# GILLETTE GENERATORS

## LIQUID COOLED NAT. GAS ENGINE GENERATOR SET

**60 HZ MODEL**

# PR-5400

| Model | | PRIME 105ºC 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.

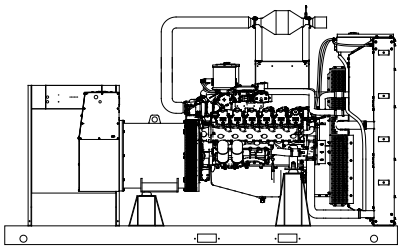
**NEC 700, 701, 702, 708**

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

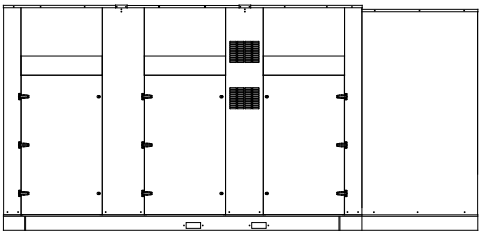
**ANSI C62.41, 27, 59, 32, 480, 40Q, 81U, 360-05**

**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 MODEL | VOLTAGE | | PH | HZ | LIQUID PROPANE GAS FUEL 105°C RISE PRIME RATING | | NATURAL GAS FUEL 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. $H_2O$*.....(3.48-4.48), 14"-18"
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<br>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. $H_20$ (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 ($m^3$/min) ..... .....1396 (40)
Radiator Air Flow cfm ($m^3$/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 ($m^3$/min)..... .....……4079 (115)
Exhaust Temp., at rated kw: °F (ºC) ……..….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

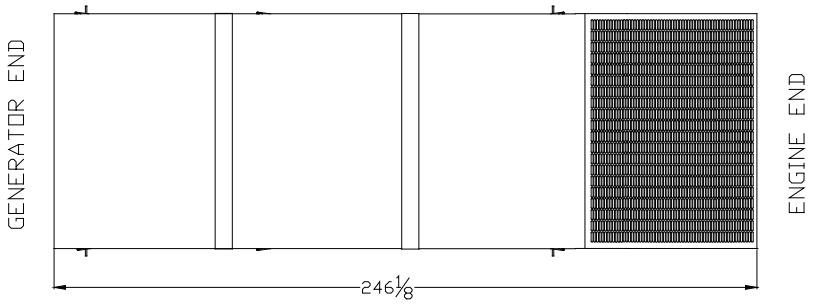
**DC ELECTRICAL SYSTEM:**

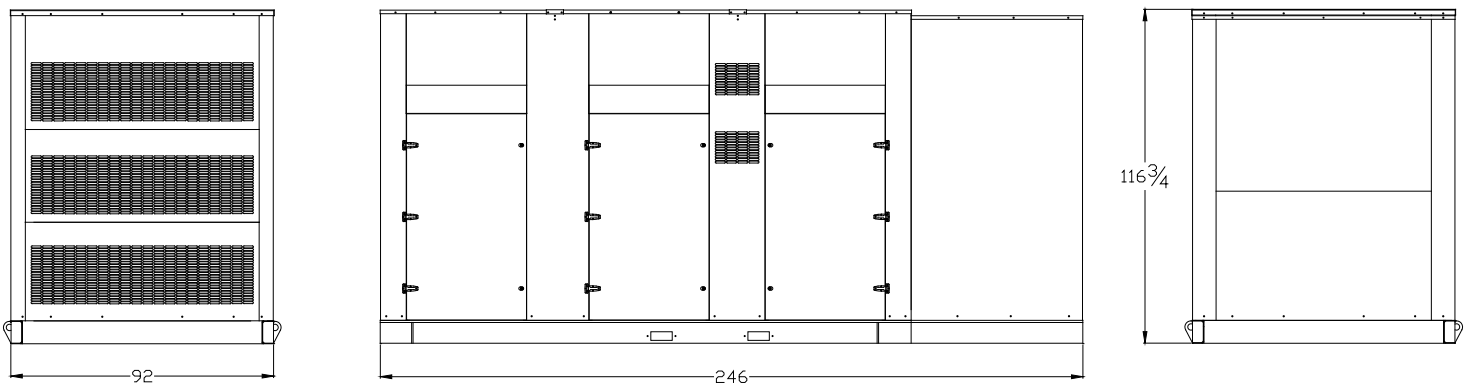
Battery tray • Battery cables • Battery hold down straps • 2-stage battery float charger with maintaining & recharging automatic charge stages

**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.



PSI HEAVY-DUTY

# 32L INDUSTRIAL STATIONARY

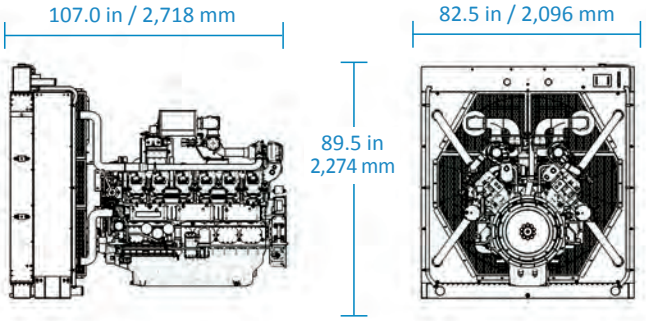
**The PSI HD 32L is a U.S. EPA-certified natural gas and propane engine developed from the block up to be a reliable and durable power unit. Built upon a proven marine-diesel grade block, the 12-cylinder V-Configuration, turbocharged and after-cooled engine features replaceable wet liners and water-cooled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

**Power Solutions International** 201 Mittel Drive, Wood Dale, IL 60191
T: 630-350-9400 • F: 630-350-9900 • **psiengines.com**

# 31.8L

[Stoic.]
Rev: 2

PSI HEAVY-DUTY

| General Engine Data[5] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | | |
| Compression Ratio | 10.5 : 1 | | | | Engine Oil Capacity[8] | | | | |
| Exhaust Manifold Type | Water Cooled | | | | Min | qts | L | 95 | 90 |
| Turbo Exhaust Outlet Pipe Size | in | mm | 3.5 | 89 | Max | qts | L | 129 | 122 |
| Catalyst Inlet Size | in | mm | 5 | 127 | ECU Oil Pressure Warning[6] | psi | kPa | 57 | 393 |
| Catalyst Dp | in-$H_2O$ | kPa | 20.5 | 5.1 | ECU Oil Pressure Shut Down[6] | psi | kPa | 47 | 324 |
| Maximum Allowable Exhaust Back Pressure | in-Hg | kPa | 3.0 | 10.2 | Oil Pressure at 1000 rpm (Idle) | | | | |
| Maximum EPR Rated Pressure | psi | kPa | 1.0 | 6.9 | Min | psi | kPa | 82 | 569 |
| Maximum Operating pressure to EPR | in-$H_2O$ | kPa | 11.0 | 2.7 | Max | psi | kPa | 74 | 512 |
| Minimum Operating pressure to EPR | in-$H_2O$ | kPa | 7.0 | 1.7 | Max Allowable Oil Temperature | °F | °C | 250 | 121 |
| Minimum Gas Supply Pipe Size[5] | in | mm | 3 | 76 | Coolant Capacity (Engine only) | gal | L | 23.3 | 88.1 |
| Maximum Pressure Drop Across CAC | psi | kPa | 1 | 6.9 | Coolant Capacity (Radiator only) | gal | L | 23.3 | 88.1 |
| Max Allowable Intake Restriction | | | | | Standard Thermostat Range | | | | |
| Clean Air Filter | in-$H_2O$ | kPa | 5 | 1.24 | Normal Operation Temperature[9] | °F | °C | 176 | 80 |
| Dirty Air Filter | in-$H_2O$ | kPa | 15 | 3.73 | Full Open Temperature[9] | °F | °C | 198 | 92 |
| Spark Plug Part Number | Bosch R6 6857 | | | | ECU Coolant Temp Warning | °F | °C | 203 | 95 |
| Standard Spark Plug Gap[10] | in | mm | 0.012 | 0.3 | ECU Coolant Temp Shutdown | °F | °C | 208 | 98 |
| Spark Plug Coil - Primary Resistance | Ohms | | 0.59Ω ± 10% | | 50°C Ambient Capable[11] | | | Pass | |
| Battery Voltage | Volts | | 24 | | Max External Coolant Friction Head | psi | kPa | 7.25 | 50 |
| Starter Motor Power | HP | kW | 15.7 | 11.7 | CAC Rise Above Ambient Specified | F | C | 15 | 9 |

| 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 System[5]** | | | | | | | | | | |
| 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 Balance[5]** | | | | | | | | | | |
| 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 14.5Psia(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 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

[Stoic.]
Rev: 2

PSI HEAVY-DUTY

| General Engine Data[5] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | | |
| Compression Ratio | 10.5 : 1 | | | | Engine Oil Capacity[8] | | | | |
| Exhaust Manifold Type | Water Cooled | | | | Min | qts | L | 95 | 90 |
| Turbo Exhaust Outlet Pipe Size | in | mm | 3.5 | 89 | Max | qts | L | 129 | 122 |
| Catalyst Inlet Size | in | mm | 5 | 127 | ECU Oil Pressure Warning[6] | psi | kPa | 57 | 393 |
| Catalyst Dp | in-$H_2O$ | kPa | 20.5 | 5.1 | ECU Oil Pressure Shut Down[6] | psi | kPa | 47 | 324 |
| Maximum Allowable Exhaust Back Pressure | in-Hg | kPa | 3.0 | 10.2 | Oil Pressure at 1000 rpm (Idle) | | | | |
| Maximum EPR Rated Pressure | psi | kPa | 1.0 | 6.9 | Min | psi | kPa | 82 | 569 |
| Maximum Operating pressure to EPR | in-$H_2O$ | kPa | 11.0 | 2.7 | Max | psi | kPa | 74 | 512 |
| Minimum Operating pressure to EPR | in-$H_2O$ | kPa | 7.0 | 1.7 | Max Allowable Oil Temperature | °F | °C | 250 | 121 |
| Minimum Gas Supply Pipe Size[5] | in | mm | 3 | 76 | Coolant Capacity (Engine only) | gal | L | 23.3 | 88.1 |
| Maximum Pressure Drop Across CAC | psi | kPa | 1 | 6.9 | Coolant Capacity (Radiator only) | gal | L | 23.3 | 88.1 |
| Max Allowable Intake Restriction | | | | | Standard Thermostat Range | | | | |
| Clean Air Filter | in-$H_2O$ | kPa | 5 | 1.24 | Normal Operation Temperature[9] | °F | °C | 176 | 80 |
| Dirty Air Filter | in-$H_2O$ | kPa | 15 | 3.73 | Full Open Temperature[9] | °F | °C | 198 | 92 |
| Spark Plug Part Number | | | Bosch R6 6857 | | ECU Coolant Temp Warning | °F | °C | 203 | 95 |
| Standard Spark Plug Gap[10] | in | mm | 0.012 | 0.3 | ECU Coolant Temp Shutdown | °F | °C | 208 | 98 |
| Spark Plug Coil - Primary Resistance | Ohms | | 0.59Ω ± 10% | | 50°C Ambient Capable[11] | | | Pass | |
| Battery Voltage | Volts | | 24 | | Max External Coolant Friction Head | psi | kPa | 7.25 | 50 |
| Starter Motor Power | HP | kW | 15.7 | 11.7 | CAC Rise Above Ambient Specified | F | C | 15 | 9 |

| 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 System[5]** | | | | | | | | | | |
| 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 Balance[5]** | | | | | | | | | | |
| 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 14.5Psia(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 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

[Stoic.]
Rev: 2

PSI HEAVY-DUTY

| General Engine Data[5] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | | |
| Compression Ratio | 10.5 : 1 | | | | Engine Oil Capacity[8] | | | | |
| Exhaust Manifold Type | Water Cooled | | | | Min | qts | L | 95 | 90 |
| Turbo Exhaust Outlet Pipe Size | in | mm | 3.5 | 89 | Max | qts | L | 129 | 122 |
| Catalyst Inlet Size | in | mm | 5 | 127 | ECU Oil Pressure Warning[6] | psi | kPa | 57 | 393 |
| Catalyst Dp | in-$H_2O$ | kPa | 20.5 | 5.1 | ECU Oil Pressure Shut Down[6] | psi | kPa | 47 | 324 |
| Maximum Allowable Exhaust Back Pressure | in-Hg | kPa | 3.0 | 10.2 | Oil Pressure at 1000 rpm (Idle) | | | | |
| Maximum EPR Rated Pressure | psi | kPa | 1.0 | 6.9 | Min | psi | kPa | 82 | 569 |
| Maximum Operating pressure to EPR | in-$H_2O$ | kPa | 11.0 | 2.7 | Max | psi | kPa | 74 | 512 |
| Minimum Operating pressure to EPR | in-$H_2O$ | kPa | 7.0 | 1.7 | Max Allowable Oil Temperature | °F | °C | 250 | 121 |
| Minimum Gas Supply Pipe Size[5] | in | mm | 3 | 76 | Coolant Capacity (Engine only) | gal | L | 23.3 | 88.1 |
| Maximum Pressure Drop Across CAC | psi | kPa | 1 | 6.9 | Coolant Capacity (Radiator only) | gal | L | 23.3 | 88.1 |
| Max Allowable Intake Restriction | | | | | Standard Thermostat Range | | | | |
| Clean Air Filter | in-$H_2O$ | kPa | 5 | 1.24 | Normal Operation Temperature[9] | °F | °C | 176 | 80 |
| Dirty Air Filter | in-$H_2O$ | kPa | 15 | 3.73 | Full Open Temperature[9] | °F | °C | 198 | 92 |
| Spark Plug Part Number | | | Bosch R6 6857 | | ECU Coolant Temp Warning | °F | °C | 203 | 95 |
| Standard Spark Plug Gap[10] | in | mm | 0.012 | 0.3 | ECU Coolant Temp Shutdown | °F | °C | 208 | 98 |
| Spark Plug Coil - Primary Resistance | Ohms | | 0.59Ω ± 10% | | 50°C Ambient Capable[11] | | | Pass | |
| Battery Voltage | Volts | | 24 | | Max External Coolant Friction Head | psi | kPa | 7.25 | 50 |
| Starter Motor Power | HP | kW | 15.7 | 11.7 | CAC Rise Above Ambient Specified | F | C | 15 | 9 |

| 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 System[5]** | | | | | | | | | | |
| 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 Balance[5]** | | | | | | | | | | |
| 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 14.5Psia(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 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

[Stoic.]
Rev: 2

PSI HEAVY-DUTY

| General Engine Data[5] | | | | | Flywheel housing | SAE No.0 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Type | V-Series | | | | Flywheel | SAE No.18 | | | |
| Number of cylinders | 12 | | | | Dry Weight (Fan to Flywheel) | lb | kg | 7100 | 3221 |
| Aspiration | Charged Cooled Forced Induction | | | | Wet Weight (Fan to Flywheel) | lb | kg | 7544 | 3422 |
| Firing Order | 1 - 8 - 5 - 10 - 3 - 7 - 6 - 11 - 2 - 9 - 4 - 12 | | | | CG From Rear Face of Block | in | mm | 37.0 | 941 |
| Rotation Viewed from Flywheel | Counter Clockwise | | | | CG Above Crank Centerline | in | mm | 0 | 0 |
| Bore | in | mm | 5.906 | 150 | Oil Specification | SAE 15W-40 Low Ash Gas engine oil (.25-.5% by wt), API CD/CF or higher | | | |
| Stroke | in | mm | 5.906 | 150 | | | | | |
| Displacement | $in^3$ | L | 1941 | 31.8 | | | | | |
| Compression Ratio | 10.5 : 1 | | | | Engine Oil Capacity[8] | | | | |
| Exhaust Manifold Type | Water Cooled | | | | Min | qts | L | 95 | 90 |
| Turbo Exhaust Outlet Pipe Size | in | mm | 3.5 | 89 | Max | qts | L | 129 | 122 |
| Catalyst Inlet Size | in | mm | 5 | 127 | ECU Oil Pressure Warning[6] | psi | kPa | 57 | 393 |
| Catalyst Dp | in-$H_2O$ | kPa | 20.5 | 5.1 | ECU Oil Pressure Shut Down[6] | psi | kPa | 47 | 324 |
| Maximum Allowable Exhaust Back Pressure | in-Hg | kPa | 3.0 | 10.2 | Oil Pressure at 1000 rpm (Idle) | | | | |
| Maximum EPR Rated Pressure | psi | kPa | 1.0 | 6.9 | Min | psi | kPa | 82 | 569 |
| Maximum Operating pressure to EPR | in-$H_2O$ | kPa | 11.0 | 2.7 | Max | psi | kPa | 74 | 512 |
| Minimum Operating pressure to EPR | in-$H_2O$ | kPa | 7.0 | 1.7 | Max Allowable Oil Temperature | °F | °C | 250 | 121 |
| Minimum Gas Supply Pipe Size[5] | in | mm | 3 | 76 | Coolant Capacity (Engine only) | gal | L | 23.3 | 88.1 |
| Maximum Pressure Drop Across CAC | psi | kPa | 1 | 6.9 | Coolant Capacity (Radiator only) | gal | L | 23.3 | 88.1 |
| Max Allowable Intake Restriction | | | | | Standard Thermostat Range | | | | |
| Clean Air Filter | in-$H_2O$ | kPa | 5 | 1.24 | Normal Operation Temperature[9] | °F | °C | 176 | 80 |
| Dirty Air Filter | in-$H_2O$ | kPa | 15 | 3.73 | Full Open Temperature[9] | °F | °C | 198 | 92 |
| Spark Plug Part Number | | | Bosch R6 6857 | | ECU Coolant Temp Warning | °F | °C | 203 | 95 |
| Standard Spark Plug Gap[10] | in | mm | 0.012 | 0.3 | ECU Coolant Temp Shutdown | °F | °C | 208 | 98 |
| Spark Plug Coil - Primary Resistance | Ohms | | 0.59Ω ± 10% | | 50°C Ambient Capable[11] | | | Pass | |
| Battery Voltage | Volts | | 24 | | Max External Coolant Friction Head | psi | kPa | 7.25 | 50 |
| Starter Motor Power | HP | kW | 15.7 | 11.7 | CAC Rise Above Ambient Specified | F | C | 15 | 9 |

| Performance Data 50Hz[3,5] | | | | | Water Pump Speed | RPM | | 3088 | |
|---|---|---|---|---|---|---|---|---|---|
| Nominal Engine Speed | RPM | | 1500 | | Engine Coolant Flow | gal/min | L/min | 297 | 1125.6 |
| Mean Piston Speed | ft/min | m/s | 1476 | 7.5 | Cooling Fan Power[11] | HP | kW | 36.4 | 27 |
| RPM Range (Min-Max) ISO 8528-5 G1 | RPM | | 1477 - 1519 | | Cooling Fan Speed | RPM | | 875 | |
| Charging Alternator Voltage | Volts | | 28 | | Cooling Fan Air Flow[11] | SCFM | $m^3$/min | 54200 | 1535 |
| Charging Alternator Current | Amps | | 53 | | | | | | |

| 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 System[5]** | | | | | | | | | | |
| 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 Balance[5]** | | | | | | | | | | |
| 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 14.5Psia(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 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.

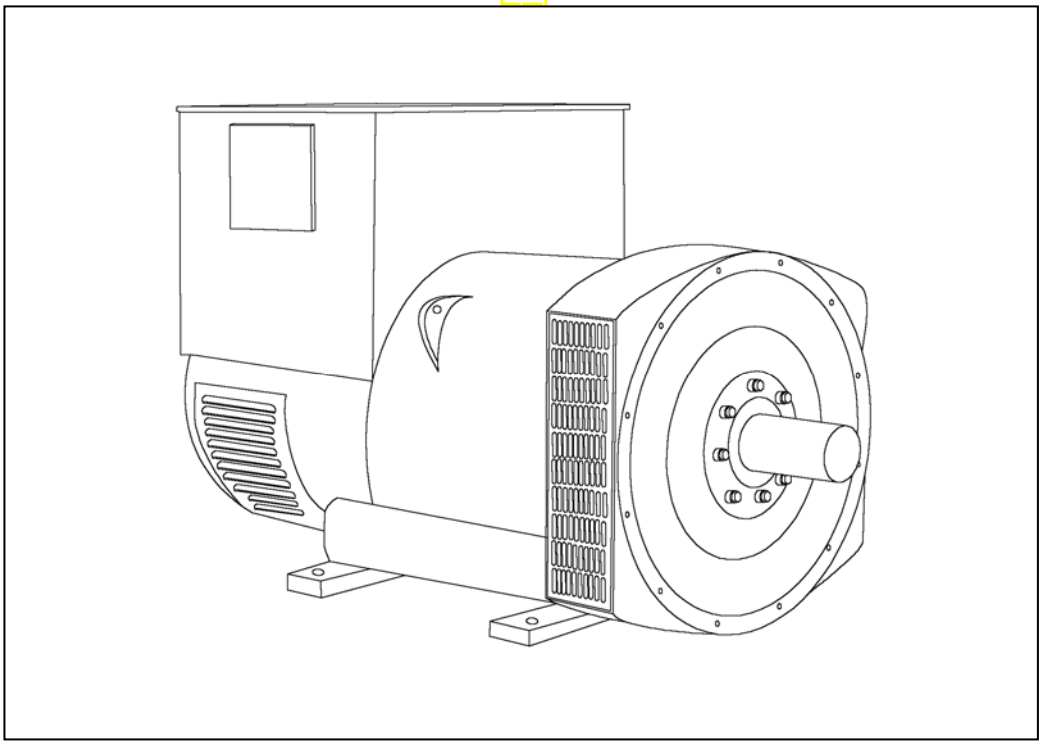
[10] ± 0.002" or 0.05mm.

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

STAMFORD®

# **HCI 534F/544F** - Winding 311

## Technical Data Sheet



# 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

### 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.*

STAMFORD

## 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 | | |
| WR² 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 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 | 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 | | | | | | |

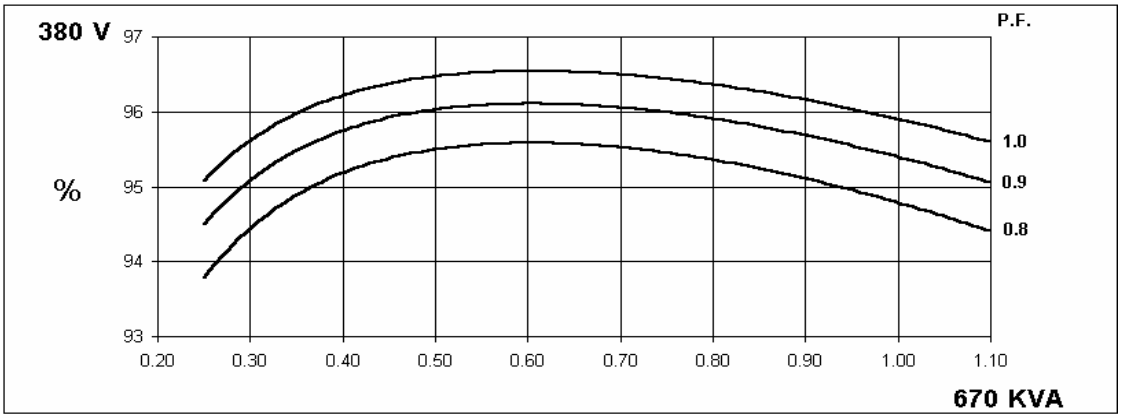
50 Hz

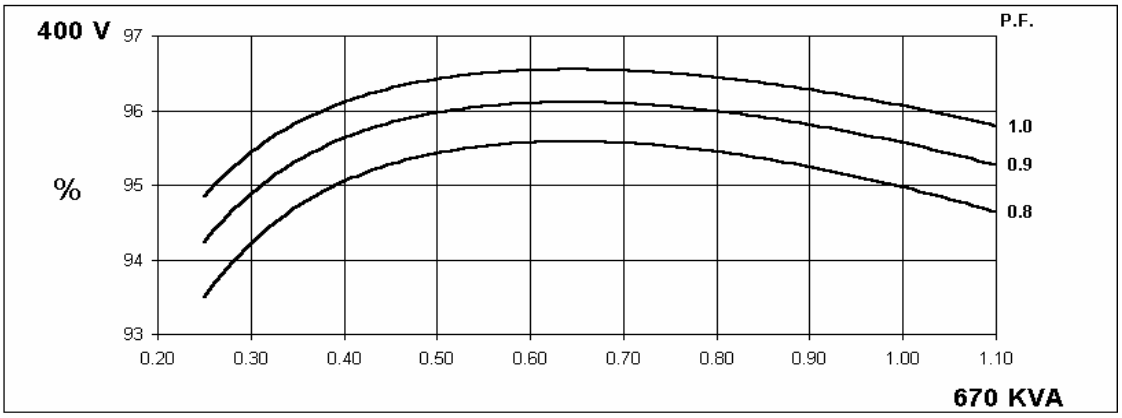
# HCI534F/544F

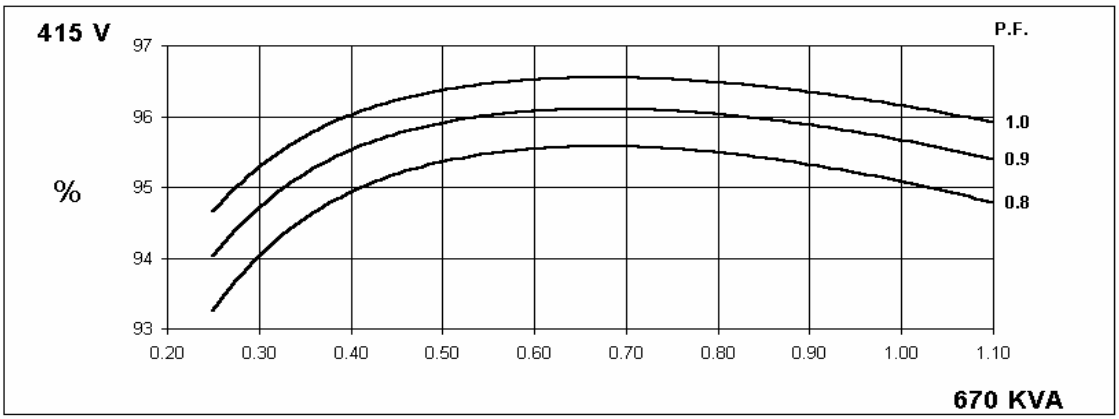
**Winding 311**

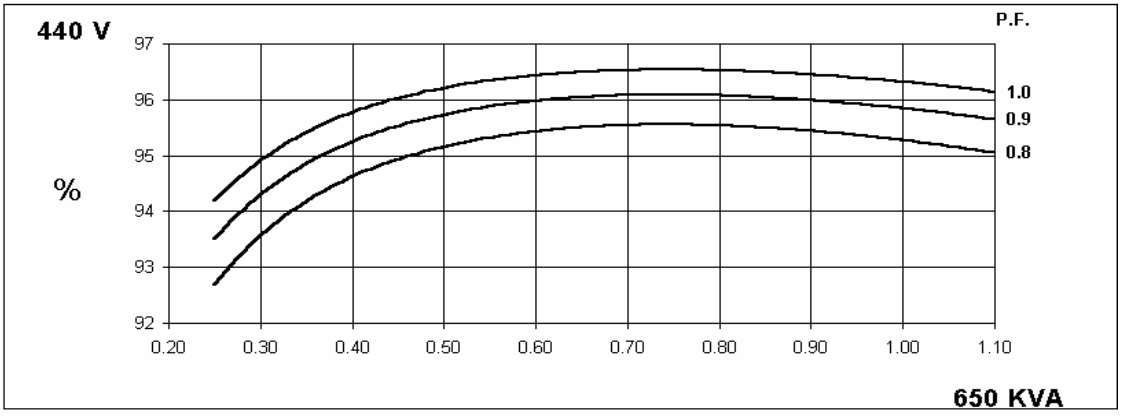
STAMFORD

## THREE PHASE EFFICIENCY CURVES



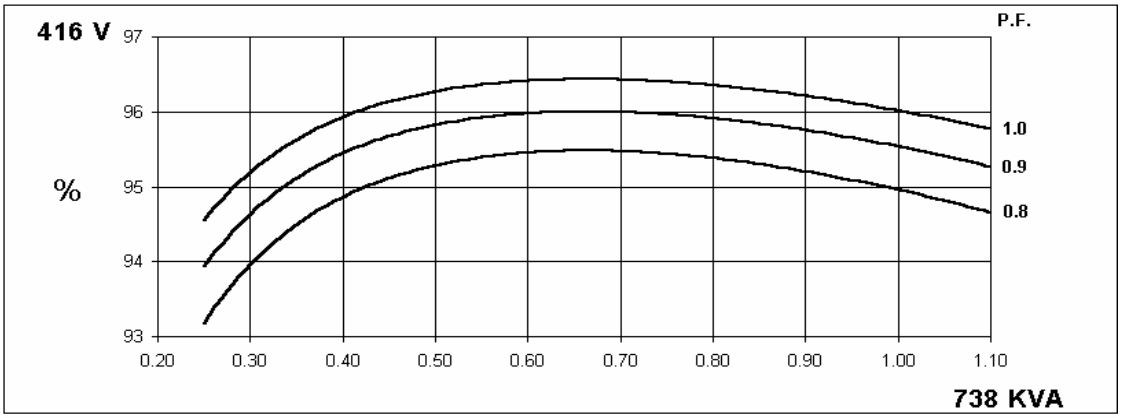
60 Hz

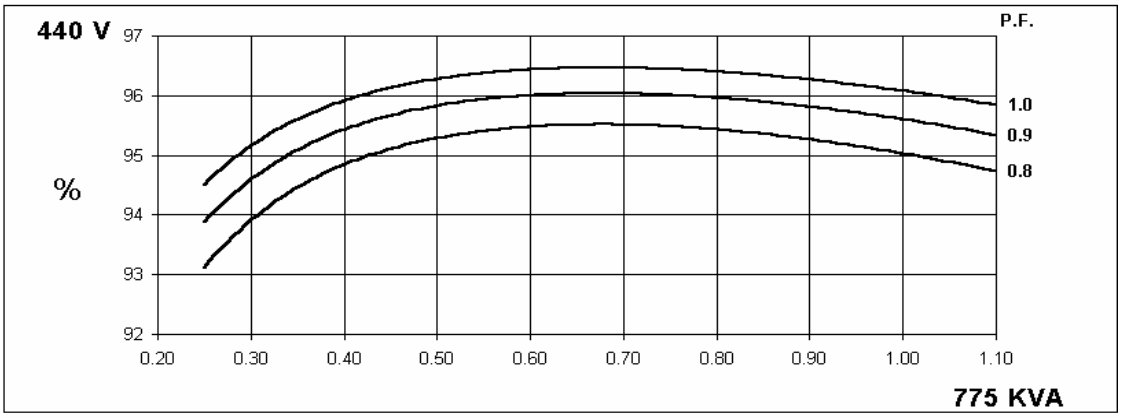
# HCI534F/544F

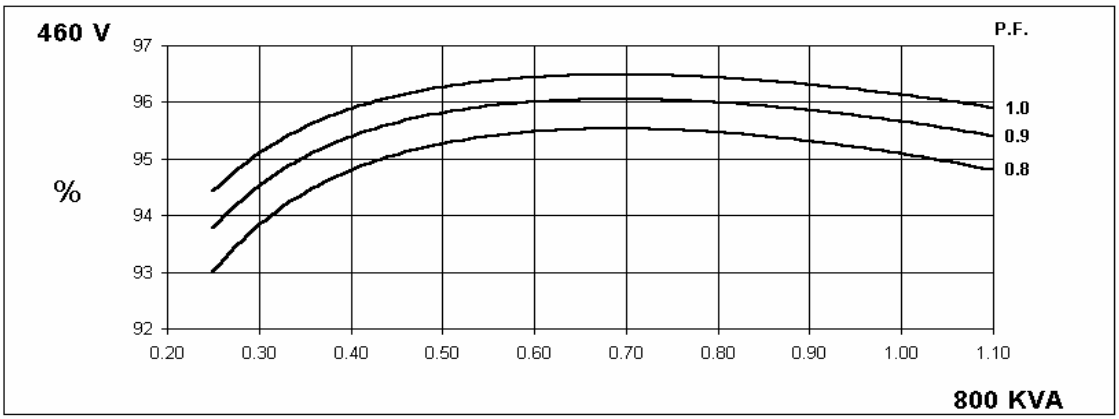
**Winding 311**

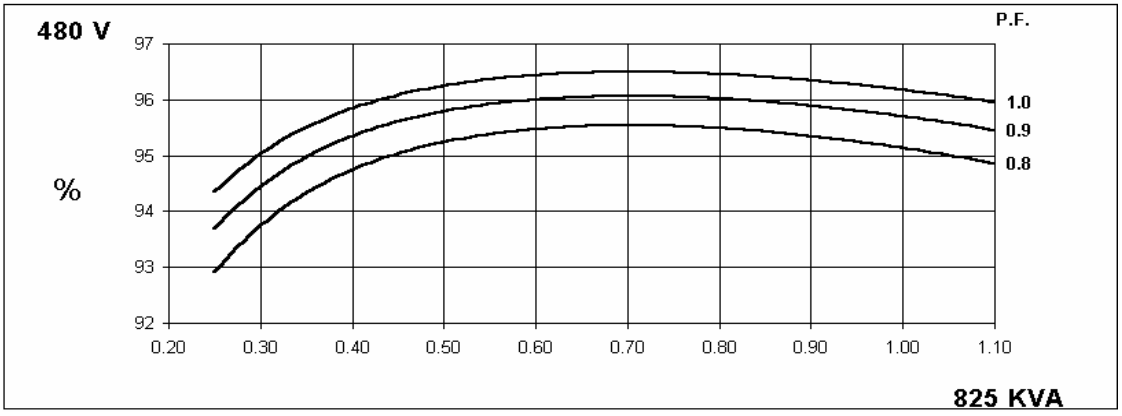
STAMFORD

## THREE PHASE EFFICIENCY CURVES



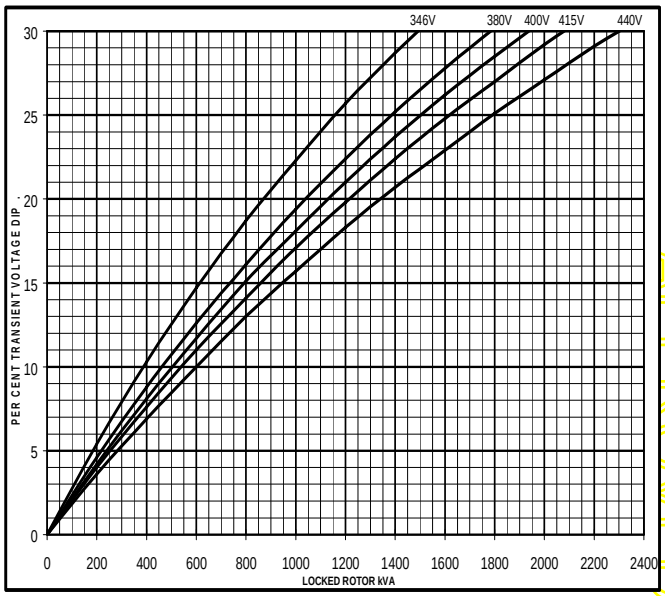
# HCI534F/544F

## Winding 311

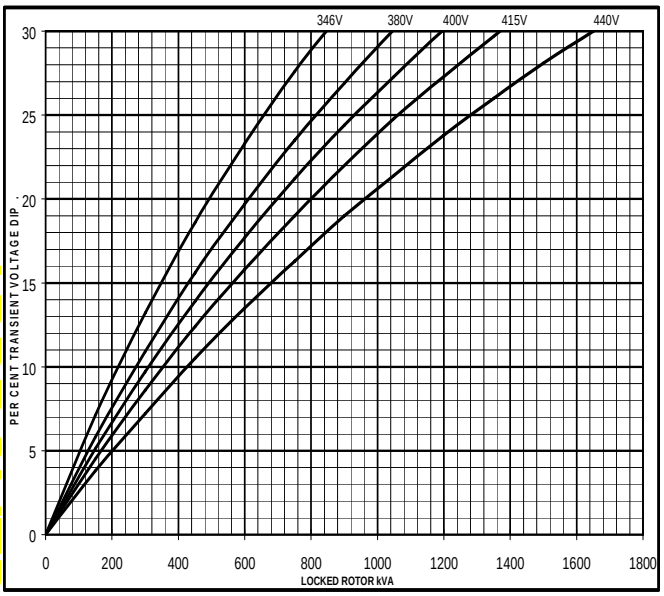
## Locked Rotor Motor Starting Curve

50 Hz

MX

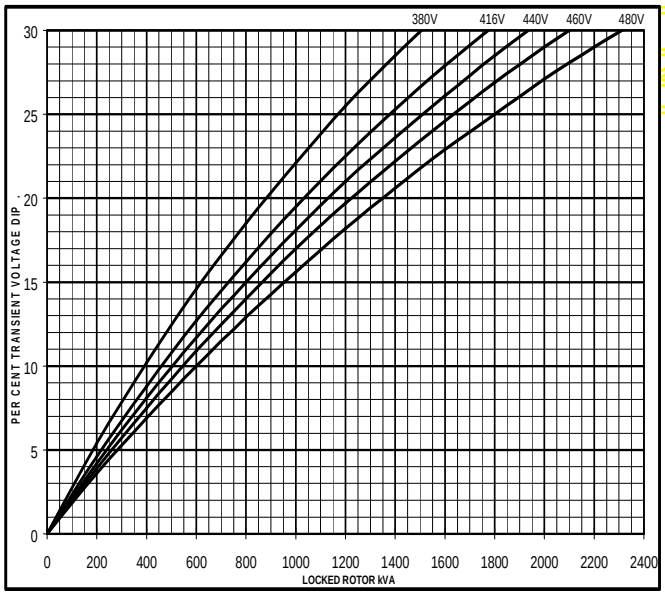



SX

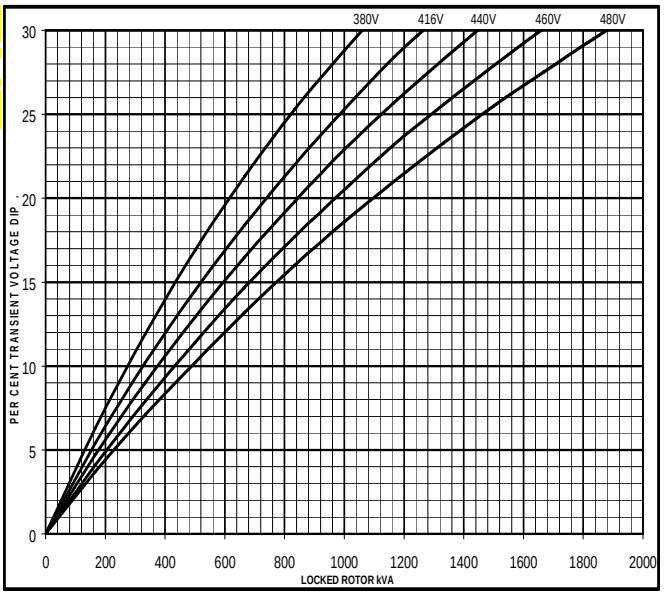



60 Hz

MX

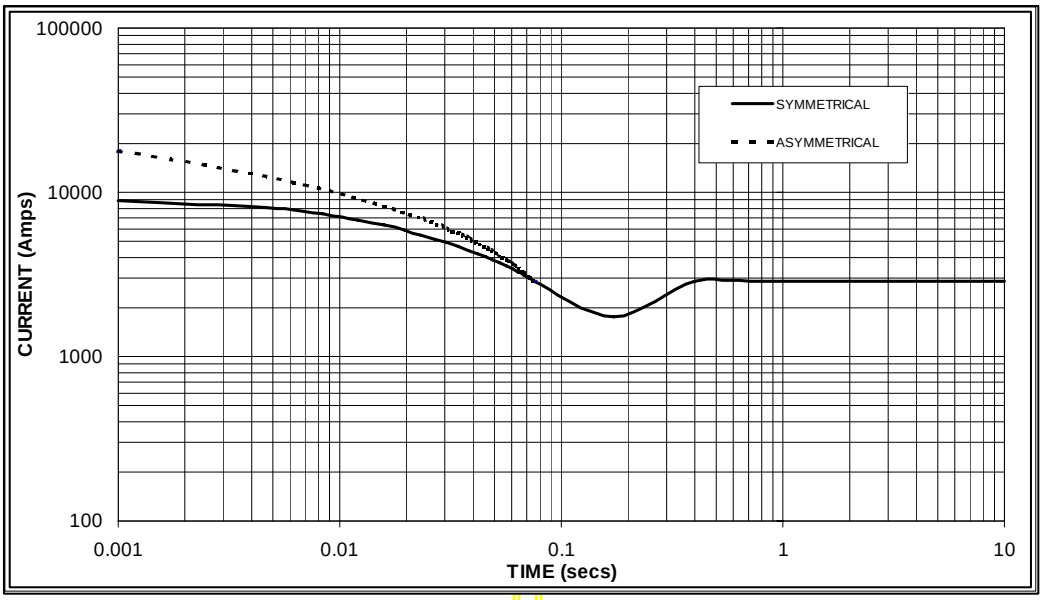



SX



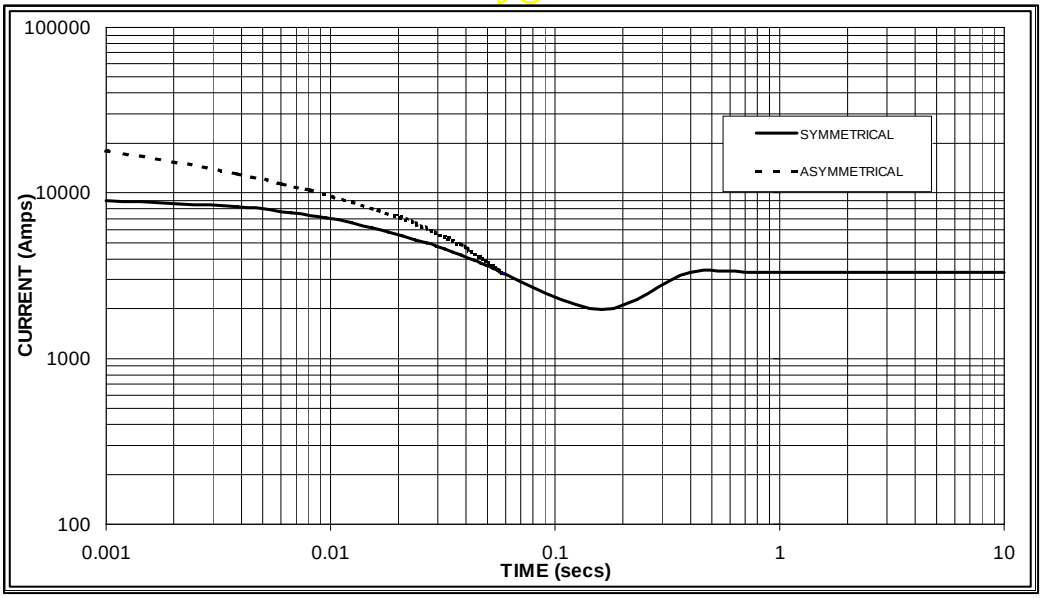
## Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed Based on star (wye) connection.

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

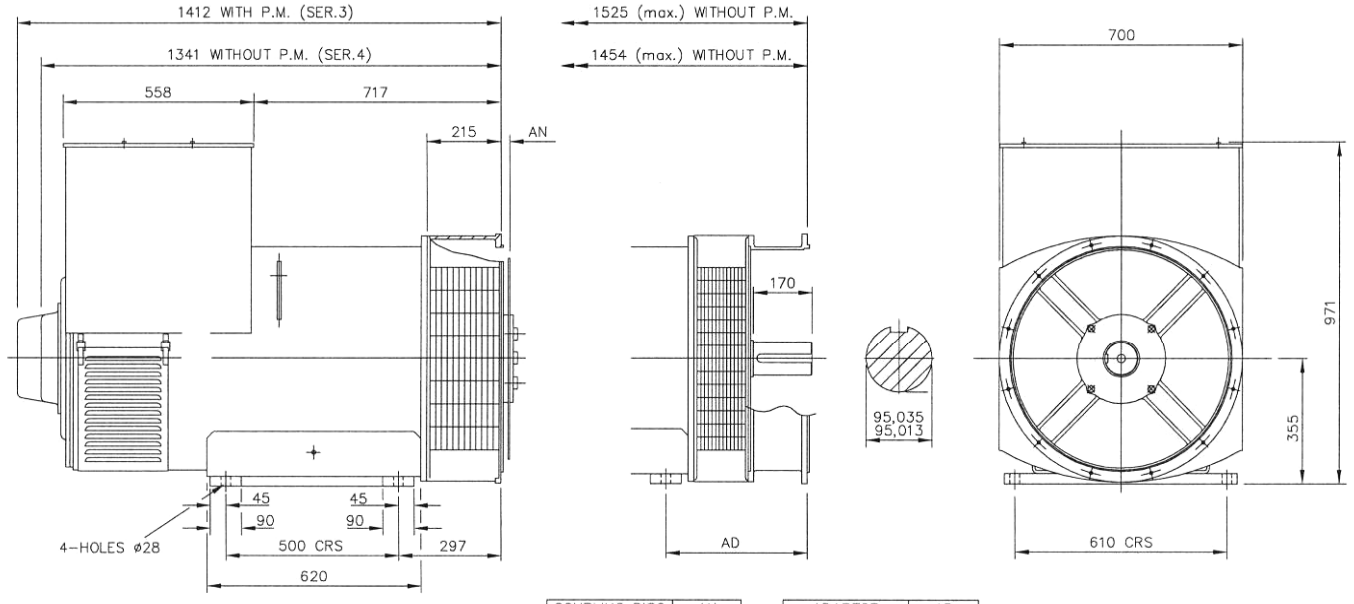
**Winding 311 0.8 Power Factor**

## 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




| COUPLING DISC | AN |
|---|---|
| SAE 14 | 25,4 |
| SAE 18 | 15,87 |
| SAE 21 | 0 |
| | |

| ADAPTOR | AD |
|---|---|
| SAE 00 | 410 |
| SAE 0 | 410 |
| SAE 1/2 | 390 |
| SAE 1 | 390 |

APPROVED DOCUMENT

STAMFORD

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Lincolnshire, PE9 2NB
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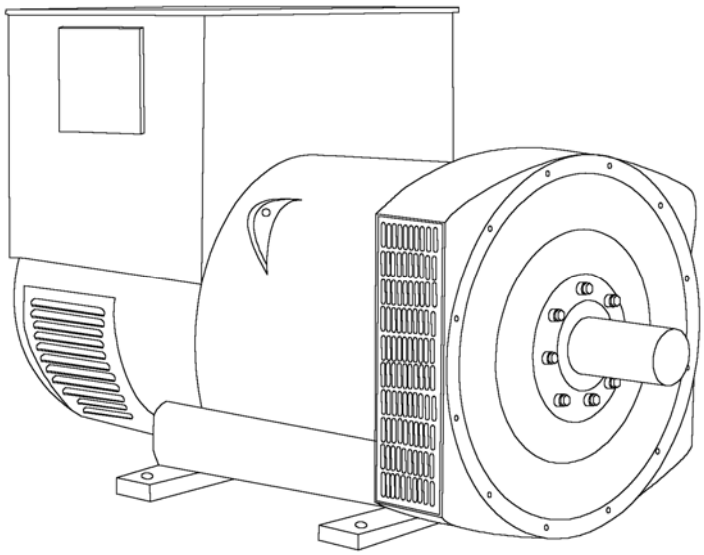
Fax: +44 (0) 1780 484100

www.cumminsgeneratortechnologies.com

STAMFORD®

# **HCI 534E/544E** - Winding 311

## Technical 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

### 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 | | |
| WR² 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 | | | | | | |

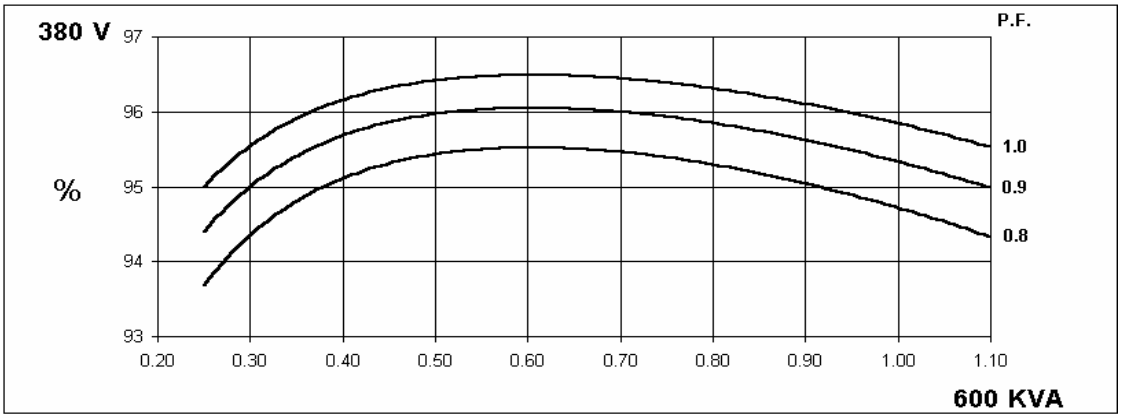
50 Hz

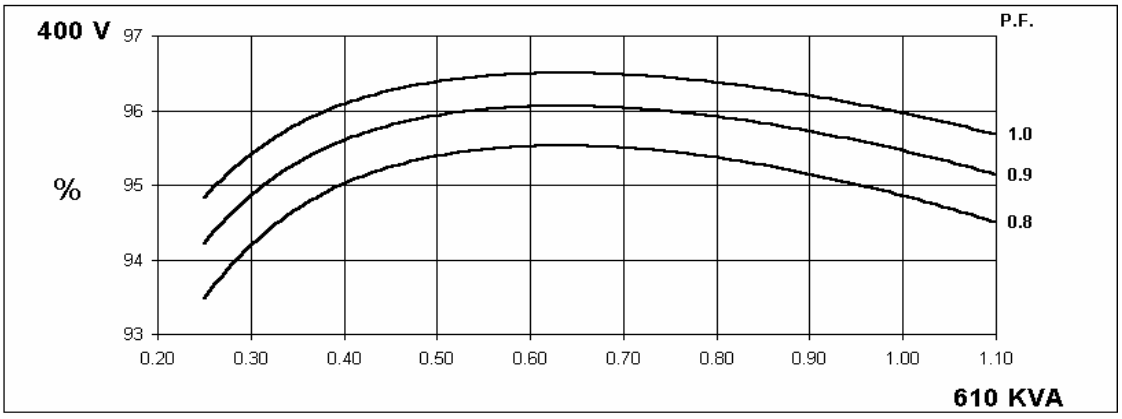
# HCI534E/544E

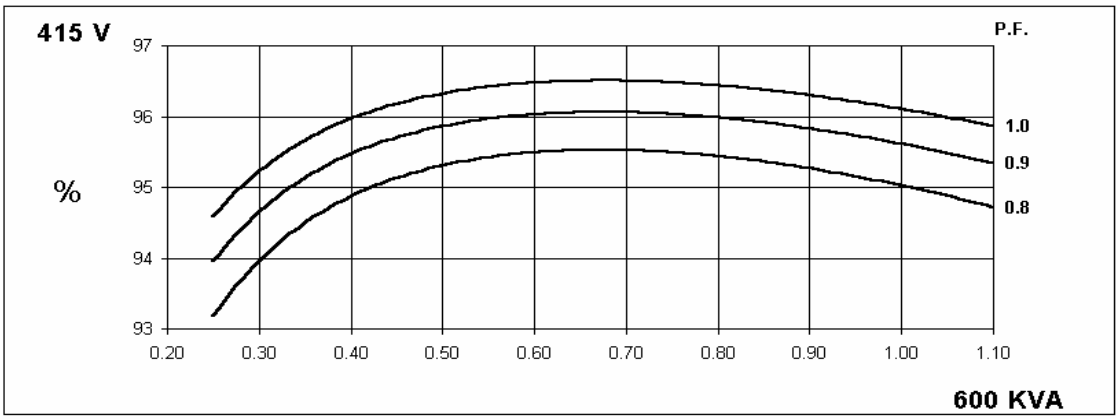
## Winding 311

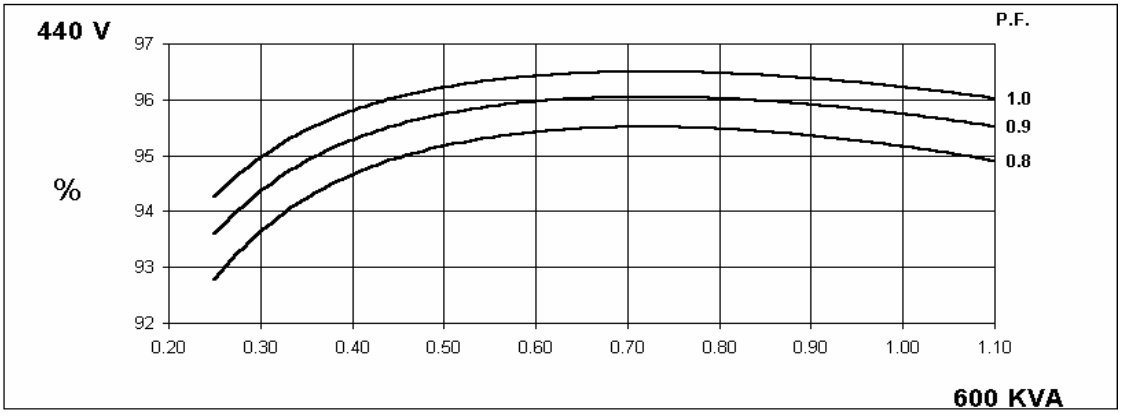
STAMFORD

## THREE PHASE EFFICIENCY CURVES



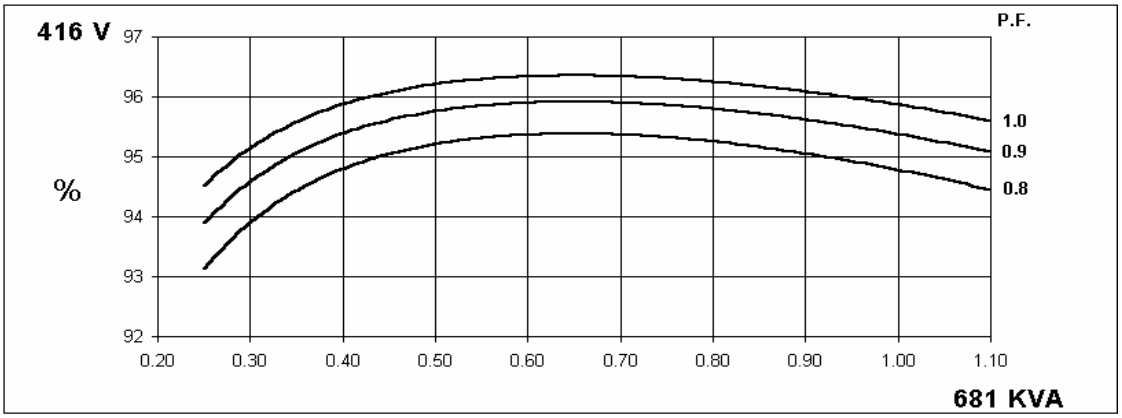
60 Hz

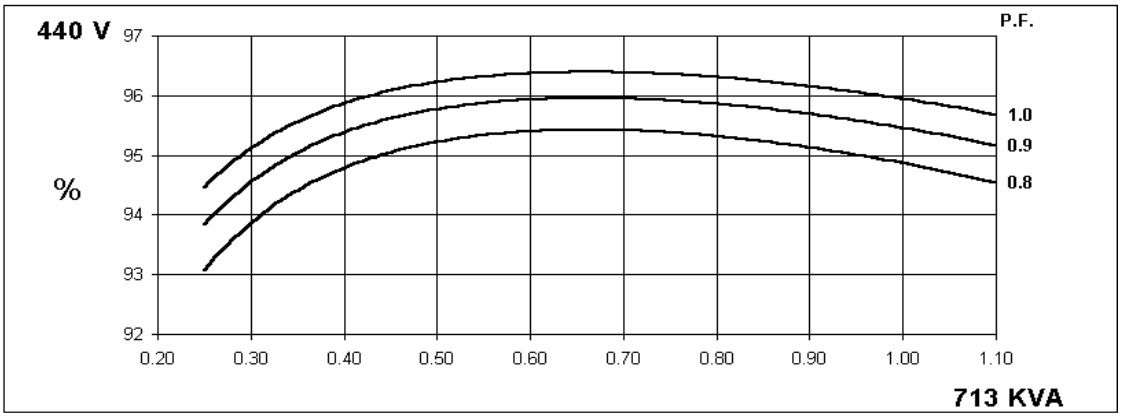
# HCI534E/544E

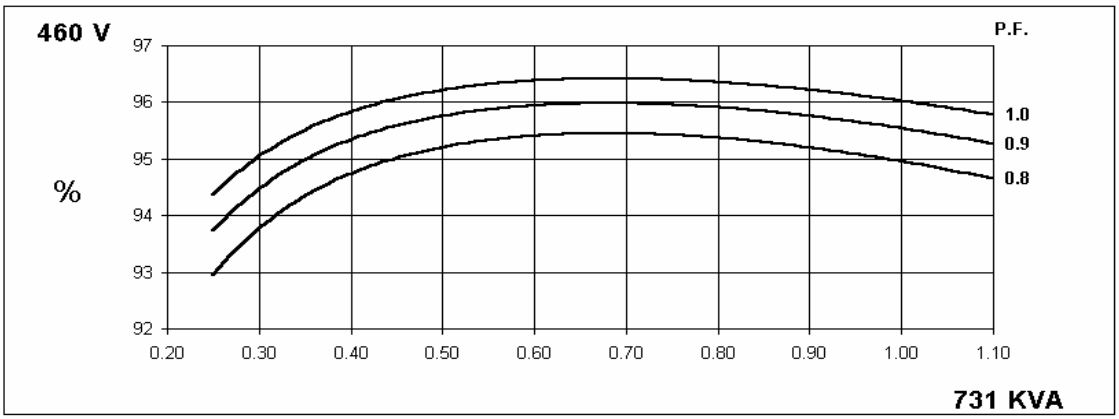
**Winding 311**

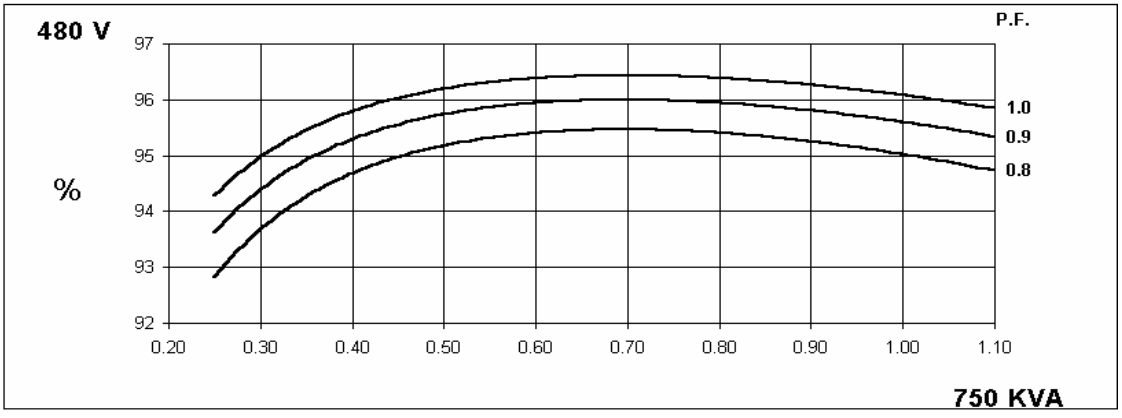
STAMFORD

## THREE PHASE EFFICIENCY CURVES



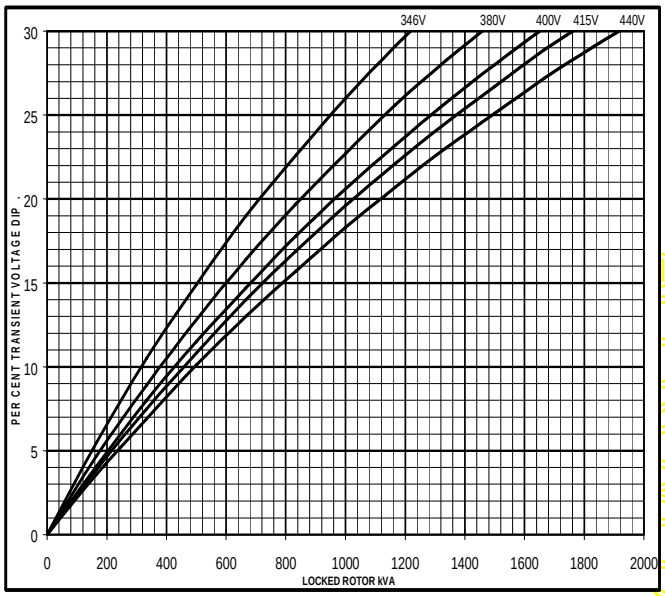
# HCI534E/544E

## Winding 311

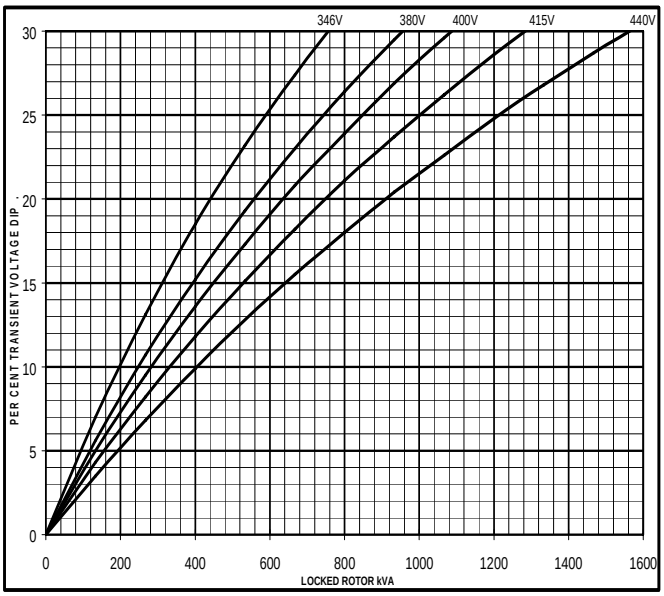
## Locked Rotor Motor Starting Curve

**50 Hz**

MX

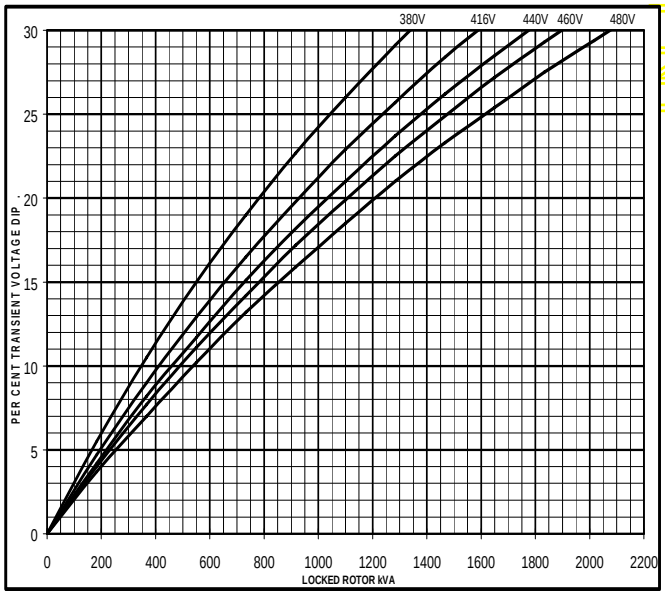



SX

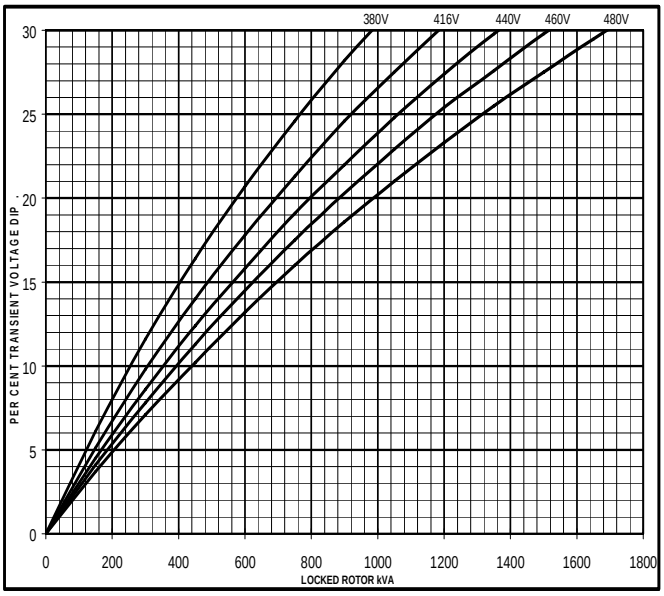



**60 Hz**

MX

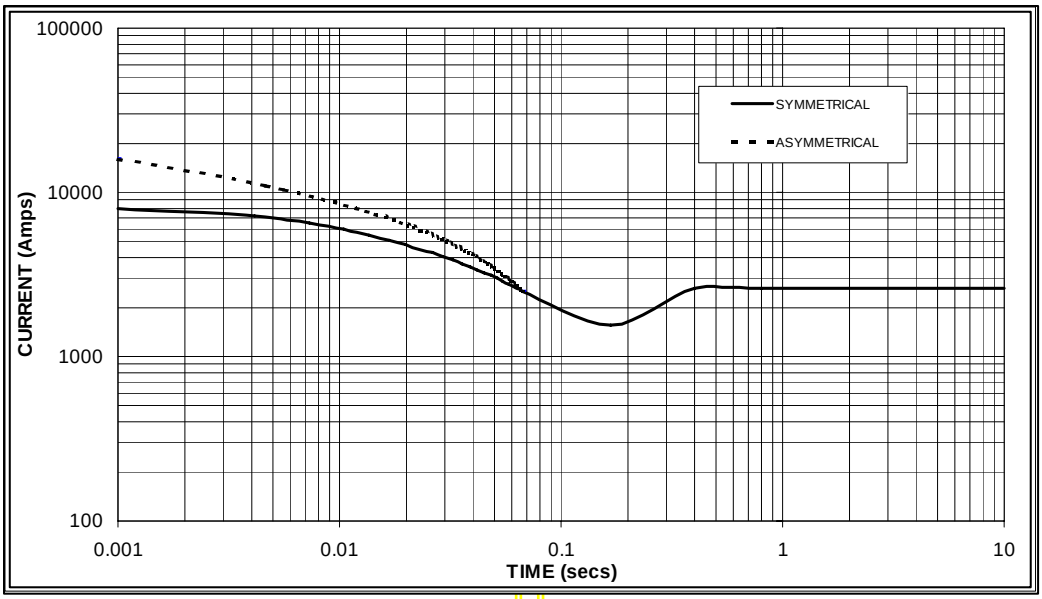



SX



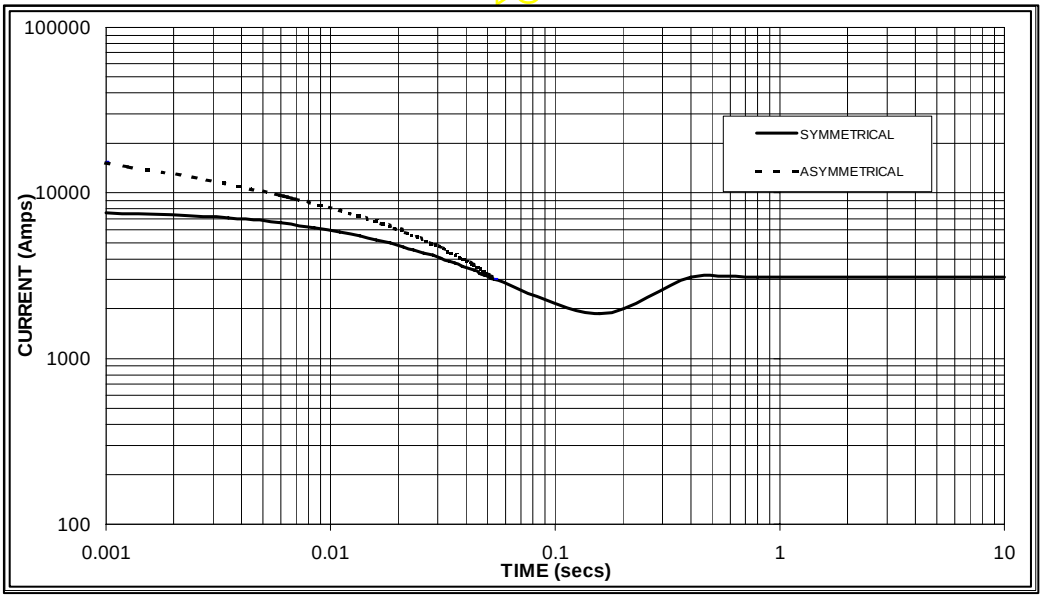
## Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed Based on star (wye) connection.

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

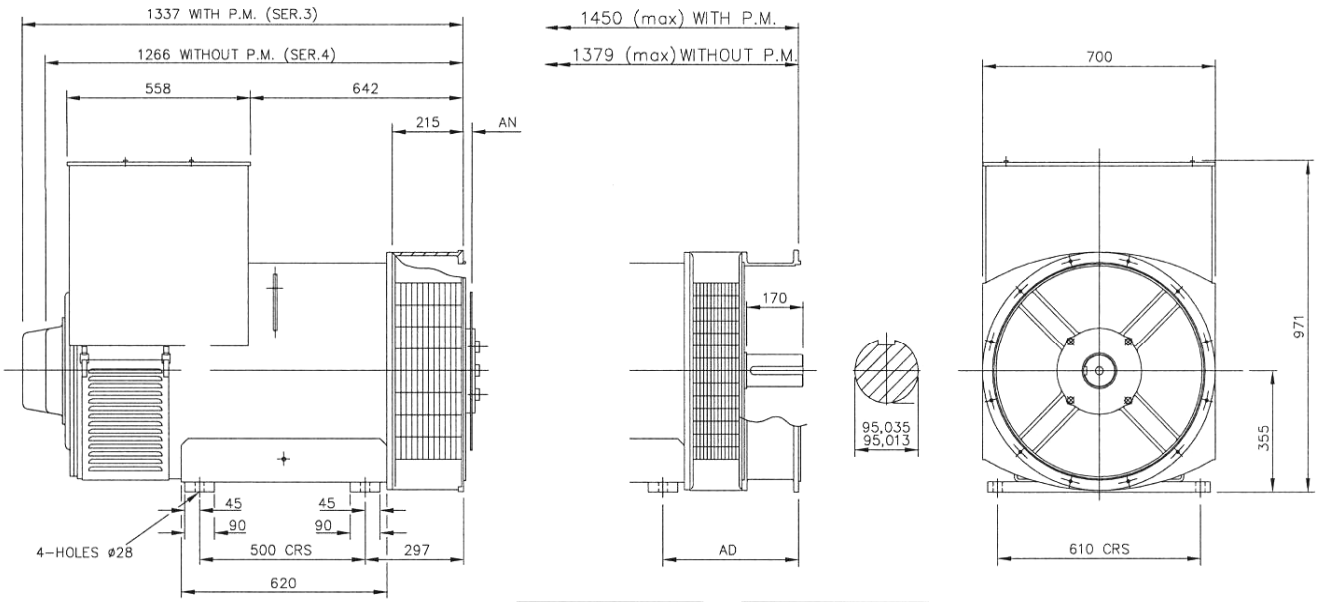
**Winding 311 0.8 Power Factor**

## 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




| COUPLING DISC | AN |
|---|---|
| SAE 14 | 25,4 |
| SAE 18 | 15,87 |
| SAE 21 | 0 |
| | |

| ADAPTOR | AD |
|---|---|
| SAE 00 | 410 |
| SAE 0 | 410 |
| SAE 1/2 | 390 |
| SAE 1 | 390 |

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Fax: +44 (0) 1780 484100

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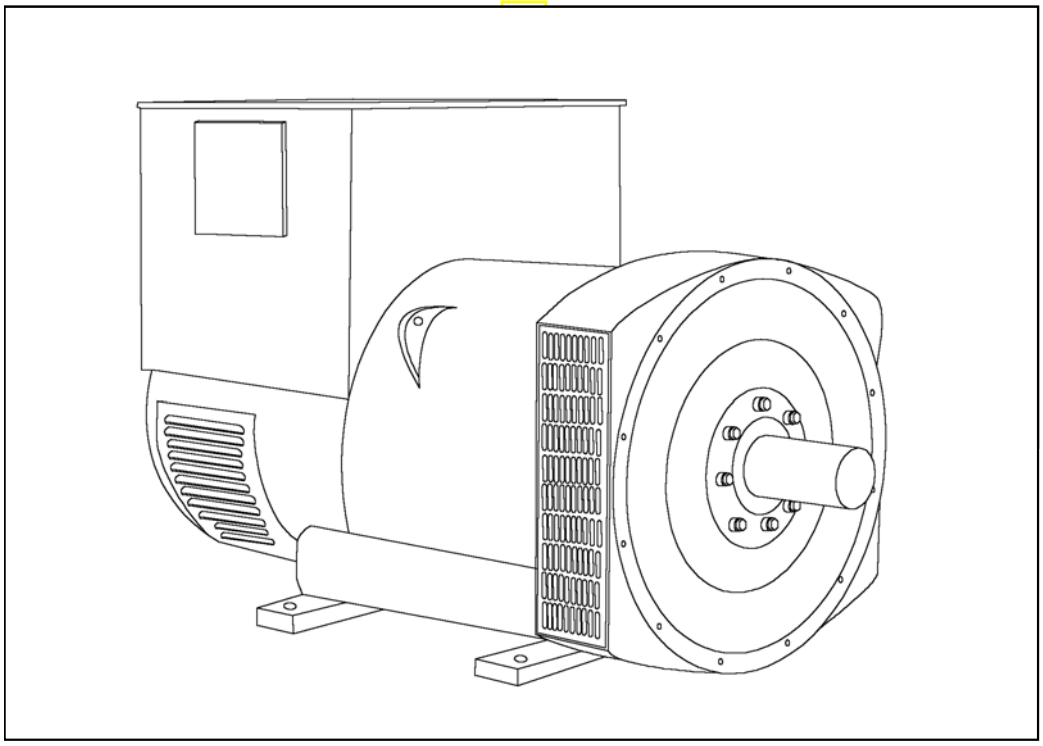
STAMFORD®

**HCI534F/544F** - Winding 17

Technical 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

### 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 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.*

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## 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 | |

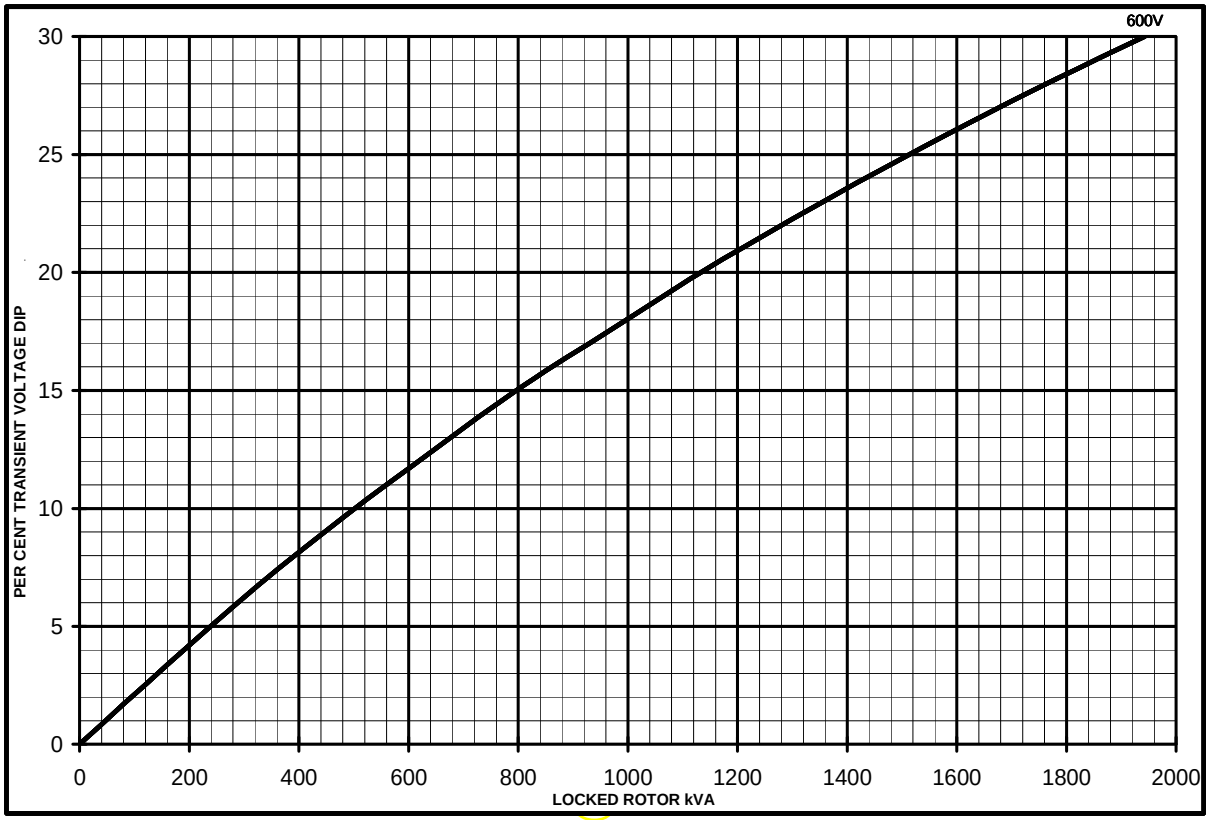
| | | |
|---|---|---|
| INSULATION SYSTEM | CLASS H | |
| PROTECTION | IP23 | |
| RATED POWER FACTOR | 0.8 | |
| STATOR WINDING | DOUBLE LAYER LAP | |
| WINDING PITCH | TWO THIRDS | |
| WINDING LEADS | 12 | |
| STATOR WDG. RESISTANCE | 0.0049 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED | |
| ROTOR WDG. 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 |
| WR² 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 $m^3$/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

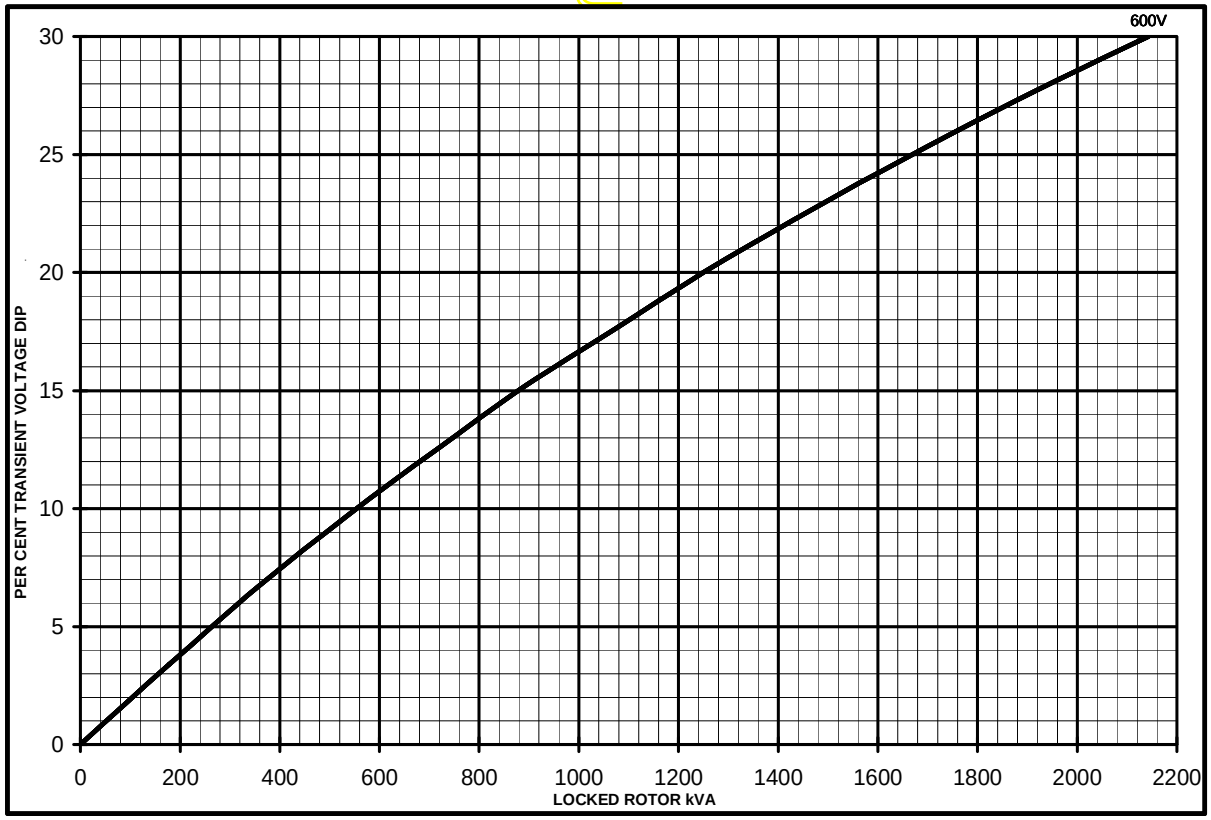
**Winding 17**

SX

## Locked Rotor Motor Starting Curves




MX



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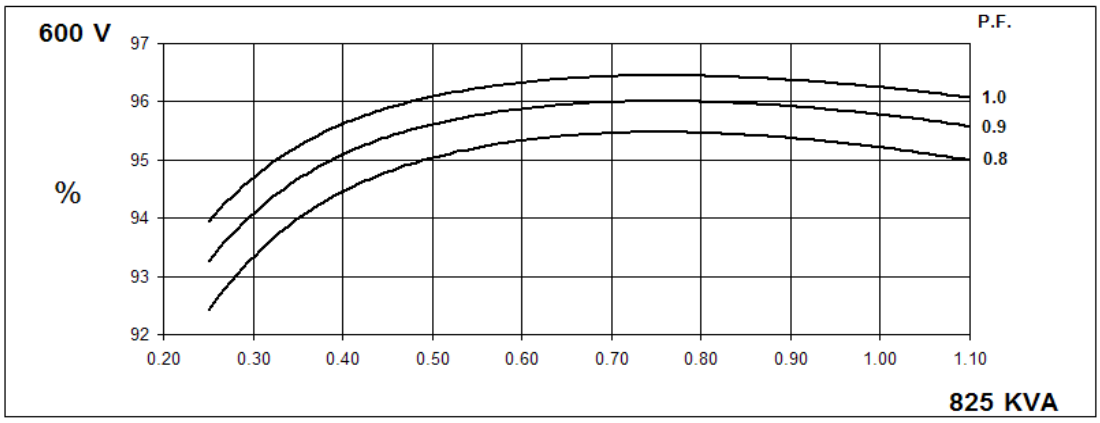
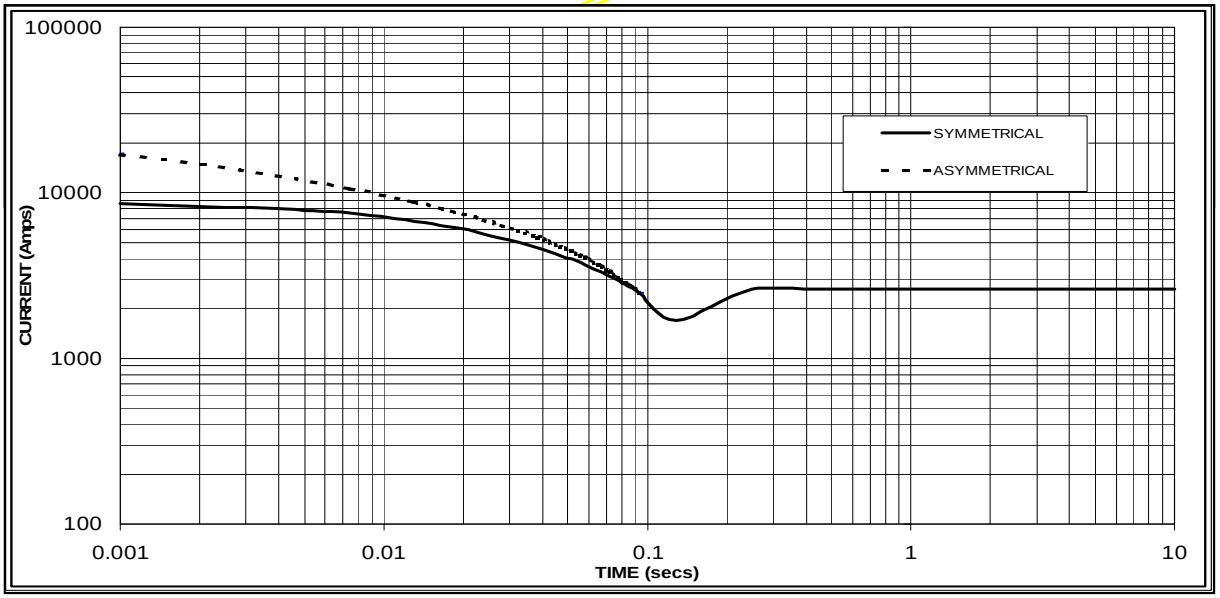
## THREE PHASE EFFICIENCY CURVES






## 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**

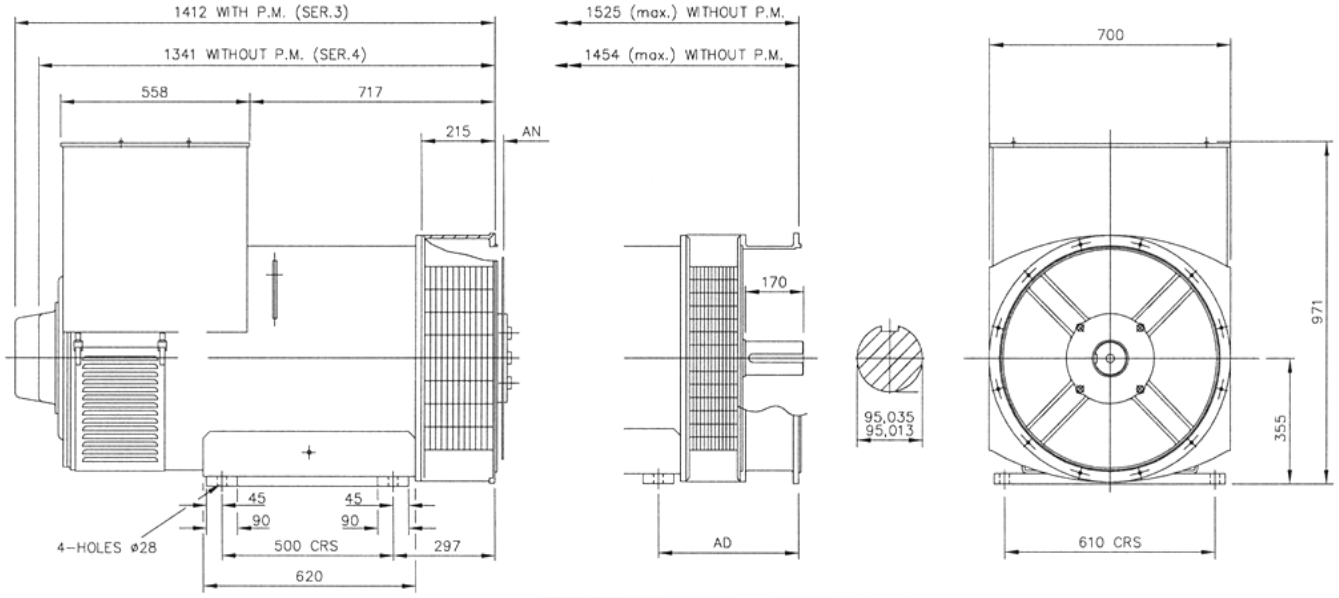
## 60Hz

## 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 |



## DIMENSIONS




| COUPLING DISC | AN |
|---|---|
| SAE 14 | 25,4 |
| SAE 18 | 15,87 |
| SAE 21 | 0 |
| | |

| ADAPTOR | AD |
|---|---|
| SAE 00 | 410 |
| SAE 0 | 410 |
| SAE 1/2 | 390 |
| SAE 1 | 390 |

APPROVED DOCUMENT

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DSEGenset

# 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 annunciate 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

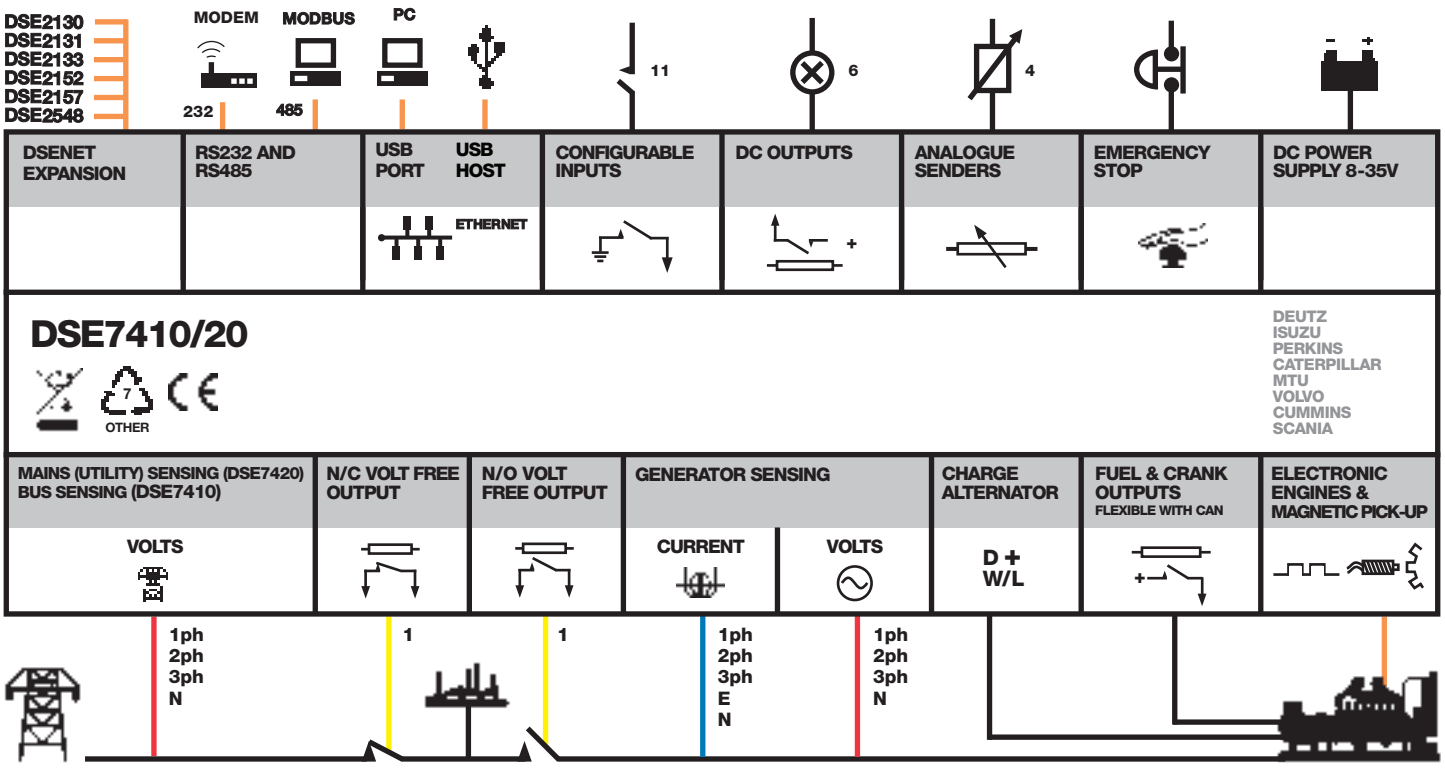
**VIBRATION**
BS EN 60068-2-6
Ten sweeps in each of three major axes
5 Hz to 8 Hz @ +/-7.5 mm,
8 Hz to 500 Hz @ 2 gn

**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




ISSUE 1

DSEGenset

# DSE7410/20

## AUTO START & AUTO MAINS FAILURE MODULES

### FEATURES

DSE7410

DSE7420

### 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 | PART NO’S |
|---|---|
| DSE7410 Installation Instructions | 053-085 |
| DSE7420 Installation Instructions | 053-088 |
| DSE74xx Quick Start Guide | 057-162 |
| DSE74xx Operator Manual | 057-161 |
| DSE74xx PC Configuration Suite Manual | 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**
Highfield House, Hunmanby Industrial Estate, Hunmanby YO14 0PH
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**EMAIL** sales@deepseausa.com **WEBSITE** www.deepseausa.com

# 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 electromechanical 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 (I1 = 0.7…1 x In) and adjustable magnetic threshold (I3 = 5…10 x In).

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)

Publication LV113
No. 1SXU210113D0201
Printed in USA, April, 2008

**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.

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 electromechanical 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)

Publication LV114
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**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

# 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)

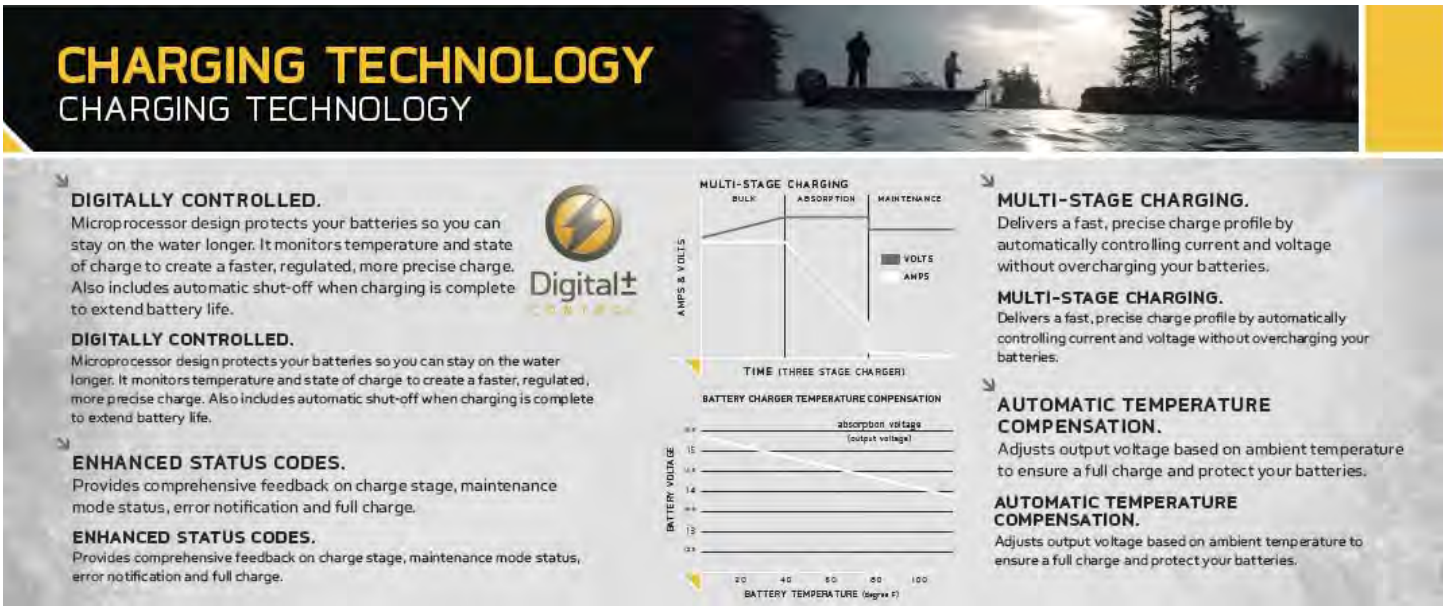
The Tmax T8 MCS are derived from the corresponding circuit breakers, of which they keep the overall dimensions, the versions, the fixing systems and the possibility of mounting accessories unchanged. This version only differs from the circuit breakers in the absence of the protection trip units. All 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

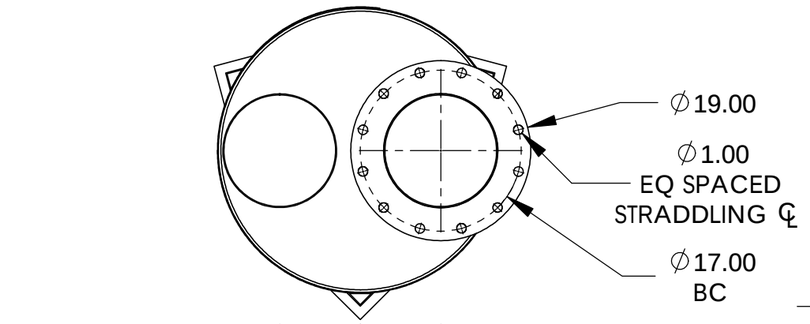



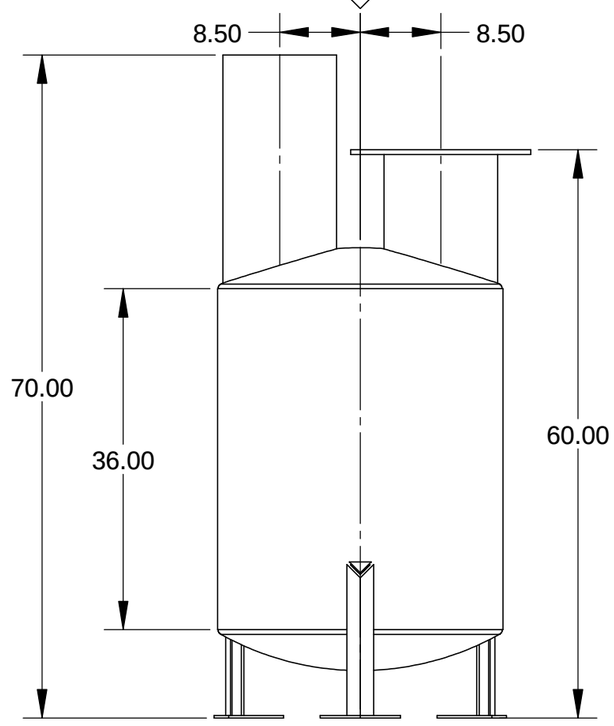
# Digital Linear Chargers

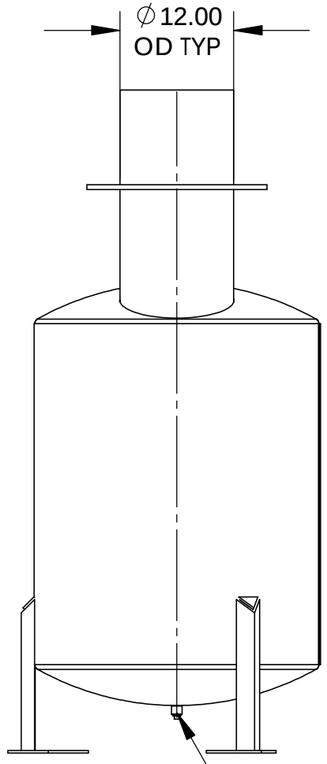
## Specifications

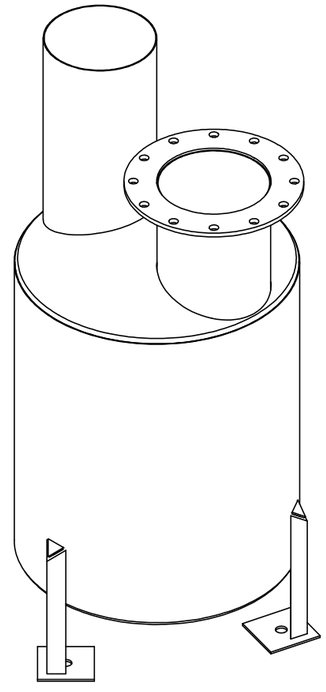
- Waterproof, shock-and vibration-resistant aluminum construction
- Saltwater tested and fully corrosion-resistant
- Short circuit, reverse polarity, and ignition protected
- For use with 12V/6 cell batteries that are flooded/wet cell, maintenance free or starved electrolyte (AGM) only
- FCC compliant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

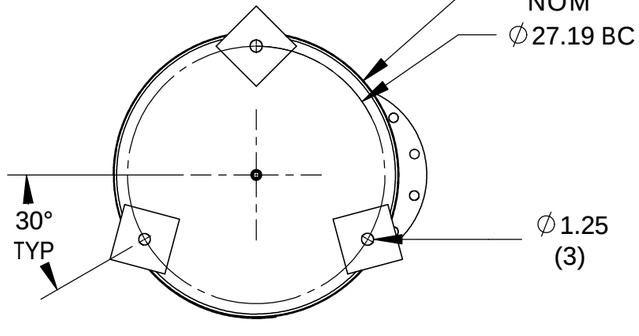

| DIGITAL LINEAR ON-BOARD CHARGERS | |
|---|---|
| PRODUCT CODE | PRODUCT DESCRIPTION |
| 1821065 | MK 106D (1 bank x 6 amps) |
| 1821105 | MK-110D (1 bank x 10 amps) |
| 1822105 | MK-210D (2 bank x 5 amps) |
| 1823155 | MK-315D (3 bank x 5 amps) |
| 1822205 | MK-220D (2 bank x 10 amps) |
| 1823305 | 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 | |
|---|---|---|---|---|
| | | CB | 08/15/2017 | BERGARI SOLUTIONS member of the mandersgroup |
| ENGINE MAKE: MITSUBISHI | RESONATOR FREQUENCY: --- | CHECKED BY: CB | DATE: 08/15/2017 | |
| ENGINE MODEL: S12A2-Y2PTAW-2 | RESONATOR ALPHA: --- | ENGINEERING: CB | DATE: | DESCRIPTION: SIL: COMP CRIT CS E-E 12.00-12.00 Ø30.00 70.00 OAL F--- |
| DISPLACEMENT: 2071 | SILENCER Km: --- | MANUFACTURING: CB | DATE: | |
| EXHAUST FLOW: 8192 | SILENCER IL: --- | TOLERANCES UNLESS OTHERWISE SPECIFIED .X = ±0.25 ALL ANGLES .XX = ±0.125 ±1° .XXX = ±0.0625 .XXXX = ±0.03125 | WEIGHT (LBS): 356 | CONSTRUCTION MATERIAL: CS |
| EXHAUST TEMPERATURE: 883 | TOLERANCES DO NOT APPLY TO GAGE THICKNESS OR COMMERCIAL FEATURES | | SHEET: 3 OF 3 | FINISH: HIGH TEMP BLACK PAINT |
| MAX BACK PRESSURE: 24 | THIRD ANGLE PROJECTION | 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. | | PART NUMBER: 500-008480 REV: 01 |
| RAW SOUND PRESSURE: --- | | | | SCALE (DO NOT SCALE): 1:12 SHEET SIZE: B |

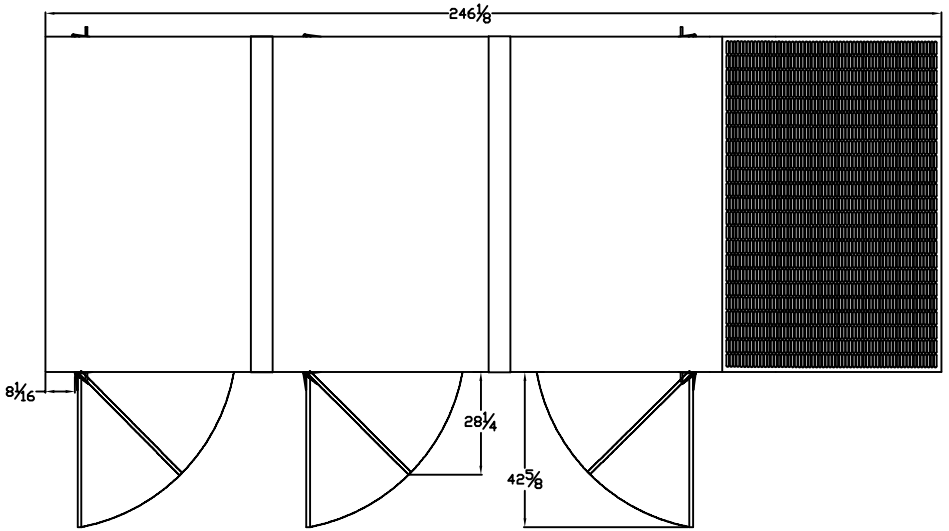
| CUSTOMER | CUSTOMER P/N |
|---|---|
| --- | --- |

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

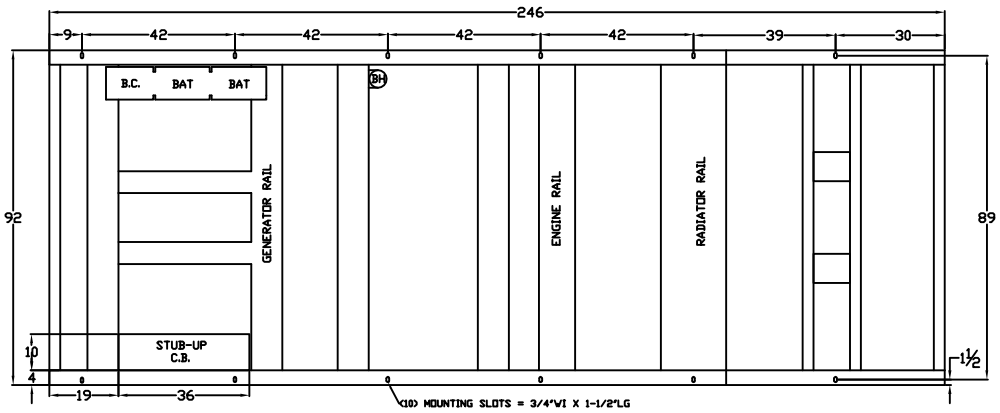
# LEVEL 2 & 3 ENCLOSURE OUTLINE DIMENSIONS FOR SP-6500

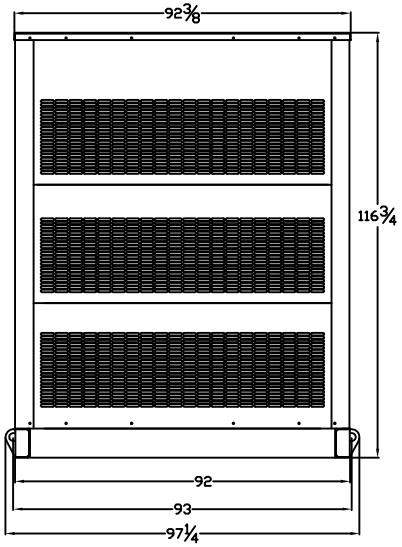
## TOP VIEW

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

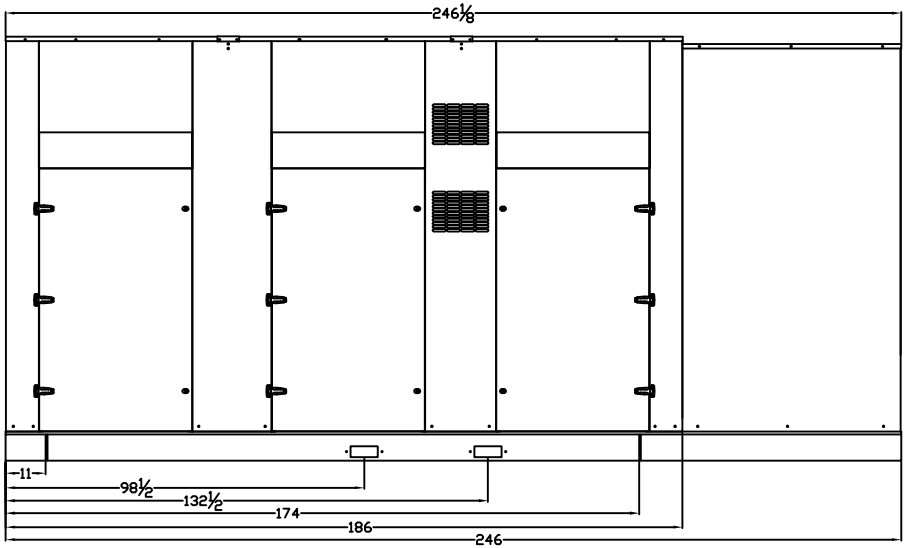



## FRAME VIEW

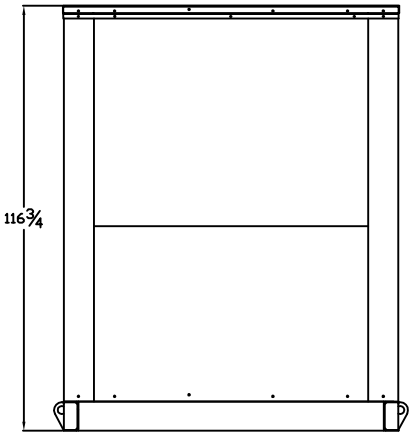



## GENERATOR END VIEW




## SIDE VIEW




## RADIATOR END VIEW

SP-6500-L2-L3-GENERATOR-SET-HINGES-OVERVIEW-20180502