

# 400 Series 403A-15G1 ElectropaK

13.2 kWm / 17.6 hp @ 1500 rpm

The Perkins® 400 Series engine family continues to set new standards in the compact engine market. Developed alongside customers to fulfill their needs in the generator set, compressor, agricultural and general industrial markets.

These new ElectropaKs provide compact power, from a robust family of 3 and 4 cylinder diesel engines designed to provide economic and durable operation at prime and standby duties, hitting the key power nodes required by the power generation industry.



Specification		
Number of cylinders	3 vertical in-line	
Bore and stroke	84 x 90 mm	3.3 x 3.5 in
Displacement	1.496 litres	91.3 in <sup>3</sup>
Aspiration	Naturally aspirated	
Cycle	4 stroke	
Combustion system	Indirect injection	
Compression ratio	22.5:1	
Rotation	Anti-clockwise, viewed on flywheel	
Total lubricating capacity	6.0 litres	1.58 US gal
Cooling system	Water cooled	
Total coolant capacity	6.0 litres	1.58 US gal

[www.perkins.com](http://www.perkins.com)

Photographs are for illustrative purposes only and may not reflect final specification.  
All information in this document is substantially correct at time of printing and may be altered subsequently.  
Final weight and dimensions will depend on completed specification.

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 **Perkins®**

THE HEART OF EVERY GREAT MACHINE

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## Features and benefits

### Powered by your needs

- The 403A-15G1 ElectropaK is a powerful but quiet 1.5 litre naturally aspirated 3-cylinder compact package

### Compact, clean, efficient power

- Design features on the 400D range of ElectropaKs ensures clean rapid starting in all conditions whilst delivering impressive performance with low operating costs in a small, efficient package size

### Lower operating costs

- Approved for operation on biodiesel\* concentrations of up to 20%
- Oil and filter changes are 500 hours, dependent on load factor
- Engine durability and reliability, the warranty offering and ease of installation combine to drive down the cost of ownership
- **Warranties and Service Contracts**

We provide one-year warranties for constant speed engines and two-year warranties for variable speed models, as standard. These are supported by multilevel Extended Service Contracts that can be bought additionally

Discover more: [www.perkins.esc](http://www.perkins.esc)

### Product support

- With highly trained Perkins distributors in thousands of communities in over 180 countries, you are never far away from expert product knowledge, genuine parts and a range of advanced diagnostic technology for keeping your engine in peak condition
- To find your local distributor: [www.perkins.com/distributor](http://www.perkins.com/distributor)

\*Subject to conformance with ASTM D6751 and EN14214

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## Technical information

### Air inlet

- Mounted air filter

### Fuel system

- Mechanically governed cassette type fuel injection pump
- Split element fuel filter

### Lubrication system

- Wet steel sump with filler and dipstick
- Spin-on full-flow lub oil filter

### Cooling system

- Thermostatically-controlled system with belt driven coolant pump and pusher fan
- Mounted radiator, piping and guards

### Electrical equipment

- 12 volt starter motor and 12 volt 15 amp alternator with DC output
- Oil pressure and coolant temperature switches
- 12 volt shut-off solenoid energised to run
- Glow plug cold start aid and heater/starter switch

### Flywheel and housing

- 1500 rpm
- High inertia flywheel to SAE J620 Size 190.5 mm (7½ in) Heavy
- Flywheel housing SAE 4 Long

### Mountings

- Front and rear engine mounting bracket

### Optional equipment

- Parts book

### Option groups

A selection of optional items is available to enable you to prepare a specification precisely matched to your needs.

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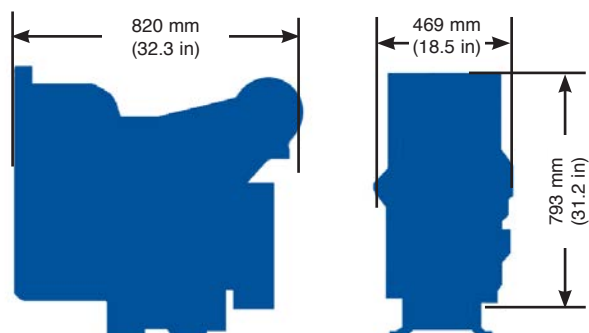
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# 400 Series 403A-15G1 ElectropaK

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Engine package weights and dimensions

Engine package weights and dimensions		
Length	820 mm	32.3 in
Width	469 mm	18.5 in
Height	793 mm	31.2 in
Weight (dry)	197 kg	434 lb

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Speed rpm	Type of operation	Typical generator output (Net)		Engine power			
				Gross		Net	
		kVA	kWe	kWm	hp	kWm	hp
1500	Prime power	13.0	10.4	12.2	16.4	12.0	16.0
	Standby power	15.0	11.4	13.5	18.1	13.2	17.6

The above ratings represent the engine performance capabilities to conditions specified in ISO 8528/1, ISO 3046/1:1986, BS 5514/1. **Derating** may be required for conditions outside these; consult Perkins Engines Company Limited.

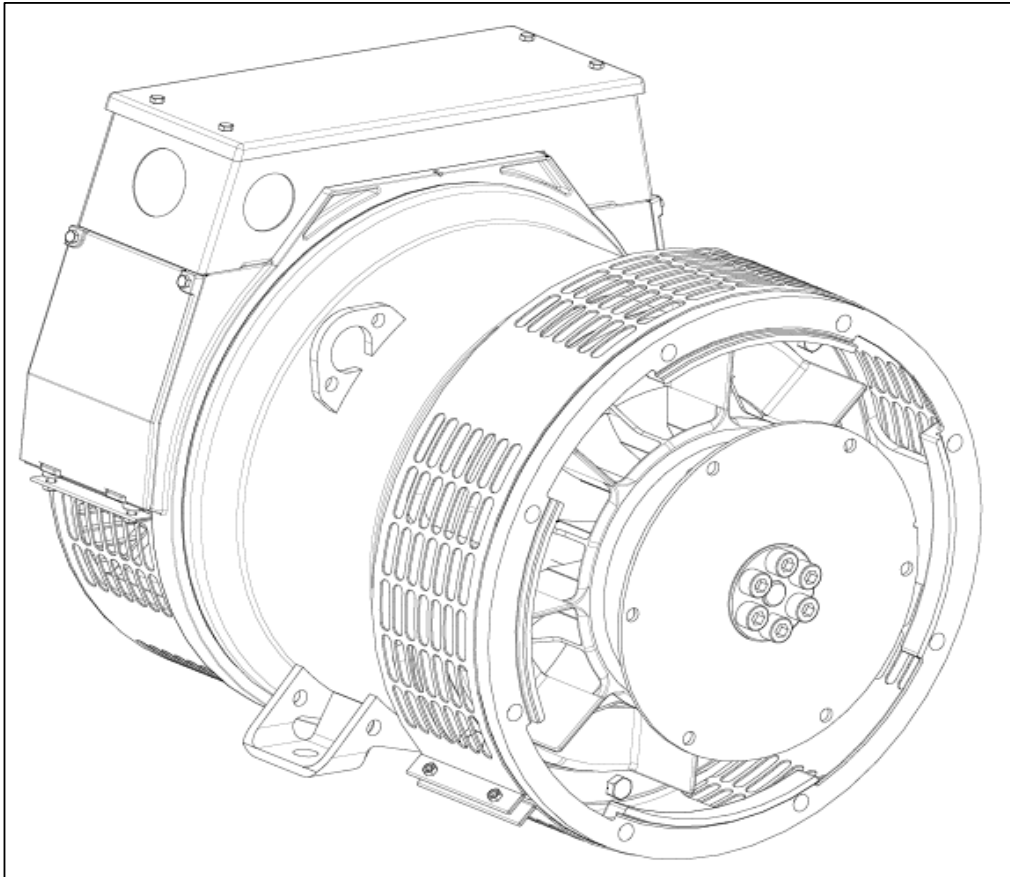
Generator powers are typical and are based on typical alternator efficiencies and a power factor (cos  $\theta$ ) of 0.8. **Fuel specification:** BS 2869: Part 2 1998 Class A2 or ASTM D975 D2.

**Rating definitions:** Prime power: Power available at variable load in lieu of a main power network. Overload of 10% is permitted for 1 hour in every 12 hours operation. Standby (maximum): Power available at variable load in the event of a main power network failure. No overload is permitted.

Percent of prime power	Fuel consumption at 1500 rpm g/kWh	Fuel consumption at 1500 rpm l/hr
Standby power	251	4.1
Prime power	248	3.7
75%	252	2.8
50%	277	2.0

# STAMFORD<sup>®</sup>

## PI044G - Technical Data Sheet



# PI044G

## SPECIFICATIONS & OPTIONS

**STAMFORD**

### STANDARDS

Stamford industrial generators meet the requirements of BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100, AS1359. Other standards and certifications can be considered on request.

### VOLTAGE REGULATOR

#### AS480 AVR fitted as STANDARD

With this self-excited system the main stator provides power via the AVR to the exciter stator. The high efficiency semi-conductors of the AVR ensure positive build-up from initial low levels of residual voltage.

The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling. The AS480 will support limited accessories, RFI suppression remote voltage trimmer and for the P1 range only a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

The AVR is can be fitted to either side of the generator in its own housing in the non-drive end bracket.

#### Excitation Boost System (EBS) (OPTIONAL)

The EBS is a single, self-contained unit, attached to the non-drive end of the generator.

The EBS unit consists of the Excitation Boost Controller (EBC) and an Excitation Boost Generator (EBG). Under fault conditions, or when the generator is subjected to a large impact load such as a motor starting, the generator voltage will drop. The EBC senses the drop in voltage and engages the output power of the EBG. This additional power feeds the generator's excitation system, supporting the load until breaker discrimination can remove the fault or enable the generator to pick up a motor and drive the voltage recovery.

### WINDINGS & ELECTRICAL PERFORMANCE

All generator stators are wound to 2/3 pitch. This eliminates triplen (3rd, 9th, 15th ...) harmonics on the voltage waveform and is found to be the optimum design for trouble-free supply of non-linear loads. The 2/3 pitch design avoids excessive neutral currents sometimes seen with higher winding pitches, when in parallel with the mains. A fully connected damper winding reduces oscillations during paralleling. This winding, with the 2/3 pitch and carefully selected pole and tooth designs, ensures very low waveform distortion.

### TERMINALS & TERMINAL BOX

Standard generators are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted at the non-drive end of the generator. Dedicated single phase generators are also available. A sheet steel terminal box contains provides ample space for the customers' wiring and gland arrangements. Alternative terminal boxes are available for customers who want to fit additional components in the terminal box.

### SHAFT & KEYS

All generator rotors are dynamically balanced to better than BS6861:Part 1 Grade 2.5 for minimum vibration in operation. Two bearing generators are balanced with a half key.

### INSULATION / IMPREGNATION

The insulation system is class 'H'.

All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

### QUALITY ASSURANCE

Generators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.

The stated voltage regulation may not be maintained in the presence of certain radio transmitted signals. Any change in performance will fall within the limits of Criteria 'B' of EN 61000-6-2:2001. At no time will the steady-state voltage regulation exceed 2%.

*NB Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.*

*Front cover drawing typical of product range.*

**PI044G**  
**WINDING 311**

**STAMFORD**

CONTROL SYSTEM	STANDARD AS480 AVR (SELF EXCITED)							
VOLTAGE REGULATION	± 1.0 %							
SUSTAINED SHORT CIRCUIT	SELF EXCITED MACHINES DO NOT SUSTAIN A SHORT CIRCUIT CURRENT							
CONTROL SYSTEM	AS480 AVR WITH OPTIONAL EXCITATION BOOST SYSTEM (EBS)							
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVE (page 7)							
STATOR WINDING	DOUBLE LAYER CONCENTRIC							
WINDING PITCH	TWO THIRDS							
WINDING LEADS	12							
STATOR WDG. RESISTANCE	0.635 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED							
ROTOR WDG. RESISTANCE	0.551 Ohms at 22°C							
EXCITER STATOR RESISTANCE	18.5 Ohms at 22°C							
EXCITER ROTOR RESISTANCE	0.228 Ohms PER PHASE AT 22°C							
EBS STATOR RESISTANCE	12.9 Ohms at 22°C							
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4, VDE 0875G, VDE 0875N. refer to factory for others							
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%							
MAXIMUM OVERSPEED	2250 Rev/Min							
BEARING DRIVE END	BALL. 6309 - 2RS. (ISO)							
BEARING NON-DRIVE END	BALL. 6306 - 2RS. (ISO)							
	1 BEARING				2 BEARING			
WEIGHT COMP. GENERATOR	96 kg				99 kg			
WEIGHT WOUND STATOR	36 kg				36 kg			
WEIGHT WOUND ROTOR	34.94 kg				35.94 kg			
WR <sup>2</sup> INERTIA	0.1266 kgm <sup>2</sup>				0.1267 kgm <sup>2</sup>			
SHIPPING WEIGHTS in a crate	112 kg				121 kg			
PACKING CRATE SIZE	71 x 51 x 67 (cm)				71 x 51 x 67 (cm)			
	50 Hz				60 Hz			
TELEPHONE INTERFERENCE	THF<2%				TIF<50			
COOLING AIR	0.09 m <sup>3</sup> /sec 191cfm				0.108 m <sup>3</sup> /sec 229 cfm			
VOLTAGE SERIES STAR	380/220	400/231	415/240	440/254	416/240	440/254	460/266	480/277
VOLTAGE PARALLEL STAR	190/110	200/115	208/120	220/127	208/120	220/127	230/133	240/138
VOLTAGE SERIES DELTA	220/110	230/115	240/120	254/127	240/120	254/127	266/133	277/138
kVA BASE RATING FOR REACTANCE VALUES	15	15	15	14.3	16.5	17.6	18.2	18.8
X <sub>d</sub> DIR. AXIS SYNCHRONOUS	1.82	1.64	1.52	1.29	2.15	2.05	1.94	1.84
X' <sub>d</sub> DIR. AXIS TRANSIENT	0.19	0.17	0.16	0.13	0.22	0.21	0.20	0.19
X'' <sub>d</sub> DIR. AXIS SUBTRANSIENT	0.12	0.11	0.10	0.09	0.15	0.14	0.14	0.13
X <sub>q</sub> QUAD. AXIS REACTANCE	0.86	0.78	0.72	0.61	1.03	0.98	0.93	0.88
X'' <sub>q</sub> QUAD. AXIS SUBTRANSIENT	0.19	0.17	0.16	0.13	0.22	0.21	0.20	0.19
X <sub>L</sub> LEAKAGE REACTANCE	0.07	0.06	0.06	0.05	0.08	0.08	0.07	0.07
X <sub>2</sub> NEGATIVE SEQUENCE	0.16	0.14	0.13	0.11	0.19	0.18	0.17	0.16
X <sub>0</sub> ZERO SEQUENCE	0.08	0.07	0.07	0.06	0.09	0.09	0.08	0.08
REACTANCES ARE SATURATED VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED								
T' <sub>d</sub> TRANSIENT TIME CONST.	0.011 s							
T'' <sub>d</sub> SUB-TRANSTIME CONST.	0.003 s							
T' <sub>do</sub> O.C. FIELD TIME CONST.	0.26 s							
T <sub>a</sub> ARMATURE TIME CONST.	0.007 s							
SHORT CIRCUIT RATIO	1/X <sub>d</sub>							

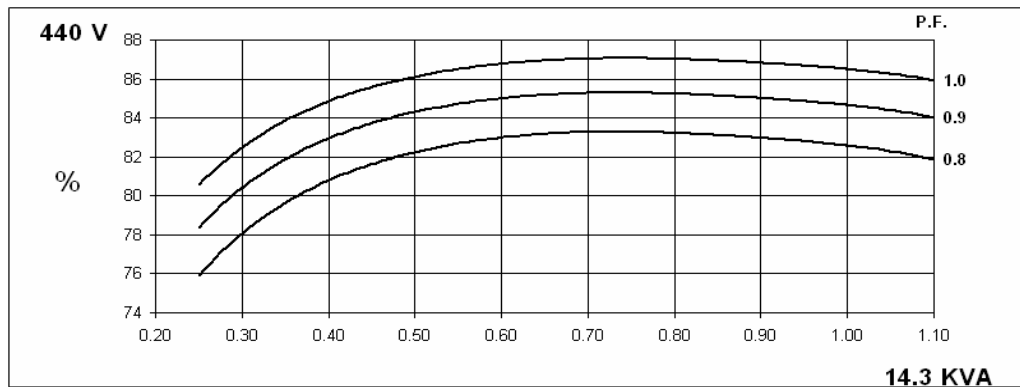
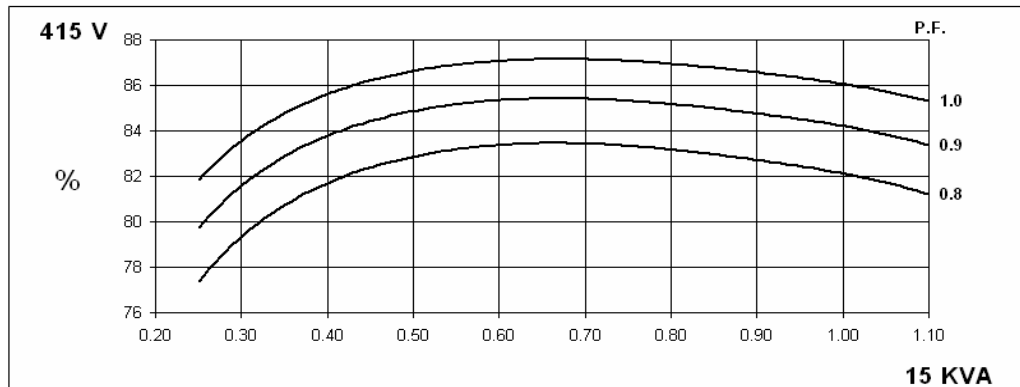
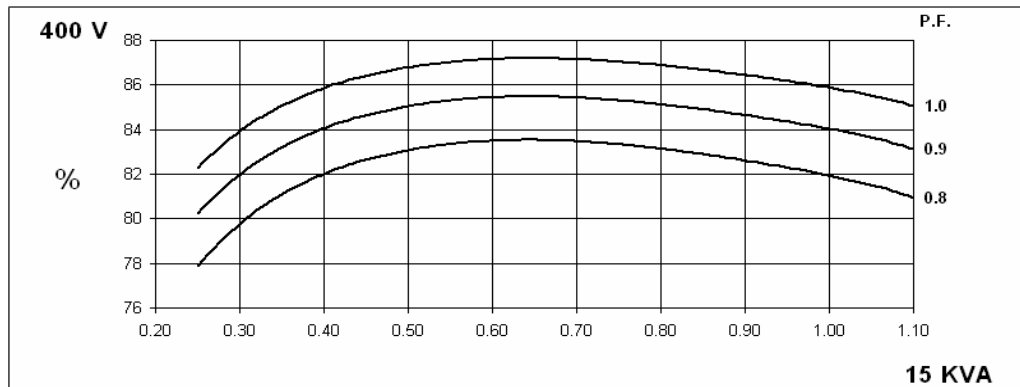
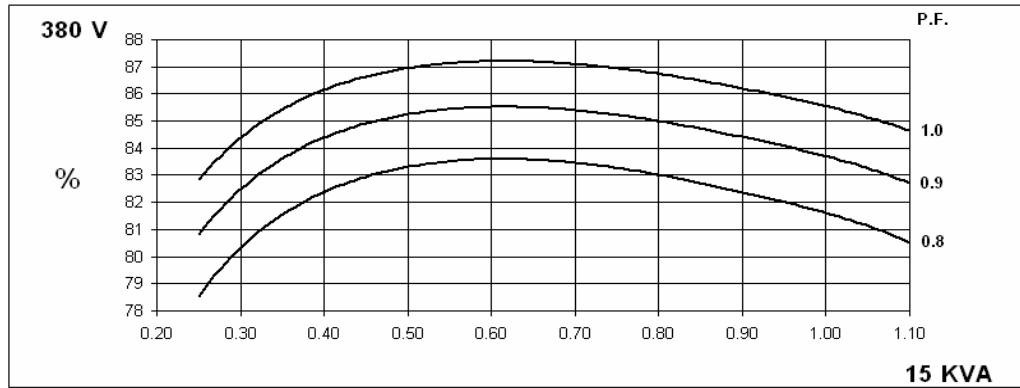


50  
Hz

PI044G  
Winding 311

**STAMFORD**

**THREE PHASE EFFICIENCY CURVES**

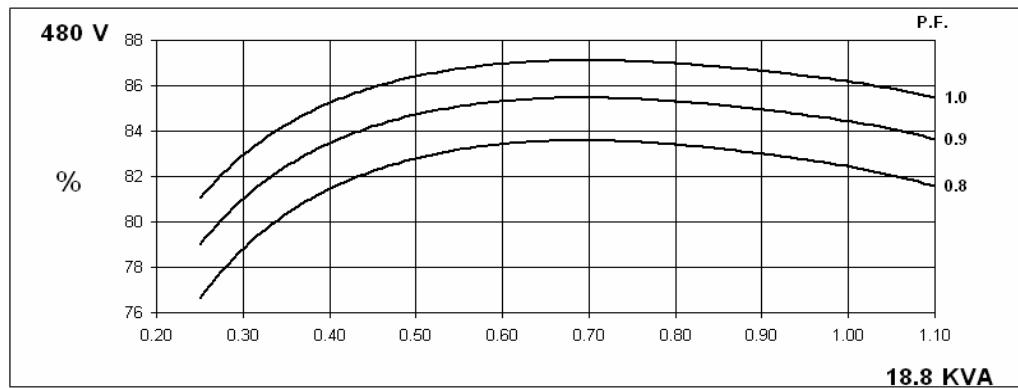
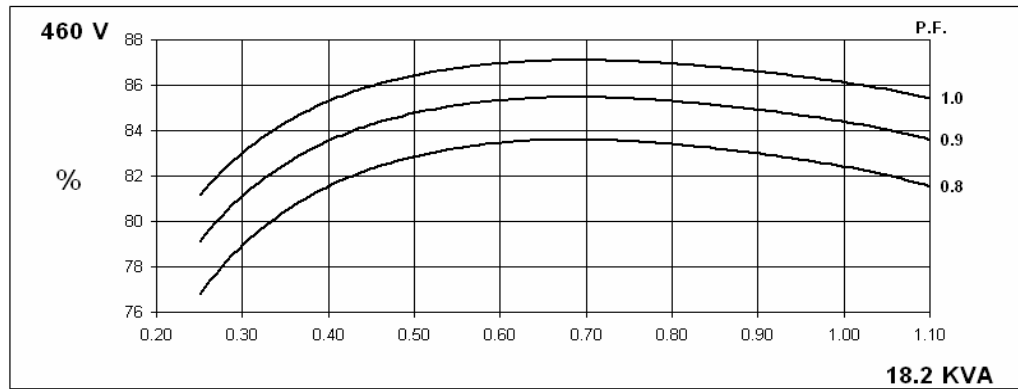
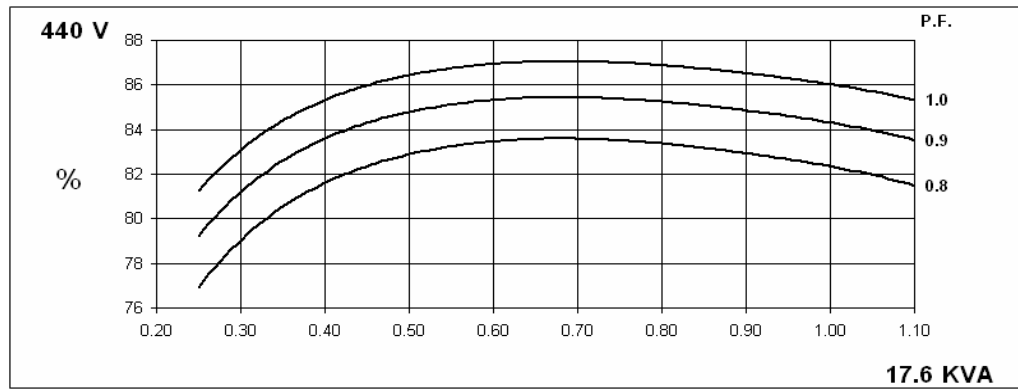
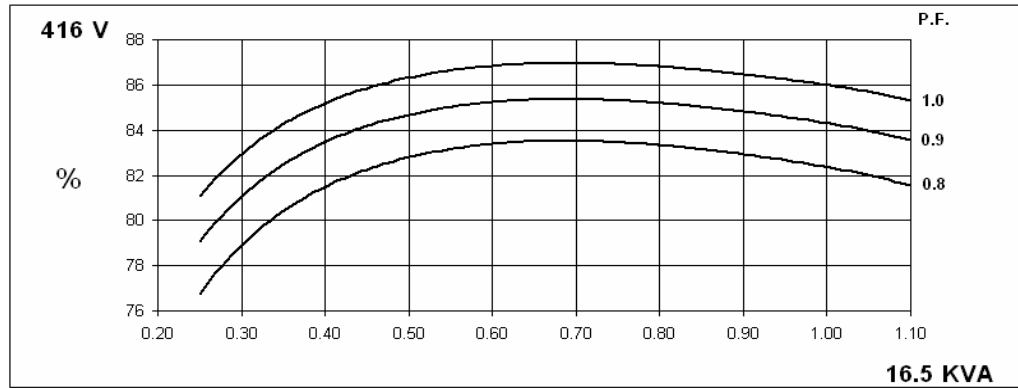


60  
Hz

PI044G  
Winding 311

**STAMFORD**

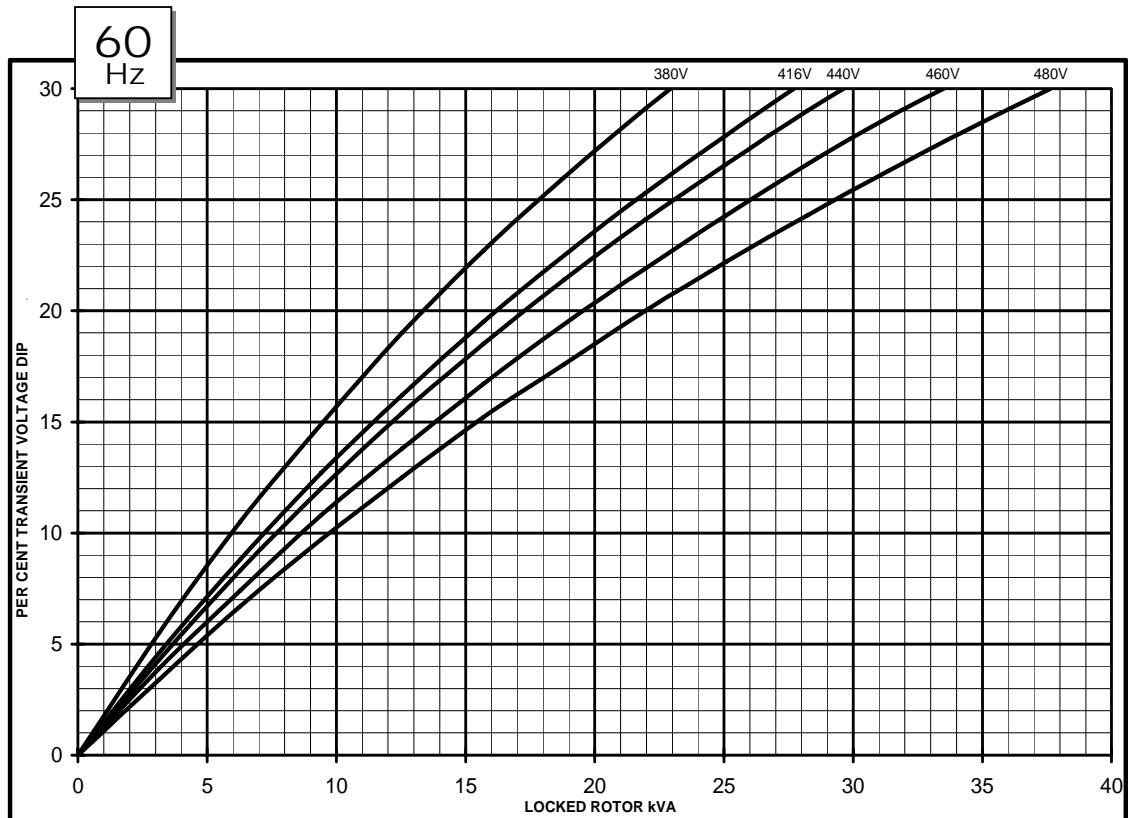
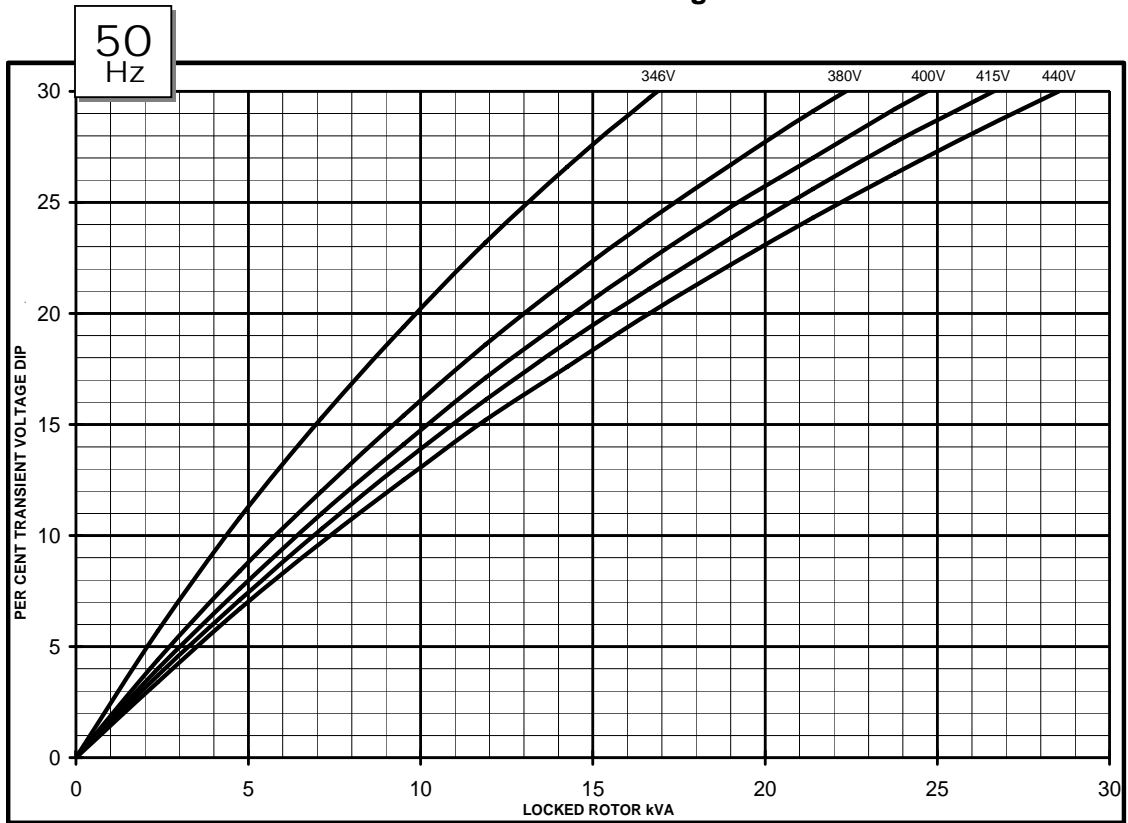
**THREE PHASE EFFICIENCY CURVES**



PI044G  
Winding 311

STAMFORD

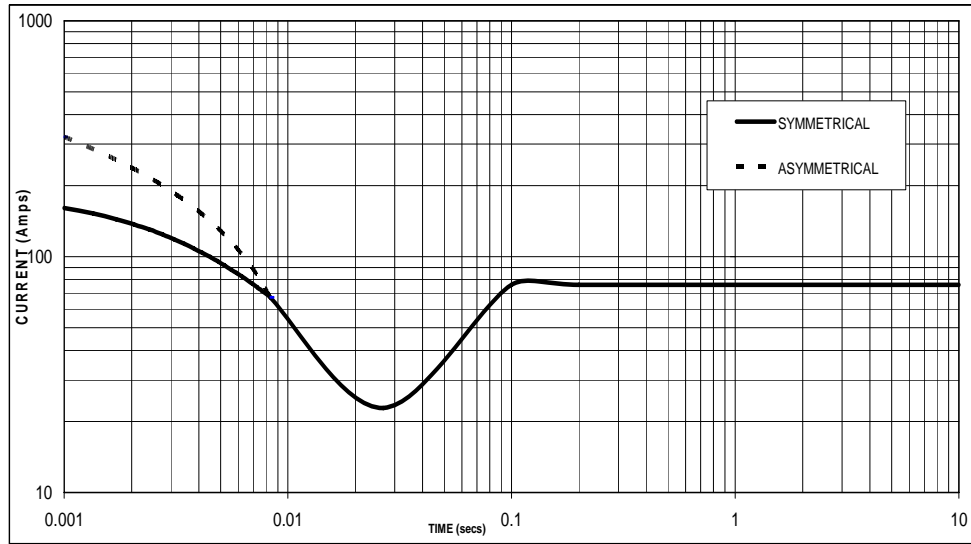
Locked Rotor Motor Starting Curve



**WITH EBS FITTED**

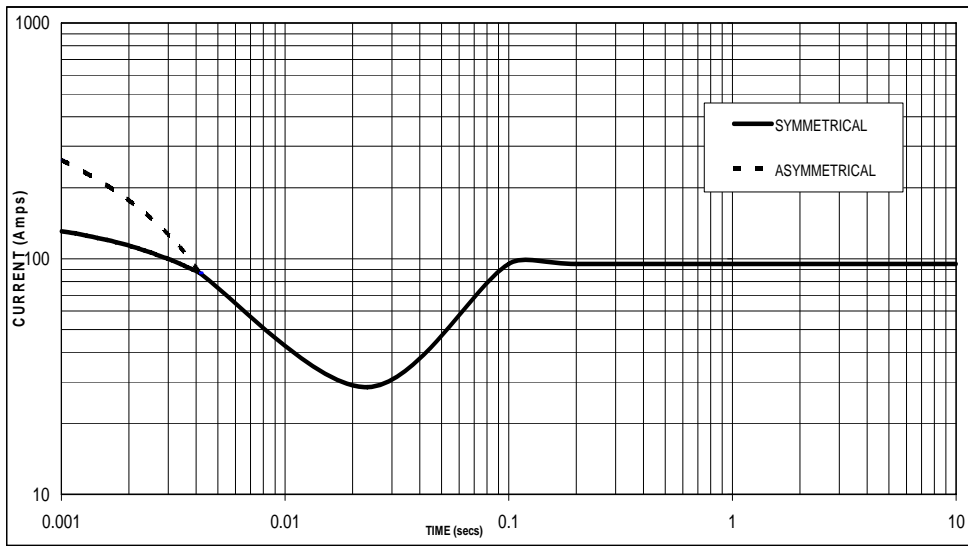
**Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed  
Based on star (wye) connection.**

50  
Hz



Sustained Short Circuit = 76 Amps

60  
Hz



Sustained Short Circuit = 95 Amps

**Note 1**

The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

50Hz		60Hz	
Voltage	Factor	Voltage	Factor
380v	X 1.00	416v	X 1.00
400v	X 1.05	440v	X 1.06
415v	X 1.09	460v	X 1.10
440v	X 1.16	480v	X 1.15

The sustained current value is constant irrespective of voltage level

**Note 2**

The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

**Note 3**

Curves are drawn for Star (Wye) connected machines. For other connection the following multipliers should be applied to current values as shown :

Parallel Star = Curve current value X 2

Series Delta = Curve current value X 1.732

**PI044G**

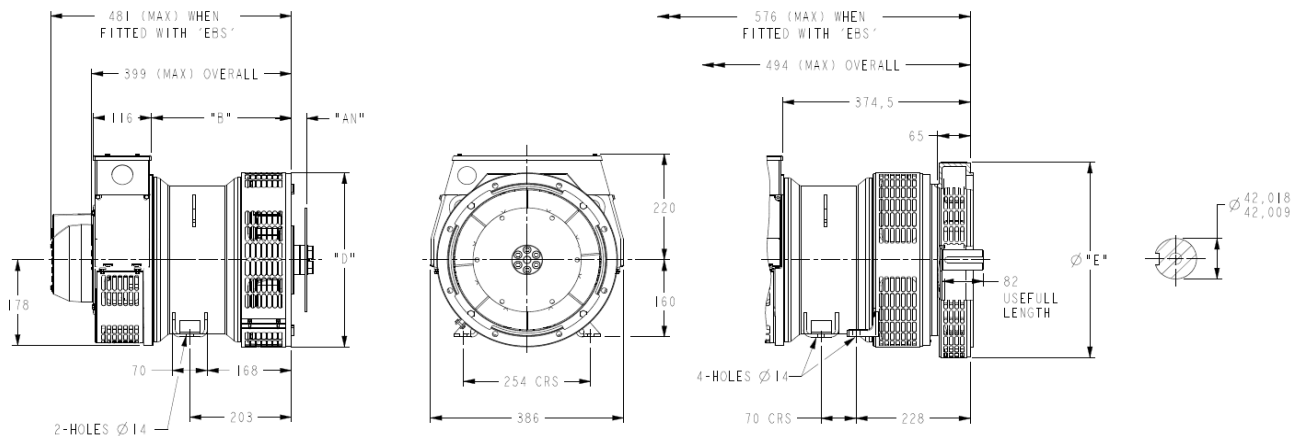
**Winding 311 / 0.8 Power Factor**

**RATINGS**

Class - Temp Rise	Cont. F - 105/40°C				Cont. H - 125/40°C				Standby - 150/40°C				Standby - 163/27°C				
<b>50 Hz</b>	Series Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	Parallel Star (V)	190	200	208	220	190	200	208	220	190	200	208	220	190	200	208	220
	Series Delta (V)	220	230	240	254	220	230	240	254	220	230	240	254	220	230	240	254
	kVA	13.7	13.7	13.7	13.0	15.0	15.0	15.0	14.3	16.2	16.2	16.2	15.4	16.5	16.5	16.5	15.7
	kW	11.0	11.0	11.0	10.4	12.0	12.0	12.0	11.4	13.0	13.0	13.0	12.3	13.2	13.2	13.2	12.6
	Efficiency (%)	82.3	82.6	82.7	83.0	81.6	81.9	82.1	82.6	80.8	81.2	81.5	82.1	80.6	81.1	81.3	82.0
	kW Input	13.4	13.3	13.3	12.5	14.7	14.7	14.6	13.8	16.1	16.0	16.0	15.0	16.4	16.3	16.2	15.4

<b>60 Hz</b>	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	Parallel Star (V)	208	220	230	240	208	220	230	240	208	220	230	240	208	220	230	240
	Delta (V)	240	254	266	277	240	254	266	277	240	254	266	277	240	254	266	277
	kVA	15.1	16.1	16.6	17.1	16.5	17.6	18.2	18.8	17.8	19.0	19.6	20.3	18.2	19.4	20.0	20.6
	kW	12.1	12.9	13.3	13.7	13.2	14.1	14.6	15.0	14.2	15.2	15.7	16.2	14.6	15.5	16.0	16.5
	Efficiency (%)	82.9	82.9	83.0	83.0	82.4	82.3	82.4	82.4	81.8	81.7	81.8	81.8	81.6	81.5	81.6	81.7
	kW Input	14.6	15.6	16.0	16.5	16.0	17.1	17.7	18.2	17.4	18.6	19.2	19.8	17.9	19.0	19.6	20.2

**DIMENSIONS**



COUPLING DISC	
SAE	"AN"
6.5	30.2
7.5	30.2
8	62
10	53.8
11.5	39.6

1-BRG ADAPTORS	
SAE	"D"
5	361
4	405
3	451
2	489

8-HOLES SPACED AS 12  
8-HOLES SPACED AS 12

2-BRG ADAPTORS	
SAE	Ø "E"
5	359
4	406
3	455
2	493