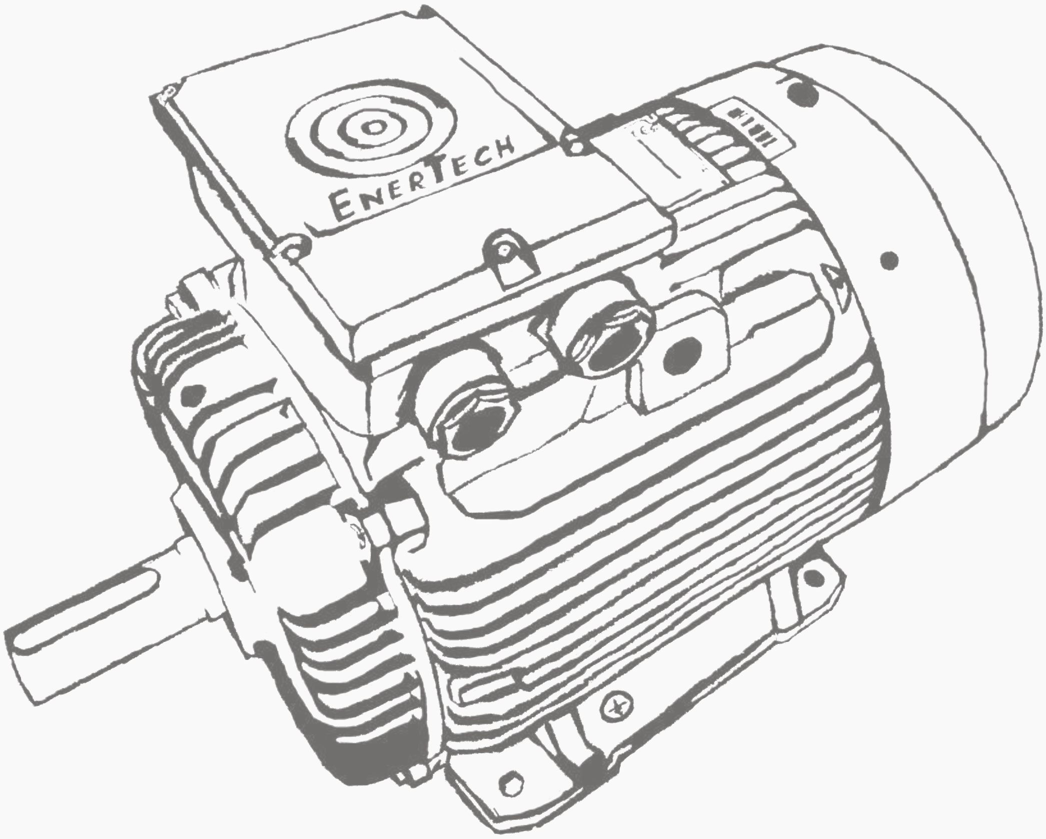


ENERTECH

IE1

Three phase asynchronous

ESC Series Motors

Enhanced performance cast iron units

enertechmotors.com.au

ENERTECH

Standards and regulations

ESC motors are built to comply with the requirements of the following international standards and regulation:

1. International Electrotechnical commission - IEC 60034 and I EC 60072.
2. British Standards - BS5000 and BS 4999.
3. Australian Standards -AS 1359.
4. The requirements of European EC marking. Low voltage Directive 73/23 (1973), modified by Directive 93/68 (1993) and the EMC - Directive 89/336. These ESC motors are designed to use with other machinery, and they should only be used if the complete machinery is in conformity with the provisions of the Directive of safety of machinery (89/93/EEC).
5. CEMEP agreement-all motors with standard rating include in this catalogue comply with efficiency class IE1 and bear the corresponding label on the rating plate. For efficiency data at 50%, 75% and full load, please refer to the performance data tables. Motors comply with efficiency class IE2 are available on request.

Standards	IEC	CENELEC	BS
General requirements for electrical machines	60034-1	EN 60034-1	4999-1 4999-69
Methods of determining losses and efficiency	60034-2	HD 53 2	4999-34
Degrees of protection	60034-5	EN60034-5	4999-20
Methods of cooling	60034-6	EN60034-6	4999-21
Mounting arrangements	60034-7	EN60034-7	4999-22
Terminal markings and direction of rotation	60034-8	HD 53 8S4	4999-3
Noise limits	60034-9	EN60034-9	4999-51
Starting performance	60034-12	EN60034-12	4999-112
Mechanical vibration	60034-14	EN60034-14	4999-50
Standard voltages	60038	HD 472 S1	---
Dimensions and output ratings	60072	---	---
Mounting dimensions and relationship framesizes-output ratings	60072	HD 231	4999-10 51-110
Shaft dimensions	60072	HD 231	4999-10
Classification of environmental conditions	600721-2-1	---	---
Insulation material	60085	---	---

* The ESC motor range corresponds to the new international standard IEC 60034-30

Shaft

ESC motors have standard shaft extension lengths which 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 and AS1359. Precision grade tolerance is available upon special order.

Finish

Standard ESC motor color is RAL 5008. 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 accommodate stringent requirements for motors in corrosive environments. Special coatings are needed to resist such substances as acid, salt water and extreme climatic conditions.

Electrical design

As standard, ESC motors have the following design and 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, 380V, 50Hz

Ambient cooling air temperature, 40°C

Altitude - 1000m Duty cycle 51 (continuous)

Rotatio - Clockwise viewed from drive end

Connection - 220 volt Delta/380 volt Star (3kW and below)

- 380 volt Delta/660 volt Star (4kW and above)

ENERTECH

Electrical Design

Voltage and frequency

Standard ESC motors are designed for a power supply of three phase 380V, 50Hz. Motors can be manufactured for any supply between 100V and 1100V and frequencies other than 50Hz. Standard ESC 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.

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
	480V 60Hz	115	120	100	100	96	95	98
525V	550V 50Hz	100	100	95	110	100	110	110
	525V 60Hz	100	120	98	83	83	70	85
	550V 60Hz	105	120	98	90	87	80	90
	575V 60Hz	110	120	98	95	91	85	94
	600V 60Hz	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) 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 380V motors except for the currents which are calculated with the accompanying formula:

Where:

$$I_x = \frac{380 \times I_N}{U_x}$$

I_x = Current

I_N = Full load current at 380 volt

U_x = Design voltage

Temperature and altitude

Rated power specified in the performance data tables apply for standard ambient conditions of 40°C 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
30°C	1.06
35°C	1.03
40°C	1.00
45°C	0.97
50°C	0.93
55°C	0.88
60°C	0.82

Altitude above sea level	Altitude factor
1000m	1.00
1500m	0.98
2000m	0.94
2500m	0.91
3000m	0.87
3500m	0.82
4000m	0.77

Effective Power = Rated Power x Temperature Factor x Altitude Factor

Example 1:

Effective Power required = 15 kW

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 18.5 kW .

Example 2:

Rated power = 11 kW

Air temperature = 50°C (factor 0.93)

Altitude = 1500 metres (factor 0.98)

Effective Power = 1 1 x 0.93 x 0.98 = 10.0 kW

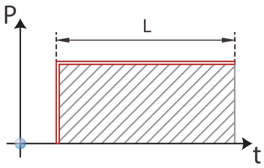
Rotation

For clockwise rotation, viewed from drive end, standard three phase ESC motor terminal markings coincide with the sequence of the phase line conductors. For counter clockwise rotation, viewed from drive end, two of the line conductors have to be reversed. This is made clear in the table of connection diagrams three phase motors with cage rotor (page 3).

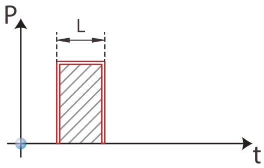
Duty

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

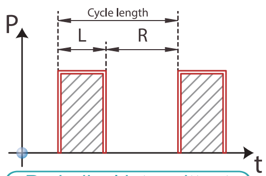
- Type and frequency of switching cycles as per duty factors S3 to 57 and duty cycle factor.
- Load torque variation during motor acceleration and braking (in graphical form).
- Moment ofi-iertia of the bad on the motor shaft.
- Type of braking (eg mechanical. electrical through phase reversal or DC injection).



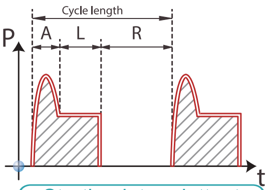
Continuous service (S1)



Temporary (S2)

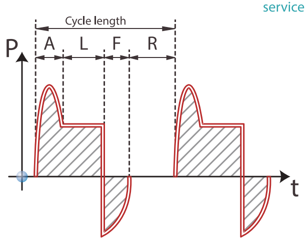


Periodical intermittent service (S3)

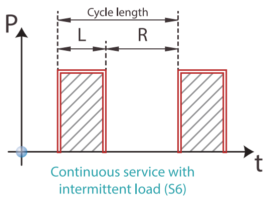


Starting interminttent service (S4)

Starting intermittent service (S4)



Starting intermittent service with electric starting and braking (S5)



Continuous service with intermittent load (S6)

Explanation

D = Cycle length

L = Load time — R= Resting time

A = Starting time — F = Braking time

Intermittent ratio calculation in percentage

S3 = L/(D)*100 — S4 = (A+L)/(D)*100

S5 = (A+L+F)/D*100 — S6 = L/(D)*100

Permissible output

Apply the factors o the axanpanying table to the output rating for motors with duty cycles that are notconbnuous. For other duties (S4. S5. S8 and S7) contact us for appropriate duty cycle factors.

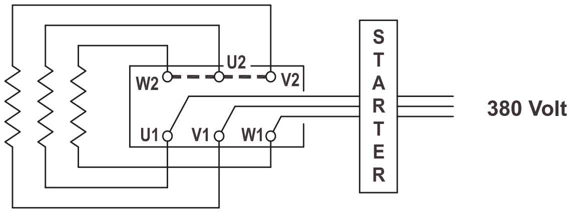
	Poles	Duty cycle factor For frames 80 to 132	 For frames 160 to 250	 For frames 280 to 355
Short-time duty, S2				
30 min	2	1.05	1.20	1.20
	4 to 8	1.10	1.20	1.20
60 min	2 to 8	1.00	1.10	1.10
Intermittent duty, S3				
15%	2	1.15	1.45	1.40
	4 to 8	1.40	1.40	1.40
25%	2	1.10	1.30	1.30
	4 to 8	1.30	1.25	1.30
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
				1.10

Connection

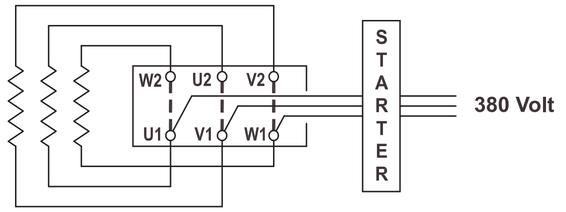
A motor's rated voltage must agree with the power suppV line-to-line voltage. It is carefully to ensure the correct connection to the motor terminals.

Internal connections, voltages and VF drive selection

Standard terminal connections for motors 3kW and below is 220V delta / 380V star. These motors are designed for 380V Direct On Line (D.O.L.) starting, when connected in the star configuration. They are also suitable for operation with 220V three phase variable frequency drives. when connected in the delta configuration. Standard terminal connections for motors 4kW and above is 380V delta / 660V star. These motors are designed for 380V Direct On Line (D.O.L.) starting, when connected in the delta configuration. They are also suitable for operation with 380V three phase variable frequency drives. Alternatively they can be operat-ed D.O.L. in the star configuration from a 660V supply or with a 660V variable 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 380V star-delta starting as described below. Motor connected for D.O.L. starting with bridges in place for star connection (3kW and below).



Motor connected for D.O.L. starting with bridges in place for delta connection (4kW and above).



Starting

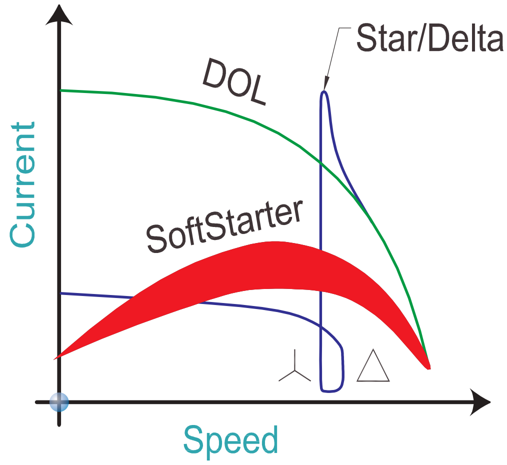
All of the following starter options are available and are the best supplied together with the motor.

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 IL. As listed in the performance data, locked rotor current can be up to 8 times the rated current IN of the motor. In circumstances where the motor starts under no load or where high starting torque is not required, it is preferble to reduce the starting current by one of the following means.

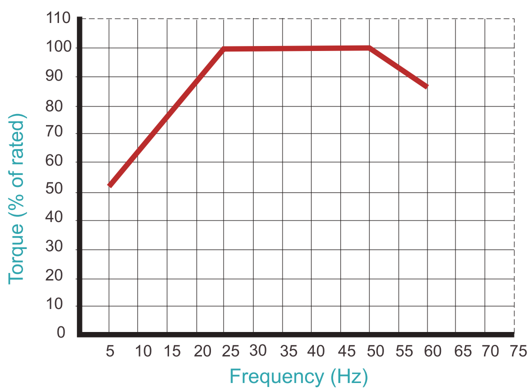
Star - Delta starting

The ESC motors 4kW 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 change over.



VVVF Drives

Variable Voltage Variable Frequency 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 to full load torque with kill load current is by using VVVF drives. The functionally flexible VVVF drive is also commonly used to reduce energy consumption on fans, pumps and compressors and offers a simple andrepeatable method of changing speeds or flow rates.



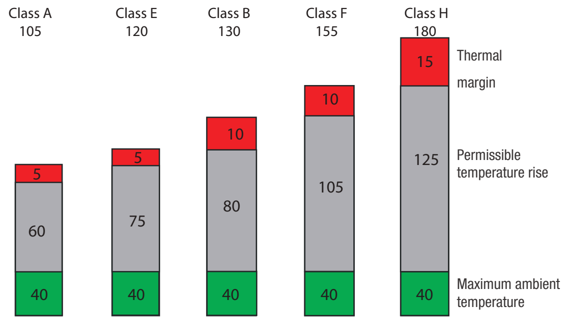
EDM Concerns

Capacitive voltages in the rotor can be generated due to an effect caused by harmonics in the waveform causing voltage discharge to earth through the beatings. This discharge results in etching of the bearing running surfaces. This effect is known as Electrical Discharge Machining (EDM). It can be control with the fitment of appropriate filters to the drive. To futher reduce the of EDM, an insulated non drive bearing can be used. ESC recommends the use of insulated bearings for all motors 315 frame and above.

Electrical Design

Insulation

The insulation system is Class F (155°C) and the motors are designed to operate with Class B (80°C). This ensures long life and reliability with the ability to withstand ambient temperatures as high as 54°C or up to 15% overload in adverse electrical supply situations. Non-Standard ESC will provide a safety margin of 45°C and can be safely operated at elevated ambient temperatures. Due to their conservative design many sizes in the ESC range of motors have temperature rises considerably less than 80°C and therefore provide even greater safety margins.



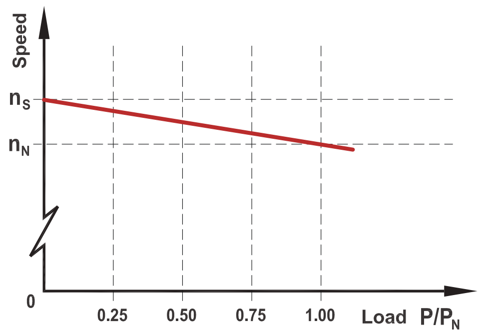
Temperxature Limits According to IEC 85

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 ESC motors, frame sizes 150°C and above, are 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 150°C (180°C for EHC series). Additional 130°C thermistors can be fitted as an option for alarm connection.

Speed at partial loads

The relationship between motor speed and degree of loading on an ESC 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 = asynchronous 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)

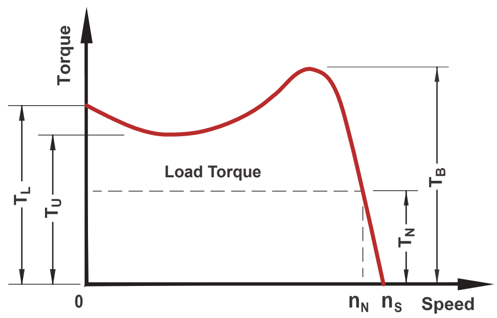
U_N = rated voltage

$\cos \varphi_x$ = partial load power factor

η_x = partial load efficiency (%)

Torque characteristics

Typical characteristics of torque behaviour 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 = asynchronous speed

ESC 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:

$$T_N = \frac{9950 \times P_N}{n_N}$$

Where:

T_N = full load torque (Nm)

P_N = full load output power (kW)

n_N = full load speed (r/min)

Design features

Permissible radial loads on the shaft with standard bearings

The values of radial load calculated considering:

- Frequency 50Hz;
- Temperature not exceeding 90°C;
- 20,000 hours of life for 2-pole motors;
- 40,000 hours of life for 4, 6, 8-pole motors.

For operation at 60Hz the values have to be reduced by 6% in order to achieve the same useful life. For double speed motors, consider always the higher speed.

* The distance of the point of action of force F_R from the shoulder of the shaft must not exceed the length of the shaft end.

Forces of belt drive on the shaft tight side when the belt tensionners is calculated by the following formula.

$$F_R = 2\sigma_0 F \sin\frac{\alpha_1}{2} z \text{ (N)}$$

Where:

σ_0 : The initial tension. (N) (trapezoid belt, flatbelt)

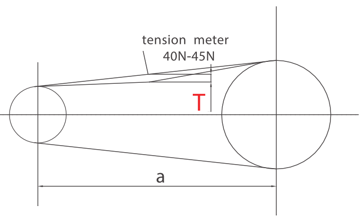
F : The cross-sectional area of the belt (cm^2)

α_1 : Arc of contact small (belt) pulley

+ $\alpha_1 = 180^\circ - (d_2 - d_1)\frac{57^\circ}{a}$ ($\alpha_1 \geqslant 120^\circ$)
+ d_1: Diameter of small(belt) pulley
+ d_2: Diameter of large (belt) pulley
+ a : Centre distance of 2(belt) pulley

z : Number of belt

Type of belt scales	The cross-sectional area F(cm^2)
A	0.81
B	1.38
C	2.3
D	4.76
E	6.92



Deflection Amount T (mm)

$$T = \frac{a}{64}$$

Example: there is 1 trapezoidbelt drive

$d_1 = 310mm$
$d_2 = 460mm$
$a = 1300mm$
$z = 8$

The angle of the wheel hug small belt

$$\alpha_1 = 180^\circ - (d_2 - d_1)\frac{57}{a}$$
$$= 180 - (460 - 310) \times 57/1300 = 173.4^\circ$$

Forces of belt drive on the shaft tight side when the belt tensioners accordance stretch panel

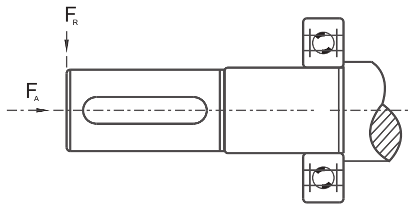
$$F_R = 2\sigma_0 F \sin\frac{\alpha_1}{2} z \text{ (N)}$$
$$= 2 \times 150 \times 2.3 \times 0.998 \times 8 = 5\,509 \text{ N}$$

Frame size	Pole number	Permissible radial load F_R [N]	
		Ball bearings	Roller bearings
63	2	365	---
	4	365	---
	6	410	---
	8	455	---
71	2	455	---
	4	450	---
	6	515	---
	8	565	---
80	2	590	---
	4	590	---
	6	670	---
	8	735	---
90	2	670	---
	4	660	---
	6	750	---
	8	830	---
100	2	1850	---
	4	915	---
	6	1045	---
	8	1150	---
112	2	1360	---
	4	1350	---
	6	1545	---
	8	1700	---
132	2	1955	---
	4	1930	---
	6	2210	---
	8	2240	---
160	2	2500	5460
	4	2480	5617
	6	2820	5722
	8	3115	5775
180	2	3275	6195
	4	3175	6720
	6	3600	7035
	8	4000	7140
200	2	4250	9240
	4	4325	9975
	6	5150	10290
	8	5275	10447
225	2	5075	11340
	4	4925	12180
	6	5575	12600
	8	6050	12810
250	2	5025	13230
	4	5475	15225
	6	5595	15750
	8	5970	15907
280	2	5000	14700
	4	5150	15225
	6	6300	15750
	8	7200	17325
315 S-M	2	5000	13650
	4	5700	26775
	6	6700	27825
	8	7600	28350
315 L	2	6200	13020
	4	6450	23625
	6	7300	26250
	8	8200	29400
355L	2	3250	---
	4	8400	---
	6	8900	---
	8	8900	---

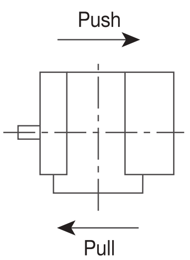
Permissible axial loads on the shaft with standard bearings

If the shaft end is loaded at X_{max} with the permissible radial load F_A, an additional axial load is allowed

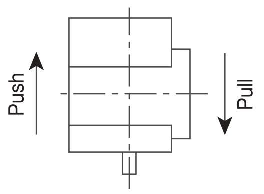
If the permissible radial load is not fully utilized, higher loads are possible in axial direction (Values on request).



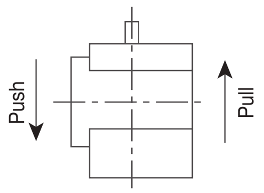
B3



V5



V6



Frame size	Pole number	Limit axial load with F_R at X_{max} - F_A [N]			
		Ball bearings		Roller bearings	
		B3 push/pull	V5/V6 push/pull	B3 push/pull	V5/V6 push/pull
63	2	120	110	---	---
	4	120	110	---	---
	6	140	130	---	---
	8	160	150	---	---
71	2	140	130	---	---
	4	140	120	---	---
	6	170	150	---	---
	8	190	170	---	---
80	2	190	170	---	---
	4	190	160	---	---
	6	220	190	---	---
	8	250	220	---	---
90	2	200	170	---	---
	4	200	160	---	---
	6	240	190	---	---
	8	270	220	---	---
100	2	280	230	---	---
	4	280	220	---	---
	6	330	260	---	---
	8	370	300	---	---
112	2	410	330	---	---
	4	410	320	---	---
	6	480	370	---	---
	8	540	430	---	---
132	2	590	430	---	---
	4	590	380	---	---
	6	690	470	---	---
	8	780	560	---	---
160	2	750	490	1000	700
	4	750	450	1200	840
	6	880	520	1300	910
	8	1000	640	1400	980
180	2	880	950	1000	700
	4	880	1150	1250	875
	6	1030	1350	1350	945
	8	1160	1550	1550	1085
200	2	1160	1100	1100	770
	4	1160	1200	1200	840
	6	1360	1400	1400	980
	8	1520	1600	1600	1120
225	2	1300	1250	1250	875
	4	1300	1350	1350	945
	6	1520	1600	1600	1120
	8	1710	1850	1850	1295
250	2	1460	1300	1300	910
	4	1460	1400	1400	980
	6	1710	1600	1600	1120
	8	1920	1920	1900	1330
280	2	5500	3850	3700	2590
	4	5500	3850	3700	2590
	6	6500	4550	4000	2800
	8	7400	5180	4500	3150
315 S-M	2	5500	3850	3700	2590
	4	5800	4060	3500	2450
	6	6800	4760	4000	2800
	8	7650	5355	4500	3150
315 L	2	2200	1540	3850	2695
	4	2200	1540	3800	2660
	6	2500	1750	4600	3220
	8	3000	2100	5500	3850
355L	2	2000	3690	---	---
	4	6000	1880	---	---
	6	7000	300	---	---
	8	8000	300	---	---

Performance Data

2 Pole - 3000 rpm asynchronous speed 50Hz

Output (kW)	Frame Size	Full lock speed (rpm)	Current: Full load I_N, 50Hz 380V (A)	400V (A)	415V (A)	Locked rotor I_L/I_N	Efficiency % at % full load 100	75	50	power factor, cos φ at % full load 100	75	50	Torque: Full load T_N (Nm)	Locked rotor T_L/T_N	Break down T_B/T_N	Moment of inertia J=1/4 GD^2 ($kgxm^2$)	Nosie level at 1 meter dB(A)	Net weight (kg)
0.75	80M1	2840	1.8	1.7	1.6	5.5	72.1	71.4	68.9	0.85	0.81	0.67	2.5	2.2	2.5	0.001	61	17
1.1	80M2	2845	2.6	2.4	2.4	5.5	75	74.7	72.1	0.84	0.79	0.67	3.7	2.2	2.6	0.001	63	18
1.5	90S	2850	3.3	3.1	3.0	6	77.2	76.5	74.4	0.85	0.81	0.71	5.0	2.7	3.2	0.001	65	23
2.2	90L	2850	4.8	4.5	4.4	6.1	79.7	78.3	76.9	0.86	0.81	0.72	7.4	2.9	3.1	0.001	69	26
3	100L	2880	6.3	5.9	5.8	6.9	81.5	81	79.8	0.87	0.85	0.75	10.0	3	3.5	0.004	72	33
4	112M1	2880	8.2	7.7	7.5	6.7	83.1	82.5	81.8	0.9	0.88	0.81	13.3	2.5	3.1	0.006	74	45
5.5	132S1	2900	11.0	10.4	10.1	7.4	84.7	84	83.2	0.87	0.84	0.76	18.1	2.5	3.3	0.011	83	58
7.5	132S2	2915	14.8	14.0	13.6	7.6	86	85.6	83.8	0.88	0.87	0.78	24.6	2.4	3.2	0.013	83	64
11	160M1	2930	20.9	19.8	19.1	7.3	87.6	87.8	86.5	0.91	0.9	0.84	35.9	2.3	2.6	0.039	83	96
15	160M2	2930	28.2	26.7	25.8	7.2	88.7	88.2	86.4	0.89	0.89	0.84	48.9	2.3	2.6	0.044	83	110
18.5	160L	2935	33.8	32.1	30.9	7.3	89.3	89.8	88.6	0.9	0.9	0.83	60.2	2.2	2.7	0.057	84	126
22	180M	2940	41.0	38.9	37.5	7	89.9	89.8	87.9	0.9	0.87	0.82	71.5	2.4	3	0.077	84	156
30	200L1	2950	55.9	53.1	51.2	5.9	90.7	91.1	89.6	0.9	0.88	0.82	97.1	1.9	3	0.125	86	206
37	200L2	2955	68.5	65.0	62.7	6.5	91.2	91	90.8	0.9	0.88	0.83	119.6	2.3	3.3	0.140	88	235
45	225M	2970	82.0	77.9	75.1	7.1	91.7	91.4	89.2	0.91	0.88	0.84	145.2	2.4	3.3	0.230	90	292
55	250M1	2970	100.9	95.9	92.3	8	92.1	92.2	89.8	0.9	0.87	0.81	177.2	2.7	3.1	0.320	90	358
75	280S	2970	135.2	128.4	123.8	6.8	92.7	91.7	90.2	0.91	0.89	0.82	241.6	2.2	3.2	0.412	90	438
90	280M1	2970	160.0	152.0	146.5	7.2	93	92.5	91	0.92	0.89	0.83	289.4	2.2	3	0.678	90	540
110	315S	2980	194.7	185.0	178.3	6.1	93.3	92.3	91.2	0.91	0.89	0.82	353.1	2.3	2.6	1.170	90	803
132	315M	2980	233.2	221.5	213.5	7.1	93.5	92.9	91.2	0.92	0.88	0.86	423.0	2.3	2.8	1.550	90	860
160	315L1	2980	282.4	268.3	258.6	7.4	93.8	93.2	91.8	0.92	0.87	0.85	512.8	2.5	2.7	1.750	91	891
200	315L2	2980	348.0	330.6	318.7	7.3	94	93.3	92	0.92	0.89	0.87	640.9	2.7	3	2.050	91	985
250	355M	2985	432.3	410.7	395.8	7.1	94	93.5	92.2	0.92	0.91	0.9	799.8	1.8	2.6	3.560	93	1482
315	355L	2985	538.3	511.4	492.9	6.3	94	93.6	92.3	0.92	0.92	0.91	1007.8	1.7	2.9	4.120	94	1706

High Output Design*

5.5	112M2	2890	11.2	10.6	10.3	7.4	84.7	83.9	83.1	0.88	0.88	0.81	18.2	2.6	3.3	0.007	78	50
11	132M	2915	21.6	20.5	19.8	7.2	87.6	86.9	85.4	0.88	0.88	0.81	36.0	2.4	3.3	0.028	83	87
75	250M2	2965	133.0	126.4	121.8	6.8	92.7	92.5	90.1	0.91	0.89	0.84	241.6	2.2	3.2	0.595	90	480
110	280M2	2970	194.7	185.0	178.3	6.8	93.3	92.5	91.6	0.91	0.89	0.82	353.7	2.6	3.1	0.860	88	605

* The motor is increased output (kW) in a reduced frame size electric motor.

4 Pole - 1500 rpm asynchronous speed 50Hz

Output (kW)	Frame Size	Full lock speed (rpm)	Current Full load I_N, 50Hz 380V (A)	400V (A)	415V (A)	Locked rotor I_L/I_N	Efficiency % at % full load 100	75	50	power factor, cos φ at % full load 100	75	50	Torque Full load T_N (Nm)	Locked rotor T_L/T_N	Break down T_B/T_N	Moment of inertia J=1/4 GD² ($kgxm^2$)	Nosie level at 1 meter dB(A)	Net weight (kg)
0.55	80M1	1410	1.5	1.4	1.4	4.6	71	70.5	68.9	0.75	0.67	0.55	3.7	2.4	2.7	0.002	54	17
0.75	80M2	1410	2.0	1.9	1.8	4.4	72.1	71.8	69.5	0.76	0.66	0.54	5.0	2.2	2.7	0.002	57	18
1.1	90S	1410	2.8	2.7	2.6	4.3	75	74.6	73.2	0.79	0.68	0.55	7.5	2.2	3	0.002	61	22
1.5	90L	1410	3.7	3.5	3.4	4.7	77.2	77	75.3	0.79	0.71	0.58	10.2	2.5	3	0.003	61	26
2.2	100L1	1420	5.1	4.8	4.7	5.3	79.7	78.9	77.4	0.81	0.73	0.59	14.8	2.5	2.9	0.007	61	33
3	100L2	1420	6.7	6.4	6.1	5.7	81.5	81.3	80.2	0.81	0.75	0.63	20.2	2.4	3	0.007	63	37
4	112M	1440	8.7	8.3	8.0	5.7	83.1	82.8	81.7	0.83	0.77	0.69	26.5	2.7	3.1	0.010	67	46
5.5	132S	1450	11.7	11.1	10.7	6.8	84.7	84.2	82.7	0.83	0.77	0.65	36.2	2.3	3.1	0.022	68	60
7.5	132M1	1450	15.5	14.7	14.2	7.2	86	85.6	83.7	0.86	0.82	0.72	49.4	2.6	3.1	0.030	68	73
11	160M	1460	22.7	21.6	20.8	6.8	87.6	87.8	85.1	0.84	0.82	0.76	72.0	2.3	2.8	0.075	70	105
15	160L	1460	30.2	28.7	27.7	7.4	88.7	88.9	87.2	0.85	0.8	0.74	98.1	2.6	3.4	0.093	73	125
18.5	180M	1465	35.8	34.0	32.8	7	89.3	88.7	86.8	0.88	0.83	0.73	120.6	2.1	3.2	0.140	75	153
22	180L	1470	41.8	39.7	38.3	6.8	89.9	89.2	87.9	0.89	0.85	0.76	142.9	2.1	3	0.159	75	170
30	200L	1475	56.5	53.7	51.7	6.5	90.7	89.6	88.2	0.89	0.87	0.81	194.2	2.2	3	0.265	80	221
37	225S	1475	70.1	66.6	64.2	7	91.2	91.1	90	0.88	0.87	0.78	239.6	2.1	3.2	0.404	81	283
45	225M	1475	83.8	79.6	76.7	6.6	91.7	91.2	89.5	0.89	0.86	0.8	291.4	2.2	2.8	0.470	82	340
55	250M1	1480	104.4	99.2	95.6	6.3	92.1	92	91	0.87	0.84	0.78	354.9	2.2	2.7	0.670	82	375
75	280S	1480	138.2	131.3	126.5	6.3	92.7	92.6	91.8	0.89	0.86	0.81	484.0	2.3	2.8	1.120	84	506
90	280M1	1485	165.4	157.1	151.5	7.1	93	92.7	91.8	0.89	0.86	0.81	578.8	2.6	3	1.460	84	590
110	315S	1485	200.7	190.7	183.8	5.8	93.3	93	92.4	0.89	0.86	0.81	707.4	2.1	2.8	3.100	88	842
132	315M	1485	240.1	228.1	219.9	6.3	93.5	93.2	92.5	0.89	0.87	0.82	848.9	2.2	2.6	3.300	88	908
160	315L1	1485	287.2	272.8	263.0	5.7	93.8	93.5	92.8	0.89	0.86	0.82	1025.5	2	2.6	3.790	87	992
200	315L2	1485	358.3	340.4	328.1	6.2	94	93.9	93	0.89	0.86	0.82	1281.9	2.3	2.7	4.500	89	1122
250	355M	1485	441.9	419.8	404.6	6.5	94	93.8	93.2	0.9	0.89	0.86	1602.3	2.1	3.1	5.670	90	1490
315	355L	1485	555.7	527.9	508.8	6	94	93.8	93.3	0.9	0.89	0.88	2019.0	2.1	3.3	6.660	90	1650

High Output Design*

11	132M2	1450	22.7	21.6	20.8	6.2	87.6	87.2	86.1	0.84	0.8	0.72	72.4	2.2	2.8	0.063	69	88
75	250M2	1480	136.0	129.2	124.5	6.3	92.7	92.6	91.9	0.89	0.87	0.83	484.0	2.2	3.2	0.880	82	455
110	280M2	1480	200.8	190.8	183.9	6.2	93.3	93.1	92.5	0.89	0.86	0.81	709.8	2.4	2.8	2.680	85	670

* The motor is increased output (kW) in a reduced frame size electric motor.

8 Pole - 750 rpm asynchronous speed 50Hz

Output (kW)	Frame Size	Full lock speed (rpm)	Current Full load I_N, 50Hz 380V (A)	Current Full load I_N, 50Hz 400V (A)	Current Full load I_N, 50Hz 415V (A)	Locked rotor I_L/I_N	Efficiency % at % full load 100	Efficiency % at % full load 75	Efficiency % at % full load 50	power factor, cos φ at % full load 100	power factor, cos φ at % full load 75	power factor, cos φ at % full load 50	Torque Full load T_N (Nm)	Torque Locked rotor T_L/T_N	Torque Break down T_B/T_N	Moment of inertia J=1/4 GD^2 ($kgxm^2$)	Nosie level at 1 meter dB(A)	Net weight (kg)
0.18	80M1	680	0.9	0.9	0.8	3.2	51	50	45	0.61	0.55	0.46	2.5	2.1	2.4	0.002	50	17
0.25	80M2	690	1.2	1.1	1.1	3.3	54	52.3	45.1	0.61	0.55	0.47	3.5	2	2.2	0.003	50	19
0.37	90S	700	1.5	1.4	1.4	3.6	62	61.2	56.2	0.61	0.53	0.44	5.0	1.9	2.5	0.004	53	23
0.55	90L	700	2.2	2.1	2.0	3.5	63	62	59.3	0.61	0.51	0.42	7.5	1.9	2.3	0.004	54	25
0.75	100L1	700	2.4	2.3	2.2	4	71	70.2	62.5	0.67	0.57	0.46	10.2	2.1	2.4	0.008	56	33
1.1	100L2	700	3.3	3.1	3.0	3.7	73	71.6	68.8	0.69	0.59	0.47	15.0	2.2	2.4	0.010	59	38
1.5	112M1	700	4.3	4.1	3.9	4.2	75	73.7	70.2	0.69	0.6	0.5	20.5	2.2	2.7	0.017	61	50
2.2	112M2	710	5.9	5.6	5.4	4.5	75	73.5	70.5	0.69	0.62	0.51	30.0	2	2.6	0.018	62	55
2.2	132S	710	5.9	5.6	5.4	4.7	78	77.3	74.6	0.71	0.63	0.51	29.8	2.1	2.5	0.030	65	58
3	132M1	710	7.8	7.4	7.1	4.6	79	77.4	75.1	0.73	0.67	0.55	40.6	2.1	2.6	0.040	65	68
4	160M1	720	10.2	9.7	9.3	4.5	81	79.8	78.5	0.74	0.66	0.56	53.8	2.1	2.7	0.075	67	76
5.5	160M2	720	13.5	12.8	12.4	5	83	81.6	78.6	0.75	0.67	0.55	73.5	2.3	2.8	0.093	68	92
7.5	160L	720	17.7	16.8	16.2	6	85.5	83.8	81.5	0.76	0.69	0.55	99.5	2.2	2.6	0.125	69	117
11	180L	730	25.4	24.1	23.3	5.5	87.5	87.2	85.9	0.77	0.67	0.56	143.9	2.2	2.5	0.202	70	154
15	200L	730	34.0	32.3	31.1	5.8	88	86.4	85.2	0.77	0.72	0.59	196.2	2.1	2.8	0.338	71	202
18.5	225S	730	41.0	39.0	37.5	6.3	90	89.5	88.8	0.76	0.73	0.65	242.0	2.1	2.5	0.490	73	251
22	225M	740	47.2	44.8	43.2	6.2	90.5	90.2	89.3	0.78	0.74	0.63	285.9	2.2	2.5	0.550	73	295
30	250M	740	63.3	60.1	58.0	5.9	91	90.5	88.6	0.81	0.76	0.65	389.8	2.3	3	0.830	74	358
37	280S	740	77.6	73.7	71.1	6.3	91.5	91.2	90.1	0.81	0.77	0.69	480.7	2.1	2.8	1.390	75	472
45	280M1	740	94.1	89.4	86.2	6.4	92	91.3	89.5	0.82	0.76	0.64	580.7	1.9	2.5	1.650	76	528
55	315S	740	110.9	105.4	101.5	6.8	92.8	92	90.5	0.82	0.78	0.7	709.8	1.9	2.7	4.790	78	729
75	315M	740	150.3	142.8	137.6	7	93	91.8	90.6	0.83	0.8	0.72	967.9	2	2.4	5.580	78	902
90	315L1	740	177.6	168.7	162.6	6.7	93.8	93.2	92	0.82	0.78	0.69	1161.5	2.4	2.8	6.370	80	969
110	315L2	740	216.6	205.8	198.3	6.4	94	93.3	92.5	0.82	0.8	0.72	1419.6	2.4	2.5	7.230	81	1112
132	355M1	740	258.8	245.9	237.0	5.8	93.5	93.1	92.2	0.82	0.81	0.72	1703.5	1.7	2.3	10.54	82	1475
160	355M2	740	317.2	301.3	290.4	5.5	93.8	92.9	91.6	0.84	0.83	0.75	2064.9	1.5	2.3	11.72	86	1528
200	355L	740	391.3	371.7	358.3	6	94	93.4	92.2	0.83	0.81	0.75	2581.1	1.3	3.3	12.85	87	1730

High Output Design*

4	132M2	705	10.3	9.8	9.4	4.6	81	80.2	79.2	0.73	0.69	0.57	54.2	1.9	2.4	0.040	67	74
55	280M2	740	108.5	103.1	99.3	6.9	92.8	91.6	90.5	0.82	0.77	0.67	709.8	2.3	2.9	3.650	77	613

PERFORMANCE DATA FOR DUAL SPEED MOTORS

Dual speed series of three phase asynchronous motors are constructed Totally Enclosed Fan Cooled (TEFC), and is available in both cast iron and aluminium housing. This series of motors has the capability of operation at multiple power output and/or multiple speeds with a wide selection of variation. Dual Speed motors utilises very special winding technology to achieve its flexible capabilities, reliable operation and professional appearance, easy to maintain, while low on noise and little vibration. This series of motors is used widely for fan and pump industry.

2/4 Poles - 3000/1500 rpm - Single Winding

Model	Power (kW)		Speed (r/min)		Current A	
	2P	4P	2P	4P	2P	4P
80B	0.8	0.16	2955	1480	1.9	0.72
90S	1.2	0.24	2955	1480	2.91	0.81
90L	1.7	0.34	2955	1480	3.91	1.09
100L	2.4	0.48	2955	1480	5.52	1.35
112M	3.3	0.66	2955	1480	7.48	1.66
132S1	4.4	0.88	2955	1480	9.92	2.23
132S2	6.1	1.2	2955	1480	13.05	3.1
160M1	8.3	1.7	2955	1480	17.53	4.26
160M2	12	2.4	2955	1480	24.23	5.56
160L	17	3.4	2955	1480	34.1	7.27
180M	20	4	2955	1480	39.84	8.5
200L1	24	4.8	2955	1480	46.22	10.13
200L2	33	6.6	2955	1480	59.15	13.09
225M	41	8.2	2955	1480	77.48	17.5
250M	50	10	2955	1480	90.74	19.09
280S	61	12	2955	1480	118.95	24.84
280M	83	17	2955	1480	150.5	34.32
315S	99	20	2955	1480	172.36	39.7
315M1	121	24	2955	1480	219.87	46.99
315L1	145	29	2955	1480	262.84	57.5
315L2	176	35	2955	1480	321.58	67.9

4/6 Poles - 1500/1000 rpm - Separate Winding

Model	Power (kW)		Speed (rpm)		Current A	
	4P	6P	4P	6P	4P	6P
80B	0.55	0.18	1480	990	1.64	0.67
90S	0.75	0.25	1480	990	2.12	0.86
90L	1.1	0.36	1480	990	2.96	1.3
100L1	1.5	0.5	1480	990	3.81	1.8
100L2	2.2	0.75	1480	990	5.11	2.32
112M	3	1	1480	990	6.84	3
132S	4	1.3	1480	990	8.88	3.91
132M	5.5	1.8	1480	990	11.76	4.78
160M	7.5	2.5	1480	990	15.65	6.21
160L	11	3.5	1480	990	22.56	9
180L	15	5	1480	990	30.32	12.5
200L1	18.5	6.1	1480	990	36.26	13.01
200L2	22	7.3	1480	990	42.9	17.1
225M	33	11	1480	990	63.48	24.52
250M	45	15	1480	990	84.59	31.66
280M	55	18	1480	990	103	37.02
315S	75	25	1480	990	138.11	51.09
315M1	90	30	1480	990	165.95	59.3
315L1	110	36	1480	990	201	70.1
315L2	132	44	1480	990	240.06	86.61

4/8 Poles - 1500/750 rpm - Single Winding

Model	Power (kW)		Speed (rpm)		Current A	
	4P	8P	4P	8P	4P	8P
80B	0.6	0.12	1480	735	1.66	0.6
90S	0.8	0.16	1480	735	2.23	0.92
90L	1.2	0.24	1480	735	3.1	1.25
100L1	1.7	0.34	1480	735	4.26	1.4
100L2	2.4	0.5	1480	735	5.56	1.72
112M	3.3	0.7	1480	735	7.27	2.19
132S	4.4	0.9	1480	735	9.1	3.24
132M	6.1	1.2	1480	735	13.09	4.31
160M	8.3	1.7	1480	735	17.5	5.8
160L	12	2.4	1480	735	24.84	6.95
180M	17	3.4	1480	735	34.32	8.85
180L	20	4	1480	735	39.7	10.87
200L	24	5	1480	735	46.99	11.71
225S	33	6.6	1480	735	65.5	15.58
225M	41	8.2	1480	735	81.24	19.11
250M	50	10	1480	735	89.32	22.79
280S	61	12	1480	735	114.69	28.88
280M	83	17	1480	735	147.2	36.5
315S	99	20	1480	735	191.82	45
315M1	121	24	1480	735	224.3	47.1
315L1	145	29	1480	735	277.11	58.53
315L2	176	35	1480	735	324.89	72.15

6/8 Poles - 1000/750 rpm - Separate Winding

Model	Power (kW)		Speed (rpm)		Current A	
	6P	8P	6P	8P	6P	8P
90S	0.55	0.24	990	735	1.87	1.25
90L	0.75	0.32	990	735	2.32	1.4
100L	1.1	0.47	990	735	3.28	1.7
112M	1.5	0.65	990	735	4.14	1.91
132S	2.2	0.95	990	735	5.61	3.58
132M1	3	1.3	990	735	7.47	4.81
132M2	4	1.7	990	735	9.76	5.8
160M	5.5	2.4	990	735	12.8	6.95
160L	7.5	3.2	990	735	17.15	8.85
180L	11	4.7	990	735	24.52	11.5
200L	13	5.5	990	735	28.99	13.6
225S	15	6.5	990	735	31.6	15.58
225M	21	9	990	735	44.71	21.09
250M	26	11	990	735	52.11	25.43
280S	30	13	990	735	59.35	30.02
280M	37	16	990	735	70.15	38.22
315S	53	23	990	735	104	49.85
315M1	65	28	990	735	122.84	58.58
315L1	80	34	990	735	162.05	71.88
315L2	92	40	990	735	170.25	82.41

ESC Motor Modification Option

The ESC series can be modified to incorporate one or more of the following options, please contact your nearest. Please contact to Enertech Electric motor (Australia) branch for more details.

- Socket head cap screws, Grades 8.8, 10.9 or 12.9 to replace all external bolts and/or screws.
- Anti-condensation heater terminated in the main terminal box.
- Stainless steel shafts.
- Alternative shaft diameters and/or shaft length.
- Double shaft extensions.
- Alternative conduit entry dimensions.
- Alternative bearing arrangements (ball, roller, angular contact or four point contact types).
- Force ventilation for frame size 200 and above.
- Low noise fan and cowl in steel or cowl only in stainless steel.
- Rain canopy for vertical mount (V1) in steel or stainless steel.
- Class H winding insulation.
- Nonstandard paint color in RAL standard.
- Two pack epoxy paint finish.
- Class H winding insulation for 180°C working environment.
- PTC and condensate heater (optional).
- Grease nipple both DE and NDE bearing for frame size 100L, 112M and 132) if required. IQF Spiral Freezer & Cooler
- Especial design for IQF tunner freezer condition.
- Working temperature -50°C max.
- IPSS with Anti-condensation heater terminated in main terminal box.
- IP 66 (optional).
- Double shaft extension.
- Anodizing of aluminium or enhanced performance cast iron units.
- Stainless steel external shaft (optional).
- Air Blast Freezer
- Stainless steel external in grades AISI 316L. Working in temperature from -18°C to 22°C.
- IP 67.
- Premium efficiency IE3.
- Smokespill application 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°C or for 30 minutes at 300°C

IE1 - Product Catalogue

Operation and Maintenance