



# GILLETTE GENERATORS

LIQUID COOLED NAT. GAS ENGINE GENERATOR SET

60 HZ MODEL  
**SP-1M**

Model	STANDBY 120°C RISE		
	HZ	LPG	N.G.
<b>SP-1M-60 HERTZ</b>	60	700	1,050



All generator sets are USA prototype built and thoroughly tested. Production models are USA factory built and 100% load tested.



**UL2200, UL1446, UL508, UL142, UL498**



**NFPA 110, 99, 70, 37**

All generator sets meet NFPA-110 Level 1, when equipped with the necessary accessories and installed per NFPA standards.



**NEC 700, 701, 702, 708**



**NEMA ICS10, MG1, ICS6, AB1**



**ANSI C62.41, 27, 59, 32, 480, 40Q, 81U, 360-05**

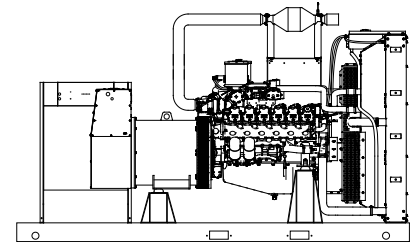


**ASCE 7-05 & 7-10**

All generator sets meet 180 MPH rating.

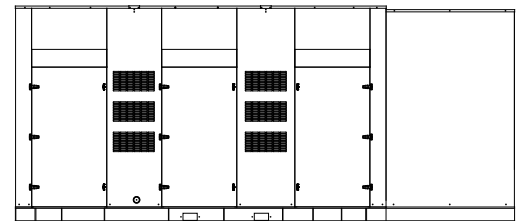


**EPA 40CFR Part 60, 1048, 1054, 1065, 1068**



“OPEN” GEN-SET

There is no enclosure, so gen-set must be placed within a weather protected area, un-inhabited by humans or animals, with proper ventilation. Silencer not supplied, as installation requirements are not known. However, this item is available as optional equipment.



“LEVEL 2” HOUSED GEN-SET

Full aluminum weather protection and superior sound attenuation for specific low noise applications. Critical grade muffler is standard.

## GENERATOR RATINGS

GENERATOR MODEL	VOLTAGE		PH	HZ	LIQUID PROPANE GAS FUEL		NATURAL GAS FUEL	
	L-N	L-L			120°C RISE STANDBY RATING		120°C RISE STANDBY RATING	
					KW/KVA	AMP	KW/KVA	AMP
<b>SP-1M-3-2</b>	120	208	3	60	700/875	2432	1050/1312	3647
<b>SP-1M-3-3</b>	120	240	3	60	700/875	2107	1050/1312	3161
<b>SP-1M-3-4</b>	277	480	3	60	700/875	1054	1050/1312	1581
<b>SP-1M-3-5</b>	127	220	3	60	700/875	1560	1050/1312	2627
<b>SP-1M-3-16</b>	346	600	3	60	700/875	2299	1050/1312	3448

RATINGS: All three phase gen-sets are 12 lead windings, rated at .8 power factor. 120°C “STANDBY RATINGS” are strictly for gen-sets that are used for back-up emergency power to a failed normal utility power source. This standby rating allows varying loads, with no overload capability, for the entire duration of utility power outage. All gen-set power ratings are based on temperature rise measured by resistance method as defined by MIL-STD 705C and IEEE STD 115, METHOD 6.4.4. All generators have class H (180°C) insulation system on both rotor and stator windings. All factory tests and KW/KVA charts shown above are based on 120°C (standby) R/R winding temperature, within a maximum 40°C ambient condition. Generators operated at standby power ratings must not exceed the temperature rise limitation for class H insulation system, as specified in NEMA MG1-22.40. Specifications & ratings are subject to change without prior notice.

# APPLICATION AND ENGINEERING DATA FOR MODEL SP-1M-60 HZ

## GENERATOR SPECIFICATIONS

Manufacturer..... Stamford AVK Electric Generators  
 Model & Type..... S6DF311-311, 4 Pole, 12 Lead, Three Phase  
 ..... S6DE311-311, 4 Pole, 12 Lead, 480V, Three Phase  
 ..... HCI634J-07, 4 Pole, 6 Lead, 600V, Three Phase  
 Exciter.....Brushless, PMG excited  
 Voltage Regulator..... Solid State, HZ/Volts  
 Voltage Regulation..... ½%, No load to full load  
 Frequency.....Field convertible, 60 HZ to 50 HZ  
 Frequency Regulation.....± ½% (1/2 cycle, no load to full load)  
 Unbalanced Load Capability..... 100% of standby amps  
 One Step Load Acceptance..... 100% of nameplate rating  
 Total Stator and Load Insulation.....Class H, 180°C  
 Temperature Rise..... 120°C R/R, standby rating @ 40°C amb.  
 3 Ø Motor Starting @ 30% Voltage Dip (208-240V)...2825 kVA  
 3 Ø Motor Starting @ 30% Voltage Dip (480V-600V) 3100 kVA  
 Bearing..... 1, Pre-lubed and sealed  
 Coupling.....Direct flexible disc.  
 Total Harmonic Distortion..... Max 3½% (MIL-STD705B)  
 Telephone Interference Factor..... Max 50 (NEMA MG1-22)  
 Deviation Factor..... Max 5% (MIL-STD 405B)  
 Alternator..... Self ventilating and drip-proof  
 Ltd. Warranty Period..... 24 Months from start-up date or  
 ..... 1000 hours use, first to occur.

## GENERATOR FEATURES

- World Renown Stamford Electric Generator having UL-1446 certification on full amortisseur windings.
- Full generator protection with **Deep Sea 7420** controller, having UL-508 certification.
- Automatic voltage regulator with over-excitation, under-frequency compensation, under-speed protection, and EMI filtering. Entire solid-state board is encapsulated for moisture protection.
- Generator power ratings are based on temperature rise, measured by resistance method, as defined in MIL-STD 705C and IEEE STD 115, Method 6.4.4.
- Power ratings will not exceed temperature rise limitation for class H insulation as per NEMA MG1-22.40.
- Insulation resistance to ground, exceeds 1.5 meg-ohm.
- Stator receives 2000 V. hi-potential test on main windings, and rotor windings receive a 1500 V. hi-potential test, as per MIL-STD 705B.
- Complete engine-generator torsional acceptance, confirmed during initial prototype testing.
- Full load testing on all engine-generator sets, before shipping.
- Self ventilating and drip-proof & revolving field design

## ENGINE SPECIFICATIONS AND APPLICATIONS DATA

### ENGINE

Manufacturer.....Power Solutions Inc. (PSI)  
 Model and Type.....Heavy Duty, 53LTCAC, 4 cycle  
 Aspiration.....Turbocharged & Charge Air Cooled  
 Cylinder Arrangement..... 16 Cylinders, Vee  
 Displacement Cu. In. (Liters).....3192 (52.3)  
 Bore & Stroke In. (Cm.).....5.91 x 7.28 (15.0 x 18.5)  
 Compression Ratio..... 10.5:1  
 Main Bearings & Style..... 16, Precision Half-Shell  
 Cylinder Head.....Cast Iron  
 Pistons..... Cast Aluminum  
 Crankshaft..... Forged Steel  
 Exhaust Valve.....Inconel, A193  
 Governor..... Electronic  
 Frequency Reg. (no load-full load)..... Isochronous  
 Frequency Reg. (steady state).....± 1/4%  
 Air Cleaner..... Dry, Replaceable Cartridge  
 Engine Speed..... 1800  
 Piston Speed, ft/min (m./min)..... .2185 (665)  
 Max Power, bhp (kwm) Standby/LPG..... 1196 (892)  
 Max Power, bhp (kwm) Standby/NG..... 1589 (1185)  
 Ltd. Warranty Period..... 12 Months or 2000 hrs., first to occur

### FUEL SYSTEM

Type.....LPG or NAT. GAS, Vapor Withdrawal  
 Fuel Pressure (kpa), in. H<sub>2</sub>O\*..... (7.5), 30"  
 Secondary Fuel Regulator..... NG or LPG Vapor System  
 Auto Fuel Lock-Off Solenoid..... Standard on all sets  
 Fuel Supply Inlet Line..... (2) 3" NPTF

### FUEL CONSUMPTION

LP GAS: FT <sup>3</sup> /HR (M <sup>3</sup> /HR)	STANDBY
100% LOAD	3643 (103)
75% LOAD	2812 (79.6)
50% LOAD	2103 (59.5)
<b>LPG = 2500 BTU X FT<sup>3</sup>/HR = Total BTU/HR</b>	
<b>LPG Conversion: 8.50 FT<sup>3</sup> = 1 LB. : 36.4 FT<sup>3</sup> = 1 GAL.</b>	

NAT. GAS: FT <sup>3</sup> /HR (M <sup>3</sup> /HR)	STANDBY
100% LOAD	12626 (358)
75% LOAD	9721 (275)
50% LOAD	6949 (197)
<b>NG = 1000 BTU X FT<sup>3</sup>/HR = Total BTU/HR</b>	

### OIL SYSTEM

Type..... Full Pressure  
 Oil Pan Capacity qt. (L)..... 120 (114)  
 Oil Pan Cap. W/ filter qt. (L)..... 181 (171)  
 Oil Filter..... 6, Replaceable Spin-On

### ELECTRICAL SYSTEM

Ignition System..... Electronic  
 Eng. Alternator/Starter:..... 24 VDC, negative ground, 55 amp/hr.  
 Recommended battery to -18°C (0° F): ....(2) 12 VDC, BCI# 31,  
 Max. Dimensions: 14"lg x 6 3/4" wi x 10" hi, with standard  
 round posts. Min output 1400 CCA. Battery tray (max. dim. at  
 15"lg x 7"wi). This model has (2) battery trays, (2) hold down  
 straps, (2) sets of battery cables, and (1) battery charger.  
 Installation of (2) 12VDC starting batteries connected in series  
 for 24VDC output is required, with possible higher AMP/HR  
 rating, as described above, if the normal environment  
 temperature averages -13° F (-25°C) or cooler.

# APPLICATION AND ENGINEERING DATA FOR MODEL SP-1M-60 HZ

## COOLING SYSTEM

Type of System ..... Pressurized, closed recovery  
 Coolant Pump .....Pre-lubricated, self-sealing  
 Cooling Fan Type (no. of blades) ..... Pusher (10)  
 Fan Diameter inches (mm)..... 68" (1727)  
 Ambient Capacity of Radiator °F (°C)..... 122 (50.0)  
 Engine Jacket Coolant Capacity Gal (L).....23.3 (88.1)  
 Radiator Coolant Capacity Gal. (L) .....43 (164)  
 Maximum Restriction of Cooling Air Intake  
 and discharge side of radiator in. H<sub>2</sub>O (kpa)..... 0.5 (.125)  
 Water Pump Flow gpm (L/min)..... 601 (2274)  
 Heat Reject Coolant: Btu/min (kw) ..... 51,593 (903)  
 Low Radiator Coolant Level Shutdown.....Standard  
 Note: Coolant temp. shut-down switch setting at 230°F (110°C) with 50/50  
 (water/antifreeze) mix.

## AIR REQUIREMENTS

Combustion Air, cfm (m<sup>3</sup>/min) ..... 2205 (62)  
 Radiator Air Flow cfm (m<sup>3</sup>/min)..... 67,300 (1905)  
 Heat Rejected to Ambient:  
     Engine: kw (btu/min)..... 373 (21290)  
     Alternator: kw (btu/min)..... 65 (3696)

## EXHAUST SYSTEM

Exhaust Outlet Size..... (2) 8"  
 Max. Back Pressure, in. hg (KPA)..... 3.8 (13)  
 Exhaust Flow, at rated kw: cfm (m<sup>3</sup>/min) ..... 7316 (207)  
 Exhaust Temp., at rated kw: °F (°C) ..... 1283 (670)  
 Engines are EPA certified for Natural Gas.

## SOUND LEVELS MEASURED IN dB(A)

	<u>Open Set</u>	<u>Level 2 Encl.</u>
Level 2, Critical Silencer .....	99	88
Level 3, Hospital Silencer.....	94	82

Note: Open sets (no enclosure) has (2) optional silencer system choices due to unknown job-site applications. Level 2 enclosure has installed critical silencer with upgrade to hospital silencer. Sound tests are averaged from several test points and taken at 23 ft. (7 m) from source of noise at normal operation.

## DERATE GENERATOR FOR ALTITUDE

3% per 1000 ft. (305m) above 3000 ft. (914m) from sea level

## DERATE GENERATOR FOR TEMPERATURE

2% per 10°F(5.6°C) above 104°F (40°C)

## DIMENSIONS AND WEIGHTS

	<u>Open Set</u>	<u>Level 2 Enclosure</u>
Length in (cm).....	208 (528)	280 (711)
Width in (cm).....	96 (244)	96 (244)
Height in (cm).....	116 (294)	121 (307)
3 Ø Net Weight lbs (kg).....	25225 (11442)	28240 (12810)
3 Ø Ship Weight lbs (kg) ....	25525 (11578)	28550 (12950)

# DEEP SEA 7420 DIGITAL MICROPROCESSOR CONTROLLER



### DEEP SEA 7420

The 7420 controller is an auto start mains (utility) failure module for single gen-set applications. This controller includes a backlit LCD display which continuously displays the status of the engine and generator at all times.

The 7420 controller will also monitor speed, frequency, voltage, current, oil pressure, coolant temp., and fuel levels. These modules have been designed to display warning and shut down status. It also includes: (11) configurable inputs • (8) configurable outputs • voltage monitoring • mains (utility) failure detection

- (250) event logs • configurable timers • automatic shutdown or warning during fault detection • remote start (on load) • engine preheat • advanced metering capability • hour meter • text LCD displays • protected solid state outputs • test buttons for: stop/reset • manual mode • auto mode • lamp test • start button • power monitoring (kWh, kVar, kVAh, kVArh) This controller includes expansion features including RS232, RS484 (using MODBUS-RTU/TCP), direct USB connection with PC, expansion optioned using DSENet for remote annunciation and remote relay interfacing for a distance of up to 3300FT. The controller software is freely downloadable from the internet and allows monitoring with direct USB cable, LAN, or by internet via the built in web interface.

**LOW LOAD CONDITIONS:** Operation of PSI HD engines at low-load conditions should be limited to no more than one (1) hour per twenty-four (24) hour period. If the application requires extended time at light loads, it is recommended that the engine load be increased to at least 70% of mechanical rating for a minimum of two (2) hours per fifty (50) hours of low-load operation. Piston sealing rings rely on adequate cylinder firing pressure and temperature to seal the combustion chamber and prevent excessive engine oil from entering the power cylinder. Under low loads these rings will not seal properly, resulting in oil being burned in the combustion chamber and carbon deposits on pistons and valves. This mechanism is well-documented in reciprocating engines of all fuel types and is often referred to as "wet-stacking."

# STANDARD FEATURES FOR MODEL SP-1M-60 HZ

## STANDARD FEATURES

### CONTROL PANEL:

- Deep Sea 7420 digital microprocessor with logic allows programming in the field. Controller has:
- STOP-MANUAL-AUTO modes and automatic engine shutdowns, signaled by full text LCD indicators:
  - Low oil pressure
  - High engine temp
  - Low Radiator Level
  - Three auxiliary alarms
  - Battery fail alarm
  - Engine fail to start
  - Engine over speed
  - Engine under speed
  - Over & under voltage
- Also included is tamper-proof engine hour meter

### ENGINE:

- Full flow oil filter • Air filter • Oil pump • Solenoid type starter motor • Hi-temp radiator • Jacket water pump
- Thermostat • Pusher fan and guard • Exhaust manifold
  - 24 VDC battery charging alternator • Flexible exhaust connector • "Isochronous" duty, electronic governor • Secondary dry fuel regulator • Dry fuel lock-off solenoid • Vibration isolators • Closed coolant recovery system with 50/50 water to anti-freeze mixture • flexible oil & radiator drain hose.

### AC GENERATOR SYSTEM:

- AC generator • Shunt excited • Brushless design • Circuit Breaker installed and wired to gen-set • Direct connection to engine with flex disc • Class H, 180°C insulation • Self ventilated • Drip proof construction • UL Certified

### VOLTAGE REGULATOR:

- ½% Voltage regulation • EMI filter • Under-speed protection • Over-excitation protection • total encapsulation

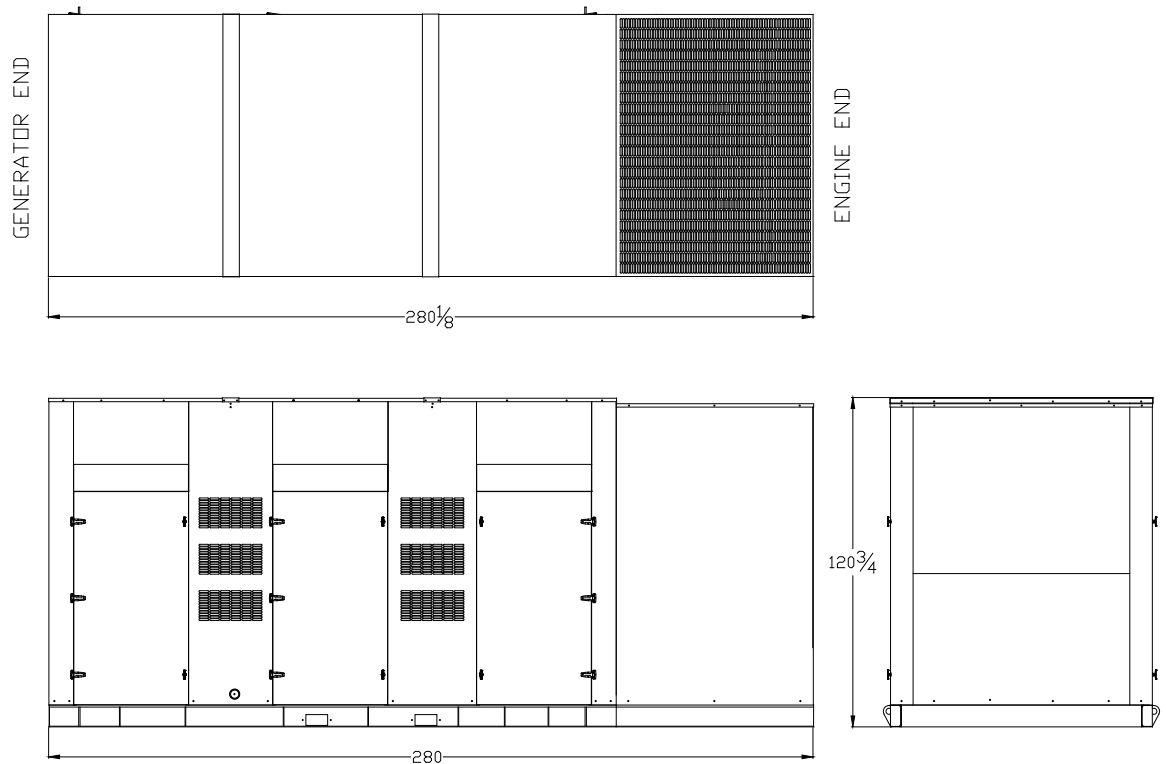
### DC ELECTRICAL SYSTEM:

- Battery tray • Battery cables • Battery hold down straps
- 2-stage battery float charger with maintaining & recharging automatic charge stages

### WEATHER/SOUND PROOF ALUMINUM HOUSING CORROSION RESISTANT PROTECTION CONSISTING OF:

- 9 Heated and Agitated Wash Stages
- Zinc Phosphate Etching-coating Stage
- Final Baked On Enamel Powder Coat
- 18/8 Stainless Steel Hardware

Design & specifications subject to change without prior notice. Dimensions shown are approximate. Contact Gillette for certified drawings. DO NOT USE DIMENSIONS FOR INSTALLATION PURPOSES.





General Engine Data <sup>5</sup>														
Type	V-type 4-cycle				Flywheel housing				SAE #0					
Number of cylinders	16				Flywheel				SAE #18					
Aspiration	Charge Cooled Forced Induction				Dry Weight	Fan to Flywheel		lb	kg	5500				
Firing Order	1 - 7 - 12 - 14 - 4 - 16 - 2 - 8 - 11 - 13 - 3 - 5 - 10 - 6 - 9 - 15					Radiator to Flywheel		lb	kg	13625	6180			
Rotation Viewed from Flywheel	Counter-Clockwise				Wet Weight	Fan to Flywheel		lb	kg	12692	5757			
Bore	in	mm	5.91	150		Radiator to Flywheel		lb	kg	14541	6596			
Stroke	in	mm	7.28	185	CG From Rear Face of Flywheel Housing				in	mm	51.3	1303		
Displacement	in <sup>3</sup>	L	3192	52.3	CG Above Crank Centerline				in	mm	7.3	186		
Compression Ratio	10.5 : 1				Oil Specification				SAE 15W-40 Low Ash Gas engine oil Ash content 0.25 - 0.5% by weight					
Exhaust Manifold Type	Water Cooled				Engine Oil Capacity		Min	qts	L	120	114			
Turbo Exhaust Outlet Pipe Size	in	mm	3.5	89			Max	qts	L	181	171			
Catalyst Inlet Size (O.D)	in	mm	6	152	ECU Oil Pressure Warning <sup>6</sup>				psi	bar	57	3.9		
Catalyst Dp	in-H <sub>2</sub> O	kPa	33	8.3	ECU Oil Pressure Shut Down <sup>6</sup>				psi	bar	47	3.2		
Maximum Allowable Exhaust Back Pressure	in-Hg	kPa	3.8	13	Oil Pressure at 1000 RPM (Idle)		Min	psi	bar	53	4			
Maximum Fuel System Pressure <sup>8</sup>	psi	kPag	29	200			Max	psi	bar	82	6			
Maximum Operating pressure to MFG	in-H <sub>2</sub> O	kPa	30	7.5	Max Allowable Oil Temperature				°F	°C	250	121		
Minimum Operating pressure to MFG	in-H <sub>2</sub> O	kPa	20	5.0	Coolant Capacity (Engine only)				gal	L	26	100		
Minimum Gas Supply Pipe Size <sup>13</sup>	in	mm	3	76	Coolant Capacity (Radiator only)				gal	L	39	148		
Maximum Pressure Drop Across CAC	psi	kPa	1.5	10.3	Radiator Weight (Dry)				lb	kg	1500	680		
Maximum Allowable Intake Restriction	Clean Air Filter	in-H <sub>2</sub> O	kPa	5.2	1.3	Thermostat Operating Temperature Range <sup>9</sup>		Cracking	°F	°C	176	80		
	Dirty Air Filter	in-H <sub>2</sub> O	kPa	14.9	3.7			Full Open	°F	°C	198	92		
Spark Plug Part Number	Denso GK3-5				ECU Coolant Temp Warning				°F	°C	219	104		
Standard Spark Plug Gap <sup>10</sup>	in	mm	0.012	0.3	ECU Coolant Temp Shutdown				°F	°C	230	110		
Spark Plug Coil - Primary Resistance	Ohms		0.59Ω ± 10%		Maximum Radiator Cooling Air Temp				°F	°C	140	60		
Battery Voltage	Volts				24		Max External Coolant Friction Head				psi	kPa	9	60
Starter Motor Power (2X starters)	HP	kW	13.4	10	CAC Rise Above Ambient Specified				°F	°C	15	8		

Performance Data 60Hz <sup>3,5</sup>														
Nominal Engine Speed	RPM				1800		Total Engine Coolant Flow		gal/min	L/min	601	2274		
Mean Piston Speed	ft/min	m/s	2185	11.1	Cooling Fan Power <sup>11</sup>				HP	kW	107	80		
Steady-State RPM Range - ISO 8528-5 G3	RPM				1791 - 1809		Cooling Fan Speed				RPM	1206		
Charging Alternator Voltage	Volts				28		Cooling Fan Air Flow <sup>11</sup>				SCFM	m <sup>3</sup> /min	67300	1906
Charging Alternator Current	Amps				55									

Standby 60Hz Natural Gas	Load		100%		75%		50%		25%	
	Power Rating <sup>1,2,3,4</sup> Per ISO 3046	HP	kWm	1589	1185	1192	889	795	593	397
Brake Mean Effective Pressure	psi	bar	219	15.1	164	11.3	110	7.6	55	3.8
Fuel Consumption <sup>3,4,7,12</sup>	lb/hr	kg/hr	565	256	435	197	311	141	193	88
	ft <sup>3</sup> /hr	m <sup>3</sup> /hr	12626	358	9721	275	6949	197	4312	122
Brake Specific Fuel Consumption	lb/(hp-hr)	g/(kW-hr)	0.356	216	0.365	222	0.391	238	0.486	296
Turbine Outlet Temperature	°F	°C	1212	655	1187	642	1171	633	1133	612
Exhaust Flow at Turbine Outlet Conditions (entire engine)	lb/hr	kg/hr	9946	4512	7653	3471	5461	2477	3371	1529
	ACFM	m <sup>3</sup> /min	6855	194	5207	147	3685	104	2230	63
Air Induction System <sup>5</sup>										
Combustion Air required (entire engine)	lb/hr	kg/hr	9381	4255	7217	3274	5150	2336	3178	1441
	ACFM	m <sup>3</sup> /min	2205	62	1696	48	1210	34	747	21
Compressor Outlet Temperature <sup>2</sup>	°F	°C	309	154	253	123	188	87	130	55
Thermal Balance <sup>5</sup>										
Total Fuel	BTU/min	kW	192296	3381	148044	2603	105834	1861	65667	1155
Mechanical Power	BTU/min	kW	67390	1185	50542	889	33695	593	16847	296
Heat Rejected to Cooling Water	BTU/min	kW	51593	907	42945	755	34297	603	25649	451
Heat Rejected to CAC	BTU/min	kW	8923	157	5259	92	2212	39	412	7
Heat Rejection to Exhaust	BTU/min	kW	59975	1055	45184	795	31289	550	18290	322
Engine Radiated Heat	BTU/min	kW	4416	78	4114	72	4342	76	4470	79

1: Max load and overload ratings based on ISO 3046 gross flywheel power. For additional information on ratings and duty cycles see PSI Power Systems Technical Spec #56100017 - Engine Ratings Guidelines

2: Technical data based on ISO 3046-1 standards of 77°F(25°C), barometric pressure 14.5Psia (100kPa) and 30% relative humidity.

3: Production tolerances in engines and installed components can account for power variations of ± 5%. Altitude, temperature and excessive exhaust and intake restrictions should be applied to power calculations.

4: All fuel and thermal calculations unless otherwise noted are done at ISO 3046 rated load using LHV for NG of 48.17 MJ/kg.

5: All values in the following section are provided for informational purpose only and are non-binding.

6: >1400RPM.

7: See PSI Power Systems Technical Spec. 56100019 - Fuel Standard.

8: Maximum pressure the fuel system components can withstand without being damaged. Operating pressure should fall between the listed minimum and maximum pressures.

9: ± 2 degrees Celsius.

10: ± 0.002" or 0.05mm.

11: At 0.5 in-H<sub>2</sub>O of Package Restriction at STP.

12: Volume calculated using density of 0.717 kg/m<sup>3</sup> for NG, 0.51 kg/L for LPG

13: See 56100051 - MFG Fuel System Setup Guide



General Engine Data <sup>5</sup>														
Type	V-type 4-cycle				Flywheel housing				SAE #0					
Number of cylinders	16				Flywheel				SAE #18					
Aspiration	Charge Cooled Forced Induction				Dry Weight	Fan to Flywheel		lb	kg	5500				
Firing Order	1 - 7 - 12 - 14 - 4 - 16 - 2 - 8 - 11 - 13 - 3 - 5 - 10 - 6 - 9 - 15					Radiator to Flywheel		lb	kg	13625	6180			
Rotation Viewed from Flywheel	Counter-Clockwise				Wet Weight	Fan to Flywheel		lb	kg	12692	5757			
Bore	in	mm	5.91	150		Radiator to Flywheel		lb	kg	14541	6596			
Stroke	in	mm	7.28	185	CG From Rear Face of Flywheel Housing				in	mm	51.3	1303		
Displacement	in <sup>3</sup>	L	3192	52.3	CG Above Crank Centerline				in	mm	7.3	186		
Compression Ratio	10.5 : 1				Oil Specification				SAE 15W-40 Low Ash Gas engine oil Ash content 0.25 - 0.5% by weight					
Exhaust Manifold Type	Water Cooled				Engine Oil Capacity		Min	qts	L	120	114			
Turbo Exhaust Outlet Pipe Size	in	mm	3.5	89			Max	qts	L	181	171			
Catalyst Inlet Size (O.D)	in	mm	6	152	ECU Oil Pressure Warning <sup>6</sup>				psi	bar	57	3.9		
Catalyst Dp	in-H <sub>2</sub> O	kPa	33	8.3	ECU Oil Pressure Shut Down <sup>6</sup>				psi	bar	47	3.2		
Maximum Allowable Exhaust Back Pressure	in-Hg	kPa	3.8	13	Oil Pressure at 1000 RPM (Idle)		Min	psi	bar	53	4			
Maximum Fuel System Pressure <sup>8</sup>	psi	kPag	29	200			Max	psi	bar	82	6			
Maximum Operating pressure to MFG	in-H <sub>2</sub> O	kPa	30	7.5	Max Allowable Oil Temperature				°F	°C	250	121		
Minimum Operating pressure to MFG	in-H <sub>2</sub> O	kPa	20	5.0	Coolant Capacity (Engine only)		gal	L	26	100				
Minimum Gas Supply Pipe Size <sup>13</sup>	in	mm	3	76	Coolant Capacity (Radiator only)		gal	L	39	148				
Maximum Pressure Drop Across CAC	psi	kPa	1.5	10.3	Radiator Weight (Dry)				lb	kg	1500	680		
Maximum Allowable Intake Restriction	Clean Air Filter	in-H <sub>2</sub> O	kPa	5.2	1.3	Thermostat Operating Temperature Range <sup>9</sup>		Cracking	°F	°C	176	80		
	Dirty Air Filter	in-H <sub>2</sub> O	kPa	14.9	3.7			Full Open	°F	°C	198	92		
Spark Plug Part Number	Denso GK3-5				ECU Coolant Temp Warning				°F	°C	219	104		
Standard Spark Plug Gap <sup>10</sup>	in	mm	0.012	0.3	ECU Coolant Temp Shutdown				°F	°C	230	110		
Spark Plug Coil - Primary Resistance	Ohms		0.59Ω ± 10%		Maximum Radiator Cooling Air Temp				°F	°C	140	60		
Battery Voltage	Volts				24		Max External Coolant Friction Head				psi	kPa	9	60
Starter Motor Power (2X starters)	HP	kW	13.4	10	CAC Rise Above Ambient Specified				°F	°C	15	8		

Performance Data 60Hz <sup>3,5</sup>													
Nominal Engine Speed	RPM				1800		Total Engine Coolant Flow		gal/min	L/min	601	2274	
Mean Piston Speed	ft/min	m/s	2185	11.1	Cooling Fan Power <sup>11</sup>				HP	kW	107	80.0	
Steady-State RPM Range - ISO 8528-5 G3	RPM				1791 - 1809		Cooling Fan Speed				RPM		1206
Charging Alternator Voltage	Volts				28		Cooling Fan Air Flow <sup>11</sup>		SCFM	m <sup>3</sup> /min	67300	1906	
Charging Alternator Current	Amps				55								

Standby 60Hz LPG	Load		100%		75%		50%		25%	
	HP	kWm	1196	892	897	669	598	446	299	223
Power Rating <sup>1,2,3,4</sup> Per ISO 3046	HP	kWm	1196	892	897	669	598	446	299	223
Brake Mean Effective Pressure	psi	bar	165	11.4	124	8.5	82	5.7	41	2.8
Fuel Consumption <sup>3,4,7,12</sup>	lb/hr	kg/hr	496	225	371	168	261	118	166	75
	gal/hr	L/hr	117	442	87	330	61	232	39	148
Brake Specific Fuel Consumption	lb/(hp-hr)	g/(kW-hr)	0.415	252	0.414	252	0.436	265	0.555	337
Turbine Outlet Temperature	°F	°C	1317	714	1252	678	1182	639	1120	604
Exhaust Flow at Turbine Outlet Conditions (entire engine)	lb/hr	kg/hr	8245	3740	6126	2779	4280	1941	2707	1228
	ACFM	m <sup>3</sup> /min	6007	170	4313	122	2904	82	1777	50
Air Induction System <sup>5</sup>										
Combustion Air required (entire engine)	lb/hr	kg/hr	7749	3515	5755	2611	4019	1823	2541	1152
	ACFM	m <sup>3</sup> /min	1779	50	1321	37	923	26	583	17
Compressor Outlet Temperature <sup>2</sup>	°F	°C	273	134	207	97	152	66	114	45
Thermal Balance <sup>5</sup>										
Total Fuel	BTU/min	kW	167074	2938	124899	2196	87822	1544	55843	982
Mechanical Power	BTU/min	kW	50727	892	38045	669	25364	446	12682	223
Heat Rejected to Cooling Water	BTU/min	kW	48746	857	41120	723	33495	589	25870	455
Heat Rejected to CAC	BTU/min	kW	6213	109	2893	51	1015	18	196	3
Heat Rejection to Exhaust	BTU/min	kW	54192	953	37542	660	24222	426	14233	250
Engine Radiated Heat	BTU/min	kW	7196	127	5298	93	3726	66	2863	50

1: Max load and overload ratings based on ISO 3046 gross flywheel power. For additional information on ratings and duty cycles see PSI Power Systems Technical Spec #56100017 - Engine Ratings Guidelines

2: Technical data based on ISO 3046-1 standards of 77°F(25°C), barometric pressure 14.5Psia (100kPa) and 30% relative humidity.

3: Production tolerances in engines and installed components can account for power variations of ± 5%. Altitude, temperature and excessive exhaust and intake restrictions should be applied to power calculations.

4: All fuel and thermal calculations unless otherwise noted are done at ISO 3046 rated load using LHV for NG of 48.17 MJ/kg.

5: All values in the following section are provided for informational purpose only and are non-binding.

6: >1400RPM.

7: See PSI Power Systems Technical Spec. 56100019 - Fuel Standard.

8: Maximum pressure the fuel system components can withstand without being damaged. Operating pressure should fall between the listed minimum and maximum pressures.

9: ± 2 degrees Celsius.

10: ± 0.002" or 0.05mm.

11: At 0.5 in-H<sub>2</sub>O of Package Restriction at STP.

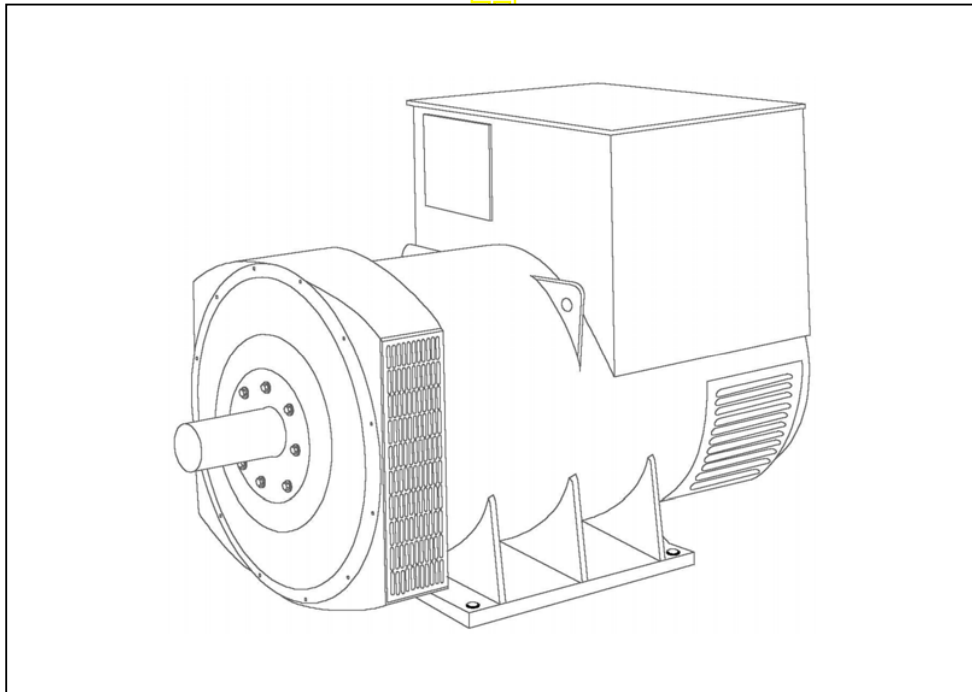
12: Volume calculated using density of 0.717 kg/m<sup>3</sup> for NG, 0.51 kg/L for LPG

13: See 56100051 - MFG Fuel System Setup Guide

# STAMFORD®

**HCI634K** - Winding 311 and 312

Technical Data Sheet



**SPECIFICATIONS & OPTIONS  
WINDING 311 and 312****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 REGULATORS****MX321 AVR - STANDARD**

This sophisticated Automatic Voltage Regulator (AVR) is incorporated into the Stamford Permanent Magnet Generator (PMG) system and is fitted as standard to generators of this type.

The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.

Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

**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 feature a main stator with either 6 ends (Winding 312) or 12 ends (Winding 311) brought out to the terminals, which are mounted on the frame at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

**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%.

**DE RATES**

All values tabulated on page 8 are subject to the following reductions

5% when air inlet filters are fitted.

10% when IP44 Filters are fitted.

3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.

3% for every 5°C by which the operational ambient temperature exceeds 40°C.

Note: Requirement for operating in an ambient exceeding 60°C must be referred to the factory.

*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.*

APPROVED DOCUMENT



## WINDING 311 and 312

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.	
A.V.R.	MX321	
VOLTAGE REGULATION	± 0.5 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 7)	

INSULATION SYSTEM	CLASS H
PROTECTION	IP23
RATED POWER FACTOR	0.8
STATOR WINDING	DOUBLE LAYER LAP
WINDING PITCH	TWO THIRDS
WINDING LEADS	6 (Wdg 312) or 12 (Wdg 311)
STATOR WDG. RESISTANCE	0.002 Ohms PER PHASE AT 22°C STAR CONNECTED
ROTOR WDG. RESISTANCE	2.36 Ohms at 22°C
EXCITER STATOR RESISTANCE	17 Ohms at 22°C
EXCITER ROTOR RESISTANCE	0.079 Ohms PER PHASE 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. 6224 (ISO)
BEARING NON-DRIVE END	BALL. 6317 (ISO)

	1 BEARING	2 BEARING
WEIGHT COMP. GENERATOR	2541 kg	2581 kg
WEIGHT WOUND STATOR	1294 kg	1294 kg
WEIGHT WOUND ROTOR	1093 kg	1048 kg
WR <sup>2</sup> INERTIA	26.5295 kgm <sup>2</sup>	25.9823 kgm <sup>2</sup>
SHIPPING WEIGHTS in a crate	2601kg	2622kg
PACKING CRATE SIZE	194 x 92 x 147(cm)	194 x 92 x 147(cm)

	50 Hz	60 Hz
TELEPHONE INTERFERENCE	THF<2%	TIF<50

	1.614 m <sup>3</sup> /sec 3420 cfm	1.961 m <sup>3</sup> /sec 4156 cfm
COOLING AIR		

	380/220	400/231	415/240	440/254	416/240	440/254	460/266	480/277
VOLTAGE STAR								
VOLTAGE PARALLEL STAR (*)	190/110	200/115	208/120	220/127	208/120	220/127	230/133	240/138
VOLTAGE DELTA	220	230	240	254	240	254	266	277
kVA BASE RATING FOR REACTANCE VALUES	1110	1135	1110	1110	1275	1338	1388	1438
X <sub>d</sub> DIR. AXIS SYNCHRONOUS	2.78	2.57	2.33	2.08	3.20	3.00	2.85	2.71
X' <sub>d</sub> DIR. AXIS TRANSIENT	0.22	0.20	0.18	0.16	0.26	0.24	0.23	0.22
X'' <sub>d</sub> DIR. AXIS SUBTRANSIENT	0.15	0.14	0.13	0.11	0.18	0.17	0.16	0.15
X <sub>q</sub> QUAD. AXIS REACTANCE	1.63	1.50	1.36	1.21	1.88	1.76	1.67	1.59
X'' <sub>q</sub> QUAD. AXIS SUBTRANSIENT	0.23	0.21	0.19	0.17	0.27	0.25	0.24	0.23
X <sub>L</sub> LEAKAGE REACTANCE	0.08	0.07	0.06	0.06	0.09	0.08	0.08	0.07
X <sub>2</sub> NEGATIVE SEQUENCE	0.22	0.20	0.18	0.16	0.26	0.24	0.23	0.22
X <sub>0</sub> ZERO SEQUENCE	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03

REACTANCES ARE SATURATED

VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED

T' <sub>d</sub> TRANSIENT TIME CONST.	0.185
T'' <sub>d</sub> SUB-TRANSTIME CONST.	0.025
T' <sub>do</sub> O.C. FIELD TIME CONST.	3.4
T <sub>a</sub> ARMATURE TIME CONST.	0.049
SHORT CIRCUIT RATIO	1/X <sub>d</sub>

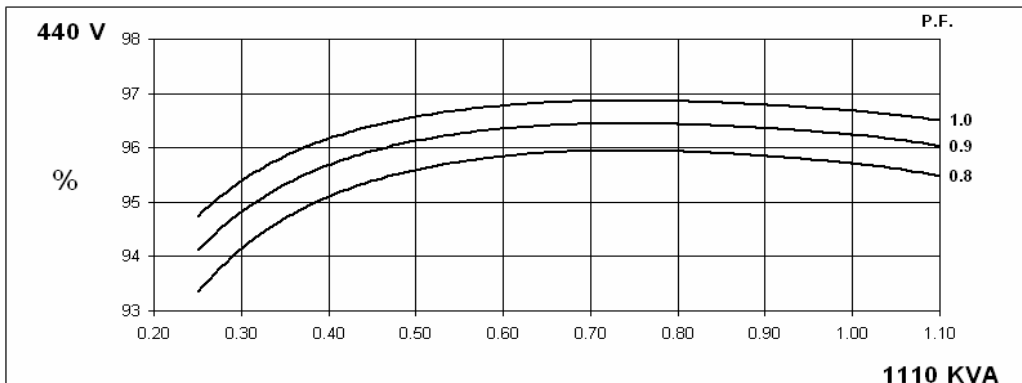
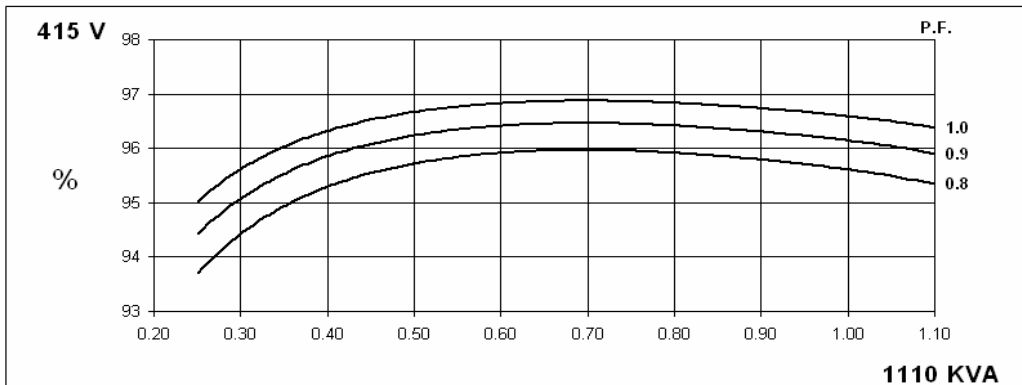
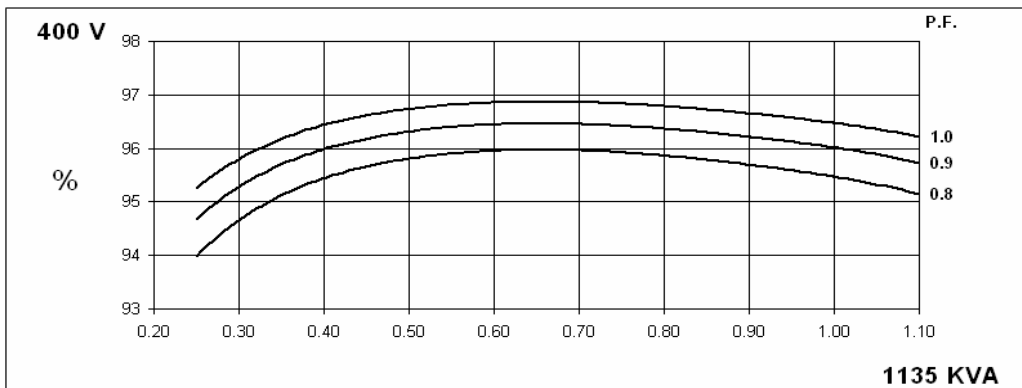
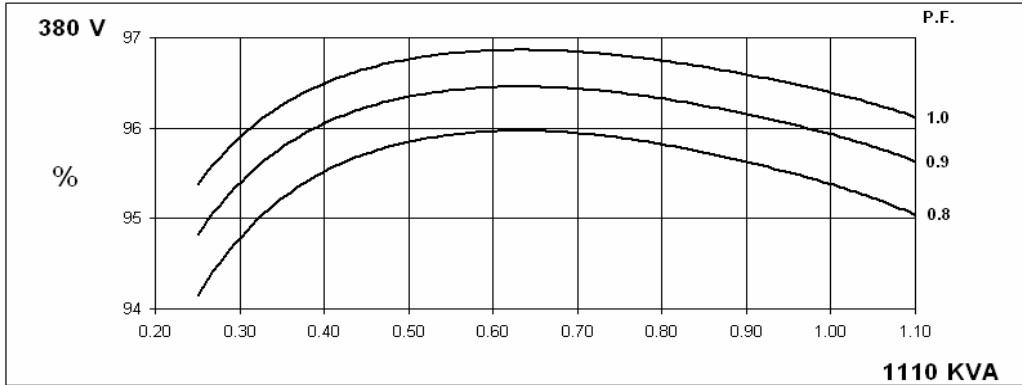
(\*) Parallel Star connection only available with Wdg 311

**50  
Hz**

**HCI634K**  
**WINDING 311 and 312**

**STAMFORD**

**THREE PHASE EFFICIENCY CURVES**

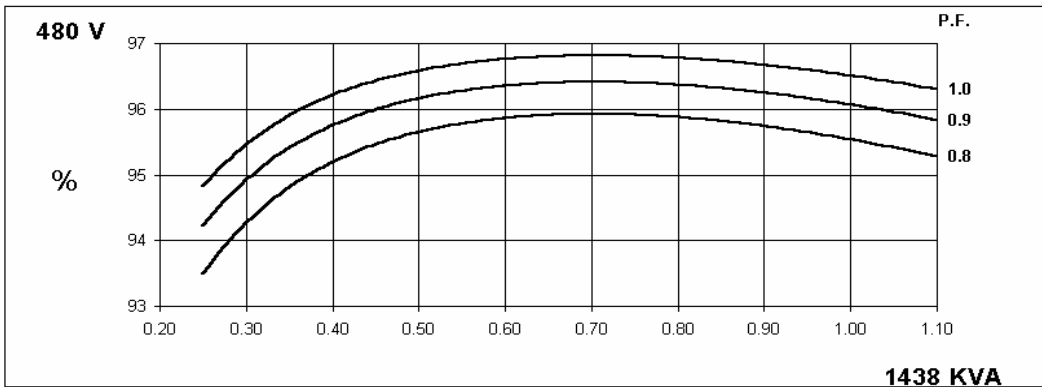
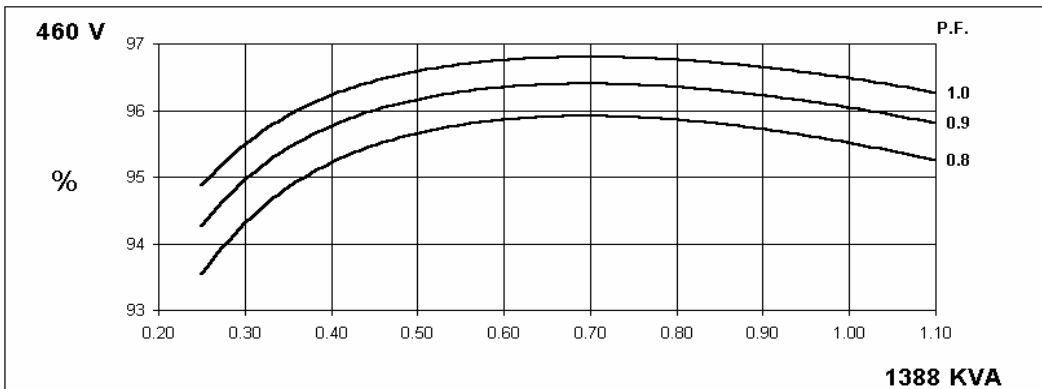
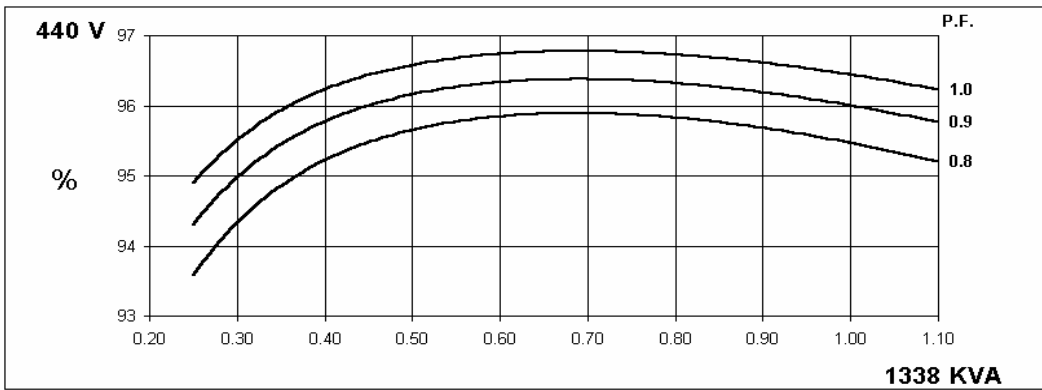
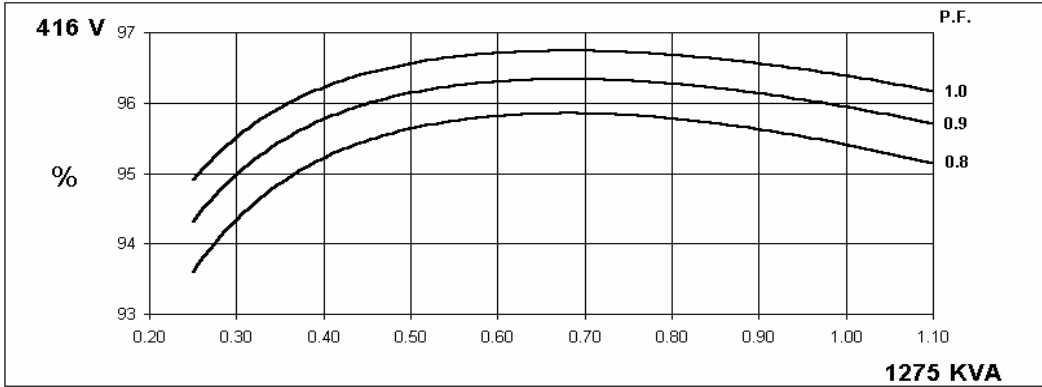


**60  
Hz**

**HCI634K**  
**WINDING 311 and 312**

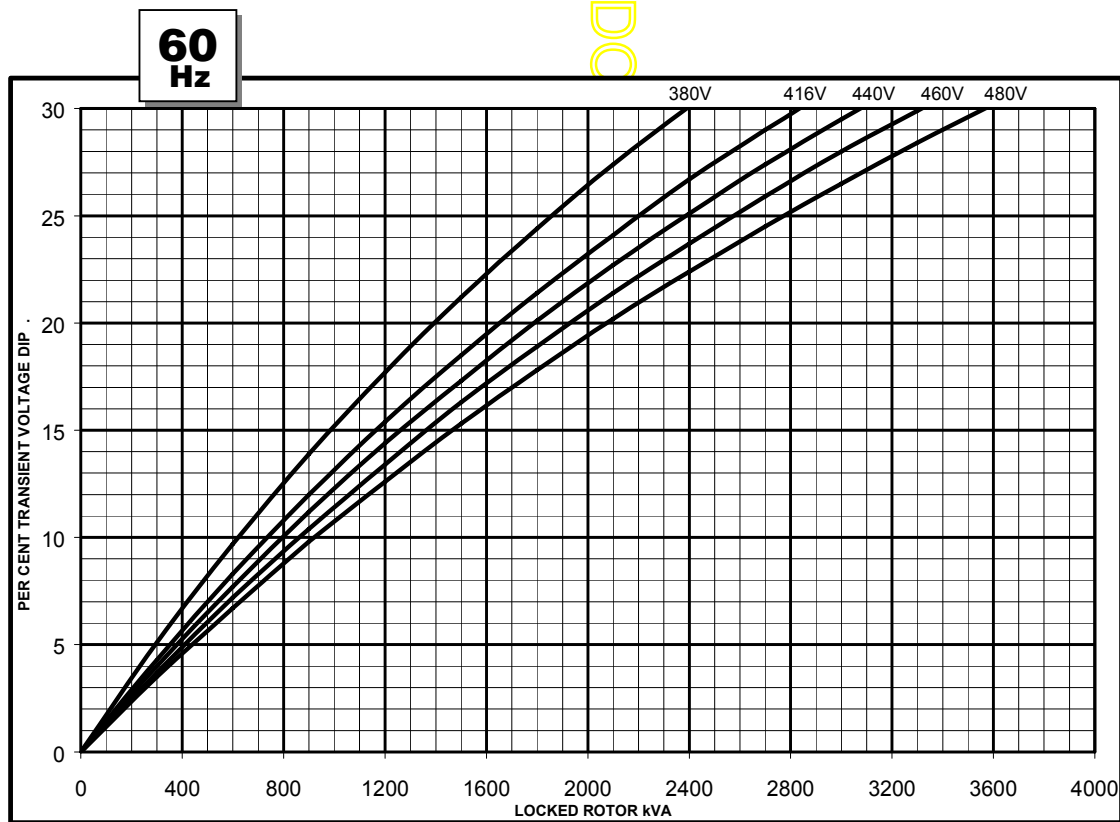
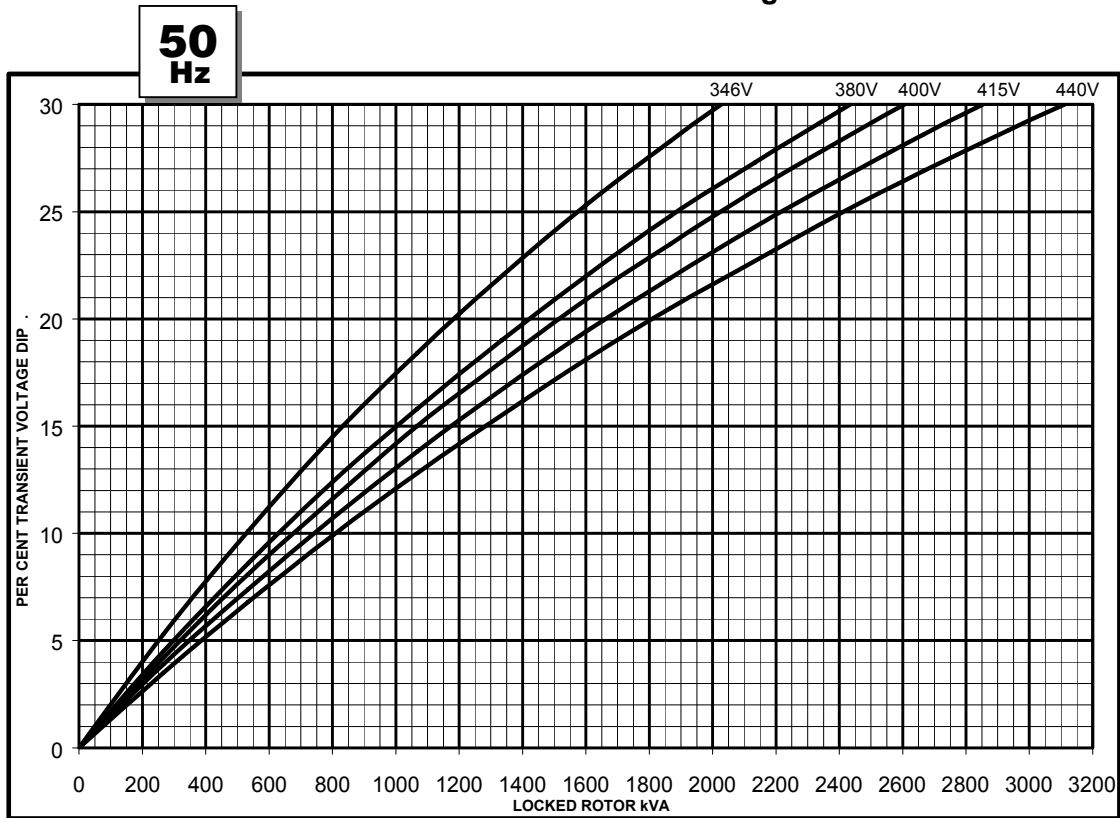
**STAMFORD**

**THREE PHASE EFFICIENCY CURVES**



WINDING 311 and 312

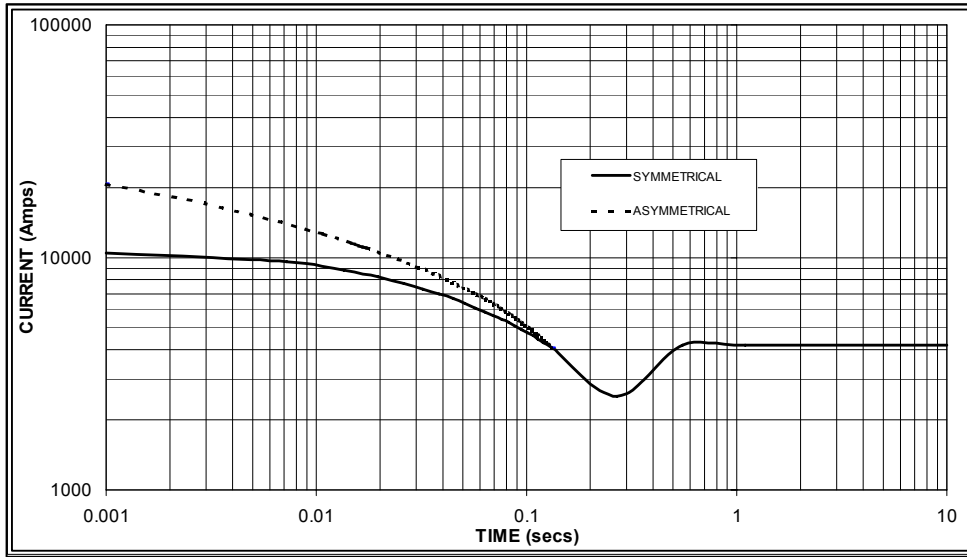
Locked Rotor Motor Starting Curve



**WINDING 311 and 312**

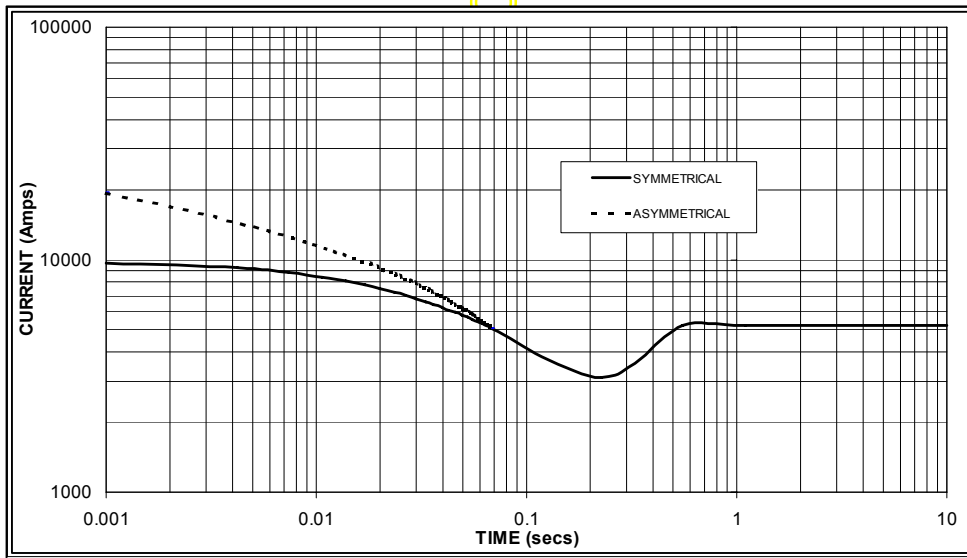
**Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed  
Based on star (wye) connection.**

**50  
Hz**



Sustained Short Circuit = 4,200 Amps

**60  
Hz**



Sustained Short Circuit = 5,200 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 1.07	440v	x 1.06
415v	X 1.12	460v	x 1.12
440v	X 1.18	480v	x 1.17

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**

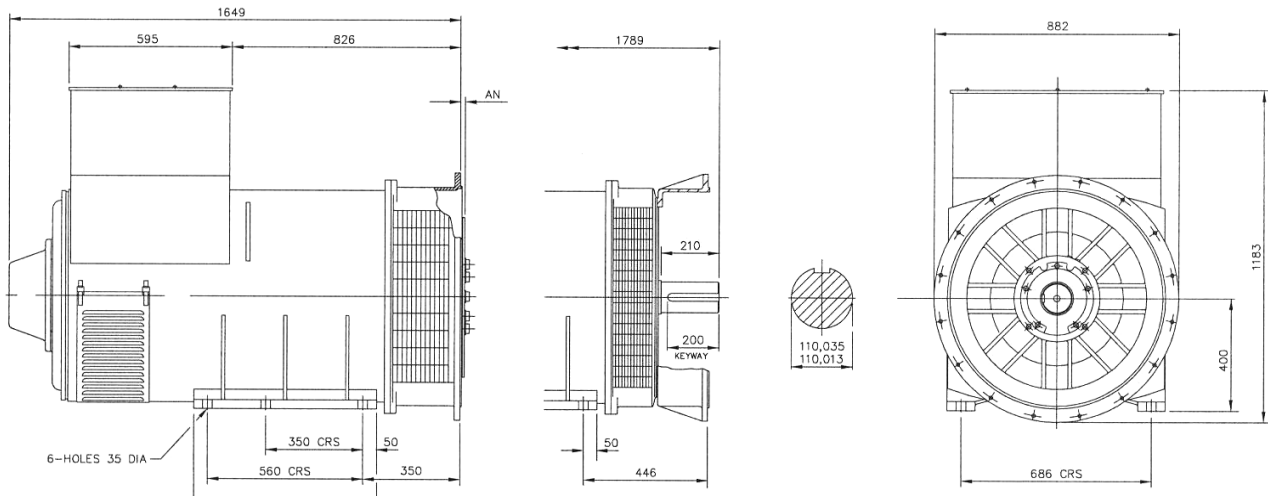
Curves are drawn for Star (Wye) connected machines.  
For Delta connection multiply the Curve current value by 1.732

**RATINGS**

Class - Temp Rise		Cont. F - 105/40°C				Cont. H - 125/40°C				Standby - 150/40°C				Standby - 163/27°C			
<b>50Hz</b>	Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	Parallel Star (V) *	180	200	208	220	180	200	208	220	180	200	208	220	180	200	208	220
	Delta (V)	220	230	240	254	220	230	240	254	220	230	240	254	220	230	240	254
	kVA	1000	1018	1000	1000	1110	1135	1110	1110	1180	1190	1180	1180	1220	1230	1220	1220
	kW	800	814	800	800	888	904	888	888	944	952	944	944	976	984	976	976
	Efficiency (%)	95.6	95.7	95.8	95.9	95.4	95.5	95.6	95.7	95.2	95.3	95.5	95.6	95.1	95.2	95.4	95.5
	kW Input	837	851	835	834	931	951	929	928	992	999	988	987	1026	1034	1023	1022
<b>60Hz</b>	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	1188	1238	1275	1313	1275	1338	1388	1438	1350	1413	1469	1525	1400	1463	1519	1575
	kW	950	990	1020	1050	1020	1070	1110	1150	1080	1130	1175	1220	1120	1170	1215	1260
	Efficiency (%)	95.6	95.6	95.7	95.7	95.4	95.5	95.5	95.5	95.3	95.3	95.4	95.4	95.1	95.2	95.3	95.3
	kW Input	994	1036	1066	1098	1069	1121	1163	1205	1133	1186	1232	1279	1178	1229	1275	1322

\* Parallel Star only available with Wdg 311

**DIMENSIONS**



<b>SAE</b>	14	18	21	24
<b>AN</b>	25.4	15.87	0	0

APPROVED DOCUMENT

**STAMFORD**

Head Office Address:  
Barnack Road, Stamford  
Lincolnshire, PE9 2NB  
United Kingdom  
Tel: +44 (0) 1780 484000  
Fax: +44 (0) 1780 484100

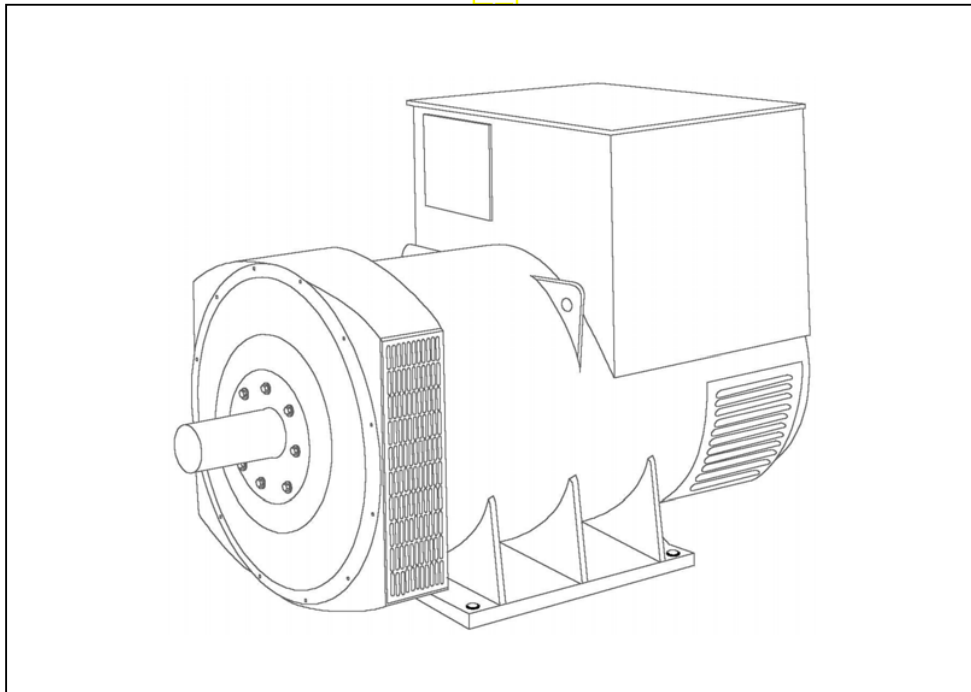
[www.cumminsgeneratortechnologies.com](http://www.cumminsgeneratortechnologies.com)

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# STAMFORD®

**HCI634J** - Winding 311 and 312

Technical **TA** Data Sheet





**SPECIFICATIONS & OPTIONS  
WINDING 311 and 312****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 REGULATORS****MX321 AVR - STANDARD**

This sophisticated Automatic Voltage Regulator (AVR) is incorporated into the Stamford Permanent Magnet Generator (PMG) system and is fitted as standard to generators of this type.

The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.

Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

**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 feature a main stator with either 6 ends (Winding 312) or 12 ends (Winding 311) brought out to the terminals, which are mounted on the frame at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

**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%.

**DE RATES**

All values tabulated on page 8 are subject to the following reductions

5% when air inlet filters are fitted.

10% when IP44 Filters are fitted.

3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.

3% for every 5°C by which the operational ambient temperature exceeds 40°C.

Note: Requirement for operating in an ambient exceeding 60°C must be referred to the factory.

*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.*

APPROVED DOCUMENT

**WINDING 311 and 312**

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.	
A.V.R.	MX321	
VOLTAGE REGULATION	± 0.5 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 7)	

INSULATION SYSTEM	CLASS H
PROTECTION	IP23
RATED POWER FACTOR	0.8
STATOR WINDING	DOUBLE LAYER LAP
WINDING PITCH	TWO THIRDS
WINDING LEADS	6 (Wdg 312) or 12 (Wdg 311)
STATOR WDG. RESISTANCE	0.002 Ohms PER PHASE AT 22°C STAR CONNECTED
ROTOR WDG. RESISTANCE	2.09 Ohms at 22°C
EXCITER STATOR RESISTANCE	17 Ohms at 22°C
EXCITER ROTOR RESISTANCE	0.079 Ohms PER PHASE 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. 6224 (ISO)
BEARING NON-DRIVE END	BALL. 6317 (ISO)

	1 BEARING	2 BEARING
WEIGHT COMP. GENERATOR	2279 kg	2300 kg
WEIGHT WOUND STATOR	1120 kg	1120 kg
WEIGHT WOUND ROTOR	962 kg	916 kg
WR <sup>2</sup> INERTIA	22.9287 kgm <sup>2</sup>	22.3814 kgm <sup>2</sup>
SHIPPING WEIGHTS in a crate	2328kg	2329kg
PACKING CRATE SIZE	183 x 92 x 140(cm)	183 x 92 x 140(cm)

	50 Hz	60 Hz
TELEPHONE INTERFERENCE	THF<2%	TIF<50

COOLING AIR	1.614 m <sup>3</sup> /sec 3420 cfm	1.961 m <sup>3</sup> /sec 4156 cfm
-------------	------------------------------------	------------------------------------

VOLTAGE 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 DELTA	220	230	240	254	240	254	266	277
kVA BASE RATING FOR REACTANCE VALUES	1000	1030	1030	1000	1150	1200	1250	1300
X <sub>d</sub> DIR. AXIS SYNCHRONOUS	3.02	2.81	2.61	2.25	3.49	3.25	3.10	2.96
X' <sub>d</sub> DIR. AXIS TRANSIENT	0.24	0.23	0.21	0.18	0.28	0.26	0.25	0.24
X'' <sub>d</sub> DIR. AXIS SUBTRANSIENT	0.17	0.15	0.14	0.12	0.19	0.18	0.17	0.16
X <sub>q</sub> QUAD. AXIS REACTANCE	1.78	1.66	1.54	1.33	2.05	1.91	1.82	1.74
X'' <sub>q</sub> QUAD. AXIS SUBTRANSIENT	0.21	0.20	0.19	0.16	0.25	0.23	0.22	0.21
X <sub>L</sub> LEAKAGE REACTANCE	0.09	0.08	0.07	0.07	0.10	0.10	0.09	0.09
X <sub>2</sub> NEGATIVE SEQUENCE	0.21	0.20	0.19	0.16	0.25	0.23	0.22	0.21
X <sub>0</sub> ZERO SEQUENCE	0.03	0.02	0.02	0.02	0.03	0.03	0.03	0.03

REACTANCES ARE SATURATED VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED

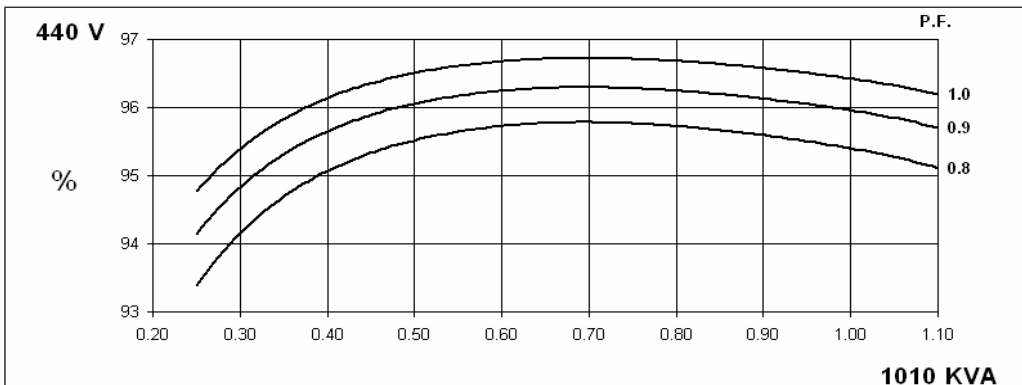
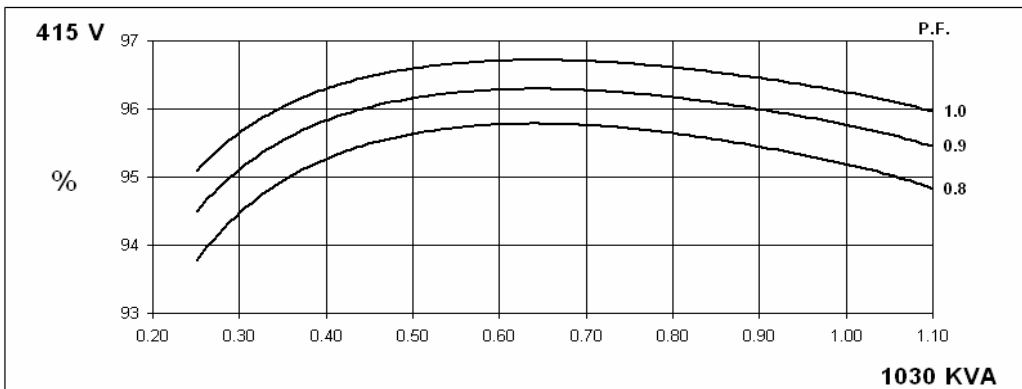
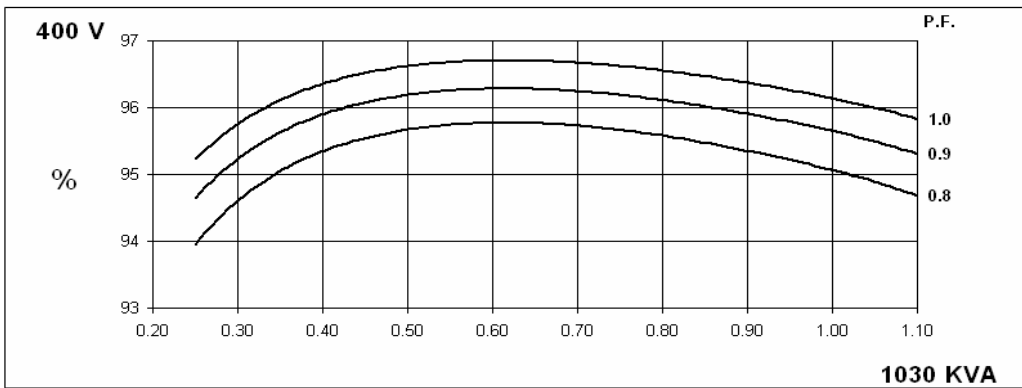
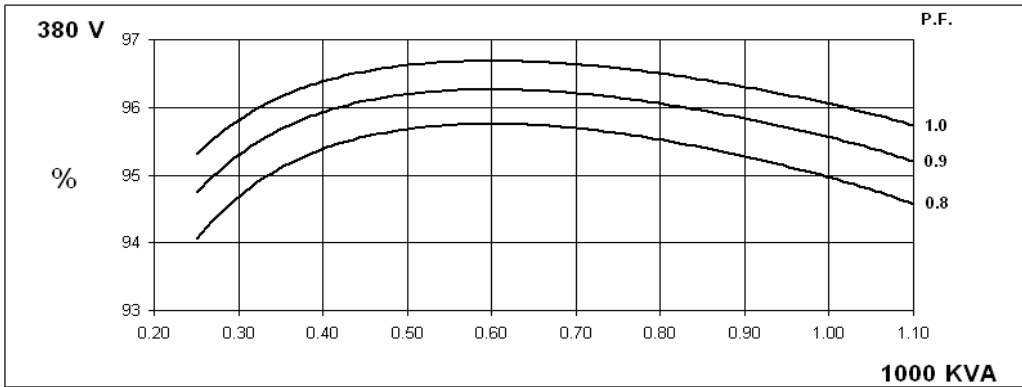
T' <sub>d</sub> TRANSIENT TIME CONST.	0.185
T'' <sub>d</sub> SUB-TRANSTIME CONST.	0.025
T' <sub>do</sub> O.C. FIELD TIME CONST.	3.03
T <sub>a</sub> ARMATURE TIME CONST.	0.046
SHORT CIRCUIT RATIO	1/X <sub>d</sub>

**50  
Hz**

**HCI634J**  
**WINDING 311 and 312**

**STAMFORD**

**THREE PHASE EFFICIENCY CURVES**

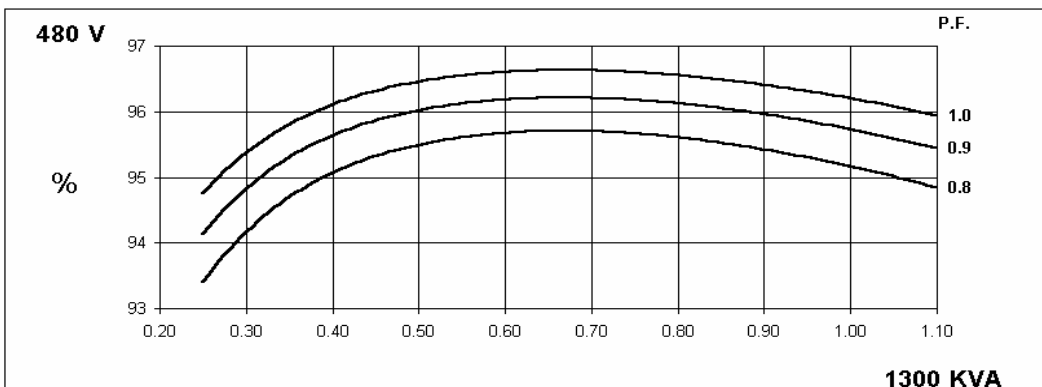
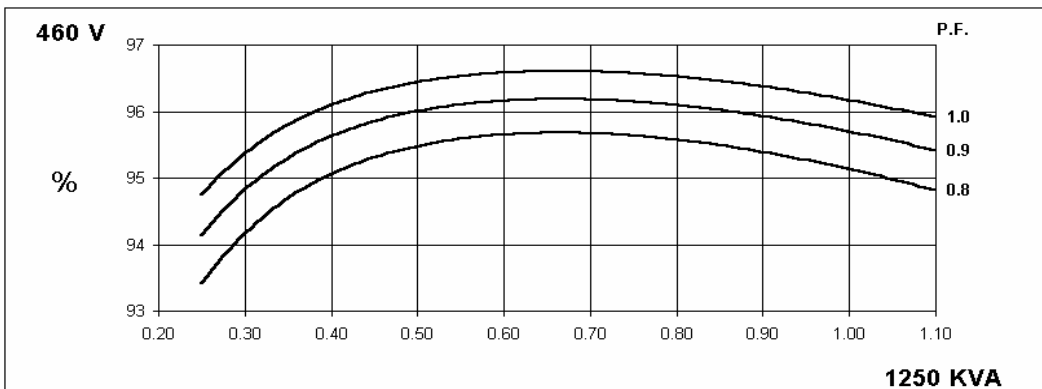
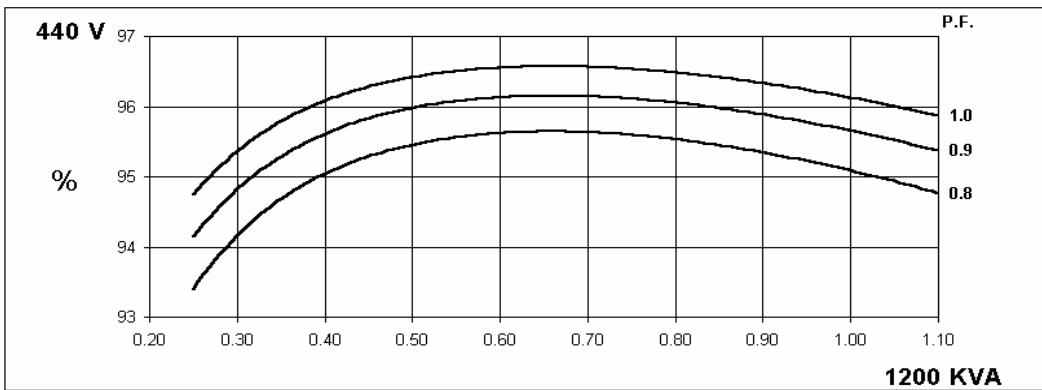
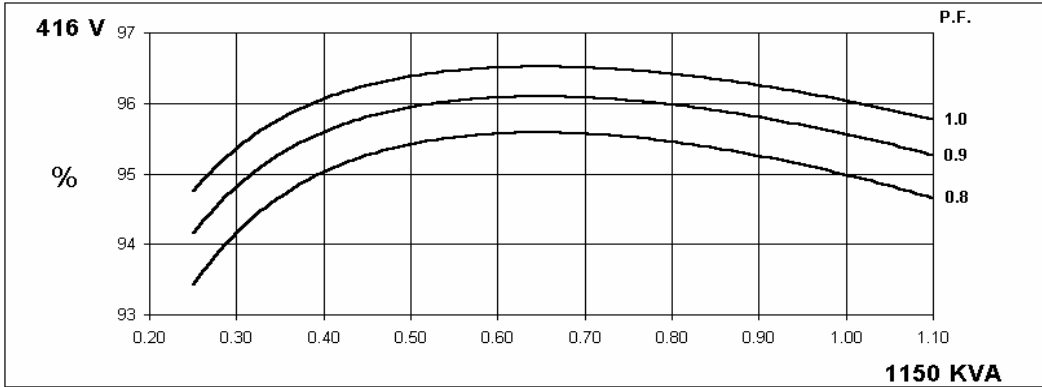


**60  
Hz**

**HCI634J**  
**WINDING 311 and 312**

**STAMFORD**

**THREE PHASE EFFICIENCY CURVES**

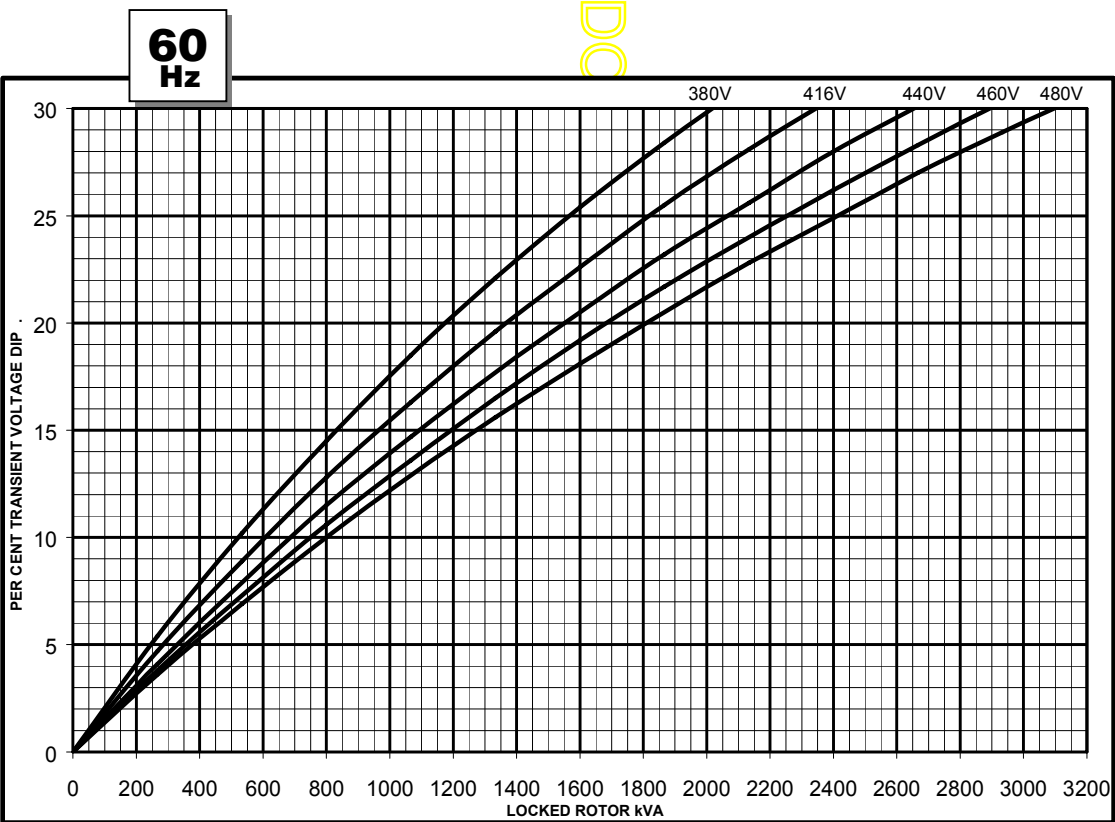
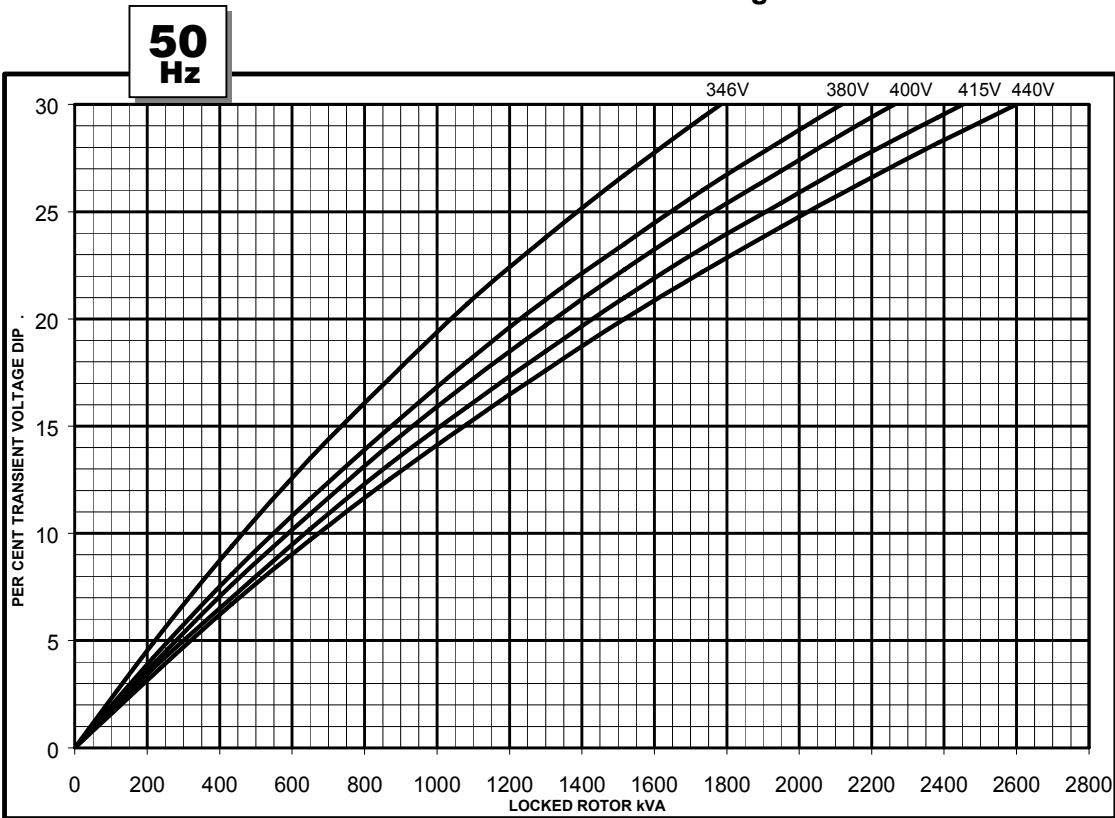


# HCI634J

**STAMFORD**

## WINDING 311 and 312

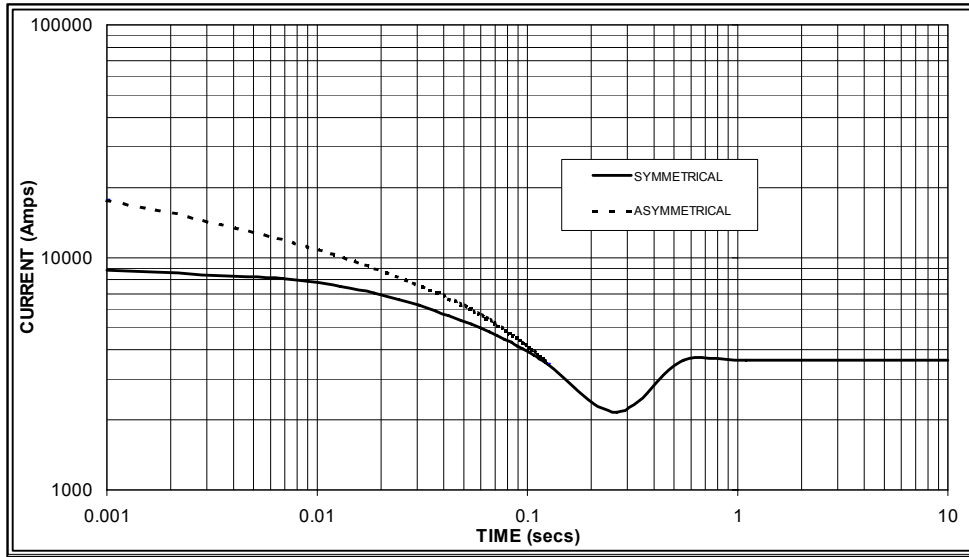
### Locked Rotor Motor Starting Curve



**WINDING 311 and 312**

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

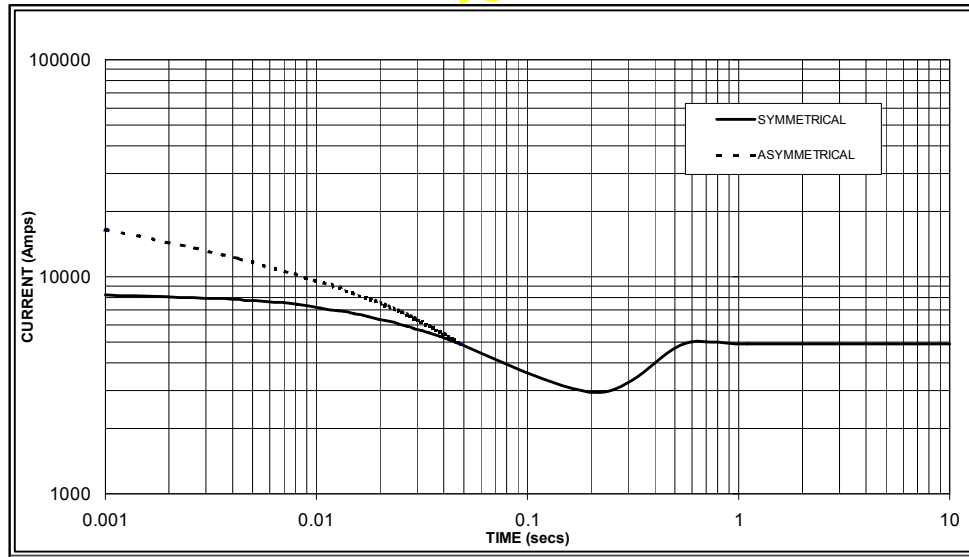
**50  
Hz**



Sustained Short Circuit = 3,600 Amps



**60  
Hz**



Sustained Short Circuit = 4,900 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 1.07	440v	x 1.06
415v	X 1.12	460v	x 1.12
440v	X 1.18	480v	x 1.17

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**

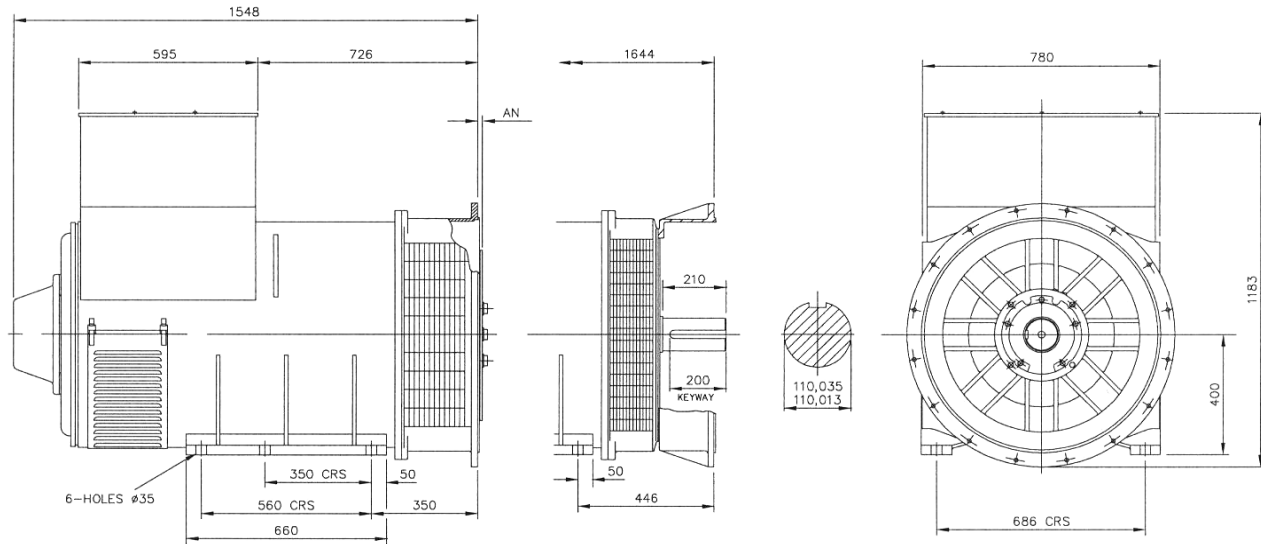
Curves are drawn for Star (Wye) connected machines.  
For Delta connection multiply the Curve current value by 1.732

**RATINGS**

Class - Temp Rise		Cont. F - 105/40°C				Cont. H - 125/40°C				Standby - 150/40°C				Standby - 163/27°C			
<b>50Hz</b>	Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	Parallel Star (V) *	180	200	208	220	180	200	208	220	180	200	208	220	180	200	208	220
	Delta (V)	220	230	240	254	220	230	240	254	220	230	240	254	220	230	240	254
	kVA	900	927	927	900	1000	1030	1030	1010	1060	1070	1070	1060	1100	1110	1110	1100
	kW	720	742	742	720	800	824	824	808	848	856	856	848	880	888	888	880
	Efficiency (%)	95.3	95.4	95.5	95.6	95.0	95.1	95.2	95.4	94.7	94.9	95.1	95.3	94.6	94.8	94.9	95.2
	kW Input	756	777	777	753	842	866	866	847	895	902	900	890	930	937	936	924
<b>60Hz</b>	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	1063	1100	1150	1188	1150	1200	1250	1300	1206	1250	1300	1350	1250	1300	1350	1400
	kW	850	880	920	950	920	960	1000	1040	965	1000	1040	1080	1000	1040	1080	1120
	Efficiency (%)	95.2	95.3	95.3	95.4	95.0	95.1	95.1	95.2	94.8	95.0	95.0	95.1	94.7	94.8	94.9	94.9
	kW Input	893	923	965	996	968	1009	1052	1092	1018	1053	1095	1136	1056	1097	1138	1180

\* Parallel Star only available with Wdg 311

**DIMENSIONS**



<b>SAE</b>	14	18	21	24
<b>AN</b>	25.4	15.87	0	0

APPROVED DOCUMENT

**STAMFORD**

Head Office Address:  
Barnack Road, Stamford  
Lincolnshire, PE9 2NB  
United Kingdom  
Tel: +44 (0) 1780 484000  
Fax: +44 (0) 1780 484100

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

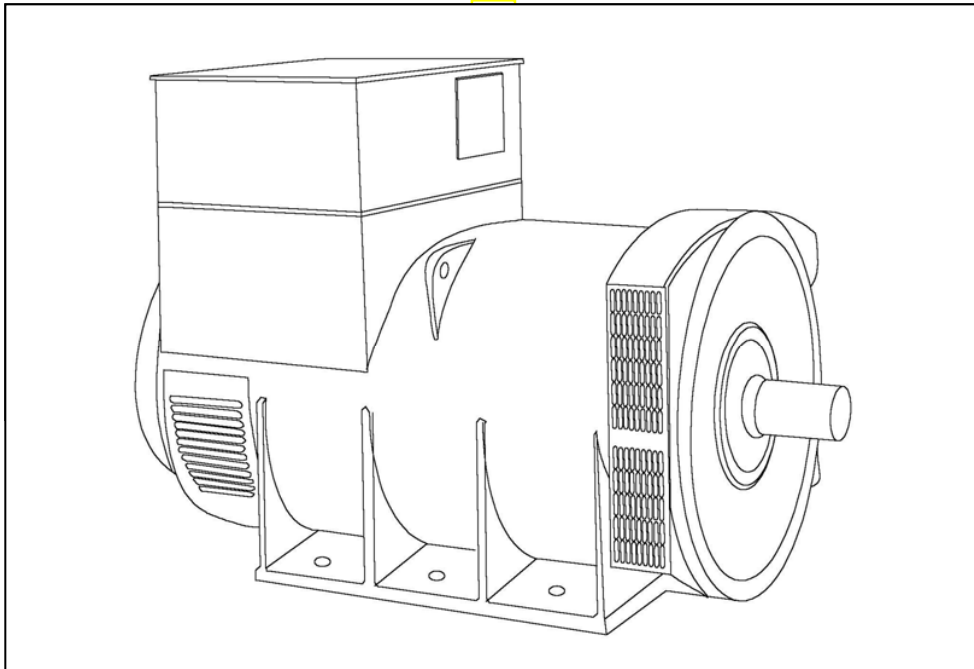
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# STAMFORD<sup>®</sup>

**HCI634J - Winding 07**

Technical **VA** Data Sheet



**SPECIFICATIONS & OPTIONS****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 REGULATORS****MX321 AVR - STANDARD**

This sophisticated Automatic Voltage Regulator (AVR) is incorporated into the Stamford Permanent Magnet Generator (PMG) system and is fitted as standard to generators of this type.

The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds. Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

**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 feature a main stator with 6 ends brought out to the terminals, which are mounted on the frame at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

**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%.

**DE RATES**

All values tabulated on page 6 are subject to the following reductions

5% when air inlet filters are fitted.

10% when IP44 filters are fitted.

3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.

3% for every 5 C by which the operational ambient temperature exceeds 40 C.

Note: Requirement for operating in an ambient exceeding 60 C must be referred to the factory.

*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.*

APPROVED DOCUMENT

# HCI634J

**STAMFORD**

## WINDING 07

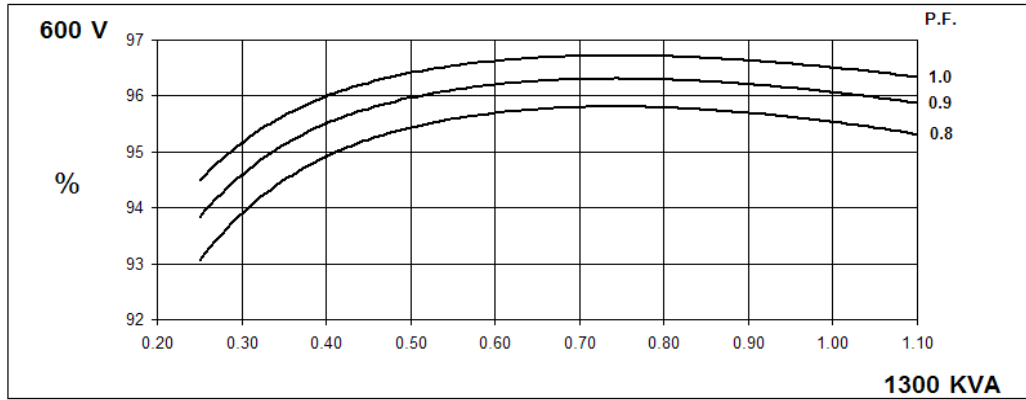
CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.	
A.V.R.	MX321	
VOLTAGE REGULATION	± 0.5 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 5)	
INSULATION SYSTEM	CLASS H	
PROTECTION	IP23	
RATED POWER FACTOR	0.8	
STATOR WINDING	DOUBLE LAYER LAP	
WINDING PITCH	TWO THIRDS	
WINDING LEADS	6	
STATOR WDG. RESISTANCE	0.003 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED	
ROTOR WDG. RESISTANCE	2.09 Ohms at 22°C	
EXCITER STATOR RESISTANCE	17 Ohms at 22°C	
EXCITER ROTOR RESISTANCE	0.079 Ohms PER PHASE 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. 6224 (ISO)	
BEARING NON-DRIVE END	BALL. 6317 (ISO)	
	1 BEARING	2 BEARING
WEIGHT COMP. GENERATOR	2279 kg	2300 kg
WEIGHT WOUND STATOR	1120 kg	1120 kg
WEIGHT WOUND ROTOR	962 kg	916 kg
WR <sup>2</sup> INERTIA	22.9287 kgm <sup>2</sup>	22.3814 kgm <sup>2</sup>
SHIPPING WEIGHTS in a crate	2328 kg	2329 kg
PACKING CRATE SIZE	183 x 92 x 140(cm)	183 x 92 x 140(cm)
TELEPHONE INTERFERENCE	THF<2%	TIF<50
COOLING AIR	1.961 m <sup>3</sup> /sec 4156 cfm	
VOLTAGE STAR	600V	
VOLTAGE DELTA	346V	
KVA BASE RATING FOR REACTANCE VALUES	1300	
X <sub>d</sub> DIR. AXIS SYNCHRONOUS	2.53	
X' <sub>d</sub> DIR. AXIS TRANSIENT	0.19	
X'' <sub>d</sub> DIR. AXIS SUBTRANSIENT	0.14	
X <sub>q</sub> QUAD. AXIS REACTANCE	1.48	
X'' <sub>q</sub> QUAD. AXIS SUBTRANSIENT	0.17	
X <sub>L</sub> LEAKAGE REACTANCE	0.06	
X <sub>2</sub> NEGATIVE SEQUENCE	0.17	
X <sub>0</sub> ZERO SEQUENCE	0.02	
REACTANCES ARE SATURATED VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED		
T' <sub>d</sub> TRANSIENT TIME CONST.	0.185s	
T'' <sub>d</sub> SUB-TRANSTIME CONST.	0.025s	
T' <sub>do</sub> O.C. FIELD TIME CONST.	3.03s	
T <sub>a</sub> ARMATURE TIME CONST.	0.046s	
SHORT CIRCUIT RATIO	1/X <sub>d</sub>	

**HCI634J**

**STAMFORD**

Winding 07

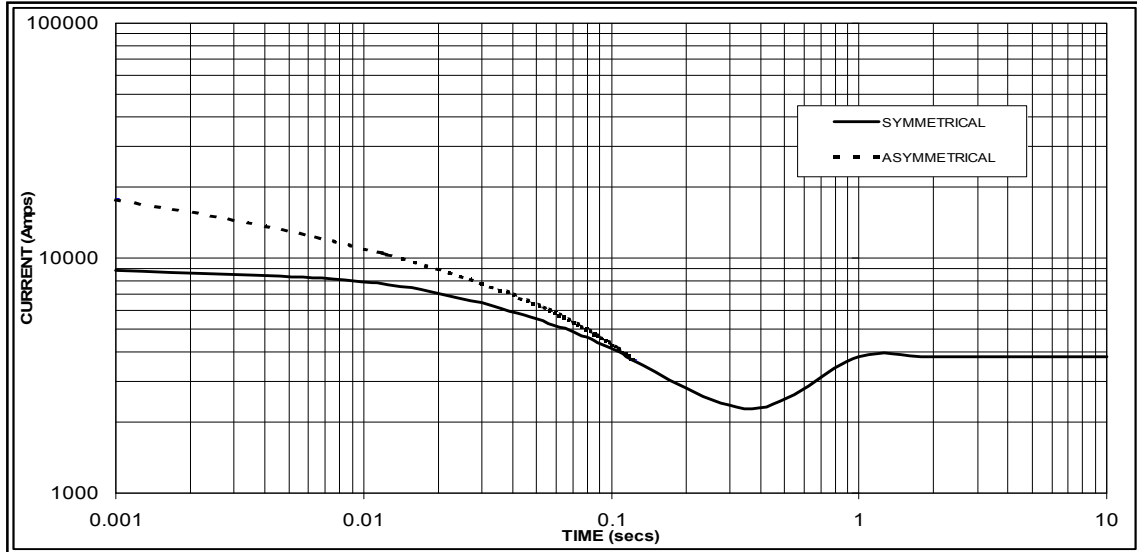
**THREE PHASE EFFICIENCY CURVES**



**Locked Rotor Motor Starting Curve**



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



Sustained Short Circuit = 3800 Amps

**Note**

The following multiplication factor should be used to convert the values from curve for 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

# HCI634J

**STAMFORD**

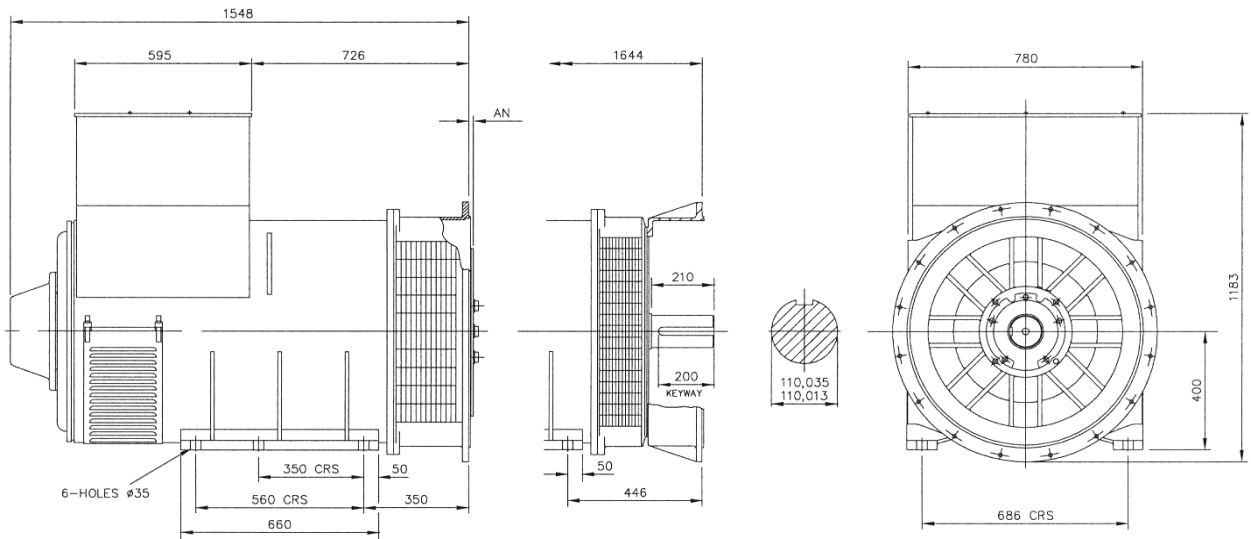
Winding 07 / 0.8 Power Factor

**60Hz**

## RATINGS

Class - Temp Rise	Cont. F - 105/40°C	Cont. H - 125/40°C	Standby - 150/40°C	Standby - 163/27°C
Star (V)	600	600	600	600
Delta (V)	346	346	346	346
kVA	1188	1300	1350	1400
kW	950	1040	1080	1120
Efficiency (%)	95.7	95.5	95.5	95.4
kW Input	993	1089	1131	1174

APPROVED  
**DIMENSIONS**



SAE	14	18	21	24
AN	25.4	15.87	0	0

APPROVED DOCUMENT

**STAMFORD**

Head Office Address:  
Barnack Road, Stamford  
Lincolnshire, PE9 2NB  
United Kingdom  
Tel: +44 (0) 1780 484000  
Fax: +44 (0) 1780 484100

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

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# DSE7410/20 MKII

## AUTO START & AUTO MAINS FAILURE CONTROL MODULES

DSE7420 MKII



DSE7410 MKII



### KEY FEATURES

- 4-Line back-lit LCD text display
- Multiple Display Languages
- Five key menu navigation
- LCD alarm indication
- Heated display option available
- Customisable power-up text and images
- DSENet expansion compatibility
- Data logging facility upto 20 parameters
- Internal PLC editor
- Protections disable feature
- Fully configurable via PC using USB, RS232, RS485 and ethernet communication
- Front panel configuration with multi-level PIN protection
- Power save mode
- 3 phase generator sensing and protection
- 3 phase mains (utility) sensing and protection (DSE7420 MKII only)
- Automatic load transfer control (DSE7420 MKII only)
- Generator current and power monitoring (kW, kvar, kVA, pf)
- Mains current and power monitoring (kW, kvar, kVA, pf) (DSE7420 MKII only)
- kW and kvar overload and reverse power alarms
- Over current protection
- Unbalanced load protection
- Independent earth fault protection
- Breaker control via fascia buttons
- Fuel and start outputs configurable when using CAN
- 6 configurable DC outputs

- 2 configurable volt-free relay outputs
- 6 configurable analogue/digital inputs
- Support for 0 V to 10 V & 4 mA to 20 mA sensors
- Support for 3 kΩ resistive sensors
- 8 configurable digital inputs
- Configurable 5 stage dummy load and load shedding outputs
- CAN, MPU and alternator frequency speed sensing in one variant
- Real time clock
- Manual and automatic fuel pump control
- Engine pre-heat and post-heat functions
- Engine run-time scheduler
- Engine idle control for starting & stopping
- Fuel usage monitor and low fuel level alarms
- Simultaneous use of RS232, RS485 & ethernet communication ports
- True dual mutual standby using RS232 or RS485 for accurate hours balancing.
- MODBUS RTU & TCP support with configurable MODBUS pages.
- SNMP GET, SET and TRAP support built in.
- Advanced SMS messaging (additional external modem required)
- Start & stop capability via SMS messaging
- 3 configurable maintenance alarms
- Compatible with a wide range of CAN engines, including tier 4 engine support
- J1939-75 support & CAN alarm ignore function
- Uses DSE Configuration Suite PC Software for simplified configuration
- Licence-free PC software
- IP65 rating (with supplied gasket) offers increased resistance to water ingress
- Modules can be integrated into building management systems (BMS) using MODBUS RTU & TCP
- Configurable CAN parameters to read and display CAN information from external CAN devices.

### KEY BENEFITS

- Automatically transfers between mains (utility) and generator (DSE7420 MKII only) for convenience.
- Hours counter provides accurate information for monitoring and maintenance periods
- User-friendly set-up and button layout for ease of use
- Multiple parameters are monitored & displayed simultaneously for full visibility
- The module can be configured to suit a wide range of applications for user flexibility
- PLC editor allows user configurable functions to meet user specific application requirements.

### SPECIFICATIONS

#### DC SUPPLY

##### CONTINUOUS VOLTAGE RATING

8 V to 35 V Continuous  
5 V for up to 1 minute

#### CRANKING DROPOUTS

Able to survive 0 V for 100 mS, providing supply was at least 10 V before dropout and supply recovers to 5 V. This is achieved without the need for internal batteries. LEDs and backlight will not be maintained during cranking.

#### MAXIMUM OPERATING CURRENT

510 mA at 12 V, 240 mA at 24 V

#### MAXIMUM STANDBY CURRENT

330 mA at 12 V, 160 mA at 24 V

#### CHARGE FAIL/EXCITATION RANGE

0 V to 35 V

#### GENERATOR & MAINS (UTILITY)

##### VOLTAGE RANGE

15 V to 415 V AC (Ph to N)  
26 V to 719 V AC (Ph to Ph)

##### FREQUENCY RANGE

3.5 Hz to 75 Hz

##### MAGNETIC PICKUP

##### VOLTAGE RANGE

+/- 0.5 V to 70 V

##### FREQUENCY RANGE

10,000 Hz (max)

#### INPUTS

##### DIGITAL INPUTS A TO H

Negative switching

##### ANALOGUE INPUTS A, B, E & F

Configurable as:

Negative switching digital input

0 V to 10 V sensor

4 mA to 20 mA sensor

Resistive sensor

##### ANALOGUE INPUTS C & D

Configurable as:

Negative switching digital input

Resistive sensor

#### OUTPUTS

##### OUTPUT A & B (FUEL & START)

15 A DC at supply voltage

##### OUTPUTS C & D

8 A AC at 250 V AC (Volt-free)

##### AUXILIARY OUTPUTS E, F, G, H, I & J

2 A DC at supply voltage

#### DIMENSIONS

##### OVERALL

245 mm x 184 mm x 51 mm

9.6" x 7.2" x 2.0"

##### PANEL CUT-OUT

220 mm x 160 mm

8.7" x 6.3"

##### MAXIMUM PANEL THICKNESS

8 mm

0.3"

##### STORAGE TEMPERATURE RANGE

-40°C to +85 °C

-40 °F to +185 °F

##### OPERATING TEMPERATURE RANGE

##### NON-HEATED DISPLAY VARIANT

-30°C to +70 °C

-22 °F to +158 °F

##### HEATED DISPLAY VARIANT

-40 °C to +70 °C

-40 °F to +158 °F

### RELATED MATERIALS

#### TITLE

DSE7410 MKII & DSE7420 MKII Installation Instructions

DSE7410 MKII & DSE7420 MKII Operator Manual

DSE7410 MKII & DSE7420 MKII Configuration Suite PC Manual

### DEEP SEA ELECTRONICS PLC UK

Highfield House, Hunmanby Industrial Estate, Hunmanby YO14 0PH

TELEPHONE +44 (0) 1723 890099 FACSIMILE +44 (0) 1723 893303

EMAIL sales@deepseapl.com WEBSITE www.deepseapl.com

### PART NO.

053-191

057-263

057-262

### DEEP SEA ELECTRONICS INC USA

3230 Williams Avenue, Rockford, IL 61101-2668 USA

TELEPHONE +1 (815) 316 8706 FACSIMILE +1 (815) 316 8708

EMAIL sales@deepseausa.com WEBSITE www.deepseausa.com



# DSE7410/20 MKII

## AUTO START & AUTO MAINS FAILURE CONTROL MODULES

The DSE7410 MKII is an Auto Start Control Module and the DSE7420 MKII is an Auto Mains (Utility) Failure Control Module suitable for a wide variety of single, diesel or gas, gen-set applications.

Monitoring an extensive number of engine parameters, the modules will display warnings, shutdown and engine status information on the back-lit LCD screen, illuminated LEDs, remote PC and via SMS text alerts (with external modem).

The DSE7420 MKII will also monitor the mains (utility) supply. The modules include USB, RS232, RS485 and Ethernet ports as well as dedicated DSENet® terminals for system expansion.

Both modules are compatible with electronic (CAN) and non-electronic (magnetic pick-up/alternator sensing) engines and offer an extensive number of flexible inputs, outputs and extensive engine protections so the system can be easily adapted to meet the most demanding industry requirements.

The extensive list of features includes enhanced event and performance monitoring, remote communications & PLC functionality.

Dual mutual standby is now available on both the DSE7410 MKII & DSE7420 MKII using RS232 or RS485 communications. This provides for a simpler and more convenient installation with more advanced features such as true hours balancing.

The modules also feature SNMP functionality for connection to SNMP systems.

The modules can be easily configured using the DSE Configuration Suite PC software. Selected front panel editing is also available.

### ENVIRONMENTAL TESTING STANDARDS

#### ELECTRO-MAGNETIC COMPATIBILITY

BS EN 61000-6-2  
EMC Generic Immunity Standard for the Industrial Environment  
BS EN 61000-6-4  
EMC Generic Emission Standard for the Industrial Environment

#### ELECTRICAL SAFETY

BS EN 60950  
Safety of Information Technology Equipment, including Electrical Business Equipment

#### TEMPERATURE

BS EN 60068-2-1  
Ab/Ae Cold Test -30 °C  
BS EN 60068-2-2  
Bb/Be Dry Heat +70 °C

#### VIBRATION

BS EN 60068-2-6  
Ten sweeps in each of three major axes  
5 Hz to 8 Hz at +/-7.5 mm,  
8 Hz to 500 Hz at 2 gn

#### HUMIDITY

BS EN 60068-2-30  
Db Damp Heat Cyclic 20/55 °C at 95% RH 48 Hours  
BS EN 60068-2-78  
Cab Damp Heat Static 40 °C at 93% RH 48 Hours

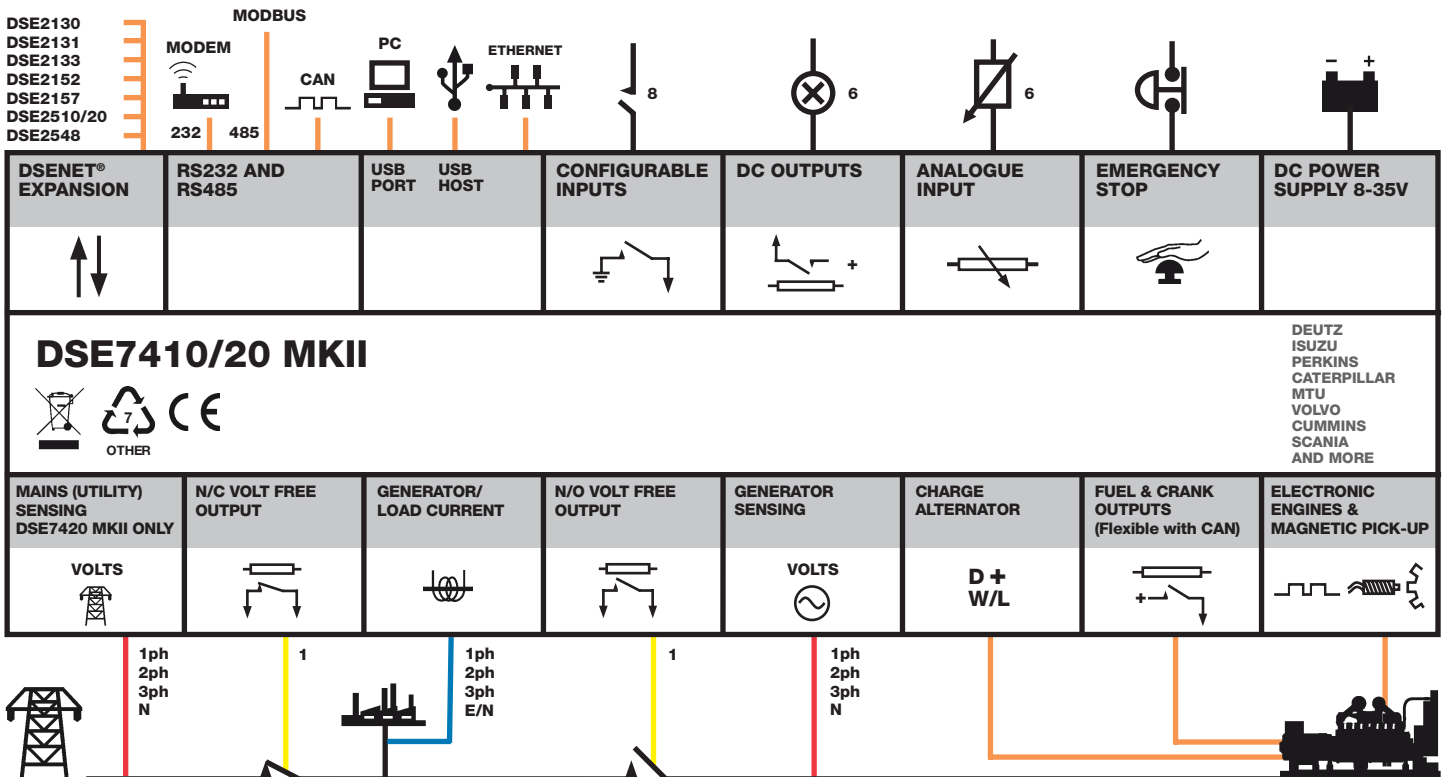
#### SHOCK

BS EN 60068-2-27  
Three shocks in each of three major axes  
15 gn in 11 mS

#### DEGREES OF PROTECTION PROVIDED BY ENCLOSURES

BS EN 60529  
IP65 - Front of module when installed into the control panel with the supplied sealing gasket.

## COMPREHENSIVE FEATURE LIST TO SUIT A WIDE VARIETY OF GEN-SET APPLICATIONS



**Molded Case Circuit Breakers**  
**Power Defense™ UL Global Series**  
**Part Number: PDG63M1600E3RNNNNNNN**



Datasheet creation date: 26/08/2019

**PRODUCT VIEW** *(Use Mouse to Rotate and Zoom)*

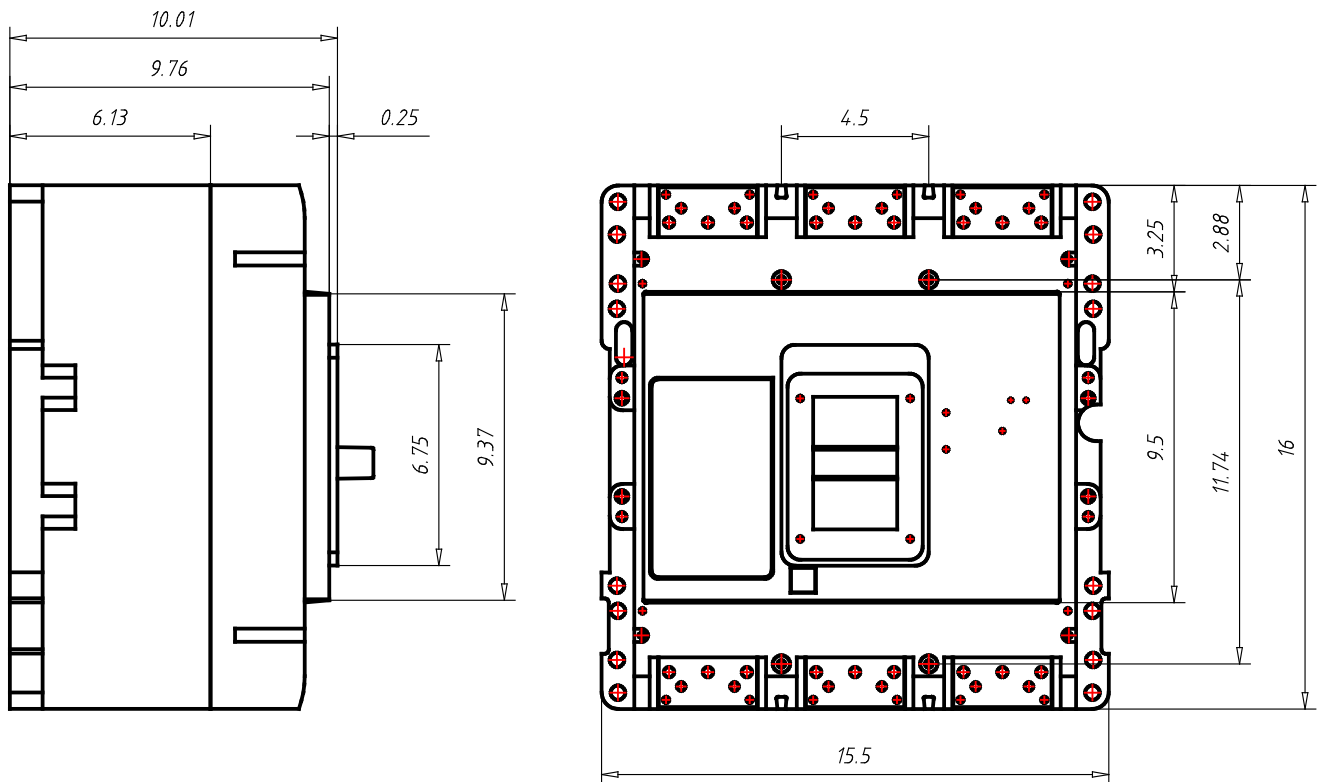
Eaton's Power Defense™ molded case circuit breakers, a globally rated platform designed to help keep your power system safe with latest protection technology. Engineered for the future: IoT and Industry 4.0 features such as built-in communications, advanced energy metering, and algorithms that signal breaker maintenance; zone selective interlock technology that clears faults quickly and locally; ArcFlash reduction options that help protect your people, and not to mention Eaton's best-in-class support and service.

**Tech Data for Configured Product**

Power Defense Catalog Number	PDG63M1600E3RNNNNNNN
Frame Size	Frame 6
Poles	3 Pole
Voltage	480V AC
Interruption or Breaking Capacity ( Icu/Ics)	65kA
Continuous Current Rating (In)	1600A
Trip Unit Type	PXR20
Trip Unit Options 1	LSIG
Trip Unit Options 2	Relays
Indicating Accessories	None
Indicating Accessories Terminal	None
Tripping Accessories	None
Tripping Accessory Terminal	None
Tripping Accessory Voltage	None
Line Type Description	None
Line Conductor Options	N/A
Line Terminal Type	N/A
Load Type Description	None
Load Conductor Options	N/A
Load Terminal Type	N/A
Special Options - Type of Modification	None
Details	None
Additional Description	None

**Molded Case Circuit Breakers**  
**Power Defense™ UL Global Series**  
**Part Number: PDG63M1600E3RNNNNNNN**

**Technical drawings**



**Molded Case Circuit Breakers**  
**Power Defense™ UL Global Series**  
**Part Number: PDG63M1600E3RNNNNNNN**

**General Technical Data**

Frame Rating (In)	1600A
Reference Standard	UL489, CSA 22.2, IEC 60947-2 & GB
Number of poles	3
Neutral rating	-
Interruption Rating Designator	M / N / P
UL Interruption Rating to UL 489 (240Vac)	125 / 150 / 200kA
UL Interruption Rating to UL 489 (480Vac)	65 / 85 / 100kA
UL Interruption Rating to UL 489 (600Vac)	35 / 50 / 65kA
UL Interruption Rating to UL 489 (125/250Vdc)	
UL Current Limiting	-
Rated breaking capacity to IEC 60947-2 (220-240 Vac Icu)	135 / 150 / 200kA
Rated breaking capacity to IEC 60947-2 (220-240 Vac Ics)	100 / 100 / 100kA
Rated breaking capacity to IEC 60947-2 (380-415 Vac Icu)	70 / 70 / 100kA
Rated breaking capacity to IEC 60947-2 (380-415 Vac Ics)	50 / 50 / 50kA
Rated breaking capacity to IEC 60947-2 (440 Vac Icu)	50 / 70 / 100kA
Rated breaking capacity to IEC 60947-2 (440 Vac Ics)	40 / 50 / 50kA
Rated breaking capacity to IEC 60947-2 (525 Vac Icu)	30 / 35 / 40kA
Rated breaking capacity to IEC 60947-2 (525 Vac Ics)	25 / 25 / 25kA
Rated breaking capacity to IEC 60947-2 (690 Vac Icu)	15 / 20 / 35kA
Rated breaking capacity to IEC 60947-2 (690 Vac Ics)	7.5 / 13 / 18kA
Rated breaking capacity to IEC 60947-2 (125V DC Icu)	
Rated breaking capacity to IEC 60947-2 (250V DC 2P in series Ics)	25
Frequency	50/60Hz
Trip Unit Type	PXR20
Continuous Current Range	Fixed
100% UL489 Rated	Yes
Instantaneous/Short Circuit Range	Adjustable
Magnetic/Instantaneous Override	17500A
Dimensions H x W x D (inches)	16 x 15.5 x 9.75
Pole to pole distance inches	4,5
Approx Weight lbs	135
RoHS Compliance	Yes
UL File Number	E7819
Ambient Temp Calibration	
Derating at 50C	
Derating at 60C	
Derating at 70C	

1. 480Vac corresponds to 277Vac for 1P
2. 600Vac corresponds to 347Vac for 1P

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## Main characteristics

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The Tmax family, conforming to the UL 489 and CSA C22.2 No. 5.1 Standards, is enriched with the Tmax T8 size, which allows 3000 A to be reached. Also available in the 1600 A, 2000 A and 2500 A frames, Tmax T8 is equipped with the same electronic trip units as Tmax T7, thereby guaranteeing extremely high performances able to satisfy all installation requirements. Adequately sized for the performances offered (W=16.8 / D=11.2 / H=15.0 in). Tmax T8 is able to interrupt the following short-circuit currents: 125 kA@480 V and 100 kA@600 V.



# Main characteristics

## General characteristics

The Tmax T8 size has both circuit breakers and molded case switches (MCS). The following tables show the main characteristics of these ranges.

### Circuit breakers for power distribution

			<b>Tmax T8</b>
Frame size	[A]		1600/2000/2500/3000
Number of poles	[No]		3/4
Rated voltage	(AC) 50-60 Hz	[V]	600
	(DC)	[V]	–
Test voltage (1 min) 50-60 Hz		[V]	3000
Interrupting ratings		[kA rms]	V
	240 V AC	[kA rms]	125
	480 V AC	[kA rms]	125
	600 V AC	[kA rms]	100
Trip units	Electronic	PR232/P-T8	■
		PR331/P	■
		PR332/P	■
Dimensions fixed version (3p)	H	[in-mm]	15.0 - 382
	W	[in-mm]	16.8 - 427
	D	[in-mm]	11.2 - 282
Mechanical life		[operations]	15000
Weight (fixed 3p)	1600/2000/2500 A	[lbs]	161
	3000 A	[lbs]	236

### Molded case switches (MCS)

The Tmax T8 MCS are derived from the corresponding circuit breakers, of which they keep the overall dimensions, the versions, the fixing systems and the possibility of mounting accessories unchanged. This version only differs from the circuit breakers in the absence of the protection trip units. All molded case switches comply with the UL 489 and CSA C22.2 Standards and are self-protected.

			<b>Tmax T8V-D</b>
Rating	[A]		2000/2500/3000
Poles	[No]		3/4
Magnetic override		[A]	40000
Rated voltage	AC (50-60 Hz)	[V]	600
	DC	[V]	–

# NRG

## Intelligent Engine Start Battery Charger



### The Smart Choice for Mission-Critical Engine Starting

- Fast, accurate, mission-critical charging – gives best starting reliability
- 4-rate, temperature-compensated output – offers longest battery life
- Replace nearly any charger – without planning ahead
- Industry-first battery-fault alarm – helps dispatch service early
- Lasting reliability – field MTBF > 1 million hours with industry-best warranty
- IBC seismic certification – meets latest building codes, no installation delays
- Optional OSHPD pre-approval – already approved for California hospital projects



# NRG Battery Charger Benefits and Features



**Failure to start due to battery problems is the leading cause of inoperable engine generator sets.**

SENS NRG battery charger maximizes starting system reliability while slashing genset servicing costs:

**One NRG replaces almost any charger without extra site visits.** Installers can select or change at any time 120, 208 or 240 volts AC input, 12 or 24-volt battery and output settings optimized for nearly any lead-acid or nickel cadmium battery.

**Easy to understand user interface provides state-of-the-art system status** – including digital metering, NFPA 110 alarms and a battery fault alarm that can send service personnel to the site before failure to start.

**Batteries charged by NRG give higher performance and last longer.** In uncontrolled environments precision charging by SENS increases battery life and watering intervals 400% or more.

**NRG meets all relevant industry standards** – including UL, NFPA 110 and CE. Seismic Certification per International Building Code (IBC) 2000, 2003, 2006. All units are C-UL listed. 50/60 Hz units add CE marking to UL agency marks.

**EnerGenius reliability technology built into every charger includes:**

- All-electronic operation with generous component de-rating
- Disconnected/reversed/incorrect voltage battery alarm and protection
- Protection of connected equipment against load dump transients
- Widest temperature rating, and overtemperature protection
- Superior lightning and voltage transient protection
- Demonstrated field MTBF > 1 million hours
- Standard 3-year warranty (10 years magnetics and power semiconductors) and available 10-year extended warranty

**Earn the best return on your charger investment – choose SENS NRG**



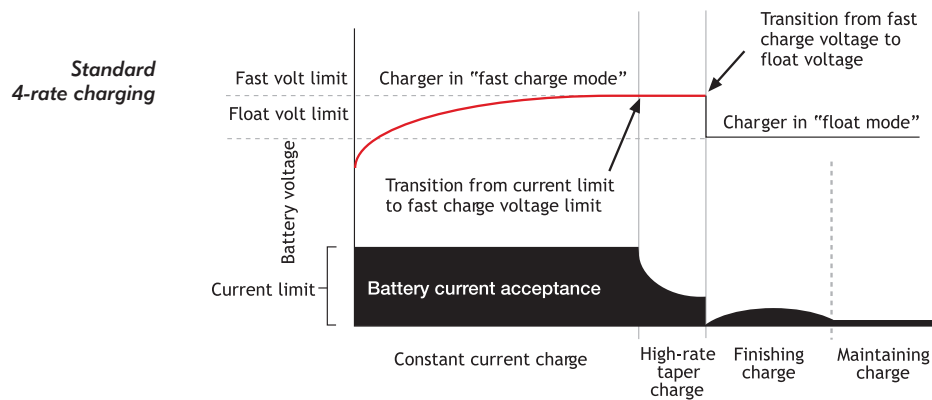
# NRG Specifications

## AC Input

Voltage	110-120/208-240 VAC, $\pm 10\%$ , single phase, field selectable
Input current	10A charger: 6.6/3.3 amps maximum 20A charger: 12.6/6.3 amps maximum
Frequency	60 Hz $\pm 5\%$ standard; 50/60 Hz $\pm 5\%$ optional
Input protection	1-pole fuse, soft-start, transient suppression

## Charger Output

Nominal voltage ratings	12 or 24 volt nominal
Optional voltage rating	12/24 volt, field selectable
Battery settings	Six discrete battery voltage programs - Low or high S.G. flooded - Low or high S.G. VRLA - Nickel cadmium 9, 10, 18, 19 or 20 cells
Regulation	$\pm 0.5\%$ (1/2%) line and load regulation
Current	10 or 20 amps nominal
Electronic current limit	105% rated output typical – no crank disconnect required
Charge characteristic	Constant voltage, current limited, 4-rate automatic equalization
Temperature compensation	Enable or disable anytime, remote sensor optional
Output protection	Current limit, 1-pole fuse, transient suppression



## User Interface, Indication and Alarms

Digital meter	Automatic meter alternately displays output volts, amps <sup>1</sup>
Accuracy	$\pm 2\%$ volts, $\pm 5\%$ amps
Alarms	LED and Form C contact(s) per table:



Front panel status display

## Alarm System Functions

Alarm code "C" (meets requirements of NFPA 110)	
AC good	LED
Float mode	LED
Fast charge	LED
Temp comp active	LED
AC fail	LED and Form C contact <sup>2</sup>
Low battery volts	LED and Form C contact <sup>2</sup>
High battery volts	LED and Form C contact <sup>2</sup>
Charger fail	LED and Form C contact <sup>2</sup>
Battery fault <sup>3</sup>	LED and Form C contact <sup>2</sup>

- Three-position jumper allows user to select from three display settings: alternating volts / amps (normal), constant volts, or constant amps
- Contacts rated 2A @ 30 VDC resistive
- Battery fault alarm indicates these fault conditions:
  - Battery disconnected - Battery polarity reversed - Mismatched charger battery voltage - Open or high resistance charger to battery connection
  - Open battery cell or excessive internal resistance

## Controls

AC input voltage select  
Optional 12/24-volt output select  
Battery program select  
Meter display select  
Fast charger enable/disable  
Temp compensation enable  
Remote temp comp enable

Field-selectable switch  
Field-selectable two-position jumper  
Field-selectable six-position jumper  
Field-selectable three-position jumper  
Field-selectable two-position jumper  
Standard. Can be disabled or re-enabled in the field  
Connect optional remote sensor to temp comp port



*Simple field adjustments*

## Environmental

Operating temperature  
Over temperature protection  
Humidity  
Vibration (10A unit)  
Transient immunity  
Seismic Certification

-20C to +60C, meets full specification to +45C  
Gradual current reduction to maintain safe power device temperature  
5% to 95%, non-condensing  
UL 991 Class B (2G sinusoidal)  
ANSI/IEEE C62.41, Cat. B, EN50082-2 heavy industrial, EN 61000-6-2  
IBC 2000, 2003, 2006, 2009 Maximum S<sub>ds</sub> of 2.28 g, Optional OSHPD pre-approval

## Agency Standards

Safety  
  
Agency marking  
  
EMC  
  
NFPA standards  
Optional agency compliance

C-UL listed to UL 1236 (required for UL 2200 gensets), UL Category BBGQ,  
CSA standard 22.2 no. 107.2-M89  
CE: 50/60 Hz units DOC to EN 60335  
60 Hz: C-UL-US listed  
50/60 Hz: C-UL-US listed plus CE marked  
Emissions: FCC Part 15, Class B; EN 50081-2  
Immunity: EN 61000-6-2  
NFPA 70, NFPA 110. (NFPA 110 requires Alarms "C")  
OSHPD pre-approval

## Construction

Housing/configuration  
Dimensions  
Printed circuit card  
Cooling  
Protection degree  
Damage prevention  
Electrical connections

Material: Non-corroding aluminum. C-UL listed enclosure.  
See Drawings and Dimensions page for details  
Surface mount technology, conformal coated  
Natural convection  
Listed housing: NEMA-1 (IP20). Optional IP21 drip shield. Optional NEMA 3R enclosure  
Fully recessed display and controls  
Compression terminal blocks

## Warranty

Standard warranty  
  
Optional warranty

Three year parts and labor warranty (10 years magnetics and power semiconductors) from date of shipment  
If specified at time of order, warranty coverage for the standard warranty period can be upgraded to reimburse customer's documented field service costs up to the original charger price. Alternatively, standard parts and labor warranty coverage can be increased to 5 or 10 years. Contact the factory for full details

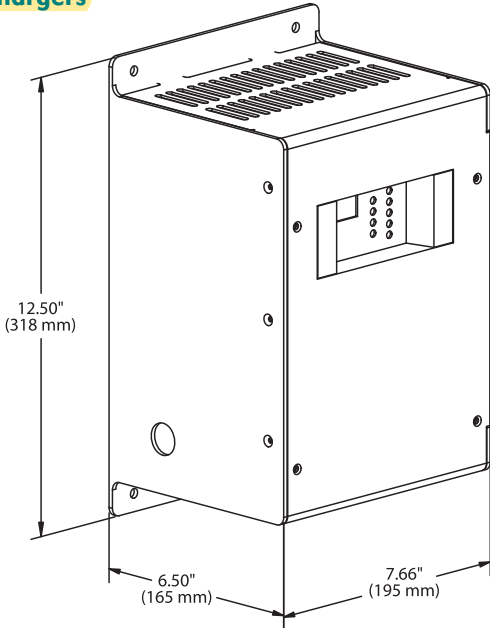
## Optional features

Input  
Remote temp comp sensor  
Drip shield meets s/b (IP21)  
NEMA 3R housing

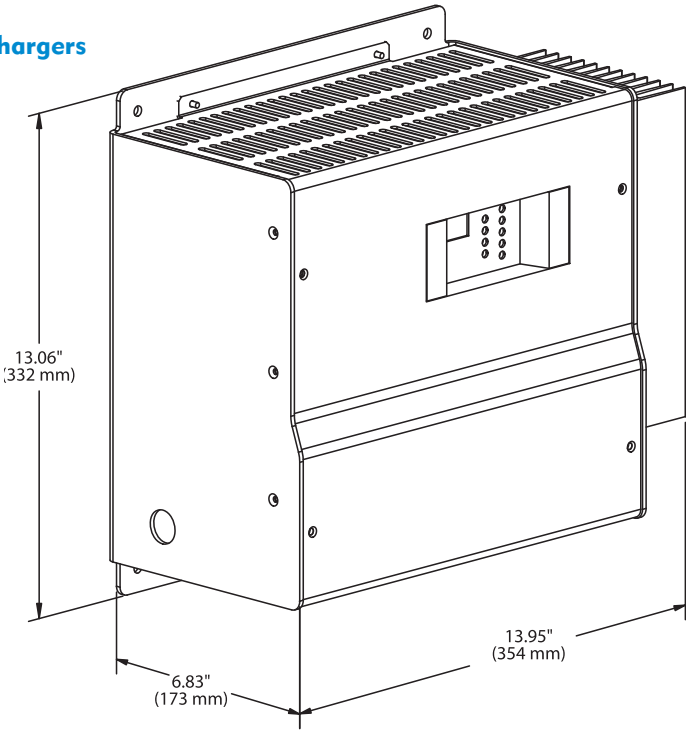
Input frequency, 50/60 Hz  
Recommended where battery and charger are in different locations  
Protects from dripping water  
Enables outdoor installation (remote temp sensor recommended)

# Drawings and Dimensions

## 10A Chargers



## 20A Chargers



Housing Dimensions Table			
Amps	Width	Depth	Height
10	7.66" (195 mm)	6.50" (165 mm)	12.50" (318 mm)
20	13.95" (354 mm)	6.83" (173 mm)	13.06" (332 mm)

## NRG Ordering Information

Output volts	Output amps	Model	NFPA 110 Alarms	Lbs/Kg	Shipping Lbs/Kg
12	10	NRG12-10-RC	Yes	23 / 10.4	25 / 11.4
24	10	NRG24-10-RC	Yes	23 / 10.4	25 / 11.4
12/24	10	NRG22-10-RC	Yes	23 / 10.4	25 / 11.4
12	20	NRG12-20-RC	Yes	39 / 17.7	43 / 19.5
24	20	NRG24-20-RC	Yes	42 / 19.1	46 / 20.9
12/24	20	NRG22-20-RC	Yes	42 / 19.1	46 / 20.9

All models offer field-selectable input 120/208-240 volts. 60 Hz input is standard with C-UL listing. Optional 50/60 Hz input includes C-UL listing and adds CE mark.

### Model Number Breakout - 10 Amp Models



**Model**  
**Output voltage**  
 12: 12 volts  
 24: 24 volts  
 22: 12/24-volt  
 field selectable

**AC input**  
 R: 120/208-240 VAC, 60 Hz  
 H: 120/208-240 VAC, 50/60 Hz

**Option code**  
 E: OSHPD Pre-Approved

All NRG models are  
 C-UL Listed to UL1236

All NRG models provide  
 LEDs and Form C contacts  
 to meet NFPA 110

### Model Number Breakout - 20 Amp Models



**Model**  
**Output voltage**  
 12: 12 volts  
 24: 24 volts  
 22: 12/24-volt  
 field selectable

**AC input**  
 R: 120/208-240 VAC, 60 Hz  
 H: 120/208-240 VAC, 50/60 Hz

**Option code**  
 E: OSHPD Pre-Approved

## The Smart Choice for Mission-Critical Engine Starting

### Additional Information

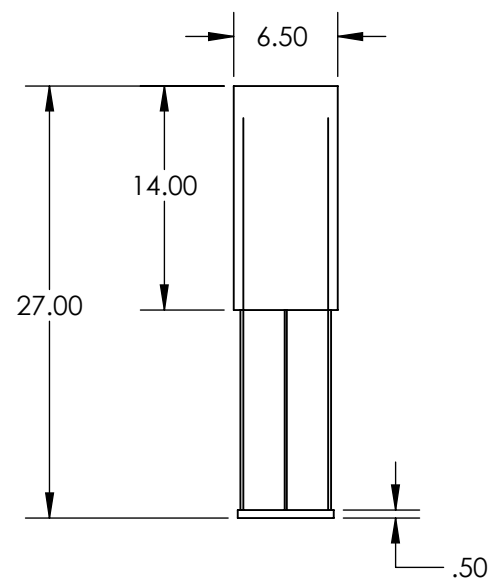
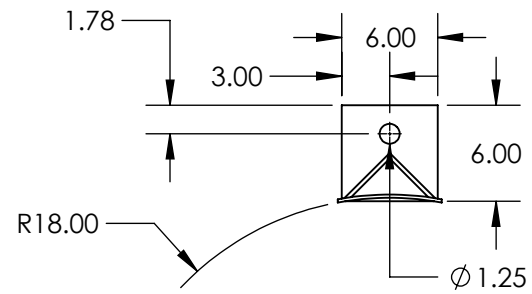
Contact SENS or your local sales representative for additional specification, engineering and installation information. Check the SENS web site for latest available data. Specification is subject to change without notice.



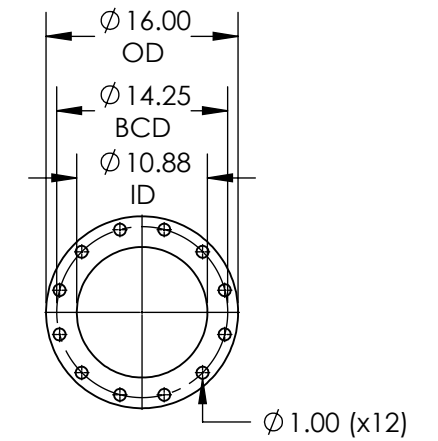
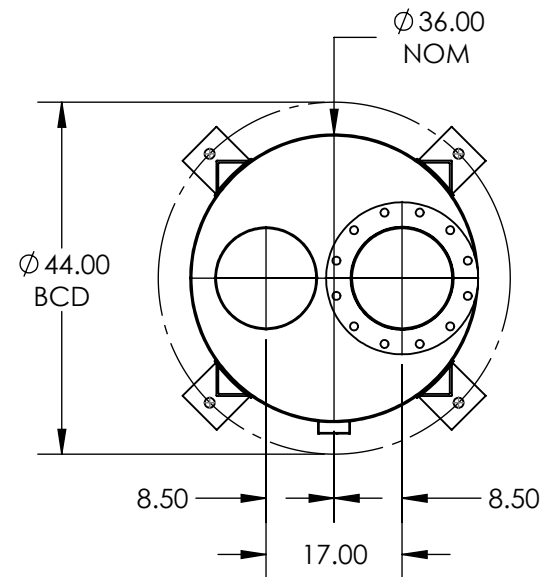
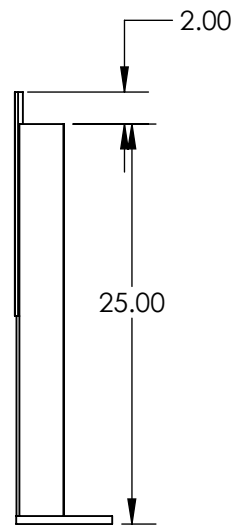
### Contact Information

For information and service on any SENS product, please contact us at:  
 Sales 1.866.736.7872 • 303.678.7500 • Fax 303.678.7504  
 www.sens-usa.com • info@sens-usa.com  
 1840 Industrial Circle, Longmont, CO 80501 USA

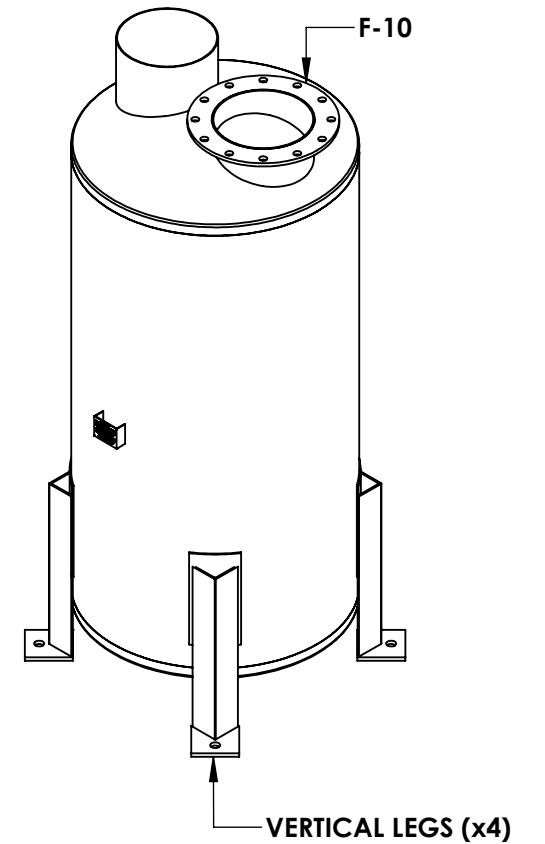
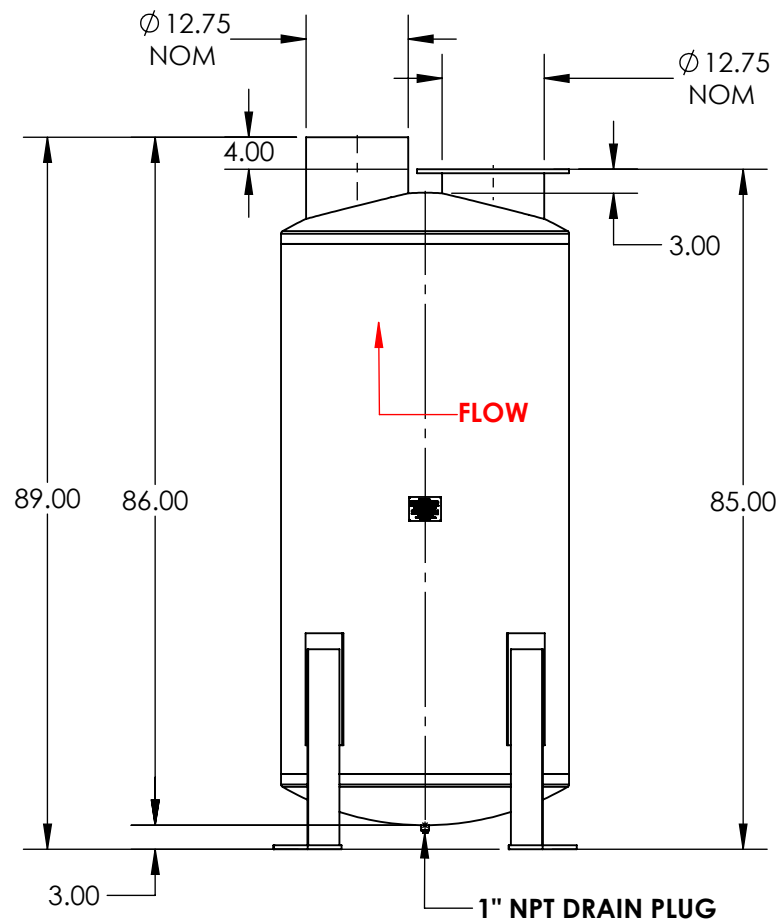




**DETAIL VERTICAL LEG (x4)**  
 1/4" THICK PAD, 4" X4" X1/4" ANGLE,  
 6" X 6" X1/2" THICK FEET



**DETAIL F-10**  
 10" ANSI 150# FLANGE




**SILENCER DETAIL**

- SILENCER GRADE: HOSPITAL GRADE
- ATTENUATION: 35 - 40 dBA
- SILENCER SHELL: STANDARD SHELL (NO INSULATION)
- SILENCER TUBES: STANDARD TUBES (NO INSULATION)

**NOTES:**

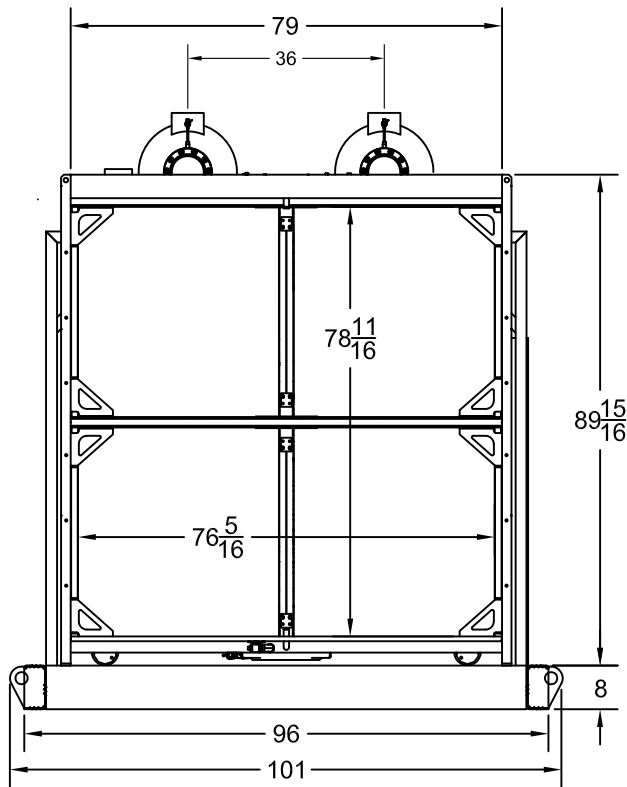
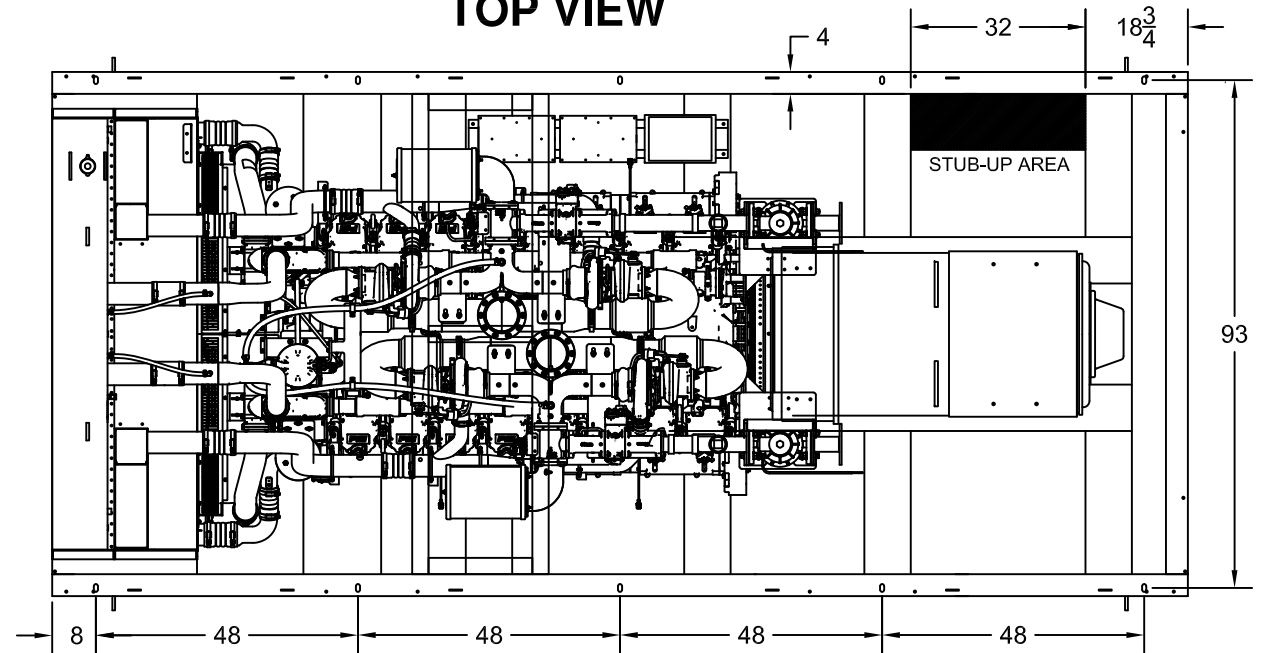
- ALL DIMENSIONS ARE IN INCHES
- DRAWING REQUIRES APPROVAL BEFORE PRODUCTION
- THIS IS NOT A FINAL PRODUCTION DRAWING, SOME DIMENSIONS MAY BE SUBJECT TO CHANGE

REV	DESCRIPTION	DATE (MM/DD/YY)	DRAWN BY	CHECKED BY

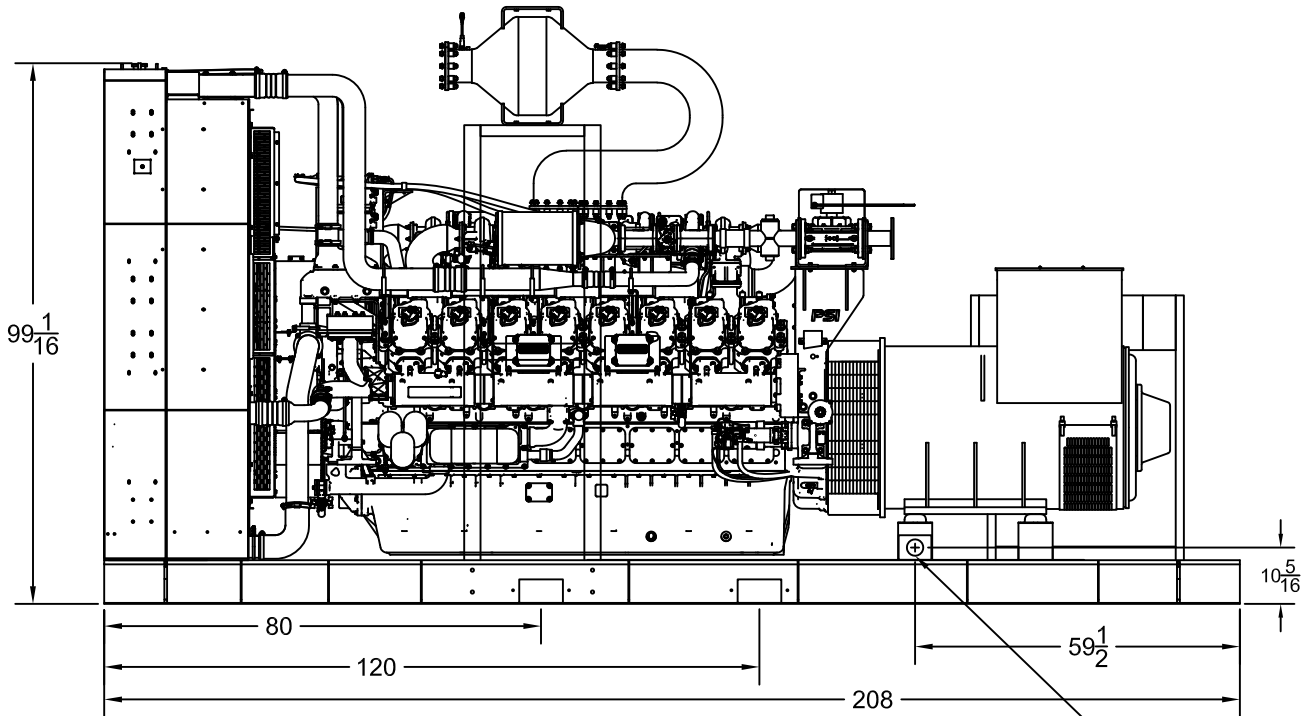
MATERIAL: CARBON STEEL CONSTRUCTION		PAINT: HIGH HEAT BLACK		APPROX. WEIGHT (LBS): 700	
<small>UNLESS OTHERWISE NOTED          1. REMOVE ALL BURRS AND SHARP EDGES          2. DIMENSIONS ARE IN INCHES          TOLERANCES          0.XX ± 1/8"          0.XXX ± 1/16"</small>		 <b>E. I. WILLIAMS INDUSTRIES INC.</b> Building Sound Solutions		CONTACT # 905-428-0950 INFO@EIWILLIAMS.COM WWW.EIWILLIAMS.COM	
TITLE: CYLINDRICAL SILENCER		DRAWING #: QUOTE #23012		DATE: 2023-01-12	
MODEL #: GE6S-12-SP		DRAWN BY: BHAVY PATEL		REV: 00 SHEET: 1 OF 1	

# SP-1M OPEN DIMENSIONAL OVERVIEW

## TOP VIEW



## RADIATOR VIEW



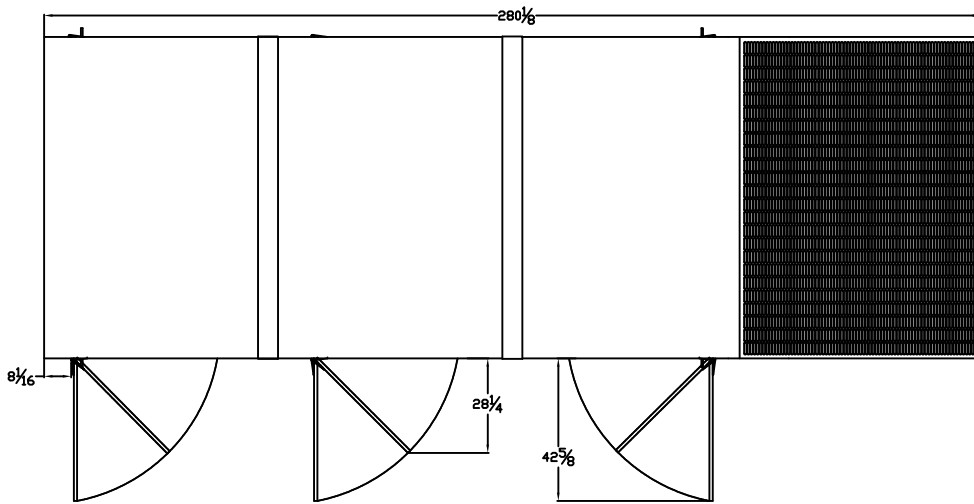
## SIDE VIEW

3" NPTF COUPLING  
FOR DRY FUEL CONNECTION  
LOCATED ON BOTH SIDES

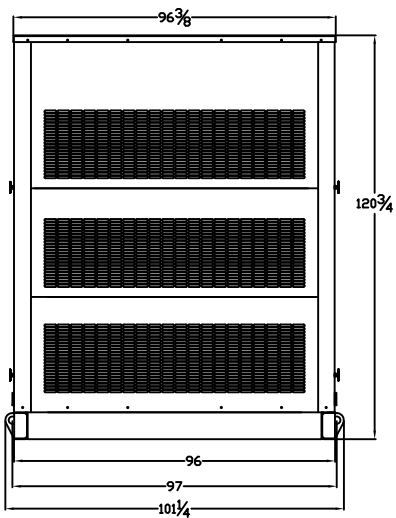
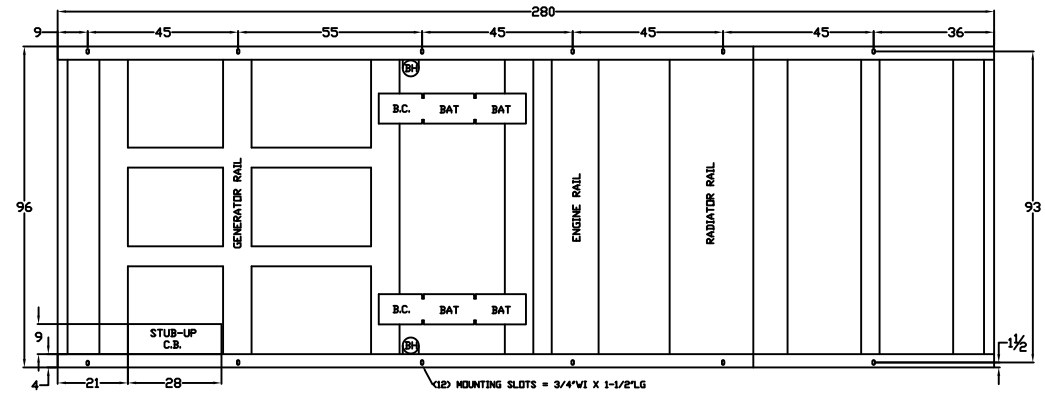
# LEVEL 2 & 3 ENCLOSURE OUTLINE DIMENSIONS FOR SP-1M

TOP VIEW

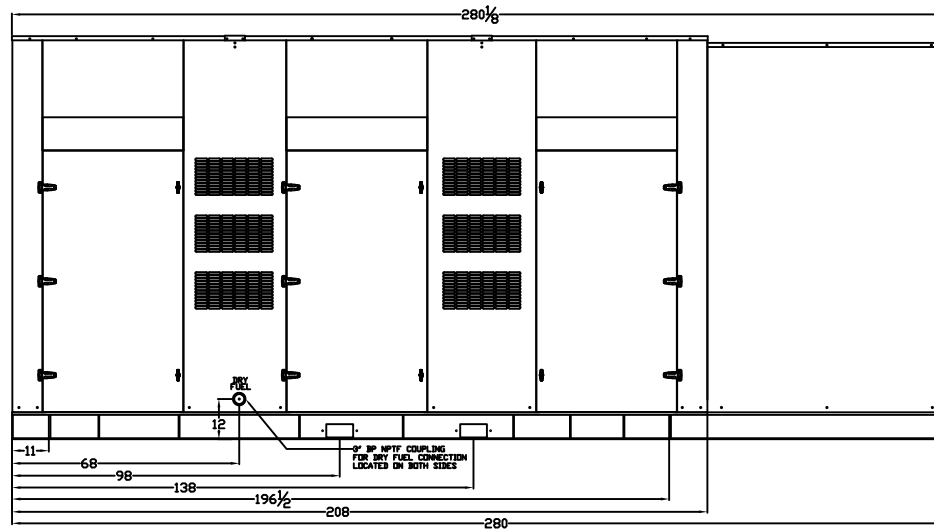
(GEN-SET HAS (6) DOORS, (3) SHOWN OPEN ARE TYPICAL FOR BOTH SIDES)



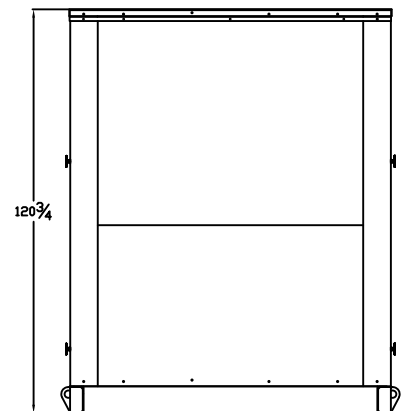
FRAME VIEW



GENERATOR END VIEW



SIDE VIEW



RADIATOR END VIEW