



GILLETTE GENERATORS

LIQUID COOLED NAT. GAS ENGINE GENERATOR SET

60 HZ MODEL

PR-5400

Model	PRIME 105°C RISE		
	HZ	LPG	N.G.
PR-5400-60 HERTZ	60	350	540



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



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

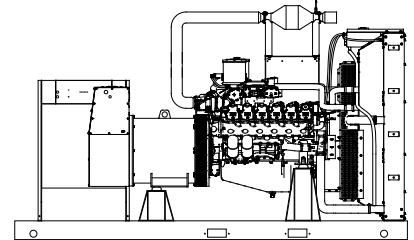


ASCE 7-05 & 7-10

All generator sets meet 180 MPH rating.

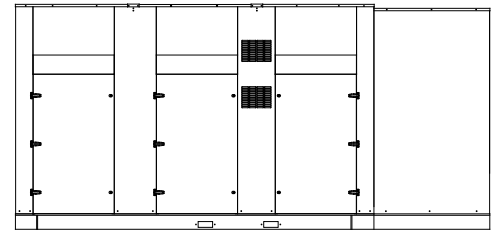


EPA 40CFR Part 60, 1048, 1054, 1065, 1068



“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 RATINGS					LIQUID PROPANE GAS FUEL		NATURAL GAS FUEL	
GENERATOR MODEL	VOLTAGE		PH	HZ	105°C RISE PRIME RATING		105°C RISE PRIME RATING	
	L-N	L-L			KW/KVA	AMP	KW/KVA	AMP
PR-5400-3-2	120	208	3	60	350/438	1216	540/675	1875
PR-5400-3-3	120	240	3	60	350/438	1054	540/675	1625
PR-5400-3-4	277	480	3	60	350/438	527	540/675	812
PR-5400-3-5	127	220	3	60	350/438	1150	540/675	1773
PR-5400-3-16	346	600	3	60	350/438	421	540/675	650

RATINGS: All single phase gen-sets are dedicated 4 lead windings, rated at unity (1.0) power factor. All three phase gen-sets are 12 lead windings, rated at (.8) power factor. 105°C “PRIME RATINGS” are strictly for gen-sets provide the prime source of electric power, where normal utility power is unavailable or unreliable. A 10% overload is allowed for a total of 1 hour, within every 12 hours of operation of PRIME RATED systems. 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 105°C (prime) R/R winding temperature, within a maximum 40°C ambient condition. Specifications & ratings are subject to change without prior notice.

APPLICATION AND ENGINEERING DATA FOR MODEL PR-5400-60 HZ

GENERATOR SPECIFICATIONS

Manufacturer.....Stamford Electric Generators
Model & Type.....HCI534F.311, 4 Pole, 12 Lead, Three Phase
.....HCI534E.311, 4 Pole, 12 Lead, 480V, Three Phase
.....HCI534F.07, 4 Pole, 12 Lead, 600V, Three Phase
Exciter.....Brushless, shunt 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% (½ cycle, no load to full load)
Unbalanced Load Capability.....100% of prime amps
Total Stator and Load Insulation.....Class H, 180°C
Temperature Rise.....105°C R/R, prime rating @ 40°C amb.
3 Ø Motor Starting @ 30% Voltage Dip (208-240V)...1760 kVA
3 Ø Motor Starting @ 30% Voltage Dip (480V-600V) 2140 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)
Ltd. Warranty Period.....24 Months from date of start-up 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, 31.8LTCAC, 4 cycle
Aspiration.....Turbocharged & Charge Air Cooled
Cylinder Arrangement.....12 Cylinders, Vee
Displacement Cu. In. (Liters).....1941 (31.8)
Bore & Stroke In. (Cm.).....5.91 x 5.91 (150 x 150)
Compression Ratio.....10.5:1
Main Bearings & Style.....14, 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).....1772 (450)
Max Power, bhp (kwm) Prime/LPG.....543 (405)
Max Power, bhp (kwm) Prime/NG.....805 (600)
Ltd. Warranty Period.....12 Months or 1000 hrs., first to occur

FUEL SYSTEM

Type.....LPG or NAT. GAS, Vapor Withdrawal
Fuel Pressure (kpa), in. H₂O*.....(2.74), 11"
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 ³ /HR (M ³ /HR)	PRIME
100% LOAD	2117 (60.0)
75% LOAD	1567 (44.4)
50% LOAD	1113 (31.5)
LPG = 2500 BTU X FT ³ /HR = Total BTU/HR LPG Conversion: 8.50 FT ³ = 1 LB. : 36.4 FT ³ = 1 GAL.	

NAT. GAS: FT ³ /HR (M ³ /HR)	PRIME
100% LOAD	5797 (164.1)
75% LOAD	4450 (126.1)
50% LOAD	3254 (92.1)
NG = 1000 BTU X FT ³ /HR = Total BTU/HR	

OIL SYSTEM

Type.....Full Pressure
Oil Pan Capacity qt. (L).....95 (90)
Oil Pan Cap. W/ filter qt. (L).....119 (113)
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 PR-5400-60 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) 125 (51.6)
Engine Jacket Coolant Capacity Gal (L) 23.3 (88.1)
Radiator Coolant Capacity Gal. (L) 39 (148)
Maximum Restriction of Cooling Air Intake
and discharge side of radiator in. H₂O (kpa) 0.5 (.125)
Water Pump Flow gpm (L/min) 436 (1650)
Heat Reject Coolant: Btu/min (kw) 34,074 (599)
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 (m³/min) 1396 (40)
Radiator Air Flow cfm (m³/min) 65,100 (1843)
Heat Rejected to Ambient:
Engine: kw (btu/min) 146 (8310)
Alternator: kw (btu/min) 65 (3696)

EXHAUST SYSTEM

Exhaust Outlet Size (2) 6"
Max. Back Pressure, in. hg (KPA) 3.0 (10.2)
Exhaust Flow, at rated kw: cfm (m³/min) 4079 (115)
Exhaust Temp., at rated kw: °F (°C) 1183 (639)
Engines are EPA certified for Natural Gas.

SOUND LEVELS MEASURED IN dB(A)

	Open Set	Level 2 Encl.
Level 2, Critical Silencer	97	86
Level 3, Hospital Silencer	92	80

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

	Open Set	Level 2 Enclosure
Length in (cm).....	186 (472)	246 (625)
Width in (cm).....	92 (234)	92 (234)
Height in (cm).....	98 (249)	116 (295)
3 Ø Net Weight lbs (kg).....	15950 (7235)	18940 (8591)
3 Ø Ship Weight lbs (kg)	16340 (7412)	19340 (8772)

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 PR-5400-60 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

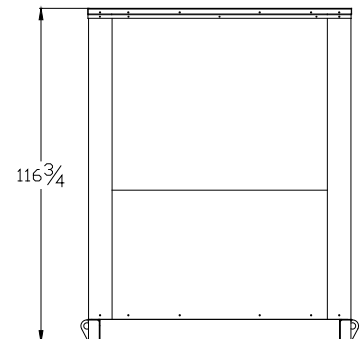
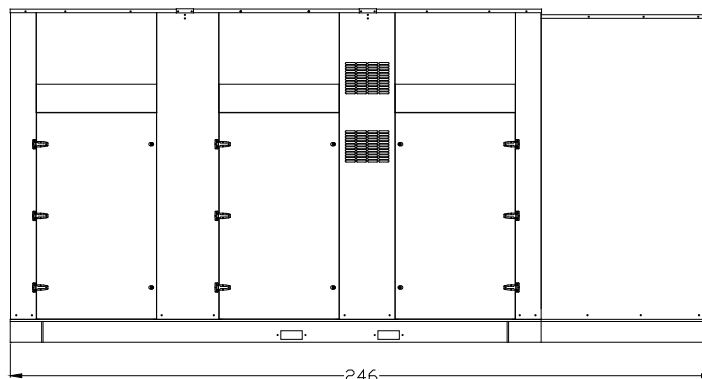
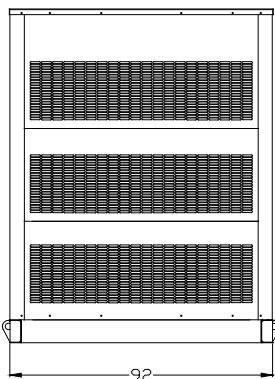
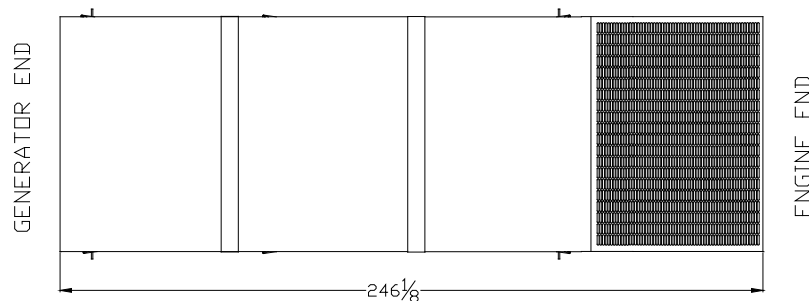
DC ELECTRICAL SYSTEM:

- 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.



32L INDUSTRIAL STATIONARY

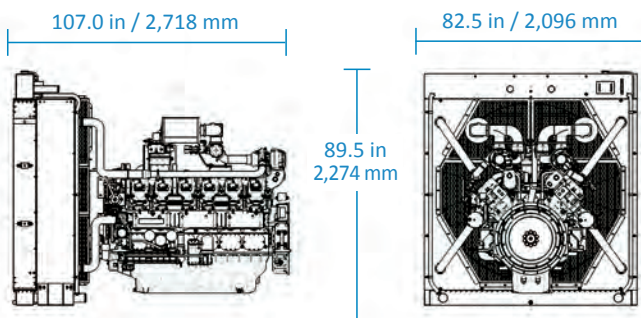
The PSI HD 32L is a U.S. EPA-certified natural gas and propane engine developed from the block up to be a reliable and durable power unit. Built upon a proven marine-diesel grade block, the 12-cylinder V-Configuration, turbocharged and after-cooled engine features replaceable wet liners and water-cooled exhaust.

Superior engine performance is driven by an ECU that integrates and coordinates all critical functions including: Governor, Variable Ignition Timing, Air Fuel Ratio Control, Knock Suppression and Engine Protection.

PSI is the market leader in providing heavy-duty products. PSI has seven models in its HD product lineup with displacements of 8.1L, 11.1L, 14.6L, 18.3L, 21.9L, 32L and 65L. These engines are an extension of the PSI product line, which is based upon blocks from 650cc to 8.8L. All PSI engines feature the same fuel systems and controls, simplifying your application development and support.

GENERAL DATA

- Turbo-charged and after cooled, cast iron with wet cylinder liners v-block
- Cast iron cylinder block with inspection door per cylinder
- Modular 4 valve cast iron cylinder heads
- Weichai supplied engine block
- High strength alloy steel forged crankshaft
- Thermostatically-controlled cooling system with engine integrated oil cooler
- Belt driven dual water pump and engine mounted fan
- J1939 CANBUS interface
- 3-Way Catalyst
- High efficiency air filter
- Variety of flywheels (14", 18"), ring gears and housings available (SAE #0, #1)
- Proven US ECU, fuel system and engine control



FEATURES

- U.S. EPA-Certified 2018
- Oil cooled light alloy pistons with high performance piston rings
- Hardened valves and valve seats
- Valley mounted water cooled exhaust manifold
- ECU based engine protection
- Telematics compatibility
- Full flow oil filter
- Manual oil pump for pre-lubrication

PSI 32-LITER ENGINE DATA

Model Number	32L
Cylinders	90°, V-12
Induction system	Turbocharged & air-to-air charge-cooled
Combustion system	Spark-ignited
Cooling system	Water-cooled
Displacement	1,941 cid (31,800 cc)
Compression ratio	10.5:1
Bore & Stroke	5.91 in x 5.91 in (150 mm x 150 mm)
Fuel Type	Natural Gas / Propane
Direction of rotation	Counter-clockwise viewed on flywheel
Dry Weight	6,001 lb (2,722 kg)

kWe

		1500 RPM	1800 RPM
Standby*	NG	481 kWe	650 kWe
	LPG	350 kWe	420 kWe
Prime*	NG	433 kWe	540 kWe
	LPG	315 kWe	378 kWe

*Assumes 10% losses for fans and genset. Ratings subject to PSI application and duty cycle guidelines.

31.8L



HEAVY-DUTY

[Stoic.]

Rev: 2

General Engine Data⁵

Type	V-Series				Flywheel housing		SAE No.0			
Number of cylinders	12				Flywheel		SAE No.18			
Aspiration	Charged Cooled Forced Induction				Dry Weight (Fan to Flywheel)		lb	kg	7100	3221
Firing Order	1 - 8 - 5 - 10 - 3 - 7 - 6 - 11 - 2 - 9 - 4 - 12				Wet Weight (Fan to Flywheel)		lb	kg	7544	3422
Rotation Viewed from Flywheel	Counter Clockwise				CG From Rear Face of Block		in	mm	37.0	941
Bore	in	mm	5.906	150	CG Above Crank Centerline		in	mm	0	0
Stroke	in	mm	5.906	150	Oil Specification		SAE 15W-40 Low Ash Gas engine oil (.25-.5% by wt), API CD/CF or higher			
Displacement	in ³	L	1941	31.8	Engine Oil Capacity ⁸					
Compression Ratio	10.5 : 1				Min		qts	L	95	90
Exhaust Manifold Type	Water Cooled				Max		qts	L	129	122
Turbo Exhaust Outlet Pipe Size	in	mm	3.5	89	ECU Oil Pressure Warning ⁶		psi	kPa	57	393
Catalyst Inlet Size	in	mm	5	127	ECU Oil Pressure Shut Down ⁶		psi	kPa	47	324
Catalyst Dp	in-H ₂ O	kPa	20.5	5.1	Oil Pressure at 1000 rpm (Idle)					
Maximum Allowable Exhaust Back Pressure	in-Hg	kPa	3.0	10.2	Min		psi	kPa	82	569
Maximum EPR Rated Pressure	psi	kPa	1.0	6.9	Max		psi	kPa	74	512
Maximum Operating pressure to EPR	in-H ₂ O	kPa	11.0	2.7	Max Allowable Oil Temperature		°F	°C	250	121
Minimum Operating pressure to EPR	in-H ₂ O	kPa	7.0	1.7	Coolant Capacity (Engine only)		gal	L	23.3	88.1
Minimum Gas Supply Pipe Size ⁵	in	mm	3	76	Coolant Capacity (Radiator only)		gal	L	23.3	88.1
Maximum Pressure Drop Across CAC	psi	kPa	1	6.9	Standard Thermostat Range					
Max Allowable Intake Restriction					Normal Operation Temperature ⁹		°F	°C	176	80
Clean Air Filter	in-H ₂ O	kPa	5	1.24	Full Open Temperature ⁹		°F	°C	198	92
Dirty Air Filter	in-H ₂ O	kPa	15	3.73	ECU Coolant Temp Warning		°F	°C	203	95
Spark Plug Part Number	Bosch R6 6857				ECU Coolant Temp Shutdown		°F	°C	208	98
Standard Spark Plug Gap ¹⁰	in	mm	0.012	0.3	50°C Ambient Capable ¹¹		Pass			
Spark Plug Coil - Primary Resistance	Ohms		0.59Ω ± 10%		Max External Coolant Friction Head		psi	kPa	7.25	50
Battery Voltage	Volts		24		CAC Rise Above Ambient Specified		F	C	15	9
Starter Motor Power	HP	kW	15.7	11.7						

Performance Data 60Hz^{3,5}

Nominal Engine Speed	RPM		1800		Water Pump Speed		RPM		3705	
Mean Piston Speed	ft/min	m/s	1772	9.0	Engine Coolant Flow		gal/min	L/min	361	1368
RPM Range (Min-Max) ISO 8528-5 G1	RPM		1778 - 1823		Cooling Fan Power ¹¹		HP	kW	62.8	47
Charging Alternator Voltage	Volts		28		Cooling Fan Speed		RPM		1050	
Charging Alternator Current	Amps		55		Cooling Fan Air Flow ¹¹		SCFM	m ³ /min	65100	1843

NG 60hz	Load		100%		75%		50%		25%	
Stand-By Power Rating ^{1,2,3,4} Per ISO 3046	HP	kW	966	720	724	540	483	360	243	181
MEP (@ rated Load on NG)	psi	bar	219	15.1	164	11.3	109	7.5	55	3.8
Fuel Consumption ^{3,4,7}	lb/hr	kg/hr	357	162	278	126	200	91	123	56
BSFC	lb/(hp-hr)	g/(kW-hr)	0.370	225	0.383	233	0.415	253	0.508	309
Turbine Outlet Temperature	°F	°C	1183	639	1111	600	1055	568	1006	541
Exhaust Mass Flow (entire engine)	lb/hr	kg/hr	6412	2908	4921	2232	3586	1627	2227	1010
Exhaust Flow at Turbine Outlet Conditions	ACFM	m ³ /min	4079	115	3126	89	2263	64	1390	39

Air Induction System⁵

Combustion Air required (entire engine)	lb/hr	kg/hr	6055	2746	4644	2106	3385	1536	2104	954
Combustion Air Volume Required (entire engine)	ACFM	m ³ /min	1320	37	1012	29	738	21	458	13
Compressor Outlet Temperature ²	°F	°C	269	132	252	122	207	97	140	60

Thermal Balance⁵

Total Fuel	BTU/min	kW	123393	2170	95872	1686	69190	1217	43019	756
Mechanical Power	BTU/min	kW	40946	720	30709	540	20473	360	10295	181
Heat Rejected to Cooling Water at Rated Load	BTU/min	kW	34074	599	26768	471	21379	376	15114	266
Heat Rejection CAC at Rated Power	BTU/min	kW	4169	73	2661	47	1435	25	475	8
Heat Rejection to Exhaust (LHV to 150C)	BTU/min	kW	27496	483	19649	346	13115	231	7370	130
Engine Radiated Heat	BTU/min	kW	16710	294	16085	283	12788	225	9765	172

¹ Standby and overload ratings based on ISO 3046 gross flywheel power.² Technical data based on ISO 3046-1 standards of 77°F(25°C), absolute pressure 14.5Psi(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 HD Technical Spec. 56300002 - Fuel Specification.⁸ Standard Sump Capacity.⁹ ± 2 degrees Celsius.¹⁰ ± 0.002" or 0.05mm.¹¹ At 0.5 in-H₂O of Package Restriction at STP.

31.8L



HEAVY-DUTY

[Stoic.]

Rev: 2

General Engine Data⁵

Type	V-Series				Flywheel housing	SAE No.0			
Number of cylinders	12				Flywheel	SAE No.18			
Aspiration	Charged Cooled Forced Induction				Dry Weight (Fan to Flywheel)	lb	kg	7100	3221
Firing Order	1 - 8 - 5 - 10 - 3 - 7 - 6 - 11 - 2 - 9 - 4 - 12				Wet Weight (Fan to Flywheel)	lb	kg	7544	3422
Rotation Viewed from Flywheel	Counter Clockwise				CG From Rear Face of Block	in	mm	37.0	941
Bore	in	mm	5.906	150	CG Above Crank Centerline	in	mm	0	0
Stroke	in	mm	5.906	150	Oil Specification	SAE 15W-40 Low Ash Gas engine oil (.25-.5% by wt), API CD/CF or higher			
Displacement	in ³	L	1941	31.8	Engine Oil Capacity ⁸				
Compression Ratio	10.5 : 1				Min	qts	L	95	90
Exhaust Manifold Type	Water Cooled				Max	qts	L	129	122
Turbo Exhaust Outlet Pipe Size	in	mm	3.5	89	ECU Oil Pressure Warning ⁶	psi	kPa	57	393
Catalyst Inlet Size	in	mm	5	127	ECU Oil Pressure Shut Down ⁶	psi	kPa	47	324
Catalyst Dp	in-H ₂ O	kPa	20.5	5.1	Oil Pressure at 1000 rpm (Idle)				
Maximum Allowable Exhaust Back Pressure	in-Hg	kPa	3.0	10.2	Min	psi	kPa	82	569
Maximum EPR Rated Pressure	psi	kPa	1.0	6.9	Max	psi	kPa	74	512
Maximum Operating pressure to EPR	in-H ₂ O	kPa	11.0	2.7	Max Allowable Oil Temperature	°F	°C	250	121
Minimum Operating pressure to EPR	in-H ₂ O	kPa	7.0	1.7	Coolant Capacity (Engine only)	gal	L	23.3	88.1
Minimum Gas Supply Pipe Size ⁵	in	mm	3	76	Coolant Capacity (Radiator only)	gal	L	23.3	88.1
Maximum Pressure Drop Across CAC	psi	kPa	1	6.9	Standard Thermostat Range				
Max Allowable Intake Restriction					Normal Operation Temperature ⁹	°F	°C	176	80
Clean Air Filter	in-H ₂ O	kPa	5	1.24	Full Open Temperature ⁹	°F	°C	198	92
Dirty Air Filter	in-H ₂ O	kPa	15	3.73	ECU Coolant Temp Warning	°F	°C	203	95
Spark Plug Part Number	Bosch R6 6857				ECU Coolant Temp Shutdown	°F	°C	208	98
Standard Spark Plug Gap ¹⁰	in	mm	0.012	0.3	50°C Ambient Capable ¹¹	Pass			
Spark Plug Coil - Primary Resistance	Ohms		0.59Ω ± 10%		Max External Coolant Friction Head	psi	kPa	7.25	50
Battery Voltage	Volts		24		CAC Rise Above Ambient Specified	F	C	15	9
Starter Motor Power	HP	kW	15.7	11.7					

Performance Data 50Hz^{3,5}

Nominal Engine Speed	RPM		1500		Water Pump Speed	RPM		3088	
Mean Piston Speed	ft/min	m/s	1476	7.5	Engine Coolant Flow	gal/min	L/min	297	1126
RPM Range (Min-Max) ISO 8528-5 G1	RPM		1477 - 1519		Cooling Fan Power ¹¹	HP	kW	36	27
Charging Alternator Voltage	Volts		28		Cooling Fan Speed	RPM		875	
Charging Alternator Current	Amps		53		Cooling Fan Air Flow ¹¹	SCFM	m ³ /min	54200	1535

NG 50hz	Load		100%		75%		50%		25%	
Stand-By Power Rating ^{1,2,3,4} Per ISO 3046	HP	kW	805	600	603	450	402	300	202	151
MEP (@ rated Load on NG)	psi	bar	219	15.1	164	11.3	109	7.5	55	3.8
Fuel Consumption ^{3,4,7}	lb/hr	kg/hr	292	133	225	102	164	74	102	46
BSFC	lb/(hp-hr)	g/(kW-hr)	0.363	221	0.373	227	0.408	248	0.502	306
Turbine Outlet Temperature	°F	°C	1078	581	1032	556	990	532	915	491
Exhaust Mass Flow (entire engine)	lb/hr	kg/hr	4863	2206	3814	1730	2771	1257	1733	786
Exhaust Flow at Turbine Outlet Conditions	ACFM	m ³ /min	3183	90	2477	70	1772	50	1071	30

Air Induction System⁵

Combustion Air required (entire engine)	lb/hr	kg/hr	4571	2073	3589	1628	2607	1183	1631	740
Combustion Air Volume Required (entire engine)	ACFM	m ³ /min	996	28	782	22	568	16	355	10
Compressor Outlet Temperature ²	°F	°C	254	124	223	106	172	78	124	51

Thermal Balance⁵

Total Fuel	BTU/min	kW	99707	1753	78048	1372	56389	992	34855	613
Mechanical Power	BTU/min	kW	34121	600	25591	450	17061	300	8580	151
Heat Rejected to Cooling Water at Rated Load	BTU/min	kW	27127	477	23202	408	18642	328	13478	237
Heat Rejection CAC at Rated Power	BTU/min	kW	3151	55	2041	36	902	16	247	4
Heat Rejection to Exhaust (LHV to 150C)	BTU/min	kW	18671	328	13756	242	9269	163	5094	90
Engine Radiated Heat	BTU/min	kW	16637	293	13458	237	10516	185	7456	131

¹ Standby and overload ratings based on ISO 3046 gross flywheel power.² Technical data based on ISO 3046-1 standards of 77°F(25°C), absolute pressure 14.5Psi(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 HD Technical Spec. 56300002 - Fuel Specification.⁸ Standard Sump Capacity.⁹ ± 2 degrees Celsius.¹⁰ ± 0.002" or 0.05mm.¹¹ At 0.5 in-H₂O of Package Restriction at STP.

31.8L



HEAVY-DUTY

[Stoic.]

Rev: 2

General Engine Data⁵

Type	V-Series				Flywheel housing	SAE No.0			
Number of cylinders	12				Flywheel	SAE No.18			
Aspiration	Charged Cooled Forced Induction				Dry Weight (Fan to Flywheel)	lb	kg	7100	3221
Firing Order	1 - 8 - 5 - 10 - 3 - 7 - 6 - 11 - 2 - 9 - 4 - 12				Wet Weight (Fan to Flywheel)	lb	kg	7544	3422
Rotation Viewed from Flywheel	Counter Clockwise				CG From Rear Face of Block	in	mm	37.0	941
Bore	in	mm	5.906	150	CG Above Crank Centerline	in	mm	0	0
Stroke	in	mm	5.906	150	Oil Specification	SAE 15W-40 Low Ash Gas engine oil (.25-.5% by wt), API CD/CF or higher			
Displacement	in ³	L	1941	31.8	Engine Oil Capacity ⁸				
Compression Ratio	10.5 : 1				Min	qts	L	95	90
Exhaust Manifold Type	Water Cooled				Max	qts	L	129	122
Turbo Exhaust Outlet Pipe Size	in	mm	3.5	89	ECU Oil Pressure Warning ⁶	psi	kPa	57	393
Catalyst Inlet Size	in	mm	5	127	ECU Oil Pressure Shut Down ⁶	psi	kPa	47	324
Catalyst Dp	in-H ₂ O	kPa	20.5	5.1	Oil Pressure at 1000 rpm (Idle)				
Maximum Allowable Exhaust Back Pressure	in-Hg	kPa	3.0	10.2	Min	psi	kPa	82	569
Maximum EPR Rated Pressure	psi	kPa	1.0	6.9	Max	psi	kPa	74	512
Maximum Operating pressure to EPR	in-H ₂ O	kPa	11.0	2.7	Max Allowable Oil Temperature	°F	°C	250	121
Minimum Operating pressure to EPR	in-H ₂ O	kPa	7.0	1.7	Coolant Capacity (Engine only)	gal	L	23.3	88.1
Minimum Gas Supply Pipe Size ⁵	in	mm	3	76	Coolant Capacity (Radiator only)	gal	L	23.3	88.1
Maximum Pressure Drop Across CAC	psi	kPa	1	6.9	Standard Thermostat Range				
Max Allowable Intake Restriction					Normal Operation Temperature ⁹	°F	°C	176	80
Clean Air Filter	in-H ₂ O	kPa	5	1.24	Full Open Temperature ⁹	°F	°C	198	92
Dirty Air Filter	in-H ₂ O	kPa	15	3.73	ECU Coolant Temp Warning	°F	°C	203	95
Spark Plug Part Number	Bosch R6 6857				ECU Coolant Temp Shutdown	°F	°C	208	98
Standard Spark Plug Gap ¹⁰	in	mm	0.012	0.3	50°C Ambient Capable ¹¹	Pass			
Spark Plug Coil - Primary Resistance	Ohms		0.59Ω ± 10%		Max External Coolant Friction Head	psi	kPa	7.25	50
Battery Voltage	Volts		24		CAC Rise Above Ambient Specified	F	C	15	9
Starter Motor Power	HP	kW	15.7	11.7					

Performance Data 60Hz^{3,5}

Nominal Engine Speed	RPM		1800		Water Pump Speed	RPM		3705	
Mean Piston Speed	ft/min	m/s	1772	9.0	Engine Coolant Flow	gal/min	L/min	361	1368
RPM Range (Min-Max) ISO 8528-5 G1	RPM		1778 - 1823		Cooling Fan Power ¹¹	HP	kW	62.8	47
Charging Alternator Voltage	Volts		28		Cooling Fan Speed	RPM		1050	
Charging Alternator Current	Amps		55		Cooling Fan Air Flow ¹¹	SCFM	m ³ /min	65100	1843

LPG 60hz	Load		100%		75%		50%		25%	
Stand-By Power Rating ^{1,2,3,4} Per ISO 3046	HP	kW	637	475	478	356	318	238	160	119
MEP (@ rated Load on NG)	psi	bar	144	10.0	108	7.5	72	5.0	36	2.5
Fuel Consumption ^{3,4,7}	lb/hr	kg/hr	300	136	222	101	153	69	107	49
BSFC	lb/(hp-hr)	g/(kW-hr)	0.471	287	0.465	283	0.479	291	0.669	407
Turbine Outlet Temperature	°F	°C	1208	653	1117	603	1057	569	973	523
Exhaust Mass Flow (entire engine)	lb/hr	kg/hr	4851	2201	3601	1633	2556	1160	1737	788
Exhaust Flow at Turbine Outlet Conditions	ACFM	m ³ /min	3439	97	2493	71	1748	49	1123	32

Air Induction System⁵

Combustion Air required (entire engine)	lb/hr	kg/hr	4551	2064	3379	1533	2404	1090	1630	739
Combustion Air Volume Required (entire engine)	ACFM	m ³ /min	992	28	736	21	524	15	355	10
Compressor Outlet Temperature ²	°F	°C	255	124	220	104	164	73	123	50

Thermal Balance⁵

Total Fuel	BTU/min	kW	97288	1711	72203	1270	51298	902	34824	612
Mechanical Power	BTU/min	kW	27013	475	20260	356	13506	238	6792	119
Heat Rejected to Cooling Water at Rated Load	BTU/min	kW	30994	545	25757	453	20306	357	14388	253
Heat Rejection CAC at Rated Power	BTU/min	kW	3127	55	1868	33	770	14	240	4
Heat Rejection to Exhaust (LHV to 150C)	BTU/min	kW	22299	392	14605	257	9642	170	5609	99
Engine Radiated Heat	BTU/min	kW	13855	244	9713	171	7073	124	7796	137

¹ Standby and overload ratings based on ISO 3046 gross flywheel power.

² Technical data based on ISO 3046-1 standards of 77°F(25°C), absolute pressure 14.5Psi(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 LPG 46.38 MJ/kg.

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

⁶ >1400RPM.

⁷ See PSI HD Technical Spec. 56300002 - Fuel Specification.

⁸ Standard Sump Capacity.

⁹ ± 2 degrees Celsius.

¹⁰ ± 0.002" or 0.05mm.

¹¹ At 0.5 in-H₂O of Package Restriction at STP.

31.8L



HEAVY-DUTY

[Stoic.]

Rev: 2

General Engine Data⁵

Type	V-Series				Flywheel housing		SAE No.0			
Number of cylinders	12				Flywheel		SAE No.18			
Aspiration	Charged Cooled Forced Induction				Dry Weight (Fan to Flywheel)		lb	kg	7100	3221
Firing Order	1 - 8 - 5 - 10 - 3 - 7 - 6 - 11 - 2 - 9 - 4 - 12				Wet Weight (Fan to Flywheel)		lb	kg	7544	3422
Rotation Viewed from Flywheel	Counter Clockwise				CG From Rear Face of Block		in	mm	37.0	941
Bore	in	mm	5.906	150	CG Above Crank Centerline		in	mm	0	0
Stroke	in	mm	5.906	150	Oil Specification		SAE 15W-40 Low Ash Gas engine oil (.25-.5% by wt), API CD/CF or higher			
Displacement	in ³	L	1941	31.8	Engine Oil Capacity ⁸					
Compression Ratio	10.5 : 1				Min		qts	L	95	90
Exhaust Manifold Type	Water Cooled				Max		qts	L	129	122
Turbo Exhaust Outlet Pipe Size	in	mm	3.5	89	ECU Oil Pressure Warning ⁶		psi	kPa	57	393
Catalyst Inlet Size	in	mm	5	127	ECU Oil Pressure Shut Down ⁶		psi	kPa	47	324
Catalyst Dp	in-H ₂ O	kPa	20.5	5.1	Oil Pressure at 1000 rpm (Idle)					
Maximum Allowable Exhaust Back Pressure	in-Hg	kPa	3.0	10.2	Min		psi	kPa	82	569
Maximum EPR Rated Pressure	psi	kPa	1.0	6.9	Max		psi	kPa	74	512
Maximum Operating pressure to EPR	in-H ₂ O	kPa	11.0	2.7	Max Allowable Oil Temperature		°F	°C	250	121
Minimum Operating pressure to EPR	in-H ₂ O	kPa	7.0	1.7	Coolant Capacity (Engine only)		gal	L	23.3	88.1
Minimum Gas Supply Pipe Size ⁵	in	mm	3	76	Coolant Capacity (Radiator only)		gal	L	23.3	88.1
Maximum Pressure Drop Across CAC	psi	kPa	1	6.9	Standard Thermostat Range					
Max Allowable Intake Restriction					Normal Operation Temperature ⁹		°F	°C	176	80
Clean Air Filter	in-H ₂ O	kPa	5	1.24	Full Open Temperature ⁹		°F	°C	198	92
Dirty Air Filter	in-H ₂ O	kPa	15	3.73	ECU Coolant Temp Warning		°F	°C	203	95
Spark Plug Part Number	Bosch R6 6857				ECU Coolant Temp Shutdown		°F	°C	208	98
Standard Spark Plug Gap ¹⁰	in	mm	0.012	0.3	50°C Ambient Capable ¹¹		Pass			
Spark Plug Coil - Primary Resistance	Ohms		0.59Ω ± 10%		Max External Coolant Friction Head		psi	kPa	7.25	50
Battery Voltage	Volts		24		CAC Rise Above Ambient Specified		F	C	15	9
Starter Motor Power	HP	kW	15.7	11.7						

Performance Data 50Hz^{3,5}

Nominal Engine Speed	RPM		1500		Water Pump Speed		RPM		3088	
Mean Piston Speed	ft/min	m/s	1476	7.5	Engine Coolant Flow		gal/min	L/min	297	1125.6
RPM Range (Min-Max) ISO 8528-5 G1	RPM		1477 - 1519		Cooling Fan Power ¹¹		HP	kW	36.4	27
Charging Alternator Voltage	Volts		28		Cooling Fan Speed		RPM		875	
Charging Alternator Current	Amps		53		Cooling Fan Air Flow ¹¹		SCFM	m ³ /min	54200	1535

LPG 50hz	Load		100%		75%		50%		25%	
Stand-By Power Rating ^{1,2,3,4} Per ISO 3046	HP	kW	543	405	407	304	272	203	137	102
MEP (@ rated Load on NG)	psi	bar	148	10.2	111	7.6	74	5.1	37	2.6
Fuel Consumption ^{3,4,7}	lb/hr	kg/hr	249	113	179	81	129	58	87	40
BSFC	lb/(hp-hr)	g/(kW-hr)	0.459	279	0.439	267	0.474	288	0.640	389
Turbine Outlet Temperature	°F	°C	1168	631	1077	581	1022	550	947	508
Exhaust Mass Flow (entire engine)	lb/hr	kg/hr	4051	1838	2895	1313	2097	951	1440	653
Exhaust Flow at Turbine Outlet Conditions	ACFM	m ³ /min	2913	82	2017	57	1426	40	943	27

Air Induction System⁵

Combustion Air required (entire engine)	lb/hr	kg/hr	3802	1725	2716	1232	1969	893	1352	613
Combustion Air Volume Required (entire engine)	ACFM	m ³ /min	829	23	592	17	429	12	295	8
Compressor Outlet Temperature ²	°F	°C	246	119	185	85	144	62	113	45

Thermal Balance⁵

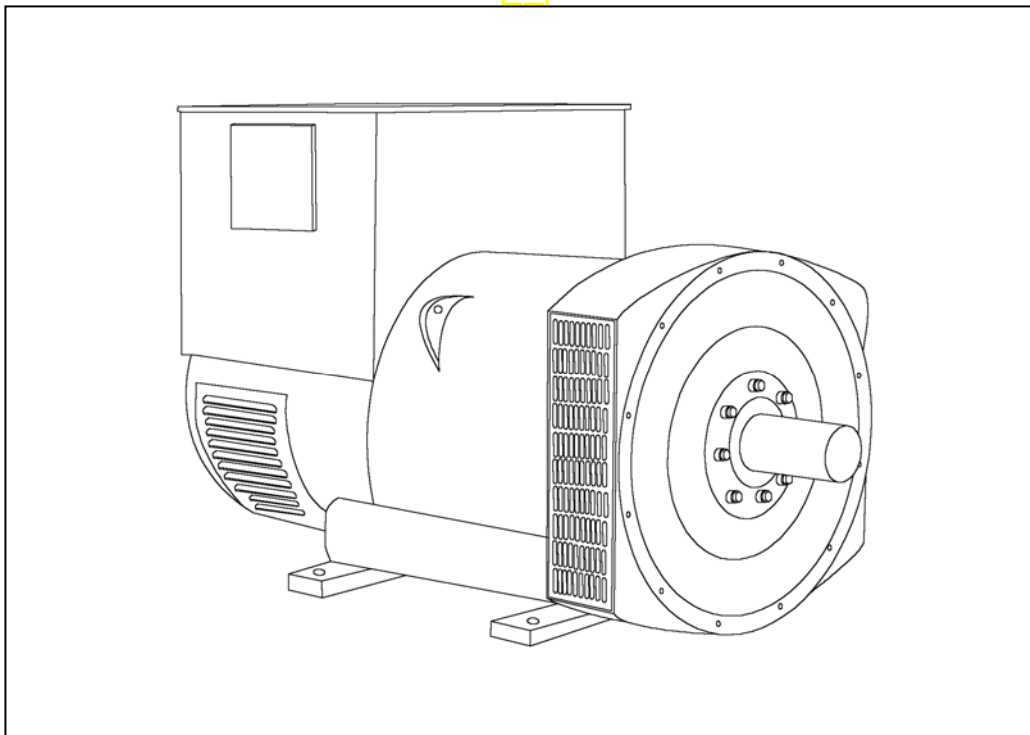
Total Fuel	BTU/min	kW	81417	1432	58071	1021	42143	741	28738	505
Mechanical Power	BTU/min	kW	23032	405	17274	304	11516	203	5791	102
Heat Rejected to Cooling Water at Rated Load	BTU/min	kW	26302	462	20356	358	16728	294	12536	220
Heat Rejection CAC at Rated Power	BTU/min	kW	2486	44	1115	20	486	9	145	3
Heat Rejection to Exhaust (LHV to 150C)	BTU/min	kW	17788	313	11078	195	7540	133	4416	78
Engine Radiated Heat	BTU/min	kW	11809	208	8248	145	5873	103	5850	103

¹ Standby and overload ratings based on ISO 3046 gross flywheel power.² Technical data based on ISO 3046-1 standards of 77°F(25°C), absolute pressure 14.5Psi(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 LPG 46.38 MJ/kg.⁵ All values in the following section are provided for informational purpose only and are non-binding.⁶ >1400RPM.⁷ See PSI HD Technical Spec. 56300002 - Fuel Specification.⁸ Standard Sump Capacity.⁹ ± 2 degrees Celsius.¹⁰ ± 0.002" or 0.05mm.¹¹ At 0.5 in-H₂O of Package Restriction at STP.

STAMFORD®

HCI 534F/544F - Winding 311

Technical  Data Sheet



HCI534F/544F

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 REGULATORS

AS440 AVR - STANDARD

With this self-excited system the main stator provides power via the Automatic Voltage Regulator (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 AS440 will support a range of electronic accessories, including a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

MX341 AVR

This sophisticated AVR is incorporated into the Stamford Permanent Magnet Generator (PMG) control system.

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.

An engine relief load acceptance feature can enable full load to be applied to the generator in a single step.

If three-phase sensing is required with the PMG system the MX321 AVR must be used.

We recommend three-phase sensing for applications with greatly unbalanced or highly non-linear loads.

MX321 AVR

The most sophisticated of all our AVRs combines all the features of the MX341 with, additionally, three-phase rms sensing, for improved regulation and performance.

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 are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted on a cover 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.

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.

WINDING 311

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.		
A.V.R.	MX321	MX341	
VOLTAGE REGULATION	± 0.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 7)		

CONTROL SYSTEM	SELF EXCITED		
A.V.R.	AS440		
VOLTAGE REGULATION	± 1.0 %	With 4% ENGINE GOVERNING	
SUSTAINED SHORT CIRCUIT	SERIES 4 CONTROL DOES NOT SUSTAIN A SHORT CIRCUIT CURRENT		

INSULATION SYSTEM	CLASS H		
PROTECTION	IP23		
RATED POWER FACTOR	0.8		
STATOR WINDING	DOUBLE LAYER LAP		
WINDING PITCH	TWO THIRDS		
WINDING LEADS	12		

STATOR WDG. RESISTANCE	0.0037 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED		
ROTOR WDG. RESISTANCE	2.16 Ohms at 22°C		
EXCITER STATOR RESISTANCE	17 Ohms at 22°C		
EXCITER ROTOR RESISTANCE	0.092 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. 6220 (ISO)		
BEARING NON-DRIVE END	BALL. 6314 (ISO)		

	1 BEARING		2 BEARING	
WEIGHT COMP. GENERATOR	1685 kg		1694 kg	
WEIGHT WOUND STATOR	805 kg		805 kg	
WEIGHT WOUND ROTOR	684 kg		655 kg	
WR ² INERTIA	10.033 kgm ²		9.7551 kgm ²	
SHIPPING WEIGHTS in a crate	1775 kg		1780kg	
PACKING CRATE SIZE	166 x 87 x 124(cm)		166 x 87 x 124(cm)	
	50 Hz		60 Hz	
TELEPHONE INTERFERENCE	THF<2%		TIF<50	
COOLING AIR	1.035 m ³ /sec 2202 cfm		1.312 m ³ /sec 2780 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	670	670	670	650	738	775	800	825
Xd DIR. AXIS SYNCHRONOUS	2.90	2.62	2.43	2.10	3.33	3.13	2.95	2.80
X'd DIR. AXIS TRANSIENT	0.16	0.14	0.13	0.11	0.16	0.15	0.14	0.13
X''d DIR. AXIS SUBTRANSIENT	0.11	0.10	0.09	0.08	0.11	0.10	0.10	0.09
Xq QUAD. AXIS REACTANCE	2.42	2.19	2.03	1.75	2.66	2.50	2.36	2.23
X''q QUAD. AXIS SUBTRANSIENT	0.25	0.23	0.21	0.18	0.31	0.29	0.27	0.26
X _L LEAKAGE REACTANCE	0.05	0.04	0.04	0.03	0.05	0.05	0.04	0.04
X ₂ NEGATIVE SEQUENCE	0.18	0.16	0.15	0.13	0.21	0.20	0.19	0.18
X ₀ ZERO SEQUENCE	0.08	0.08	0.07	0.06	0.09	0.08	0.08	0.08

REACTANCES ARE SATURATED		VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED	
T'd TRANSIENT TIME CONST.		0.08s	
T''d SUB-TRANSTIME CONST.		0.012s	
T'do O.C. FIELD TIME CONST.		2.5s	
Ta ARMATURE TIME CONST.		0.019s	
SHORT CIRCUIT RATIO		1/Xd	

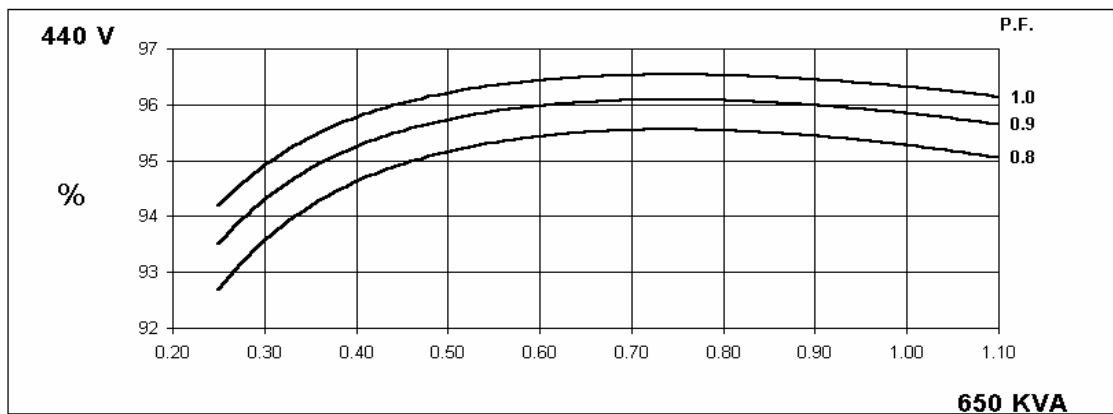
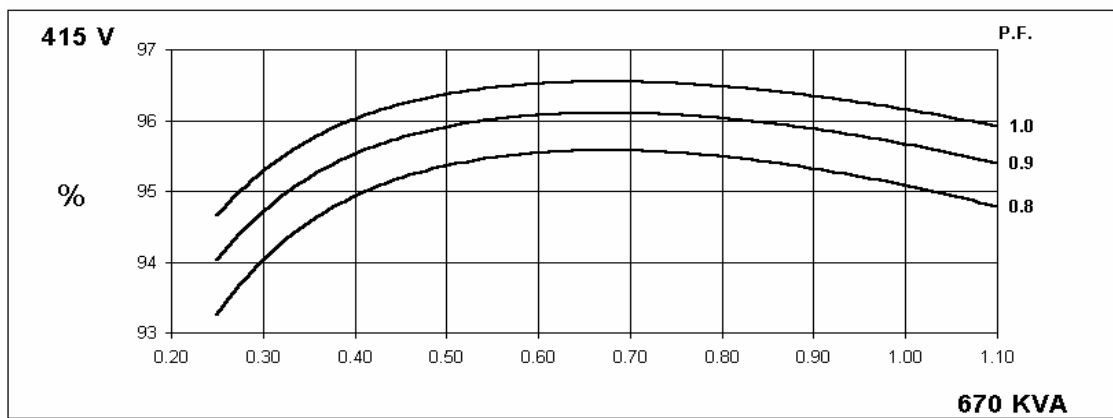
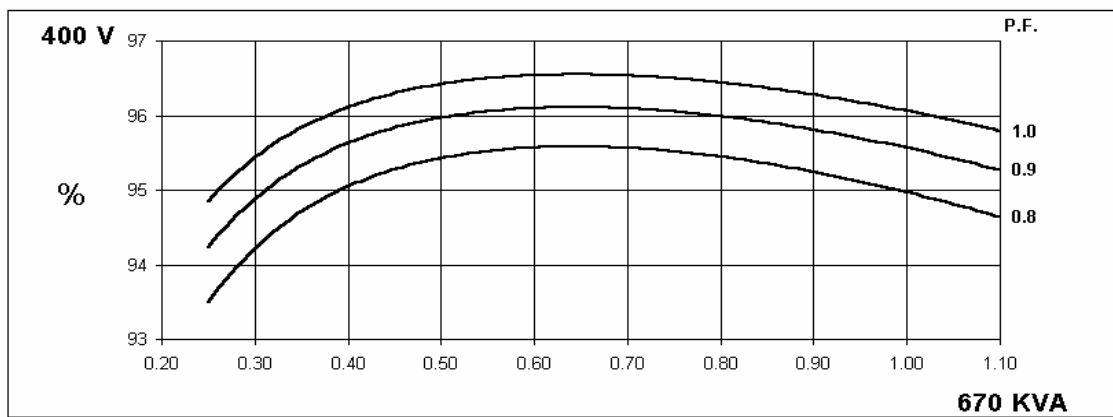
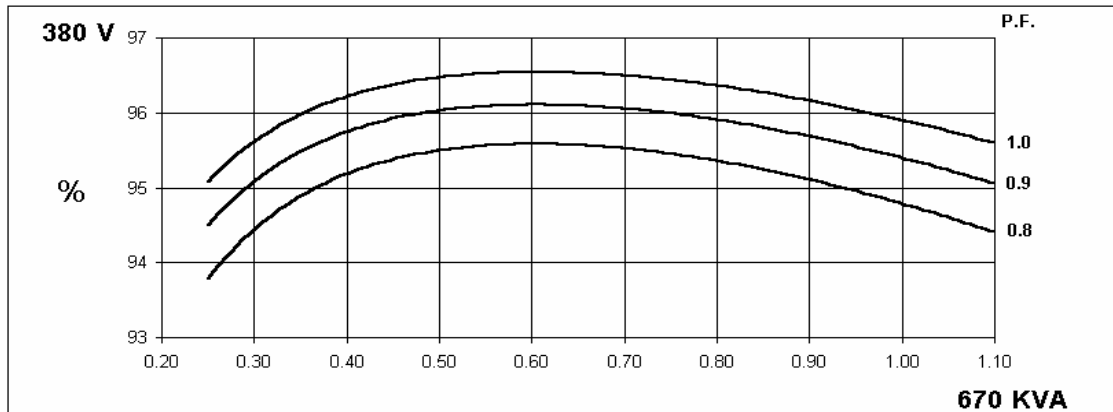
50
Hz

HCI534F/544F

Winding 311

STAMFORD

THREE PHASE EFFICIENCY CURVES



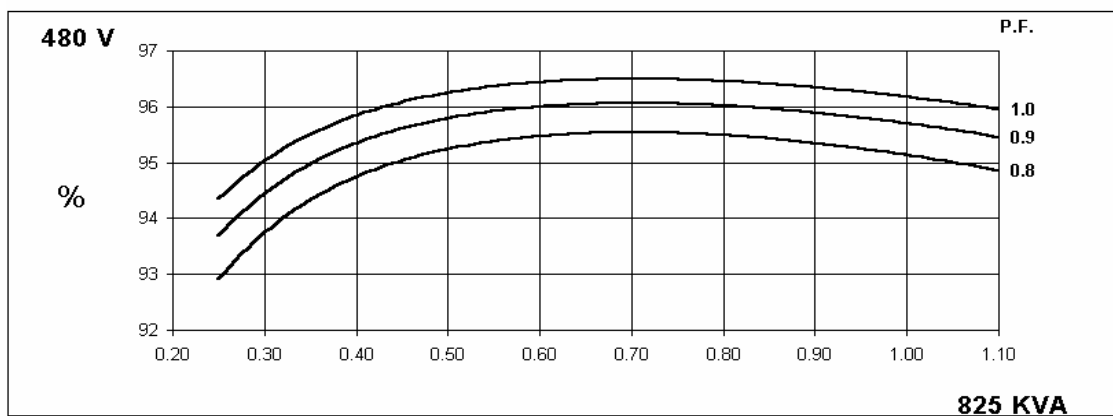
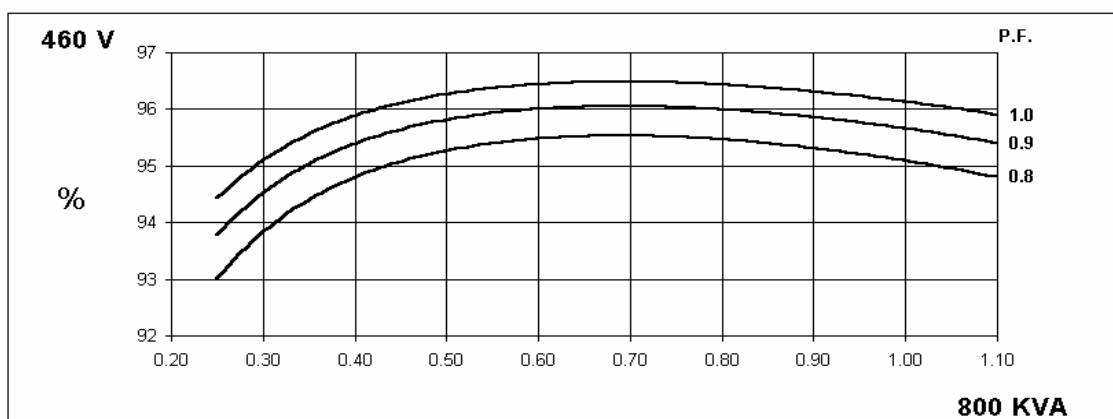
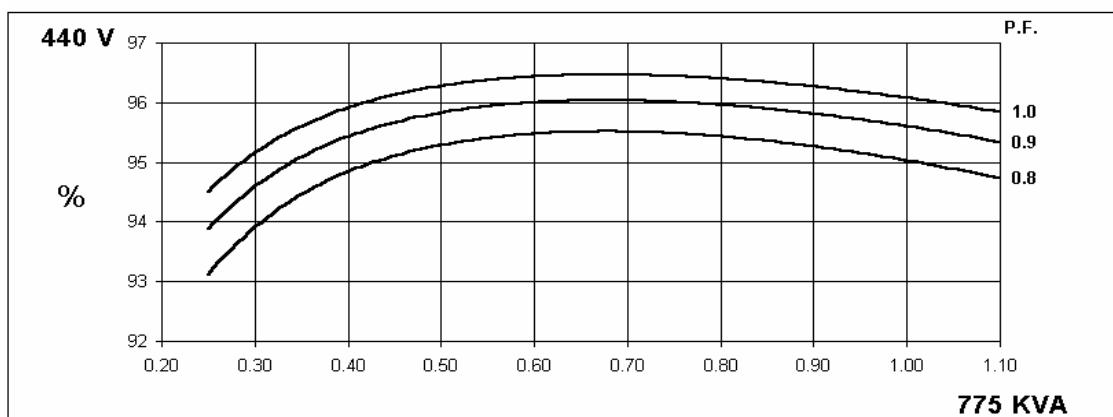
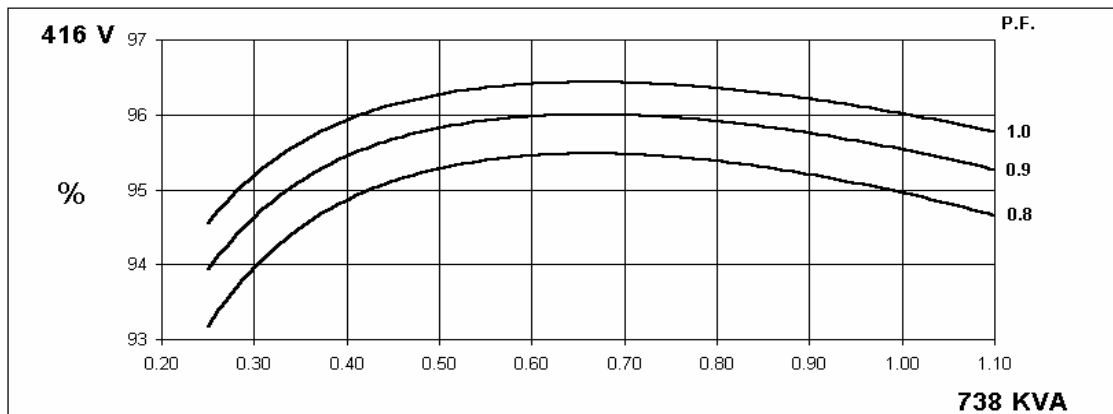
60
Hz

HCI534F/544F

Winding 311

STAMFORD

THREE PHASE EFFICIENCY CURVES

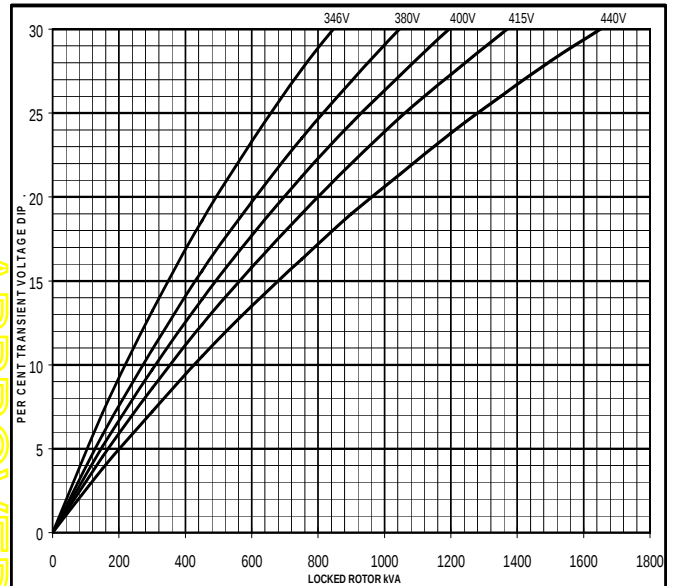
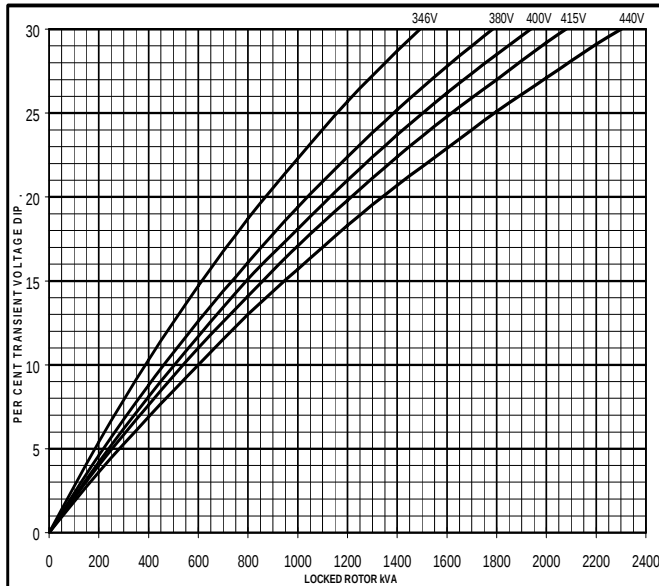


Locked Rotor Motor Starting Curve

50
Hz

MX

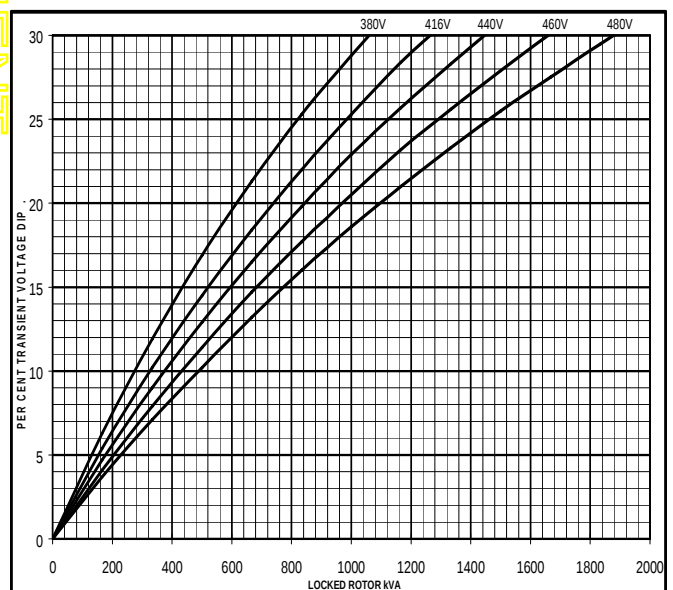
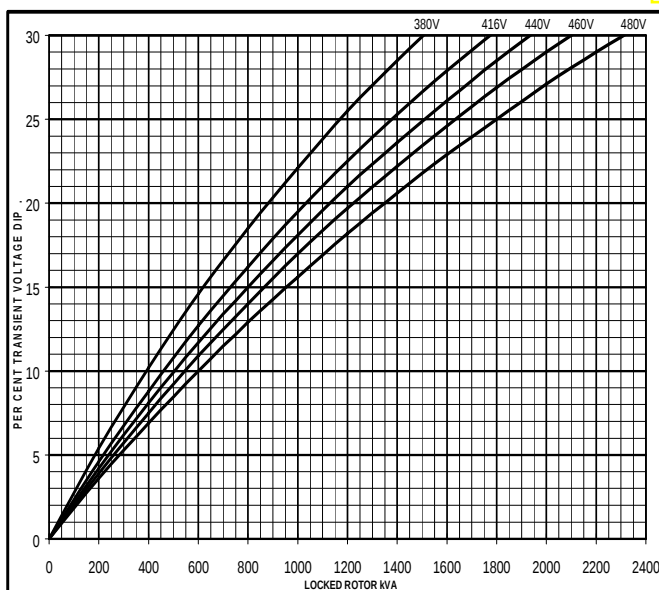
SX



60
Hz

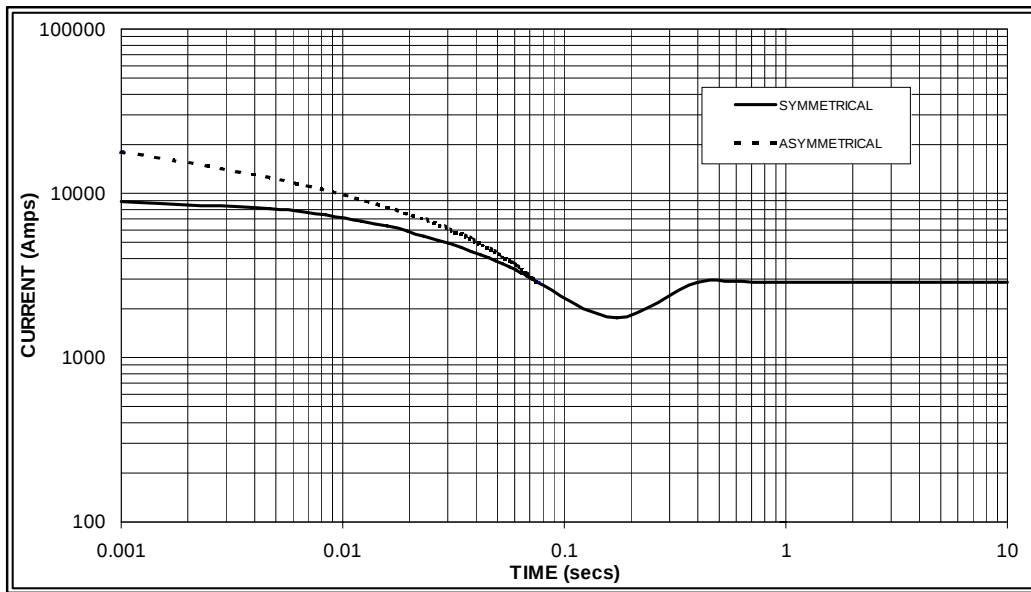
MX

SX



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

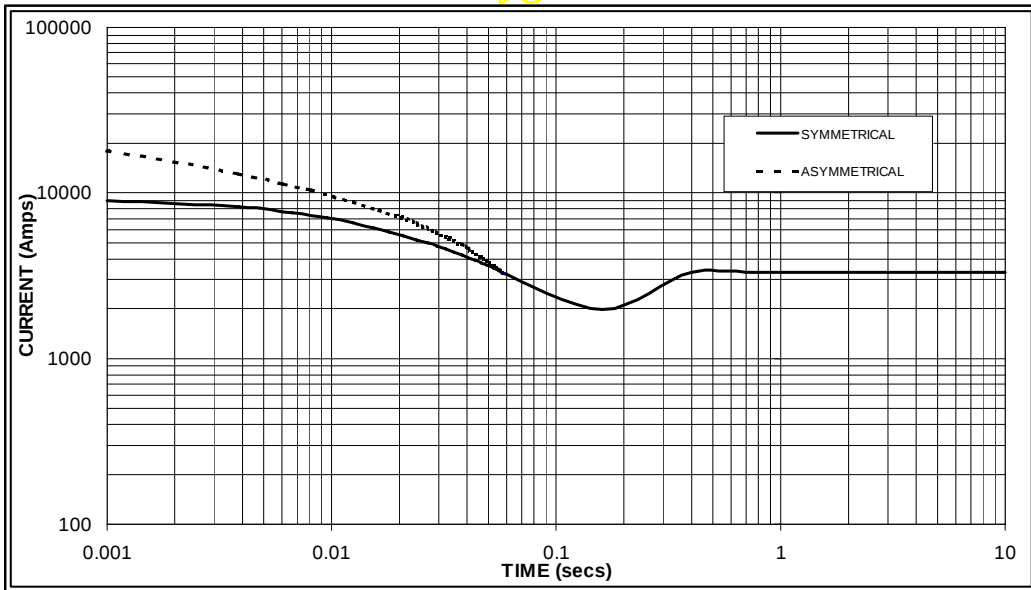
**50
Hz**



Sustained Short Circuit = 2,900 Amps



**60
Hz**



Sustained Short Circuit = 3,300 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 1.06	440v	X 1.06
415v	X 1.09	460v	X 1.12
440v	X 1.12	480v	X 1.20

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 connections 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

HCI534F/544F

Winding 311 0.8 Power Factor

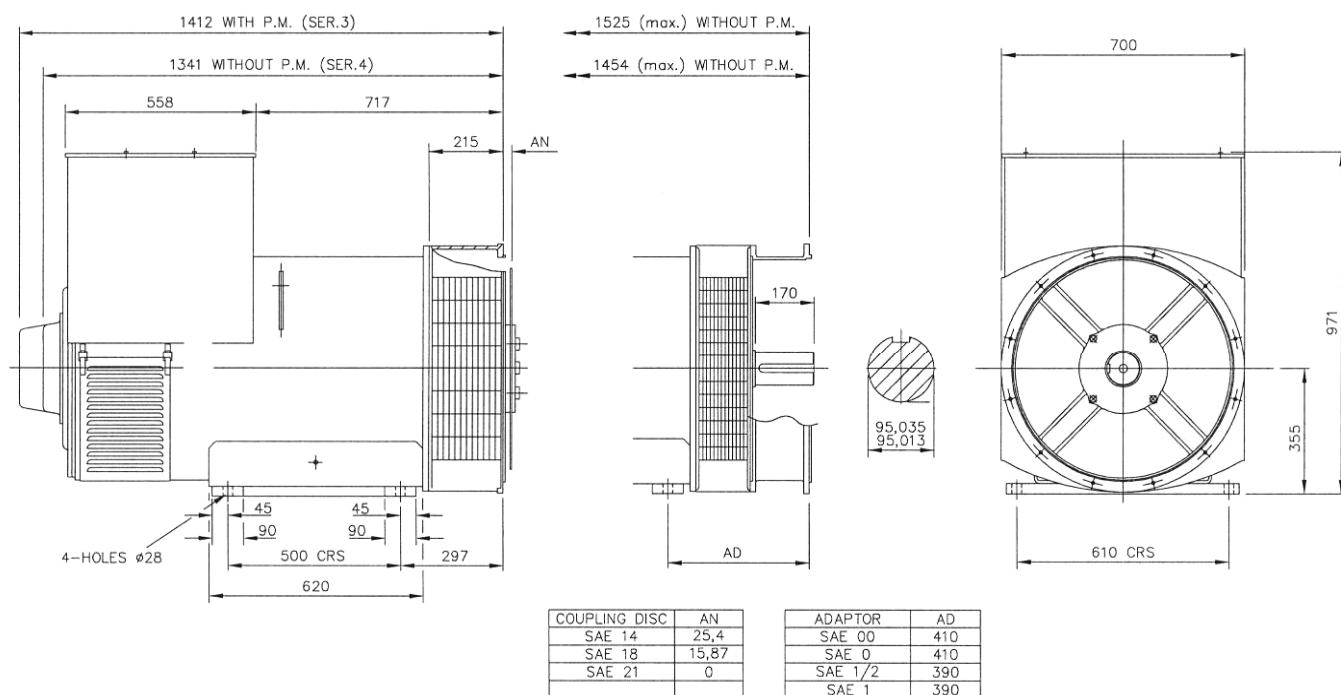
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RATINGS

Class - Temp Rise		Cont. F - 105/40°C				Cont. H - 125/40°C				Standby - 150/40°C				Standby - 163/27°C			
50 Hz	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	620	620	620	600	670	670	670	650	710	710	710	690	738	738	738	715
	kW	496	496	496	480	536	536	536	520	568	568	568	552	590	590	590	572
	Efficiency (%)	95.0	95.2	95.3	95.4	94.8	95.0	95.1	95.3	94.6	94.8	94.9	95.1	94.4	94.6	94.8	95.1
	kW Input	522	521	520	503	565	564	564	546	600	599	599	580	625	624	623	601

60 Hz	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	688	719	731	750	738	775	800	825	781	819	848	875	806	844	878	906
	kW	550	575	585	600	590	620	640	660	625	655	678	700	645	675	702	725
	Efficiency (%)	95.1	95.2	95.3	95.3	95.0	95.0	95.1	95.1	94.8	94.9	94.9	95.0	94.7	94.8	94.8	94.9
	kW Input	579	604	614	630	621	653	673	694	659	690	715	737	681	712	741	764

DIMENSIONS



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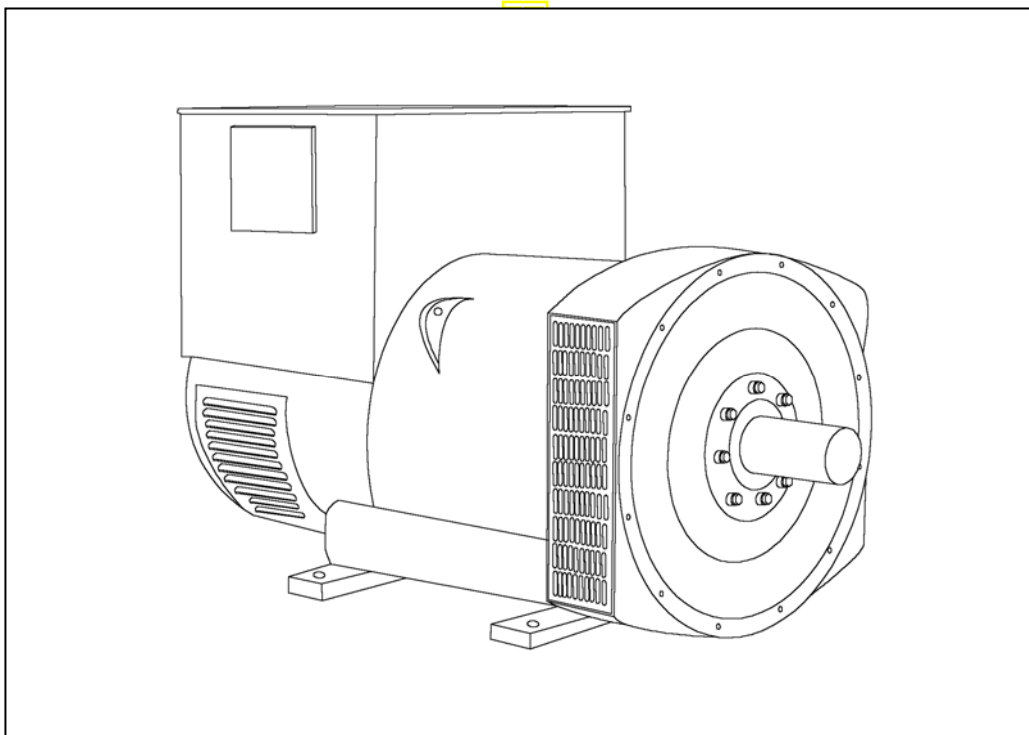
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HC5F-311-TD-EN-SG-A

STAMFORD®

HCI 534E/544E - Winding 311

Technical  Data Sheet



HCI534E/544E

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 REGULATORS

AS440 AVR - STANDARD

With this self-excited system the main stator provides power via the Automatic Voltage Regulator (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 AS440 will support a range of electronic accessories, including a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

MX341 AVR

This sophisticated AVR is incorporated into the Stamford Permanent Magnet Generator (PMG) control system.

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.

An engine relief load acceptance feature can enable full load to be applied to the generator in a single step.

If three-phase sensing is required with the PMG system the MX321 AVR must be used.

We recommend three-phase sensing for applications with greatly unbalanced or highly non-linear loads.

MX321 AVR

The most sophisticated of all our AVRs combines all the features of the MX341 with, additionally, three-phase rms sensing, for improved regulation and performance.

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 are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted on a cover 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.

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.

WINDING 311

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.		
A.V.R.	MX321	MX341	
VOLTAGE REGULATION	± 0.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 7)		

CONTROL SYSTEM	SELF EXCITED		
A.V.R.	AS440		
VOLTAGE REGULATION	± 1.0 %	With 4% ENGINE GOVERNING	
SUSTAINED SHORT CIRCUIT	SERIES 4 CONTROL DOES NOT SUSTAIN A SHORT CIRCUIT CURRENT		

INSULATION SYSTEM	CLASS H		
PROTECTION	IP23		
RATED POWER FACTOR	0.8		
STATOR WINDING	DOUBLE LAYER LAP		
WINDING PITCH	TWO THIRDS		
WINDING LEADS	12		

STATOR WDG. RESISTANCE	0.0043 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED		
ROTOR WDG. RESISTANCE	1.96 Ohms at 22°C		
EXCITER STATOR RESISTANCE	17 Ohms at 22°C		
EXCITER ROTOR RESISTANCE	0.092 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. 6220 (ISO)		
BEARING NON-DRIVE END	BALL. 6314 (ISO)		

	1 BEARING		2 BEARING	
WEIGHT COMP. GENERATOR	1543 kg		1535 kg	
WEIGHT WOUND STATOR	722 kg		722 kg	
WEIGHT WOUND ROTOR	617 kg		588 kg	
WR ² INERTIA	8.9828 kgm ²		8.7049 kgm ²	
SHIPPING WEIGHTS in a crate	1635 kg		1625 kg	
PACKING CRATE SIZE	166 x 87 x 124(cm)		166 x 87 x 124(cm)	
	50 Hz		60 Hz	
TELEPHONE INTERFERENCE	THF<2%		TIF<50	
COOLING AIR	1.035 m³/sec 2202 cfm		1.312 m³/sec 2780 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	600	610	600	600	681	713	731	750
Xd DIR. AXIS SYNCHRONOUS	3.14	2.88	2.63	2.34	3.53	3.30	3.10	2.92
X'd DIR. AXIS TRANSIENT	0.17	0.15	0.14	0.12	0.17	0.16	0.15	0.14
X''d DIR. AXIS SUBTRANSIENT	0.12	0.11	0.10	0.09	0.12	0.11	0.11	0.10
Xq QUAD. AXIS REACTANCE	2.45	2.25	2.05	1.82	2.82	2.64	2.48	2.33
X''q QUAD. AXIS SUBTRANSIENT	0.26	0.24	0.22	0.20	0.34	0.32	0.30	0.28
X _L LEAKAGE REACTANCE	0.06	0.05	0.05	0.04	0.06	0.06	0.05	0.05
X ₂ NEGATIVE SEQUENCE	0.18	0.16	0.15	0.13	0.23	0.22	0.20	0.19
X ₀ ZERO SEQUENCE	0.08	0.08	0.07	0.06	0.10	0.09	0.09	0.08

REACTANCES ARE SATURATED		VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED	
T'd TRANSIENT TIME CONST.		0.08s	
T''d SUB-TRANSTIME CONST.		0.012s	
T'do O.C. FIELD TIME CONST.		2.5s	
Ta ARMATURE TIME CONST.		0.019s	
SHORT CIRCUIT RATIO		1/Xd	

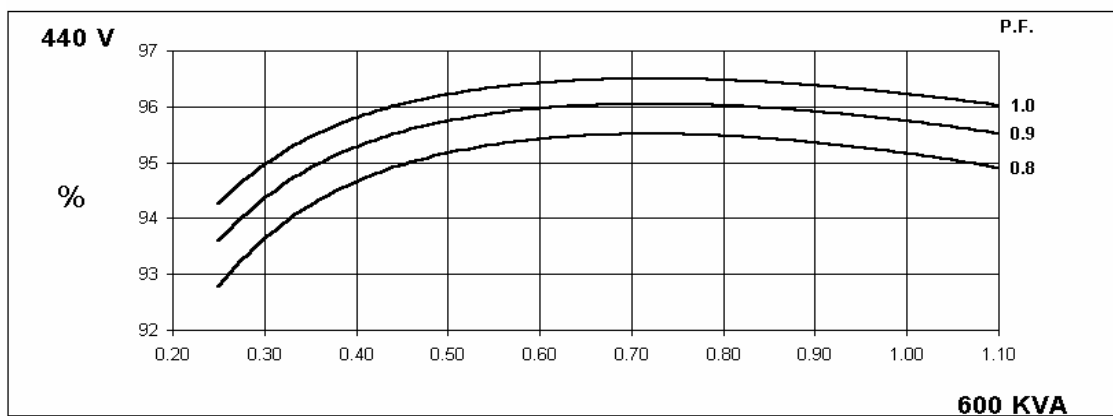
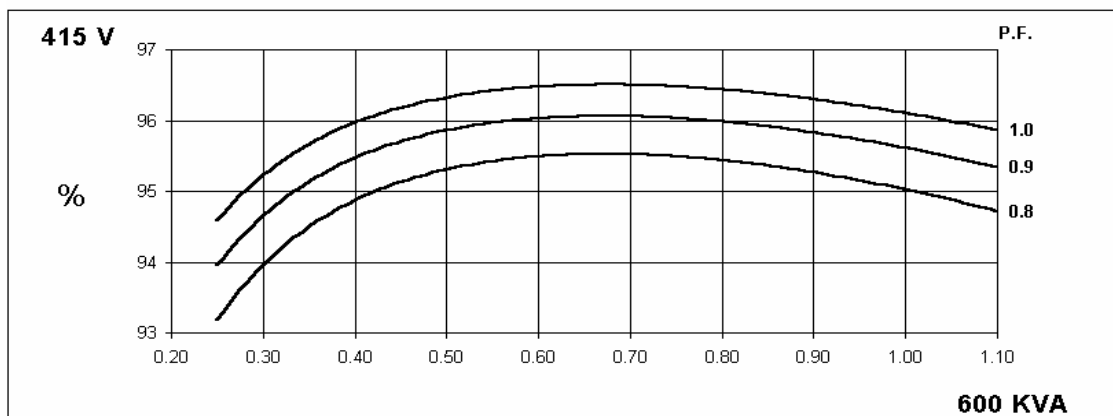
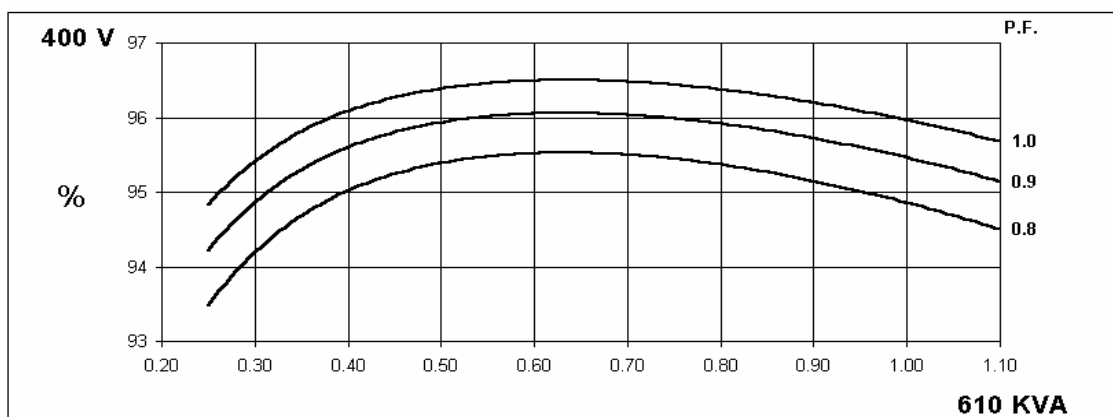
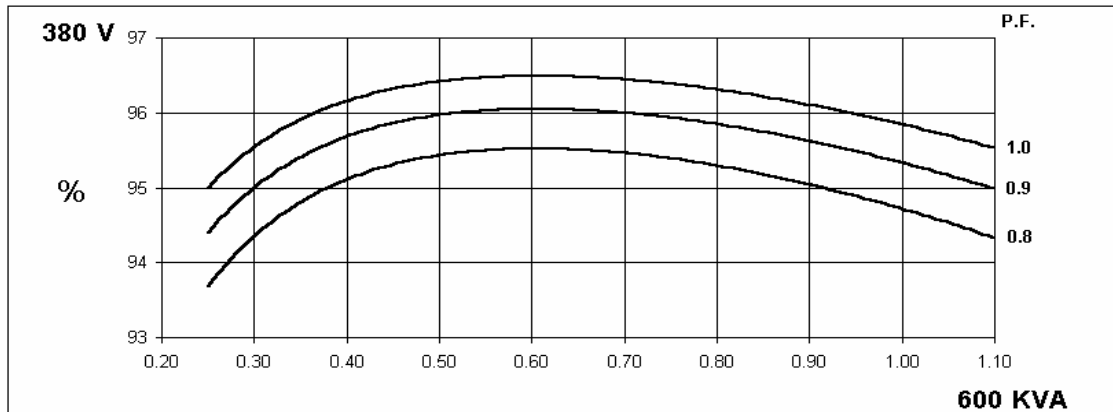
50
Hz

HCI534E/544E

Winding 311

STAMFORD

THREE PHASE EFFICIENCY CURVES



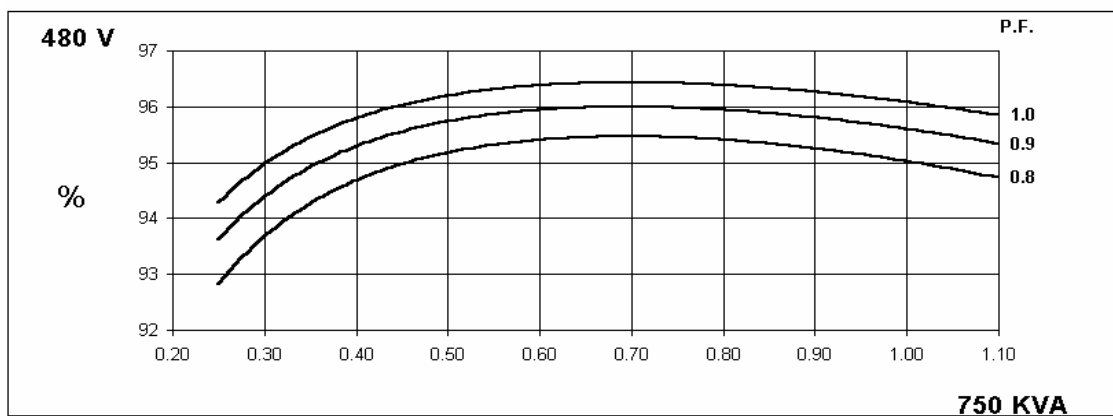
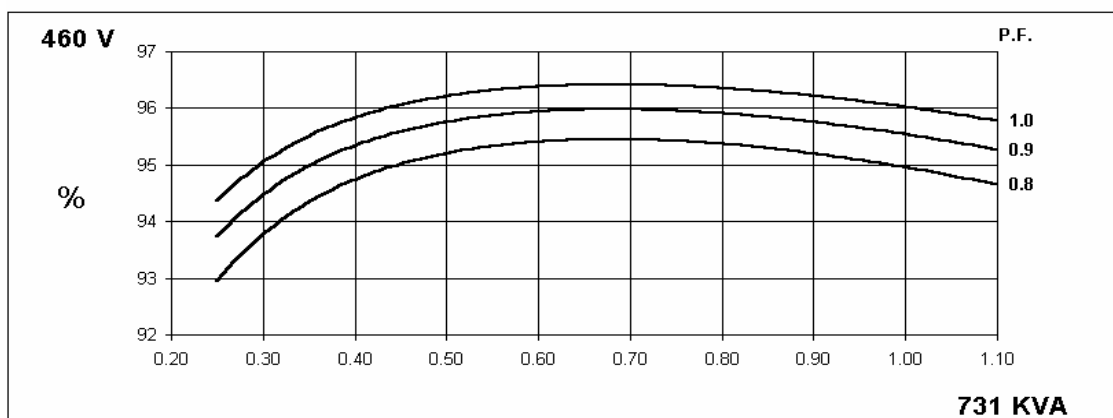
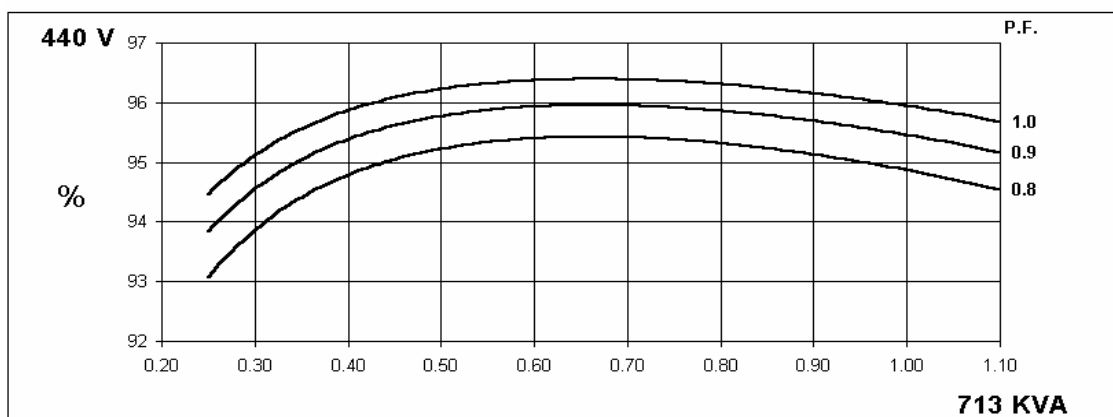
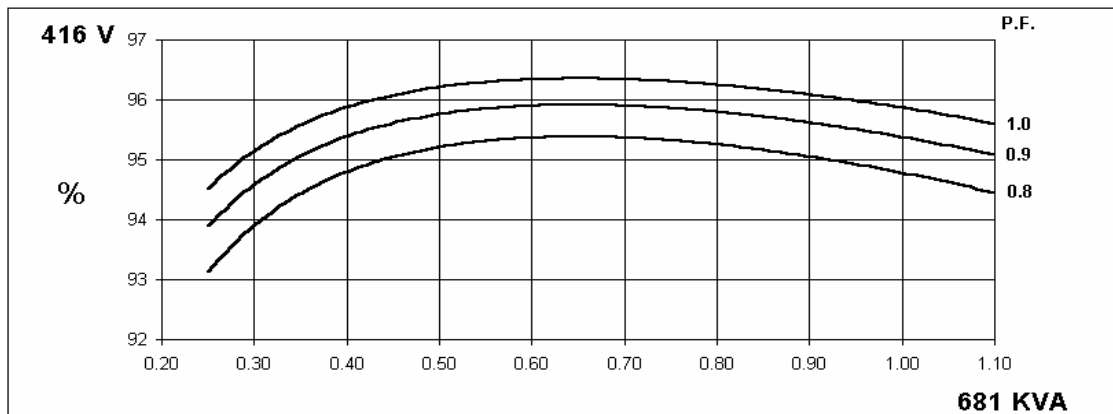
60
Hz

HCI534E/544E

Winding 311

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THREE PHASE EFFICIENCY CURVES

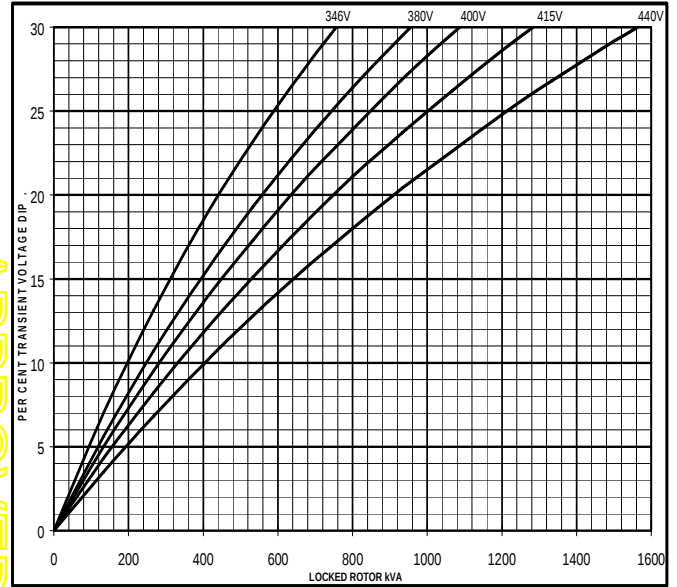
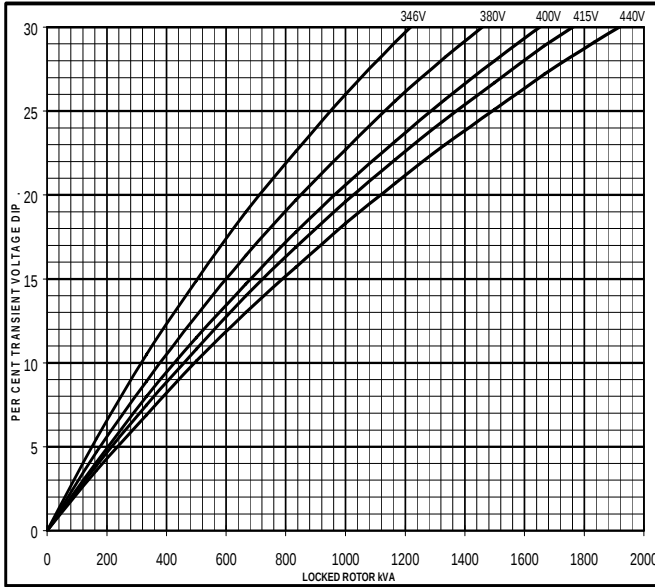


Locked Rotor Motor Starting Curve

50
Hz

MX

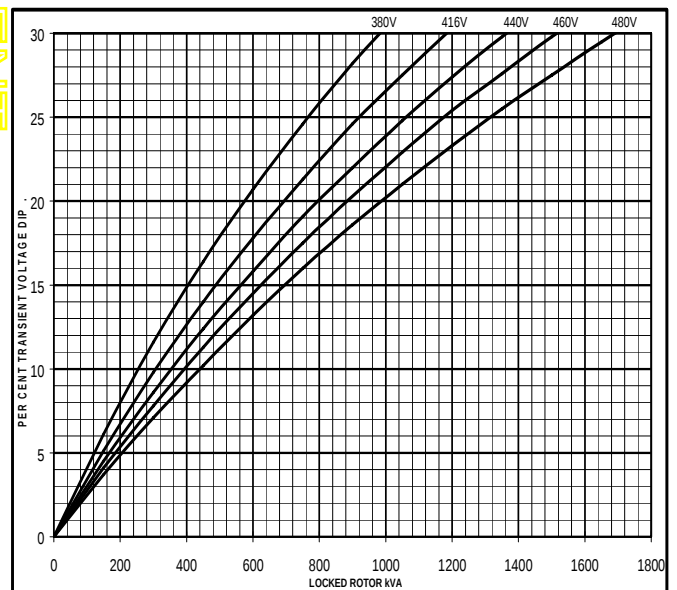
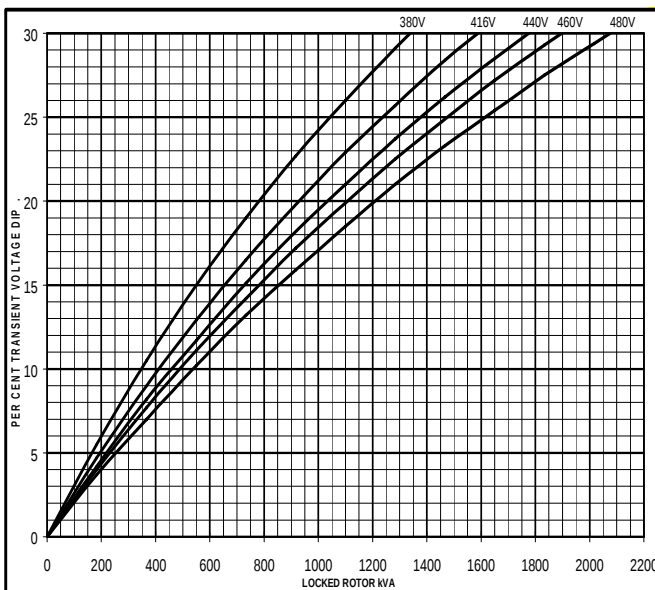
SX



60
Hz

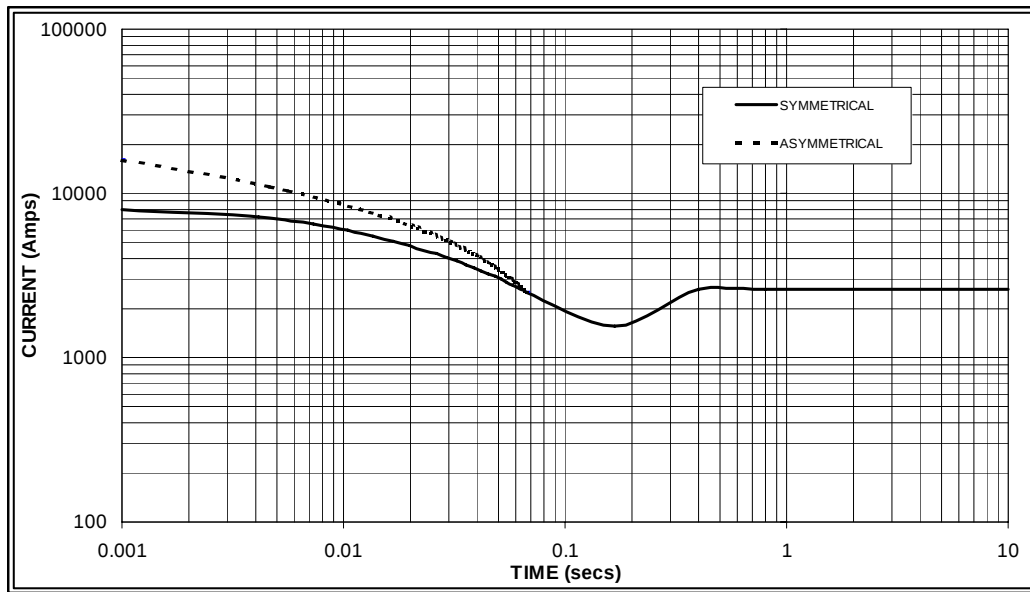
MX

SX



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

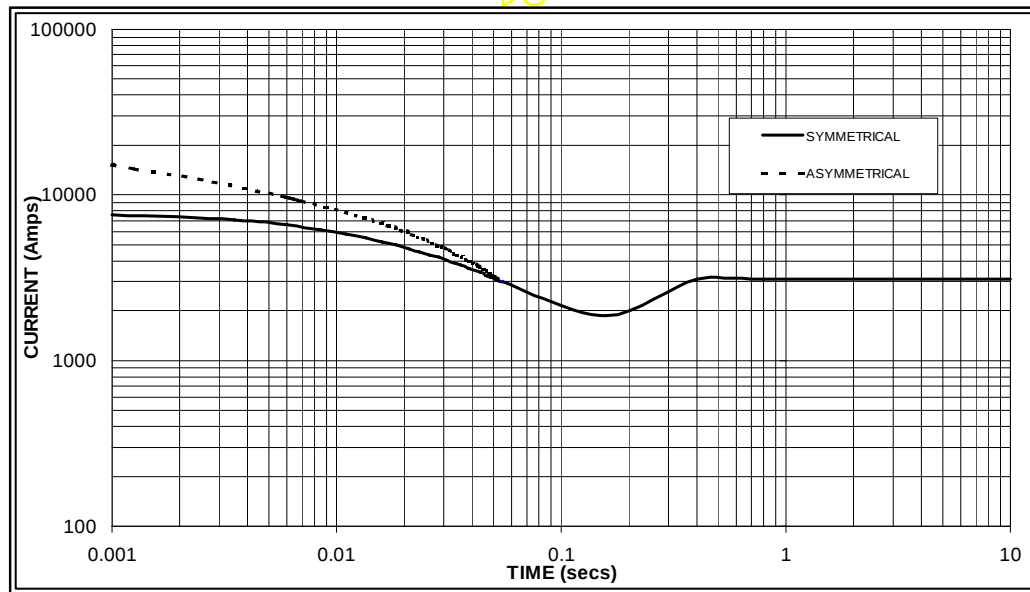
**50
Hz**



Sustained Short Circuit = 2,600 Amps



**60
Hz**



Sustained Short Circuit = 3,100 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 1.06	440v	X 1.06
415v	X 1.09	460v	X 1.12
440v	X 1.12	480v	X 1.20

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

HCI534E/544E

Winding 311 0.8 Power Factor

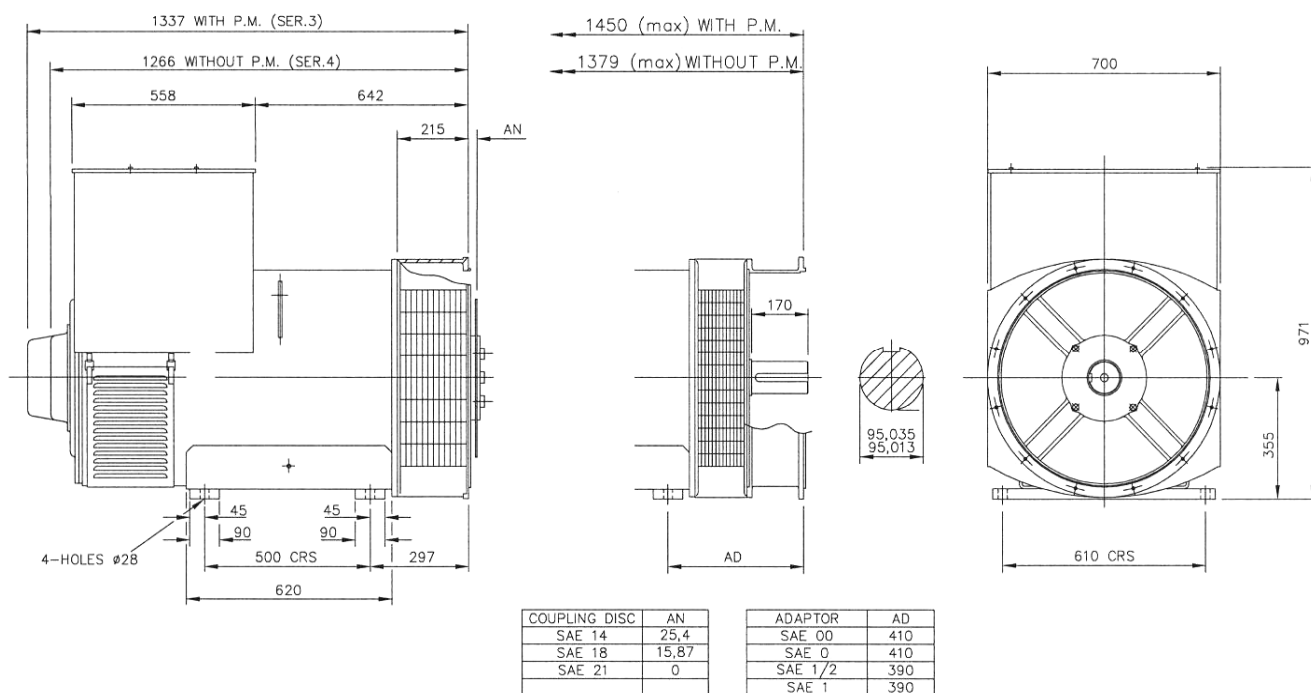
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RATINGS

Class - Temp Rise		Cont. F - 105/40°C				Cont. H - 125/40°C				Standby - 150/40°C				Standby - 163/27°C			
50 Hz	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	550	560	550	550	600	610	600	600	636	640	636	636	660	665	660	660
	kW	440	448	440	440	480	488	480	480	509	512	509	509	528	532	528	528
	Efficiency (%)	95.0	95.1	95.2	95.3	94.7	94.9	95.0	95.2	94.5	94.7	94.8	95.0	94.3	94.5	94.7	94.9
	kW Input	463	471	462	462	507	514	505	504	538	541	537	536	560	563	558	556

60 Hz	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	625	650	663	675	681	713	731	750	719	750	780	800	738	769	798	819
	kW	500	520	530	540	545	570	585	600	575	600	624	640	590	615	638	655
	Efficiency (%)	95.0	95.1	95.2	95.3	94.8	94.9	95.0	95.0	94.6	94.7	94.8	94.8	94.5	94.6	94.7	94.8
	kW Input	526	547	557	567	575	601	616	632	608	634	658	675	625	650	674	691

DIMENSIONS



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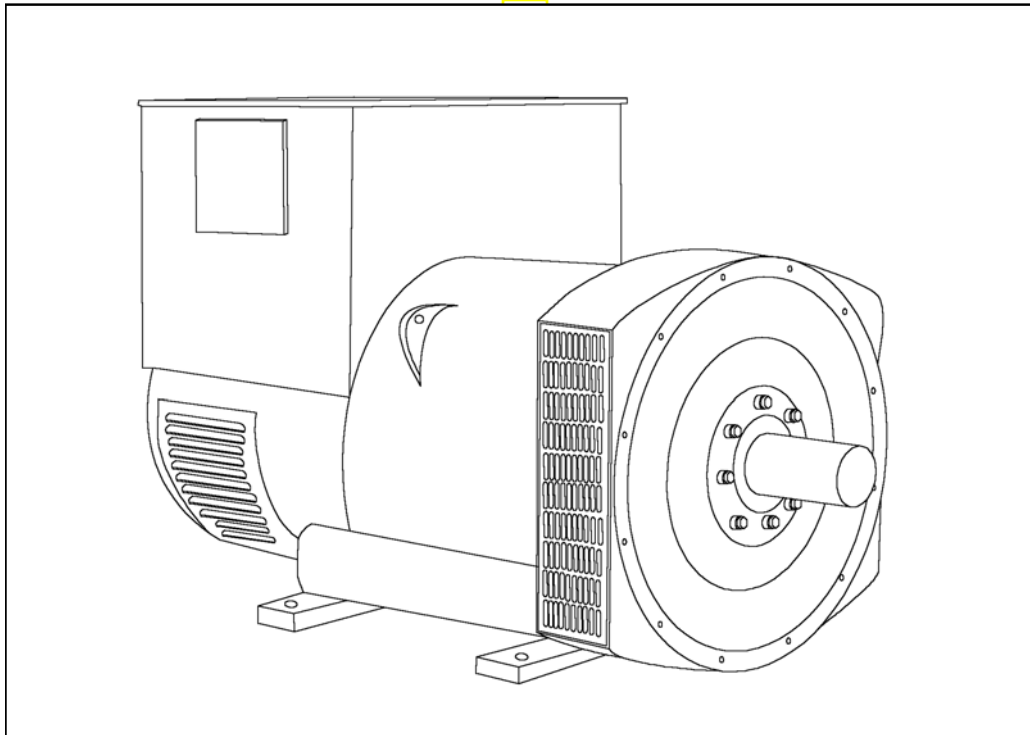
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HC5E-311-TD-EN-SG-A

STAMFORD[®]

HCI534F/544F - Winding 17

Technical  Data Sheet



HCI534F/544F

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 REGULATORS

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

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This sophisticated AVR is incorporated into the Stamford Permanent Magnet Generator (PMG) control system.

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.

An engine relief load acceptance feature can enable full load to be applied to the generator in a single step.

If three-phase sensing is required with the PMG system the MX321 AVR must be used.

We recommend three-phase sensing for applications with greatly unbalanced or highly non-linear loads.

MX321 AVR

The most sophisticated of all our AVRs combines all the features of the MX341 with, additionally, three-phase rms sensing, for improved regulation and performance.

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 are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted on a cover 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.

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

HCI534F/544F

STAMFORD

WINDING 17

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.		
A.V.R.	MX321	MX341	
VOLTAGE REGULATION	± 0.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 5)		

CONTROL SYSTEM	SELF EXCITED		
A.V.R.	AS440		
VOLTAGE REGULATION	± 1.0 %	With 4% ENGINE GOVERNING	
SUSTAINED SHORT CIRCUIT	WILL NOT SUSTAIN A SHORT CIRCUIT		

INSULATION SYSTEM	CLASS H	
PROTECTION	IP23	
RATED POWER FACTOR	0.8	
STATOR WINDING	DOUBLE LAYER LAP	
WINDING PITCH	TWO THIRDS	
WINDING LEADS	12	
STATOR WDG. RESISTANCE	0.0049 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED	
ROTOR WDG. RESISTANCE	2.16 Ohms at 22°C	
EXCITER STATOR RESISTANCE	17 Ohms at 22°C	
EXCITER ROTOR RESISTANCE	0.092 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. 6220 (ISO)	
BEARING NON-DRIVE END	BALL. 6314 (ISO)	
	1 BEARING	2 BEARING
WEIGHT COMP. GENERATOR	1685 kg	1694 kg
WEIGHT WOUND STATOR	805 kg	805 kg
WEIGHT WOUND ROTOR	684 kg	655 kg
WR ² INERTIA	10.033 kgm ²	9.7551 kgm ²
SHIPPING WEIGHTS in a crate	1775 kg	1780 kg
PACKING CRATE SIZE	166 x 87 x 124 (cm)	166 x 87 x 124 (cm)
TELEPHONE INTERFERENCE	THF<2%	TIF<50
COOLING AIR	1.035 m³/sec 2202 cfm	
VOLTAGE SERIES STAR	600V	
VOLTAGE PARALLEL STAR	300V	
VOLTAGE SERIES DELTA	346V	
kVA BASE RATING FOR REACTANCE VALUES	825	
Xd DIR. AXIS SYNCHRONOUS	2.44	
X'd DIR. AXIS TRANSIENT	0.11	
X''d DIR. AXIS SUBTRANSIENT	0.09	
Xq QUAD. AXIS REACTANCE	1.95	
X''q QUAD. AXIS SUBTRANSIENT	0.23	
X _L LEAKAGE REACTANCE	0.04	
X ₂ NEGATIVE SEQUENCE	0.16	
X ₀ ZERO SEQUENCE	0.07	
REACTANCES ARE SATURATED		VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED
T'd TRANSIENT TIME CONST.	0.08 s	
T''d SUB-TRANSTIME CONST.	0.012 s	
T'do O.C. FIELD TIME CONST.	2.5 s	
Ta ARMATURE TIME CONST.	0.019 s	
SHORT CIRCUIT RATIO	1/Xd	

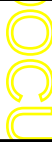
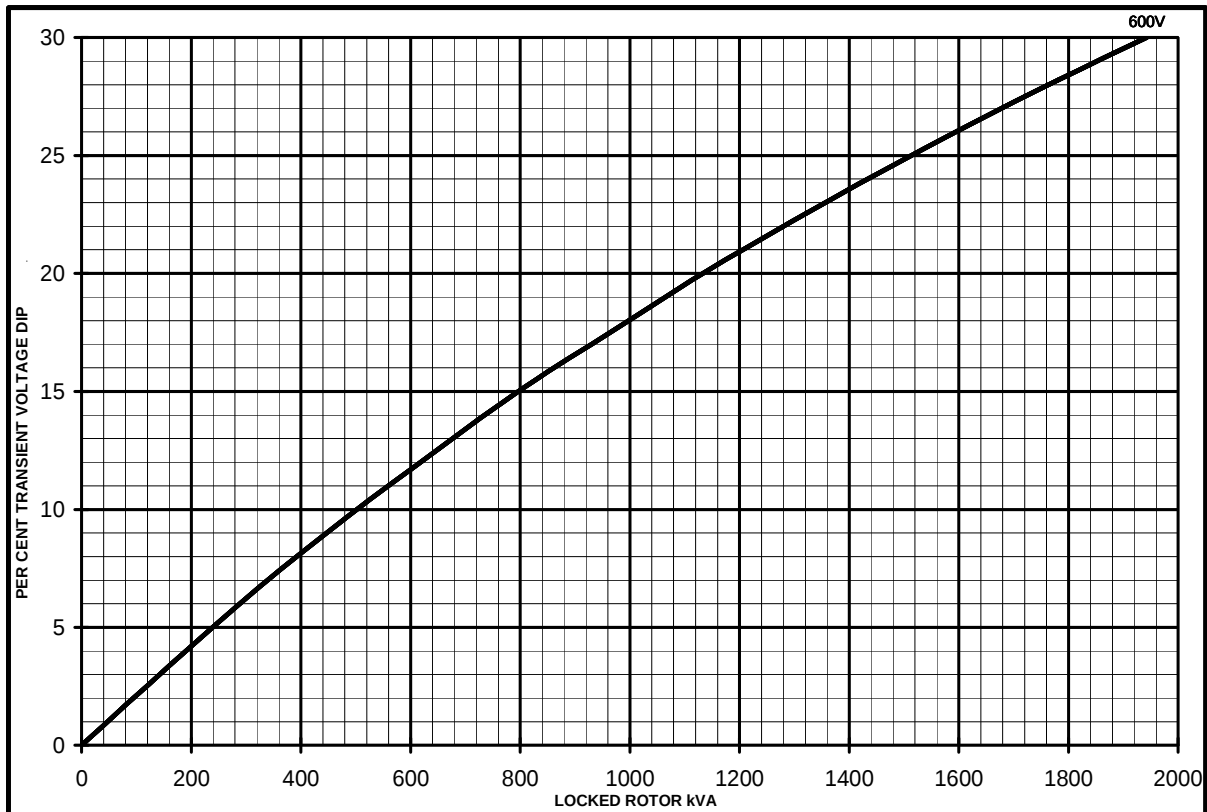
HCI534F/544F

STAMFORD

Winding 17

SX

Locked Rotor Motor Starting Curves



MX

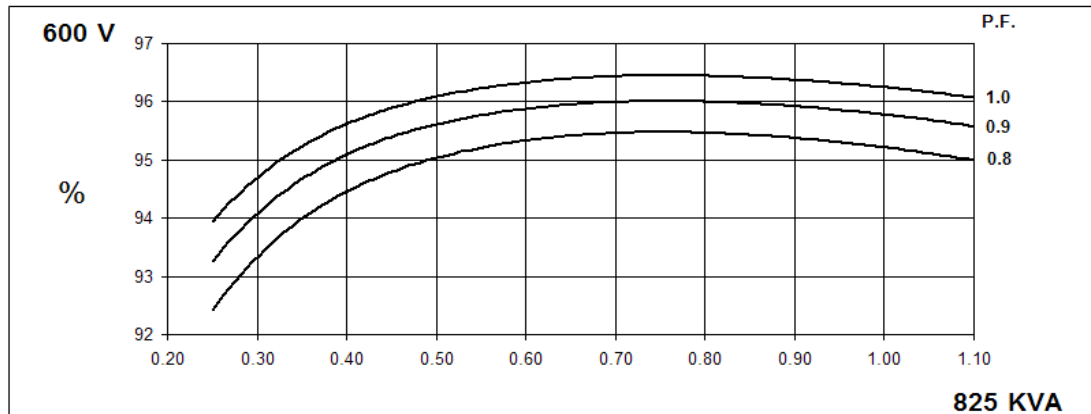


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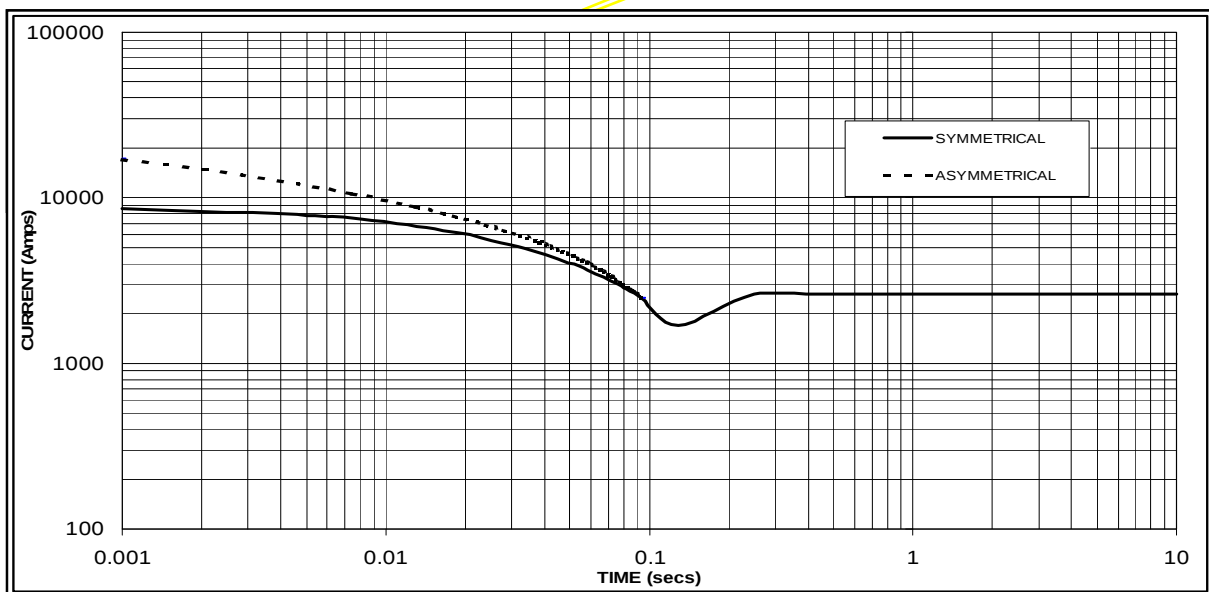
Winding 17

STAMFORD

THREE PHASE EFFICIENCY CURVES



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



Sustained Short Circuit = 2600 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

HCI534F/544F

Winding 17 / 0.8 Power Factor

STAMFORD

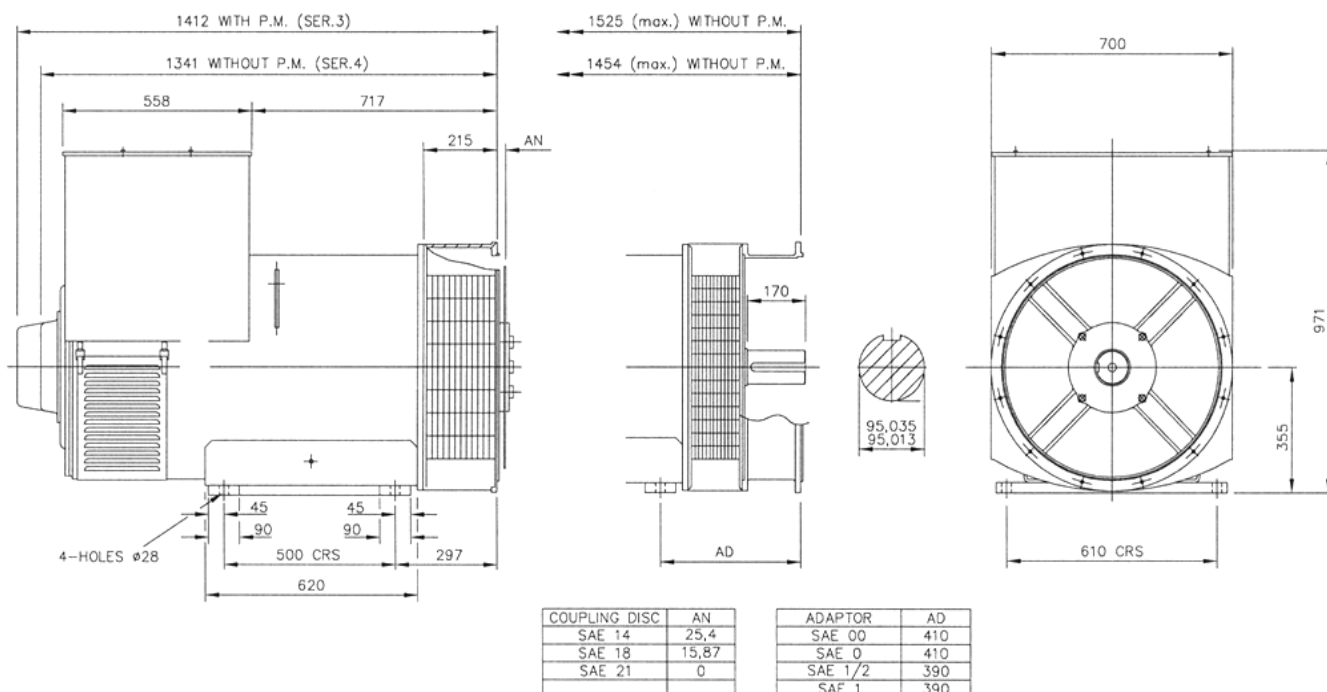
60Hz

RATINGS

Class - Temp Rise	Cont. F - 105/40°C	Cont. H - 125/40°C	Standby - 150/40°C	Standby - 163/27°C
Series Star (V)	600	600	600	600
Parallel Star (V)	300	300	300	300
Series Delta (V)	346	346	346	346
kVA	750	825	875	906
kW	600	660	700	725
Efficiency (%)	95.4	95.2	95.1	95.0
kW Input	629	692	734	760

APPROVED

DIMENSIONS



APPROVED DOCUMENT

STAMFORD

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DSE7410/20

AUTO START & AUTO MAINS FAILURE MODULES

FEATURES



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

A sophisticated module monitoring an extensive number of engine parameters, the DSE74xx will announce warnings, shutdown and engine status information on the back-lit LCD screen, illuminated LED, remote PC, audible alarm and via SMS text alerts. The module includes RS232, RS485 & Ethernet ports as well as dedicated terminals for system expansion.

The DSE7400 Series modules are compatible with electronic (CAN) and non-electronic (magnetic pick-up/alternator sensing) engines and offer a comprehensive number of flexible inputs, outputs and extensive engine protections so the system can be easily adapted to meet the most demanding industry paralleling requirements.

The modules can be easily configured using the DSE Configuration Suite 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 @ +/-7.5 mm,
8 Hz to 500 Hz @ 2 gn

HUMIDITY

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

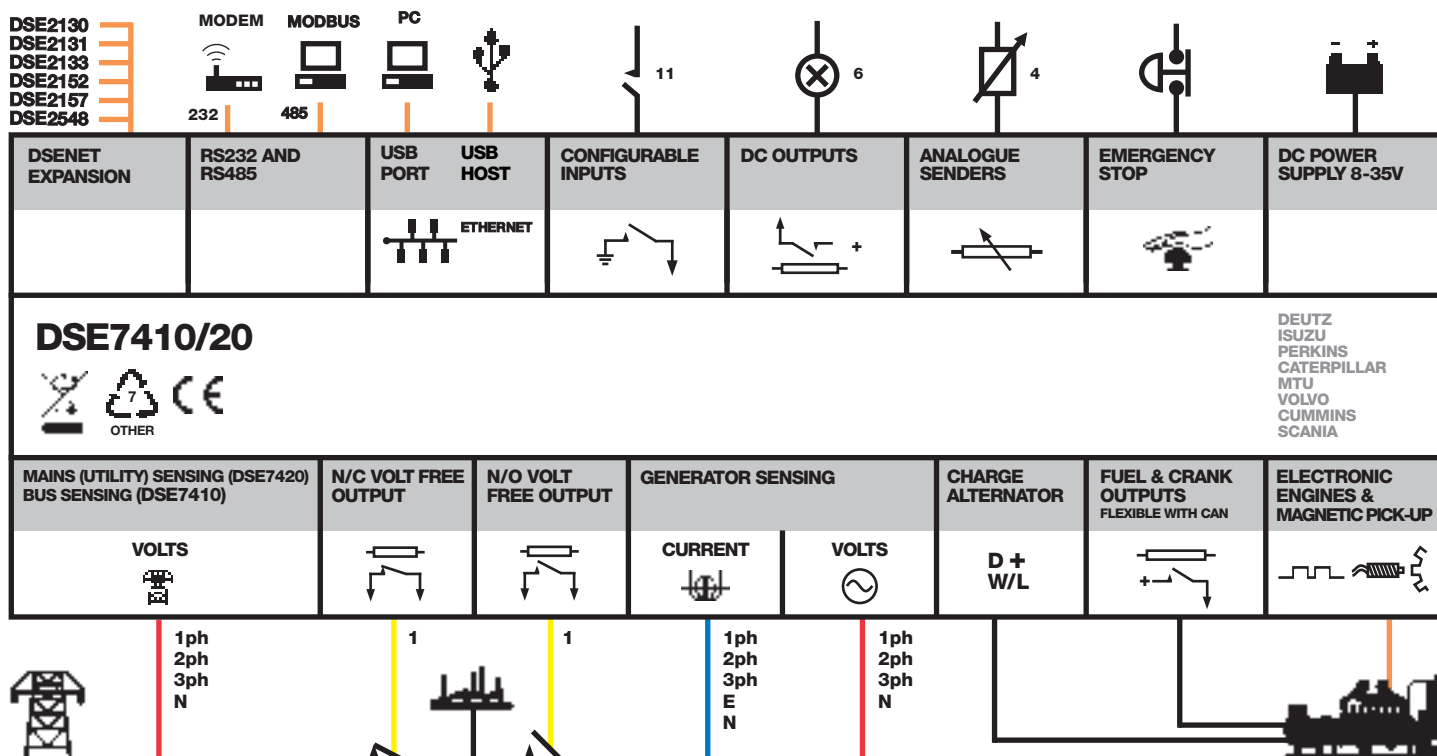
SHOCK

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



DSE7410/20

AUTO START & AUTO MAINS FAILURE MODULES

FEATURES



DSE7420

DSE7410



KEY FEATURES

- Configurable inputs (11)
- Configurable outputs (8)
- Voltage measurement
- Mains (utility) failure detection
- Dedicated load test button
- kW overload alarms
- Comprehensive electrical protection
- RS232, RS485 & Ethernet remote communications
- Modbus RTU/TCP
- PLC functionality
- Multi event exercise timer
- Back-lit LCD 4-line text display
- Multiple display languages
- Automatic start/Manual start
- Audible alarm
- Fixed and flexible LED indicators
- Event log (250)
- Engine protection
- Fault condition notification to a designated PC
- Front panel mounting
- Protected front panel programming
- Configurable alarms and timers
- Configurable start and stop timers

- Five key menu navigation
- Front panel editing with PIN protection
- 3 configurable maintenance alarms
- CAN and magnetic pick-up/Alt. sensing
- Fuel usage monitor and low fuel alarms
- Charge alternator failure alarm
- Manual speed control (on compatible CAN engines)
- Manual fuel pump control
- "Protections disabled" feature
- Reverse power protection
- Power monitoring (kW h, kV Ar, kV A h, kV Ar h)
- Load switching (load shedding and dummy load outputs)
- Automatic load transfer (DSE7420)
- Unbalanced load protection
- Independent earth fault trip
- Fully configurable via DSE Configuration Suite PC software
- Configurable display languages
- Remote SCADA monitoring via DSE Configuration Suite PC software

- Advanced SMS messaging (additional external modem required)
- Start & stop capability via SMS messaging
- Additional display screens to help with modem diagnostics
- DSENet® expansion
- Integral PLC editor

KEY BENEFITS

- RS232, RS485 & Ethernet can be used at the same time
- DSENet® connection for system expansion
- PLC functionality
- Five step dummy load support
- Five step load shedding support
- High number of inputs and outputs
- Worldwide language support
- Direct USB connection to PC
- Ethernet monitoring
- USB host
- Data logging & trending

RELATED MATERIALS

TITLE

DSE7410 Installation Instructions
DSE7420 Installation Instructions
 DSE74xx Quick Start Guide
 DSE74xx Operator Manual
 DSE74xx PC Configuration Suite Manual

PART NO'S

053-085
 053-088
 057-162
 057-161
 057-160

SPECIFICATION

DC SUPPLY

CONTINUOUS VOLTAGE RATING
 8 V to 35 V Continuous

CRANKING DROPOUTS

Able to survive 0 V for 50 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

MAXIMUM OPERATING CURRENT

260 mA at 12 V, 130 mA at 24 V

MAXIMUM STANDBY CURRENT

120 mA at 12 V, 65 mA at 24 V

CHARGE FAIL/EXCITATION RANGE

0 V to 35 V

OUTPUTS

OUTPUT A (FUEL)

15 A DC at supply voltage

OUTPUT B (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

GENERATOR

VOLTAGE RANGE

15 V to 333 V AC (L-N)

FREQUENCY RANGE

3.5 Hz to 75 Hz

MAINS (UTILITY) (DSE7420)

VOLTAGE RANGE

15 V to 333 V AC (L-N)

FREQUENCY RANGE

3.5 Hz to 75 Hz

BUS (DSE7410)

VOLTAGE RANGE

15 V to 333 V AC (L-N)

FREQUENCY RANGE

3.5 Hz to 75 Hz

MAGNETIC PICK UP

VOLTAGE RANGE

+/- 0.5 V to 70 V

FREQUENCY RANGE

10,000 Hz (max)

DIMENSIONS

OVERALL

240 mm x 172 mm x 57 mm
 9.4" x 6.8" x 2.2"

PANEL CUTOUT

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

DEEP SEA ELECTRONICS PLC UK

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Tmax-Molded Case Circuit Breakers

T6 800A Frame

AC Circuit Breakers and Switches

DC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



Dimensions 3P Fixed Version 10.55H x 8.26W x 4.07D

Weight 20.9 (lbs)

Compliance with Standards

UL 489

CSA C22.2 No.5.1

IEC 60947-2

Standards

EC directive:

– “Low Voltage Directives” (LVD) no. 73/23 EEC

– “Electromagnetic Compatibility Directive” (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)		T6			
Continuous Current Rating		800			
Number of Poles		3-4			
		N	S	H	L
AC					
	240V	65	100	200	200
	480V	35	50	65	100
	600V	20	25	35	42
DC*					
	500V 2 poles in series	35	35	50	65
	600V 3 poles in series	20	20	35	50

*Thermal Magnetic Trip Only

Company Quality Systems and Environmental Systems

The new Tmax series has a hologram on the front, obtained using special anti-imitation techniques, which guarantees the quality and that the circuit breaker is an original ABB product.

Attention to protection of the environment and to health and safety in the work place is another priority commitment for ABB and, as confirmation of this, the company environmental management system has been certified by RINA in 1997, in conformity with the international ISO 14001 Standard. This certification has been integrated in 1999 with the Management System for Health and Safety in the workplace, according to OHSAS 18001 (British Standards), obtaining one of the first certification of integrated management System, QES (Quality, Environment,

Safety) issued by RINA. ABB - the first industry in the electro-mechanical section in Italy to obtain this recognition - thanks to a revision of the production process with an eye to ecology has been able to reduce the consumption of raw materials and waste from processing by 20%. ABB's commitment to safeguarding the environment is also shown in a concrete way by the Life Cycle Assessments of its products carried out directly by the ABB Research and Development in collaboration with the ABB Research Center. Selection of materials, processes and packing materials is made optimizing the true environmental impact of the product, also foreseeing the possibility of its being recycled.

Mounting

Fixed
Drawout

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

TMA thermal magnetic trip units, with adjustable thermal threshold ($I_1 = 0.7 \dots 1 \times I_n$) and adjustable magnetic threshold ($I_3 = 5 \dots 10 \times I_n$).

PR221DS, PR222DS/P, and PR222DS/PD-A electronic trip unit

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Front for lever operating mechanism - FLD
- Direct rotary handle - RHD
- Stored energy motor operator - MOE
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal - ES
- Rear orientated terminal - R
- Phase separators
- Residual current relay (IEC Only)



ABB Inc.

1206 Hatton Road
Wichita Falls, TX 76302
For more information and
the location of your local
field office please go to
www.abb-control.com

Tmax-Molded Case Circuit Breakers

T7 1200A Frame

AC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



Dimensions 3P Fixed Version 10.55H x 8.26W x 6.06D

Weight 21.4 (lbs)

Compliance with Standards

UL 489

CSA C22.2 No.5.1

IEC 60947-2

Standards

EC directive:

– “Low Voltage Directives” (LVD) no. 73/23 EEC

– “Electromagnetic Compatibility Directive” (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)		T7		
Continuous Current Rating		1200		
Number of Poles		3-4		
		S	H	L
AC				
	240V	65	100	150
	480V	50	65	100
	600V	25	50	65

Company Quality Systems and Environmental Systems

The new Tmax series has a hologram on the front, obtained using special anti-imitation techniques, which guarantees the quality and that the circuit breaker is an original ABB product.

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Safety) issued by RINA. ABB - the first industry in the electro-mechanical section in Italy to obtain this recognition - thanks to a revision of the production process with an eye to ecology has been able to reduce the consumption of raw materials and waste from processing by 20%. ABB's commitment to safeguarding the environment is also shown in a concrete way by the Life Cycle Assessments of its products carried out directly by the ABB Research and Development in collaboration with the ABB Research Center. Selection of materials, processes and packing materials is made optimizing the true environmental impact of the product, also foreseeing the possibility of its being recycled.

Mounting

Fixed
Drawout

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

PR231/P, PR232/P, PR331DS, and PR332DS/P electronic trip unit

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Padlock provision - PLL
- Direct rotary handle - RHD
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal - ES
- Rear orientated terminal - R
- Phase separators
- Residual current relay (IEC Only)



ABB Inc.

1206 Hatton Road
Wichita Falls, TX 76302
For more information and
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field office please go to
www.abb-control.com

Annex to the
technical catalog



Tmax T8

Low voltage molded case
circuit breaker up to 3000 A

UL 489 and CSA C22.2 Standard

1SDC210026D0201 – 2008 Edition



ABB

Main characteristics

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

			Tmax T8
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.

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

Digital Linear Chargers

Specifications (cont.)

- New 4-color package design



minnkotamotors.com

minn KOTA

ON-BOARD MARINE BATTERY CHARGER

DIGITALLY CONTROLLED 2X FASTER CHARGING PROTECTS BATTERIES

Digital[±] CONTROL

MK210D

10AMPS

MK 210D
2 CHARGING BANKS
5 AMPS PER BANK
10 AMPS TOTAL OUTPUT

FC



CHARGING TECHNOLOGY

DIGITALLY CONTROLLED.
Microprocessor design protects your batteries so you can stay on the water longer. It monitors temperature and state of charge to create a faster, regulated, more precise charge. Also includes automatic shut-off when charging is complete to extend battery life.

DIGITALLY CONTROLLED.
Microprocessor design protects your batteries so you can stay on the water longer. It monitors temperature and state of charge to create a faster, regulated, more precise charge. Also includes automatic shut-off when charging is complete to extend battery life.

ENHANCED STATUS CODES.
Provides comprehensive feedback on charge stage, maintenance mode status, error notification and full charge.

ENHANCED STATUS CODES.
Provides comprehensive feedback on charge stage, maintenance mode status, error notification and full charge.

Digital[±] CONTROL

MULTI-STAGE CHARGING.
Delivers a fast, precise charge profile by automatically controlling current and voltage without overcharging your batteries.

MULTI-STAGE CHARGING.
Delivers a fast, precise charge profile by automatically controlling current and voltage without overcharging your batteries.

AUTOMATIC TEMPERATURE COMPENSATION.
Adjusts output voltage based on ambient temperature to ensure a full charge and protect your batteries.

AUTOMATIC TEMPERATURE COMPENSATION.
Adjusts output voltage based on ambient temperature to ensure a full charge and protect your batteries.

TIME (THREE STAGE CHARGER)

BATTERY CHARGER TEMPERATURE COMPENSATION

BATTERY VOLTAGE

BATTERY TEMPERATURE (degrees F)

2010

minn KOTA

HUMMINBIRD

CANNON

Digital Linear Chargers

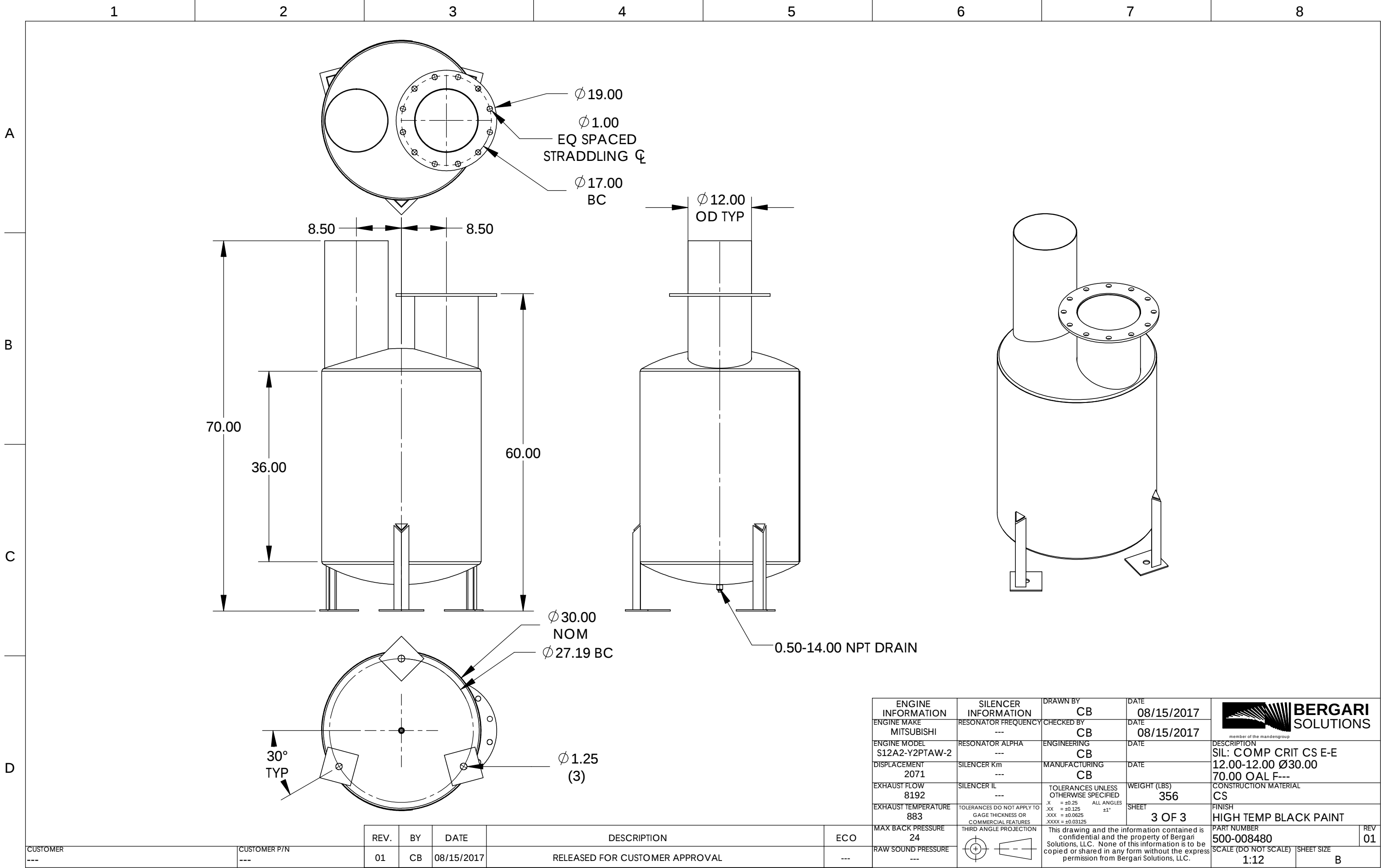
Specifications

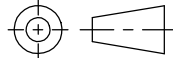
- Waterproof, shock-and vibration-resistant aluminum construction
- Saltwater tested and fully corrosion-resistant
- Short circuit, reverse polarity, and ignition protected
- For use with 12V/6 cell batteries that are flooded/wet cell, maintenance free or starved electrolyte (AGM) only
- FCC compliant
- UL listed to marine standard 1236
- 3 year warranty
- Replaces all existing current on-board chargers (excluding portables)
- No Price Increase
- Availability: November 2010



DIGITAL LINEAR ON-BOARD CHARGERS

PRODUCT CODE	PRODUCT DESCRIPTION
1821065	MK 106D (1 bank x 6 amps)
1821105	MK-110D (1 bank x 10 amps)
1822105	MK-210D (2 bank x 5 amps)
1823155	MK-315D (3 bank x 5 amps)
1822205	MK-220D (2 bank x 10 amps)
1823305	MK-330D (3 bank x 10 amps)
1824405	MK-440D (4 bank x 10 amps)
1822305	MK-230D (2 bank x 15 amps)
1823455	MK-345D (3 bank x 15 amps)
1824605	MK-460D (4 bank x 15 amps)



ENGINE INFORMATION	SILENCER INFORMATION	DRAWN BY	DATE	 BERGARI SOLUTIONS member of the mandengroup
ENGINE MAKE	RESONATOR FREQUENCY	CHECKED BY	DATE	
MITSUBISHI	---	CB	08/15/2017	
ENGINE MODEL	RESONATOR ALPHA	ENGINEERING	DATE	
S12A2-Y2PTAW-2	---	CB		
DISPLACEMENT	SILENCER Km	MANUFACTURING	DATE	DESCRIPTION
2071	---	CB		SIL: COMP CRIT CS E-E
EXHAUST FLOW	SILENCER IL	TOLERANCES UNLESS OTHERWISE SPECIFIED	WEIGHT (LBS)	12.00-12.00 Ø30.00
8192	---	.X = ±0.25 ALL ANGLES .XX = ±0.125 ±1° .XXX = ±0.0625 .XXXX = ±0.03125	356	70.00 OAL F---
EXHAUST TEMPERATURE	TOLERANCES DO NOT APPLY TO GAGE THICKNESS OR COMMERCIAL FEATURES	THIRD ANGLE PROJECTION	SHEET	CONSTRUCTION MATERIAL
883			3 OF 3	CS
MAX BACK PRESSURE		This drawing and the information contained is confidential and the property of Bergari Solutions, LLC. None of this information is to be copied or shared in any form without the express permission from Bergari Solutions, LLC.		FINISH
24				HIGH TEMP BLACK PAINT
RAW SOUND PRESSURE				PART NUMBER
---				500-008480

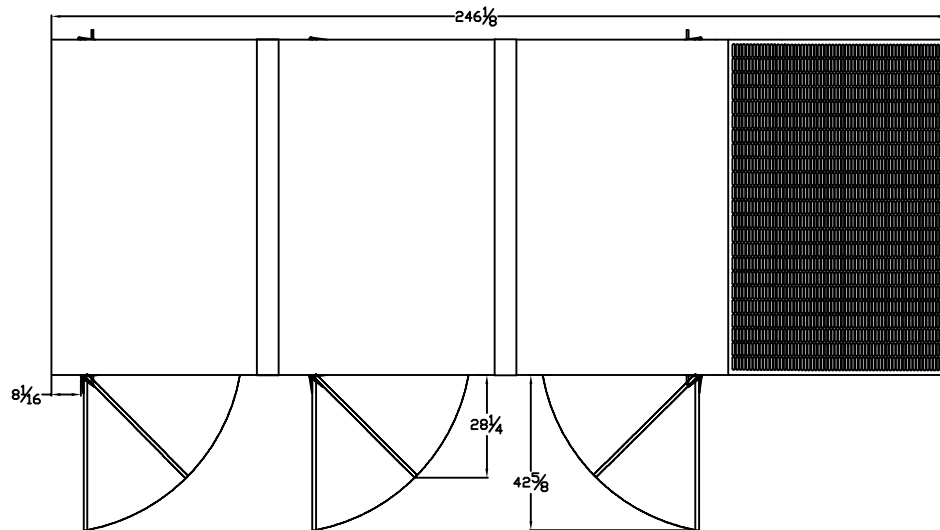
CUSTOMER	CUSTOMER P/TN	REV.	BY	DATE	DESCRIPTION	ECO
---	---	01	CB	08/15/2017	RELEASED FOR CUSTOMER APPROVAL	---

SCALE (DO NOT SCALE)	SHEET SIZE	REV
1:12	B	01

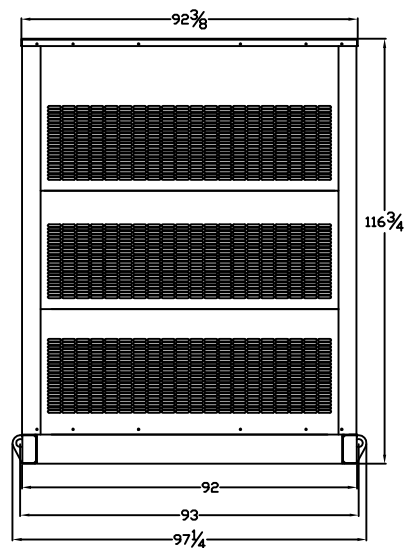
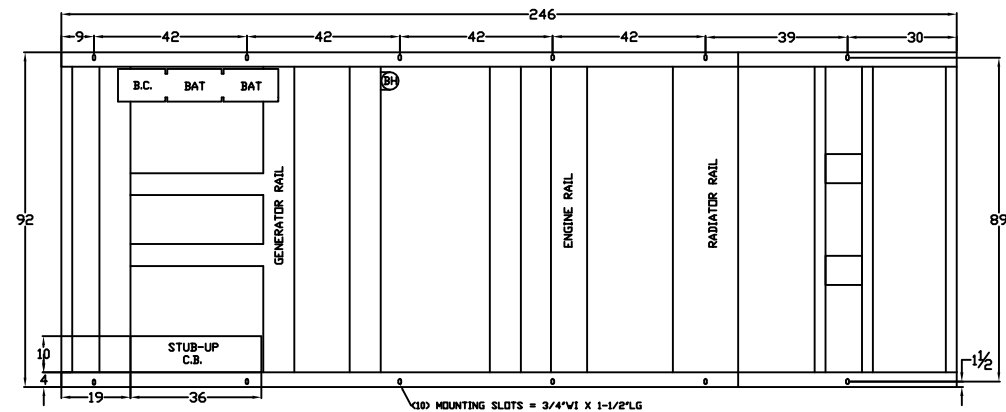
LEVEL 2 & 3 ENCLOSURE OUTLINE DIMENSIONS FOR SP-6500

TOP VIEW

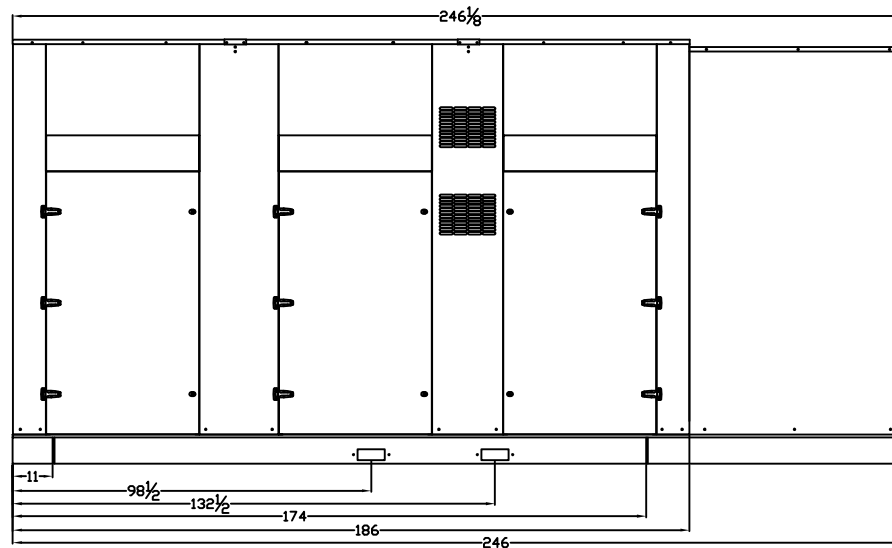
(GEN-SET HAS (6) DOORS, (3) SHOWN OPEN ARE TYPICAL FOR BOTH SIDES)



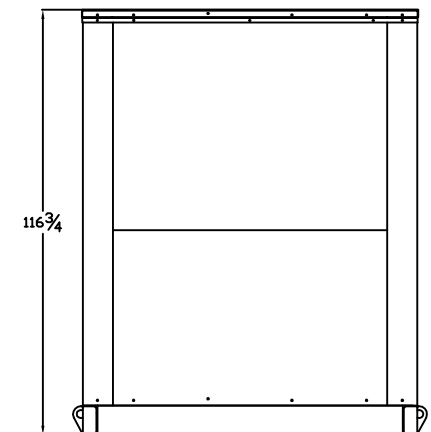
FRAME VIEW



GENERATOR END VIEW



SIDE VIEW



RADIATOR END VIEW