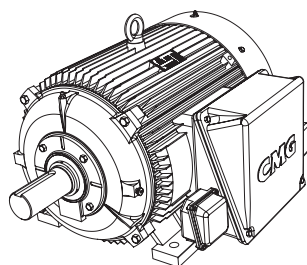


CMG

SOLUTIONS, not just products

Edition 4 Issue 3



PPA & PPC series motors

High specification cast iron units



SOLUTIONS, not just products

Specialists in Electric Motors, Geared Motors & AC Drives

At CMG we offer customised packages to the most demanding industrial markets. Our success is built on a strong commitment to our customers' needs and a willingness to find the best solution possible. We have been in business since 1948 so you can be confident our experience and knowledge is second to none.

With over 650 staff around the globe, our branches extend across Australia, New Zealand, Asia Pacific, South Africa, Europe and the Middle East.

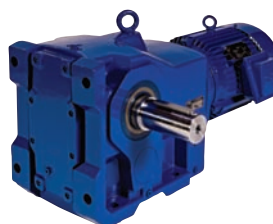
We have the capability to value-add our products through partnerships with leading international companies whose technical skills are equal to ours, including Gear Motors from Reggiana Riduttori and NORD, and AC Drives from VACON. In return we offer these companies superior technical support that complements their own R&D capabilities.

Our manufacturing facility in Melbourne, Australia, demonstrates our commitment to efficient automated manufacturing processes. This facility includes a NATA & ILAC accredited laboratory which offers complete design and testing services.

"We specialise in an extensive range of Electric Motors, Geared Motors and AC Drives. Offering a 'complete package' ensures our customers get the most efficient, cost effective solution possible."



» Electric Motors



» Geared Motors

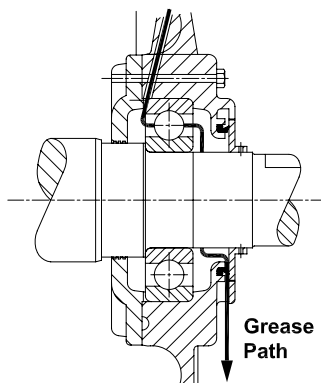


» AC Drives

PPA & PPC High Efficiency cast iron motors H Class, IP66, Sizes 80 to 450

CMG's premium high efficiency motor range up to 1000kW features all of your engineers' specifications as standard.

- ☐ **Meets world market needs and standards**
 - Three phase 380V, 400V, 415V, 440V, 525V, 690V, 1000V & 1100V, 50Hz & 60Hz (page 9)
 - Australian/British and CENELEC frame allocations
- ☐ **H Class insulation, B class (80°C) temperature rise** (page 9)
- ☐ **Totally enclosed IP66 protection standard** (page 6)
- ☐ **20 years design life** (page 4)
- ☐ **Maintenance without downtime**
 - thru flushing grease relief valve system (page 4)
- ☐ **Designed and built for arduous environments and mining specifications**
- ☐ **Custom designs from 100 to 1100V, 40 to 60Hz available** (page 9)
- ☐ **Sensors and Protection built in**
 - Thermistors
 - SPM vibration stud
 - Anti-condensation heaters
 - Additional external earth screw
- ☐ **Low noise low vibration design** (page 8)
- ☐ **Cast iron fan, steel fan cover, and stainless steel nameplates** (page 5)
- ☐ **Standard 2-pack epoxy or customized surface finishes** (page 5)
- ☐ **Eff 1 / MEPS efficiency** (page 4)
- ☐ **Oversized and reversible terminal box** (page 6)
- ☐ **Full cast iron construction** (page 5)



Hazardous locations motors, certified to IEC and Australian standards, are also available (page 24)

IEC/EX

Exe Zone 1

ExnA Zone 2 (formerly Exn)

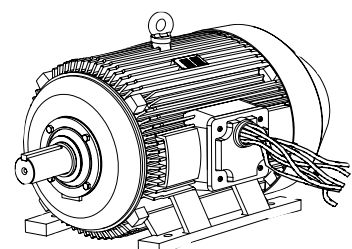
ExtD (formerly DIP)

AUS/EX

Exe

Exn

DIP



Note: Features vary according to frame size.

CMG Motors | PPA 0811 (edition 4.3.0)

Introduction

This catalogue details CMG's premium range of PPA & PPC series motors. PPA & PPC motors are three phase squirrel cage TEFC (IC411), available in frame sizes 80 to 450, and have been designed and manufactured in accordance with AS/NZS1359 (IEC 60034 & IEC 60072). 'PPA' is commonly used to refer to both PPA and PPC ranges.

High specification design

Electric motors are installed in a wide range of conditions from sub zero temperatures to tropical environments and dusty deserts. The PPA range, with its rugged cast iron enclosure, is designed to suit these harsh conditions and provide both high operational reliability and low operating costs.

20 year design life

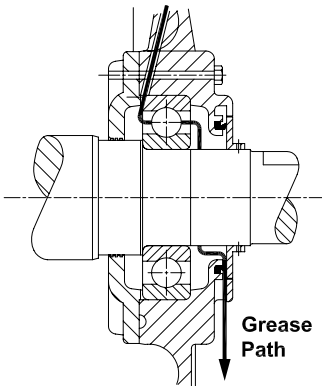
All motors in the PPA range are manufactured with Class H insulation. They are designed to operate with a temperature rise of 80°C or less (Class B), and provide a thermal reserve in excess of 45°C when operating in a 40°C ambient. This ample thermal reserve means the PPA has a winding design life of 20 years.

Ultimate protection

The entire PPA range has an enclosure protection rating of IP66. The windings are tropic protected and oil resistant with the motors being weather protected as standard.

High efficiency

The PPA range of motors comply to AS/NZS 1359.5.2004 for standard efficiency motors. PPA efficiencies are also in line with European EFF1 and correspond to IE2 levels (High Efficiency) of IEC 60034-30



Thru-flushing grease relief valve

The pressure grease relief valve, incorporating a V-ring seal, eliminates downtime by enabling relubrication of the bearings without stopping the motor.

A complete selection

PPA series motors can be designed for use on 100 to 1100V systems and for all common world frequencies including 40Hz, 50Hz and 60Hz. The most common power supplies are 380V, 400V, 415V, 440V, 525V, 690V, 1000V and 1100V. Customer specified variations on these standards

are readily available.

Standards and specifications

The main dimensions and rated outputs of PPA motors generally conform to IEC 60072 and AS/NZS1359 (Australian/British kW-frame size allocation table). The PPC range has a similar specification to that of the PPA range with the kW/frame allocation being taken from the CENELEC table. (The term 'PPC' is used only where the frame allocation is different from the PPA.)

CMG Technology offer full load testing in their NATA and ILAC accredited laboratory on all motors within the PPA and PPC ranges. Speed-torque / current / efficiency curves are available upon request.

Hazardous location certification

PPA motors are certified for use in hazardous locations as per IEC and Australian standards. IEC certificate number is IEC Ex TSA 06.0035X. Australian certificate numbers are as below:

Location	Protection	Ambient temp.	Certificate
Zone 1	Exe II T3	50°C	AUS Ex 3852X
Zone 2	ExnA II T3	60°C	AUS Ex 3853X
	ExtD A21 T _A T4	50°C	AUS Ex 3853X

Note: ExtD was formerly known as DIP.

Product code specification

When placing an order the motor product code should be specified. The product code of the motor is composed in accordance with the following example:

M	3	2	0	0	1	5	0	3	P	P	A	E	/	4	0	5
1	2	3	4-8					9	10 - 12	13...	Suffix					

Position 1
M = metric frame size

Position 2
Phase
3 = three phase single speed motor

Position 3
Number of poles
2 = 2 poles 4 = 4 poles
6 = 6 poles 8 = 8 poles
A = 10 poles C = 12 poles

Positions 4 to 8
Rated power output
(kW x 100)

Position 9
Mounting arrangement
1 = V1 3 = B3
4 = B3/B5 5 = B5

Positions 10 to 12
Series
PPA = PPA series motors
PPC = PPC series motors

Position 13...*
Series variation
Blank = Standard
E = Zone 1 Exe
F = Flying leads
N = Zone 2 ExnA
D = ExtD (DIP)
L = LHS terminal box
R = Airstream rated

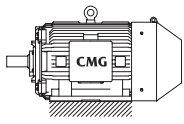
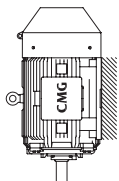
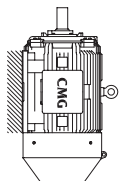
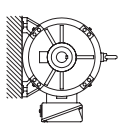
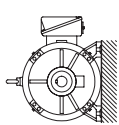
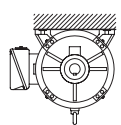
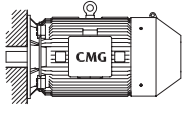
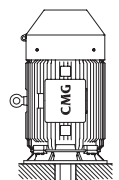
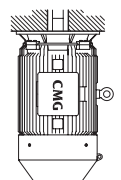
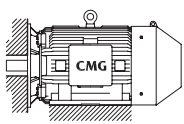
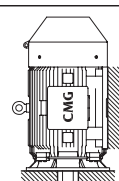
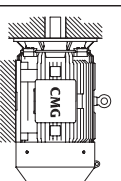
* Multiple letters indicate multiple variation.

Suffix
Winding design
Blank = 415V / 50 Hz
/385 = 380V / 50 Hz
/405 = 400V / 50 Hz
/445 = 440V / 50 Hz
/525 = 525V / 50 Hz
/695 = 690V / 50 Hz
/A05 = 1000V / 50 Hz
/B05 = 1100V / 50 Hz
/386 = 380V / 60 Hz
/406 = 400V / 60 Hz

Mechanical design

Mountings

CMG PPA motors are available in the mounting arrangements shown below. For all other mounting arrangements please contact CMG directly.

Foot mount  B3 (IM1001)* [PPA 80 - 450]	 V5 (IM1011) [PPA 80 - 280]	 V6 (IM1031) [PPA 80 - 280]
 B6 (IM1051) [PPA 80 - 280]	 B7 (IM1061) [PPA 80 - 280]	 B8 (IM1071) [PPA 80 - 280]
Flange mount  B5 (IM3001)* [PPA 80 - 280]	 V1 (IM3011)* [PPA 80 - 450]	 V3 (IM3031) [PPA 80 - 280]
Flange and feet  B3/B5 (IM2001)* [PPA 80 - 450]	 V1/V5 (IM2011) [PPA 80 - 280]	 V3/V6 (IM2031) [PPA 80 - 280]

* Most common mounting arrangements

Materials and construction

General

Frames 80-450	Cast iron construction, one piece
Endshields	Cast iron construction
Terminal box	Cast iron construction
Fan	Bi-directional cast iron or fabricated steel
Fan Cowl	Fabricated steel (heavy gauge)
Fasteners	Corrosion protected (stainless optional)

Endshields

Endshields are manufactured from close-grained pearlite grey cast iron having a 250MPa tensile strength. The endshields are adequately ribbed to provide cooling to the area around the bearing. Their shallow design ensures they remain rigid under the stresses of starting and running, and are designed to withstand the radial and axial forces encountered during most applications.

Stator frame

Stator frames are manufactured from close-grained pearlitic grey cast iron having a 250MPa tensile strength. Their one piece design ensures the stator remains rigid under all starting and running conditions. The ribs are designed to dissipate the optimum amount of heat with the lowest airflow over the motor. This helps to ensure that windage noise is minimized. Adequate spacing between ribs is maintained to lessen the possibility of blockage due to the build up of dirt.

Shaft

Shafts are manufactured from high quality steel and adequately proportioned to provide strength and rigidity in operation. Bearing journals are ground to ensure an accurate bearing fit and positioning. Keys are provided with each motor.

Shaft extension run out, concentricity, and perpendicularity to the face of standard flange mount motors comply with normal grade tolerance as specified in IEC 60072 and AS/NZS1359. Precision grade tolerance is available upon special order. Non-standard dimensions and shaft materials are available on request.

Rotor

Rugged one piece rotor cages are die cast aluminium. After fitting the rotor core to the shaft the rotor assembly is dynamically balanced to G1 limits for smooth operation.

Finish

All castings and steel parts are primed with a 2-pack epoxy coating, followed by a top coat of 2-pack epoxy to the customer's color specification.

Standard colours are as follows:

- RAL 5010 Gentian Blue (except Australia)
- RAL 2008 Bright Red Orange (Australia only)
- RAL 5019 Capri Blue (1000V motors only)

Special paint systems can be provided to accommodate stringent requirements for motors in corrosive environments, selected to resist substances such as acid, salt water and extreme climatic conditions.

Stainless steel nameplates

The motor nameplate is manufactured from stainless steel, with markings engraved, not printed, to provide permanency. Thermistor and heater labels are all manufactured from stainless steel.

Protection

For vertically mounted motors

The PPA series motor can be mounted vertically shaft up without the need for additional covers or protection. When mounted vertically shaft down protective hoods are available upon request.

Solar radiation

High solar radiation from exposure to direct sunlight may result in an adverse total motor temperature. In these circumstances motors should be screened with adequate and appropriate sunshades without inhibiting airflow.

Degree of protection

Standard levels of enclosure protection for all PPA series motors is IP66 for both motor and terminal box. Sintered bronze porous drain plugs are fitted to the lowest point of the motor enclosure, as standard.

IP66 enclosure protection means dust tight (no ingress of dusts), and protection against heavy seas (water from heavy seas or water projected in powerful jets shall not enter the enclosure in harmful quantities).

Enclosure designations comply with IEC 60529 and AS60529. The enclosure protection rating required depends upon the environmental and operational conditions in which the motor is to operate.

Additional earth terminal

Additional to the earth terminal fitted within the main terminal box an external earth, for grounding of the frame, is fitted on the motor foot for frame sizes 250 and above. (Optional on smaller sizes.)

Terminal box

Cast iron diagonally split terminal boxes are provided on all PPA motors. They are located on the centre line of the stator allowing easy change of the terminal box from the right hand side to the left (except 450 frame, which must be specifically ordered). Refer to the "Modification, variations and optional extras" section on page 27.

The terminal box is designed oversize to accommodate fitting of larger than standard cables used to minimise voltage drop over long cable runs. The box's ample dimensions also allow aluminium cables to be terminated using bi-metal lugs.

A removable gland plate is fitted to all terminal boxes, frame 225 and above (smaller frames optional). For frames 80 to 315 the gland entry is drilled and tapped with standard metric threads as per the accompanying table. Motor frames 355 and above are fitted with undrilled ferrous gland plates. (Non ferrous optional). The terminal box is supplied with the conduit entry facing downward and can be rotated through 360° in 90° increments.

Conduit entries

Motor frame	Standard		Alternative (South Africa std)	
	Number of entries	Entry / pitch	Number of entries	Entry / pitch
80	2	M20 x 1.5	2	M20 x 1.5
90	2	M20 x 1.5	2	M20 x 1.5
100	2	M20 x 1.5	2	M20 x 1.5
112	2	M25 x 1.5	2	M25 x 1.5
132	2	M25 x 1.5	2	M25 x 1.5
160	1	M50 x 1.5	2	M25 x 1.5
180	1	M50 x 1.5	2	M32 x 1.5
200	1	M50 x 1.5	2	M32 x 1.5
225	1	M63 x 1.5	2	M40 x 1.5
250	1	M63 x1.5	2	M40 x 1.5
280	1	M63 x 1.5	2	M50 x 1.5
315	1	M63 x 1.5	2	M63 x 1.5
355	Nil	BGP	Nil	BGP
400	Nil	BGP	Nil	BGP
450	Nil	BGP	Nil	BGP

BGP = Blank Gland Plate.

Nitrile gaskets are fitted between all mating surfaces to ensure that the IP66 degree of protection is maintained.

During transportation and storage the conduit entry hole is fitted with a removable plug to limit the ingress of moisture.

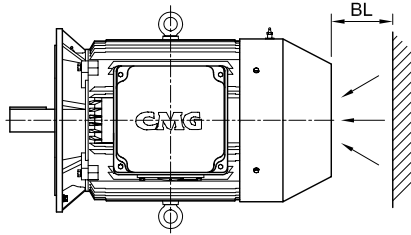
Cooling

PPA motors are fitted with a low noise bi-directional cast iron or fabricated steel fan. The fan, with its radial blades, and the fan cover of a conical shape, is designed to minimise turbulence within the fan housing and allow smooth airflow.

In most instances the fan and cover are designed to eliminate the need for special acoustic attenuation required to meet stringent noise level standards.

For special applications such as low speed, operation through a VVVF drive, or frequent starting and stopping, a separately driven cooling fan is available as an optional extra. See VVVF Drive Kit A in the "Modification, variations and optional extras" section on page 27.

Cooling air flows from the non-drive-end to the drive end. When the motor is installed care should be taken not to impede the airflow into the motor cowl.



As a guide the following minimum dimension BL should be adopted:

Motor frame	BL [mm]
80 - 132	40
160 - 200	60
225 - 450	80

Bearings and lubrication

Bearings

As standard all PPA motors have high quality bearings made from vacuum degassed steel. The standard bearings in the range are selected to provide long operational life, quiet running, and high load carrying capacity.

4, 6 and 8 pole motors up to 280 frame, and all 2 pole motors, as standard are fitted with high quality deep groove ball bearings. 4, 6 and 8 pole motors 315 frame and above are fitted with cylindrical roller bearings on the drive end.

Motor frame	DE Standard	DE Optional	NDE Standard
80	6204ZZ		6204ZZ
90	6205ZZ		6205ZZ
100	6206ZZ		6206ZZ
112	6306	NU306	6306
132	6308	NU308	6308
160	6309	NU309	6309
180	6310	NU310	6310
200	6312	NU312	6312
225	6313	NU313	6313
250 - 2	6313		6313
250 - 4, 6, 8	6315	NU315	6313
280 - 2	6314		6314
280 - 4, 6, 8	6317	NU317	6314
315 - 2	6316		6316
315 - 4, 6, 8	NU318		6316
355 - 2	6318		6318
355 - 4, 6, 8	NU324		6324
400 - 2	6318		6318
400 - 4, 6, 8	NU326		6326
450 - 4, 6, 8	NU328		6326

In standard arrangement, non-drive end bearing is locked to prevent axial movement.

Drive and non-drive bearing housings

PPA motors frames 80 to 100 have sealed non-regreasable bearing housings. The bearings are prelubricated with a lithium based grease. All motors of frame 112 and above are fitted with a thru-flushing pressure grease relief valve incorporating a V-ring seal which allows the bearing to be relubricated without stopping the motor.

Optional roller bearings

For motor frames 112 to 280, in applications with increased radial force, ball bearings can be substituted for cylindrical roller bearings at the drive end, in accordance with the bearings table on this page.

Shaft locking clamps

All motors within the PPA range 200 frame and above are fitted with a substantial shaft-locking clamp to help prevent false brinnelling in transport. The motors should always be transported or stored with this clamp fitted and tensioned to avoid bearing damage.

Once the motor has reached its final destination and is ready for installation the shaft-locking clamp must be removed before the motor is run no-load to confirm that the bearings are in good condition.

After this initial run normal installation can continue with additions of pulleys or couplings.

Lubrication

Standard bearings are lubricated with a lithium based rolling contact bearing grease, having an R3 consistency and suitable for operation within the cooling air temperature range of -20°C to +55°C. For operation outside this temperature range special lubricants are required.

Special lubricants or additional maintenance may also be required in cases where motors are exposed to a comparatively high degree of pollution, high humidity, increased or changed bearing loads, or prolonged continuous operation. For details of grease quantities, re-lubrication intervals, and recommended grease types refer to the "Installation and maintenance" instructions on page 28.

Balancing, vibration and noise

Balancing

PPA motors have their rotor balanced separately to the external cooling fan so that the fan can be removed or changed without altering the balance of the rotor.

All rotors are balanced with a half key to fine tolerances (G1).

Pulleys or couplings used with motors must be appropriately balanced.

Vibration

PPA series motors fall within the limits of vibration severity as set out in IEC 60034-14, which are listed below. Values relate to rotating machinery measured in soft suspension.

Vibration severity limit

Motor frame	Maximum RMS vibration velocity [mm/s]
80	1.6
90	1.6
100	1.6
112	1.6
132	1.6
160	2.2
180	2.2
200	2.2
225	2.2
250	2.2
280	2.2
315	2.8
355	2.8
400	2.8
450	2.8

Vibration sensors

Provision for fitting vibration sensors for condition monitoring is standard on all motors of frame size 250 and above (optional on smaller sizes).

Vibration levels can be checked with an SPM monitor, or its equivalent, when the motor is new and on a regular basis, usually at the same time as re-greasing. This ensures optimum bearing life is achieved and bearing failures avoided.

Low noise

The PPA fan cooling system is designed to achieve the required air flow with minimum losses. This enables the fan to cool the motor whilst keeping noise levels to a minimum.

The table below shows the overall sound pressure levels of PPA motors at 1 metre (no load).

Sound pressure level

kW	Sound pressure level dB(A) at 1 metre			
	3000 r/min	1500 r/min	1000 r/min	750 r/min
0.37	60	58	54	51
0.55	60	58	54	51
0.75	60	58	58	51
1.1	60	62	60	54
1.5	60	62	63	54
2.2	60	62	63	63
3	63	62	67	63
4	63	62	67	63
5.5	74	62	67	63
7.5	74	62	67	63
11	74	72	67	63
15	77	72	67	68
18.5	77	72	71	68
22	77	72	71	68
30	79	72	72	68
37	80	73	72	68
45	80	73	72	68
55	80	73	72	68
75	80	74	73	73
90	82	75	74	73
110	82	76	75	73
132	82	78	77	73
150	83	78	77	73
185	84	79	77	74
200	85	79	77	74
220	87	81	77	74
250	89	83	77	74
280	90	83	77	74
315	90	84	77	74
355	90	85	78	74
400	90	88	78	
450	95	88	78	
500	95	89	78	
560	95	90	85	
630		90	85	
710		91	85	
800		93	85	
900		93		
1000		93		

Alternate devices are available for noise reduction where very low levels are specified. These include uni-directional fans, separately driven cooling fans, inlet attenuation, and full motor attenuation.

Electrical design

Operating parameters

Standard PPA series motors have the design and operating parameters listed below. Performance data is based on this standard.

Three phase	See voltage and frequency below
Ambient cooling air Temperature	40°C
Altitude	up to 1000m
Duty cycle	S1 (continuous)
Rotation	Refer table on page 10.

Any variation from these operating parameters should be examined and performance data altered in accordance with the information provided in this section.

Voltage and frequency

PPA motors are manufactured for various rated power supplies. Standard rated supplies include:

380V 50Hz	1000V 50Hz
400V 50Hz	1100V 50Hz
415V 50Hz	380V 60Hz
525V 50Hz	440V 60Hz
690V 50Hz	

Motors can be manufactured for any supply from 100 to 1100V and frequencies other than 50Hz or 60Hz.

PPA motors are designed to operate on VVVF drives and will provide constant torque on the condition that the voltage/frequency ratio remains constant.

PPA motors may operate when connected to other non-standard voltages and frequencies. Rated performance data values should be multiplied by the factors in the table below to give more realistic operating data values which, if used, will reduce additional motor temperature rise.

Apply these factors to motors rated at 415V 50Hz but operated on other supplies:

Supply [Volts / Hz]	Rated speed	Rated power	Rated current I_N	Rated torque T_N	Locked rotor torque T_L	Break down torque T_B
380/50	1.00	0.95	1.00	0.95	0.83	0.83
400/50	1.00	1.00	1.00	1.00	0.93	0.93
415/50	1.00	1.00	1.00	1.00	1.00	1.00
440/50	1.00	1.00	1.00	1.00	1.10	1.10
415/60	1.20	1.00	1.00	0.83	0.69	0.69
440/60	1.20	1.05	1.00	0.87	0.77	0.77
460/60	1.20	1.10	1.00	0.91	0.85	0.85
480/60	1.20	1.15	1.00	0.96	0.92	0.92

For critical applications data should be confirmed.

The performance data for motors with other supply ratings is the same as that provided on pages 12, 14, 16 & 18 for 415V motors, except for the currents which are presented on pages 13, 15, 17 & 19.

Temperature and altitude

Rated output power specified in the performance data tables apply for standard ambient conditions of 40°C up to 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

$$\text{Effective power} = \text{Rated power} \times \text{Temperature factor} \times \text{Altitude factor}$$

Insulation

PPA 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 a design life in excess of 20 years.

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

	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

Duty

PPA motors are supplied suitable for S1 operation (continuous operation under rated load). To determine the correct motor size for duty cycles other than S1 please contact CMG with the following information:

- Type and frequency of switching (short time, intermittent, periodic, high inertia, braking)
- Load torque variation during motor acceleration and braking (in graphical form)
- Moment of inertia of the load on the motor shaft
- Type of braking (e.g. mechanical, electrical through phase reversal or DC injection).

Rotation

For clockwise rotation (standard), viewed from drive end, standard three phase PPA 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 accompanying table.

Non-standard motors, with the terminal box located on the left when viewed from drive end, have a counter-clockwise rotation for coinciding markings, and reversing two of the line conductors will reverse the rotation to clockwise.

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

Connection and starting

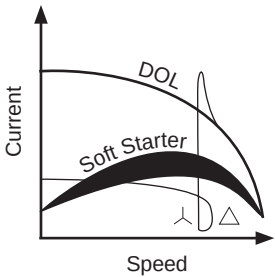
PPA motors are suitable for use with both rated voltage DOL operation and rated voltage three phase variable frequency drives. 3kW and below can also be used with 220-250V three phase variable frequency drives when connected in Delta.

Alternatively, 380-415V, 4kW to 630kW Delta connected motors can be operated DOL, or in the Star configuration with a 690V supply or with a 690V variable frequency drive. When used with a VVVF drive they must be supplied with an output reactor to protect the winding insulation. These motors are also suitable for Star/Delta starting. For motors 710kW and above the standard connection is Delta with a rated voltage of 690V.

Electronic soft starters and VVVF drives are available through CMG Drives Division, and are best supplied together with the motor.

Electronic soft starters

Through the use of an electronic soft starter, which controls parameters such as current and voltage, the starting sequence can be totally controlled. The starter can be programmed to limit the amount of starting current where, by limiting the rate of the current increase, the startup time can be extended.



VVVF Drives

The PPA motor performs excellently without cogging at low speed when operating in conjunction with a VVVF (Variable Voltage Variable Frequency) Drive. Variable voltage variable frequency (VVVF) 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 full 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 offer a simple and repeatable method of changing speeds or flow rates.

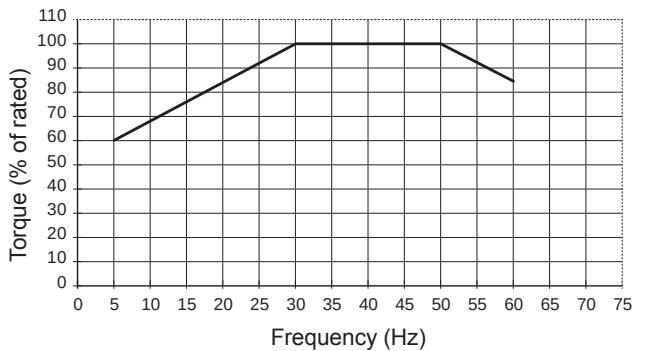
The standard insulation provided on PPA motors can accept a rise time of 3000V/ μ s and a peak voltage of 2600V. To ensure that this parameter is not exceeded care should be taken in the selection of the VVVF drive and, where necessary, suitable output voltage filters should be used. All drives supplied by the CMG Drives Division will comply with this parameter.

For operation below 30Hz motor cooling fan efficiency drops significantly. Hence, in the constant torque applications, a separately driven cooling fan should be fitted to provide sufficient cooling of the motor.

For operation between 30Hz and 50Hz speed range the motor is capable of delivering full rated torque with its standard fan.

For operation above 50Hz, all PPA 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 100Hz. In the case of applications between 60Hz and 100Hz please contact CMG for advice on suitability.

The PPA range of motors will operate without modification on VVVF drives however under certain conditions additional features should be considered (see EDM Concerns below). The graph below shows the PPA motors' loadability with a frequency converter.



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 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 appropriate filters to the drive.

To further reduce the effect of EDM, an insulated non drive bearing can be used. CMG recommends the use of insulated bearings for all motors 315 frame and above.

Thermal protection

Resistance Temperature Detectors (RTDs) and additional thermistors can be installed in both the windings and the bearings.

Thermistors

PPA motors are fitted, as standard, with one set (3) of PTC thermistors, selected for a tripping temperature of 145°C. These thermo-variable resistors have a positive temperature coefficient and are fitted one per phase in the motor windings.

Additional sets of thermistors, if required for such functions as alarm or spare, can be fitted with the same or alternate tripping temperatures.

Frames 80 to 132: the thermistors are terminated within the main terminal box.

Frames 160 and above: the thermistors are terminated in the right hand auxiliary terminal box.

RTDs

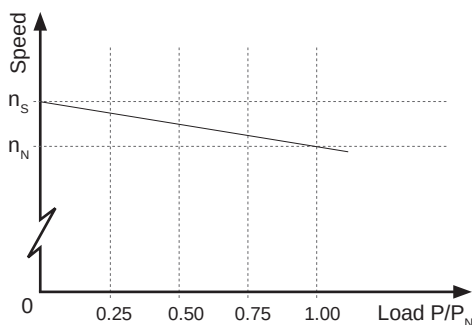
An additional method of monitoring temperature is to fit 3 wire PT100 Resistance Temperature Detectors (RTDs). RTDs are terminated in an auxiliary terminal box affixed to the main terminal box. These devices have a linear temperature / resistance gradient and can be used in conjunction with electronic control equipment e.g. PLC's. Winding RTDs are fitted as standard in 315 frame, optional in smaller frames.

Anti-condensation heaters

PPA motors frames 250 and above are fitted with anti-condensation heaters (optional on smaller sizes). These heaters are connected during manufacture for 220 - 250V operation and can be supplied connected for 380 - 440V operation against special order. They are terminated in the left hand auxiliary terminal box.

Speed at partial loads

The relationship between motor speed and degree of loading in a PPA motor is approximately linear up to the rated load.



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:

$$I_x = \frac{P_{out_x}}{\sqrt{3} \times U_N \times \cos \phi_x \times \eta_x} \times 10^5$$

I_x = partial load current (amps)
 P_{out_x} = partial load (kW)
 U_N = full load voltage
 $\cos \phi_x$ = 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.

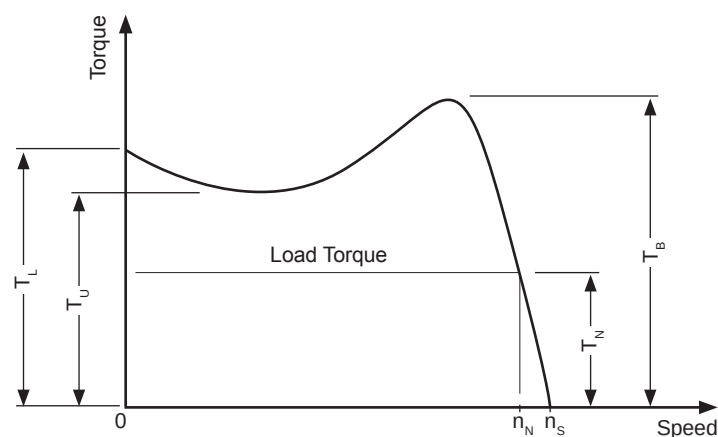
PPA motors all exceed the minimum starting torque requirements for Design N (Normal torque) as specified in IEC 60034-12 and AS1359.41.

Full load 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 power (kW)
 n_N = full load speed (r/min)
 T_L = locked rotor torque
 T_U = pull-up torque
 T_B = break down torque
 n_s = synchronous speed



Performance data

PPA series, Three phase, 415V 50Hz

IP66, H class insulation, B class temperature rise

kW	Motor frame	Speed [r/min]	Efficiency [%] at % full load			Power factor [cos φ] at % full load			Current			Torque				Moment of Inertia J=¼GD2 [kg•m²]	Weight of foot mount motor [kg]	
			100	75	50	100	75	50	Full load I _N [A]	Locked rotor I _L /I _N	t _E ¹⁾ time [sec]	Full load T _N [Nm]	Locked rotor T _L /T _N	Pull up T _U /T _N	Break down T _B /T _N			
3000 r/min = 2 poles																		
0.55	80A	- 19	2880	80.7	80.3	77.1	0.85	0.79	0.68	1.2	7.9	-	1.8	2.7	2.2	3.3	0.00020	20
0.75	80B	- 19	2885	81.8	81.6	79.1	0.85	0.79	0.68	1.5	7.0	22	2.5	2.7	2.4	3.2	0.00022	21
1.1	80C	- 19	2880	83.8	84.2	82.4	0.86	0.80	0.69	2.2	8.0	15	3.6	2.9	2.5	3.3	0.00023	24
1.5	90S	- 24	2890	86.3	86.6	84.9	0.88	0.84	0.75	2.8	8.3	25	5.0	2.7	2.2	3.0	0.0003	29
2.2	90L	- 24	2880	87.1	88.0	87.5	0.87	0.84	0.76	4.1	7.8	15	7.3	2.8	2.2	2.9	0.00035	33
3	100L	- 28	2910	88.2	88.3	86.8	0.89	0.85	0.75	5.4	7.9	20	9.8	2.2	2.0	3.3	0.00073	45
4	112M	- 28	2920	87.6	87.6	87.2	0.88	0.86	0.81	7.3	9.0	10	13.1	2.6	1.8	3.6	0.0014	55
5.5	132SA	- 38	2940	89.3	88.8	86.8	0.89	0.86	0.78	9.6	7.8	30	17.9	2.3	1.7	3.6	0.0030	84
7.5	132SB	- 38	2940	90.3	90.3	89.0	0.90	0.87	0.81	12.8	7.6	12	24.4	2.2	1.8	3.4	0.0032	88
11	160MA	- 42	2930	90.6	90.5	88.9	0.91	0.90	0.83	18.5	7.0	20	35.9	2.0	1.4	2.5	0.054	139
15	160MB	- 42	2940	91.3	91.1	89.8	0.90	0.89	0.84	25.5	7.4	9	48.7	2.1	1.5	2.5	0.056	144
18.5	160L	- 42	2940	91.9	92.0	90.9	0.92	0.91	0.86	30.5	7.5	7	60.1	2.7	1.7	2.9	0.066	163
22	180M	- 48	2945	92.2	92.1	90.6	0.92	0.90	0.82	36.5	7.9	11	71.3	3.3	1.8	3.4	0.094	217
30	200LA	- 55	2950	92.9	92.7	91.4	0.90	0.88	0.82	50	8.0	8	97.1	2.4	1.7	2.9	0.167	282
37	200LB	- 55	2955	93.3	93.2	92.2	0.91	0.89	0.84	61	7.8	6	120	2.7	1.7	2.9	0.174	290
45	225M	- 55	2975	93.7	93.0	91.4	0.94	0.87	0.84	72	8.0	6	144	2.7	1.9	3.1	0.30	382
55	250S	- 60	2975	94.3	94.1	92.9	0.89	0.88	0.83	91	7.2	6	177	2.2	1.6	2.8	0.38	437
75	250M	- 60	2985	94.9	94.5	93.1	0.91	0.89	0.82	122	7.1	5	240	3.0	1.9	3.1	0.47	506
90	280S	- 65	2972	95.3	95.2	94.5	0.90	0.89	0.85	146	6.8	6	289	3.0	2.4	3.2	0.79	645
110	280M	- 65	2976	95.1	94.8	93.8	0.92	0.92	0.91	175	7.7	6	353	3.3	2.1	3.4	0.93	723
132	315S	- 65	2982	95.6	95.2	94.1	0.93	0.91	0.87	207	6.4	8	423	1.9	1.7	2.9	1.40	1135
150	315M	- 65	2979	95.6	95.2	94.2	0.92	0.91	0.88	237	6.4	7	481	2.0	1.7	2.9	1.55	1185
185	315L	- 65	2979	95.8	95.4	94.5	0.90	0.88	0.84	298	7.5	6	593	2.1	1.6	2.9	1.73	1240
200	315LXA	- 65	2980	95.9	95.7	94.7	0.93	0.92	0.90	312	6.3	6	641	2.0	1.5	3.0	1.81	1280
220	315LXB	- 65	2978	95.7	95.4	94.3	0.92	0.91	0.87	348	7.5	6	706	2.7	1.5	2.6	2.00	1320
250	355LA	- 85	2979	95.6	95.2	94.0	0.87	0.85	0.81	416	7.4	7	801	2.1	1.4	2.7	4.46	1630
280	355LB	- 85	2979	96.0	95.8	94.6	0.90	0.89	0.86	452	7.2	7	898	2.0	1.6	2.9	4.87	1700
315	355LC	- 85	2979	96.2	95.9	95.0	0.91	0.91	0.89	501	6.2	7	1010	1.9	1.6	2.8	4.90	1750
355	355LX	- 85	2986	96.7	96.5	95.7	0.92	0.91	0.87	557	7.0	6	1135	2.2	1.9	3.2	5.46	2245
400	355LX	- 85	2985	96.4	96.2	96.0	0.91	0.89	0.87	635	6.2	7	1280	1.8	1.4	2.5	5.60	2420
450 ²⁾	400LA	- 85	2980	96.5	96.6	96.4	0.90	0.89	0.86	721	5.9	6	1442	1.8	1.4	2.5	9.47	2700
500 ²⁾	400LX	- 85	2985	96.6	96.8	96.5	0.91	0.89	0.86	791	6.9	6	1600	2.0	1.7	2.9	11.39	3070
560 ²⁾	400LX	- 85	2980	96.7	96.8	96.6	0.91	0.91	0.89	885	6.2	7	1795	1.9	1.5	2.6	11.60	3170

PPC series 415V 50Hz

45	225M	-55	2975	93.7	93.0	91.4	0.94	0.87	0.84	72	9.5	6	144	2.7	1.9	3.1	0.30	382
55	250M	-60	2975	94.3	94.1	92.9	0.89	0.88	0.83	91	6.5	8	177	2.2	1.6	2.8	0.38	437
75	280S	-65	2975	94.6	94.8	94.5	0.90	0.89	0.85	123	7.9	7	241	3.0	2.1	3.1	0.67	550
90	280M	-65	2972	95.3	95.2	94.5	0.90	0.89	0.85	146	7.8	6	289	3.0	2.4	3.2	0.79	645
110	315S	-65	2981	95.1	94.5	93.0	0.91	0.89	0.85	178	6.7	-	352	2.0	1.7	3.1	1.15	965
132	315MA	-65	2982	95.6	95.2	94.1	0.93	0.91	0.87	207	6.5	9	423	1.9	1.7	2.9	1.40	1135
160 ³⁾	315MB	-65	2977	95.6	95.2	94.2	0.92	0.91	0.88	253	6.0	-	513	1.9	1.6	2.7	1.55	1185
200	355LA	-80	2980	95.5	95.6	95.4	0.89	0.88	0.85	328	6.6	7	641	2.0	1.7	2.7	3.78	1300
225	355LB	-80	2981	96.4	96.3	95.4	0.93	0.92	0.86	349	6.8	-	721	1.9	1.5	3.1	4.11	1535
250	355LC	-80	2980	95.5	95.6	95.4	0.89	0.88	0.85	409	6.8	7	801	2.2	1.8	2.8	4.46	1600
280	355LD	-80	2985	96.2	96.2	95.9	0.91	0.89	0.86	445	7.0	7	896	2.0	1.6	2.9	4.87	1700

¹⁾ t_E time applies to Ex e motors only and is explained in the hazardous areas section

²⁾ For hazardous location versions in these frames only AUS Ex Certification is available

³⁾ For the hazardous location version the rating will be 150kW and performance data as per PPA

This data is provided for guidance only, guaranteed only when confirmed by CMG.

Full load currents at various power supplies

PPA series, Three phase

Specifically wound for nominated power supply

			Current Full load I _N 50Hz							Current Full load I _N 60Hz		Speed 60Hz
			380V [A]	400V [A]	415V [A]	525V [A]	690V [A]	1000V [A]	1100V [A]	380V [A]	440V [A]	[r/min]
3000\3600 r/min = 2 poles												
0.55	80A	- 19	1.3	1.2	1.2	0.9	0.7	0.5	0.5	1.3	1.1	3456
0.75	80B	- 19	1.6	1.6	1.5	1.2	0.9	0.6	0.6	1.6	1.4	3462
1.1	80C	- 19	2.4	2.3	2.2	1.7	1.3	0.9	0.8	2.4	2.1	3456
1.5	90S	- 24	3.1	2.9	2.8	2.2	1.7	1.2	1.1	3.1	2.6	3468
2.2	90L	- 24	4.5	4.3	4.1	3.2	2.5	1.7	1.5	4.5	3.9	3456
3	100L	- 28	5.9	5.6	5.4	4.3	3.2	2.2	2.0	5.9	5.1	3492
4	112M	- 28	8.0	7.6	7.3	5.8	4.4	3.0	2.8	8.0	6.9	3504
5.5	132SA	- 38	10.5	10	9.6	7.6	5.8	4.0	3.6	10.5	9.1	3528
7.5	132SB	- 38	14	13.3	12.8	10.1	7.7	5.3	4.8	14	12.1	3528
11	160MA	- 42	20.2	19.2	18.5	14.6	11.1	7.7	7.0	20.2	17.4	3516
15	160MB	- 42	27.8	26.5	25.5	20.2	15.3	10.6	9.6	27.8	24.1	3528
18.5	160L	- 42	33.3	31.6	30.5	24.1	18.3	12.7	11.5	33.3	28.8	3528
22	180M	- 48	39.9	37.9	36.5	28.9	22	15.1	13.8	39.9	34.4	3534
30	200LA	- 55	55	52	50	39.5	30.1	20.8	18.9	55	47.2	3540
37	200LB	- 55	67	63	61	48.2	36.7	25.3	23	67	58	3546
45	225M	- 55	79	75	72	57	43.3	29.9	27.2	79	68	3570
55	250S	- 60	99	94	91	72	55	37.8	34.3	99	86	3570
75	250M	- 60	133	127	122	96	73	51	46	133	115	3582
90	280S	- 65	159	151	146	115	88	61	55	159	138	3566
110	280M	- 65	191	182	175	138	105	73	66	191	165	3571
132	315S	- 65	226	215	207	164	125	86	78	226	195	3578
150	315M	- 65	259	246	237	187	143	98	89	259	224	3575
185	315L	- 65	325	309	298	236	179	124	112	325	281	3575
200	315LXA	- 65	341	324	312	247	188	129	118	341	294	3576
220	315LXB	- 65	380	361	348	275	209	144	131	380	328	3574
250	355LA	- 85	454	432	416	329	250	173	157	454	392	3575
280	355LB	- 85	494	469	452	357	272	188	171	494	426	3575
315	355LC	- 85	547	520	501	396	301	208	189	547	473	3575
355	355LD	- 85	608	578	557	440	335	231	210	608	525	3583
400	355LX	- 85	693	659	635	502	382	264	240	693	599	3582
450	400LA	- 85	787	748	721	570	434	299	272	787	680	3576
500	400LX	- 85	864	821	791	625	476	328	298	864	746	3582
560	400LX	- 85	967	918	885	700	532	367	334	967	835	3576

PPC series

45	225M	- 55	79	75	72	57	43.3	29.9	27.2	79	68	3570
55	250M	- 60	99	94	91	72	55	37.8	34.3	99	86	3570
75	280S	- 65	134	128	123	97	74	51	46.4	134	116	3570
90	280M	- 65	159	151	146	115	88	61	55	159	138	3566
110	315S	- 65	194	185	178	141	107	74	67	194	168	3577
132	315MA	- 65	226	215	207	164	125	86	78	226	195	3578
160	315MB	- 65	276	262	253	200	152	105	95	276	239	3572
200	355LA	- 80	358	340	328	259	197	136	124	358	309	3576
225	355LB	- 80	381	362	349	276	210	145	132	381	329	3577
250	355LC	- 80	403	383	369	292	222	153	139	403	348	3576
280	355LD	- 80	486	462	445	352	268	185	168	486	420	3582

This data is provided for guidance only, guaranteed only when confirmed by CMG.

Performance data

PPA series, Three phase, 415V 50Hz

IP66, H class insulation, B class temperature rise

kW	Motor frame	Speed [r/min]	Efficiency [%] at % full load			Power factor [cos φ] at % full load			Current			Torque				Moment of Inertia J=¼GD2 [kg•m²]	Weight of foot mount motor [kg]	
			100	75	50	100	75	50	Full load I _N [A]	Locked rotor I _L /I _N	t _E ¹⁾ time [sec]	Full load T _N [Nm]	Locked rotor T _L /T _N	Pull up T _U /T _N	Break down T _B /T _N			
1500 r/min = 4 poles																		
0.55	80A	-19	1440	81.0	80.4	77.0	0.71	0.62	0.49	1.4	8.4	30	3.6	2.7	2.5	3.0	0.00020	21
0.75	80B	-19	1445	83.1	82.4	79.2	0.72	0.63	0.50	1.8	7.4	28	5.0	3.3	3.0	3.4	0.00025	23
1.1	90S	-24	1440	85.7	85.7	83.7	0.77	0.7	0.57	2.4	7.7	35	7.3	3.3	2.6	3.2	0.0005	30
1.5	90L	-24	1440	85.8	85.7	83.6	0.76	0.68	0.55	3.2	7.9	25	9.9	3.5	2.8	3.2	0.0006	34
2.2	100LA	-28	1455	86.9	86.7	84.8	0.84	0.78	0.66	4.3	8.4	22	14.4	3.7	3.4	4.9	0.0007	40
3	100LB	-28	1455	87.6	87.6	85.9	0.84	0.79	0.68	5.7	8.5	17	19.7	2.7	2.4	3.3	0.0009	50
4	112M	-28	1445	87.7	88.3	87.7	0.88	0.83	0.74	7.3	7.8	13	26.4	2.7	2.5	3.1	0.002	57
5.5	132S	-38	1460	89.7	90.1	89.2	0.83	0.78	0.65	10.3	7.3	13	36.0	2.0	1.8	3.1	0.003	95
7.5	132M	-38	1465	91.0	91.4	90.6	0.83	0.77	0.64	13.8	8.7	12	48.9	1.8	1.6	3.3	0.007	98
11	160M	-42	1470	91.8	92.0	91.1	0.85	0.82	0.74	19.6	7.1	20	71.5	2.3	1.6	2.6	0.089	141
15	160L	-42	1470	91.8	91.7	90.7	0.84	0.81	0.73	27.0	7.6	10	97.4	2.6	1.6	2.7	0.103	163
18.5	180M	-48	1475	92.3	92.7	92.2	0.88	0.85	0.81	32.0	7.3	10	120	2.5	1.8	2.9	0.16	195
22	180L	-48	1475	92.7	93.1	92.8	0.91	0.88	0.81	36.5	7.4	10	142	2.3	1.7	2.8	0.18	215
30	200L	-55	1480	93.9	93.9	93.2	0.89	0.84	0.75	51	7.9	15	194	2.4	2.0	3.2	0.31	293
37	225S	-60	1485	94.6	94.6	93.9	0.90	0.88	0.82	61	8.1	20	238	2.4	1.7	2.9	0.53	370
45	225M	-60	1485	94.5	94.5	93.9	0.90	0.87	0.81	74	8.1	13	289	2.1	1.7	2.4	0.58	395
55	250S	-70	1480	94.5	94.8	94.3	0.90	0.90	0.88	90	7.5	13	355	2.5	1.7	2.7	0.79	487
75	250M	-70	1485	94.8	94.9	94.4	0.91	0.89	0.81	122	7.9	7	482	2.9	2.0	3.0	0.90	536
90	280S	-80	1489	95.2	95.2	94.5	0.91	0.89	0.84	145	7.0	13	577	2.5	1.9	3.0	1.60	692
110	280M	-80	1492	95.9	95.9	95.1	0.92	0.90	0.86	174	7.2	7	704	2.4	2.1	3.1	1.89	787
132	315S	-85	1486	95.6	95.5	94.7	0.87	0.85	0.80	220	7.9	13	848	2.3	1.2	2.6	2.73	1100
150	315M	-85	1486	95.7	95.7	95.0	0.87	0.86	0.81	250	8.3	15	964	2.2	1.2	2.6	3.04	1135
185	315LA	-85	1487	96.2	96.3	95.8	0.90	0.89	0.80	298	7.8	8	1188	2.4	1.2	2.5	3.43	1280
200	315LB	-85	1485	95.8	95.8	95.1	0.88	0.86	0.80	330	9.0	7	1287	2.4	1.3	2.7	3.62	1330
220	315LC	-85	1485	95.9	95.9	95.4	0.88	0.87	0.81	364	7.3	7	1415	2.4	1.3	2.7	3.89	1400
250	315LX	-85	1485	95.9	95.9	95.3	0.88	0.86	0.81	412	8.9	7	1608	2.4	1.4	2.7	4.14	1480
280	355LA	-110	1489	96.1	95.8	95.0	0.84	0.79	0.73	483	4.9	10	1795	1.6	1.3	2.3	7.82	2080
315	355LB	-110	1490	96.6	96.5	95.9	0.87	0.86	0.79	520	5.3	10	2019	1.5	1.3	2.4	8.27	2125
355	355LC	-110	1489	96.5	96.5	95.9	0.88	0.87	0.81	580	5.0	9	2277	1.5	1.3	2.4	8.90	2240
400	355LD	-110	1490	96.3	96.1	95.3	0.88	0.86	0.80	658	5.1	8	2564	1.4	1.4	2.4	9.76	2340
450	355LX	-110	1491	97.0	97.0	96.5	0.88	0.86	0.79	734	5.5	8	2882	1.7	1.5	2.6	10.76	2510
500	400LA	-110	1494	96.9	96.7	96.0	0.88	0.87	0.81	813	5.8	7	3196	1.9	1.6	2.8	18.68	3010
560	400LB	-110	1490	96.8	96.9	96.7	0.87	0.87	0.83	925	5.2	9	3589	1.7	1.5	2.5	19.70	3200
630	400LX	-110	1490	96.9	97.0	96.8	0.87	0.86	0.82	1040	5.4	11	4038	1.5	1.2	2.5	21.64	3320
800	450L	-125	1492	96.8	96.3	95.3	0.89	0.87	0.82	780 ²⁾	6.7	-	5121	1.7	1.3	3.0	37.1	5700
1000	450L	-125	1495	96.9	96.4	95.3	0.90	0.88	0.82	960 ²⁾	6.6	-	6401	1.6	1.2	3.0	46.4	6100

PPC series 415V 50Hz

37	225S	-60	1485	94.6	94.6	93.9	0.90	0.88	0.82	61	7.7	20	238	2.4	1.7	2.9	0.53	370
45	225M	-60	1485	94.5	94.5	93.9	0.90	0.87	0.81	74	7.8	13	289	2.1	1.7	2.4	0.58	395
55	250M	-65	1480	94.5	94.8	94.3	0.90	0.90	0.88	90	7.1	13	355	2.5	1.7	2.7	0.79	487
75	280S	-75	1485	94.9	94.8	94.2	0.90	0.89	0.84	123	6.9	13	482	2.9	2.0	2.9	0.92	655
90	280M	-75	1489	95.2	95.2	94.5	0.91	0.89	0.84	145	7.4	13	577	2.5	1.9	3.0	1.60	692
110	315S	-80	1484	95.3	95.3	94.5	0.86	0.83	0.77	188	6.6	25	708	2.0	1.3	2.5	1.96	985
132	315MA	-80	1486	95.6	95.5	94.7	0.87	0.85	0.80	220	6.9	13	848	2.3	1.2	2.6	2.73	1100
160 ³⁾	315MB	-80	1485	95.6	95.7	95.0	0.87	0.86	0.81	268	6.6	15	1029	2.0	1.1	2.4	3.04	1135
200	355LA	-100	1488	96.0	95.8	95.1	0.87	0.84	0.78	335	7.5	10	1284	2.3	1.3	2.7	3.62	1480
225	355LC	-100	1485	95.7	95.8	95.6	0.87	0.85	0.78	376	7.1	10	1447	2.4	1.3	2.7	3.89	1500
250	355LD	-100	1487	96.1	96.1	95.6	0.87	0.85	0.80	416	7.6	10	1606	2.5	1.4	2.7	4.14	1630
280	355LE	-100	1485	95.8	95.8	95.4	0.88	0.86	0.80	462	5.3	10	1801	1.5	1.3	2.4	7.82	2080

¹⁾ t_E time applies to Ex e motors only (see page 24)

³⁾ For the hazardous location version the rating will be 150kW and performance data as per PPA

²⁾ Current at 690V 50Hz

Notes on page 15 also apply.

CMG Motors | PPA 0811 (edition 4.3.0)

Full load currents at various power supplies

PPA series, Three phase

Specifically wound for nominated power supply

kW	Motor frame		Current Full load I _N 50Hz							Current Full load I _N 60Hz		Speed 60Hz
			380V [A]	400V [A]	415V [A]	525V [A]	690V [A]	1000V [A]	1100V [A]	380V [A]	440V [A]	[r/min]
1500\1800 r/min = 4 poles												
0.55	80A	- 19	1.5	1.5	1.4	1.1	0.8	0.6	0.5	1.5	1.3	1728
0.75	80B	- 19	2.0	1.9	1.8	1.4	1.1	0.7	0.7	2.0	1.7	1734
1.1	90S	- 24	2.6	2.5	2.4	1.9	1.4	1.0	0.9	2.6	2.3	1728
1.5	90L	- 24	3.5	3.3	3.2	2.5	1.9	1.3	1.2	3.5	3.0	1728
2.2	100LA	- 28	4.7	4.5	4.3	3.4	2.6	1.8	1.6	4.7	4.1	1746
3	100LB	- 28	6.2	5.9	5.7	4.5	3.4	2.4	2.2	6.2	5.4	1746
4	112M	- 28	8.0	7.6	7.3	5.8	4.4	3.0	2.8	8.0	6.9	1734
5.5	132S	- 38	11.2	10.7	10.3	8.1	6.2	4.3	3.9	11.2	9.7	1752
7.5	132M	- 38	15.1	14.3	13.8	10.9	8.3	5.7	5.2	15.1	13	1758
11	160M	- 42	21.4	20.3	19.6	15.5	11.8	8.1	7.4	21.4	18.5	1764
15	160L	- 42	29.5	28	27.0	21.3	16.2	11.2	10.2	29.5	25.5	1764
18.5	180M	- 48	34.9	33.2	32.0	25.3	19.2	13.3	12.1	34.9	30.2	1770
22	180L	- 48	39.9	37.9	36.5	28.9	22	15.1	13.8	39.9	34.4	1770
30	200L	- 55	56	53	51	40.3	30.7	21.2	19.2	56	48.1	1776
37	225S	- 60	67	63	61	48.2	36.7	25.3	23	67	58	1782
45	225M	- 60	81	77	74	58	44.5	30.7	27.9	81	70	1782
55	250S	- 70	98	93	90	71	54	37.4	34	98	85	1776
75	250M	- 70	133	127	122	96	73	51	46	133	115	1782
90	280S	- 80	158	150	145	115	87	60	55	158	137	1787
110	280M	- 80	190	181	174	138	105	72	66	190	164	1790
132	315S	- 85	240	228	220	174	132	91	83	240	208	1783
150	315M	- 85	273	259	250	198	150	104	94	273	236	1783
185	315LA	- 85	325	309	298	236	179	124	112	325	281	1784
200	315LB	- 85	360	342	330	261	198	137	125	360	311	1781
220	315LC	- 85	398	378	364	288	219	151	137	398	343	1781
250	315LX	- 85	450	427	412	326	248	171	155	450	389	1782
280	355LA	- 110	527	501	483	382	291	200	182	527	456	1787
315	355LB	- 110	568	540	520	411	313	216	196	568	490	1788
355	355LC	- 110	633	602	580	458	349	241	219	633	547	1787
400	355LD	- 110	719	683	658	520	396	273	248	719	621	1788
450	355LX	- 110	802	762	734	580	441	305	277	802	692	1789
500	400LA	- 110	888	843	813	643	489	337	307	888	767	1793
560	400LB	- 110	1010	960	925	731	556	384	349	1010	872	1788
630	400LX	- 110	1136	1079	1040	822	626	432	392	1136	981	1788
800	450LB	- 125	-	-	-	-	780	538	489	-	-	-
1000	450LD	- 125	-	-	-	-	960	662	602	-	-	-
PPC series												
37	225S	- 60	67	63	61	48.2	36.7	25.3	23	67	58	1782
45	225M	- 60	81	77	74	58	44.5	30.7	27.9	81	70	1782
55	250M	- 65	98	93	90	71	54	37.4	34	98	85	1776
75	280S	- 75	134	128	123	97	74	51	46.4	134	116	1782
90	280M	- 75	158	150	145	115	87	60	55	158	137	1787
110	315S	- 80	205	195	188	149	113	78	71	205	177	1781
132	315MA	- 80	240	228	220	174	132	91	83	240	208	1783
160	315MB	- 80	293	278	268	212	161	111	101	293	253	1782
200	355LA	- 100	366	348	335	265	201	139	126	366	316	1786
225	355LC	- 100	411	390	376	297	226	156	142	411	355	1782
250	355LD	- 100	454	432	416	329	250	173	157	454	392	1784
280	355LE	- 100	505	479	462	365	278	192	174	505	436	1782

For the performance data of motors 710kW and 900kW please refer to CMG
This data is provided for guidance only, guaranteed only when confirmed by CMG.

Performance data

PPA series, Three phase, 415V 50Hz
IP66, H class insulation, B class temperature rise

kW	Motor frame		Speed [r/min]	Efficiency [%] at % full load			Power factor [cos φ] at % full load			Current			Torque				Moment of Inertia J=¼GD2 [kg•m²]	Weight of foot mount motor [kg]
				100	75	50	100	75	50	Full load I _N [A]	Locked rotor I _L /I _N	t _E ¹⁾ time [sec]	Full load T _N [Nm]	Locked rotor T _L /T _N	Pull up T _U /T _N	Break down T _B /T _N		
1000 r/min = 6 poles																		
0.37	80A	- 19	930	69.3	69.4	65.4	0.71	0.61	0.48	1.1	3.9	-	3.8	1.8	1.4	2.4	0.0004	20
0.55	80B	- 19	930	72.3	72.3	68.5	0.70	0.60	0.46	1.6	4.2	-	5.6	2.1	1.7	2.7	0.0005	21
0.75	90S	- 24	950	79.1	78.8	75.5	0.70	0.61	0.48	1.9	5.3	45	7.5	2.2	1.8	2.7	0.0007	28
1.1	90L	- 24	950	80.6	80.5	77.5	0.70	0.61	0.47	2.7	5.1	25	11.1	2.3	1.8	2.7	0.0009	32
1.5	100L	- 28	970	82.4	81.5	78.0	0.72	0.63	0.50	3.6	6.5	20	14.8	2.3	1.8	2.9	0.0017	49
2.2	112M	- 28	960	84.0	84.0	81.7	0.73	0.65	0.51	5.0	6.4	17	21.9	2.4	1.7	2.9	0.035	53
3	132S	- 38	975	87.0	87.1	85.5	0.77	0.70	0.57	6.2	7.1	20	29.4	2.0	1.4	2.8	0.007	78
4	132MA	- 38	970	86.9	87.5	86.5	0.79	0.73	0.60	8.2	6.7	12	39.4	2.3	1.8	2.6	0.009	91
5.5	132MB	- 38	970	87.8	88.6	87.9	0.79	0.73	0.62	11.0	7.0	11	54.1	2.0	1.9	2.6	0.046	100
7.5	160M	- 42	975	89.4	89.5	88.3	0.78	0.73	0.62	15.0	6.3	15	73.5	2.5	1.9	2.8	0.11	139
11	160L	- 42	970	89.7	89.8	88.5	0.76	0.70	0.57	22.5	7.2	19	108	2.5	1.9	2.6	0.13	161
15	180L	- 48	975	90.6	91.1	90.4	0.86	0.81	0.69	27.0	7.5	12	147	2.4	2.0	2.6	0.25	211
18.5	200LA	- 55	985	91.8	91.9	90.7	0.84	0.79	0.68	33.5	7.4	10	179	2.7	1.9	2.7	0.31	262
22	200LB	- 55	975	91.6	92.2	91.8	0.85	0.83	0.76	39.5	6.8	13	215	2.4	1.8	2.6	0.41	282
30	225M	- 60	985	92.8	92.7	91.6	0.84	0.80	0.75	54	7.0	25	291	2.4	2.0	3.0	0.67	373
37	250S	- 70	985	93.0	93.5	93.1	0.88	0.87	0.82	63	6.5	15	359	2.1	1.6	2.6	0.94	443
45	250M	- 70	990	93.9	94.2	93.7	0.90	0.88	0.83	75	7.0	20	434	2.2	1.8	2.6	1.15	501
55	280S	- 80	994	94.8	94.8	94.3	0.90	0.89	0.87	90	6.6	20	528	2.4	1.9	2.7	1.82	613
75	280M	- 80	992	94.9	95.0	94.3	0.90	0.89	0.83	123	6.6	13	722	2.8	2.1	3.0	2.33	735
90	315S	- 85	991	94.9	94.8	93.9	0.87	0.84	0.77	152	6.6	22	867	2.2	1.8	2.6	4.57	1015
110	315MA	- 85	991	95.5	95.6	95.1	0.86	0.84	0.77	185	6.1	15	1060	2.1	2.0	3.4	4.83	1075
132	315MB	- 85	990	95.4	95.6	95.2	0.87	0.85	0.80	222	6.1	7	1274	2.0	1.5	2.4	5.32	1145
150	315L	- 85	990	95.5	95.8	95.5	0.90	0.90	0.89	244	6.0	10	1447	2.3	1.4	2.3	5.95	1170
185	315LX	- 85	990	95.8	95.9	95.9	0.88	0.88	0.86	306	4.9	6	1785	2.2	1.3	2.1	6.64	1570
200	355LA	- 110	989	95.8	96.0	95.7	0.87	0.86	0.80	334	5.5	8	1931	1.7	1.1	2.3	8.63	1900
220	355LB	- 110	987	95.7	96.1	96.0	0.88	0.88	0.84	362	5.2	8	2129	1.6	1.0	2.2	9.17	1985
250	355LC	- 110	989	96.1	96.3	96.0	0.87	0.86	0.82	415	5.7	9	2414	1.5	1.1	2.4	9.83	2050
280	355LD	- 110	989	95.9	96.3	96.3	0.88	0.87	0.84	462	5.2	9	2704	1.4	0.8	2.4	10.64	2150
315	355LX	- 110	992	96.1	96.2	95.7	0.88	0.86	0.81	521	6.1	7	3033	1.8	1.2	2.5	11.25	2245
355	400LA	- 110	994	96.6	96.6	96.0	0.88	0.86	0.80	584	8.1	8	3411	2.4	1.3	3.0	16.56	2790
400	400LB	- 110	993	96.9	97.0	96.7	0.88	0.86	0.81	655	7.6	7	3847	2.3	1.3	2.8	19.26	2960
450	400LX	- 110	994	96.6	96.8	96.7	0.88	0.87	0.83	737	7.9	8	4323	2.3	0.8	2.8	20.34	3050
500	400LX	- 110	994	96.7	96.6	96.0	0.87	0.85	0.79	824	8.4	7	4804	2.7	1.4	3.1	21.83	3140
630	450L	- 125	995	96.7	96.3	95.4	0.86	0.85	0.79	1055	6.6	-	6047	2.2	1.7	2.9	36.5	4800
800	450L	- 125	995	96.7	96.4	95.5	0.86	0.85	0.78	810 ²⁾	8.0	-	7678	2.4	2.0	3.2	43.1	5800

PPC series 415V 50Hz

30	225M	-60	985	92.8	92.7	91.6	0.84	0.80	0.75	54	7.3	25	291	2.4	2.0	3.0	0.67	373
37	250M	-65	985	93.0	93.5	93.1	0.88	0.87	0.82	63	6.5	20	359	2.1	1.6	2.6	0.94	443
45	280S	-75	990	93.5	93.6	92.8	0.88	0.87	0.80	76	6.3	12	434	2.3	1.8	2.6	1.20	558
55	280M	-75	994	94.8	94.8	94.3	0.90	0.89	0.87	90	7.4	12	528	2.4	1.9	2.7	1.82	613
75	315S	-80	990	94.4	94.3	93.2	0.86	0.83	0.76	129	6.4	7	723	1.9	1.7	2.5	3.80	930
90	315MA	-80	991	94.9	94.8	93.9	0.87	0.84	0.77	152	6.5	7	867	2.2	1.8	2.6	4.57	1015
110	315MB	-80	991	95.5	95.6	95.1	0.86	0.84	0.77	185	6.5	6	1060	2.1	2.0	3.4	4.83	1075
132	315MC	-80	990	95.4	95.6	95.2	0.87	0.85	0.80	222	6.2	7	1274	2.0	1.5	2.4	5.32	1145
160 ³⁾	315L	-80	989	95.5	95.8	95.5	0.90	0.90	0.89	259	5.8	6	1545	2.1	1.3	2.1	5.95	1170
185	355LA	-100	989	95.8	95.9	95.9	0.88	0.88	0.86	306	5.9	8	1786	2.2	1.3	2.1	6.64	1620
200	355LB	-100	989	95.8	96.2	96.2	0.87	0.86	0.84	334	5.2	8	1931	1.4	0.9	2.2	8.63	1900
225	355LC	-100	986	95.8	96.0	96.1	0.88	0.87	0.84	372	5.0	8	2179	1.6	0.9	2.2	9.17	2000
250	355LD	-100	989	95.9	96.2	96.2	0.87	0.86	0.83	417	5.6	9	2414	1.5	0.8	2.4	9.83	2050
280	355LE	-100	989	95.9	96.3	96.3	0.88	0.87	0.84	462	5.2	9	2704	1.4	0.8	2.2	10.84	2150

¹⁾ t_E time applies to Ex e motors only (see page 24)

²⁾ Current at 690V 50Hz

³⁾ For the hazardous location version the rating will be 150kW and performance data as per PPA

Notes on page 17 also apply

For the performance data of motors 560kW and 710kW please refer to CMG.

Full load currents at various power supplies

PPA series, Three phase

Specifically wound for nominated power supply

kW	Motor frame		Current Full load I _N 50Hz							Current Full load I _N 60Hz		Speed 60Hz
			380V [A]	400V [A]	415V [A]	525V [A]	690V [A]	1000V [A]	1100V [A]	380V [A]	440V [A]	[r/min]
1000\1200 r/min = 6 poles												
0.37	80A	- 19	1.2	1.1	1.1	0.9	0.7	0.5	0.4	1.2	1.0	1116
0.55	80B	- 19	1.7	1.7	1.6	1.3	1.0	0.7	0.6	1.7	1.5	1116
0.75	90S	- 24	2.1	2.0	1.9	1.5	1.1	0.8	0.7	2.1	1.8	1140
1.1	90L	- 24	2.9	2.8	2.7	2.1	1.6	1.1	1.0	2.9	2.5	1140
1.5	100L	- 28	3.9	3.7	3.6	2.8	2.2	1.5	1.4	3.9	3.4	1164
2.2	112M	- 28	5.5	5.2	5.0	4.0	3.0	2.1	1.9	5.5	4.7	1152
3	132S	- 38	6.8	6.4	6.2	4.9	3.7	2.6	2.3	6.8	5.8	1170
4	132MA	- 38	9.0	8.5	8.2	6.5	4.9	3.4	3.1	9.0	7.7	1164
5.5	132MB	- 38	12	11.4	11.0	8.7	6.6	4.6	4.2	12	10.4	1164
7.5	160M	- 42	16.4	15.6	15.0	11.9	9.0	6.2	5.7	16.4	14.1	1170
11	160L	- 42	24.6	23.3	22.5	17.8	13.5	9.3	8.5	24.6	21.2	1164
15	180L	- 48	29.5	28	27.0	21.3	16.2	11.2	10.2	29.5	25.5	1170
18.5	200LA	- 55	36.6	34.8	33.5	26.5	20.1	13.9	12.6	36.6	31.6	1182
22	200LB	- 55	43.1	41	39.5	31.2	23.8	16.4	14.9	43.1	37.3	1170
30	225M	- 60	59	56	54	42.7	32.5	22.4	20.4	59	51	1182
37	250S	- 70	69	65	63	50	37.9	26.1	23.8	69	59	1182
45	250M	- 70	82	78	75	59	45.1	31.1	28.3	82	71	1188
55	280S	- 80	98	93	90	71	54	37.4	34	98	85	1193
75	280M	- 80	134	128	123	97	74	51	46.4	134	116	1190
90	315S	- 85	166	158	152	120	91	63	57	166	143	1189
110	315MA	- 85	202	192	185	146	111	77	70	202	174	1189
132	315MB	- 85	242	230	222	175	134	92	84	242	209	1188
150	315L	- 85	266	253	244	193	147	101	92	266	230	1188
185	315LX	- 85	334	317	306	242	184	127	115	334	289	1188
200	355LA	- 110	365	347	334	264	201	139	126	365	315	1187
220	355LB	- 110	395	376	362	286	218	150	137	395	341	1184
250	355LC	- 110	453	431	415	328	250	172	157	453	391	1187
280	355LD	- 110	505	479	462	365	278	192	174	505	436	1187
315	355LX	- 110	569	541	521	412	313	216	197	569	491	1190
355	400LA	- 110	638	606	584	462	351	242	220	638	551	1193
400	400LB	- 110	715	680	655	518	394	272	247	715	618	1192
450	400LX	- 110	805	765	737	583	443	306	278	805	695	1193
500	400LX	- 110	900	855	824	651	496	342	311	900	777	1193
630	450LB	- 125	1152	1095	1055	834	635	438	398	1152	995	1194
800	450LD	- 125	-	-	-	-	810	559	508	-	-	-
PPC series												
30	225M	- 60	59	56	54	42.7	32.5	22.4	20.4	59	51	1182
37	250M	- 65	69	65	63	50	37.9	26.1	23.8	69	59	1182
45	280S	- 75	83	79	76	60	45.7	31.5	28.7	83	72	1188
55	280M	- 75	98	93	90	71	54	37.4	34	98	85	1193
75	315S	- 80	141	134	129	102	78	54	48.7	141	122	1188
90	315MA	- 80	166	158	152	120	91	63	57	166	143	1189
110	315MB	- 80	202	192	185	146	111	77	70	202	174	1189
132	315MC	- 80	242	230	222	175	134	92	84	242	209	1188
160	315L	- 80	283	269	259	205	156	107	98	283	244	1187
185	355LA	- 100	334	317	306	242	184	127	115	334	289	1187
200	355LB	- 100	365	347	334	264	201	139	126	365	315	1187
225	355LC	- 100	406	386	372	294	224	154	140	406	351	1183
250	355LD	- 100	455	433	417	330	251	173	157	455	393	1187
280	355LE	- 100	505	479	462	365	278	192	174	505	436	1187

This data is provided for guidance only, guaranteed only when confirmed by CMG.

Performance data

PPA series, Three phase, 415V 50Hz

IP66, H class insulation, B class temperature rise

kW	Motor frame	Speed [r/min]	Efficiency [%] at % full load			Power factor [cos φ] at % full load			Current			Torque				Moment of Inertia J=¼GD2 [kg•m²]	Weight of foot mount motor [kg]
			100	75	50	100	75	50	Full load I _N [A]	Locked rotor I _L /I _N	t _E ¹⁾ time [sec]	Full load T _N [Nm]	Locked rotor T _L /T _N	Pull up T _U /T _N	Break down T _B /T _N		

750 r/min = 8 poles

1.1	100L	- 28	700	76.3	70.5	64.7	0.82	0.54	0.42	2.5	3.5	-	15.0	2.3	1.8	2.8	0.0028	33
1.5	112M	- 28	700	78.4	77.3	74.5	0.89	0.60	0.48	3.0	4.0	-	20.5	2.1	1.8	2.8	0.0062	45
2.2	132S	- 38	705	80.9	84.0	84.6	0.73	0.69	0.59	5.2	5.5	20	29.8	2.1	1.5	2.1	0.031	65
3	132M	- 38	705	82.7	85.6	86.2	0.73	0.69	0.59	6.9	5.5	18	40.6	2.1	1.6	2.1	0.040	80
4	160MA	- 42	720	84.2	85.3	85.2	0.77	0.69	0.56	8.6	5.5	12	53.1	2.2	1.7	2.6	0.085	110
5.5	160MB	- 42	720	85.8	87.0	86.7	0.78	0.70	0.57	11.4	5.6	10	73.0	2.3	1.8	2.6	0.10	115
7.5	160L	- 42	720	87.2	88.1	87.6	0.76	0.68	0.55	15.7	5.8	8	99.5	2.6	2.0	2.8	0.18	139
11	180L	- 48	730	88.8	89.3	88.6	0.78	0.71	0.56	22.1	6.2	15	144	2.3	1.7	2.7	0.24	205
15	200L	- 55	730	90.0	90.8	90.6	0.78	0.70	0.58	29.7	5.3	11	196	2.1	1.5	2.4	0.37	300
18.5	225S	- 60	735	90.7	91.0	90.4	0.77	0.72	0.58	36.9	5.8	12	240	2.3	1.6	2.5	0.60	360
22	225M	- 60	735	91.2	91.5	90.9	0.77	0.72	0.58	43.6	5.9	11	286	2.3	1.6	2.6	0.69	400
30	250S	- 70	740	92.1	92.6	92.5	0.79	0.75	0.63	57	5.7	10	387	2.0	1.6	2.4	0.96	565
37	250M	- 70	740	92.7	93.2	93.0	0.80	0.76	0.68	69	5.3	11	478	1.9	1.4	2.2	1.15	575
45	280S	- 80	745	93.2	93.6	93.4	0.82	0.79	0.71	82	5.8	10	577	2.1	1.5	2.4	1.82	650
55	280M	- 80	743	94.0	93.7	92.5	0.80	0.74	0.63	103	6.5	8	707	2.7	2.2	3.0	2.14	678
75	315S	- 85	740	94.4	94.8	94.2	0.82	0.78	0.70	135	4.9	10	968	1.5	1.2	2.0	4.60	1000
90	315M	- 85	740	94.7	94.9	94.8	0.83	0.80	0.72	159	4.9	11	1161	1.5	1.3	2.0	5.32	1100
110	315L	- 85	740	95.2	95.3	95.0	0.83	0.79	0.70	194	5.1	9	1420	1.6	1.2	2.1	5.95	1270
132	315LXA	- 85	740	95.4	95.6	95.2	0.82	0.78	0.71	235	5.3	8	1704	1.6	1.3	2.1	6.70	1480
150	315LXB	- 85	740	95.7	95.8	95.7	0.83	0.80	0.73	263	4.7	8	1936	1.2	0.9	1.8	9.11	1680
185	355LA	- 110	740	95.5	95.6	95.1	0.83	0.80	0.73	327	5.1	12	2386	1.9	1.1	2.3	9.87	2125
200	355LB	- 110	740	95.8	96.0	96.0	0.83	0.82	0.75	350	4.8	11	2581	1.3	0.9	1.8	10.64	2400
220	355LB	- 110	740	95.8	96.0	96.1	0.83	0.82	0.76	385	4.7	11	2839	1.2	0.9	1.8	11.19	2580
250	355LX	- 110	742	95.9	95.9	95.9	0.83	0.81	0.75	437	5.2	10	3218	1.6	1.1	2.2	12.48	2650
280	400LA	- 110	745	96.1	96.3	96.2	0.83	0.82	0.75	488	6	13	3589	1.3	1.0	2.4	17.25	3000
315	400LB	- 110	744	95.9	95.8	94.8	0.81	0.77	0.66	565	6.8	12	4043	1.8	1.2	3.2	18.24	3030
355	400LX	- 110	745	96.2	96.5	96.4	0.83	0.82	0.76	618	6.1	11	4551	1.3	0.9	2.4	26.16	3500

PPC series 415V 50Hz

30	250M	- 65	740	92.1	92.6	92.5	0.79	0.75	0.63	57	5.7	10	387	2.0	1.6	2.4	0.96	575
37	280S	- 75	740	92.7	93.1	93.0	0.80	0.76	0.69	69	5.6	11	478	2.0	1.4	2.2	1.60	625
45	280M	- 75	745	93.2	93.6	93.4	0.82	0.79	0.71	82	5.8	10	577	2.1	1.5	2.4	1.82	675
55	315S	- 80	740	93.7	93.9	93.5	0.82	0.78	0.70	100	4.9	10	710	1.4	1.1	2.0	3.60	800
75	315MA	- 85	740	94.4	94.8	94.2	0.82	0.78	0.70	135	4.9	10	968	1.5	1.2	2.0	4.60	1050
90	315MB	- 80	740	94.7	94.9	94.8	0.83	0.80	0.72	160	4.9	11	1161	1.5	1.3	2.0	5.32	1100
110	315L	- 80	740	95.4	95.3	95.0	0.83	0.79	0.70	194	5.1	9	1420	1.6	1.2	2.1	5.95	1270
132	355LA	- 100	740	95.4	95.6	95.2	0.82	0.78	0.71	235	5.3	12	1704	1.6	1.3	2.1	7.60	1530
160 ²⁾	355LB	- 100	740	95.7	95.8	95.7	0.83	0.80	0.73	281	4.5	12	2065	1.1	0.8	1.7	9.11	1730
185	355LC	- 100	740	95.5	95.6	95.1	0.83	0.80	0.73	326	5.1	12	2388	1.9	1.1	2.3	9.87	2125
200	355LD	- 100	740	95.8	96.0	96.0	0.83	0.82	0.75	350	4.8	11	2581	1.3	0.9	1.8	10.64	2400
220	355LE	- 100	740	95.8	96.0	96.1	0.83	0.82	0.76	385	4.7	11	2839	1.2	0.9	1.8	11.19	2580
250	355LX	- 100	742	95.7	96.1	96.1	0.83	0.82	0.76	438	5.0	10	3218	1.3	0.9	1.9	12.48	2650

¹⁾ t_E time applies to Ex e motors only (see page 24)

²⁾ For the hazardous location version the rating will be 150kW and performance data as per PPA

For the performance data of motors 400, 450, 500 and 560kW please refer to CMG

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Full load currents at various power supplies

PPA series, Three phase

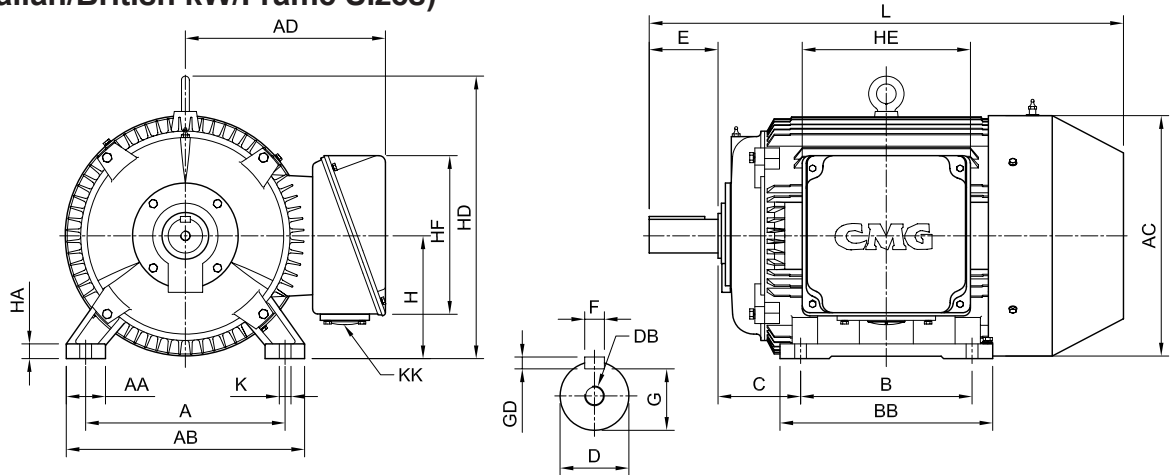
Specifically wound for nominated power supply

kW	Motor frame		Current Full load I _N 50Hz							Current Full load I _N 60Hz		Speed 60Hz
			380V [A]	400V [A]	415V [A]	525V [A]	690V [A]	1000V [A]	1100V [A]	380V [A]	440V [A]	[r/min]
750\900 r/min = 8 poles												
1.1	100L	- 28	2.7	2.6	2.5	2.0	1.5	1.0	0.9	2.7	2.4	840
1.5	112M	- 28	3.3	3.1	3.0	2.4	1.8	1.2	1.1	3.3	2.8	840
2.2	132S	- 38	5.7	5.4	5.2	4.1	3.1	2.2	2.0	5.7	4.9	846
3	132M	- 38	7.5	7.2	6.9	5.5	4.2	2.9	2.6	7.5	6.5	846
4	160MA	- 42	9.4	8.9	8.6	6.8	5.2	3.6	3.2	9.4	8.1	864
5.5	160MB	- 42	12.5	11.8	11.4	9.0	6.9	4.7	4.3	12.5	10.8	864
7.5	160L	- 42	17.1	16.3	15.7	12.4	9.4	6.5	5.9	17.1	14.8	864
11	180L	- 48	24.1	22.9	22.1	17.5	13.3	9.2	8.3	24.1	20.8	876
15	200L	- 55	32.4	30.8	29.7	23.5	17.9	12.3	11.2	32.4	28	876
18.5	225S	- 60	40.3	38.3	36.9	29.2	22.2	15.3	13.9	40.3	34.8	882
22	225M	- 60	47.6	45.2	43.6	34.5	26.2	18.1	16.4	47.6	41.1	882
30	250S	- 70	63	60	57	45.4	34.5	23.8	21.7	63	54	888
37	250M	- 70	76	72	69	55	41.7	28.8	26.2	76	65	888
45	280S	- 80	89	85	82	65	49.3	34	30.9	89	77	894
55	280M	- 80	112	107	103	81	62	42.7	38.9	112	97	892
75	315S	- 85	147	140	135	107	81	56	51	147	127	888
90	315M	- 85	174	165	159	126	96	66	60	174	150	888
110	315L	- 85	212	201	194	153	117	81	73	212	183	888
132	315LXA	- 85	257	244	235	186	141	98	89	257	222	888
150	315LXB	- 85	287	273	263	208	158	109	99	287	248	888
185	355LA	- 110	357	339	327	258	197	136	123	357	308	888
200	355LB	- 110	382	363	350	277	211	145	132	382	330	888
220	355LB	- 110	420	399	385	304	232	160	145	420	363	888
250	355LX	- 110	477	453	437	345	263	181	165	477	412	890
280	400LA	- 110	533	506	488	386	294	203	184	533	460	894
315	400LB	- 110	617	586	565	447	340	234	213	617	533	893
355	400LX	- 110	675	641	618	489	372	256	233	675	583	894
PPC series												
30	250M	- 65	63	60	57	45.4	34.5	23.8	21.7	63	54	888
37	280S	- 75	76	72	69	55	41.7	28.8	26.2	76	65	888
45	280M	- 75	89	85	82	65	49.3	34	30.9	89	77	894
55	315S	- 80	109	103	100	79	60	41.3	37.6	109	94	888
75	315MA	- 85	147	140	135	107	81	56	51	147	127	888
90	315MB	- 80	175	166	160	126	96	66	60	175	151	888
110	315L	- 80	212	201	194	153	117	81	73	212	183	888
132	355LA	- 100	257	244	235	186	141	98	89	257	222	888
160	355LB	- 100	307	292	281	222	169	117	106	307	265	888
185	355LC	- 100	356	338	326	258	196	135	123	356	307	888
200	355LD	- 100	382	363	350	277	211	145	132	382	330	888
220	355LE	- 100	420	399	385	304	232	160	145	420	363	888
250	355LF	- 100	478	454	438	346	263	182	165	478	413	890

This data is provided for guidance only, guaranteed only when confirmed by CMG.

Dimensional drawings - PPA

(Australian/British kW/Frame Sizes)



Foot mount B3 (IM1001)

Motor frame		A	AA	AB	AC	AD	B	BB	C	D	DB	E	F	GD	G	H	HA	HD	HE	HF	K	KK ³⁾	L
80	- 19	125	35	160	175	152	100	182	50	19	M6	40	6	6	15.5	80	10	210	134	121	10	M20 ¹⁾	340
90S	- 24	140	40	180	185	158	100	196	56	24	M8	50	8	7	20	90	12	215	134	121	10	M20 ¹⁾	375
90L	- 24	140	40	180	185	158	125	221	56	24	M8	50	8	7	20	90	12	215	134	121	10	M20 ¹⁾	400
100L	- 28	160	40	200	220	186	140	235	63	28	M10	60	8	7	24	100	14	250	134	121	12	M20 ¹⁾	450
112M	- 28	190	50	240	235	210	140	245	70	28	M10	60	8	7	24	112	15	270	160	171	12	M25 ¹⁾	470
132S	- 38	216	60	276	265	230	140	238	89	38	M12	80	10	8	33	132	18	315	160	171	12	M25 ¹⁾	525
132M	- 38	216	60	276	265	230	178	276	89	38	M12	80	10	8	33	132	18	315	160	171	12	M25 ¹⁾	565
160M	- 42	254	70	325	320	280	210	314	108	42	M16	110	12	8	37	160	20	380	238	223	15	M50	655
160L	- 42	254	70	325	320	280	254	354	108	42	M16	110	12	8	37	160	20	380	238	223	15	M50	695
180M	- 48	279	70	349	355	305	241	349	121	48	M16	110	14	9	42.5	180	22	420	238	223	15	M50	715
180L	- 48	279	70	349	355	305	279	349	121	48	M16	110	14	9	42.5	180	22	420	238	223	15	M50	715
200L	- 55	318	70	395	395	325	305	380	133	55	M20	110	16	10	49	200	25	470	238	223	19	M50	805
225S	- 60	356	75	435	442	390	286	370	149	60	M20	140	18	11	53	225	25	525	342	326	19	M63	860
225M	- 55*	356	75	435	442	390	311	395	149	55	M20	110	16	10	49	225	25	525	342	326	19	M63	855
225M	- 60	356	75	435	442	390	311	395	149	60	M20	140	18	11	53	225	25	525	342	326	19	M63	885
250S	- 60*	406	80	485	485	415	311	395	168	60	M20	140	18	11	53	250	30	580	342	326	24	M63	930
250S	- 70	406	80	485	485	415	311	395	168	70	M20	140	20	12	62.5	250	30	580	342	326	24	M63	930
250M	- 60*	406	80	485	485	415	349	433	168	60	M20	140	18	11	53	250	30	580	342	326	24	M63	965
250M	- 70	406	80	485	485	415	349	433	168	70	M20	140	20	12	62.5	250	30	580	342	326	24	M63	965
280S	- 65*	457	85	550	544	445	368	530	190	65	M20	140	18	11	58	280	35	660	342	326	24	M63	1035
280S	- 80	457	85	550	544	445	368	530	190	80	M20	170	22	14	71	280	35	660	342	326	24	M63	1065
280M	- 65*	457	85	550	544	445	419	580	190	65	M20	140	18	11	58	280	35	660	342	326	24	M63	1085
280M	- 80	457	85	550	544	445	419	580	190	80	M20	170	22	14	71	280	35	660	342	326	24	M63	1115
315S	- 65*	508	114	622	700	610	406	508	216	65	M20	140	18	11	58	315	32	775	470	445	28	M63	1155
315S	- 85	508	114	622	700	610	406	508	216	85	M20	170	22	14	76	315	32	775	470	445	28	M63	1185
315M	- 65*	508	114	622	700	610	457	559	216	65	M20	140	18	11	58	315	32	775	470	445	28	M63	1205
315M	- 85	508	114	622	700	610	457	559	216	85	M20	170	22	14	76	315	32	775	470	445	28	M63	1235
315L	- 65*	508	114	622	700	610	508	610	216	65	M20	140	18	11	58	315	32	775	470	445	28	M63	1255
315L	- 85	508	114	622	700	610	508	610	216	85	M20	170	22	14	76	315	32	775	470	445	28	M63	1285
315LX	- 65*	508	114	622	700	610	508	810	216	65	M20	140	18	11	58	315	32	775	470	445	28	M63	1455
315LX	- 85	508	114	622	700	610	508	810	216	85	M20	170	22	14	76	315	32	775	470	445	28	M63	1485
355L	- 85*	610	145	735	810	675	630	810	254	85	M20	170	22	14	76	355	40	845	530	500	28	BGP ²⁾	1630
355L	- 110	610	145	735	810	675	630	810	254	110	M24	210	28	16	100	355	40	845	530	500	28	BGP ²⁾	1670
355LX	- 85*	610	145	735	810	675	630	965	254	85	M20	170	22	14	76	355	40	845	530	500	28	BGP ²⁾	1760
355LX	- 110	610	145	735	810	675	630	965	254	110	M24	210	28	16	100	355	40	845	530	500	28	BGP ²⁾	1800
400L	- 85*	686	165	810	910	725	710	920	280	85	M20	170	22	14	76	400	45	935	530	500	35	BGP ²⁾	1725
400L	- 110	686	165	810	910	725	710	920	280	110	M24	210	28	16	100	400	45	935	530	500	35	BGP ²⁾	1765
400LX	- 85*	686	165	810	910	725	710	1070	280	85	M20	170	22	14	76	400	45	935	530	500	35	BGP ²⁾	1805
400LX	- 110	686	165	810	910	725	710	1070	280	110	M24	210	28	16	100	400	45	935	530	500	35	BGP ²⁾	1845
450L	- 125	800	200	980	1040	815	1120	1610	310	125	M24	210	32	18	114	450	50	1080	530	500	35	BGP ²⁾	2495

* 2 pole motors only

¹⁾ Two conduit entries provided

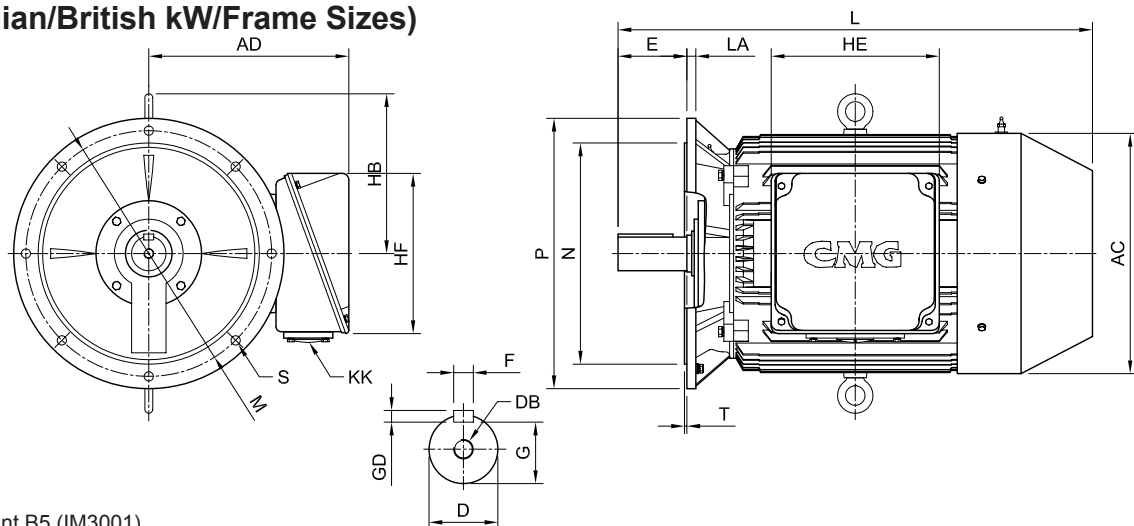
²⁾ BGP = Blank Gland Plate

³⁾ See page 6 for alternative conduit entry options

This data is provided for guidance only, guaranteed only when confirmed by CMG.

Dimensional drawings - PPA

(Australian/British kW/Frame Sizes)



Flange mount B5 (IM3001)

Motor frame	AC	AD	D	DB	E	F	GD	G	HB	HE	HF	KK ⁽³⁾	L	LA	M	N	P	S ⁽⁴⁾	T
80 - 19	175	152	19	M6	40	6	6	15.5	130	134	121	M20 ⁽¹⁾	340	12	165	130	200	12	3.5
90S - 24	185	158	24	M8	50	8	7	20	125	134	121	M20 ⁽¹⁾	375	12	165	130	200	12	3.5
90L - 24	185	158	24	M8	50	8	7	20	125	134	121	M20 ⁽¹⁾	400	12	165	130	200	12	3.5
100L - 28	220	186	28	M10	60	8	7	24	150	134	121	M20 ⁽¹⁾	450	14	215	180	250	12	4
112M - 28	235	210	28	M10	60	8	7	24	155	160	171	M25 ⁽¹⁾	470	14	215	180	250	15	4
132S - 38	266	230	38	M12	80	10	8	33	183	160	171	M25 ⁽¹⁾	525	14	265	230	300	15	4
132M - 38	266	230	38	M12	80	10	8	33	183	160	171	M25 ⁽¹⁾	565	14	265	230	300	15	4
160M - 42	320	280	42	M16	110	12	8	37	220	238	223	M50	655	16	300	250	350	19	5
160L - 42	320	280	42	M16	110	12	8	37	220	238	223	M50	695	16	300	250	350	19	5
180M - 48	355	305	48	M16	110	14	9	42.5	240	238	223	M50	715	16	300	250	350	19	5
180L - 48	355	305	48	M16	110	14	9	42.5	240	238	223	M50	715	16	300	250	350	19	5
200L - 55	395	325	55	M20	110	16	10	49	270	238	223	M50	805	16	350	300	400	19	5
225S - 60	442	390	60	M20	140	18	11	53	300	342	326	M63	860	18	400	350	450	19	5
225M - 55*	442	390	55	M20	110	16	10	49	300	342	326	M63	855	18	400	350	450	19	5
225M - 60	442	390	60	M20	140	18	11	53	300	342	326	M63	885	18	400	350	450	19	5
250S - 60*	485	415	60	M20	140	18	11	53	330	342	326	M63	930	18	500	450	550	19	5
250S - 70	485	415	70	M20	140	20	12	62.5	330	342	326	M63	930	18	500	450	550	19	5
250M - 60*	485	415	60	M20	140	18	11	53	330	342	326	M63	965	18	500	450	550	19	5
250M - 70	485	415	70	M20	140	20	12	62.5	330	342	326	M63	965	18	500	450	550	19	5
280S - 65*	544	445	65	M20	140	18	11	58	380	342	326	M63	1035	18	500	450	550	19	5
280S - 80	544	445	80	M20	170	22	14	71	380	342	326	M63	1065	18	500	450	550	19	5
280M - 65*	544	445	65	M20	140	18	11	58	380	342	326	M63	1085	18	500	450	550	19	5
280M - 80	544	445	80	M20	170	22	14	71	380	342	326	M63	1115	18	500	450	550	19	5
315S - 65*	700	610	65	M20	140	18	11	58	460	470	445	M63	1155	25	600	550	660	24	6
315S - 85	700	610	85	M20	170	22	14	76	460	470	445	M63	1185	25	600	550	660	24	6
315M - 65*	700	610	65	M20	140	18	11	58	460	470	445	M63	1205	25	600	550	660	24	6
315M - 85	700	610	85	M20	170	22	14	76	460	470	445	M63	1235	25	600	550	660	24	6
315L - 65*	700	610	65	M20	140	18	11	58	460	470	445	M63	1255	25	600	550	660	24	6
315L - 85	700	610	85	M20	170	22	14	76	460	470	445	M63	1285	25	600	550	660	24	6
315LX - 65*	700	610	65	M20	140	18	11	58	460	470	445	M63	1455	25	600	550	660	24	6
315LX - 85	700	610	85	M20	170	22	14	76	460	470	445	M63	1485	25	600	550	660	24	6
355L - 85*	810	675	85	M20	170	22	14	76	490	530	500	BGP ⁽²⁾	1630	30	740	680	800	24	6
355L - 110	810	675	110	M24	210	28	16	100	490	530	500	BGP ⁽²⁾	1670	30	740	680	800	24	6
355LX - 85*	810	675	85	M20	170	22	14	76	490	530	500	BGP ⁽²⁾	1760	30	740	680	800	24	6
355LX - 110	810	675	110	M24	210	28	16	100	490	530	500	BGP ⁽²⁾	1800	30	740	680	800	24	6
400L - 85*	910	725	85	M20	170	22	14	76	535	530	500	BGP ⁽²⁾	1725	30	940	880	1000	28	6
400L - 110	910	725	110	M24	210	28	16	100	535	530	500	BGP ⁽²⁾	1765	30	940	880	1000	28	6
400LX - 85*	910	725	85	M20	170	22	14	76	535	530	500	BGP ⁽²⁾	1805	30	940	880	1000	28	6
400LX - 110	910	725	110	M24	210	28	16	100	535	530	500	BGP ⁽²⁾	1845	30	940	880	1000	28	6
450L - 125	1040	815	125	M24	210	32	18	114	630	530	500	BGP ⁽²⁾	2945	30	1080	1000	1150	28	7

* 2 pole motors only

⁽¹⁾ Two conduit entries provided

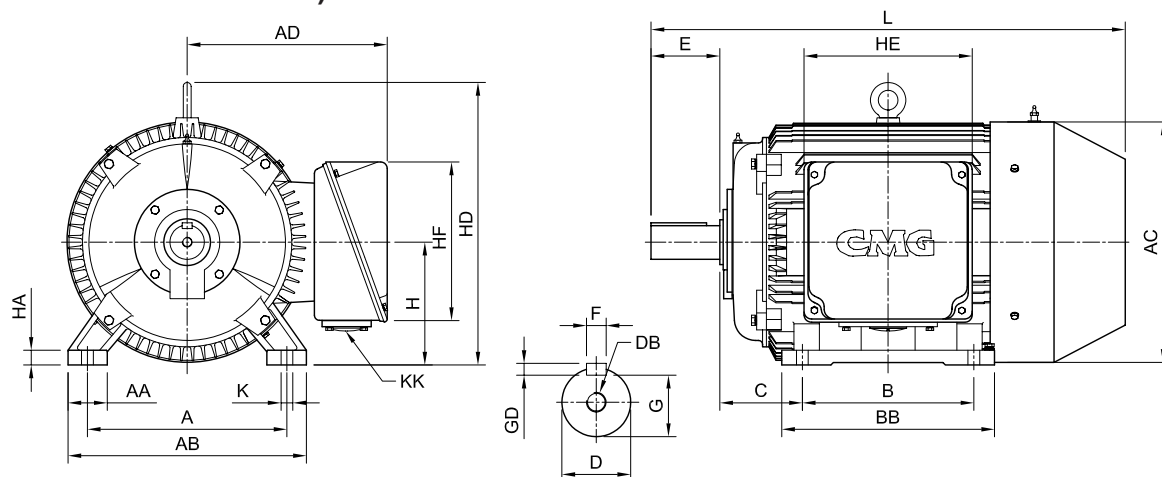
⁽²⁾ BGP = Blank Gland Plate

⁽³⁾ See page 6 for alternative conduit entry options

⁽⁴⁾ Mounting Holes: Frames 80 - 200 have 4 holes at 45° offset from top. Frames 225 and above have 8 holes at 0° offset from top
This data is provided for guidance only, guaranteed only when confirmed by CMG.

Dimensional drawings - PPC

(CENELEC kW/Frame Sizes)



Foot mount B3 (IM1001)

Motor frame	A	AA	AB	AC	AD	B	BB	C	D	DB	E	F	GD	G	H	HA	HD	HE	HF	K	KK ⁽³⁾	L	
80	- 19	125	35	160	175	152	100	182	50	19	M6	40	6	6	15.5	80	10	210	134	121	10	M20 ⁽¹⁾	340
90S	- 24	140	40	180	185	158	100	196	56	24	M8	50	8	7	20	90	12	215	134	121	10	M20 ⁽¹⁾	375
90L	- 24	140	40	180	185	158	125	221	56	24	M8	50	8	7	20	90	12	215	134	121	10	M20 ⁽¹⁾	400
100L	- 28	160	40	200	220	186	140	235	63	28	M10	60	8	7	24	100	14	250	134	121	12	M20 ⁽¹⁾	450
112M	- 28	190	50	240	235	210	140	245	70	28	M10	60	8	7	24	112	15	270	160	171	12	M25 ⁽¹⁾	470
132S	- 38	216	60	276	265	230	140	238	89	38	M12	80	10	8	33	132	18	315	160	171	12	M25 ⁽¹⁾	525
132M	- 38	216	60	276	265	230	178	276	89	38	M12	80	10	8	33	132	18	315	160	171	12	M25 ⁽¹⁾	565
160M	- 42	254	70	325	320	280	210	314	108	42	M16	110	12	8	37	160	20	380	238	223	15	M50	655
160L	- 42	254	70	325	320	280	254	354	108	42	M16	110	12	8	37	160	20	380	238	223	15	M50	695
180M	- 48	279	70	349	355	305	241	349	121	48	M16	110	14	9	42.5	180	22	420	238	223	15	M50	715
180L	- 48	279	70	349	355	305	279	349	121	48	M16	110	14	9	42.5	180	22	420	238	223	15	M50	715
200L	- 55	318	70	395	395	325	305	380	133	55	M20	110	16	10	49	200	25	470	238	223	19	M50	805
225S	- 60	356	75	435	442	390	286	370	149	60	M20	140	18	11	53	225	25	525	342	326	19	M63	860
225M*	- 55	356	75	435	442	390	311	395	149	55	M20	110	16	10	49	225	25	525	342	326	19	M63	855
225M	- 60	356	75	435	442	390	311	395	149	60	M20	140	18	11	53	225	25	525	342	326	19	M63	885
250M	- 60*	406	80	485	485	415	349	433	168	60	M20	140	18	11	53	250	30	580	342	326	24	M63	965
250M	- 65	406	80	485	485	415	349	433	168	65	M20	140	18	11	58	250	30	580	342	326	24	M63	965
280S	- 65*	457	85	550	544	445	368	530	190	65	M20	140	18	11	58	280	35	660	342	326	24	M63	1035
280S	- 75	457	85	550	544	445	368	530	190	75	M20	140	20	12	67.5	280	35	660	342	326	24	M63	1035
280M	- 65*	457	85	550	544	445	419	580	190	65	M20	140	18	11	58	280	35	660	342	326	24	M63	1085
280M	- 75	457	85	550	544	445	419	580	190	75	M20	140	20	12	67.5	280	35	660	342	326	24	M63	1085
315S	- 65*	508	114	622	700	610	406	508	216	65	M20	140	18	11	58	315	32	775	470	445	28	M63	1155
315S	- 80	508	114	622	700	610	406	508	216	80	M20	170	22	14	71	315	32	775	470	445	28	M63	1185
315M	- 65*	508	114	622	700	610	457	559	216	65	M20	140	18	11	58	315	32	775	470	445	28	M63	1205
315M	- 80	508	114	622	700	610	457	559	216	80	M20	170	22	14	71	315	32	775	470	445	28	M63	1235
315L	- 65*	508	114	622	700	610	508	610	216	65	M20	140	18	11	58	315	32	775	470	445	28	M63	1255
315L	- 80	508	114	622	700	610	508	610	216	80	M20	170	22	14	71	315	32	775	470	445	28	M63	1285
315LX	- 65*	508	114	622	700	610	508	610	216	65	M20	140	18	11	58	315	32	775	470	445	28	M63	1455
315LX	- 80	508	114	622	700	610	508	610	216	80	M20	170	22	14	71	315	32	775	470	445	28	M63	1485
355L	- 80*	610	145	735	810	675	630	810	254	80	M20	170	22	14	71	355	40	845	530	500	28	BGP ⁽²⁾	1603
355L	- 100	610	145	735	810	675	630	810	254	100	M24	210	28	16	90	355	40	845	530	500	28	BGP ⁽²⁾	1670
355LX	- 80*	610	145	735	810	675	630	810	254	80	M20	170	22	14	71	355	40	845	530	500	28	BGP ⁽²⁾	1760
355LX	- 100	610	145	735	810	675	630	810	254	100	M24	210	28	16	90	355	40	845	530	500	28	BGP ⁽²⁾	1800

*2 pole motors only

¹⁾ Two conduit entries provided

²⁾ BGP = Blank Gland Plate

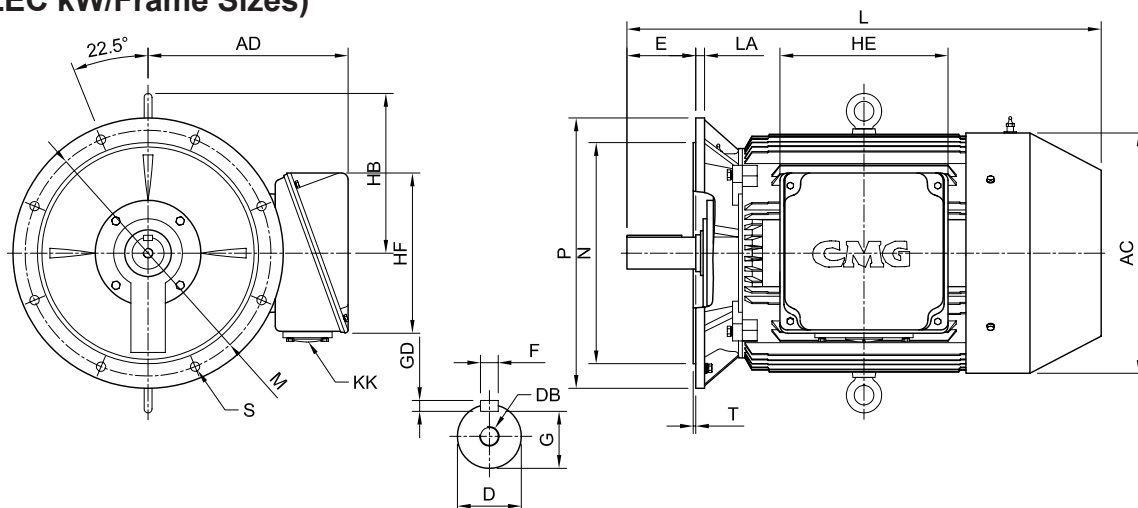
³⁾ See page 6 for alternative conduit entry options

Frames 400 and 450 are available in PPA

This data is provided for guidance only, guaranteed only when confirmed by CMG.

Dimensional drawings - PPC

(CENELEC kW/Frame Sizes)



Flange mount B5 (IM3001)

Motor frame	AC	AD	D	DB	E	F	GD	G	HB	HE	HF	KK ³⁾	L	LA	M	N	P	S ⁴⁾	T	
80	- 19	175	152	19	M6	40	6	6	15.5	130	134	121	M20 ¹⁾	340	12	165	130	200	12	3.5
90S	- 24	185	158	24	M8	50	8	7	20	125	134	121	M20 ¹⁾	375	12	165	130	200	12	3.5
90L	- 24	185	158	24	M8	50	8	7	20	125	134	121	M20 ¹⁾	400	12	165	130	200	12	3.5
100L	- 28	220	186	28	M10	60	8	7	24	150	134	121	M20 ¹⁾	450	14	215	180	250	12	4
112M	- 28	234	210	28	M10	60	8	7	24	155	160	171	M25 ¹⁾	470	14	215	180	250	15	4
132S	- 38	266	230	38	M12	80	10	8	33	183	160	171	M25 ¹⁾	525	14	265	230	300	15	4
132M	- 38	266	230	38	M12	80	10	8	33	183	160	171	M25 ¹⁾	565	14	265	230	300	15	4
160M	- 42	320	280	42	M16	110	12	8	37	220	238	223	M50	655	16	300	250	350	19	5
160L	- 42	320	280	42	M16	110	12	8	37	220	238	223	M50	695	16	300	250	350	19	5
180M	- 48	355	305	48	M16	110	14	9	42.5	240	238	223	M50	715	16	300	250	350	19	5
180L	- 48	355	305	48	M16	110	14	9	42.5	240	238	223	M50	715	16	300	250	350	19	5
200L	- 55	395	325	55	M20	110	16	10	49	270	238	223	M50	805	16	350	300	400	19	5
225S	- 60	442	390	60	M20	140	18	11	53	300	342	326	M63	860	18	400	350	450	19	5
225M	- 55*	442	390	55	M20	110	16	10	49	300	342	326	M63	855	18	400	350	450	19	5
225M	- 60	442	390	60	M20	140	18	11	53	300	342	326	M63	885	18	400	350	450	19	5
250M	- 60*	485	415	60	M20	140	18	11	53	330	342	326	M63	965	18	500	450	550	19	5
250M	- 65	485	415	65	M20	140	18	11	58	330	342	326	M63	965	18	500	450	550	19	5
280S	- 65*	544	445	65	M20	140	18	11	58	380	342	326	M63	1035	18	500	450	550	19	5
280S	- 75	544	445	75	M20	140	20	12	67.5	380	342	326	M63	1035	18	500	450	550	19	5
280M	- 65*	544	445	65	M20	140	18	11	58	380	342	326	M63	1085	18	500	450	50	19	5
280M	- 75	544	445	75	M20	140	20	12	67.5	380	342	326	M63	1085	18	500	450	550	19	5
315S	- 65*	700	610	65	M20	140	18	11	58	460	470	445	M63	1155	25	600	550	660	24	6
315S	- 80	700	610	80	M20	170	22	14	71	460	470	445	M63	1185	25	600	550	660	24	6
315M	- 65*	700	610	65	M20	140	18	11	58	460	470	445	M63	1205	25	600	550	660	24	6
315M	- 80	700	610	80	M20	170	22	14	71	460	470	445	M63	1235	25	600	550	660	24	6
315L	- 65*	700	610	65	M20	140	18	11	58	460	470	445	M63	1255	25	600	550	660	24	6
315L	- 80	700	610	80	M20	170	22	14	71	460	470	445	M63	1285	25	600	550	660	24	6
315LX	- 65*	700	610	65	M20	140	18	11	58	460	470	445	M63	1455	25	600	550	660	24	6
315LX	- 80	700	610	80	M20	170	22	14	71	460	470	445	M63	1485	25	600	550	660	24	6
355L	- 80*	810	675	80	M20	170	22	14	71	490	530	500	BGP ²⁾	1630	30	740	680	800	24	6
355L	- 100	810	675	100	M24	210	28	16	90	490	530	500	BGP ²⁾	1670	30	740	680	800	24	6
355LX	- 80*	810	675	80	M20	170	22	14	71	490	530	500	BGP ²⁾	1760	30	740	680	800	24	6
355LX	- 100	810	675	100	M24	210	28	16	90	490	530	500	BGP ²⁾	1800	30	740	680	800	24	6

* 2 pole motors only

¹⁾ Two conduit entries provided

²⁾ BGP = Blank Gland Plate

³⁾ See page 6 for alternative conduit entry options

⁴⁾ Mounting Holes: Frames 80- 200 have 4 holes at 45° offset from top. Frames 225 and above have 8 holes at 22.5° offset from top
Frames 400 and 450 are available in PPA

This data is provided for guidance only, guaranteed only when confirmed by CMG.

Motors for hazardous areas

PPAE/PPAN/PPAD

Motors used within a hazardous location require a higher level of protection against the risk of harmful occurrences. PPA motors are available in the three most common high protection configurations, Exe, ExnA (formerly Exn) and ExtD (formerly DIP), all supplied with a protection rating of IP66. Most PPA hazardous area motor versions are available in frame sizes 80 to 400. Combinations of protection such as Exe and ExtD, or ExnA and ExtD, are also available.

International and Australian standards

AS/NZS2381.1 specifies 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. (See AS/NZS3000).

Paint

For PPA hazardous location motors sold in Australia (unless otherwise specified), the standard paint colours are as follows:

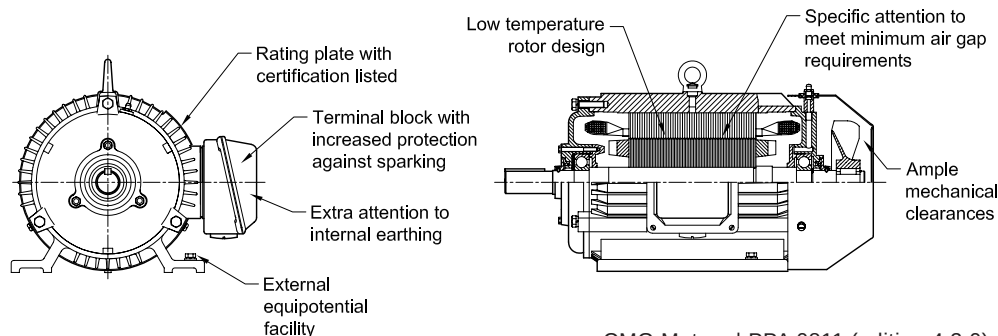
- PPAE (Exe) Golden Yellow (RAL 1004)
- PPAN (ExnA) Bright Red Orange (RAL 2008)
- PPAD (ExtD) Bright Red Orange (RAL 2008)

For paint specifications in all other countries, please contact your local CMG office directly.

Motor protection types

PPAE – Exe

Exe motor protection designates increased safety as outlined in IEC 60079-7 and AS2380.6-1988.



Exe type increased safety protection describes electrical equipment that does not produce arcs or sparks in normal service, in 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. Exe motors are suitable for Zone 1, Group II (A, B & C) hazardous areas, and CMG provides for a temperature class of T3 (200°C) in a 50°C ambient.

Exe 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 of suitable current-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.

PPAN – ExnA (formerly Exn)

ExnA motor protection designates non-sparking as outlined in IEC 60079-15 and AS2380.9-1991.

ExnA type non-sparking protection describes electrical equipment that, in normal operation, is not capable of igniting a surrounding explosive atmosphere, and a fault capable of causing ignition is not likely to occur.

ExnA motors are suitable for Zone 2, Group IIA,B&C hazardous areas, and CMG provides for a temperature class of T3 (200°C) in a 60°C ambient.

PPAD – ExtD (formerly DIP)

ExtD motor protection designates electrical apparatus for use in presence of combustible dust, protection by enclosure as outlined in IEC or AS/NZS61241 series of standards. ExtD 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.

ExtD motors are suitable for Zone 21 and 22 dust laden hazardous areas, and CMG provides for a temperature class of T4 (135°C) in a 50°C 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 atmospheres are 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 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°C where coal dust can form a layer, and 450°C for internal surfaces where the above risk is avoided by sealing against ingress or dust.

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

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

Electrical apparatus of Group II may be subdivided according to the nature of the potentially explosive atmosphere for which it is intended.

Group specification and characteristics of some common flammable liquids, gases, and vapors are listed in the table below:

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

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 an explosive gas/air mixture in the air immediately above the surface.

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:

Equipment Group Certified to:	Allowable Gas Group
IIA	IIA
IIB	IIA, IIB
IIC	IIA, IIB, 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 atmosphere.

Areas where dusts, flyings and fibres 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 and 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 for 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 or layers cannot be assured then the area is to be classified Zone 21.

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 following table 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:

Ignition temperature	Material minimum ignition energy [mJ]	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, and optional extras

VVVF drives

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

VVVF drive kit A – Separately driven cooling fan (240 & 415V)

This fan should be used when the motor speed is required to be reduced below 30Hz 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, refer page 10.

VVVF drive kit B1 – Standard motor (EDM)

This kit incorporates a single insulated bearing, normally at the non-drive end, and an earthing brush at the drive end. Together they are designed to remove the effect of electrical discharge through the bearings.

VVVF drive kit B2 – Hazardous location motors (EDM)

In hazardous locations earthing brushes are not permitted. In this case two insulated bearings should be fitted to control the effects of EDM.

Vertical hoods and dust shields

PPA motors have IP66 protection as standard and do not need rain hoods for motors mounted vertically shaft down. However, where additional protection from solids in the atmosphere is required hoods can be fitted.

For use in very dusty environments, dust shields are available manufactured from stainless steel. These shields are fitted over the motor in the IM1001 (B3), IM2001 (B3/B5) or IM3001 (B5) horizontal mounted position, and prevent the ribs of the motor from clogging with dust.

Testing services

CMG can provide both type test certificates and individual motor test reports on any CMG SGA motor. Testing is carried out by CMG Technology Pty Ltd in our own NATA and ILAC accredited test laboratory.

Type test reports and outline drawings of standard motors are available at www.cmgroup.com.au.



Special shafts

PPA motors come standard with a single output shaft to standard dimensions. CMG can provide customer specific shaft designs including the following common alternatives:

- Double shaft extension
- Special shaft extension
- Stainless steel shaft material
- Reduced shafts for geared motors.

Bearings and bearing RTDs

In applications where bearings need special consideration CMG can provide the following solutions:

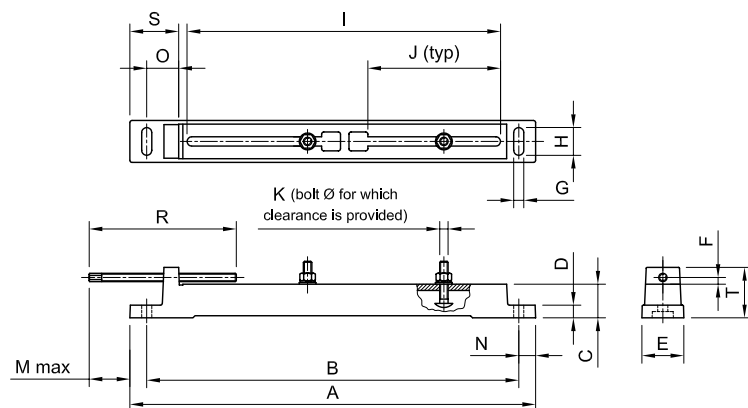
- Bearing monitors
- Alternative bearing types
- Low/high temperature bearing grease
- Insulated bearings.

In addition to the winding RTDs previously described in this catalogue, bearing RTDs (one per bearing) are available as an option on the full PPA range. These RTD can be terminated in the winding RTD terminal box or their own auxiliary box.

Slide rails

Slide rails are designed for motor position adjustment when belt drives are used. Applications include tension adjustment for belt driven equipment.

CMG stock slide rails to suit frame sizes 80 to 355. Rail sets are manufactured from cast iron and provided with mounting bolts and nuts between motor and rail.



Slide rail dimensions

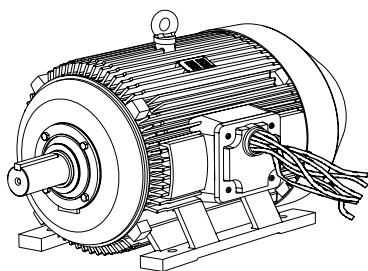
Slide rail product code	To suit motor frame	Dimensions [mm]																	Weight per set [kg]
		A	B	C	D	E	F	G	H	I	J	K	M	N	O	R	S	T	
MR080090	80 & 90	380	328	30	15	48	10	15	25	245	95	8	75	25	40	145	65	50	3
MR100132	100, 112 & 132	475	425	37	19	70	10	14	35	340	150	10	135	26	42	200	68	62	6.5
MR160180	160 & 180	567	515	48	19	72	11	18	35	390	162	12	115	28	57	200	85	70	10
MR200225	200 & 225	790	730	60	32	92	16	20	20	610	265	16	200	30	60	290	90	92	22
MR250280	250 & 280	945	870	70	38	105	16	21	21	725	305	20	240	35	70	350	105	110	40
MR315355	315 & 355	1220	1115	125	40	122	22	30	30	920	420	24	285	50	105	450	155	170	105

Terminal box

PPA motors come standard with a terminal box on the right hand side viewed from drive end.

The following alternatives are available:

- Left hand terminal box – **PPAL**
 - 80-400 frame by modification of standard unit
 - 450 frame new manufacturing
- Removed terminal box – **PPAF**
 - fitted with a blanking plate and threaded conduit entry, and extended leads, including earth connector.



Special identification plates

Additional identification and warning plates in stainless steel or other specified materials can be fitted to this PPA range. These include:

- Equipment number plates
- Direction of rotation (arrow) plates
- RTD plates
- Lubrication instruction plates.

Protection against harsh environments

Where environmental factors need special consideration CMG can provide the following modifications:

- Winding temperature monitors
- Anti-condensation heaters on motors below frame 250
- Separately driven cooling fans
- Tropic proofing
- Special paint finish.

Where the motor is to be installed in harsh chemical conditions optional surface treatments are available to protect against acid and alkaline splashing. In addition to these surface systems we are able to supply stainless steel nuts, bolts and screws, plus inlet fan grills manufactured from stainless steel.

Special fans

CMG offer a range of uni-directional and bi-directional low-noise fans.

Installation and maintenance

PPA series motors are designed and manufactured to be robust and reliable for minimal maintenance. The following items should be taken into consideration to ensure trouble free installation and reliable running throughout the motors' life.

Inspection

On receipt of the motor check the following:

- Rating plate details and enclosure are as ordered
- Shaft turns freely
- Motor was not damaged during transport
- Condensation drain holes are in the correct position for the motor mounting application. (They should be located at the lowest point of the motor when it is in its operating position.)
- If the winding is meggered to earth, ensure that the thermal protectors are not inadvertently damaged. (The thermistor leads should be shorted together whilst meggering takes place).

Storage

When the motor is not for immediate use store in a clean, dry location, free from vibration. (Bearings are susceptible to damage from vibration.)

Ensure shaft locking clamps, where supplied, are fitted securely. Anti-condensation heaters, where fitted, should be energised if the environment is likely to be damp.

Installation

The following items should be considered when installing to ensure motor reliability:

Surroundings

Ensure that the motor is properly protected against ingress of oil, water or dust if construction work is in progress around the motor.

Shaft locking clamp

Motors 200 frame and above are fitted with a shaft-locking clamp. The clamp should remain fitted for as long as possible, preferably until the motor is put into service. Motors that are likely to remain stationary for lengthy periods should have locking clamps refitted. Shaft-locking clamps stop axial movement of the rotor assembly caused by vibration. This causes a phenomenon known as 'false brinelling', which eventually leads to premature bearing failure particularly where roller bearings are fitted.

Pulleys and couplings

- Pulleys and couplings should be machined to H7 limits. Both shaft and bore should be cleaned and lubricated. If the fit is still too tight the pulley or coupling should be heated up in air or oil to approximately 95°C.
- Shock methods must not be used in removing pulleys and couplings. Proper wheel or pulley removers should be used to prevent shaft and bearing damage.

- Pulleys and couplings should be balanced before the keyway is cut to eliminate vibration caused by lack of balancing. (Rotor and shaft assemblies have been finely balanced during manufacture, and drive end shafts balanced with a half key.)
- When slide rails are used in conjunction with pulley drives the adjusting screw ends should be positioned between the motor and load at drive shaft end and the other diagonally opposite. This helps speedy and accurate belt aligning, tensioning and replacement.

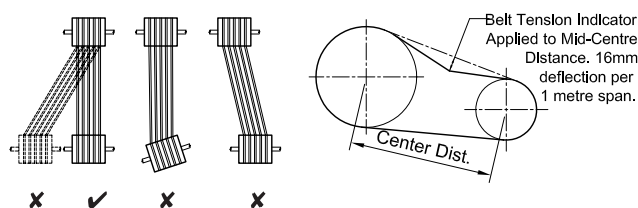
Shafts and keys

Shafts are machined to AS1359.10-1985 dimensions.

Shaft diameter	Tolerance		Length	Key size	Seat
19	+0.009	-0.004	40	6x6x25	15.5
24	+0.009	-0.004	50	8x7x32	20
28	+0.009	-0.004	60	8x7x40	24
38	+0.018	+0.002	80	10x8x56	33
42	+0.018	+0.002	110	12x8x80	37
48	+0.018	+0.002	110	14x9x80	42.5
55	+0.030	+0.011	110	16x10x80	49
60	+0.030	+0.011	140	18x11x110	53
65	+0.030	+0.011	140	18x11x110	58
70	+0.030	+0.011	140	20x12x110	62.5
75	+0.030	+0.011	140	20x12x110	67.5
80	+0.030	+0.011	170	22x14x140	71
85	+0.035	+0.013	170	22x14x140	76
100	+0.035	+0.013	210	28x16x160	90
110	+0.035	+0.013	210	28x16x160	100
125	+0.040	+0.015	210	32x18x160	114

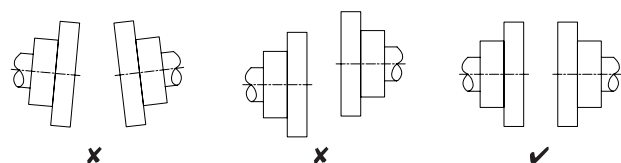
Belt Drives

The belt manufacturer's recommendations for installation, alignment and tensioning must be strictly adhered to when fitting belt drives.



Direct coupling

Care must be taken in checking alignment of driving and driven shafts. The motor and driven equipment must be in alignment from all aspects.



WARNING: MISALIGNMENT OF PULLEYS WILL LEAD TO PREMATURE BEARING FAILURE

Connection

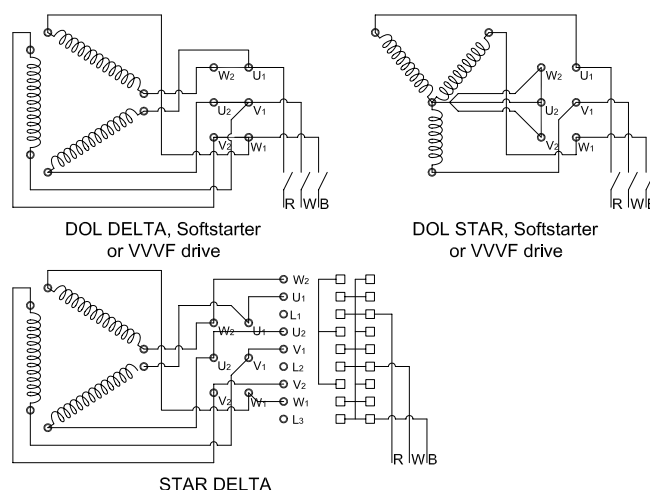
PPA motors should be connected to the rated voltage a follows:

up to 3kW	Star (220-250V three phase Delta)
4kW to 630kW	Delta
710kW and above	Delta (rated 690V)

PPA motors are suitable for use with both rated voltage DOL operation and rated voltage three phase variable frequency drives. 3kW and below can also be used with 220-250V three phase variable frequency drives.

Alternatively, 380-415kW, 4kW to 630kW Delta connected motors can be operated DOL, or in the Star configuration with a 690V supply or with a 690V variable frequency drive. When used with a VVVF drive they must be used in conjunction with an output reactor to protect the winding insulation. These motors are also suitable for Star/Delta starting.

For motors 710kW and above the standard connection is Delta with a minimum voltage of 690V.



Where special windings are supplied, a separate connection diagram will be supplied with the motor. All motors are provided with suitable earthing studs.

Running current check

Check the running current of the motor on no load and full load.

Basic maintenance

Bearings

When re-greasing motors ensure that the correct type of grease is used. If in doubt about the existing grease type, clean out old grease thoroughly from bearings and bearing housings, prior to regreasing.

WARNING: NEVER MIX GREASE TYPES

Grease replenishment

The addition of fresh grease, to renew the original charge, must be made at regular intervals.

PPA motors with frames 80 to 100 are fitted with sealed bearing housing (non regreasable). Thru-flushing grease valves are fitted to all PPA motors. For frames 112 and above replenishment should be carried out whilst the motor is running. The rotating slinger expels excess grease through an exhaust port in the bearing cap ensuring the correct level of fresh grease is maintained in the bearing housing. See the table on page 31 for bearing relubrication volumes.

Grease packing

Assembly

The thru-flushing grease valve operates automatically and cannot be overgreased. This feature eliminates problems associated with overpacking as any excess will be expelled from the housing as the motor operates. (Overpacking can cause churning and over-heating which may result in breakdown of the grease and leakage from the housing. Too little grease can result in dry running and cage wear.)

Bearing

The bearing itself should always be packed as full as possible, working the grease thoroughly into the bearing parts in order to ensure proper lubrication immediately upon starting.

Bearing caps

The most convenient way of packing bearing caps is to fill the inner-bearing cap completely and the outer bearing cap to one third of its capacity, preferably on the opposite side to the exhaust port.

Dismantling

If a motor is dismantled, cover the bearings with a plastic sheet or clean lint free rag to prevent ingress of foreign matter. Never use cotton waste.

Removing and fitting bearings

If bearings are removed they should be renewed, not refitted. Proper drawing and fitting equipment must be used when removing bearings as the bearings have an interference fit on the shaft. Replacement bearings must be the correct size and have the correct internal clearance grade. See the table on page 31 for bearing sizes. C3 clearances are normally preferred.

Recommended grease types

General purpose grease (standard)

- Lithium hydroxy-stearate grease
- NLGI consistency No. 3
- Operating temperature -20°C to +120°C
- High oxidation resistance
- Retains consistency after extreme periods of service
- Contains effective rust inhibitors
- Shell Alvania no. 3 or equivalent.

Extreme temperature range grease (optional)

- PTFE (Teflon) base with mineral oils
- Operating temperature -40°C to +260°C
- Non melting with high oxidation resistance
- Retains consistency
- Contains rust inhibitors
- Magnalube G or equivalent.

Current

Check periodically that the current drawn is balanced and is the same as at the time of installation.

Cable terminations

Cable terminations should have all incoming supply leads compressed between two nuts, locked with a locking nut. Other combinations may cause overheating due to high resistance joints.

WARNING: THE CORRECT CLEARANCE BETWEEN LIVE PARTS MUST BE MAINTAINED

Thermal protection devices

Standard

One set (3) of PTC thermistors are embedded in the head windings. The leads are terminated in an auxiliary terminal box for PPA motors frame 160 and above, and terminate in the main terminal box for frames 80 to 132.

Resistance Temperature Detectors (RTDs) are fitted to windings of 315 frame and above (leads terminated in separate auxiliary terminal box).

Optional

Other thermal protection devices may be optionally fitted, including bearing RTDs, winding RTDs for smaller frames, additional sets of PTC thermistors, or bi-metal thermal protectors.

WARNING: DO NOT APPLY MORE THAN 2.5V ACROSS ANY PROTECTION DEVICE

Insulation testing

When checking for insulation resistance (IR) the test voltage must not be applied across the protection device. The correct procedure is to short the entire protector leads together and apply the test voltage between the shorted leads and earth and/or phases. 'Meggering' across the terminals of the device, when not shorted, is likely to cause irreparable damage, and must not be carried out.

PPA & PPC bearing size and relubrication data

Standard bearings									Optional bearings				
Drive end (ball bearing)					Non-Drive end (ball bearing)				Drive end (roller bearing)				
Fame size	Bearing no.	Bearing size	Relubrication		Bearing no.	Bearing size	Relubrication		Bearing no.	Bearing size	Relubrication		
			Qty [g]	Interval [hours]			Qty [g]	Interval [hours]			Qty [g]	Interval [hours]	
3000 r/min = 2 pole													
112	6306	30x72x19	7	9000	6306	30x72x19	7	9000					
132	6308	40x90x23	11	7500	6308	40x90x23	11	7500					
160	6309	45x100x25	13	6500	6309	45x100x25	13	6500					
180	6310	50x110x27	15	6000	6310	50x110x27	15	6500					
200	6312	60x130x31	20	5000	6312	60x130x31	20	5000					
225	6313	65x140x33	23	4800	6313	65x140x33	23	4800					
250	6313	65x140x33	30	4200	6313	65x140x33	23	4800					
280	6314	70x150x35	37	2500	6314	70x150x35	26	4000					
315	6316	80x170x39	41	2000	6316	80x170x39	41	2000					
355	6318	90x190x43	41	2000	6318	90x190x43	41	2000					
400	6318	90x190x43	41	2000	6318	90x190x43	41	2000					
1500 r/min = 4 pole													
112	6306	30x72x19	7	12000	6306	30x72x19	7	12000	NU306	30x72x19	7	11000	
132	6308	40x90x23	11	11000	6308	40x90x23	11	11000	NU308	40x90x23	11	9500	
160	6309	45x100x25	13	11000	6309	45x100x25	13	11000	NU309	45x100x25	13	8500	
180	6310	50x110x27	15	10500	6310	50x110x27	15	11000	NU310	50x110x27	15	8500	
200	6312	60x130x31	20	10000	6312	60x130x31	20	10000	NU312	60x130x31	20	6000	
225	6313	65x140x33	23	9500	6313	65x140x33	23	9500	NU313	65x140x33	23	7000	
250	6315	75x160x37	30	9100	6313	65x140x33	23	9500	NU315	75x160x37	30	7000	
280	6317	85x180x41	37	8900	6314	70x150x35	26	8900	NU317	85x180x41	37	6800	
315	NU318	90x190x43	41	6500	6316	80x170x39	41	7000					
355	NU324	120x260x55	72	4000	6324	120x260x55	72	7000					
400	NU326	130x280x58	81	3500	6326	130x280x58	81	6200					
450	NU328	140x210x62	93	2500	6326	130x280x58	81	6200					
1000 r/min = 6 pole													
112	6306	30x72x19	7	17000	6306	30x72x19	7	17000	NU306	30x72x19	7	14000	
132	6308	40x90x23	11	15000	6308	40x90x23	11	15000	NU308	40x90x23	11	11000	
160	6309	45x100x25	13	14000	6309	45x100x25	13	14000	NU309	45x100x25	13	8500	
180	6310	50x110x27	15	14000	6310	50x110x27	15	14000	NU310	50x110x27	15	8500	
200	6312	60x130x31	20	14000	6312	60x130x31	20	14000	NU312	60x130x31	20	6000	
225	6313	65x140x33	23	13500	6313	65x140x33	23	13500	NU313	65x140x33	23	7000	
250	6315	75x160x37	30	13000	6313	65x140x33	23	13500	NU315	75x160x37	30	7000	
280	6317	85x180x41	37	12500	6314	70x150x35	26	12500	NU317	85x180x41	37	6800	
315	NU318	90x190x43	41	9500	6316	80x170x39	41	10000					
355	NU324	120x260x55	72	8000	6324	120x260x55	72	7000					
400	NU326	130x280x58	81	7000	6326	130x280x58	81	6200					
450	NU328	140x210x62	93	4500	6326	130x280x58	81	6200					
750 r/min = 8 pole													
112	6306	30x72x19	7	20000	6306	30x72x19	7	20000	NU306	30x72x19	7	17000	
132	6308	40x90x23	11	17000	6308	40x90x23	11	17000	NU308	40x90x23	11	13000	
160	6309	45x100x25	13	16000	6309	45x100x25	13	16000	NU309	45x100x25	13	8500	
180	6310	50x110x27	15	15500	6310	50x110x27	15	16000	NU310	50x110x27	15	8500	
200	6312	60x130x31	20	15000	6312	60x130x31	20	15000	NU312	60x130x31	20	6000	
225	6313	65x140x33	23	15000	6313	65x140x33	23	15000	NU313	65x140x33	23	7000	
250	6315	75x160x37	30	14500	6313	65x140x33	23	15000	NU315	75x160x37	30	7000	
280	6317	85x180x41	37	14000	6314	70x150x35	26	14000	NU317	85x180x41	37	6800	
315	NU318	90x190x43	41	13000	6316	80x170x39	41	13000					
355	NU324	120x260x55	72	10000	6324	120x260x55	72	7000					
400	NU326	130x280x58	81	9000	6326	130x280x58	81	6200					
450	NU328	140x210x62	93	7500	6326	130x280x58	81	6200					

Note: The bearings fitted to 80, 90 & 100 frames are greased for life. For these bearing sizes, refer to the table listed on page 7.