# GILLETTE GENERATORS

## LIQUID COOLED NAT. GAS ENGINE GENERATOR SET

**60 HZ MODEL**

# SP-4500

| Model | | STANDBY 120°C RISE | |
|---|---|---|---|
| | HZ | LPG | N.G. |
| **SP-4500-60 HERTZ** | 60 | 300 | 450 |

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

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

**NFPA 110, 99, 70, 37**
All generator sets meet NFPA-110 Level 1, when equipped with the necessary accessories and installed per NFPA standards.

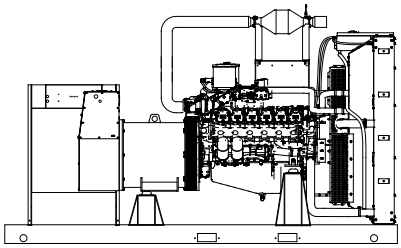
**NEC 700, 701, 702, 708**

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

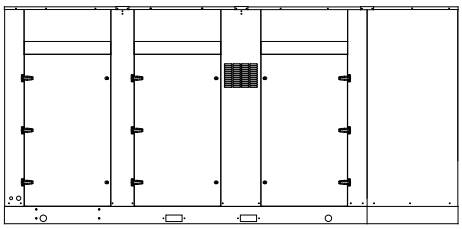
**ANSI C62.41, 27, 59, 32, 480, 40Q, 81U, 360-05**

**ASCE 7-05 & 7-10**
All generator sets meet 180 MPH rating.

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



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



"LEVEL 2" HOUSED GEN-SET
Full aluminum weather protection and superior sound attenuation for specific low noise applications. Critical grade muffler is standard.

## GENERATOR RATINGS

| GENERATOR MODEL | VOLTAGE | | PH | HZ | LIQUID PROPANE GAS FUEL 120°C RISE STANDBY RATING | | NATURAL GAS FUEL 120°C RISE STANDBY RATING | |
|---|---|---|---|---|---|---|---|---|
| | L-N | L-L | | | KW/KVA | AMP | KW/KVA | AMP |
| **SP-4500-3-2** | 120 | 208 | 3 | 60 | 300/400 | 1042 | 450/563 | 1563 |
| **SP-4500-3-3** | 120 | 240 | 3 | 60 | 300/400 | 903 | 450/563 | 1354 |
| **SP-4500-3-4** | 277 | 480 | 3 | 60 | 300/400 | 451 | 450/563 | 677 |
| **SP-4500-3-5** | 127 | 220 | 3 | 60 | 300/400 | 985 | 450/563 | 1477 |
| **SP-4500-3-16** | 346 | 600 | 3 | 60 | 300/400 | 361 | 450/563 | 541 |

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

# APPLICATION AND ENGINEERING DATA FOR MODEL SP-4500-60 HZ

## GENERATOR SPECIFICATIONS

Manufacturer.....Stamford Electric Generators
Model & Type.....HCI534D-311, 4 Pole, 12 Lead, Three Phase
.....S5L1DC4-311, 4 Pole, 12 Lead, 480V, Three Phase
..... HCI534C-17, 4 Pole, 6 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 standby amps
Total Stator and Load Insulation.....Class H, 180°C
Temperature Rise ..... 120°C R/R, standby rating @ 40°C amb.
3 Ø Motor Starting @ 30% Voltage Dip (208-240V)...1200 kVA
3 Ø Motor Starting @ 30% Voltage Dip (480V) .....1320 kVA
3 Ø Motor Starting @ 30% Voltage Dip (600V) .....1320 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, 21.9LTCAC, 4 cycle
Aspiration.....Turbocharged & Charge Air Cooled
Cylinder Arrangement..... 12 Cylinders, Vee
Displacement Cu. In. (Liters).....1338 (21.9)
Bore & Stroke In. (Cm.).....5.04 x 5.59 (128 x 142)
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)…… .1830 (558)
Max Power, bhp (kwm) Standby/LPG..... .....471 (351)
Max Power, bhp (kwm) Standby/NG..... .....684 (510)
Ltd. Warranty Period.....12 Months or 2000 hrs., first to occur

## FUEL SYSTEM

Type .....LPG or NAT. GAS, Vapor Withdrawal
Fuel Pressure (kpa), in. $H_2O$* .....(1.74-2.74), 7"-11"
Secondary Fuel Regulator..... NG or LPG Vapor System
Auto Fuel Lock-Off Solenoid ..... Standard on all sets
Fuel Supply Inlet Line..... (2) 2" NPTF

## FUEL CONSUMPTION

| LP GAS: $FT^3$/HR ($M^3$/HR) | STANDBY |
|---|---|
| 100% LOAD | 1409 (39.9) |
| 75% LOAD | 1201 (34.0) |
| 50% LOAD | 809 (22.9) |
| **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) | STANDBY |
|---|---|
| 100% LOAD | 4490 (127.0) |
| 75% LOAD | 3500 (99.00) |
| 50% LOAD | 2456 (69.54) |
| **NG = 1000 BTU X $FT^3$/HR = Total BTU/HR** | |

## OIL SYSTEM

Type ..... Full Pressure
Oil Pan Capacity qt. (L) .....42.3 (40.0)
Oil Pan Cap. W/ filter qt. (L) .....49.1 (47.1)
Oil Filter..... 2, Replaceable Spin-On

## ELECTRICAL SYSTEM

Ignition System .....Electronic
Eng. Alternator/Starter: 24 VDC, negative ground, 45 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 1000 CCA. Battery tray (max. dim. at 15"lg x 7"wi). This model has (2) battery trays, (2) hold down straps, (2) sets of battery cables, and (1) battery charger. Installation of (2) 12VDC starting batteries connected in series for 24VDC output is required, with possible higher AMP/HR rating, as described above, if the normal environment temperature averages -13° F (-25°C) or cooler.

# APPLICATION AND ENGINEERING DATA FOR MODEL SP-4500-60 HZ

## COOLING SYSTEM

Type of System ..... Pressurized, closed recovery
Coolant Pump .....Pre-lubricated, self-sealing
Cooling Fan Type (no. of blades) ..... Pusher (8)
Fan Diameter inches (mm)..... 52" (1321)
Ambient Capacity of Radiator °F (°C)..... 125 (51.6)
Engine Jacket Coolant Capacity Gal (L)..... 14 (53.0)
Radiator Coolant Capacity Gal. (L) ..... 50 (189)
Maximum Restriction of Cooling Air Intake
and discharge side of radiator in. $H_20$ (kpa)..... 0.5 (.125)
Water Pump Capacity gpm (L/min)..... ..... 174 (660)
Heat Reject Coolant: Btu/min (kw) ..... ..... 25,760 (453)
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) ..... ..... 1027 (29.1)
Radiator Air Flow cfm ($m^3$/min)…… ..…29,000 (821)
Heat Rejected to Ambient:
Engine: kw (btu/min)..... ..... 66 (3765)
Alternator: kw (btu/min)..... ..... 27 (1580)

## EXHAUST SYSTEM

Exhaust Outlet Size..... (2) 5"
Max. Back Pressure, in. hg (KPA)..... 3.0 (10.2)
Exhaust Flow, at rated kw: cfm ($m^3$/min)..... ..... ……3179 (89.8)
Exhaust Temp., at rated kw: °F (ºC) ……..….1382 (750)
Engines are EPA certified for Natural Gas.

## SOUND LEVELS MEASURED IN dB(A)

| | Open Set | Level 2 Encl. |
|---|---|---|
| Level 2, Critical Silencer | 96 | 81 |
| Level 3, Hospital Silencer | | 75 |

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) | 168 (427) | 216 (548) |
| Width in (cm) | 82 (208) | 82 (208) |
| Height in (cm) | 92 (234) | 100 (254) |
| 3 Ø Net Weight lbs (kg) | 9550 (4332) | 12050 (5466) |
| 3 Ø Ship Weight lbs (kg) | 9950 (4513) | 12450 (5647) |

# DEEP SEA 7420 DIGITAL MICROPROCESSOR CONTROLLER


**DEEP SEA 7420**

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

The 7420 controller will also monitor speed, frequency, voltage, current, oil pressure, coolant temp., and fuel levels. These modules have been designed to display warning and shut down status. It also includes: (11) configurable inputs • (8) configurable outputs • voltage monitoring • mains (utility) failure detection. • (250) event logs • configurable timers • automatic shutdown or warning during fault detection • remote start (on load) • engine preheat • advanced metering capability • hour meter • text LCD displays • protected solid state outputs • test buttons for: stop/reset • manual mode • auto mode • lamp test • start button • power monitoring (kWh, kVAr, kVAh, kVArh) This controller includes expansion features including RS232, RS484 (using MODBUS-RTU/TCP), direct USB connection with PC, expansion optioned using DSENet for remote annunciation and remote relay interfacing for a distance of up to 3300FT. The controller software is freely downloadable from the internet and allows monitoring with direct USB cable, LAN, or by internet via the built in web interface.

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

# STANDARD FEATURES FOR MODEL SP-4500-60 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.

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

**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:**

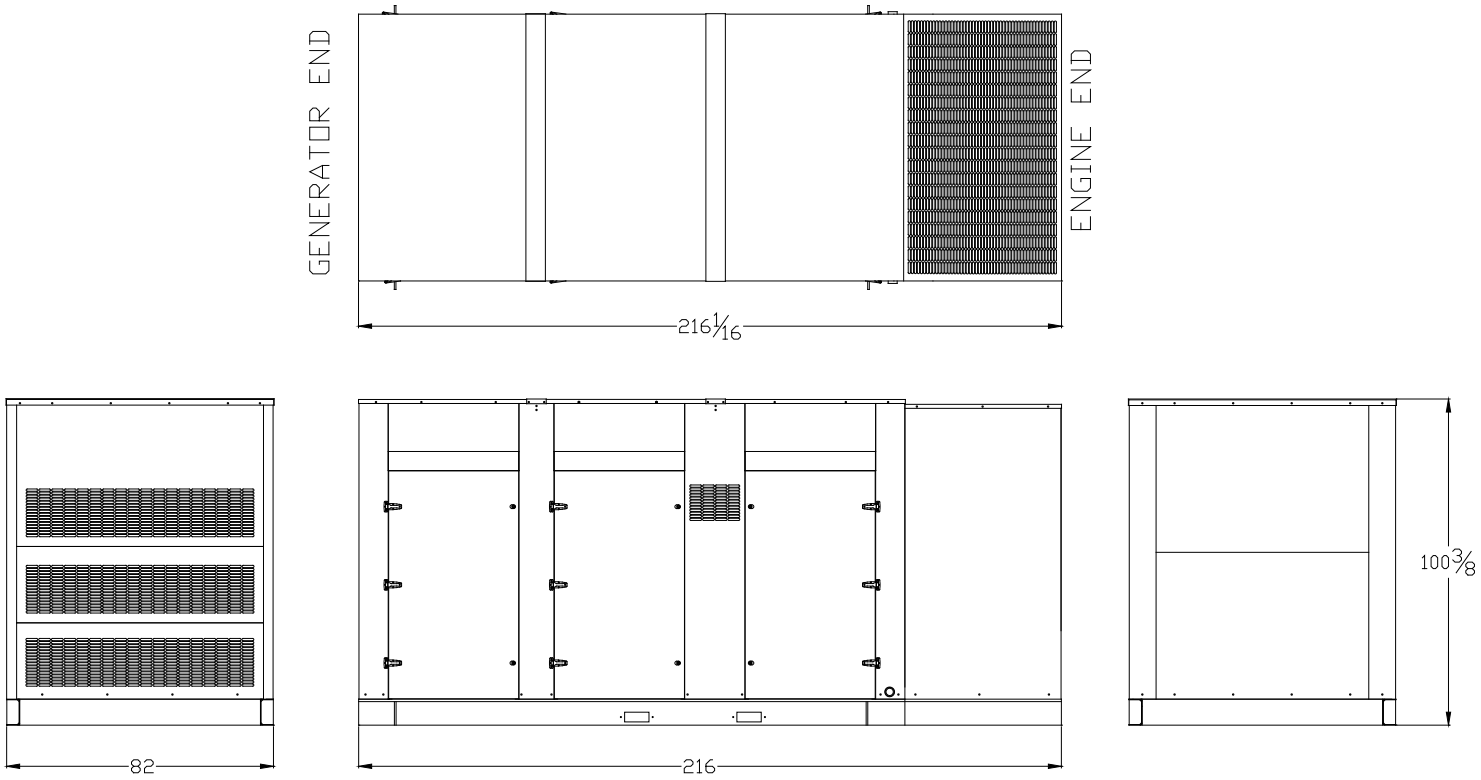
½% Voltage regulation • EMI filter • Under-speed protection • Over-excitation protection • total encapsulation

**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




 **Gillette Generators, Inc.** • 2921 Thorne Dr. •Elkhart, IN • 46514 • Ph: 574-264-9639 • Fax: 574-262-1840 • Web: www.gillettegenerators.com • spc4-230130

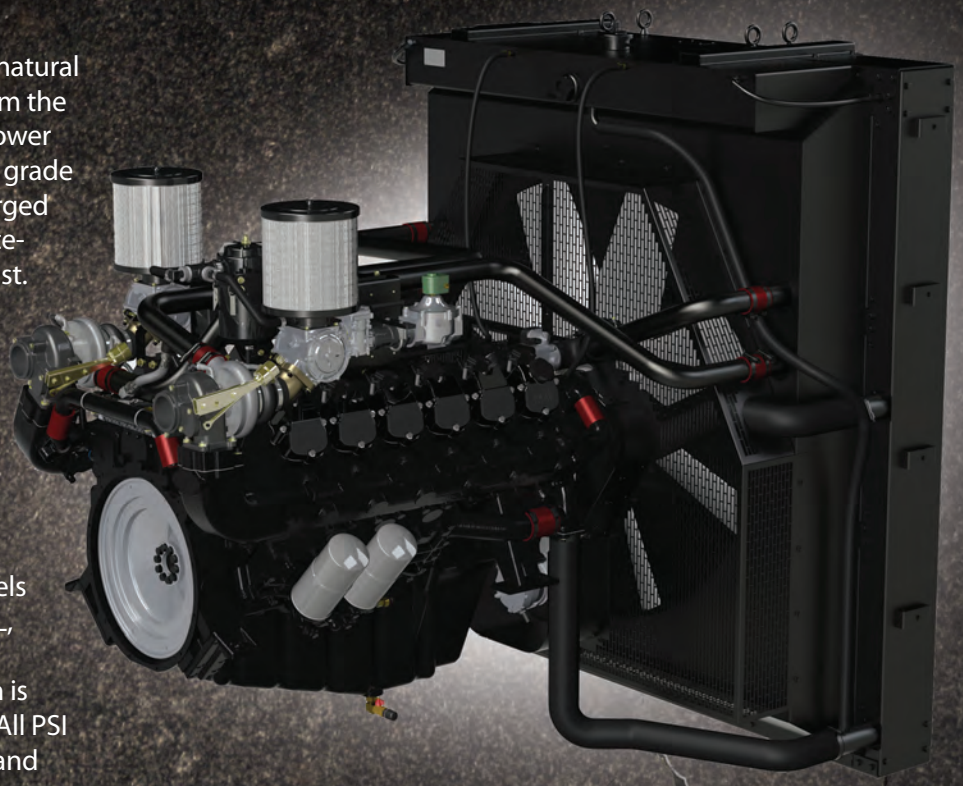
PSI HEAVY-DUTY

21.9L ENGINE

INDUSTRIAL STATIONARY

# Product Overview

The PSI HD 21.9L 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 in-line, turbocharged and after-cooled engine features replaceable wet liners and water-cooled exhaust.



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

The PSI HD product lineup has six models with displacements of 8.1L, 11.1L, 14.6L, 18.3L and 21.9L. 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.

## FEATURES

- U.S. EPA-Certified and CARB-Compliant
- Dual Fuel with Automatic Change-Over
- 50C Ambient Cooling Capacity
- 3-Way Catalytic Converter
- Air Filtration
- UL2200-Compliant or Listed Components
- MasterTrak Telematics service (included for 1 year)

MAXIMUM PERFORMANCE NO COMPROMISES

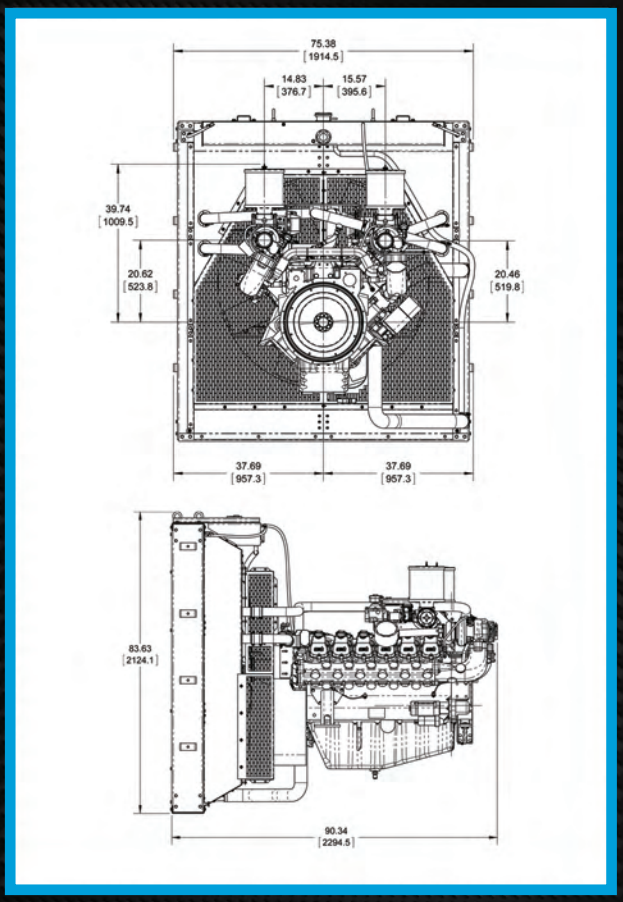
POWER & PERFORMANCE • EMISSION-CERTIFIED • FUEL-FLEXIBLE

PSI HEAVY-DUTY

# 21.9L ENGINE
## ENGINEERING DATA

# 21.9 L Industrial Stationary Engine

| | | |
|---|---|---|
| **Displacement** | 1,338 cid | 21,930 cc |
| **Compression Ratio** | 10.5:1 | |
| **Bore & Stroke** | 5.04 in x 5.59 in | 128 mm x 142 mm |
| **kWe** | 430@1,800 rpm (Natural Gas) | 350@1,500 rpm (Natural Gas) |
| **Emission-Certified** | EPA, CARB – Industrial Stationary | |
| **Fuel Types** | Natural Gas / Propane | |




## GENERAL DATA

- Water-cooled, turbo-charged, air-to-air inter-cooled, stoichiometric, replaceable wet cylinder liners
- Cast iron block & heads, 10.5:1 compression ratio, overhead valve/2V configuration
- Crankshaft gear-driven oil system with cartridge-type filter, belt-driven centrifugal water pump
- Full ECU engine control including: coil-on-plug variable timing ignition, electronic governor and fuel-air ratio control
- Engine protection for oil pressure, coolant level, coolant temperature, fuel pressure, over-speed
- Complete fuel system for single fuel (NG/LP) operation with closed-loop control
- Alternator (45A/24VDC)
- Starter (24VDC)
- CANBUS J1939 interface

Power shown is gross engine power and has been corrected to SAE J1995. Actual installed power levels may vary depending on the application and OEM supplied components.



201 Mittel Drive, Wood Dale, IL 60191
T: 630-350-9400 F: 630-350-9900
www.psiengines.com

PSI HEAVY-DUTY

# 21.9L

| | Rev: | E | | | | |
|---|---|---|---|---|---|---|
| | Units | | 21.9L | | | |
| | Std | Metric | 1500 | | 1800 | |
| **General Engine Data** | | | | | | |
| Type | N/A | | V-type 4 cycle | | | |
| Number of cylinders | N/A | | 12 | | | |
| Aspiration | N/A | | Turbo Charge Air Cooled | | | |
| Bore | in | mm | 5.04 | 128 | 5.04 | 128 |
| Stroke | in | mm | 5.59 | 142 | 5.59 | 142 |
| Displacement | in^3 | L | 1338 | 21.9 | 1338 | 21.9 |
| Compression Ratio | N/A | | 10.5 | | | |
| Mean Piston Speed | ft/min | m/s | 1398 | 7.1 | 1677 | 8.52 |
| Gross Standby Power Rating[1,2,3] Per ISO 3046 at the Flywheel | | | | | | |
| NG | Hp | kW | 507 | 378 | 684 | 510 |
| LP | Hp | kW | 370 | 276 | 472 | 352 |
| MEP (@ rated Load on NG) | psi | bar | 200 | 13.8 | 225 | 15.5 |
| MEP (@ rated Load on LP) | psi | bar | 146 | 10.1 | 155 | 10.7 |
| Gross Prime Power Rating[1,2,3] Per ISO 3046 at the Flywheel | | | | | | |
| NG | Hp | kW | 456 | 340 | 581 | 434 |
| LP | Hp | kW | 333 | 248 | 401 | 299 |
| MEP (@ rated Load on NG) | psi | bar | 180 | 12.4 | 191 | 13.2 |
| MEP (@ rated Load on LP) | psi | bar | 131 | 9.1 | 132 | 9.1 |
| RPM Range (Min-Max) | RPM | | 1500-1800 | | | |
| Rotation Viewed from Flywheel | N/A | | Counter Clockwise | | | |
| Firing Order | N/A | | 1-12-5-8-3-10-6-7-2-11-4-9 | | | |
| Dry Weight | | | | | | |
| Fan to Flywheel | lb | kg | 3638 | 1650 | 3638 | 1650 |
| Rad to Flywheel | lb | kg | 5238 | 2376 | 5238 | 2376 |
| Wet Weight | | | | | | |
| Fan to Flywheel | lb | kg | 3813 | 1706 | 3813 | 1706 |
| Rad to Flywheel | lb | kg | 5760 | 2620 | 5760 | 2620 |
| CG | | | | | | |
| Distance from FW housing | in | mm | 24 | 602 | 24 | 602 |
| Distance above center of crankshaft | in | mm | 7 | 182 | 7 | 182 |
| **Engine Mounting** | | | | | | |
| Maximum Allowable Bending Moment at Rear of Block | lb ft | N m | 4425 | 6000 | 4425 | 6000 |
| Moment of Inertia About Roll Axis | lb ft^2 | kg m^2 | | | | |
| Flywheel housing | N/A | | SAE No.1 | | | |
| Flywheel | N/A | | No. 14 | | | |
| Number of Flywheel Teeth | N/A | | 160 | | | |
| **Exhaust System** | | | | | | |
| Type | | | Water Cooled Manifold | | | |
| Maximum allowable Back pressure | in HG | kPa | 3 | 10.2 | 3 | 10.2 |
| Standard Catalyst Back pressure | in HG | kPa | 1.5 | 5.1 | 1.5 | 5.1 |
| Exhaust Outlet Pipe Size | | | | | | |
| Maximum Turbine Inlet Temperature | F | C | 1382 | 750 | 1382 | 750 |
| Exhaust Flow at Rated Power | lb/hr | kg/hr | 3184 | 1444 | 4038 | 1832 |
| Exhaust Flow at Rated Power @1350F | cfm | m^3/min | 2427 | 68.7 | 2995 | 84.8 |
| **Air Induction System** | | | | | | |
| Maximum allowable Intake Air Restriction with Air Cleaner | | | | | | |
| Clean | inH2O | kPa | 5 | 1.24 | 5 | 1.24 |
| Dirty | inH2O | kPa | 15 | 3.74 | 15 | 3.74 |
| Combustion Air required (entire engine) | lb/hr | kg/hr | 3004 | 1362 | 3810 | 1728 |
| Combustion Air required (entire engine) | cfm | m^3/min | 763 | 22 | 968 | 27 |

PSI HEAVY-DUTY

# 21.9L

| | Rev: | E | | | | |
|---|---|---|---|---|---|---|
| | Units | | 21.9L | | | |
| | Std | Metric | 1500 | | 1800 | |
| **Electrical System** | | | | | | |
| Minimum Recommended Battery Capacity | AH | | 200 | | | |
| Cold Cranking Current | | | | | | |
| Engine only | CCA | | 1000 | | | |
| Engine with Drive train | CCA | | 1000 | | | |
| Maximum Allowable Resistance of Starting Circuit | Ohms | | 0.002 | | | |
| Starting Motor Power | HP | kW | 9.4 | 7 | 9.4 | 7 |
| Battery Charging Alternator | | | | | | |
| Voltage | Volts | | 24 | | | |
| Current | Amps | | 45 | | | |
| Coil primary Resistance | Ohms | | 0.59Ω ± 10% | | | |
| Spark Plug p/n | | | IFR7F-4D | | | |
| Spark plug gap | inches | mm | .015" (-0/+.008") .38mm (-0/+.2mm) | | | |
| **Cooling System** | | | | | | |
| Coolant Capacity | | | | | | |
| Engine only | gal | L | 11.5 | 52.3 | 11.5 | 52.3 |
| Engine with Radiator | gal | L | 50.1 | 228 | 50.1 | 228 |
| Engine Coolant Flow | gal/min | L/min | 145 | 550 | 174 | 660 |
| Water Pump Speed | RPM | | 2547 | | 3056 | |
| Heat rejected to Cooling water at rated Load | btu/min | kcal/sec | 21451 | 90.1 | 25760 | 108.2 |
| Maximum Intake Air Temperature (IAT) | F | C | 155 | 68 | 155 | 68 |
| ECU IAT Warning | F | C | 140 | 60 | 140 | 60 |
| ECU IAT Shutdown | F | C | 155 | 69 | 155 | 69 |
| Maximum Coolant Friction Head External to the engine | psi | bar | 5.8 | 0.4 | 5.8 | 0.4 |
| Maximum Air Restriction Across a Radiator | inH2O | mmH2O | 0.5 | 12.8 | 0.5 | 12.8 |
| Standard Thermostat Range | | | | | | |
| Cracking Temperature | F | C | 160 | 71 | 160 | 71 |
| Full Open Temperature | F | C | 185 | 85 | 185 | 85 |
| Maximum Output Pressure of Engine Water Pump | | | | | | |
| Maximum Allowable Pressure Cap | psi | bar | 14.7 | 1 | 14.7 | 1 |
| Ambient Clearance Open Genset (water) (Air-to-Boil) | | | | | | |
| Specified | F | C | 142 | 61 | 142 | 61 |
| Acutal | F | C | | | 142 | 61 |
| Ambient Clearance (Oil) | | | | | | |
| Specified | F | C | 142 | 61 | 142 | 61 |
| Acutal | F | C | | | 144 | 62 |
| CAC Rise over Ambient (Charge) | | | | | | |
| Specified | F | C | 15 | 9 | 15 | 9 |
| Acutal | F | C | | | 11 | 6 |
| Maximum Allowable Top Tank Temperature | F | C | 230 | 110 | 230 | 110 |
| ECU Warning | F | C | 220 | 104 | 220 | 104 |
| ECU Shutdown | F | C | 230 | 110 | 230 | 110 |
| Fan Power | HP | kW | 24 | 17.9 | 42 | 31.3 |
| Fan Diameter, including blades | in | mm | 52 | 1321 | 52 | 1321 |
| Fan Speed | RPM | | 1200 | | 1440 | |
| Cooling Fan Air Flow @ 1" Static H2O Pressure and 125F @ radiator | CFM | m^3/min | 34,286 | 971 | 40,000 | 1,133 |
| Charge Air Cooler | | | | | | |
| Compressor Outlet Temperature | F | C | 246 | 120 | 300 | 150 |
| Compressor Flow Rate per CAC | lb/hr | kg/hr | 1592 | 722 | 2019 | 916 |
| Heat Rejection per CAC | btu/min | kW | TBD | | 3040 | 53.5 |

PSI HEAVY-DUTY

# 21.9L

| | Rev: | E | | | | |
|---|---|---|---|---|---|---|
| | Units | | 21.9L | | | |
| | Std | Metric | 1500 | | 1800 | |
| **Lubrication System** | | | | | | |
| Oil Specification | | | SAE 15W-40 Low Ash Gas engine oil (.25-.5% by wt), API CD/CF or higher | | | |
| Oil Pressure | | | | | | |
| Idle | | | | | | |
| Min | Psi | Bar | 13 | 0.9 | 13 | 0.9 |
| Max | Psi | Bar | 43.5 | 3 | 43.5 | 3 |
| Rated Speed | | | | | | |
| Min | Psi | Bar | 43.5 | 3 | 43.5 | 3 |
| Max | Psi | Bar | 94.5 | 6.5 | 94.5 | 6.5 |
| Maximum Allowable Oil Temperature | F | C | 250 | 121 | 250 | 121 |
| Engine Oil Capacity | | | | | | |
| Min | Qts | L | 34.75 | 33 | 34.75 | 33 |
| Max | Qts | L | 42.25 | 40 | 42.25 | 40 |
| Oil Filter Capacity | Qts | L | 7.5 | 7.1 | 7.5 | 7.1 |
| ECU Oil Pressure Warning[5] | psi | | 30 | | | |
| ECU Oil Pressure Shut Down[5] | psi | | 25 | | | |
| **Fuel System** | | | | | | |
| Fuel Consumption[6] | | | | | | |
| NG | $Ft^3/hr$ | kg/hr | 3801 | 77 | 5400 | 110 |
| LP | $Ft^3/hr$ | kg/hr | 1162 | 62 | 1511 | 81 |
| Maximum EPR Rated Pressure | psi | kPa | 1.0 | 6.9 | 1.0 | 6.9 |
| Maximum Running pressure to Electronic Pressure Regulator (EPR) | inH2O | kPa | 11.0 | 2.7 | 11.0 | 2.7 |
| Minimum Running pressure to EPR | inH2O | kPa | 7.0 | 1.7 | 7.0 | 1.7 |
| Minimum Gas Supply Pipe Size | | | 2 x 2" NPT | | | |
| | | | | | | |
| Maximum EPR Rated Pressure | psi | kPa | 1.0 | 6.9 | 1.0 | 6.9 |
| Maximum Running Pressure to EPR | inH2O | kPa | 11.0 | 2.7 | 11.0 | 2.7 |
| Minimum Running Pressure to EPR | inH2O | kPa | 7.0 | 1.7 | 7.0 | 1.7 |
| Minimum LPG Supply Pipe Size[4] | | | 2 x 2" NPT | | | |

[1] Standby and overload ratings based on ISO3046.

[2] All ratings are gross flywheel horsepower corrected to 77°F at an altitude of 328feet with no cooling fan or alternator losses using heating value for NG of 1015 BTU/SCF.

[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] The preceeding pipe sizes are only suggestions and piping sizes may vary with temperature, pressure, distance from supply and application of local codes. Gas must be available at adequate volume and pressure for engine at the EPR.

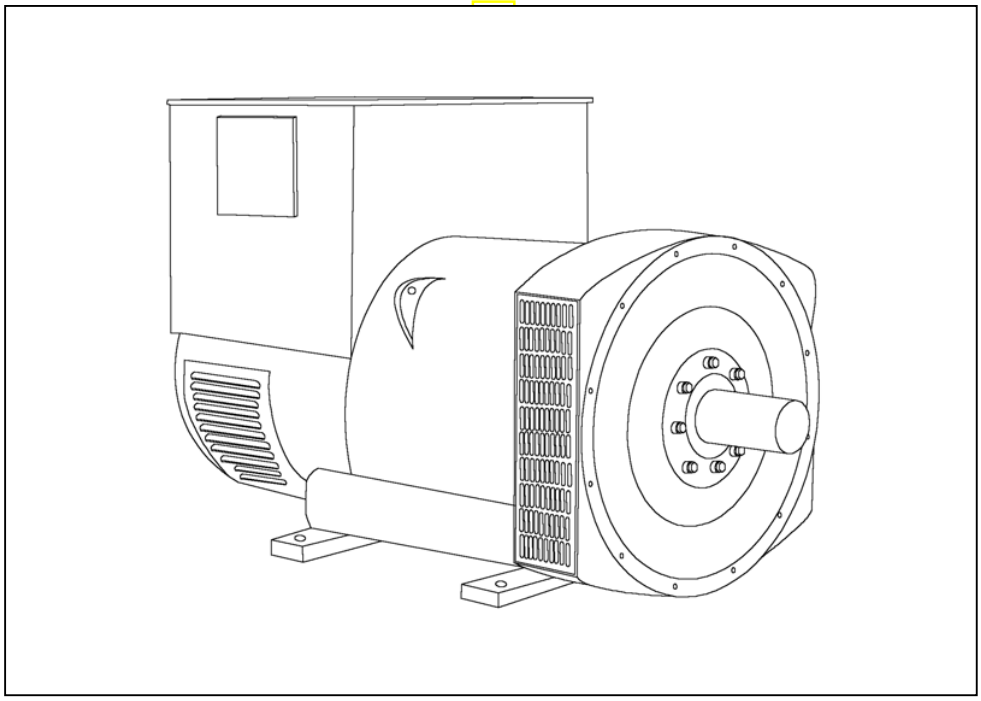
[5] >1400RPM

[6] See PSI HD Technical Spec. 56300002 - Fuel Specification. Gas properties for fuel consumption data: NG: Density =0.717 kg/m3, LHV = 927 BTU/scf; Propane: Density = 1.882 kg/m3, LHV = 2316 BTU/scf

STAMFORD®

**HCI 534D/544D** - Winding 311

Technical Data Sheet



### 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.*

# HCI534D/544D

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 | 0.0049 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED | | | | | | |
| ROTOR WDG. RESISTANCE | 1.77 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 | 1393 kg | | | | 1395 kg | | |
| WEIGHT WOUND STATOR | 657 kg | | | | 657 kg | | |
| WEIGHT WOUND ROTOR | 563 kg | | | | 535 kg | | |
| WR² INERTIA | 8.0068 $kgm^2$ | | | | 7.7289 $kgm^2$ | | |
| SHIPPING WEIGHTS in a crate | 1485 kg | | | | 1485 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 | 500 | 550 | 500 | 500 | 575 | 594 | 625 | 644 |
| Xd DIR. AXIS SYNCHRONOUS | 3.02 | 2.99 | 2.53 | 2.25 | 3.52 | 3.25 | 3.13 | 2.96 |
| X'd DIR. AXIS TRANSIENT | 0.16 | 0.15 | 0.13 | 0.12 | 0.17 | 0.16 | 0.15 | 0.14 |
| X"d DIR. AXIS SUBTRANSIENT | 0.11 | 0.11 | 0.09 | 0.08 | 0.12 | 0.11 | 0.11 | 0.10 |
| Xq QUAD. AXIS REACTANCE | 2.48 | 2.46 | 2.08 | 1.85 | 2.87 | 2.65 | 2.55 | 2.41 |
| X"q QUAD. AXIS SUBTRANSIENT | 0.27 | 0.28 | 0.23 | 0.20 | 0.31 | 0.29 | 0.28 | 0.26 |
| $X_L$ LEAKAGE REACTANCE | 0.05 | 0.04 | 0.04 | 0.04 | 0.06 | 0.06 | 0.05 | 0.05 |
| $X_2$ NEGATIVE SEQUENCE | 0.19 | 0.19 | 0.16 | 0.14 | 0.22 | 0.20 | 0.20 | 0.19 |
| $X_0$ ZERO SEQUENCE | 0.10 | 0.10 | 0.08 | 0.07 | 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. | 2.2s | | | | | | | |
| Ta ARMATURE TIME CONST. | 0.018s | | | | | | | |
| SHORT CIRCUIT RATIO | 1/Xd | | | | | | | |

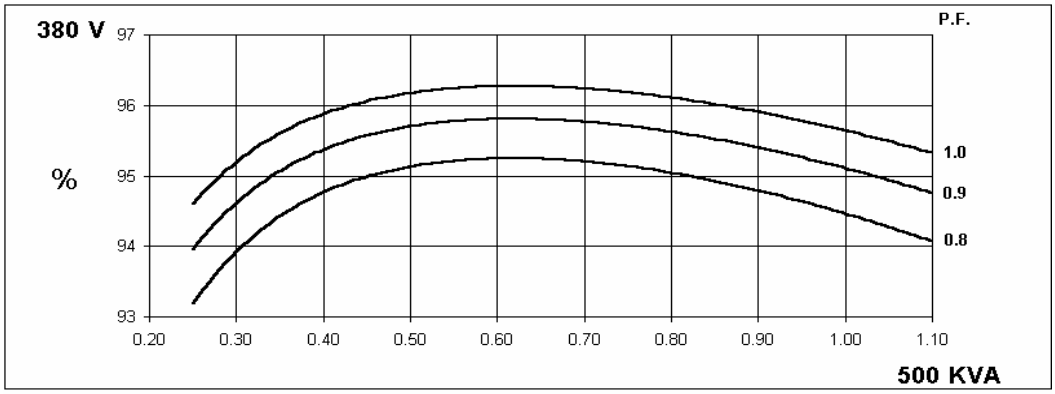
**50 Hz**

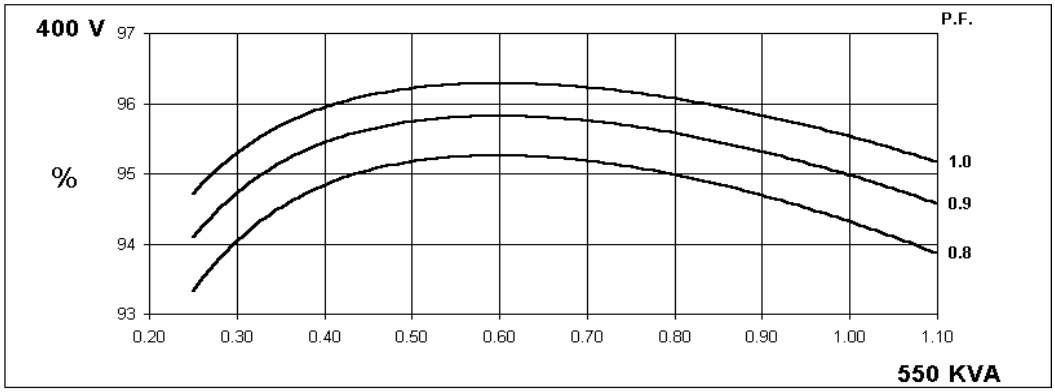
# HCI534D/544D

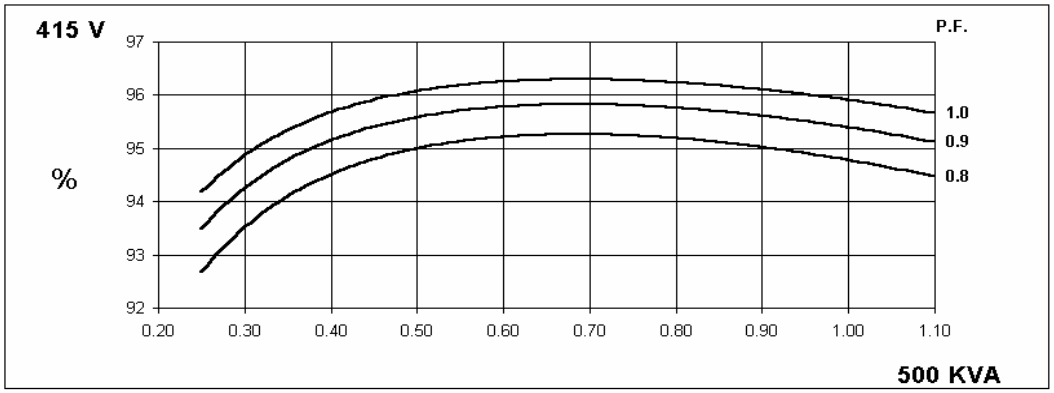
**Winding 311**

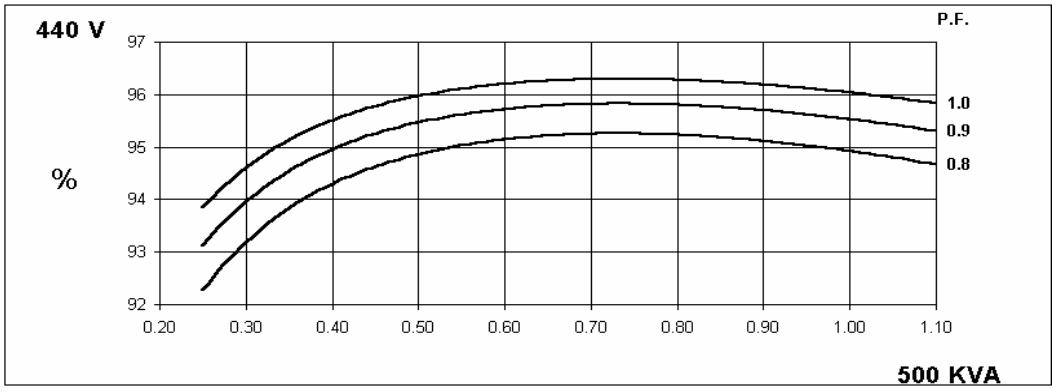
STAMFORD

## THREE PHASE EFFICIENCY CURVES



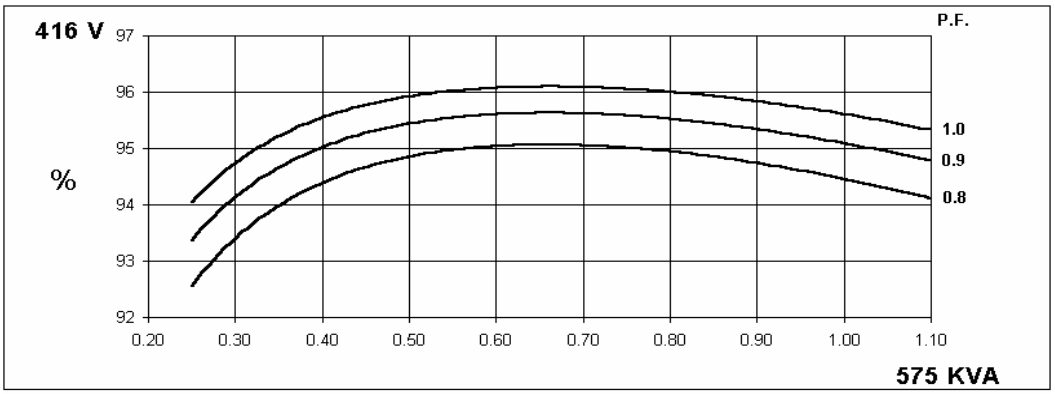
**60 Hz**

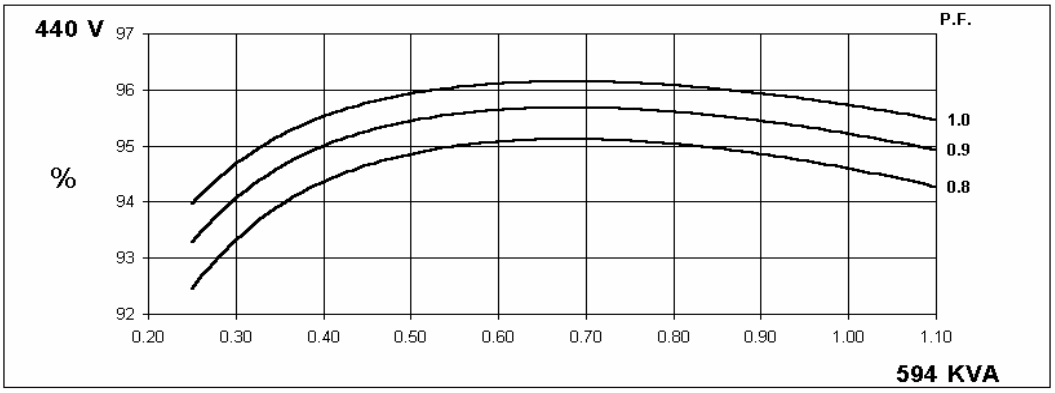
# HCI534D/544D

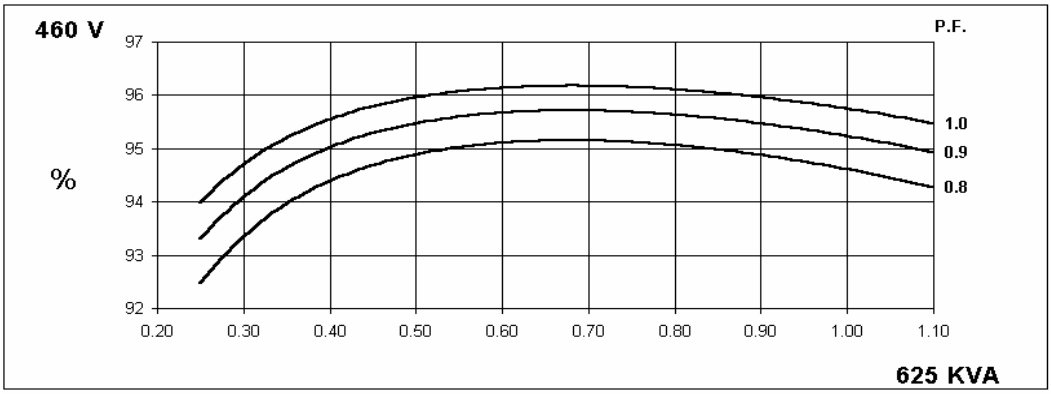
**Winding 311**

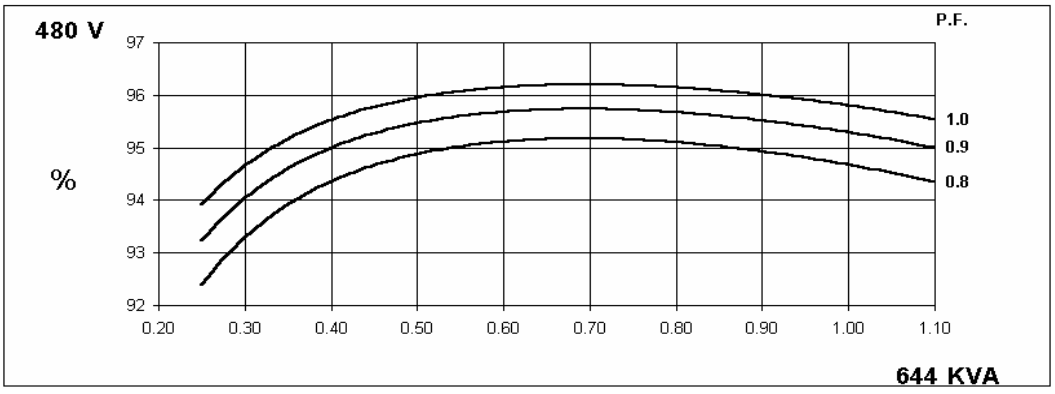
STAMFORD

## THREE PHASE EFFICIENCY CURVES



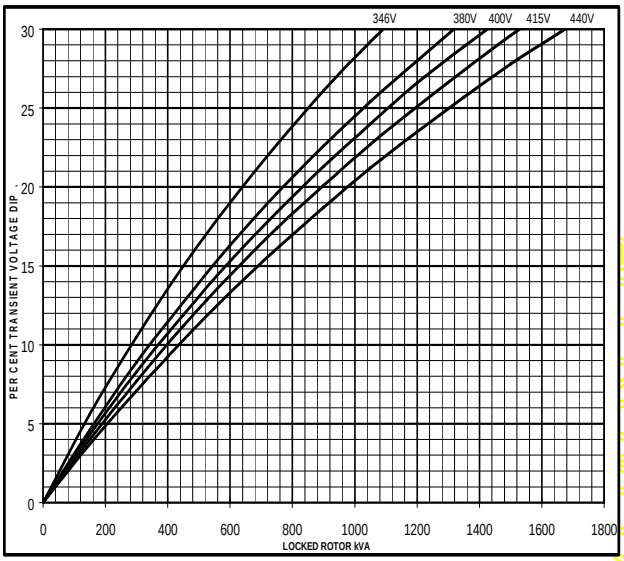
# HCI534D/544D

## Winding 311

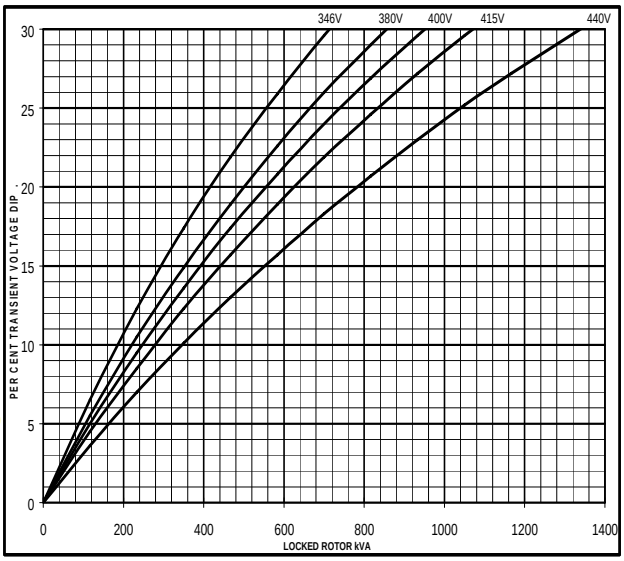
## Locked Rotor Motor Starting Curve

**50 Hz**

**MX**



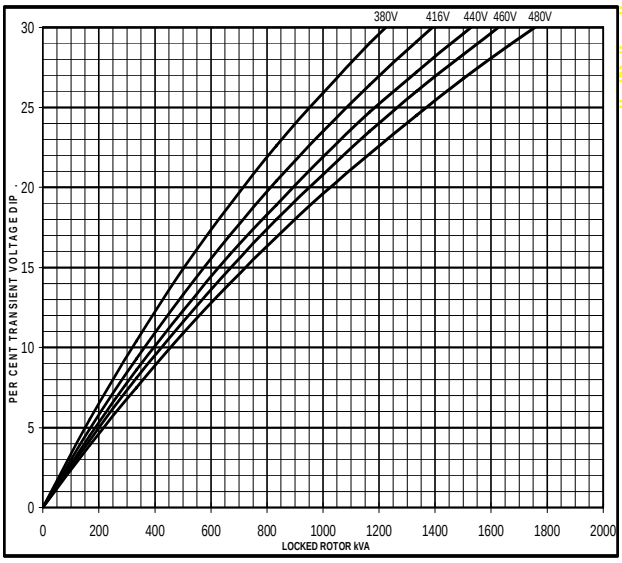

**SX**



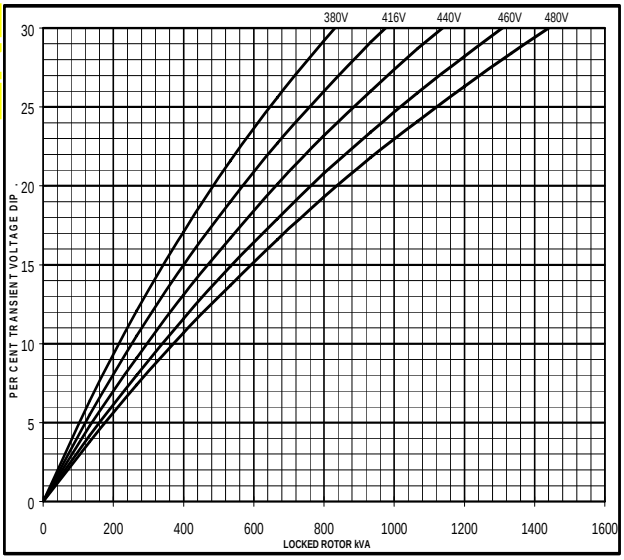



**60 Hz**

**MX**

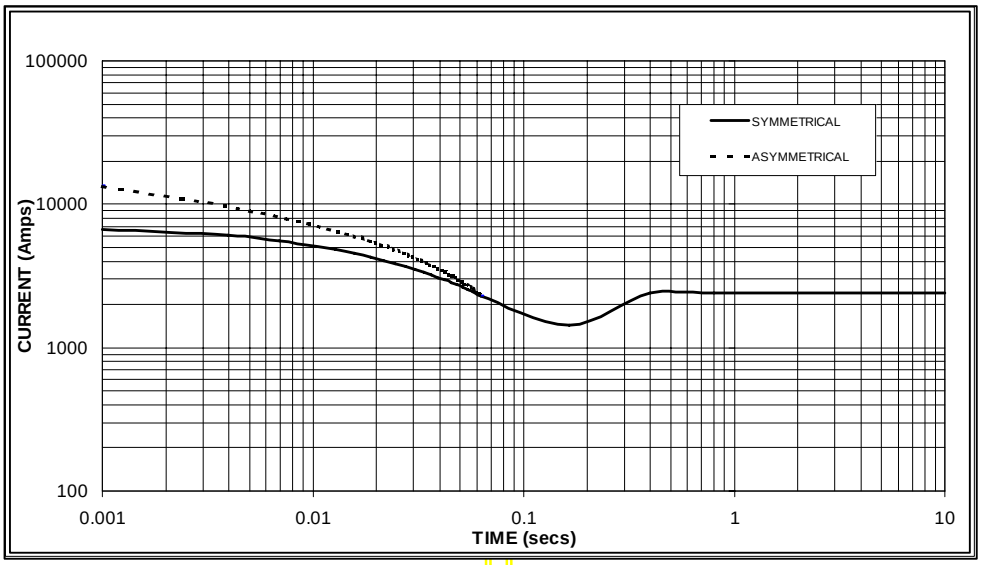



**SX**



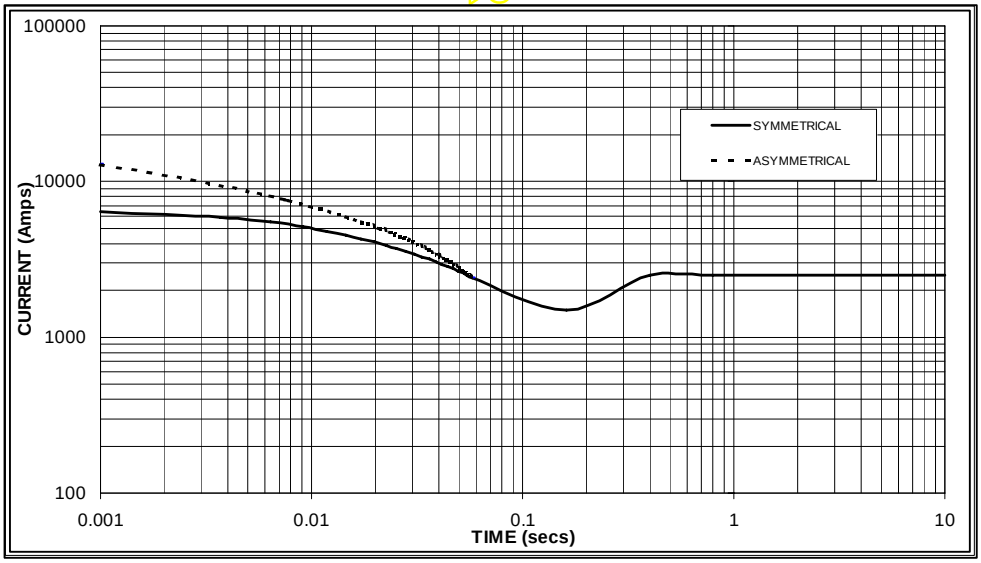
## Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed
## Based on star (wye) connection.

**50 Hz**




Sustained Short Circuit = 2,400 Amps

**60 Hz**




Sustained Short Circuit = 2,500 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

# HCI534D/544D

STAMFORD

**Winding 311 0.8 Power Factor**

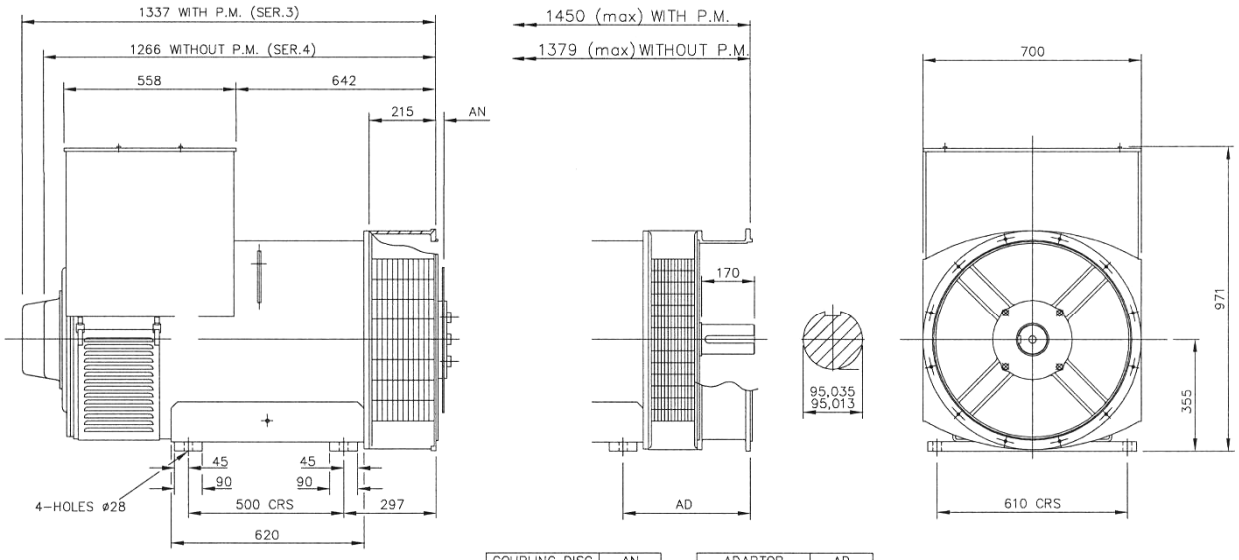
## RATINGS

| | 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 | 450 | 495 | 450 | 450 | 500 | 550 | 500 | 500 | 515 | 575 | 515 | 515 | 550 | 590 | 550 | 530 |
| | kW | 360 | 396 | 360 | 360 | 400 | 440 | 400 | 400 | 412 | 460 | 412 | 412 | 440 | 472 | 440 | 424 |
| | Efficiency (%) | 94.8 | 94.7 | 95.0 | 95.1 | 94.5 | 94.3 | 94.8 | 94.9 | 94.4 | 94.1 | 94.7 | 94.9 | 94.1 | 94.0 | 94.5 | 94.8 |
| | kW Input | 380 | 418 | 379 | 379 | 423 | 467 | 422 | 421 | 436 | 489 | 435 | 434 | 468 | 502 | 466 | 447 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 | 519 | 538 | 563 | 588 | 575 | 594 | 625 | 644 | 588 | 625 | 655 | 675 | 606 | 644 | 673 | 694 |
| | kW | 415 | 430 | 450 | 470 | 460 | 475 | 500 | 515 | 470 | 500 | 524 | 540 | 485 | 515 | 538 | 555 |
| | Efficiency (%) | 94.7 | 94.8 | 94.9 | 94.9 | 94.5 | 94.6 | 94.6 | 94.7 | 94.4 | 94.4 | 94.5 | 94.5 | 94.3 | 94.3 | 94.4 | 94.4 |
| | kW Input | 438 | 454 | 475 | 496 | 487 | 502 | 529 | 544 | 498 | 530 | 554 | 571 | 514 | 546 | 570 | 588 |



## 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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STAMFORD

# S5L1D-C4 Wdg.311 - Technical Data Sheet

**Standards**

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

**Quality Assurance**

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

**Excitation and Voltage Regulators**

| **Excitation System** | | | | | |
|---|---|---|---|---|---|
| **AVR Type** | AS440 | MX341 | MX321 | | |
| **Voltage Regulation** | ± 1% | ± 1% | ± 0.5% | | with 4% Engine Governing |
| **AVR Power** | Self-Excited | PMG | PMG | | |

| | |
|---|---|
| **No Load Excitation Voltage (V)** | 10.2 - 9.4 |
| **No Load Excitation Current (A)** | 0.6 - 0.5 |
| **Full Load Excitation Voltage (V)** | 44 |
| **Full Load Excitation Current (A)** | 2.6 |
| **Exciter Time Constant (seconds)** | 0.099 |

STAMFORD

# S5L1D-C4 Wdg.311

| Electrical Data | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Insulation System | H | | | | | | | |
| Stator Winding | Double Layer Lap | | | | | | | |
| Winding Pitch | 2/3 | | | | | | | |
| Winding Leads | 12 | | | | | | | |
| Winding Number | 311 | | | | | | | |
| Number of Poles | 4 | | | | | | | |
| IP Rating | IP23 | | | | | | | |
| RFI 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% | | | | | | | |
| Short Circuit Ratio | 1/Xd | | | | | | | |
| Steady State X/R Ratio | 12.58 | | | | | | | |
| | 50 Hz | | | | 60 Hz | | | |
| Telephone Interference | THF<2% | | | | TIF<50 | | | |
| Cooling Air Flow | 1.12 m³/sec | | | | 1.3 m³/sec | | | |
| Voltage Star (V) | 380 | 400 | 415 | 440 | 416 | 440 | 460 | 480 |
| Voltage Parallel Star (V) | 190 | 200 | 208 | 220 | 208 | 220 | 230 | 240 |
| Voltage Series Delta (V) | 220 | 230 | 240 | 254 | 240 | 254 | 266 | 277 |
| kVA Base Rating (Class H) for Reactance Values (kVA) | 455 | 500 | 455 | 450 | 525 | 550 | 581 | 594 |
| **Saturated Values in Per Unit at Base Ratings and Voltages** | | | | | | | | |
| Xd Dir. Axis Synchronous | 3.31 | 3.28 | 2.77 | 2.44 | 3.82 | 3.58 | 3.46 | 3.25 |
| X'd Dir. Axis Transient | 0.18 | 0.18 | 0.15 | 0.13 | 0.21 | 0.20 | 0.19 | 0.18 |
| X"d Dir. Axis Subtransient | 0.13 | 0.13 | 0.11 | 0.10 | 0.15 | 0.14 | 0.14 | 0.13 |
| Xq Quad. Axis Reactance | 2.69 | 2.67 | 2.26 | 1.99 | 3.11 | 2.91 | 2.82 | 2.64 |
| X"q Quad. Axis Subtransient | 0.26 | 0.26 | 0.22 | 0.19 | 0.30 | 0.28 | 0.27 | 0.26 |
| XL Stator Leakage Reactance | 0.07 | 0.07 | 0.06 | 0.05 | 0.08 | 0.08 | 0.07 | 0.07 |
| X2 Negative Sequence Reactance | 0.19 | 0.19 | 0.16 | 0.14 | 0.22 | 0.21 | 0.20 | 0.19 |
| X0 Zero Sequence Reactance | 0.11 | 0.11 | 0.09 | 0.08 | 0.13 | 0.12 | 0.12 | 0.11 |
| **Unsaturated Values in Per Unit at Base Ratings and Voltages** | | | | | | | | |
| Xd Dir. Axis Synchronous | 3.97 | 3.94 | 3.33 | 2.93 | 4.59 | 4.29 | 4.15 | 3.90 |
| X'd Dir. Axis Transient | 0.21 | 0.21 | 0.17 | 0.15 | 0.24 | 0.23 | 0.22 | 0.20 |
| X"d Dir. Axis Subtransient | 0.15 | 0.15 | 0.13 | 0.11 | 0.18 | 0.17 | 0.16 | 0.15 |
| Xq Quad. Axis Reactance | 2.77 | 2.75 | 2.32 | 2.05 | 3.20 | 3.00 | 2.90 | 2.72 |
| X"q Quad. Axis Subtransient | 0.31 | 0.31 | 0.26 | 0.23 | 0.36 | 0.34 | 0.33 | 0.31 |
| XL Stator Leakage Reactance | 0.08 | 0.08 | 0.07 | 0.06 | 0.09 | 0.09 | 0.08 | 0.08 |
| Xlr Rotor Leakage Reactance | 0.11 | 0.11 | 0.09 | 0.08 | 0.12 | 0.11 | 0.11 | 0.10 |
| X2 Negative Sequence Reactance | 0.23 | 0.23 | 0.19 | 0.17 | 0.27 | 0.25 | 0.24 | 0.23 |
| X0 Zero Sequence Reactance | 0.13 | 0.13 | 0.11 | 0.10 | 0.15 | 0.14 | 0.14 | 0.13 |

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# S5L1D-C4 Wdg.311

| Time Constants (Seconds) | | |
|---|---|---|
| T'd Transient Time Const. | 0.08 | |
| T''d Sub-Transient Time Const. | 0.0120 | |
| T'do O.C. Field Time Const. | 2 | |
| Ta Armature Time Const. | 0.0170 | |
| T''q Sub-Transient Time Const. | 0.0192 | |
| **Resistances in Ohms (Ω) at 22$^0$C** | | |
| Stator Winding Resistance (Ra), per phase for series connected | 0.0065 | |
| Rotor Winding Resistance (Rf) | 1.55 | |
| Exciter Stator Winding Resistance | 17 | |
| Exciter Rotor Winding Resistance per phase | 0.092 | |
| PMG Phase Resistance (Rpmg) per phase | 1.91 | |
| Positive Sequence Resistance (R1) | 0.0081 | |
| Negative Sequence Resistance (R2) | 0.0094 | |
| Zero Sequence Resistance (R0) | 0.0081 | |
| **Saturation Factors** | 400V | 480V |
| SG1.0 | 0.311 | 0.273 |
| SG1.2 | 1.333 | 1.094 |
| **Mechanical Data** | | |
| Shaft and Keys | All alternator 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. | |
| | 1 Bearing | 2 Bearing |
| SAE Adaptor | SAE 1, 0, 0.5 | |
| Moment of Inertia | 6.8928 kgm² | - |
| Weight Wound Stator | 584kg | - |
| Weight Wound Rotor | 502kg | - |
| Weight Complete Alternator | 1283kg | - |
| Shipping weight in a Crate | 1375kg | - |
| Packing Crate Size | 166 x 87 x 124(cm) | - |
| Maximum Over Speed | 2250 RPM for two minutes | |
| Bearing Drive End | - | - |
| Bearing Non-Drive End | BALL.6314(ISO) | - |

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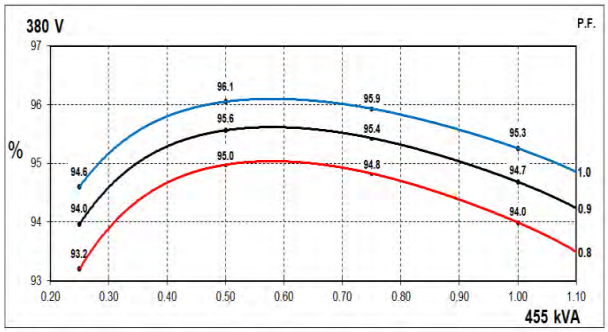
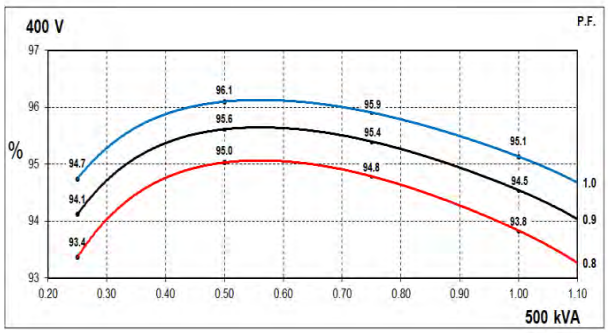
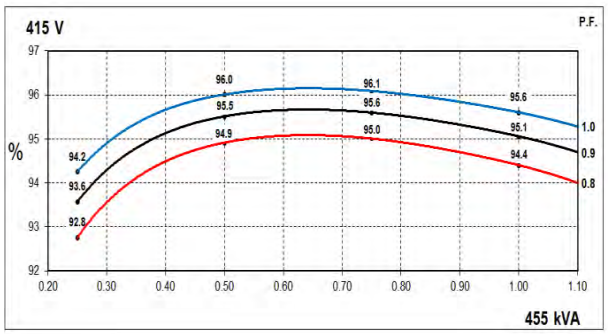
**S5L1D-C4 Wdg.311**

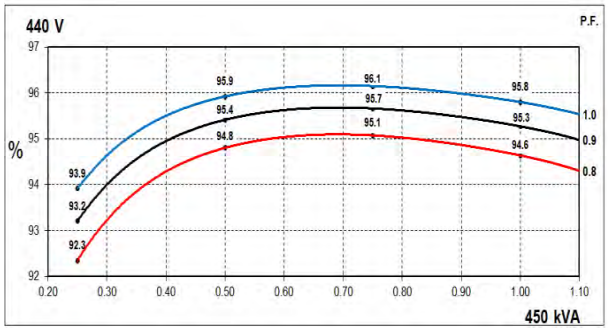
## THREE PHASE EFFICIENCY CURVES

### 50Hz

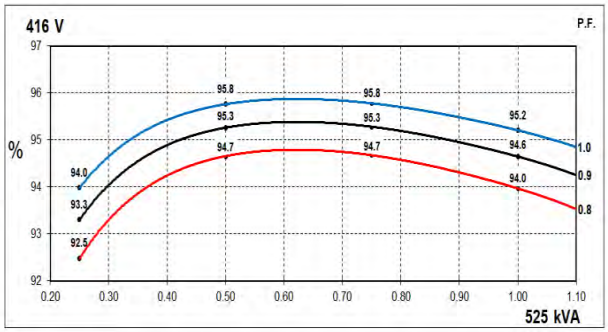


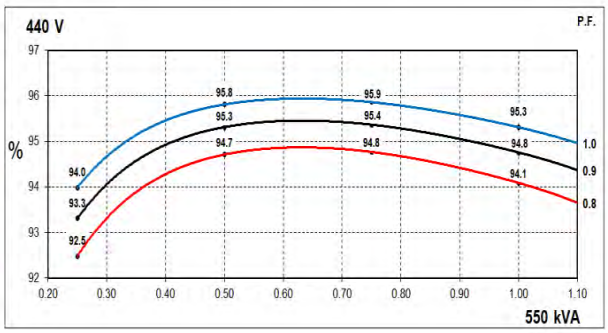



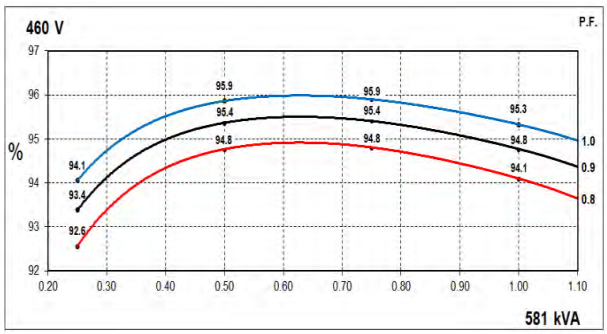



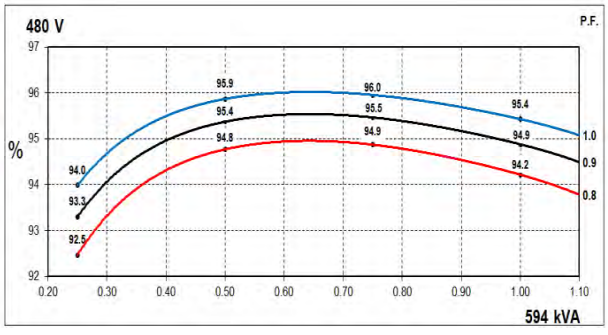




### 60Hz



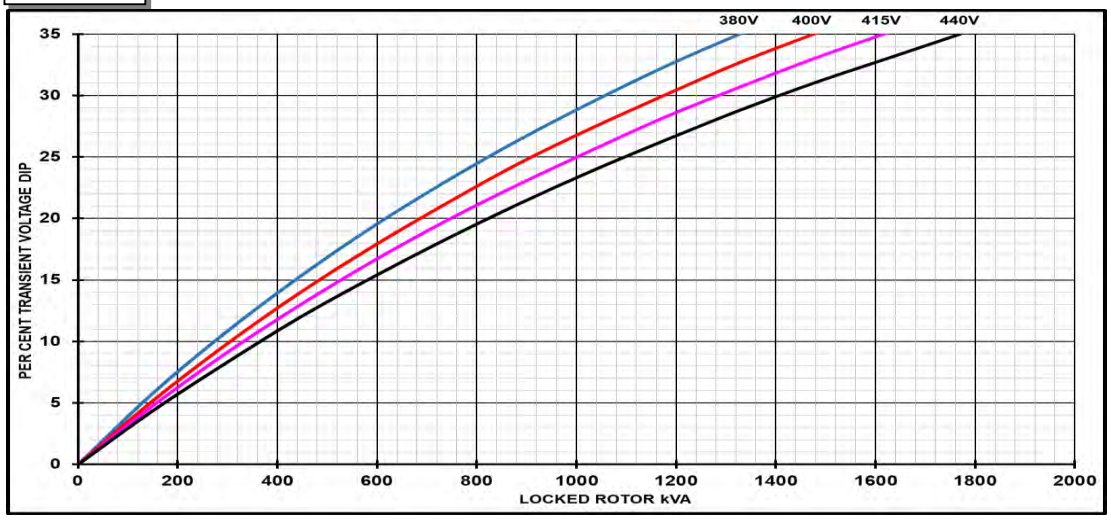



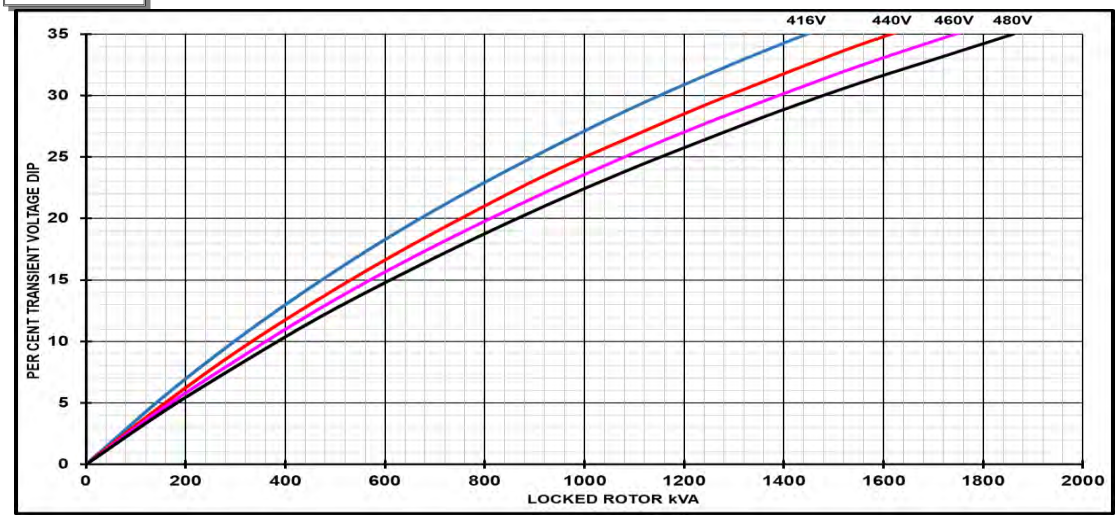



## Locked Rotor Motor Starting Curves - Separately Excited

**50Hz**



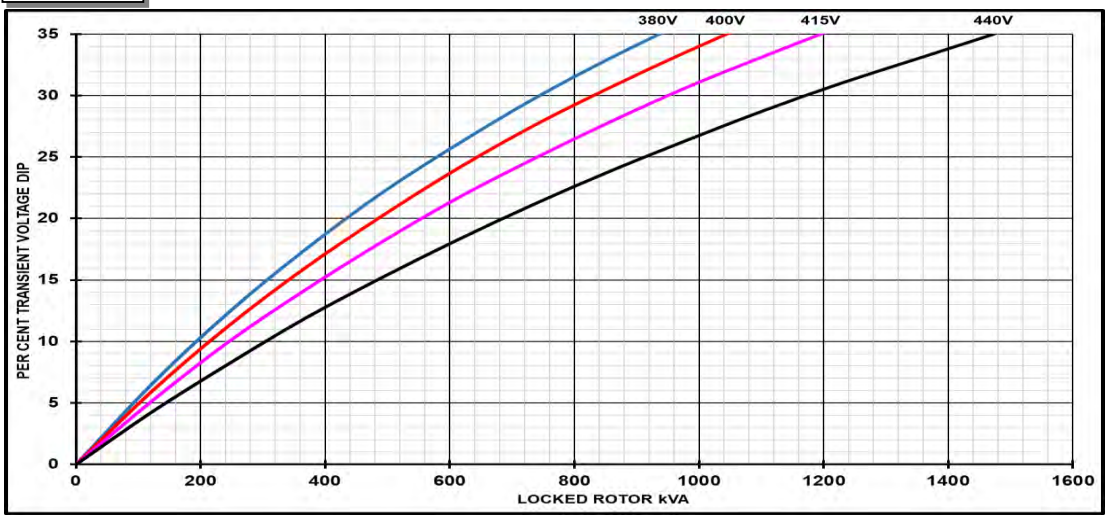

**60Hz**



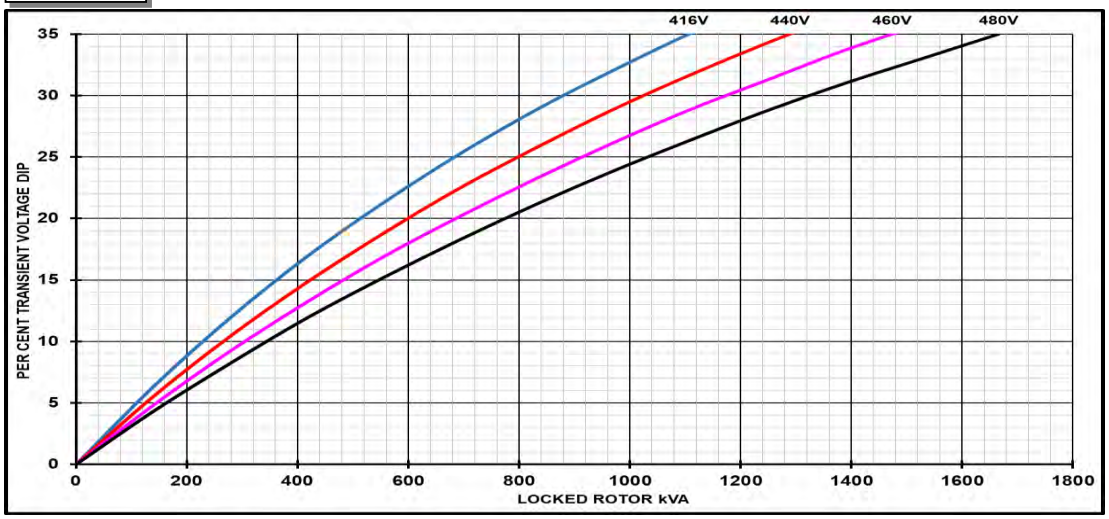

| Transient Voltage Dip Scaling Factor | | Transient Voltage Rise Scaling Factor |
|---|---|---|
| PF | Factor | For voltage rise multiply voltage dip by 1.25 |
| < 0.5 | 1 | |
| 0.5 | 0.97 | |
| 0.6 | 0.93 | |
| 0.7 | 0.9 | |
| 0.8 | 0.85 | |
| 0.9 | 0.83 | |

## Locked Rotor Motor Starting Curves - Self Excited

**50Hz**



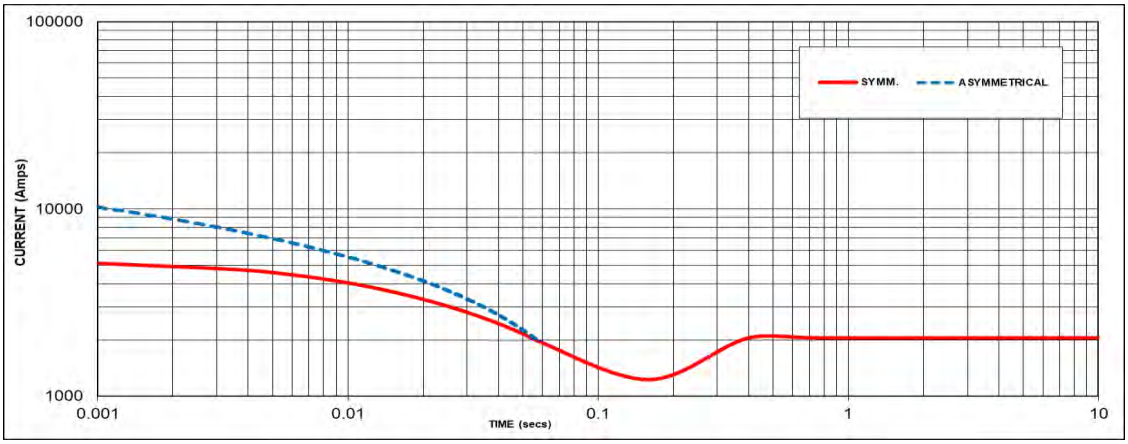

**60Hz**




| Transient Voltage Dip Scaling Factor | | Transient Voltage Rise Scaling Factor |
|---|---|---|
| PF | Factor | For voltage rise multiply voltage dip by 1.25 |
| < 0.5 | 1 | |
| 0.5 | 0.97 | |
| 0.6 | 0.93 | |
| 0.7 | 0.9 | |
| 0.8 | 0.85 | |
| 0.9 | 0.83 | |

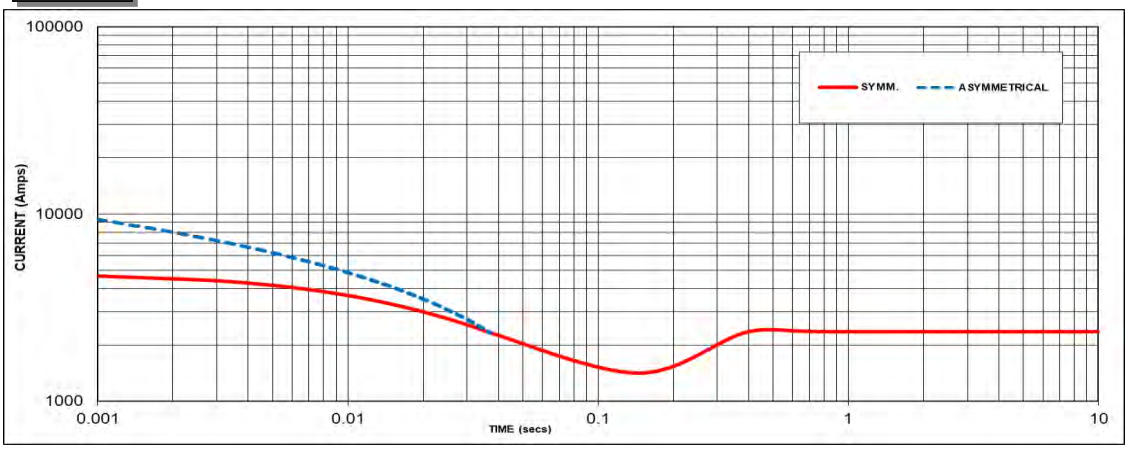
## Three-phase Short Circuit Decrement Curve - Separately Excited

**50Hz**




Sustained Short Circuit = 2050 Amps

**60Hz**




Sustained Short Circuit = 2350 Amps

**Note 1**
The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

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

The sustained current value is constant irrespective of voltage level

**Note 2**
The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

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

**Note 3** All other times are unchanged
Curves are drawn for Star connection under no-load excitation at rated speeds. For other connection (where applicable) 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

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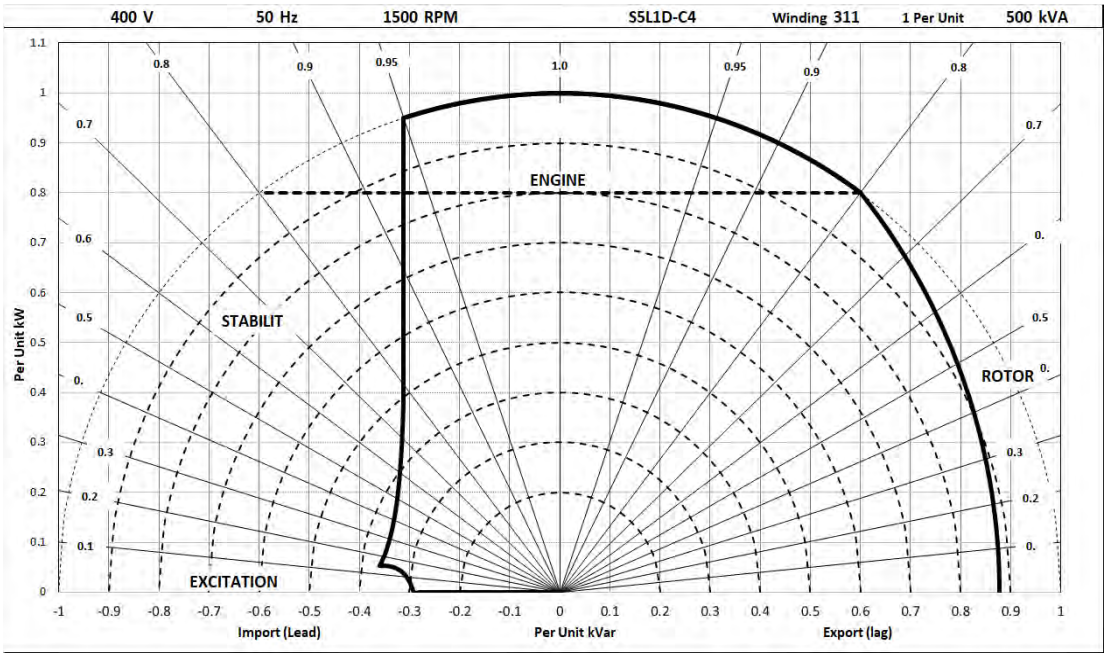
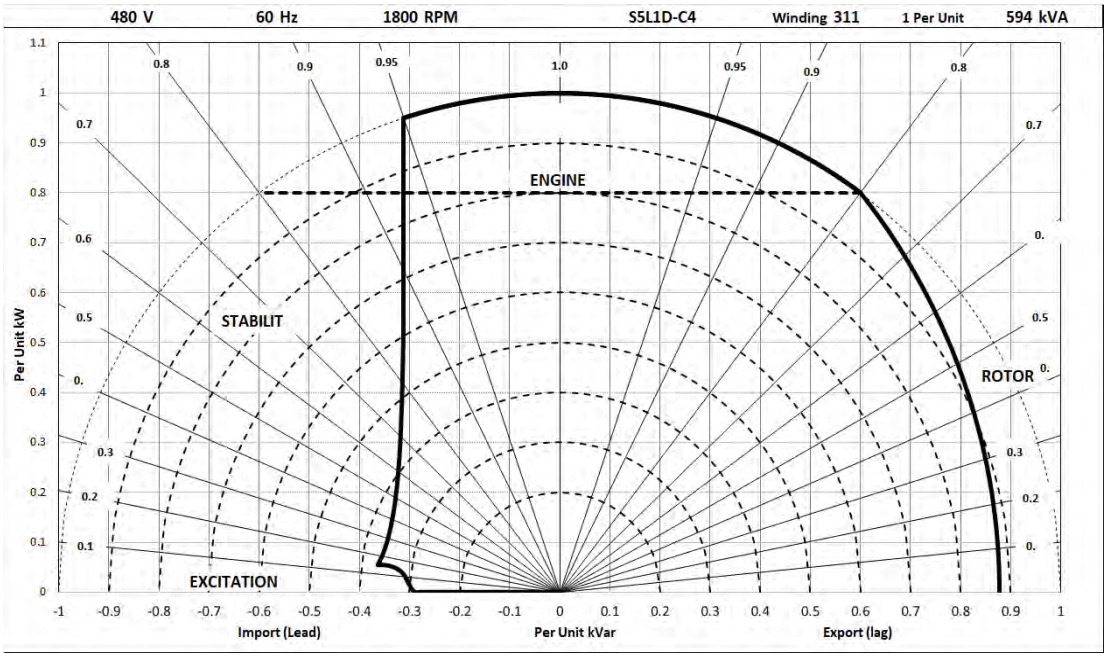
**S5L1D-C4 Wdg.311**

## Typical Alternator Operating Charts

### 400V/50Hz




### 480V/60Hz



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**S5L1D-C4 Wdg.311**

## RATINGS AT 0.8 POWER FACTOR

| | Class - Temp Rise | Standby - 163/27°C | | | | Standby - 150/40°C | | | | Cont. H - 125/40°C | | | | Cont. F - 105/40°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 | 500 | 520 | 500 | 495 | 478 | 512 | 478 | 478 | 455 | 500 | 455 | 450 | 400 | 445 | 400 | 400 |
| | kW | 400 | 416 | 400 | 396 | 382 | 410 | 382 | 382 | 364 | 400 | 364 | 360 | 320 | 356 | 320 | 320 |
| | Efficiency (%) | 93.5 | 93.6 | 94.0 | 94.3 | 93.8 | 93.7 | 94.2 | 94.4 | 94.0 | 93.8 | 94.4 | 94.6 | 94.5 | 94.3 | 94.8 | 94.9 |
| | kW Input | 428 | 444 | 425 | 420 | 408 | 437 | 406 | 405 | 387 | 426 | 386 | 380 | 339 | 377 | 338 | 337 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 |
| | Series Delta (V) | 240 | 254 | 266 | 277 | 240 | 254 | 266 | 277 | 240 | 254 | 266 | 277 | 240 | 254 | 266 | 277 |
| | kVA | 569 | 600 | 631 | 644 | 550 | 581 | 613 | 625 | 525 | 550 | 581 | 594 | 481 | 500 | 531 | 538 |
| | kW | 455 | 480 | 505 | 515 | 440 | 465 | 490 | 500 | 420 | 440 | 465 | 475 | 385 | 400 | 425 | 430 |
| | Efficiency (%) | 93.6 | 93.7 | 93.7 | 93.9 | 93.8 | 93.9 | 93.9 | 94.0 | 94.0 | 94.1 | 94.1 | 94.2 | 94.3 | 94.4 | 94.4 | 94.5 |
| | kW Input | 486 | 512 | 539 | 549 | 469 | 495 | 522 | 532 | 447 | 468 | 494 | 504 | 408 | 424 | 450 | 455 |

**De-Rates**

All values tabulated above are subject to the following reductions:

- 5% when air inlet filters are fitted
- 3% for every 500 meters by which the operating altitude exceeds 1000 meters above mean sea level
- 3% for every 5°C by which the operational ambient temperature exceeds 40°C @ Class H temperature rise (please refer to applications for ambient temperature de-rates at other temperature rise classes)
- For any other operating conditions impacting the cooling circuit please refer to applications

Note: Requirement for operating in an ambient exceeding 60°C and altitude exceeding 4000 meters (for <690V) or 1500 meters (for >690V) must be referred to applications.

**Dimensional and Torsional Drawing**

For dimensional and torsional information please refer to the alternator General Arrangement and rotor drawings available on our website (http://stamford-avk.com/)

**Note:** Continuous development of our products means that the information contained in our data sheets can change without notice, and specifications should always be confirmed with Cummins Generator Technologies prior to purchase.

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**For General Enquiries:**
**Stamford-avk@cummins.com**

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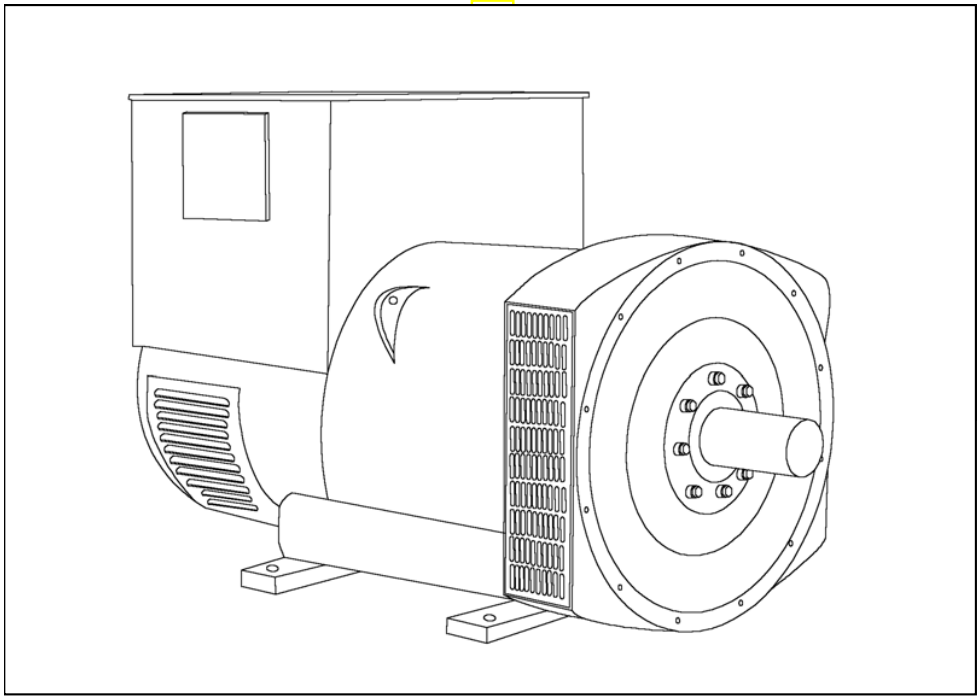
**HCI534C/544C** - Winding 17

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 | |

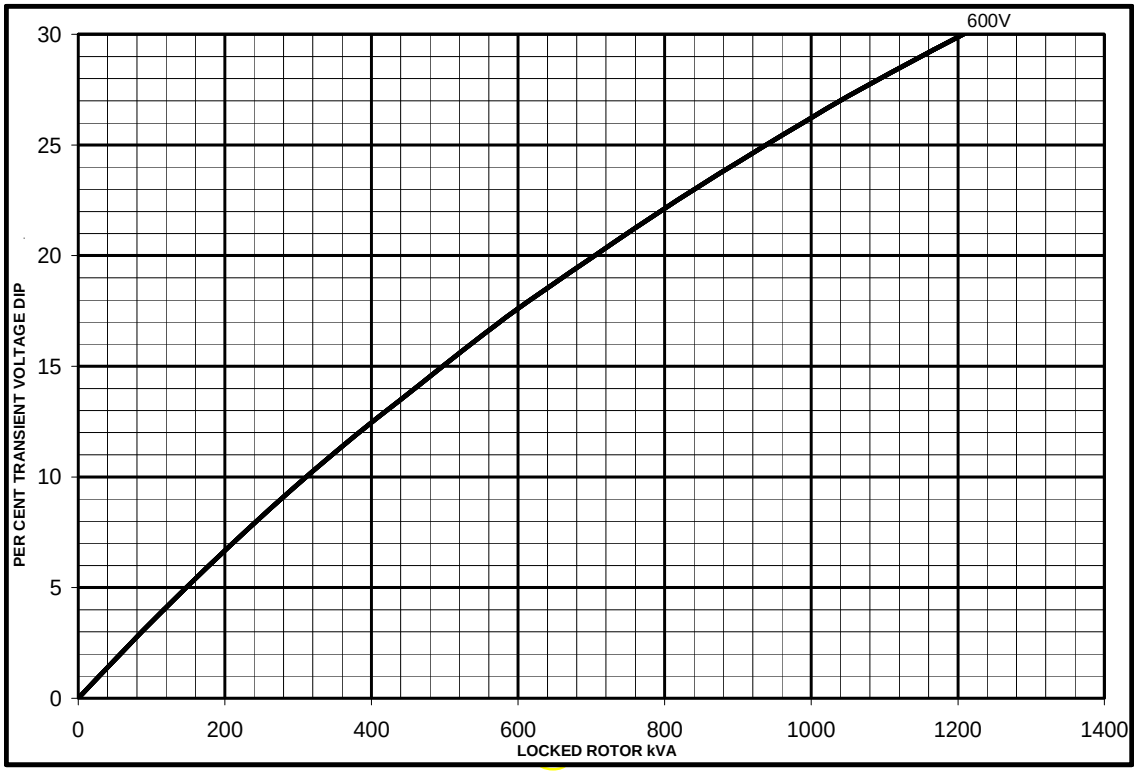
| | | |
|---|---|---|
| INSULATION SYSTEM | CLASS H | |
| PROTECTION | IP23 | |
| RATED POWER FACTOR | 0.8 | |
| STATOR WINDING | DOUBLE LAYER LAP | |
| WINDING PITCH | TWO THIRDS | |
| WINDING LEADS | 12 | |
| STATOR WDG. RESISTANCE | 0.0105 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED | |
| ROTOR WDG. RESISTANCE | 1.55 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 | 1263 kg | 1275 kg |
| WEIGHT WOUND STATOR | 584 kg | 584 kg |
| WEIGHT WOUND ROTOR | 502 kg | 473 kg |
| WR² INERTIA | 6.8928 $kgm^2$ | 6.6149 $kgm^2$ |
| SHIPPING WEIGHTS in a crate | 1355 kg | 1395 kg |
| PACKING CRATE SIZE | 166 x 87 x 124 (cm) | 166 x 87 x 124 (cm) |
| TELEPHONE INTERFERENCE | THF<2% | TIF<50 |
| COOLING AIR | 1.312 m³/sec 2780 cfm | |
| VOLTAGE SERIES STAR | 600V | |
| VOLTAGE PARALLEL STAR | 300V | |
| VOLTAGE SERIES DELTA | 346V | |
| kVA BASE RATING FOR REACTANCE VALUES | 563 | |
| Xd DIR. AXIS SYNCHRONOUS | 2.95 | |
| X'd DIR. AXIS TRANSIENT | 0.13 | |
| X"d DIR. AXIS SUBTRANSIENT | 0.10 | |
| Xq QUAD. AXIS REACTANCE | 2.33 | |
| X"q QUAD. AXIS SUBTRANSIENT | 0.26 | |
| $X_L$ LEAKAGE REACTANCE | 0.06 | |
| $X_2$ NEGATIVE SEQUENCE | 0.18 | |
| $X_0$ ZERO SEQUENCE | 0.08 | |
| 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 s | |
| Ta ARMATURE TIME CONST. | 0.017 s | |
| SHORT CIRCUIT RATIO | 1/Xd | |

# HCI534C/544C

**Winding 17**

SX

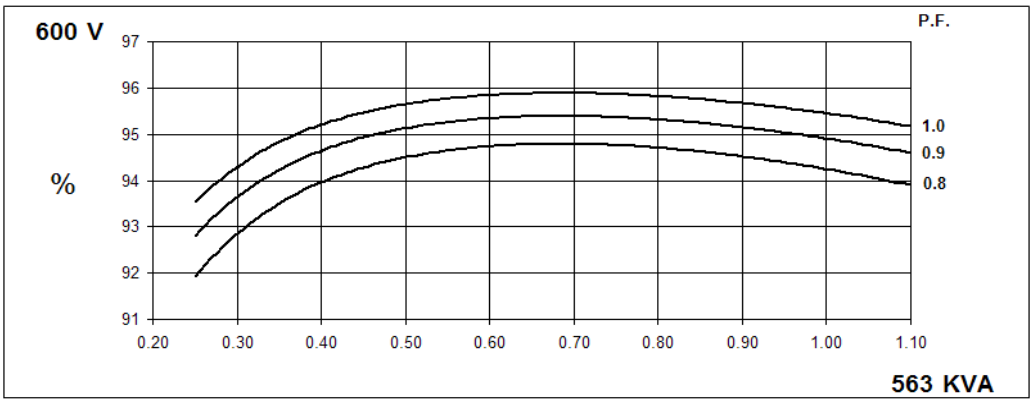
## Locked Rotor Motor Starting Curves



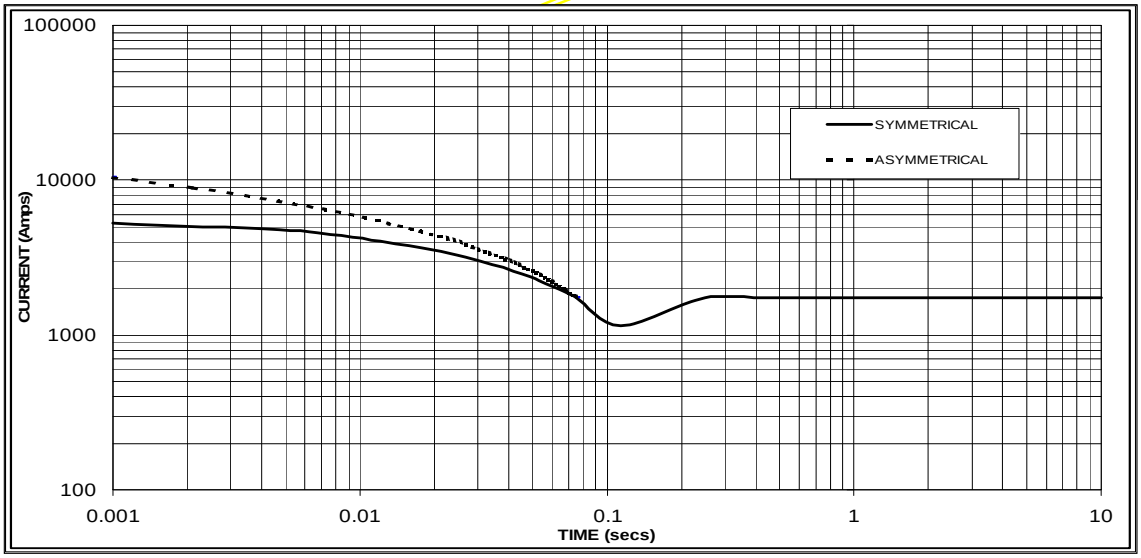

MX

STAMFORD

## THREE PHASE EFFICIENCY CURVES




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




Sustained Short Circuit = 1750 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

# HCI534C/544C

**Winding 17 / 0.8 Power Factor**

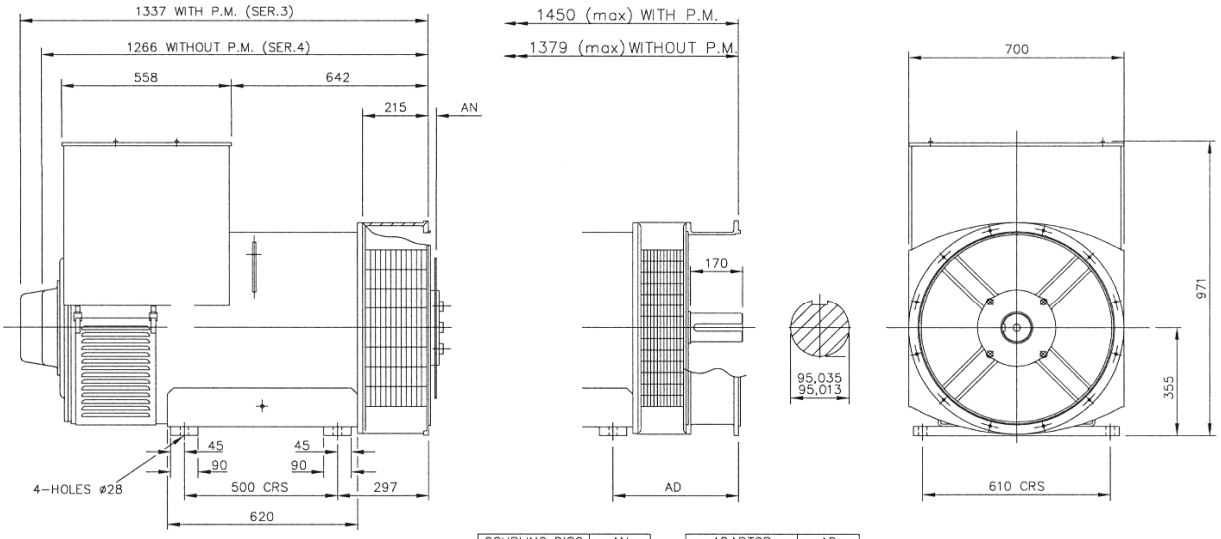
## 60Hz

### 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 | 515 | 563 | 595 | 615 |
| kW | 412 | 450 | 476 | 492 |
| Efficiency (%) | 94.5 | 94.2 | 94.1 | 93.9 |
| kW Input | 436 | 478 | 506 | 524 |



### 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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DSEGenset

DSE

# 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

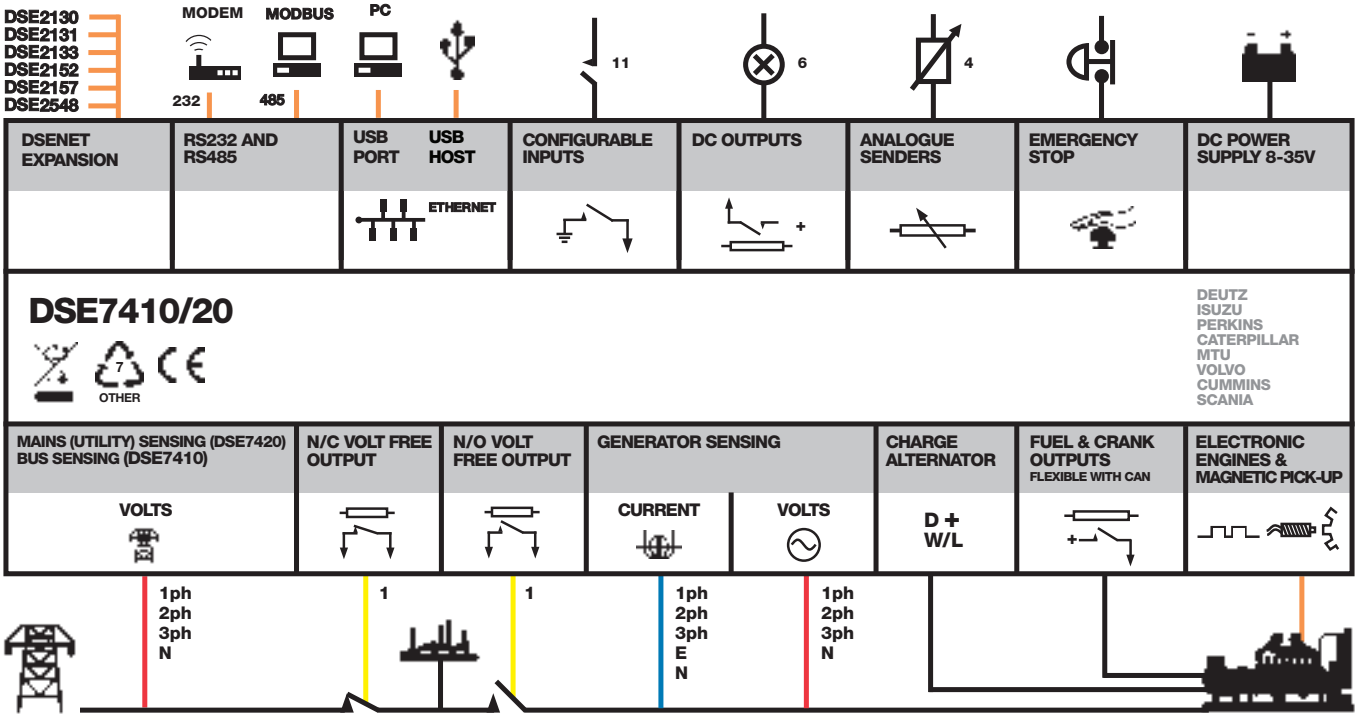
**VIBRATION**
BS EN 60068-2-6
Ten sweeps in each of three major axes
5 Hz to 8 Hz @ +/-7.5 mm,
8 Hz to 500 Hz @ 2 gn

**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

DSE

# DSE7410/20

## AUTO START & AUTO MAINS FAILURE MODULES

### FEATURES

DSE7420

DSE7410

### KEY FEATURES

- Configurable inputs (11)
- Configurable outputs (8)
- Voltage measurement
- Mains (utility) failure detection
- Dedicated load test button
- kW overload alarms
- Comprehensive electrical protection
- RS232, RS485 & Ethernet remote communications
- Modbus RTU/TCP
- PLC functionality
- Multi event exercise timer
- Back-lit LCD 4-line text display
- Multiple display languages
- Automatic start/Manual start
- Audible alarm
- Fixed and flexible LED indicators
- Event log (250)
- Engine protection
- Fault condition notification to a designated PC
- Front panel mounting
- Protected front panel programming
- Configurable alarms and timers
- Configurable start and stop timers
- Five key menu navigation
- Front panel editing with PIN protection
- 3 configurable maintenance alarms
- CAN and magnetic pick-up/Alt. sensing
- Fuel usage monitor and low fuel alarms
- Charge alternator failure alarm
- Manual speed control (on compatible CAN engines)
- Manual fuel pump control
- “Protections disabled” feature
- Reverse power protection
- Power monitoring (kW h, kV Ar, kV A h, kV Ar h)
- Load switching (load shedding and dummy load outputs)
- Automatic load transfer (DSE7420)
- Unbalanced load protection
- Independent earth fault trip
- Fully configurable via DSE Configuration Suite PC software
- Configurable display languages
- Remote SCADA monitoring via DSE Configuration Suite PC software
- Advanced SMS messaging (additional external modem required)
- Start & stop capability via SMS messaging
- Additional display screens to help with modem diagnostics
- DSENet® expansion
- Integral PLC editor

### KEY BENEFITS

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

### RELATED MATERIALS

| TITLE | 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

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VAT No.316923457

**055-108/01/12 (1)**

# Molded Case Circuit Breakers

## Power Defense ™ UL Global Series

## Part Number: PDG33G0600B2NJNNNNNN

Datasheet creation date: 02/12/2019

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

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

## Tech Data for Configured Product

| | |
|---|---|
| **Power Defense Catalog Number** | PDG33G0600B2NJNNNNNN |
| **Frame Size** | Frame 3 |
| **Poles** | 3 Pole |
| **Voltage** | 480V AC |
| **Interruption or Breaking Capacity ( Icu/Ics)** | 35kA |
| **Continuous Current Rating (In)** | 600A |
| **Trip Unit Type** | PXR10 |
| **Trip Unit Options 1** | LSI |
| **Trip Unit Options 2** | None |
| **Indicating Accessories** | None |
| **Indicating Accessories Terminal** | None |
| **Tripping Accessories** | None |
| **Tripping Accessory Terminal** | None |
| **Tripping Accessory Voltage** | None |
| **Line Type Description** | Option 1 - Standard Terminal |
| **Line Conductor Options** | (2) 2 - 500 |
| **Line Terminal Type** | Aluminum |
| **Load Type Description** | Option 1 - Standard Terminal |
| **Load Conductor Options** | (2) 2 - 500 |
| **Load Terminal Type** | Aluminum |
| **Special Options - Type of Modification** | None |
| **Details** | None |
| **Additional Description** | None |

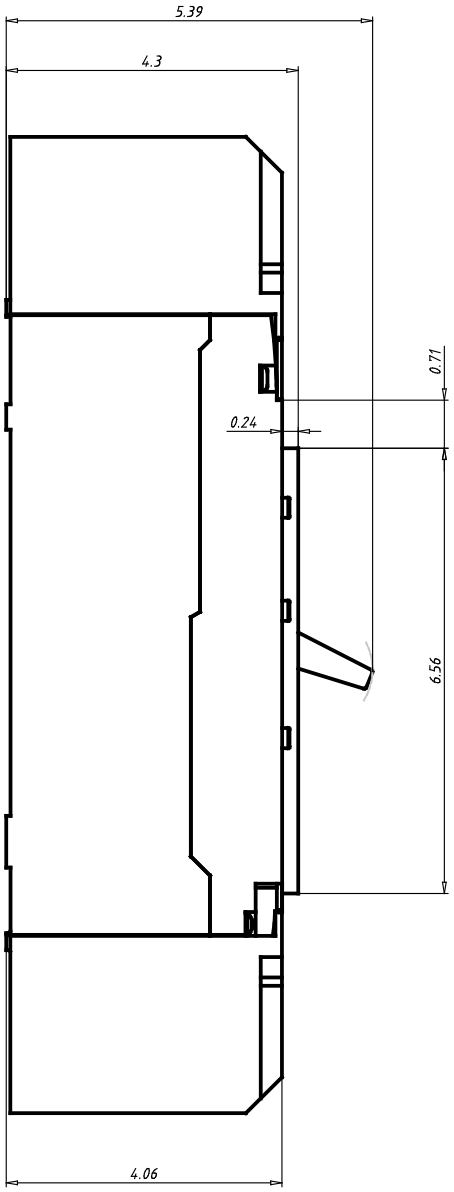
# Molded Case Circuit Breakers

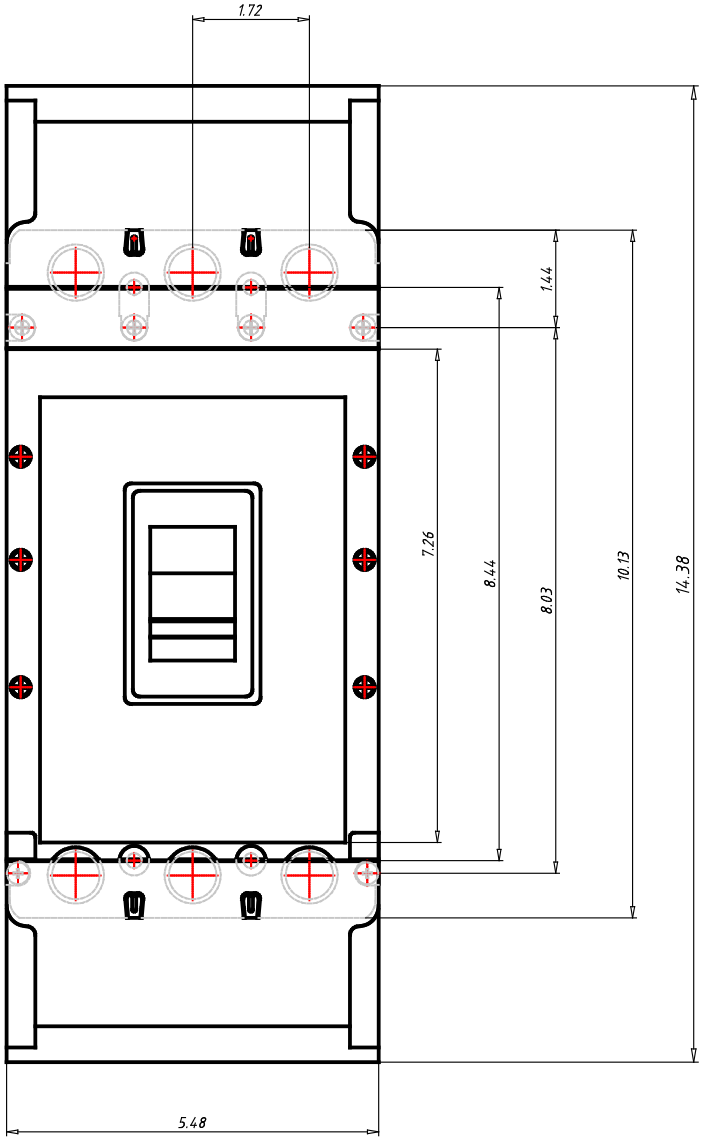
## Power Defense ™ UL Global Series

## Part Number: PDG33G0600B2NJNNNNNN

Datasheet creation date: 02/12/2019

## Technical drawings



# Molded Case Circuit Breakers

## Power Defense ™ UL Global Series

## Part Number: PDG33G0600B2NJNNNNNN

Datasheet creation date: 02/12/2019

## General Technical Data

| | |
|---|---|
| **Frame Rating (In)** | 600A |
| **Reference Standard** | UL489, CSA 22.2, IEC 60947-2 & GB |
| **Number of poles** | 3 |
| **Neutral rating** | - |
| **Interruption Rating Designator** | F / G / K / M / N / P |
| **UL Interruption Rating to UL 489 (240Vac)** | 35 / 65 / 85 / 100 / 150 / 200kA |
| **UL Interruption Rating to UL 489 (480Vac)** | 25 / 35 / 50 / 65(a) / 85 / 100kA |
| **UL Interruption Rating to UL 489 (600Vac)** | 14 / 18 / 25 / 35 / 50 / 65kA |
| **UL Interruption Rating to UL 489 (125/250Vdc)** | |
| **UL Current Limiting** | N / N / N / N / Y / Y |
| **Rated breaking capacity to IEC 60947-2 (220-240 Vac Icu)** | 35 / 55 / 85 / 100 / 150 / 200kA |
| **Rated breaking capacity to IEC 60947-2 (220-240 Vac Ics)** | 35 / 55 / 85 / 100 / 100 / 150kA |
| **Rated breaking capacity to IEC 60947-2 (380-415 Vac Icu)** | 25 / 36 / 50 / 70 / 70 / 100kA |
| **Rated breaking capacity to IEC 60947-2 (380-415 Vac Ics)** | 25 / 36 / 50 / 53 / 70 / 70kA |
| **Rated breaking capacity to IEC 60947-2 (440 Vac Icu)** | 25 / 30 / 35 / 50 / 70 / 100kA |
| **Rated breaking capacity to IEC 60947-2 (440 Vac Ics)** | 20 / 22.5 / 35 / 40 / 50 / 50kA |
| **Rated breaking capacity to IEC 60947-2 (525 Vac Icu)** | 18 / 20 / 25 / 30 / 35 / 40kA |
| **Rated breaking capacity to IEC 60947-2 (525 Vac Ics)** | 5 / 7.5 / 10 / 15 / 25 / 25kA |
| **Rated breaking capacity to IEC 60947-2 (690 Vac Icu)** | - / 8 / 10 / 15 / 20 / 20kA |
| **Rated breaking capacity to IEC 60947-2 (690 Vac Ics)** | - / 4 / 5 /7. 5 / 10 / 10kA |
| **Rated breaking capacity to IEC 60947-2 (125V DC Icu)** | |
| **Rated breaking capacity to IEC 60947-2 (250V DC 2P in series Ics)** | 10 / 10 / 10 / 22 / 22 / 22kA |
| **Frequency** | 50/60Hz |
| **Trip Unit Type** | PXR10 |
| **Continuous Current Range** | 250 - 600A |
| **100% UL489 Rated** | Yes |
| **Instantaneous/Short Circuit Range** | 2 - 10 In |
| **Magnetic/Instantaneous Override** | 7200A |
| **Dimensions H x W x D (inches)** | 10.125 x 5.47 x 4.297 |
| **Pole to pole distance inches** | 1,719 |
| **Approx Weight lbs** | 16 |
| **RoHS Compliance** | Yes |
| **UL File Number** | E7819 |
| **Ambient Temp Calibration** | |
| **Derating at 50C** | |
| **Derating at 60C** | |
| **Derating at 70C** | |

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

# Molded Case Circuit Breakers

## Power Defense ™ UL Global Series

## Part Number: PDG43G0800B2NJNNNNNN

Datasheet creation date: 20/11/2019

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

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

## Tech Data for Configured Product

| | |
|---|---|
| **Power Defense Catalog Number** | PDG43G0800B2NJNNNNNN |
| **Frame Size** | Frame 4 |
| **Poles** | 3 Pole |
| **Voltage** | 240V AC |
| **Interruption or Breaking Capacity ( Icu/Ics)** | 55kA |
| **Continuous Current Rating (In)** | 800A |
| **Trip Unit Type** | PXR10 |
| **Trip Unit Options 1** | LSI |
| **Trip Unit Options 2** | None |
| **Indicating Accessories** | None |
| **Indicating Accessories Terminal** | None |
| **Tripping Accessories** | None |
| **Tripping Accessory Terminal** | None |
| **Tripping Accessory Voltage** | None |
| **Line Type Description** | Option 1 - Standard Terminal |
| **Line Conductor Options** | (3) 3/0 - 400 |
| **Line Terminal Type** | Aluminum |
| **Load Type Description** | Option 1 - Standard Terminal |
| **Load Conductor Options** | (3) 3/0 - 400 |
| **Load Terminal Type** | Aluminum |
| **Special Options - Type of Modification** | None |
| **Details** | None |
| **Additional Description** | None |

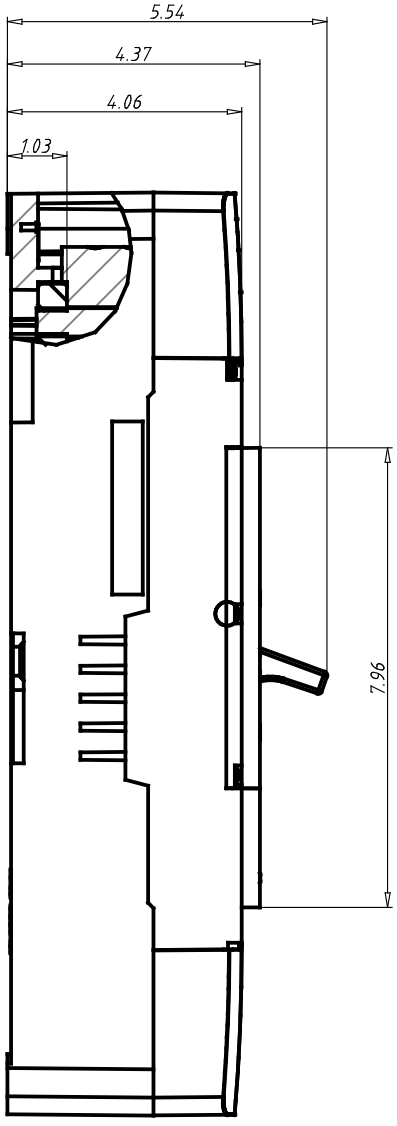
# Molded Case Circuit Breakers

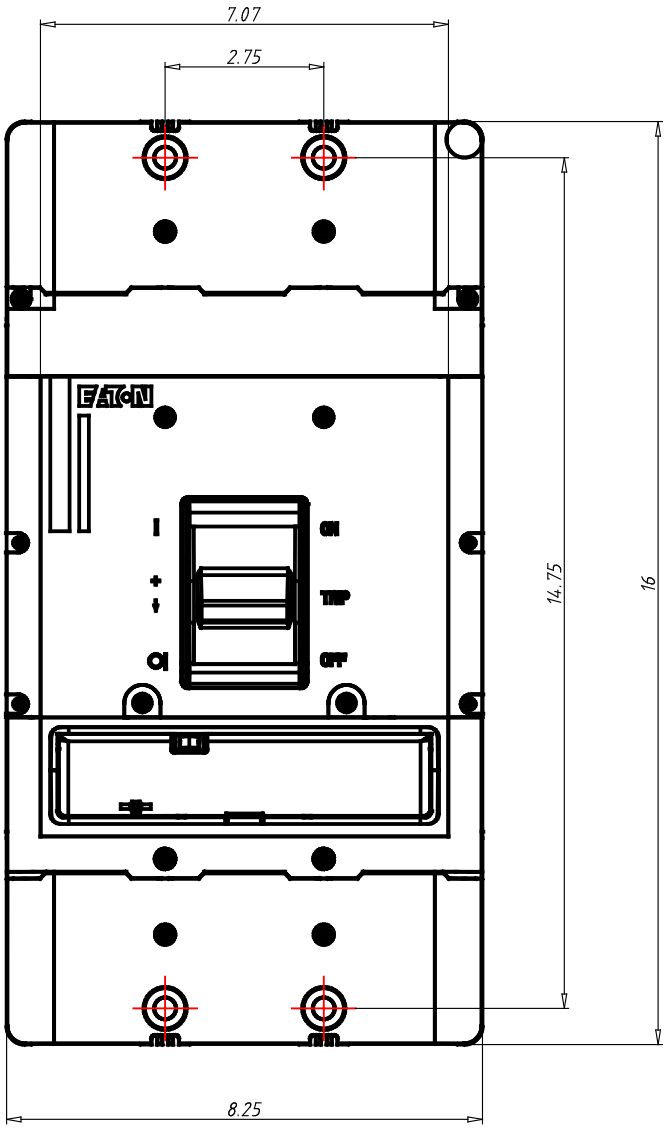
## Power Defense ™ UL Global Series

## Part Number: PDG43G0800B2NJNNNNNN

Datasheet creation date: 20/11/2019

## Technical drawings



# Molded Case Circuit Breakers

## Power Defense ™ UL Global Series

## Part Number: PDG43G0800B2NJNNNNNN

Datasheet creation date: 20/11/2019

## General Technical Data

| | |
|---|---|
| **Frame Rating (In)** | 800A |
| **Reference Standard** | UL489, CSA 22.2, IEC 60947-2 & GB |
| **Number of poles** | 3 |
| **Neutral rating** | - |
| **Interruption Rating Designator** | G / K / M |
| **UL Interruption Rating to UL 489 (240Vac)** | 65 / 85 / 100kA |
| **UL Interruption Rating to UL 489 (480Vac)** | 35 / 50 / 65(a)kA |
| **UL Interruption Rating to UL 489 (600Vac)** | 18 / 25 / 35kA |
| **UL Interruption Rating to UL 489 (125/250Vdc)** | |
| **UL Current Limiting** | - |
| **Rated breaking capacity to IEC 60947-2 (220-240 Vac Icu)** | 55 / 85 / 100 / 100kA |
| **Rated breaking capacity to IEC 60947-2 (220-240 Vac Ics)** | 55 / 85 / 100 / 100kA |
| **Rated breaking capacity to IEC 60947-2 (380-415 Vac Icu)** | 36 / 50 / 70 / 70kA |
| **Rated breaking capacity to IEC 60947-2 (380-415 Vac Ics)** | 36 / 50 / 53 / 70kA |
| **Rated breaking capacity to IEC 60947-2 (440 Vac Icu)** | 30 / 35 / 50 / 65kA |
| **Rated breaking capacity to IEC 60947-2 (440 Vac Ics)** | 22.5 / 35 / 40 / 50kA |
| **Rated breaking capacity to IEC 60947-2 (525 Vac Icu)** | 20 / 25 / 30 / 35kA |
| **Rated breaking capacity to IEC 60947-2 (525 Vac Ics)** | 16.5 / 20 / 25 / 25kA |
| **Rated breaking capacity to IEC 60947-2 (690 Vac Icu)** | 8 / 10 / 15 / 20kA |
| **Rated breaking capacity to IEC 60947-2 (690 Vac Ics)** | 4 / 5 /7. 5 / 10kA |
| **Rated breaking capacity to IEC 60947-2 (125V DC Icu)** | |
| **Rated breaking capacity to IEC 60947-2 (250V DC 2P in series Ics)** | 22 / 22 / 25kA |
| **Frequency** | 50/60Hz |
| **Trip Unit Type** | PXR10 |
| **Continuous Current Range** | 320 - 800A |
| **100% UL489 Rated** | Yes |
| **Instantaneous/Short Circuit Range** | 2 - 8 In |
| **Magnetic/Instantaneous Override** | 6800A |
| **Dimensions H x W x D (inches)** | 16 x 8.25 x 4.38 |
| **Pole to pole distance inches** | 2,75 |
| **Approx Weight lbs** | 29,98 |
| **RoHS Compliance** | Yes |
| **UL File Number** | E7819 |
| **Ambient Temp Calibration** | |
| **Derating at 50C** | |
| **Derating at 60C** | |
| **Derating at 70C** | |

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

# Molded Case Circuit Breakers

## Power Defense ™ UL Global Series

## Part Number: PDG63M1600E3RNNNNNNN

Datasheet creation date: 26/08/2019

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

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

## Tech Data for Configured Product

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

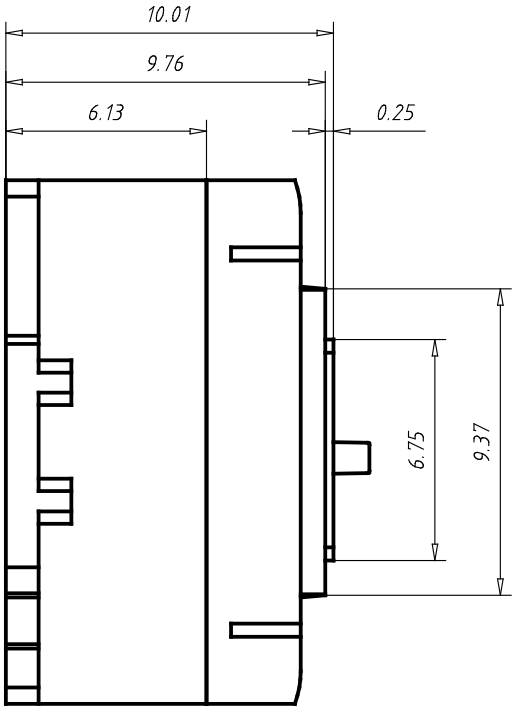
# Molded Case Circuit Breakers

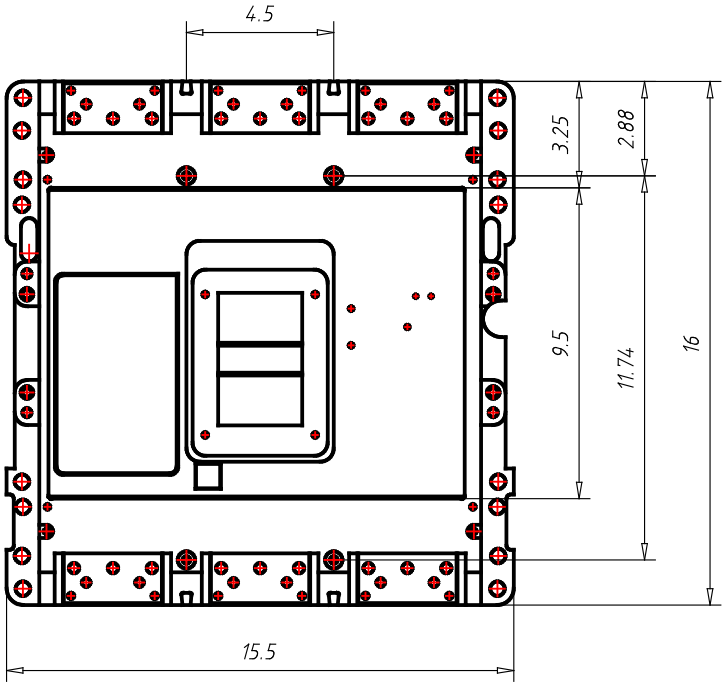
## Power Defense ™ UL Global Series

## Part Number: PDG63M1600E3RNNNNNNN

Datasheet creation date: 26/08/2019

## Technical drawings



# Molded Case Circuit Breakers

## Power Defense ™ UL Global Series

## Part Number: PDG63M1600E3RNNNNNNN

Datasheet creation date: 26/08/2019

## General Technical Data

| | |
|---|---|
| **Frame Rating (In)** | 1600A |
| **Reference Standard** | UL489, CSA 22.2, IEC 60947-2 & GB |
| **Number of poles** | 3 |
| **Neutral rating** | - |
| **Interruption Rating Designator** | M / N / P |
| **UL Interruption Rating to UL 489 (240Vac)** | 125 / 150 / 200kA |
| **UL Interruption Rating to UL 489 (480Vac)** | 65 / 85 / 100kA |
| **UL Interruption Rating to UL 489 (600Vac)** | 35 / 50 / 65kA |
| **UL Interruption Rating to UL 489 (125/250Vdc)** | |
| **UL Current Limiting** | - |
| **Rated breaking capacity to IEC 60947-2 (220-240 Vac Icu)** | 135 / 150 / 200kA |
| **Rated breaking capacity to IEC 60947-2 (220-240 Vac Ics)** | 100 / 100 / 100kA |
| **Rated breaking capacity to IEC 60947-2 (380-415 Vac Icu)** | 70 / 70 / 100kA |
| **Rated breaking capacity to IEC 60947-2 (380-415 Vac Ics)** | 50 / 50 / 50kA |
| **Rated breaking capacity to IEC 60947-2 (440 Vac Icu)** | 50 / 70 / 100kA |
| **Rated breaking capacity to IEC 60947-2 (440 Vac Ics)** | 40 / 50 / 50kA |
| **Rated breaking capacity to IEC 60947-2 (525 Vac Icu)** | 30 / 35 / 40kA |
| **Rated breaking capacity to IEC 60947-2 (525 Vac Ics)** | 25 / 25 / 25kA |
| **Rated breaking capacity to IEC 60947-2 (690 Vac Icu)** | 15 / 20 / 35kA |
| **Rated breaking capacity to IEC 60947-2 (690 Vac Ics)** | 7. 5 / 13 / 18kA |
| **Rated breaking capacity to IEC 60947-2 (125V DC Icu)** | |
| **Rated breaking capacity to IEC 60947-2 (250V DC 2P in series Ics)** | 25 |
| **Frequency** | 50/60Hz |
| **Trip Unit Type** | PXR20 |
| **Continuous Current Range** | Fixed |
| **100% UL489 Rated** | Yes |
| **Instantaneous/Short Circuit Range** | Adjustable |
| **Magnetic/Instantaneous Override** | 17500A |
| **Dimensions H x W x D (inches)** | 16 x 15.5 x 9.75 |
| **Pole to pole distance inches** | 4,5 |
| **Approx Weight lbs** | 135 |
| **RoHS Compliance** | Yes |
| **UL File Number** | E7819 |
| **Ambient Temp Calibration** | |
| **Derating at 50C** | |
| **Derating at 60C** | |
| **Derating at 70C** | |

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

# Digital Linear Chargers

## Specifications

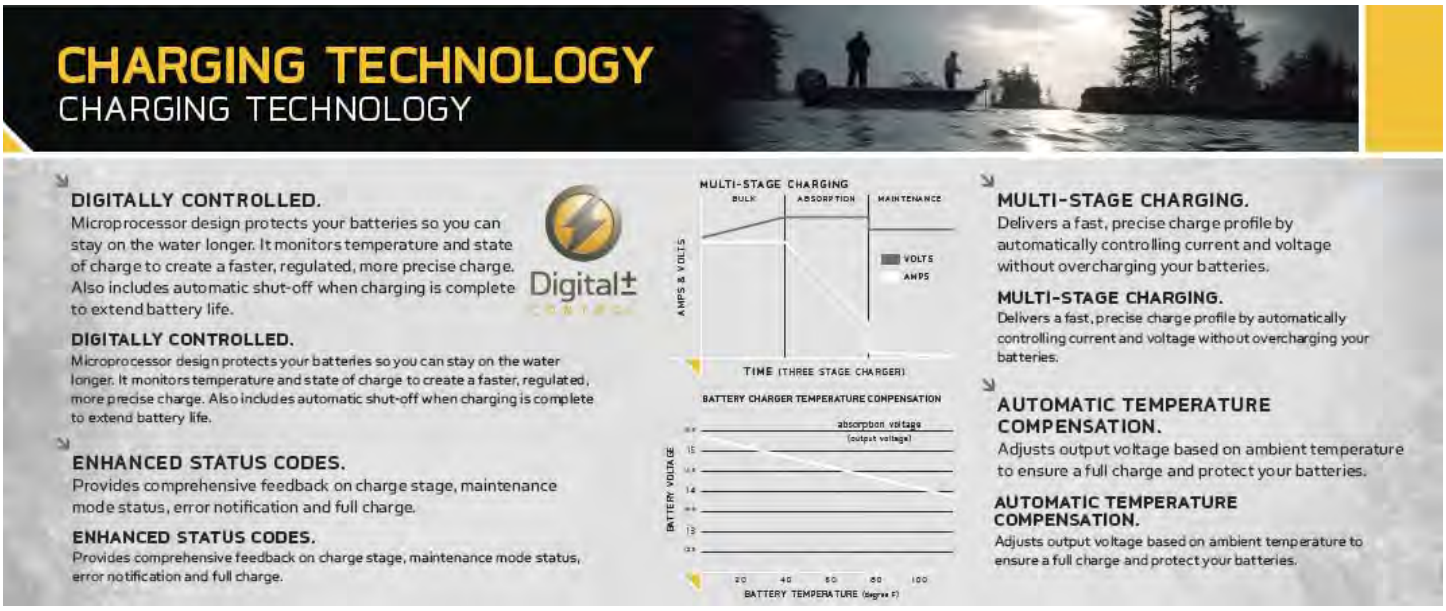
- Waterproof, shock-and vibration-resistant aluminum construction
- Saltwater tested and fully corrosion-resistant
- Short circuit, reverse polarity, and ignition protected
- For use with 12V/6 cell batteries that are flooded/wet cell, maintenance free or starved electrolyte (AGM) only
- FCC compliant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

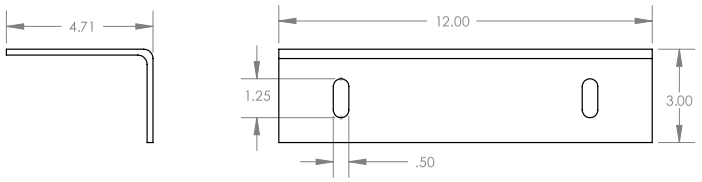

| DIGITAL LINEAR ON-BOARD CHARGERS | |
|---|---|
| PRODUCT CODE | PRODUCT DESCRIPTION |
| 1821065 | MK 106D (1 bank x 6 amps) |
| 1821105 | MK-110D (1 bank x 10 amps) |
| 1822105 | MK-210D (2 bank x 5 amps) |
| 1823155 | MK-315D (3 bank x 5 amps) |
| 1822205 | MK-220D (2 bank x 10 amps) |
| 1823305 | 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) |

# Digital Linear Chargers

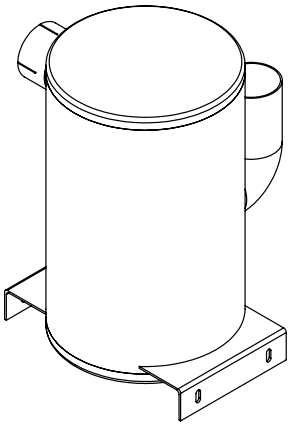
## Specifications (cont.)

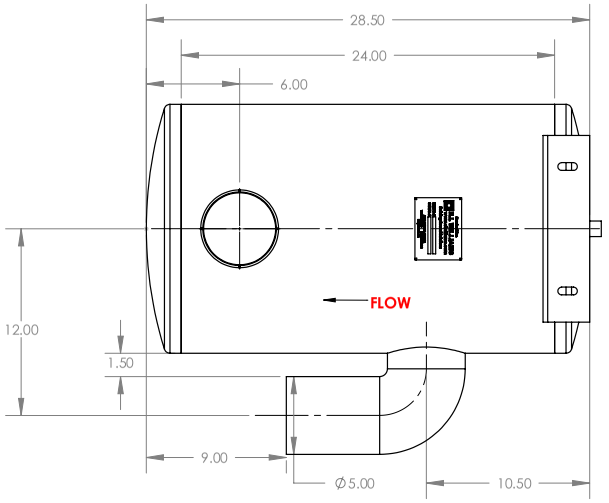
- New 4-color package design

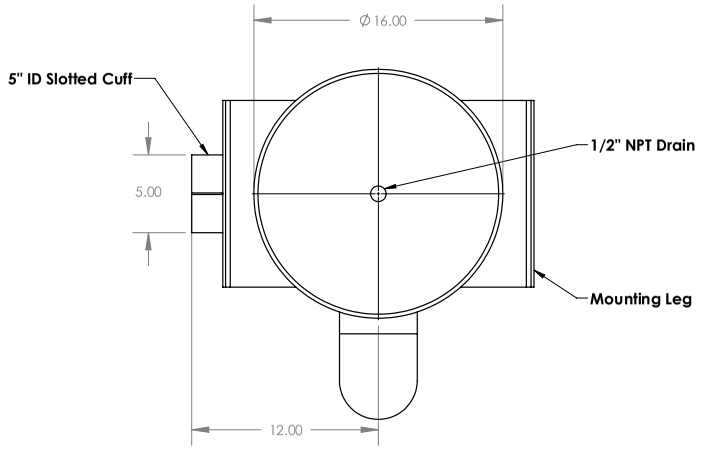






**Detail Mounting Leg (x2)**






**Notes:**
All Dimensions are in Inches
Material: Carbon Steel Construction
Paint: High Heat Black Paint
Weight: Approx. 75lbs

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

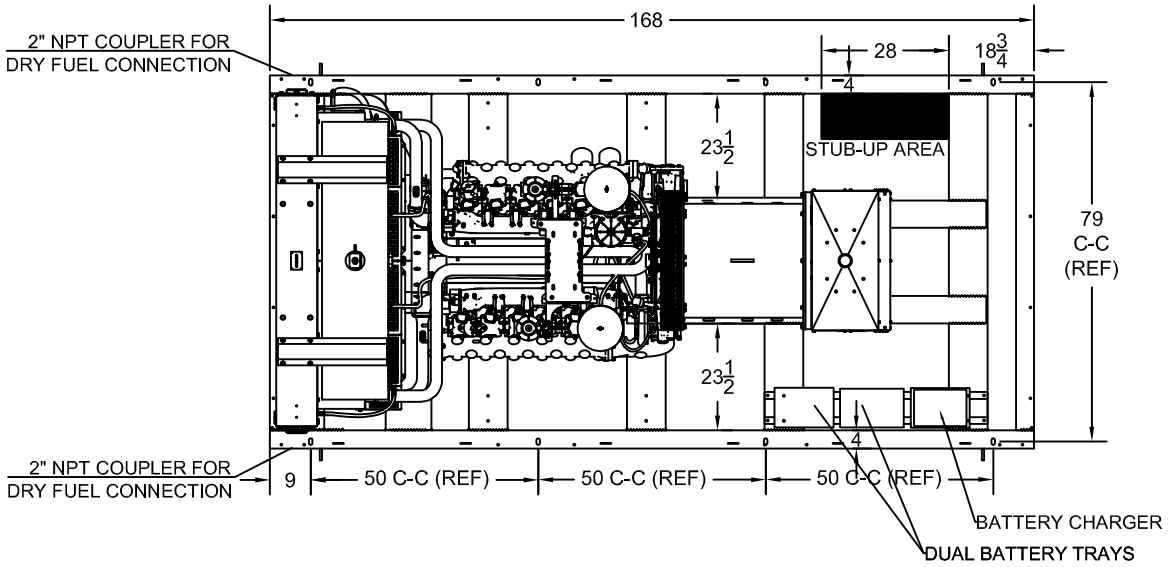
UNLESS OTHERWISE NOTED
1. REMOVE ALL BURRS AND SHARP EDGES
2. DIMENSIONS ARE IN INCHES
TOLERANCES
0.X ± 0.2
0.XX ± 0.12
0.XXX ± 0.063

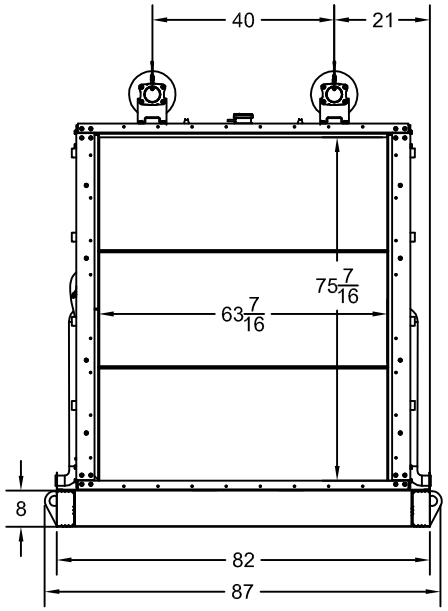
E. I. WILLIAMS INDUSTRIES INC.
Building Sound Solutions
264 FAIRALL STREET, AJAX, ONTARIO, CANADA L1S 1R6
T: 905-428-0950
F: 905-428-8343
WWW.EIWILLIAMS.COM

| TITLE | | CUSTOMER | |
|---|---|---|---|
| COMPACT CRITICAL GRADE SILENCER | | GILLETTE | |
| APPLICATION | PROJECT | DWG NO. | DRAWN BY |
| | | 500-008810 | Ahmad J |
| DATE | SCALE | FILE NAME | REV |
| 08/21/2019 | | | 0 |

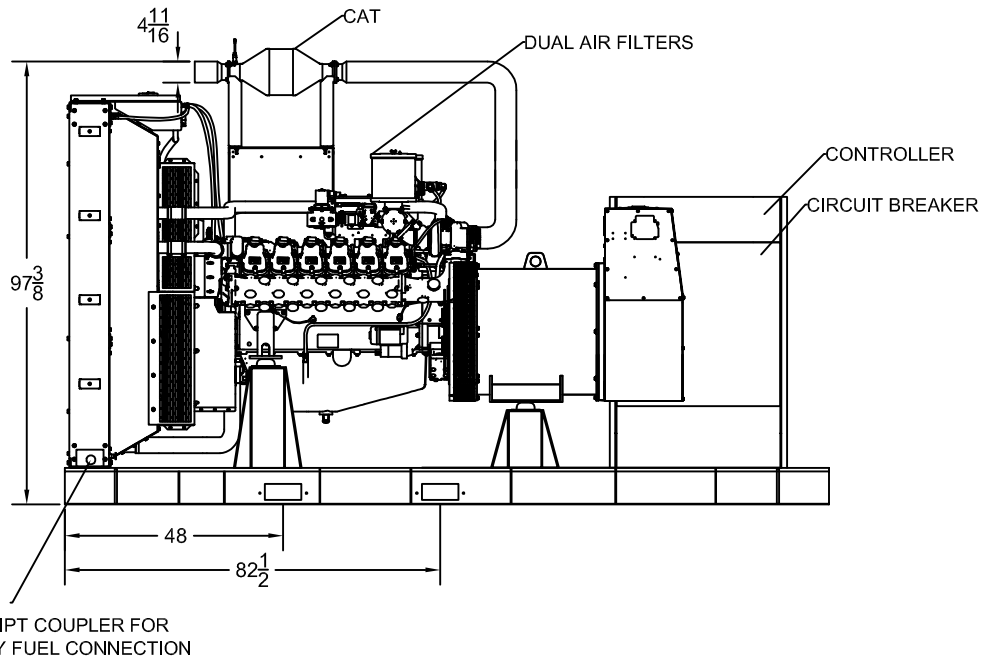
# SP-4500 OPEN DIMENSIONAL OVERVIEW

## TOP VIEW




RADIATOR VIEW

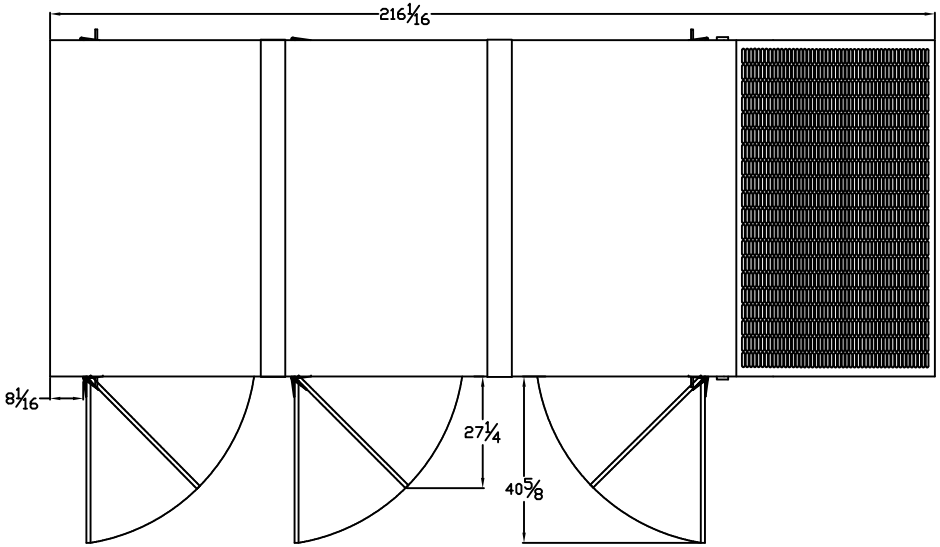



SIDE VIEW

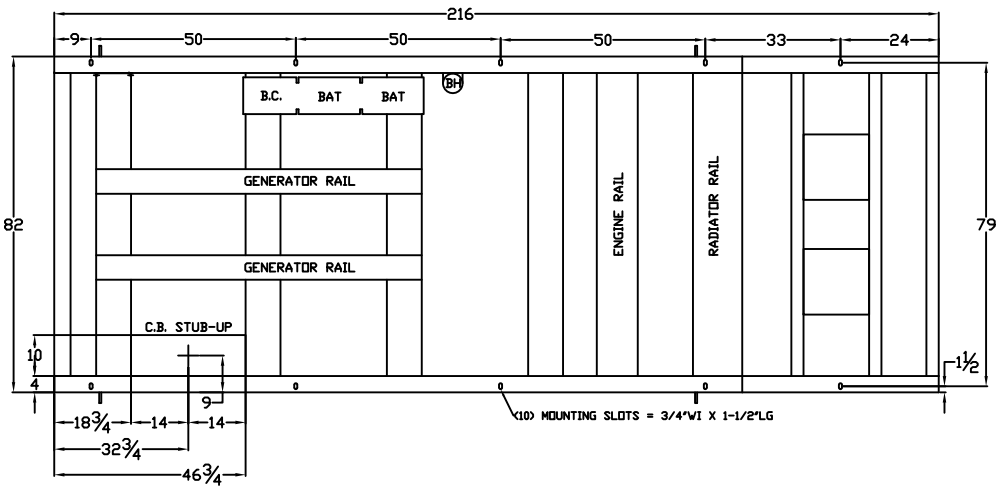
# LEVEL 2 & 3 ENCLOSURE OUTLINE DIMENSIONS
## FOR SP-4000 THRU SP-5000

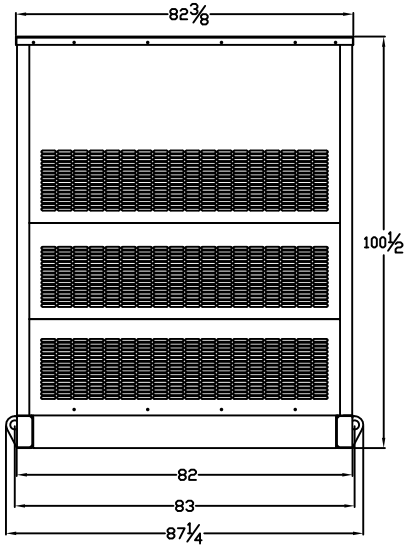
### TOP VIEW

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

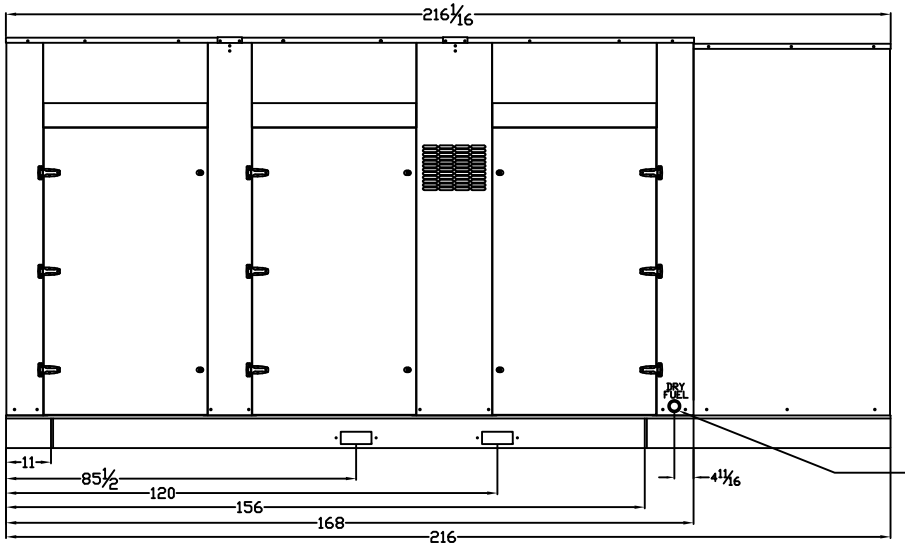



### FRAME VIEW

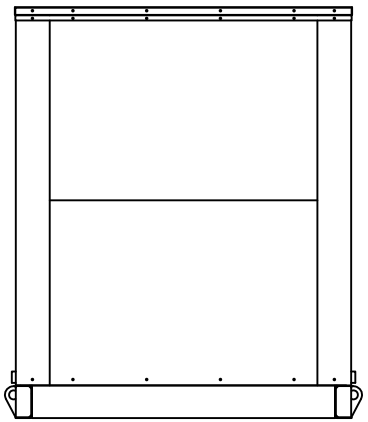



### GENERATOR END VIEW




### SIDE VIEW



### RADIATOR END VIEW