2980	Ø70	364.25	267.29	0.91	95.8	705.00	7.2	1.8	2.2	1300
355ML	250	2982	Ø90	413.92	301.03	0.91	95.8	800.60	7.2	1.6	2.2	1685
355ML	280	2982	Ø90	463.59	337.15	0.91	95.8	898.82	7.2	1.6	2.2	1790
355ML	300	2982	Ø90	496.70	357.31	0.91	95.8	960.80	7.2	1.6	2.2	1808
355ML	315	2982	Ø90	521.53	379.30	0.91	95.8	1009.00	7.2	1.6	2.2	1734
355ML	355	2975	Ø90	587.76	427.46	0.91	95.8	1140.00	6.5	1.3	2.5	1828
355ML	400	2975	Ø90	662.27	492.47	0.91	95.8	1284.00	6.5	1.3	2.5	2300
400L	400	2982	Ø100	655.07	487.00	0.92	95.8	1281.00	6.5	1.3	2.5	2950
355ML	450	2975	Ø90	745.05	554.03	0.91	95.8	1445.00	6.5	1.3	2.5	2470
400L	450	2982	Ø100	736.95	547.30	0.92	95.8	1441.00	6.5	1.3	2.5	3200
355L	500	2978	Ø90	846.44	615.59	0.89	95.8	1603.43	7.0	1.4	2.0	2580
400L	500	2982	Ø100	818.83	606.85	0.92	95.8	1601.00	6.5	1.3	2.5	3340

Cast Iron Three Phase Premium IE3 Motors Class H Insulation IP66
4 POLE

Frame	kW	Speed 50Hz	Shaft	Rated Current 50Hz 400V	Rated Current 50Hz 550V	Power Factor cos φ	Efficiency % at 50Hz	Rated Torque Nm	Starting Current	Ratio Starting Torque	B-down Torque	Weight kg
80M	0.75	1420	Ø19	1.75	1.27	0.75	82.5	5.04	6.6	2.3	2.3	18.4
90S	1.1	1445	Ø24	2.48	1,81	0.76	84.1	7.27	6.8	2.3	2.3	24.2
90L	1.5	1445	Ø24	3.30	2.40	0.77	85.3	9.91	7.0	2.3	2.3	29.7
100L	2.2	1435	Ø28	4.52	3.29	0.81	86.7	14.64	7.6	2.3	2.3	41.5
100L	3	1435	Ø28	6.02	4.38	0.82	87.7	19.97	7.6	2.3	2.3	46
112M	4	1440	Ø28	7.95	5.78	0.82	88.6	26.53	7.8	2.2	2.3	63.2
132S	5.5	1460	Ø38	10.67	7.76	0.83	89.6	35.98	7.9	2.0	2.3	71.2
132M	7.5	1460	Ø38	14.26	10.37	0.84	90.4	49.06	7.5	2.0	2.3	85.1
160M	11	1465	Ø42	20.44	14.86	0.85	91.4	71.71	7.7	2.2	2.3	121
160L	15	1465	Ø42	27.33	19.88	0.86	92.1	97.78	7.8	2.2	2.3	142
180M	18.5	1470	Ø48	33.53	24.39	0.86	92.6	120.19	7.8	2.0	2.3	181
180L	22	1470	Ø48	39.70	28.87	0.86	93.0	142.93	7.8	2.0	2.3	209
200L	30	1475	Ø55	53.79	39.12	0.86	93.6	194.24	7.3	2.0	2.3	284
225SM	37	1485	Ø60	66.13	48.10	0.86	93.9	237.95	7.4	2.0	2.3	328
225SM	45	1485	Ø60	80.18	58.31	0.86	94.2	289.39	7.4	2.0	2.3	363
250SM	55	1485	Ø70	97.58	70.97	0.86	94.6	353.70	7.4	2.2	2.3	442
250SM	75	1486	Ø70	129.49	94.17	0.88	95.0	482.00	6.9	2.0	2.3	569
280SM	90	1486	Ø80	155.06	112.77	0.88	95.2	578.40	6.9	2.0	2.3	639
280SM	110	1488	Ø80	187.00	136.00	0.89	95.4	705.98	7.0	2.0	2.2	939
315SM	132	1488	Ø85	223.93	162.86	0.89	95.6	847.18	7.0	2.0	2.2	1033
315SM	160	1488	Ø85	270.86	196.99	0.89	95.8	1026.88	7.1	2.0	2.2	1126
315SM	185	1488	Ø90	309.38	237.47	0.90	95.9	1187.00	7.1	2.0	2.2	1200
315SM	200	1490	Ø90	334.11	242.99	0.90	96.0	1282.00	7.1	2.0	2.2	1238
315SM	220	1485	Ø90	383.88	279.18	0.88	94.0	1414.81	6.3	1.9	2.0	1200
355ML	250	1490	Ø100	417.64	303.74	0.90	96.0	1602.00	7.1	2.0	2.2	1830
355ML	280	1490	Ø100	467.76	344.01	0.90	96.0	1795.00	7.1	2.0	2.2	1915
355ML	300	1490	Ø100	501.17	364.49	0.90	96.0	1923.00	7.1	2.0	2.2	2000
355ML	315	1490	Ø100	526.23	382.71	0.90	96.0	2019.00	7.1	2.0	2.2	1950
355ML	355	1485	Ø100	606.53	436.16	0.88	96.0	2283.00	6.5	1.6	2.5	2060
315SM	400	1485	Ø90	691.27	502.74	0.87	96.0	2572.39	7.5	1.4	2.0	2200
355ML	400	1485	Ø100	683.42	502.74	0.88	96.0	2572.00	6.5	1.6	2.5	2420
400ML	400	1492	Ø110	668.23	503.27	0.90	96.0	2560.00	6.5	1.4	1.5	3000
355SM	450	1485	Ø100	760.20	566.18	0.89	96.0	2893.94	6.5	1.6	2.5	2580
400ML	450	1492	Ø110	751.76	552.88	0.90	96.0	2880.00	6.5	1.4	2.5	3150
355ML	500	1485	Ø100	864.99	629.08	0.87	95.9	3215.49	7.0	1.4	2.0	2800

Cast Iron Three Phase Premium IE3 Motors Class H Insulation IP66
6 POLE

Frame	kW	Speed 50Hz	Shaft	Rated Current 50Hz 400V	Rated Current 50Hz 550V	Power Factor cos φ	Efficiency % at 50Hz	Rated Torque Nm	Starting Current	Ratio Starting Torque	B-down Torque	Weight kg
90S	0.75	935	Ø24	1.93	1.41	0.71	78.9	7.66	6.0	2.0	2.1	24.1
90L	1.1	945	Ø24	2.69	1.95	0.73	81.0	11.12	6.0	2.0	2.1	25.7
100L	1.5	949	Ø28	3.59	2.61	0.73	82.5	15.09	6.5	2.0	2.1	34.9
112M	2.2	955	Ø28	5.09	3.70	0.74	84.3	22.00	6.6	2.0	2.1	54.2
132S	3	968	Ø38	6.84	4.97	0.74	85.6	29.60	6.8	2.0	2.1	62.3
132M	4	968	Ø38	8.99	6.54	0.74	86.8	39.46	6.8	2.0	2.1	75.2
132M	5.5	968	Ø38	12.03	8.75	0.75	88.0	54.26	7.0	2.0	2.1	82.3
160M	7.5	970	Ø42	15.38	11.18	0.79	89.1	73.84	7.0	2.0	2.1	112
160L	11	970	Ø42	21.98	15.98	0.80	90.3	108.30	7.2	2.0	2.1	134
180L	15	978	Ø48	29.31	21.32	0.81	91.2	146.47	7.3	2.0	2.1	197
200L	18.5	980	Ø55	35.95	26.15	0.81	91.7	180.28	7.3	2.0	2.1	234
200L	22	980	Ø55	42.52	30.92	0.81	92.2	214.39	7.4	2.0	2.1	251
225SM	30	980	Ø60	56.16	40.84	0.83	92.9	292.35	6.9	2.0	2.1	308
250SM	37	985	Ø70	68.14	49.56	0.84	93.3	358.73	7.1	2.0	2.1	383
250SM	45	985	Ø70	81.55	59.31	0.85	93.7	436.29	7.3	2.0	2.0	501
280SM	55	985	Ø80	98.10	71.34	0.86	94.1	533.25	7.3	2.0	2.0	573
280SM	75	985	Ø80	136.23	99.08	0.84	94.6	727.16	6.6	2.0	2.0	843
315SM	90	988	Ø85	161.04	117.12	0.85	94.9	869.94	6.7	2.0	2.0	941
315SM	110	988	Ø85	196.41	142.85	0.85	95.1	1063.26	6.7	2.0	2.0	1017
315SM	132	988	Ø85	232.22	168.89	0.86	95.4	1275.91	6.8	2.0	2.0	1121
355ML	160	990	Ø100	280.89	204.29	0.86	95.6	1543.43	6.8	1.8	2.0	1715
355ML	185	990	Ø100	320.72	238.49	0.87	95.7	1785.00	6.8	1.8	2.0	1840
355ML	200	990	Ø100	346.36	251.90	0.87	95.8	1929.00	6.8	1.8	2.0	1846
355ML	220	990	Ø100	380.99	283.61	0.87	95.8	2122.00	6.8	1.8	2.0	1905
355ML	250	990	Ø100	432.95	314.87	0.87	95.8	2412.00	6.8	1.8	2.0	2085
355ML	280	990	Ø100	484.90	356.76	0.87	95.8	2701.00	6.8	1.8	2.0	2106
355ML	300	990	Ø100	531.76	386.74	0.85	95.8	2894.00	6.5	1.8	2.5	2570
400L	300	990	Ø110	525.58	377.84	0.86	95.8	2894.00	6.5	1.6	2.4	3350
355ML	315	990	Ø100	558.35	406.07	0.85	95.8	3039.00	6.5	1.8	2.4	2410
400L	315	994	Ø110	551.86	396.74	0.86	95.8	3026.00	6.5	1.6	2.4	3410
355ML	355	990	Ø100	629.25	457.64	0.85	95.8	3424.00	6.5	1.8	2.5	2650
400L	355	994	Ø110	621.93	447.12	0.86	95.8	3411.00	6.5	1.6	2.4	3650
355ML	400	990	Ø100	709.01	515.65	0.85	95.8	3859.00	6.5	1.6	2.4	2800
400L	400	994	Ø110	700.77	498.07	0.86	95.8	3843.00	6.5	1.6	2.4	3700

Cast Iron Three Phase Premium IE3 Motors Class H Insulation IP66
8 POLE

Frame	kW	Speed 50Hz	Shaft	Rated Current 50Hz		Power Factor cos φ	Efficiency % at 50Hz	Rated Torque Nm	Starting Current	Ratio Starting Torque	B-down Torque	Weight kg
				400V	550V							
90S	0,37	675	24	1.26	0.92	0,61	69,3	5,23	4,0	1,8	2,0	28
90L	0,55	675	24	1.78	1.3	0,61	73,0	7,78	5,0	1,8	2,0	30
100L	0,75	685	28	2.15	1.57	0,67	75,0	10,5	5,0	1,8	2,0	40
100L	1,1	685	28	2.96	2.15	0,69	77,7	15,3	6,0	1,8	2,0	41
112M	1,5	695	28	3.88	2.82	0,7	79,7	20,6	6,0	1,8	2,0	58
132S	2,2	710	38	5.46	3.97	0,71	81,9	29,6	6,0	1,9	2,0	75
132S	3	710	38	7.1	5.17	0,73	83,5	40,4	6,0	1,9	2,0	89
160M	4	725	42	9.33	6.78	0,73	84,8	52,7	6,0	1,9	2,0	101
160M	5,5	725	42	12.4	9.05	0,74	86,2	72,4	6,5	2,0	2,0	127
160L	7,5	725	42	16.5	12	0,75	87,3	98,8	6,6	2,0	2,0	136
180L	11	735	48	23.9	17.4	0,75	88,6	142,9	6,6	1,9	2,0	198
200L	15	730	55	31.8	23.1	0,76	89,6	196,2	6,6	1,9	2,0	234
225S	18,5	730	60	39	28.4	0,76	90,1	242	6,5	1,9	2,0	284
225SM	22	730	60	44.9	32.7	0,78	90,6	287,8	6,6	1,9	2,0	325
250SM	30	735	70	60	43.7	0,79	91,3	389,8	6,6	1,9	2,0	425
250SM	37	735	70	73.6	53.6	0,79	91,8	480,7	6,6	1,8	2,0	518
280SM	45	735	80	89.2	64.9	0,79	92,2	584,7	6,2	1,8	2,0	582
280SM	55	735	80	106	77.1	0,81	92,5	714,6	6,4	1,8	2,0	852
315SM	75	735	85	144	104	0,81	93,1	974,5	6,4	1,8	2,0	952
315SM	90	735	85	170	123	0,82	93,4	1169	6,4	1,8	2,0	1040
315SM	110	735	85	207	150	0,82	93,7	1429	6,4	1,8	2,0	1056
355ML	132	740	100	247	180	0,82	94,0	1704	6,4	1,8	2,0	1784
355ML	160	740	100	299	217	0,83	94,3	2065	6,4	1,8	2,0	1941
355ML	200	740	100	368	267	0,83	94,6	2581	6,4	1,8	2,0	2026

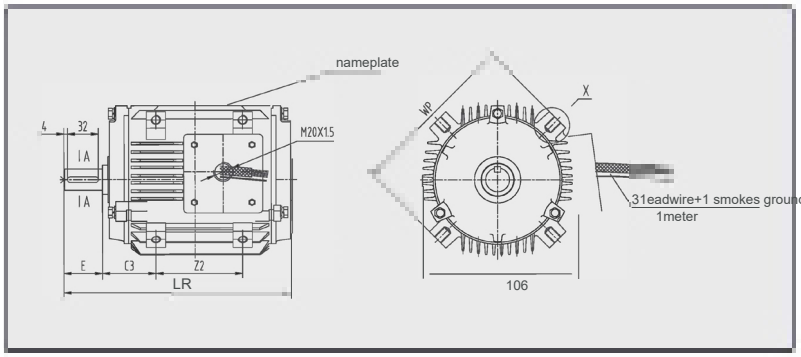
Airstream rated motors for axial fans

ELECTROMOTE offer a comprehensive range of motors specifically built for use with axial flow fans, where the motor is mounted in the airstream.

Provided the airstream ensures ample cooling, the fan and cowl normally fitted to a standard TEFC motor is redundant. Enclosure rating of the motor is also improved with the use of a solid rear endshield.

Due to the elimination of losses associated with the motor fan these motors have a higher efficiency than standard HM3 motors.

Pad mount - HM3 P



Motor frame	Dimension [LR]	Motor frame	Dimension [LR]	Motor frame	Dimension [LR]
71	210	160L	580	280M	945
80	238	180M	595	315S*	980
90S	265	180L	630	315S	1010
90L	290	200L	671	315M*	1070
100L	323	225S	725	315M	1100
112M	340	225M*	720	315L*	1140
132S	400	225M	750	315L	1170
132M	435	250M	820		
160M	538	280S	890		

*2 pole motors only

HM3P is a popular alternative to HM3, with the terminal box replaced by blanking plate and extended leads. In this case, terminal box and block are supplied loose with motor for convenience of remote leads termination.

Cooling tower

Cooling tower motors are specially developed for operation in air stream rated cooling towers. Motors are available in frame sizes 71 to 355 and rated power outputs of 0.37kW to 315kW.

APPLICATIONS

Motors are ideally suited to the cooling tower application, in industries such as food and beverage, air conditioning, chemical processing and petrochemical.

PROTECTION

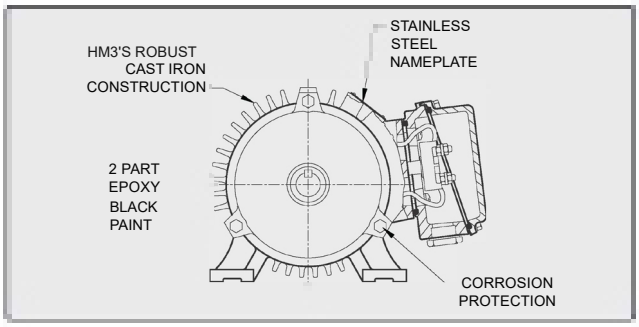
HM3C motors have a protection rating of IP66 for maximum protection against water and dust.

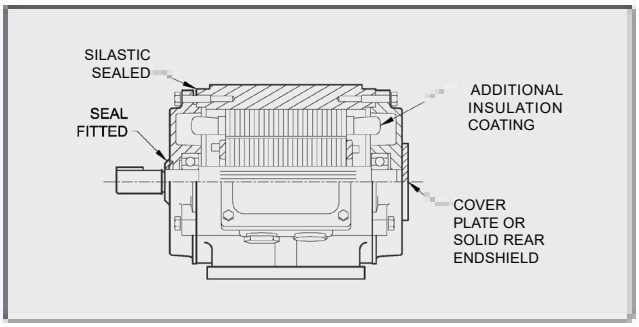
ADDITIONAL ENHANCEMENTS

- 2-part epoxy coated for excellent protection against corrosive solids and liquids.
- Stainless steel name plate.
- Corrosion protection on threads.
- Extra insulation coating (RED Isonel 300)
- Shaft seal fitted
- Silastic sealed
- Non-drive end shaft extension cut and blanking plate fitted. Alternatively, HMIR used as base motor.

PAINT

Standard paint finish for HM3C motors is a 2-part epoxy Prime RAL 7021 Grey. Electromote HM3C range of cooling tower motors combine with HM3 standard high strength and high efficiency with significant enhancements to give the perfect motor for cooling tower applications.

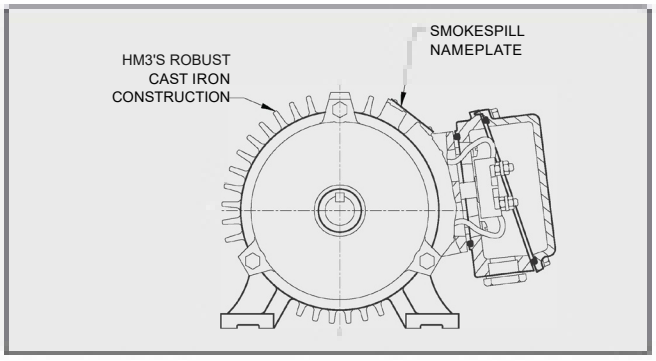


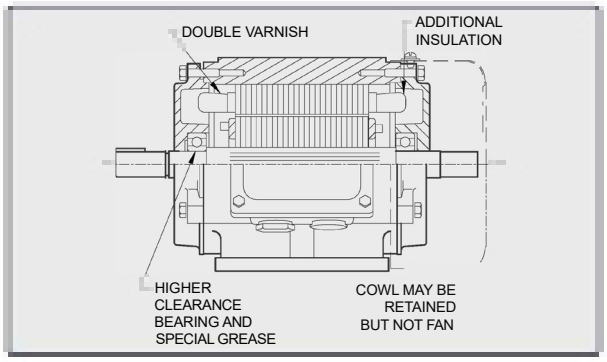


Smokespill - HM3S

Smokespill applications motors are designed to withstand the extreme environmental conditions associated with a building fire. Ventilation systems within public buildings are required to continue providing smoke extraction for 2 hours at smokespill air temperature of 200˚ or for 30 minutes at 300˚, designated respectively as rating -1 or rating -2.

HM3S range, wound with H class insulation in frame sizes 80A to 315L, meet either rating -1 or rating -2 requirements.
HM3S range is also suitable for applications at 300 ˚ for 2 hours.





SMOKESPILL FEATURES

The standard HM3 motor is inherently suitable for upgrading to the smokespill application due to its low temperature rise. When HM3S motors are ordered F Class motors are modified and when HM3HS motors are ordered H Class motors are modified in accordance with our standard operating procedures which include the following:

- C3 internal clearance bearings lubricated with extra high temperature specification grease.
- Special name plate specifying smokespill suitability.
- Double insulated terminal leads.
- Double varnish system for winding crown.
- Fan and cowl removed if present on the original motor; cowl may sometimes remain to protect from bare shaft.
- Motors tested prior to dispatch.
- Extra High Temperature Grease (Magnalube G).

CERTIFICATION AND TESTING

A range of motors was selected in consultation with a competent authority on this subject. Testing of motors was carried out in a specially designed re-circulating duct system. The test rig and the methods of test were also witness approved by a competent authority. A series of tests were conducted to certify our range of HM3S and HM13HS motors.

T. E. A. S. R. (TOTALLY ENCLOSED AIR SYSTEM RATED - NO FAN OR COWL)

The HM3's range is normally supplied without fan and cowl, relying on the air flow generated by the driven fan to provide the necessary cooling during normal operation thereby ensuring high temperature operation will not cayuse the plastic fan to melt.

Motors are normally supplied with the non-drive end stub shaft exposed, as it is expected to be shrouded by the fan housing and duct work when installed. If this presents a problem in a specific application, either removal of this shaft can be requested, or the standard fan cowl can be fitted, but without the motor fan. Alternatively, the HM3R series can be used as the base motor.

TERMINATIONS

HM3S motors can be supplied either with terminal boxes or with extended leads through a gland plate. In either case, it is the installers responsibility to ensure that suitable high temperature leads, conduit and fittings are installed to take the motor leads , conduit and fittings are installed to take the motor leads outside the fan case. Electromote can supply terminal boxes and terminal blocks for installation outside the fan drum if required.

PAINT

Standard color finish for the HM3S range is RAL 7012 Basalt Grey and RAL 3000 Flame Red for the HM3HS range. Other colors are available on request.

NAMEPLATES

ELECTROMOTE Smokespill motors are marked with special nameplates labelling its suitability for smokespill duty and stating specific nameplates labelling its suitability for smokespill duty and stating temperature conditions ratings and lubrication details. Additional plates for external mounting to fan assemblies are available on request.

MAINTENANCE

Because of the safety related nature of smokespill motors proper maintenance schedules are imperative, especially where the motor is used for dual purposes i.e continuous running for normal ventilation as well as for smokespill application. Serious consideration needs to be given to bearing and insulation deterioration caused by use for extended periods for normal ventilation duty. It is important that the motor remains within its stated rating on the initial commissioning and after any adjustments to the ventilation system.

Motors for hazardous areas

HM3E/ HM3N/ HM3D

Motors used within a hazardous location require a higher level of protection against the risk of harmful occurrences. Electromote HM3 are available in the three most common high protection configuration, EX e, EX nA (formerly EX n) and EXtD (formerly DIP), supplied with protection ratings IP55, IP65 or IP66. HM3 Hazardous area motors are available in motor frame sizes 71 to 280, with 315 frame certificates pending (EX e and Ex tD only). Combinations of protection such as Ex e and Ex tD or Ex nA and ExtD are also available.

INTERNATIONAL STANDARDS

IEC specify general requirements for the selection of electrical equipment, and its installation and maintenance to ensure safe use in areas where flammable materials are generated, prepared, processed, handled, stored or otherwise used, and which are therefore potentially hazardous.

The term 'flammable material' includes gases, vapors, liquids, mists, solids and dusts, but does not include those materials which are specifically manufactured as explosives or materials which are inherently explosive. The requirements of the listed standards apply only to the use of electrical equipment under normal or near normal atmospheric conditions.

The requirements specified for hazardous location electrical equipment are supplementary to and not alternative to any requirements which would apply to equipment and installations in non-hazardous areas.

EUROPEAN STANDARDS

European standards 'N' series are closely aligned with IEC standards. They share the same numbering and require assessment and certification to ATEX directives, issued by the European Union. The ATEX directive (94/9/EC, 23.03.94) addresses both the compliance of hazardous area equipment to specified standards, and the compliance to EH & SR (Essential Health & Safety Requirements).

PAINT

Standard color finish for the hazardous area range is RAL 7012 Basalt Grey, with primary option of RAL 1004 Golden Yellow. Other colors are available on request.

Motor protection types

HM3E-EX e

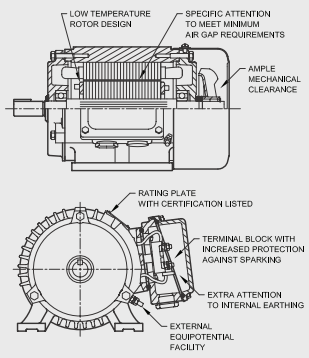
Ex e motor protection designates Increased safety as outlined in IEC.

The increased safety (EX e) type of protection describes electrical equipment that does not produce arcs or sparks in normal service which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks.

Increased safety (EX e) motors are suitable for Class I, Zone 1, Group II (A, B & C) hazardous areas, and Electromote provides for a temperature class of T3 (200˚) in a 40˚ ambient (see next page for explanation of classes, zones and groups).

EX e PROTECTION -T_E TIME

t_E time is the time it takes for the stator winding or rotor cage to heat up from normal operating temperature, at the highest permitted ambient temperature, to the highest permitted limit temperature (temperature class), with the rotor locked and the stator winding loaded with the starting current.



For selection and setting dependent protection the t_E time and the ratio of locked rotor current to nominal current are used. In the case of a rotor locking, this device must cut off the supply within the specified t_E time, which is listed in the performance data.

HMID – EX tD (FORMERLY DIP)

Ex tD motor protection designates dust-excluding ignition proofing as outlined in IEC series of standards.

Dust-excluding ignition proofing (Ex tD) type of protection describes electrical equipment which is enclosed so that it excludes dust, and which will not permit arcs, sparks or heat otherwise generated or liberated inside the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specific dust on or in the vicinity of the enclosure.

Dust-excluding ignition proofed (Ex tD) motors are suitable for Zone 21 and 22 dust laden hazardous areas, and Electromote provides a temperature class of T4 (135˚) in a 50˚ ambient.

Hazardous area classifications

Hazardous areas fall into two categories; hazards due to flammable gases (vapors or mists), and hazards due to combustible dusts (fibres or particles).

GASEOUS HAZARDS

Explosive gas atmosphere is classified into zones based on the frequency and duration of their occurrence as below:

Zone 0: an area in which an explosive gas atmosphere is present continuously, for long periods, or is present frequently.

Zone 1: an area in which an explosive gas atmosphere is likely to occur in normal operation occasionally.

Zone 2: an area in which an explosive gas atmosphere is not likely to occur in normal operation, and if it does occur it will exist for a short period only.

Electrical apparatus for potentially explosive atmospheres is divided into the following groups:

Group I: mines susceptible to fire damp (methane). Group II: other industries.

High surface temperatures can cause ignition of flammable gases or vapors therefore the surface temperature of equipment gases or vapors therefore the surface temperature of equipment in hazardous areas must not exceed the ignition temperature of these gases or vapors.

Group I electrical equipment may not have a surface temperature that exceeds 150˚ where coal dust can form a layer & 450˚ for internal surfaces where the above risk is avoided by ingress or dust.

Group II electrical equipment may not have a surface temperature that exceeds its specified temperature class, as listed in the table on the right.

Note: The data given in this table is derived from NFPA 325M, Flashpoint is the lowest temperature at which a material gives off sufficient vapour to form an explosive gas/ air mixture in the air immediately above surface.

Temperature class of electrical equipment	Maximum surface temperature of electrical equipment	Ignition temperature of gas or vapor
T1	≤ 450°C	> 450°C
T2	≤ 300°C	> 300°C
T3	≤ 200°C	> 200°C
T4	≤ 135°C	> 135°C
T5	≤ 100°C	> 100°C
T6	≤ 85°C	> 85°C

Equipment within a specific group may only be used within a location with an equal or less level of hazard. Allowable groups are summarized in the table on the right.

Note: The data given in this table is derived from NFPA 325M. Flashpoint is the lowest temperature at which a material gives off sufficient vapor to form form an explosive gas/ air mixture in the air immediately above surface. air immediately above surface.

Material	Boiling point [°C]	Flash point [°C]	Ignition temp. [°C]	Gas group
Acetone	56	-20	465	IIA
Acetylene	-83	Gas	305	IIC
Ammonia	-33	Gas	651	IIA
Benzene	80	12	498	IIA
Butane	-1	Gas	287	IIA
Carbon monoxide	-192	Gas	609	IIA
Ethane	-89	Gas	472	IIA
Ethyl alcohol	78	55	363	IIA
Ethylene	-104	Gas	450	IIB
Heptane	98	-4	204	IIA
Hydrogen	-252	Gas	500	IIC
Hydrogen cyanide	26	-18	538	IIB
Methane	-162	Gas	537	IIA
Propane	-42	Gas	432	IIA
Toluene	111	4	480	IIA

Equipment within a specific group may only be used within a location with an equal or less level of hazard. Allowable groups are summarized in the table below:

Gas group	Allowable equipment group
IIA	IIA, IIB, IIC
IIB	IIB, IIC
IIC	IIC

COMBUSTIBLE DUST HAZARDS

Many dusts which are generated, processed, handled and stored, are combustible. When ignited, they can burn rapidly and with considerable explosive force if mixed with air in the appropriate proportions. Electrical apparatus used in locations where this hazard is present, requires adequate protection so as to reduce the likelihood of ignition of the external explosive atomosphere.

Areas where dusts, flying and fibers in air occur in dangerous quantities are classified as hazardous and are divided into three zones according to the level of risk.

Zone 20: An area in which combustible dust, as a cloud, is present continuously or frequently during normal operation, in sufficient quantity to be capable of producing an explosive dust/air mixture, and/or where layers of dust of uncontrollable & excessive thickness can be formed.

Zone 21: An area not classified as Zone 20 in which combustible dust, as a cloud, is likely to occur during normal operation, in sufficient quantities to be capable of producing an explosive dust/air mixture.

Zone 22: An area not classified as Zone 21 in which combustible dust clouds may occur infrequently, and persist or only a short period, or in which accumulations or layers of combustible dust may be present under abnormal conditions and give rise to combustible dust / air mixtures. Where, following an abnormal condition, the removal of dust accumulations of layers cannot be assured then the area is to be classified.

Ignition protection is based on the limitation of the maximum surface temperature of the enclosure and on other surfaces which could be in contact with dust and on the restriction of dust ingress into the enclosure by the use of dust tight or dust protected enclosures.

The table on the right summarizes the relationship between temperature class, surface temperature and cloud or layer ignition temperature (whichever is the lower).

Temperature class of electrical equipment	Maximum surface temperature of electrical equipment	Cloud or layer ignition temperature of dust
T1	≤ 450°C	≥ 500°C
T2	≤ 300°C	≥ 350°C
T3	≤ 200°C	≥ 250°C
T4	≤ 135°C	≥ 185°C
T5	≤ 100°C	≥ 150°C
T6	≤ 85°C	≥ 135°C

Specifications and characteristics of some common combustible dusts are listed in the table below:

Material	Minimum ignition energy [mJ]	Ignition temperature	
		Cloud [°C]	Layer [°C]
Aluminium	15	550	740
Cellulose	80	480	270
Corn	40	400	250
Flax	80	230	430
Polypropylene	30	420	-
Rayon	2400	520	250
Rice	50	440	220
Rubber (synthetic)	30	320	-
Sugar	30	370	400
Wheat flour	50	380	360

Modifications, variations & optional extras

Electromote offers an extensive range of variations to the HM3 motor series. Other HM3 ranges outlined in other sections include:

Multi-speed
Brake motors – **HM3B**
Smokespill applications – **HM3S and HM3HS**
Airstream motors for axial fans – **HM3R, HM3RF and HM3RHF**
PAD mount airstream motors for axial fans – **HM3PR and HM3PRF**
Cooling tower motors – **HM3C**
Hazardous area motors – **HM3E, HM3N and HM3D**

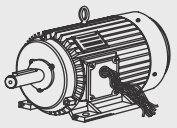
Additional to these motor ranges Electromote offer a large array of modifications available on order. These modifications are outlined below:

Terminal box

HM1 motors come standard with a terminal box on the top.

The following alternatives are available:

- Right hand terminal box – **HM3R**
- Left hand terminal box – **HM3L**
- Removed terminal box (fitted with a blanking plate and threaded conduit entry. Extended leads, including earth connector) – **HM3F**



Motor frame	Conduit size
71-132	M25 x 1.5
160-180	M32 x 1.5
200-250	M50 x 1.5
280-315	M63 x 1.5

Extended leads: 1.5m
No. of power leads: 3+1 for up to 3kW, 6+1 for 4kW and above

Bearings

Electromote can address applications where bearings need special consideration. Attention may need to be given to the following:

- Bearing monitors
- Alternative bearing types
- Low/high temperature bearing grease
- Oil seals
- Non-contact labyrinth seals
- Insulated bearings

Shafts

HM3 motors come standard with a single output shafts to standard dimensions. The following alternatives are available:

- Double shaft extension
- Special shaft extension
- Stainless steel shaft material type
- Reduces shafts for geared motors – **HM3**

Environmental considerations

Where environmental factors need special considerations Electromote can provide the following modifications:

- Winding temperature monitors and thermistors
- Anti-condensation heaters
- Separately powered cooling fans
- Tropic proofing
- Special paint finish
- Higher International Protection rating, IP56, IP65 and IP66
- High ambient temperature motors – **HM3** with H class insulation

Special performance

Electromote has the ability to provide HM3 motors with special windings. They may include:

- 10, 12, 16 and 24 pole single speed windings
- Three and four speed windings
- Windings designed for increased outputs and short time ratings
- Windings for alternative operating voltages and frequencies

VVVF drives

Two types of VVVF drives kit are available for the HM3 range to assist in maintaining satisfactory operation.

VVVF drive kit A –Separately driven cooling fan (220 & 400V)
This fan should be used when the motor speed is required to be reduced below 25Hz in constant torque mode. For centrifugal fan or pump, no separate cooling fan is required. For all other loads refer to the loadability curve in the section on VVVF drives.

VVVF drive kit B –Standard motor (EDM)
This kit incorporates a single insulated bearing, normally at the non-drive end, designed to remove the effect of electrical discharge through the bearings.

NOTES

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