



Smart solutions.
Strong relationship.

Energy Efficient AC Motors

IE3 Efficiency Class



Apex Series
a green solution



Crompton Greaves (CG) is part of the US\$ 4 bn Avantha Group, a conglomerate with an impressive global footprint. Since its inception CG has been synonymous with electricity.

The company has retained its leadership position in the management and application of electrical energy.

Today, Crompton Greaves is of the largest private sector enterprise. It has diversified extensively and is engaged in designing, manufacturing and marketing technologically advanced electrical products and services related to power generation, transmission and distribution, besides executing turnkey projects. The company is customer-centric in its focus and is the single largest source for a wide variety of electrical equipments and products.

CG employs more than 10000 people in 21 countries. With several international acquisitions, Crompton Greaves is fast emerging as a first choice global supplier for high quality equipment through its three business groups viz;

Power Systems: Transformer, Switchgear, Power Quality, Engineering Projects.

Industrial Systems: Motors, Alternators, Drives, Railway Signaling, Stampings.

Consumer Products: Fans, Appliances, Lighting, Integrated Security Solutions & Home Automation, Pumps.



Crompton Greaves Ltd

As one of the world's leading engineering corporations, CG provides end-to-end solutions, helping its customers to use electrical power effectively and to increase industrial productivity with sustainability.

CG is leading manufacturer of electric motors, with motor solutions, which benefits a wide range of customers. Our products are used in almost every industrial application including general manufacturing, petrochemicals, food processing, pharmaceuticals where they drive fans, pumps, compressors, conveyors, lifts and cranes, amongst other things.

Our core competencies lie in our design facility conforming to the international quality standards. We make continuous effort, to bring out the latest, most advanced product into marketplace.

We continuously add many new services, features and introduce new solutions so as to ensure complete customer satisfaction.

Apex Series

Apex IE3 series is an efficient solution by CG to save energy, as growing cost of energy calls for power savings at each possible step of manufacturing. Electric motor driven systems used in industrial process consume about 70% of electricity.

These motors are complying with new efficiency requirements of IEC60034-30:2008 IS12615:2011 standard.

Apex IE3 aluminum motor range covers ac squirrel cage induction motors with output from 0.75kW to 7.50 kW in frame sizes PA80 TO PA132M. Apex IE3 series cast iron range covers ac squirrel cage induction motor with output from 0.75 kW to 7.50 kW in frame PC80 to PC132M. They are being used in various range of application from food processing to chemical, from cement to steel & heating to refrigeration.

Quality Assurance

Stringent quality procedures are observed from first design to finished product in accordance with ISO9001 documented quality systems. All of our factories have been assessed to meet these requirements, a further assurance that only the highest possible standards of quality are accepted.

Multi Mount

(Aluminum motor range upto 7.5 kW) - By simply changing the position of feet, user is able to convert right, left or top terminal box position and by changing the standard end shield user can change it for flange or face version.

Benefits of APEX Series Motor

- High efficient at low running cost
- Low vibration and noise
- High torque with smooth acceleration
- Suitable for VFD application
- Paint Shade: RAL6018

IEC 60034-30:2008/IS12615:2011

International Electro technical Commission (IEC) standard IEC 60034-30:2008 & IS12615:2011 defines energy efficiency (IE code) classes for single speed, three-phase, 50 and 60 Hz induction motors.

The efficiency levels defined in above mentioned standard are based on test methods specified in IEC 60034-2-1:2007.

The standard defines three International energy efficiency (IE) classes.

- IE1 = Standard efficiency (EFF2 in the former European classification scheme)
- IE2 = High efficiency (EFF1 in the former European classification scheme and equivalent to EPAAct in USA for 60 Hz)
- IE3 = Premium efficiency (equivalent to NEMA Premium in USA for 60 Hz)

The standard covers almost all motors (for example standard, marine, brake motors, geared motor)

- Single speed, three-phase, 50Hz and 60Hz.
- 2, 4 or 6 poles.
- Rated output from 0.75 to 375kW.
- Rated voltage up to 1000V.
- Duty type S1 (continuous duty) or S3 (intermittent periodic duty) with a rated cyclic duration factor of 80 percent or higher
- Capable of operating direct online.

The following motors are excluded from the standard:

- Motors made solely for converter operation.
- Motors completely integrated into a machine (for example, pump, fan or compressor) that cannot be tested separately from the machine.
- Motors rated for duty cycles S4 and above except if an equivalent S1 duty is specified by the driven equipment manufacturer.

Additional Specifications of IS 12615-2011

The motors are capable of delivering rated output with,
a) Terminal voltage differing from its rated value by not more than 10% or
b) Frequency differing from its rated value by not more than 5% or
c) The sum of absolute percent variations of (a) & (b) not exceeding 10%

The fixing dimensions and shaft extensions of motors are conforming to the values specified in IS 1231 and IS 2223.

The relationship between output, in kW and frame number are according to IS 1231.

Apart from efficiency, Indian Standard defines following performance parameters for IE3 motors

- 1) Full load Speed
- 2) Full load Current
- 3) Breakaway Torque
- 4) Breakaway Current

IEC 60034-2-1:2007 / IS 15999 (Part 3 / sec 1) Specification

The standards introduce new rules concerning the testing methods to be used for determining losses and efficiency. It offers two ways of determining efficiency; the direct and indirect methods. The standard specifies the following parameters for determining efficiency using the indirect method:

- 1) Reference temperature
- 2) Four options for determining PLL (additional load losses):
 - a) Measurement - PLL calculated from load tests.
 - b) Estimation - PLL at assigned value 2.5% -1.0% of input power at rated load between 0.1 kW and 1000 kW.
 - c) Mathematical calculation - E_h star -alternative indirect method with mathematical calculation of PLL.
 - d) PLL from removed rotor and reverse rotation test. Winding losses in stator and rotor are determined at (25C + actual temperature rise measured).

The resulting efficiency values differ from those obtained under the previous IEC testing standard, IEC 60034-2:1996.

"It must be noted that efficiency values are only comparable if they are measured using the same method."

Reference Standard

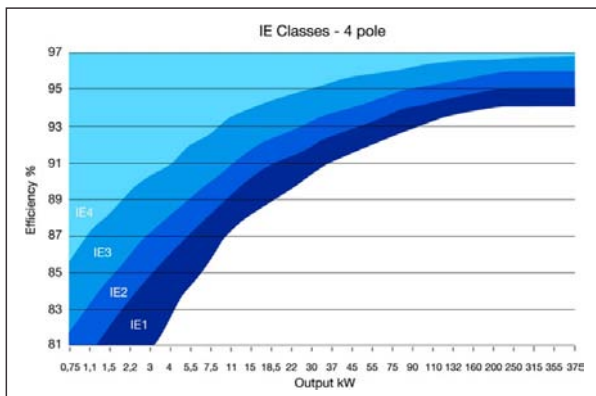
Standards	Description
IEC 60034-1-2010	Rotating electrical machines - Rating & Performance
IEC 60034-30:2008	Rotating electrical machines - IE Code for Efficiency Classes
IEC 60034-2-1:2007	Rotating electrical machines - Determination of Losses & Eff.
IEC 60034-5:2006	Rotating electrical machines - Degrees of protection
IEC 60034-9:2007	Rotating electrical machines - Noise Limits
IEC 60034-14:2007	Rotating electrical machines - Vibration Limits
IEC 60072-1:1991	Rotating electrical machines - Dimensions
IS 1231:1974	Rotating electrical machines - Dimensions foot mounted
IS 2223-1983	Rotating electrical machines - Dimensions flange mounted

Apex Series

Introduction

Minimum efficiency values defined in IEC 60034- 30:2008T

Output	IE1			IE2			IE3		
	Standard Efficiency			Standard Efficiency			Standard Efficiency		
kW	2 Pole	4 Pole	6 Pole	2 Pole	4 Pole	6 Pole	2 Pole	4 Pole	6 Pole
0.75	72.1	72.1	70.0	77.4	79.6	75.9	80.7	82.5	78.9
1.1	75.0	75.0	72.9	79.6	81.4	78.1	82.7	84.1	81.0
1.5	77.2	77.2	75.2	81.3	82.8	79.8	84.2	85.3	82.5
2.2	79.7	79.7	77.7	83.2	84.3	81.8	85.9	86.7	84.3
3	81.5	81.5	79.7	84.6	85.5	83.3	87.1	87.7	85.6
4	83.1	83.1	81.4	85.8	86.6	84.6	88.1	88.6	86.8
5.5	84.7	84.7	83.1	87.0	87.7	86.0	89.2	89.6	88.0
7.5	86.0	86.0	84.7	88.1	88.7	87.2	90.1	90.4	89.1
11	87.6	87.6	86.4	89.4	89.8	88.7	91.2	91.4	90.3
15	88.7	88.7	87.7	90.3	90.6	89.7	91.9	92.1	91.2
18.5	89.3	89.3	88.6	90.9	91.2	90.4	92.4	92.6	91.7
22	89.9	89.9	89.2	91.3	91.6	90.9	92.7	93.0	92.2
30	90.7	90.7	90.2	92.0	92.3	91.7	93.3	93.6	92.9
37	91.2	91.2	90.8	92.5	92.7	92.2	93.7	93.9	93.3
45	91.7	91.7	91.4	92.9	93.1	92.7	94.0	94.2	93.7
55	92.1	92.1	91.9	93.2	93.5	93.1	94.3	94.6	94.1
75	92.7	92.7	92.6	93.8	94.0	93.7	94.7	95.0	94.6
90	93.0	93.0	92.9	94.1	94.2	94.0	95.0	95.2	94.9
110	93.3	93.3	93.3	94.3	94.5	94.3	95.2	95.4	95.1
132	93.5	93.5	93.5	94.6	94.7	94.6	95.4	95.6	95.4
160	93.7	93.8	93.8	94.8	94.9	94.8	95.6	95.8	95.6
200	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
250	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
315	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
355	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8
375	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8



- ❖ It must be noted that efficiency values are only comparable if they are measured using the same method.
- ❖ Any efficiency value between IE1 and IE2 values is to be considered as IE1 class for motors.
- ❖ Any efficiency value between IE2 and IE3 values is to be considered as IE2 class for motors.
- ❖ The full load efficiency of any individual motor, when tested at rated voltage and frequency, shall not be less than the rated efficiency minus the tolerances on efficiency in accordance with IEC 60034-1.
- ❖ Energy efficient cage induction motors are typically built with more active material, i.e. longer core length and /or greater core diameter in order to achieve the higher efficiency. For these reason the starting performance of energy efficient motors differs somewhat from motors with a lower efficiency. On average the lock-rotor current increase by 10% to 15% for motors from one energy efficiency class compared to motors of the next higher class with the same output power. Individually, this difference depends on the construction principle of the motor and should be checked with manufacturer when replacing motors in an existing installation. It must be ensured that the control protective device is properly sized and setup.
- ❖ As per IEC60034-30 2008 Motors specially designed For special requirement of the driven machine e.g.
 - Heavy starting duty, special torque stiffness and/or breakdown torque characteristics, large number of start/stop cycles, very low rotor inertia)
 - For special characteristics of grind supply (e.g limited starting current, high tolerances of voltage and/or frequency)
 - For special ambient conditions (e.g very high or low ambient temperature: smoke extraction motors, high altitudes of installation)
 may not be able to achieve higher efficiency classifications.

PERFORMANCE DATA AS PER IEC60034-30:2008/IS12615:2011

kW	HP	FRAME	FULL LOAD CURRENT			FL RPM	FLT kg-m	EFFICIENCY			POWER FACTOR			STT %FLT	SSC %FLT	POT %FLT	GD ² KGM ²
			230V	400V	415V			FL	3/4L	1/2L	FL	3/4L	1/2L				

2 POLE: 3000 Synchronous RPM

0.75	1.00	80M	3.0	1.7	1.7	2795	0.261	80.7	80.7	80.3	0.77	0.76	0.70	250	700	300	0.004
1.10	1.50	80M	3.8	2.2	2.1	2845	0.376	82.7	82.7	82.0	0.88	0.85	0.76	225	700	275	0.007
1.50	2.00	90L	6.0	3.4	3.3	2860	0.511	84.2	84.2	83.5	0.75	0.70	0.64	225	650	275	0.007
2.20	3.00	90L	8.6	4.9	4.8	2800	0.765	85.9	85.6	84.5	0.75	0.75	0.68	275	650	325	0.008
3.00	4.00	100L	9.6	5.5	5.3	2890	1.010	88.1	88.4	88.4	0.89	0.85	0.76	350	900	375	0.031
3.70	5.00	100L	11.8	6.8	6.5	2890	1.246	87.8	88.1	88.1	0.90	0.87	0.8	350	900	350	0.032
4.00	5.50	112M	12.5	7.2	6.9	2890	1.360	88.1	89.1	90.1	0.91	0.88	0.82	275	750	350	0.033
5.50	7.50	132S	17.0	9.8	9.4	2929	1.830	89.2	89.2	89.2	0.91	0.88	0.83	300	750	350	0.076
7.50	10.00	132M	24.3	14.0	13.5	2915	2.500	90.1	90.1	90.1	0.86	0.81	0.72	300	750	350	0.090

4 POLE: 1500 Synchronous RPM

0.75	1.0	80M	3.5	2.0	1.9	1420	0.514	82.5	82.5	81.5	0.65	0.64	0.54	225	650	275	0.012
1.10	1.5	90L	4.8	2.8	2.7	1420	0.754	84.1	84.1	82.4	0.68	0.68	0.58	200	600	250	0.017
1.50	2.0	90L	6.3	3.6	3.5	1435	1.02	85.3	85.3	85.0	0.70	0.70	0.57	200	750	250	0.023
2.20	3.0	100L	10.6	6.1	5.9	1442	1.49	86.7	86.7	85.2	0.60	0.60	0.48	225	700	275	0.059
3.00	4.0	100L	13.2	7.6	7.3	1465	1.99	87.7	87.5	85.0	0.65	0.63	0.50	250	800	300	0.065
3.70	5.0	112M	13.5	7.7	7.5	1465	2.46	88.4	88.4	88.2	0.78	0.76	0.70	225	750	275	0.074
4.00	5.5	112M	14.2	8.1	7.9	1450	2.69	88.6	88.6	88.5	0.80	0.75	0.65	225	750	275	0.074
5.50	7.5	132S	18.9	10.9	10.5	1472	3.64	90.2	90.2	90.0	0.81	0.76	0.66	250	850	300	0.138
7.50	10.0	132M	25.4	14.6	14.1	1470	4.97	90.4	90.4	90.0	0.82	0.78	0.70	200	800	250	0.191

6 POLE: 1000 Synchronous RPM

0.75	1.0	90S	3.9	2.2	2.2	950	0.769	80.4	80.4	78.8	0.60	0.58	0.45	200	600	250	0.017
1.10	1.5	90L	5.7	3.3	3.1	935	1.145	81.0	80.2	78.4	0.60	0.58	0.45	215	600	265	0.023
1.50	2.0	100L	7.4	4.2	4.1	935	1.562	85.2	81.5	80.4	0.60	0.55	0.50	200	650	250	0.074
2.20	3.0	112M	9.4	5.4	5.2	950	2.254	84.3	84.3	84.0	0.70	0.65	0.50	150	700	200	0.069
3.00	4.0	132S	11.3	6.5	6.3	950	3.074	85.6	85.6	83.5	0.78	0.72	0.65	150	700	200	0.182
3.70	5.0	132S	13.8	7.9	7.6	950	3.79	86.5	86.5	86.0	0.78	0.76	0.68	150	700	200	0.180
4.00	5.5	132M	15.8	9.1	8.0	965	4.035	86.8	86.8	85.0	0.73	0.66	0.54	150	600	200	0.208
5.50 #	7.5	132M	19.6	11.3	10.9	950	5.636	88.0	88.0	86.5	0.80	0.77	0.68	150	700	200	0.208

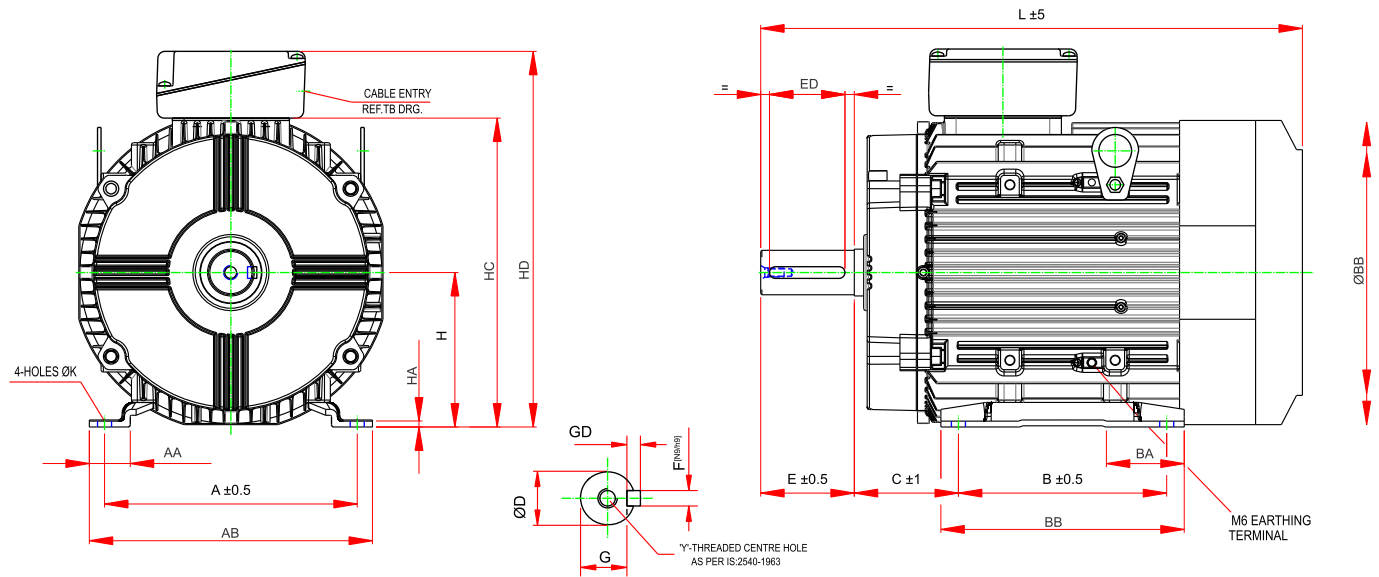
This rating is only available in cast iron construction

Tolerances are applicable as per IEC 30034-1.

Full load current indicated are given for respective voltage designs.

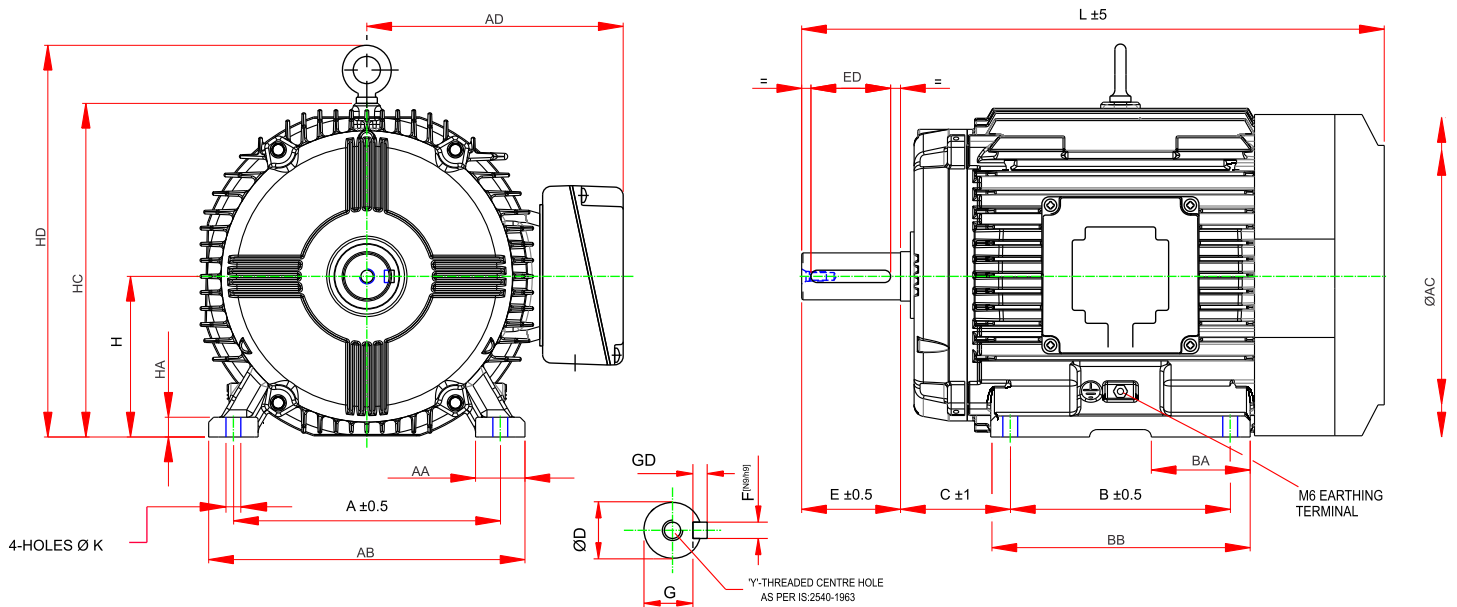
Use prefixes PA for aluminium construction and PC for Cast iron construction. e.g PA90L or PC90L

OUTLINE DIMENSION OF 3 PHASE FOOT MOUNTED ALUMINIUM MOTORS



TYPE	MANDATORY DIMENSIONS				FOOT DIMENSIONS						SHAFT DIMENSIONS							GENERAL DIMENSIONS			
	A	B	C	H	K	AA	AB	BB	BA	HA	D	E	F	G	GD	ED	Y	L	AC	HC	HD
PA80	125	100	50	80	10	27	157	127	-	4	19	40	6	15.5	6	32	M6X16	330	162	165	212
PA90S	140	100	56	90	10	28	164	150	-	4	24	50	8	20	7	40	M8X19	365	178	182	225
PA90L	140	125	56	90	10	28	164	150	-	4	24	50	8	20	7	40	M8X19	365	178	182	225
PA100L	160	140	63	100	12	28	184	170	30	4	28	60	8	24	7	50	M10X22	415	210	200	270
PA112M	190	140	70	112	12	30	212	194	60	4	28	60	8	24	7	50	M10X22	410	234	225	295
PA132S	216	140	89	132	12	32	242	208	68	5	38	80	10	33	8	70	M12X28	485	274	265	335
PA132M	216	178	89	132	12	32	242	208	68	5	38	80	10	33	8	70	M12X28	485	274	265	335

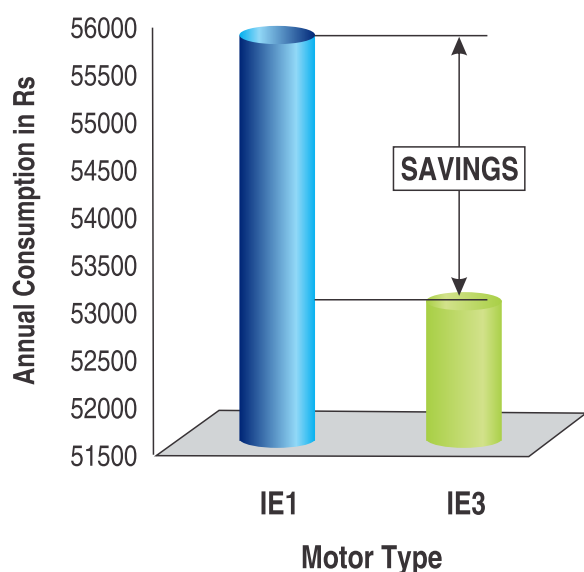
OUTLINE DIMENSION OF 3 PHASE FOOT MOUNTED CAST IRON MOTORS



TYPE	MANDATORY DIMENSIONS				FOOT DIMENSIONS						SHAFT DIMENSIONS							GENERAL DIMENSIONS				
	A	B	C	H	K	AA	AB	BB	BA	HA	D	E	F	G	GD	ED	Y	L	AC	AD	HC	HD
PC80	125	100	50	80	10	35	158	177	-	10	19	40	6	15.5	6	32	M6X16	330	160	127	160	160
PC90S	140	100	56	90	10	38	175	166	-	12	24	50	8	20	7	40	M8X19	340	190	135	190	232
PC90L	140	125	56	90	10	38	175	195	-	12	24	50	8	20	7	40	M8X19	365	190	135	190	232
PC100L	160	140	63	100	12	35	195	206	-	12	28	60	8	24	7	50	M10X22	415	225	170	225	262
PC112M	190	140	70	112	12	40	230	194	68	16	28	60	8	24	7	50	M10X22	410	235	190	234	285
PC132S	216	140	89	132	12	40	256	210	80	18	38	80	10	33	8	70	M12X28	485	275	210	275	320
PC132M	216	178	89	132	12	40	256	210	80	18	38	80	10	33	8	70	M12X28	485	275	210	275	320

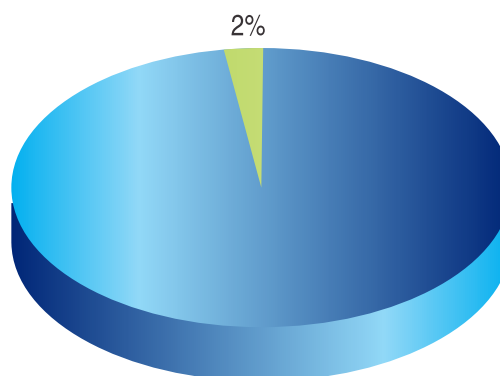
Description	Unit	IE1 Motor	IE3 Motor
Type of Motor			
Motor Rating		7.50 kW/4 pole	
Rated output of the motor (kW)		7.5	7.5
Motor Type			APEX E3
Efficiency as per IS12615 :2011		IE1	IE3
Motor loading in % of the rated? (L)		85%	85%
Efficiency (η)	In %	86 (η_1)	90.4 (η_3)
Power Tariff (C)	Rs./kWH	5	5
Operation of the motor per annum (N)	hours	7500	7500
Energy consumption per annum (E) = $L \times kW \times N \times (100/\eta_1 - 100/\eta_3)$	kWH	55596	52890
Energy Saved per annum over standard motor	kWH	-	2706
Annual Energy Bill (E x C)	Rs.	277980	264450
Savings towards energy bill per annum	Rs.	-	13530
Savings towards energy bill per month	Rs.	-	1127
Purchase price of a motor	Rs.	13393	19133
Additional investment over a standard motor	Rs.		5740
Payback over additional investment* on IE3 motor	Months		5 months
Payback of total investment (Purchase Price)	Year		1 year 5 months
Life time cost @ 20 Years	Rs.		1057799

Energy Consumption



Initial Cost Vs Life time Cost

■ Life Time Cost ■ Initial Cost



$$\text{*Payback (months)} = \frac{\text{Cost of energy efficient motor} - \text{Cost of standard motor}}{\text{Annual energy savings}} \times 12$$

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3rd Floor, Express Building,
9-10, Bahadur Shah Zafar Marg, Near RTO Crossing,
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Phones : (022) 67558590

Ahmedabad :

909-916, Sakar II, Near Ellis Bridge Police Station,
Ahmedabad - 144 001

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Pune :

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Phones : (020) 25534675 - 77

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103-B, Apollo Trade Centre, 2B Rajgarh Kothi,
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Bannerghatta Road, Bilekahalli,

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Cherupushpam Building, 5th Floor, 300-6,

Shanmugham Road, Ernakulam,

Cochin - 682 031

Phones : (0484) 2370860

Secunderabad :

4th Floor, Minerva House, 94, Sarojini Devi Road,
Secunderabad - 500 003

Phones : (040) 40002300

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Phones : (011) 23460700

East : 21, R. N. Mukherjee Road, Kolkata - 700 001. Phones : (033) 22489160.

West : Kanjur Marg (E), Mumbai - 400 042. Phones : (022) 67558590

South : 3A, MGR Salai, Kodambakkam High Road, Nungambakkam, Chennai - 600 034.

Phones : (044) 23651369



NOTE : As the design and manufacturing of Crompton Greaves electrical equipment are subject to constant improvement, the product supplied may differ in some details from the specifications and illustrations given in this booklet. For more details contact nearest Branch Office.

CG INTERNATIONAL DIVISION

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Lined area for notes or calculations.



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