GILLETTE GENERATORS

LIQUID COOLED NAT. GAS ENGINE GENERATOR SET

PRIME MODEL

PR-350

60 HERTZ

Model		PRIME 105°C RISE
	HZ	N.G.
PR-350-60 HERTZ	60	35

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

UL1446, UL508, UL142, UL498

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

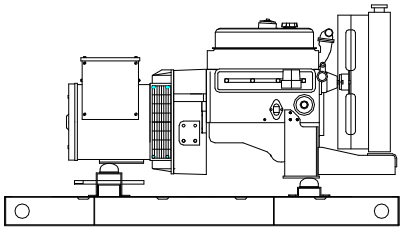
NEC 700, 701, 702, 708

NEMA ICS10, MG1, ICS6, AB1

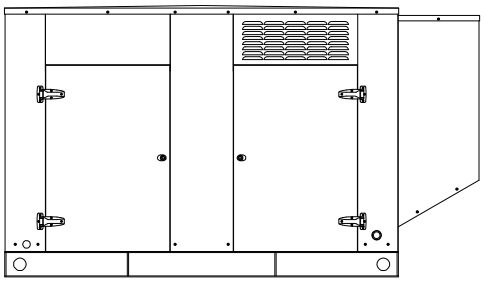
ANSI C62.41, 27, 59, 32, 480, 40Q, 81U, 360-05

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

EPA 40CFR Part 60, 1048, 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	NATURAL GAS FUEL 105°C RISE PRIME RATING		POWER LEAD CONNECTIONS
	L-N	L-L			KW/KVA	AMP	
PR-350-1-1	120	240	1	60	35/35	146	4 LEAD DEDICATED 1 PH.
PR-350-3-2	120	208	3	60	35/44	122	12 LEAD LOW WYE
PR-350-3-3	120	240	3	60	35/44	105	12 LEAD HIGH DELTA
PR-350-3-4	277	480	3	60	35/44	53	12 LEAD HIGH WYE
PR-350-3-5	127	220	3	60	35/44	115	12 LEAD LOW WYE
PR-350-3-16	346	600	3	60	35/44	42	4 LEAD DEDICATED 3 PH.

RATINGS: All single phase gen-sets are dedicated 4 lead windings, rated at unity (1.0) power factor. All three phase gen-sets are 12 lead windings, rated at (.8) power factor. 105°C "PRIME RATINGS" are strictly for gen-sets provide the prime source of electric power, where normal utility power is unavailable or unreliable. A 10% overload is allowed for a total of 1 hour, within every 12 hours of operation of PRIME RATED systems. All gen-set power ratings are based on temperature rise measured by resistance method as defined by MIL-STD 705C and IEEE STD 115, METHOD 6.4.4. All generators have class H (180°C) insulation system on both rotor and stator windings. All factory tests and KW/KVA charts shown above are based on 105°C (prime) R/R winding temperature, within a maximum 40°C ambient condition. Specifications & ratings are subject to change without prior notice.

APPLICATION AND ENGINEERING DATA FOR MODEL PR-350-60 HZ

GENERATOR SPECIFICATIONS

Manufacturer.....Stamford Electric Generators
Model & Type.....S1L2-N1-06, 4 Pole, 4 Lead, Single Phase
.....S1L2-R1-311, 4 Pole, 12 Lead re-connectable, Three Phase
.....PI144J-17, 4 Pole, 12 lead, 600 VAC, Three Phase
Exciter.....Brushless, shunt excited
Voltage Regulator.....Solid State, HZ/Volts
Voltage Regulation.....½%, No load to full load
Frequency.....Field convertible, 60 HZ to 50 HZ
Frequency Regulation.....½% (½ cycle, no load to full load)
Unbalanced Load Capability.....100% of prime amps
Total Stator and Load Insulation.....Class H, 180°C
Temperature Rise.....105°C R/R, prime rating @ 40°C amb.
1 Ø Motor Starting @ 30% Voltage Dip (240V).....48 kVA
3 Ø Motor Starting @ 30% Voltage Dip (208-240V).....75 kVA
3 Ø Motor Starting @ 30% Voltage Dip (480V).....98 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.
- 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.
- Full amortisseur windings with UL-1446 certification.
- 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.....General Motors
Model and Type.....Ind. Power Train, Vortec, 4.3L, 4 cycle
Aspiration.....Natural
Cylinder Arrangement.....6 Cylinders, V-6
Displacement Cu. In. (Liters).....262 (4.3)
Bore & Stroke In. (Cm.).....4 x 3.48 (10.2 x 8.4)
Compression Ratio.....9.05:1
Main Bearings & Style.....4, Babbitt
Cylinder Head.....Hardened Cast Iron
Pistons.....6, Silicon Aluminum
Crankshaft.....Nodular Iron
Exhaust Valve.....Forged Steel
Governor.....Electronic
Frequency Reg. (no load-full load).....Isochronous
Frequency Reg. (steady state).....± 1/4%
Air Cleaner.....Dry, Replaceable Cartridge
Engine Speed.....1800 rpm
Piston Speed, ft/min (m./min.....1044 (318)
Max Power, bhp (kwm) Prime /NG.....53 (40)
Ltd. Warranty Period.....12 Months or 2000 hrs., first to occur

FUEL SYSTEM

Type.....NAT. GAS, Vapor Withdrawal
Fuel Pressure (kpa), in. H_2O*.....(1.74) 7”
Secondary Fuel Regulator.....NG Vapor System
Auto Fuel Lock-Off Solenoid.....Standard on all sets
Fuel Supply Inlet Line.....1” NPTF
* Measured at gen-set fuel inlet, downstream of any dry fuel accessories.

FUEL CONSUMPTION

NAT. GAS: FT^3/HR (M^3/HR)	PRIME
100% LOAD	526 (15)
75% LOAD	437 (12)
50% LOAD	338 (10)
NG = 1000 BTU X FT^3/HR = Total BTU/HR	

OIL SYSTEM

Type.....Full Pressure
Oil Pan Capacity qt. (L).....5.0 (4.7)
Oil Pan Cap. W/ filter qt. (L).....6.5 (6.2)
Oil Filter.....1, Replaceable Spin-On

ELECTRICAL SYSTEM

Ignition System.....Electronic
Eng. Alternator and Starter:
Ground.....Negative
Volts DC.....12
Max. Amp Output of Alternator.....70
Recommended Battery to -18°C (0°F):..12 VDC, Size BCI# 24F Max Dimensions: ..10 3/4" lg X 6 3/4” wi X 9" hi, with standard round posts. Min. output at 600 CCA. Battery tray (max. dim. at 12”lg x 7”wi), hold down straps, battery cables, and battery charger, is furnished. Installation of (1) starting battery is required, with possible higher AMP/HR rating, as described above, if normal environment averages -13°F (-25°C) or cooler.

APPLICATION AND ENGINEERING DATA FOR MODEL PR-350-60 HZ

COOLING SYSTEM

Type of System ..... Pressurized, closed recovery
Coolant Pump ..... Pre-lubricated, self-sealing
Cooling Fan Type (no. of blades) ..... Pusher (10)
Fan Diameter inches (cm) ..... 21" (533)
Ambient Capacity of Radiator °F (°C) 125 (51.6)
Engine Jacket Coolant Capacity Gal (L) 1.8 (6.8)
Radiator Coolant Capacity (with engine) Gal. (L) 5.2 (19.7)
Maximum Restriction of Cooling Air Intake
and discharge side of radiator in. H_20 (kpa) ..... 0.5 (.125)
Water Pump Capacity gpm (L/min) 28 (106)
Heat Reject Coolant: Btu/min (kw) 2320 (40.8)
Low Radiator Coolant Level Shutdown……...Standard
Note: Coolant temp. shut-down switch setting at 212°F (100°C) with 50/50 (water/antifreeze) mix.

COOLING AIR REQUIREMENTS

Combustion Air, cfm (m^3/min) 98 (2.78)
Radiator Air Flow cfm (m^3/min) 5000 (142)
Heat Rejected to Ambient:
Engine: kw (btu/min) 19.2 (1100)
Alternator: kw (btu/min) 7.5 (422)

EXHAUST SYSTEM

Exhaust Outlet Size ..... 2.5"
Max. Back Pressure in. hg (KPA) ..... 3" (10.2)
Exhaust Flow, at rated kw: cfm (m^3/min) 330 (9.4)
Exhaust Temp., at rated kw: °F (°C) 1206 (652)
Engines are EPA certified Natural Gas.

SOUND LEVELS MEASURED IN dB(A)

	Open Set	Level 2 Encl.
Level 2, Critical Silencer	70	64
Level 3, Hospital Silencer		59

Note: Open sets (no enclosure) have silencer system choices due to unknown job-site applications. Level 2 enclosure has installed critical silencer with upgrade to Level 3 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 85°F (29.4°C)

DIMENSIONS AND WEIGHTS

	Open Set	Level 2 Enclosure
Length in (cm)	78 (198)	94 (238)
Width in (cm)	42 (107)	42 (107)
Height in (cm)	36 (91)	53 (134)
1 Ø Net Weight lbs (kg)	1326 (601)	1851 (839)
1 Ø Ship Weight lbs (kg)	1406 (638)	2011 (912)
3 Ø Net Weight lbs (kg)	1316 (597)	1771 (803)
3 Ø Ship Weight lbs (kg)	1396 (633)	1931 (875)

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.

Further expansion is available by adding the optional "WebNet" gateway interface module. This device will allow comprehensive monitoring of the generator via the cloud including identification, location, and status. Some advantages of this module include: reduced site visits and maintenance costs • remote fuel management • fault analysis • asset tracking • automatic system alerts • maximized system up-time.

STANDARD FEATURES FOR MODEL PR-350-60 HZ

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 • 12 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:

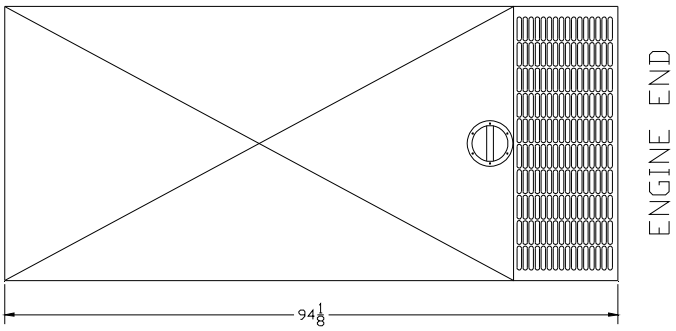
½% Voltage regulation • EMI filter • Under-speed protection • Over-excitation protection • total encapsulation

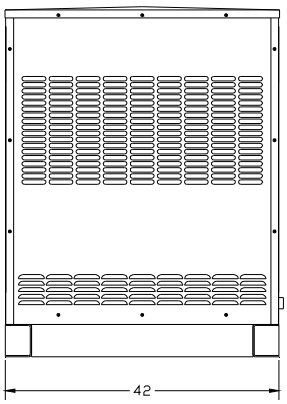
DC ELECTRICAL SYSTEM:

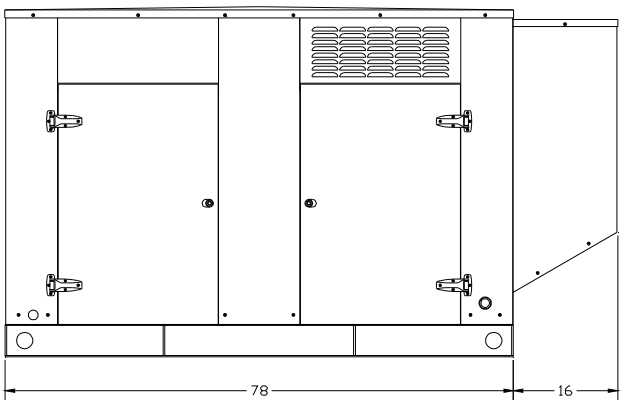
Battery tray • Battery cables • Battery hold down straps • 2-stage battery float charger with maintaining & recharging automatic charge stages

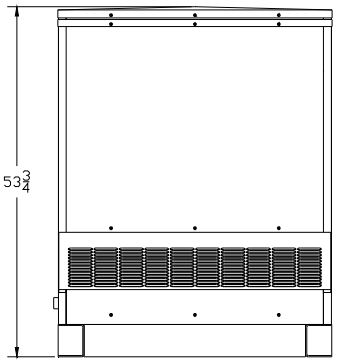
WEATHER/SOUND PROOF ALUMINUM HOUSING CORROSION RESISTANT PROTECTION CONSISTING OF:

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









PSI
POWER SOLUTIONS, INC.

4.3L
GM Industrial Engine

GM Industrial Engine Power by Power Solutions, Inc.

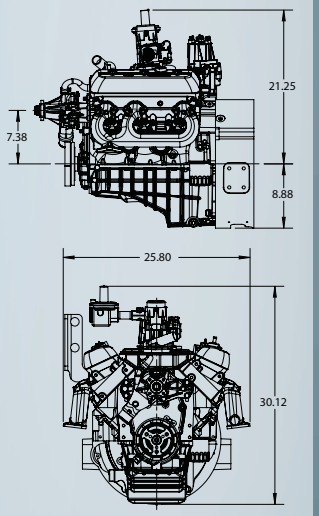
Feature/Benefits

- Designed to work with gasoline, liquid propane gas and natural gas.
- Roller valve lifters for reduced friction and improved fuel economy.
- Nodular iron crankshaft has undercut and rolled fillets for durability.
- Counter-rotating balance shaft for smooth performance and low noise.
- Engine comes completely component painted.
- Composite rocker arm cover and front cover for noise reduction.
- World-class engine sealing system for superior leak protection.
- High Energy Ignition (HEI) distributor and coil are standard.
- Cast aluminum oil pan for increased strength and noise reduction.
- Common rear face on most GM Powertrain industrial engines for easy hookup with housing.

Options

- Fuel options, LPG, NG, Gasoline
- Fuel and Emission Control System that Meets Tier II EPA/CARB Emission
- Regulations for LSI Engines
- SAE flywheel housings and flywheels
- Auxiliary drive pulleys available
- Cooling fans
- Radiators
- Dry type industrial air cleaners (safety element air cleaners available)
- Electronic governors
- Sintered powered metal exhaust valve seat

Power Solutions, Inc.



PSI Offers Turn-Key Certified and Non-Certified Engine Packages

General Data

Type: 90° 4.3L V6
Displacement: 262 cid (4294.18 cc)
Compression Ratio: 9.4:1
Valve Configuration: Pushrod Actuated Overhead Valves
Manufactured: Tonawanda, New York
Valve Lifters: Hydraulic Roller
Bore X Stroke: 4.00 X 3.48 in (101.60 X 88.39 mm)
Main Bearing Caps: 2-Bolt
Balance Method: External
Intake Manifold: 2-BBL, IAFM
Rear Oil Seal: Full Circle
Fuel Delivery: Carburetted LPG, NG, SEFI Gasoline
Oil Pan Capacity: 4.5 qt with filter
Fuel Types: Gasoline, LPG or NG
Engine Rotation: Clockwise(from the front)
Paint Protection: Completely component painted
Horsepower: 135hp @ 3000 rpm (Gasoline)
Torque: 243 lb-ft @ 2200 rpm (Gasoline)
Shipping Weight: 434 lb (197 kg)

Materials

Block: Cast Iron
Cylinder Head: Cast Iron
Intake Manifold: Cast Iron
Crankshaft: Nodular Iron
Camshaft: Steel
Pistons: High Silicon Aluminum
Exhaust Seat: Induction Hardened

Engine Sealing System

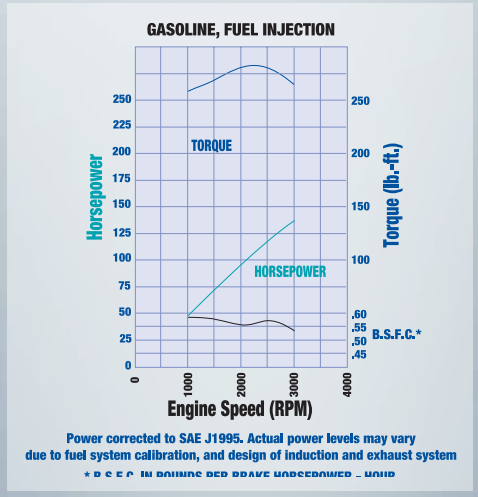
One-piece viton rear main seal
One-piece oil pan gasket
Molded rocker cover seal
Composite graphite cylinder head gaskets with stainless steel core.

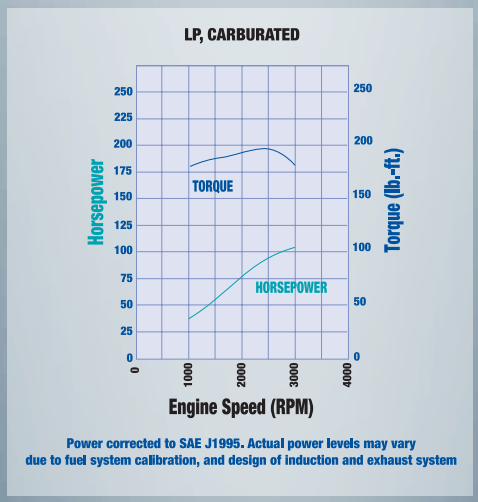
Sensors

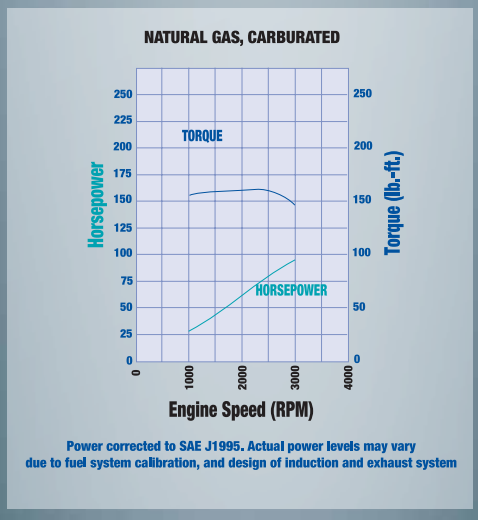
Switch & Sender: Water Temp &Oil Pressure

Fuel System Options

Closed and Open Loop Fuel Systems
Gasoline Fuel Injection
Gasoline/LPG Carb Dual Fuel
LPG (Mixer, Throttle Body, Fuel Lock, Regulator)
LPG W/Governor (Same As Above w/Elec. Governor)
LPG W/Governor (Same As Above w/Velocity Governor)
LPG Carb
NG/LPG Carb Dual Fuel
NG Carb
NG (Mixer, Throttle Body & Air Cleaner)
NG W/Governor (Same As Above w/Elec. Governor)
Three Way Catalyst Available







PSI POWER SOLUTIONS, INC.
655 Wheat Lane, Wood Dale, IL 60191
Telephone 630-350-9400
Fax 630-350-9900
www.psiengines.com

GM POWERTRAIN

STAMFORD

S1L2-N1 Winding 06 / 706

S1L2-N1 - Technical Data Sheet

Standards

STAMFORD industrial alternators meet the requirements of 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	**AVR Power**
AS540	Self-Excited / Aux winding
Voltage Regulation	± 1%
No Load Excitation Voltage (V)	13 V
Full Load Excitation Voltage (V)	47 V

STAMFORD

S1L2-N1 Winding 06 / 706

Electrical Data		
Insulation System	Class H	
Stator Winding	Double Layer Concentric	
Winding Pitch	Two Thirds	
Winding Leads	4	
Winding Number	06 / 706	
Number of Poles	4	
IP Rating	IP23	
RFI Suppression	EN 61000-6-2 & EN 61000-6-4, refer to factory for others	
Waveform Distortion	NO LOAD < 2% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%	
Short Circuit Ratio	1/Xd	
Steady State X/R Ratio	4.52	
	60 Hz	
Telephone Interference	TIF<50	
Voltage Series	240	240
Power Factor	0.8	1.0
kVA Base Rating (Class H)	36.5	40
Saturated Values in Per Unit at Base Ratings and Voltages		
Xd Dir. Axis Synchronous	1.140	1.249
X'd Dir. Axis Transient	0.142	0.156
X"d Dir. Axis Subtransient	0.118	0.129
Xq Quad. Axis Reactance	1.139	1.248
X"q Quad. Axis Subtransient	0.139	0.152
XL Stator Leakage Reactance	0.073	0.080
X2 Negative Sequence Reactance	0.192	0.210
X0 Zero Sequence Reactance	0.006	0.007
Unsaturated Values in Per Unit at Base Ratings and Voltages		
Xd Dir. Axis Synchronous	1.573	1.724
X'd Dir. Axis Transient	0.163	0.179
X"d Dir. Axis Subtransient	0.138	0.151
Xq Quad. Axis Reactance	1.173	1.286
X"q Quad. Axis Subtransient	0.167	0.183
XL Stator Leakage Reactance	0.082	0.090
X2 Negative Sequence Reactance	0.230	0.252
X0 Zero Sequence Reactance	0.007	0.008
Time Constants (Seconds)		
T'd TRANSIENT TIME CONST.	0.032	
T''d SUB-TRANSTIME CONST.	0.002	
T'do O.C. FIELD TIME CONST.	0.183	
Ta ARMATURE TIME CONST.	0.013	

STAMFORD

S1L2-N1 Winding 06 / 706

Resistances in Ohms (Ω) at 22^{0}C	
Stator Winding Resistance (Ra)	0.051 Ω per phase series connected
Rotor Winding Resistance (Rf)	1.04 Ω
Exciter Stator Winding Resistance	14.6 Ω
Exciter Rotor Winding Resistance	0.118 Ω per phase
Positive Sequence Resistance (R1)	0.064 Ω
Negative Sequence Resistance (R2)	0.074 Ω
Zero Sequence Resistance (R0)	0.064 Ω
Aux Winding Resistance (with winding 706 only)	2.382 Ω

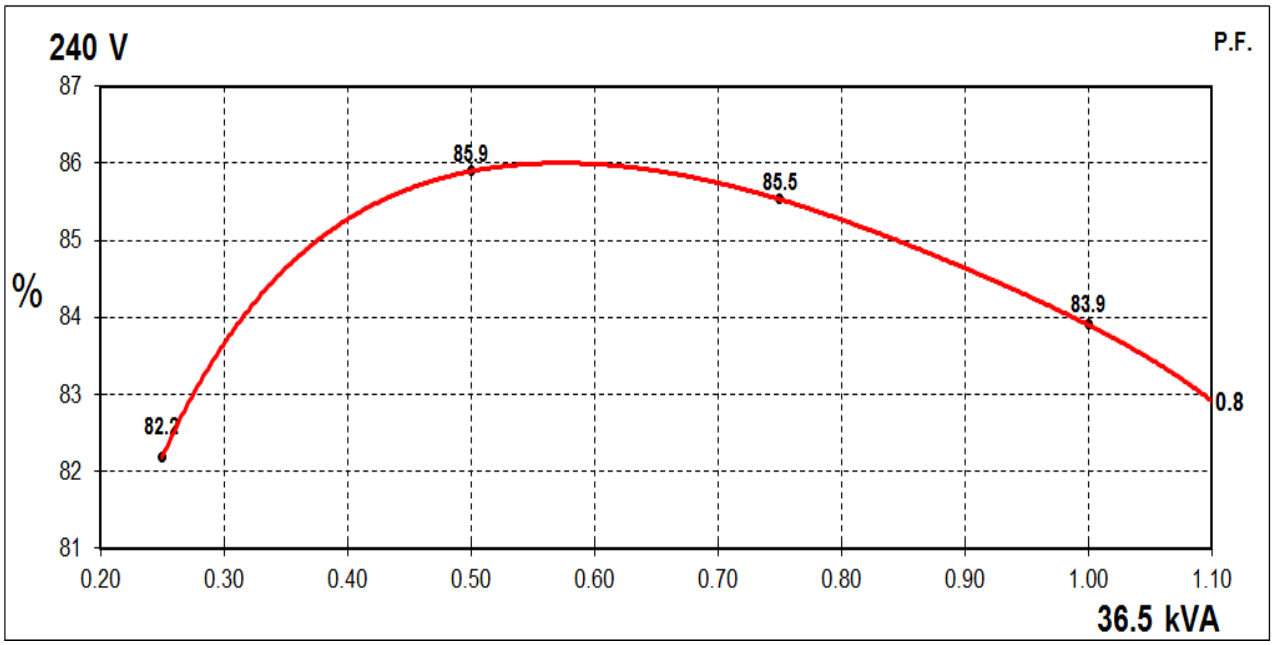
Mechanical data	
Cooling Air	0.212 m³/sec (60Hz)
Shaft and Keys	All alternator rotors are dynamically balanced to better than BS6861: Part 1 Grade 2.5 for minimum vibration in operation.
Bearing	Single Bearing
Weight Complete Alternator	189.5 kg
Weight Wound Stator	79.27 kg
Weight Wound Rotor	73.46 kg
Moment of Inertia	0.3314 kgm^2
Shipping weight in a Crate	237 kg
Packing Crate Size	1050X570X960 mm
Maximum Over Speed	2250 RPM for two minutes
Bearing Drive End	N/A
Bearing Non-Drive End	Ball Bearing, 6306-2RS1

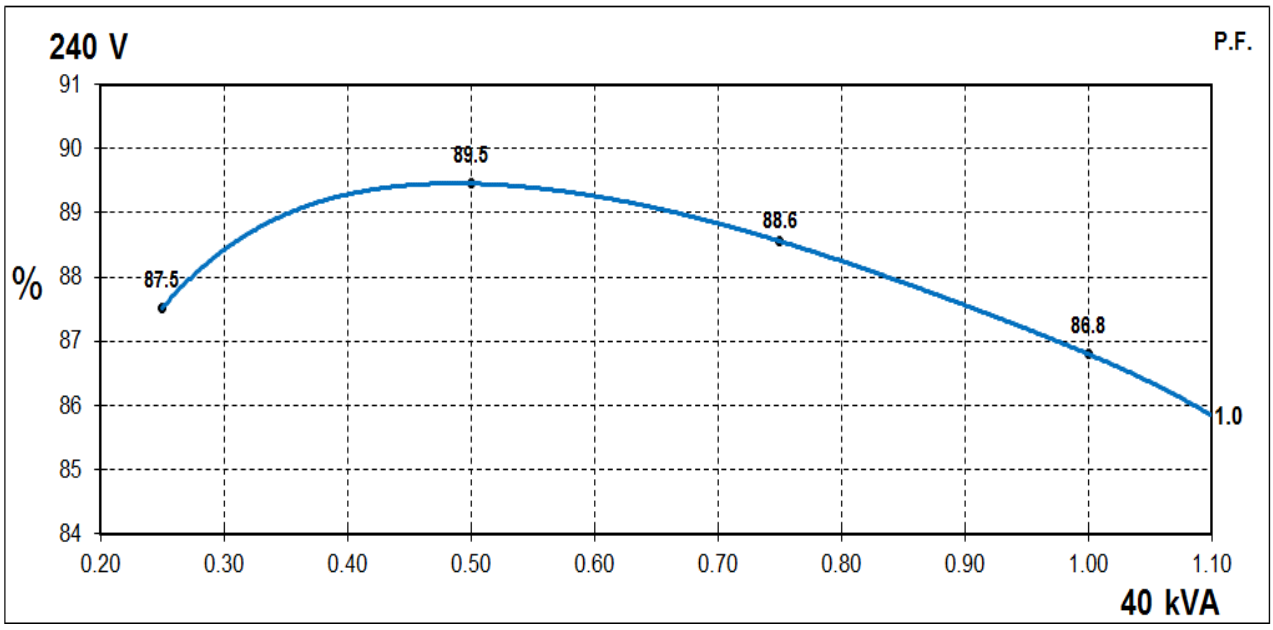
STAMFORD

S1L2-N1 Winding 06 / 706

Single Phase Efficiency Curves

60Hz



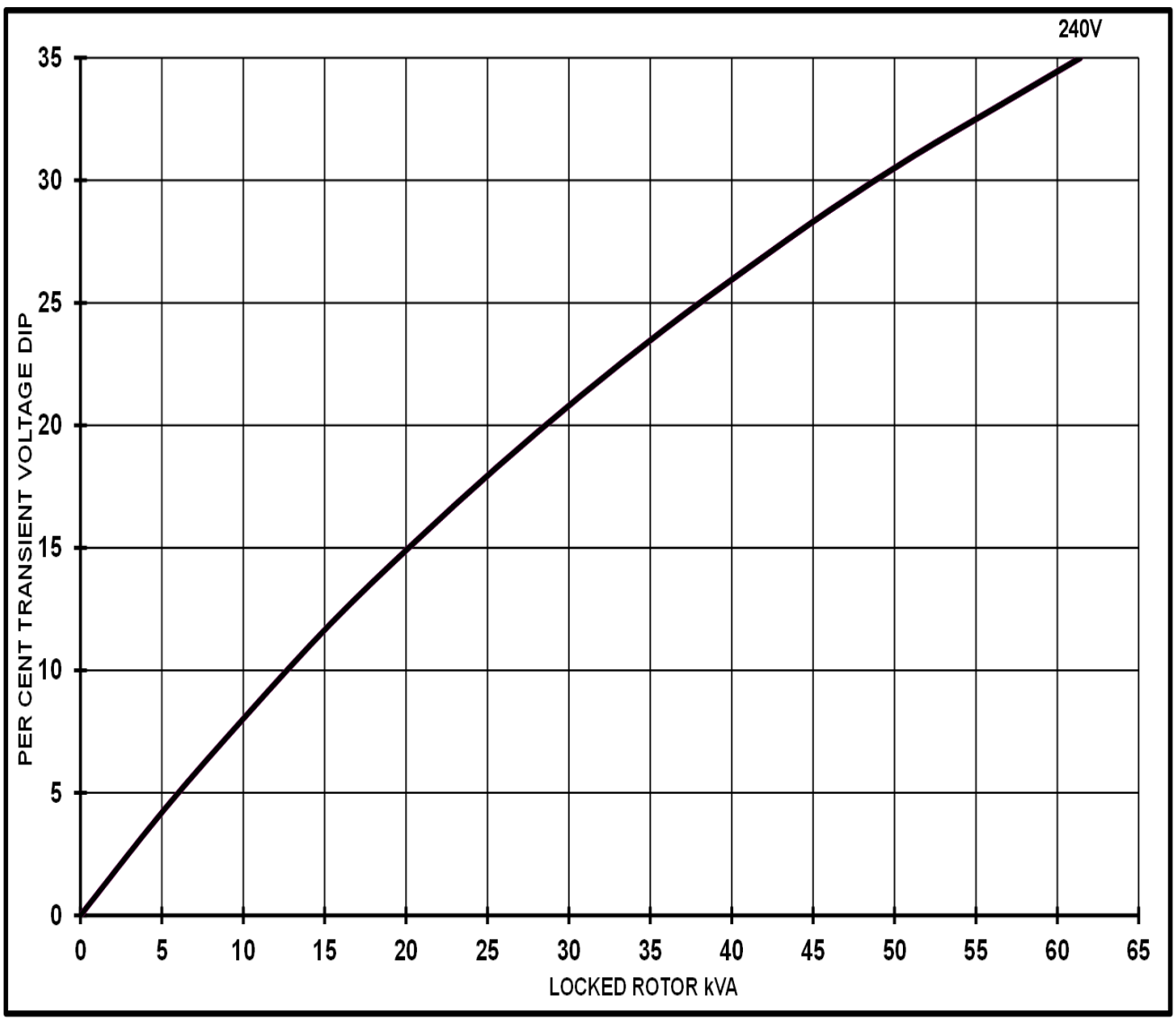


STAMFORD

S1L2-N1 Winding 06 / 706

Locked Rotor Motor Starting Curves

60Hz



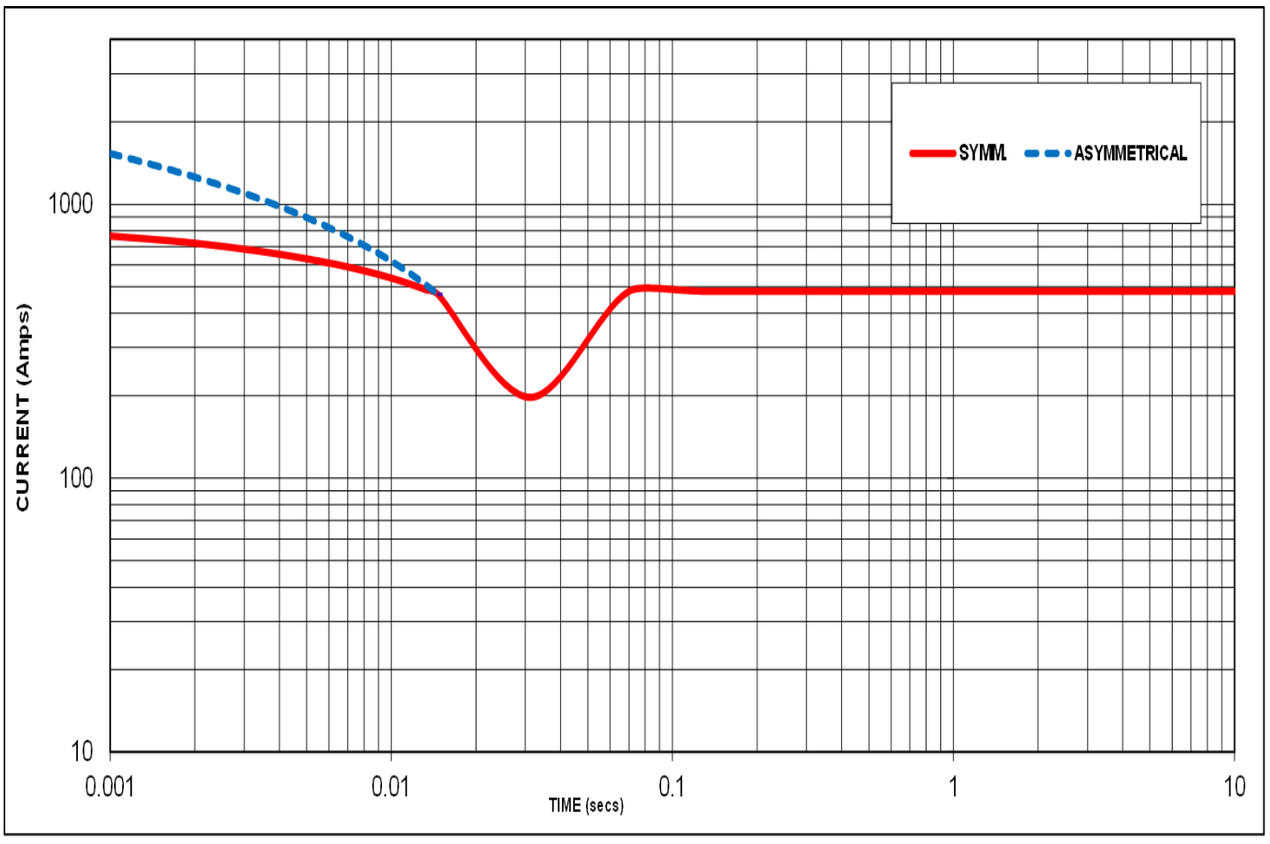
Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	For voltage rise multiply voltage dip by 1.25
< 0.5	1.00	
0.5	0.97	
0.6	0.93	
0.7	0.90	
0.8	0.85	
0.9	0.83	
1.0	0.80	

STAMFORD

S1L2-N1 Winding 06 / 706
Short Circuit Decrement Curve

Note: Applicable only for Winding 706(Auxiliary winding).
Winding 06(no Auxiliary winding) will not provide short circuit capability.

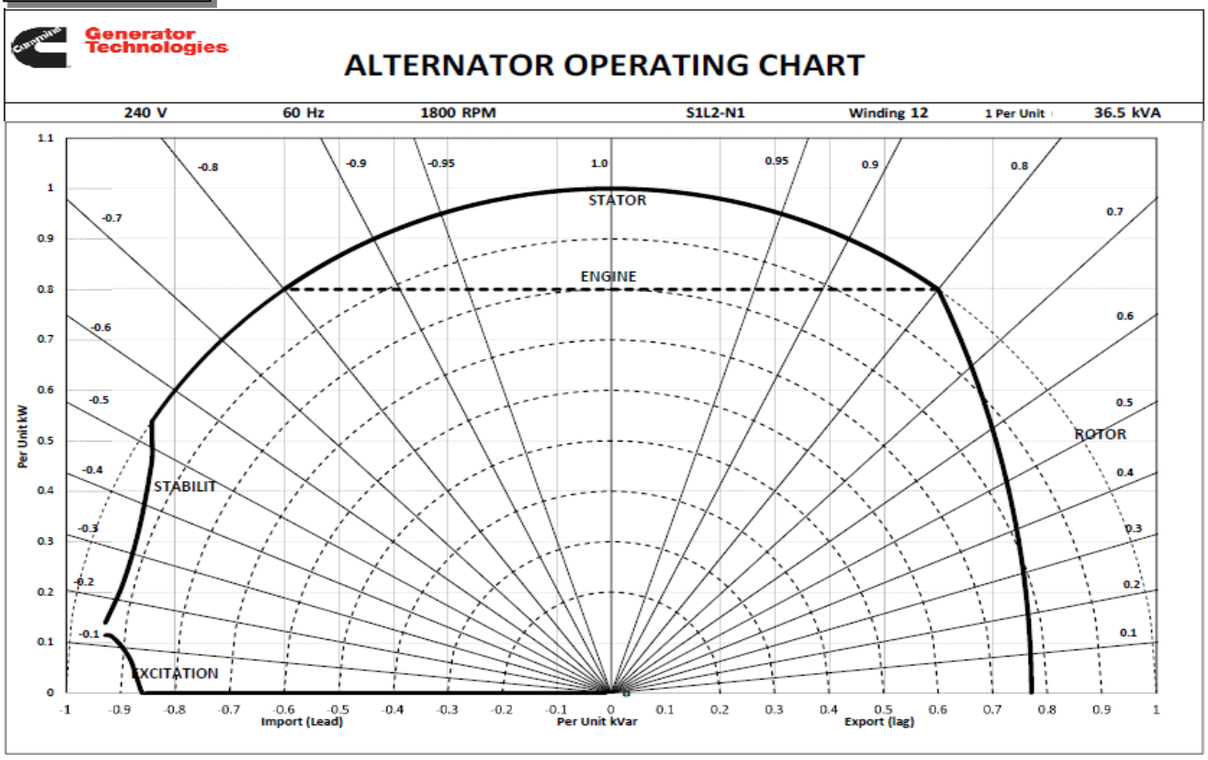
60Hz



Sustained Short Circuit = 456 Amps

Typical Alternator Operating Chart

240V/60 Hz



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S1L2-N1 Winding 06 / 706

RATINGS AT 0.8/1.0 POWER FACTOR

	Class - Temp Rise	Standby - 163/27°C		Standby - 150/40°C		Cont. H - 125/40°C		Cont. F - 105/40°C	
60 Hz	Series (V)	240	240	240	240	240	240	240	240
	Power Factor	0.8	1.0	0.8	1.0	0.8	1.0	0.8	1.0
	kVA	40.6	44.4	38.6	42.3	36.5	40.0	33.0	36.2
	kW	32.5	44.4	30.9	42.3	29.2	40.0	26.4	36.2
	Efficiency (%)	82.8	85.8	83.3	86.2	83.9	86.8	84.6	87.5
	kW Input	39.2	51.8	37.1	49.0	34.8	46.1	31.2	41.4

De-Rates

All values tabulated above are subject to the following reductions:

- 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
- 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 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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Cummins Generator Technologies

S1L2-R1 - Technical Data Sheet

Standards

STAMFORD industrial alternators meet the requirements of 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	**AVR Power**
AS540	Self-Excited / Aux winding
Voltage Regulation	± 1%
No Load Excitation Voltage (V)	13 V
Full Load Excitation Voltage (V)	47 V

STAMFORD

S1L2-R1 Winding 311 / 711

Electrical Data								
Insulation System	Class H							
Stator Winding	Double Layer Concentric							
Winding Pitch	Two Thirds							
Winding Leads	12							
Winding Number	311 / 711							
Number of Poles	4							
IP Rating	IP23							
RFI Suppression	EN 61000-6-2 & EN 61000-6-4, refer to factory for others							
Waveform Distortion	NO LOAD < 2% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%							
Short Circuit Ratio	1/Xd							
Steady State X/R Ratio	8.1							
	50 Hz				**60 Hz**			
Telephone Interference	THF<2%				TIF<50			
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 (Class H)	45.8	50	50	N/A	52.8	55.4	N/A	60
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	1.915	1.887	1.753		1.842	1.728		1.572
X'd Dir. Axis Transient	0.118	0.116	0.108		0.114	0.106		0.097
X"d Dir. Axis Subtransient	0.732	0.721	0.670		0.704	0.660		0.601
Xq Quad. Axis Reactance	1.127	1.111	1.032		1.085	1.017		0.926
X"q Quad. Axis Subtransient	0.308	0.304	0.282		0.296	0.278		0.253
XL Stator Leakage Reactance	0.070	0.069	0.064		0.067	0.063		0.057
X2 Negative Sequence Reactance	0.193	0.191	0.177		0.186	0.174		0.159
X0 Zero Sequence Reactance	0.042	0.041	0.038		0.040	0.037		0.034
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.572	2.534	2.354		2.474	2.321		2.112
X'd Dir. Axis Transient	0.136	0.134	0.124		0.131	0.122		0.111
X"d Dir. Axis Subtransient	0.856	0.844	0.784		0.824	0.773		0.703
Xq Quad. Axis Reactance	1.161	1.144	1.063		1.117	1.048		0.953
X"q Quad. Axis Subtransient	0.370	0.364	0.338		0.356	0.334		0.304
XL Stator Leakage Reactance	0.079	0.078	0.072		0.076	0.071		0.065
X2 Negative Sequence Reactance	0.232	0.229	0.212		0.223	0.209		0.191
X0 Zero Sequence Reactance	0.049	0.048	0.044		0.047	0.044		0.040
Time Constants (Seconds)								
T'd TRANSIENT TIME CONST.	0.024							
T''d SUB-TRANSTIME CONST.	0.003							
T'do O.C. FIELD TIME CONST.	0.137							
Ta ARMATURE TIME CONST.	0.001							

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S1L2-R1 Winding 311 / 711

Resistances in Ohms (Ω) at 22°C	
Stator Winding Resistance (Ra)	0.116 Ω per phase series star connected
Rotor Winding Resistance (Rf)	1.1 Ω
Exciter Stator Winding Resistance	14.7 Ω
Exciter Rotor Winding Resistance	0.201 Ω per phase
Positive Sequence Resistance (R1)	0.145 Ω
Negative Sequence Resistance (R2)	0.167 Ω
Zero Sequence Resistance (R0)	0.145 Ω
Aux Winding Resistance (with winding 711 only)	3.85 Ω

Mechanical data		
Cooling Air	0.176 m³/sec (50Hz)	0.211 m³/sec (60Hz)
Shaft and Keys	All alternator rotors are dynamically balanced to better than BS6861: Part 1 Grade 2.5 for minimum vibration in operation.	
Bearing	Single Bearing	
Weight Complete Alternator	204.56 kg	
Weight Wound Stator	89.76 kg	
Weight Wound Rotor	78.04 kg	
Moment of Inertia	0.3544 kgm^2	
Shipping weight in a Crate	252 kg	
Packing Crate Size	1050X570X960 mm	
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	N/A	
Bearing Non-Drive End	Ball Bearing, 6306-2RS1	

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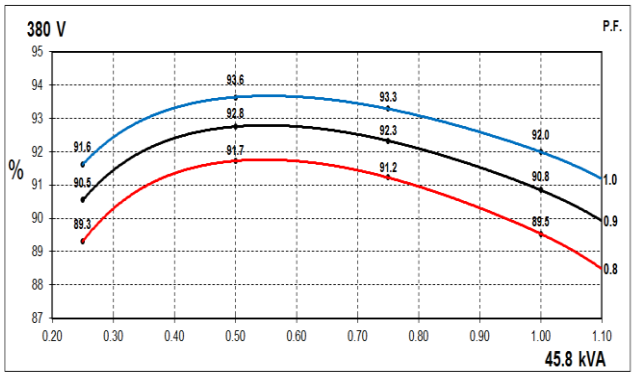
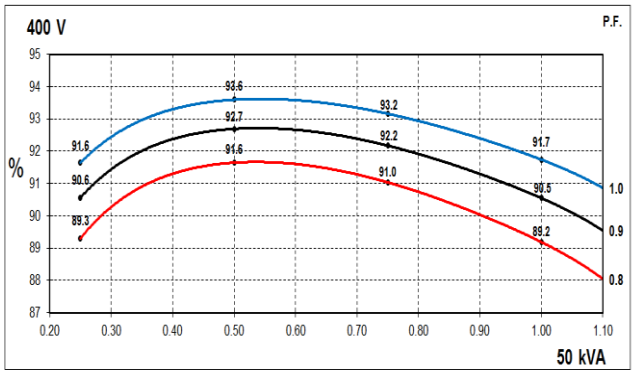
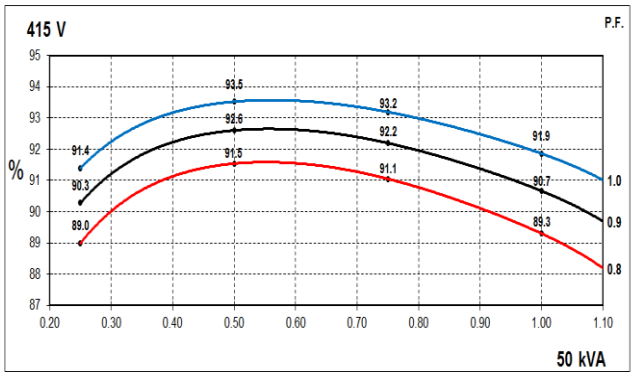
S1L2-R1 Winding 311 / 711

Three Phase Efficiency Curves

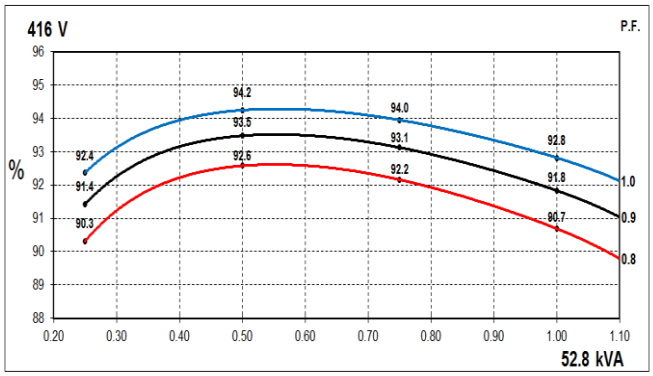
50Hz Curves

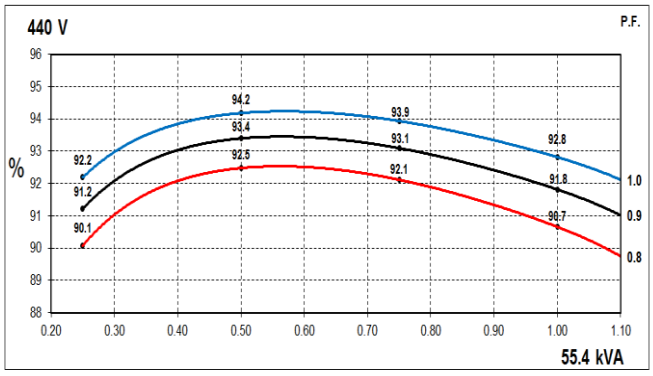


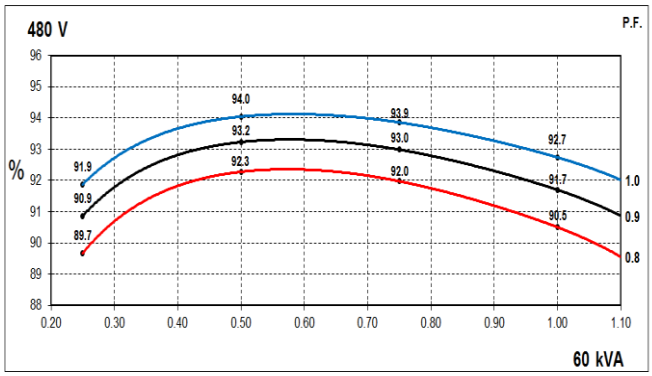




60Hz Curves

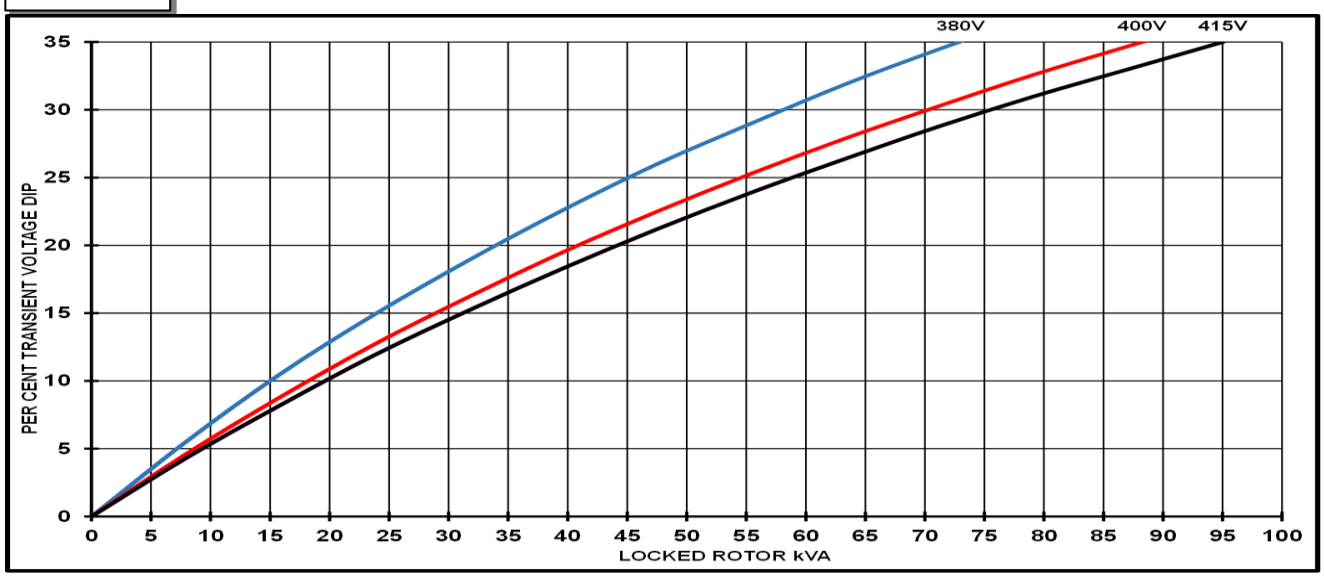




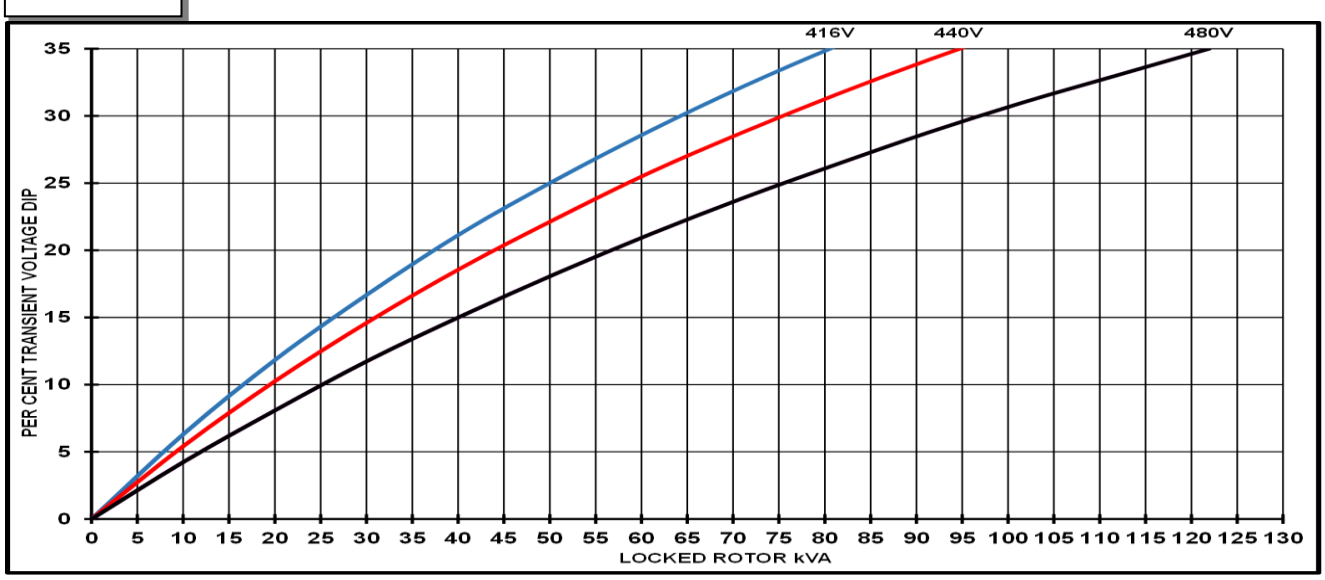


Locked Rotor Motor Starting Curves

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	1.00	
0.5	0.97	
0.6	0.93	
0.7	0.90	
0.8	0.85	
0.9	0.83	
1.0	0.80	

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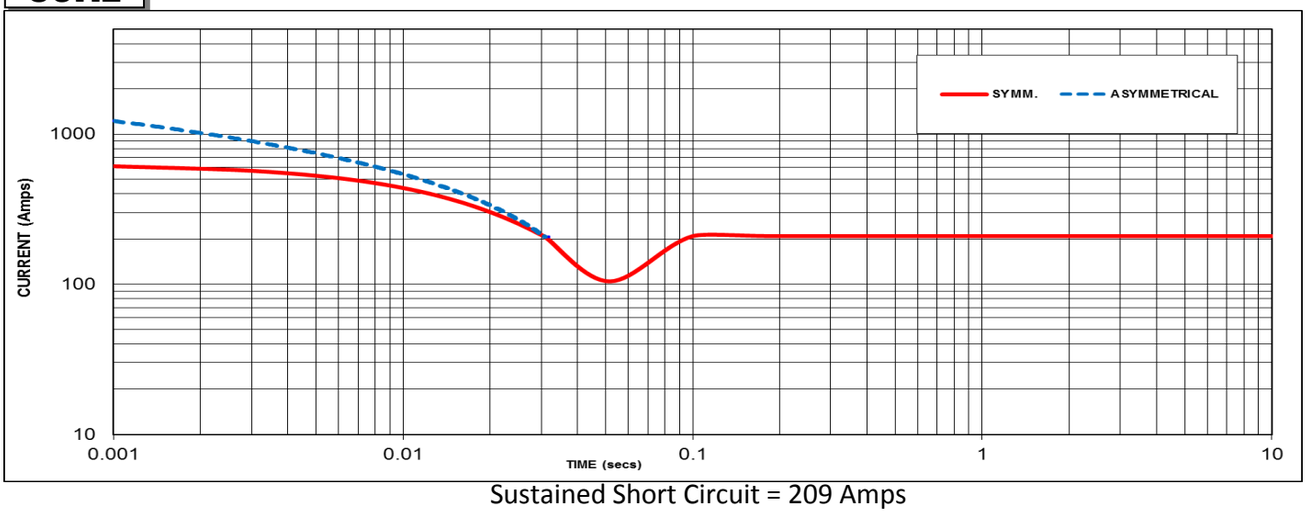
S1L2-R1 Winding 311 / 711
Three-phase Short Circuit Decrement Curve

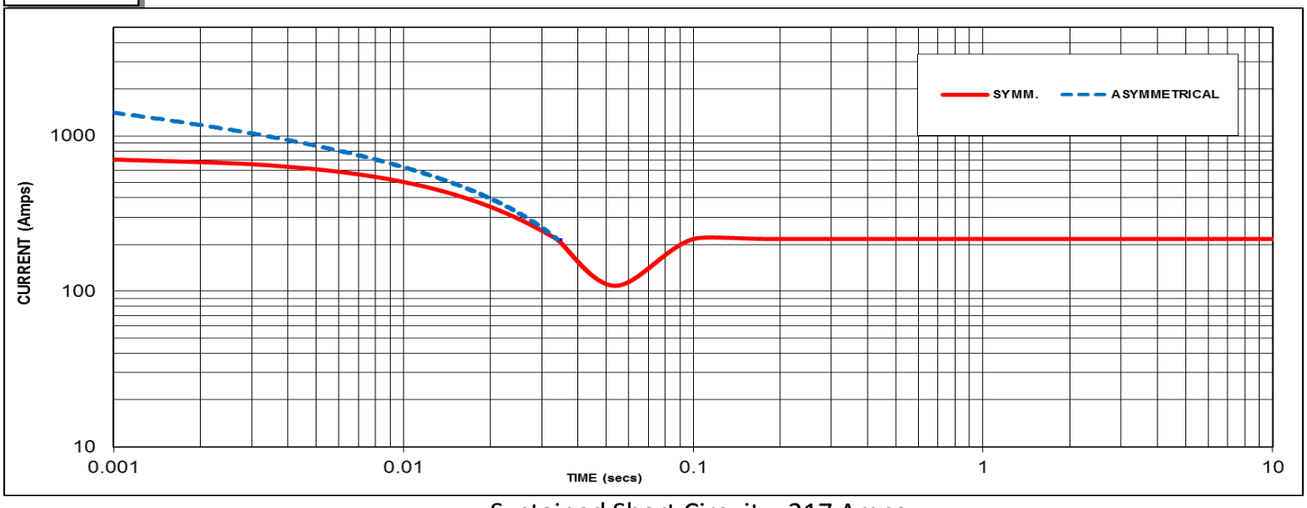
Note: Applicable only for Winding 711 (Auxiliary winding).
Winding 311 (no Auxiliary winding) will not provide short circuit capability.

50Hz



Sustained Short Circuit = 209 Amps

60Hz



Sustained Short Circuit = 217 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	N/A	416V	X 1.00
400V	X 1.00	440V	X 1.06
415v	X 1.04	460V	N/A
440V	N/A	480V	X 1.15

The sustained current value is constant irrespective of voltage level

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

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

All other times are unchanged

Note 3
Curves are drawn for Star connected machines under no-load excitation at rated speeds. For other connection the following multipliers should be applied to current values as shown :
Parallel Star = Curve current value X 2
Series Delta = Curve current value X 1.732

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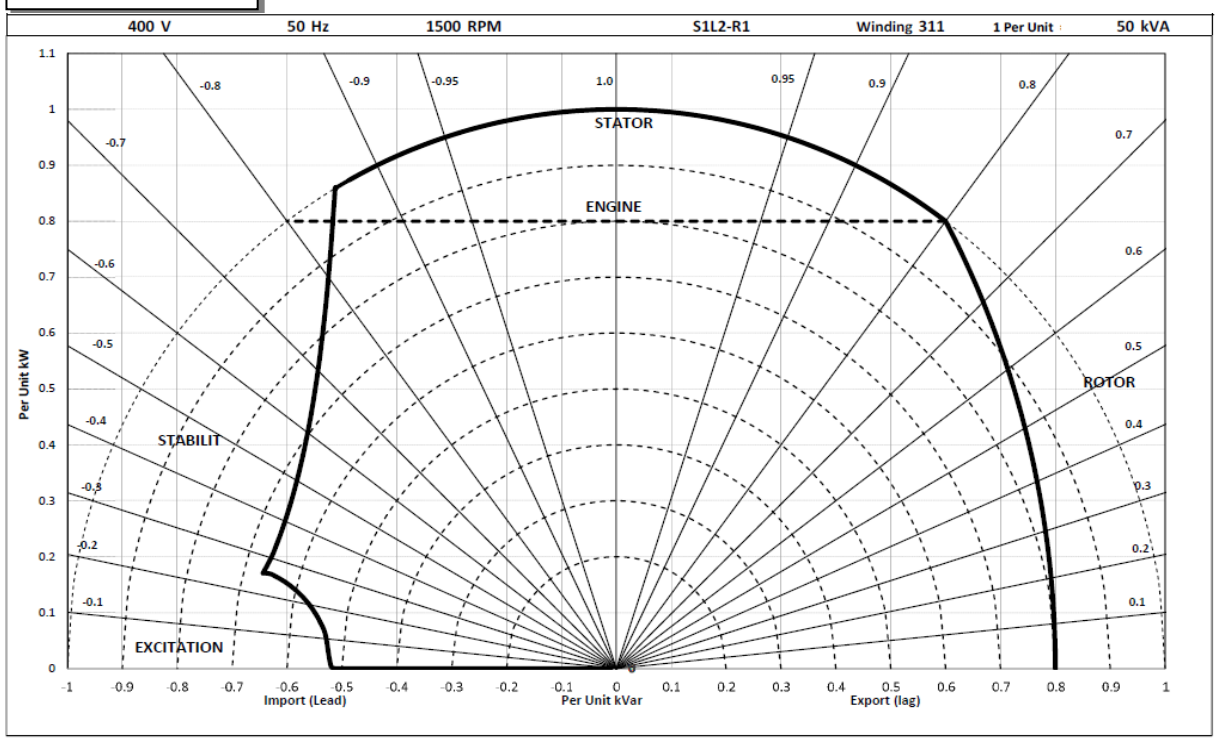
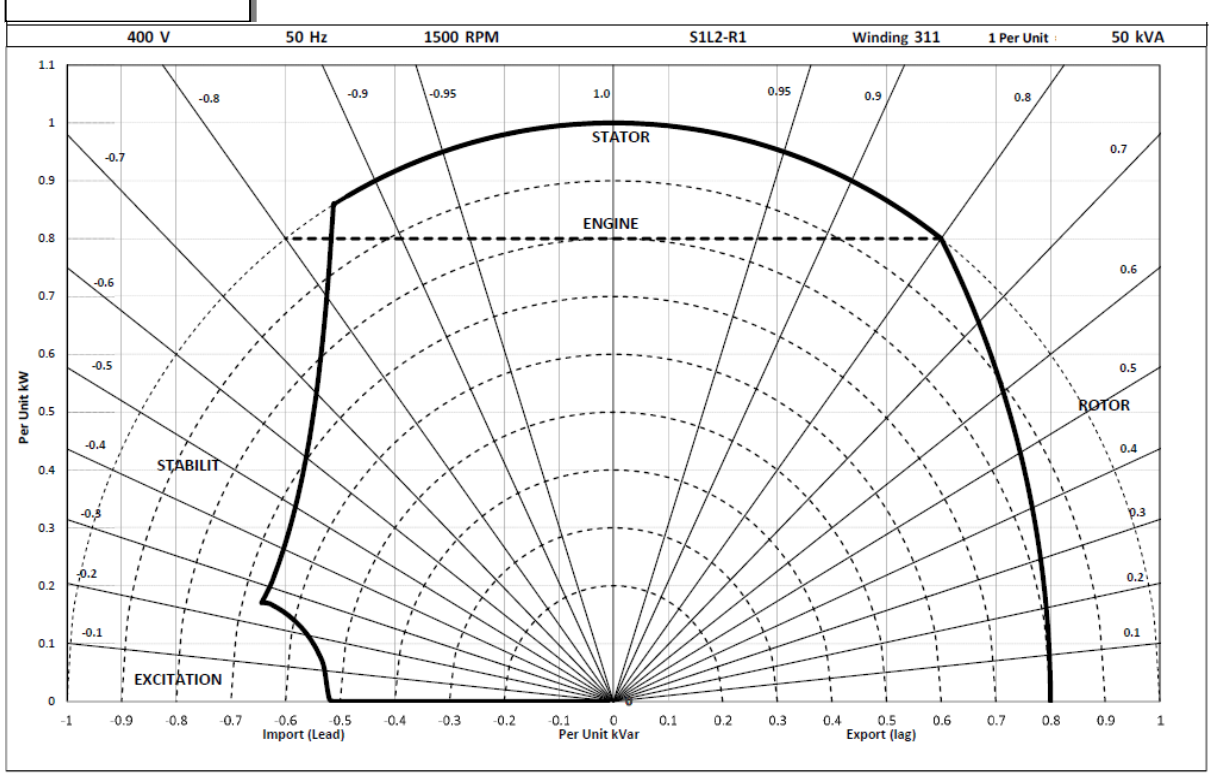
S1L2-R1 Winding 311 / 711

Typical Alternator Operating Charts

400V/50Hz



480V/60Hz



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S1L2-R1 Winding 311 / 711

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	50.4	55.0	55.0	N/A	48.8	53.3	53.3	N/A	45.8	50.0	50.0	N/A	41.7	45.5	45.5	N/A
	kW	40.3	44.0	44.0	N/A	39.0	42.6	42.6	N/A	36.6	40.0	40.0	N/A	33.4	36.4	36.4	N/A
	Efficiency (%)	88.5	88.0	88.7	N/A	88.9	88.4	88.6	N/A	89.5	89.2	89.3	N/A	90.2	89.7	90.0	N/A
	kW Input	45.6	50.0	49.6	N/A	43.9	48.2	48.1	N/A	40.9	44.8	44.8	N/A	37.0	40.6	40.4	N/A

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	58.1	61.0	N/A	66.0	56.5	59.3	N/A	64.0	52.8	55.4	N/A	60.0	48.0	50.5	N/A	54.6
	kW	46.5	48.8	N/A	52.8	45.2	47.4	N/A	51.2	42.2	44.3	N/A	48.0	38.4	40.4	N/A	43.7
	Efficiency (%)	89.8	89.7	N/A	89.6	90.1	90.0	N/A	89.9	90.7	90.7	N/A	90.5	91.3	91.3	N/A	91.1
	kW Input	51.8	54.4	N/A	59.0	50.2	52.7	N/A	57.0	46.6	48.9	N/A	53.0	42.1	44.3	N/A	47.9

De-Rates

All values tabulated above are subject to the following reductions:

- 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
- 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 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/)

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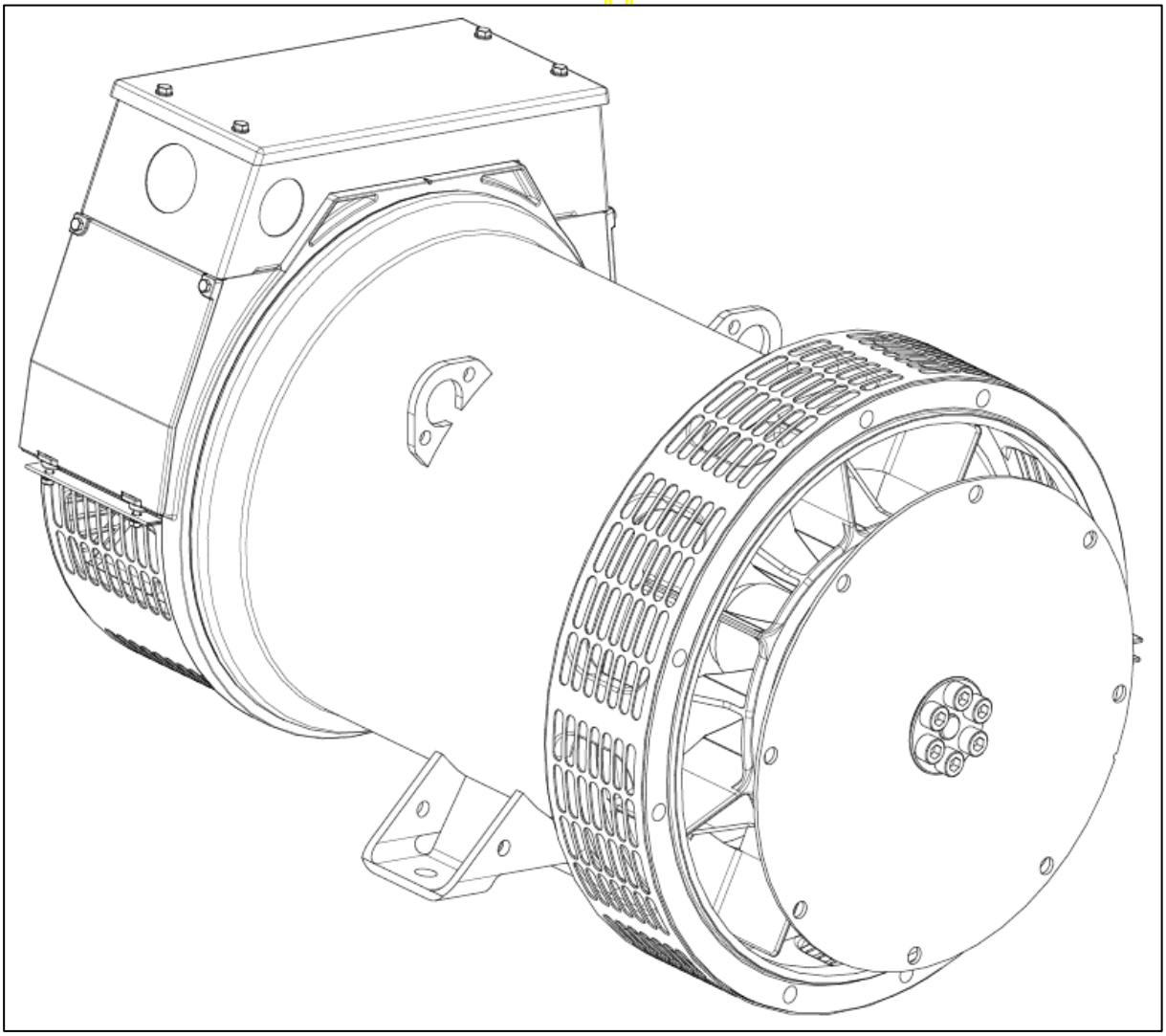
PI144J - Winding 17

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 REGULATOR

AS480 AVR fitted as STANDARD

With this self-excited system the main stator provides power via the AVR to the exciter stator. The high efficiency semi-conductors of the AVR ensure positive build-up from initial low levels of residual voltage.
The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling. The AS480 will support limited accessories, RFI suppression remote voltage trimmer and for the P1 range only a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.
The AVR is can be fitted to either side of the generator in its own housing in the non-drive end bracket.

Excitation Boost System (EBS) (OPTIONAL)

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

WINDINGS & ELECTRICAL PERFORMANCE

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

TERMINALS & TERMINAL BOX

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

SHAFT & KEYS

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

INSULATION / IMPREGNATION

The insulation system is class 'H'.
All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

QUALITY ASSURANCE

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

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

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.

5% For reverse rotation
(Standard rotation CW when viewed from DE)

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

Front cover drawing typical of product range.

STAMFORD

WINDING 17

CONTROL SYSTEM	STANDARD AS480 AVR (SELF EXCITED)
VOLTAGE REGULATION	± 1.0 %
SUSTAINED SHORT CIRCUIT	SELF EXCITED MACHINES DO NOT SUSTAIN A SHORT CIRCUIT CURRENT

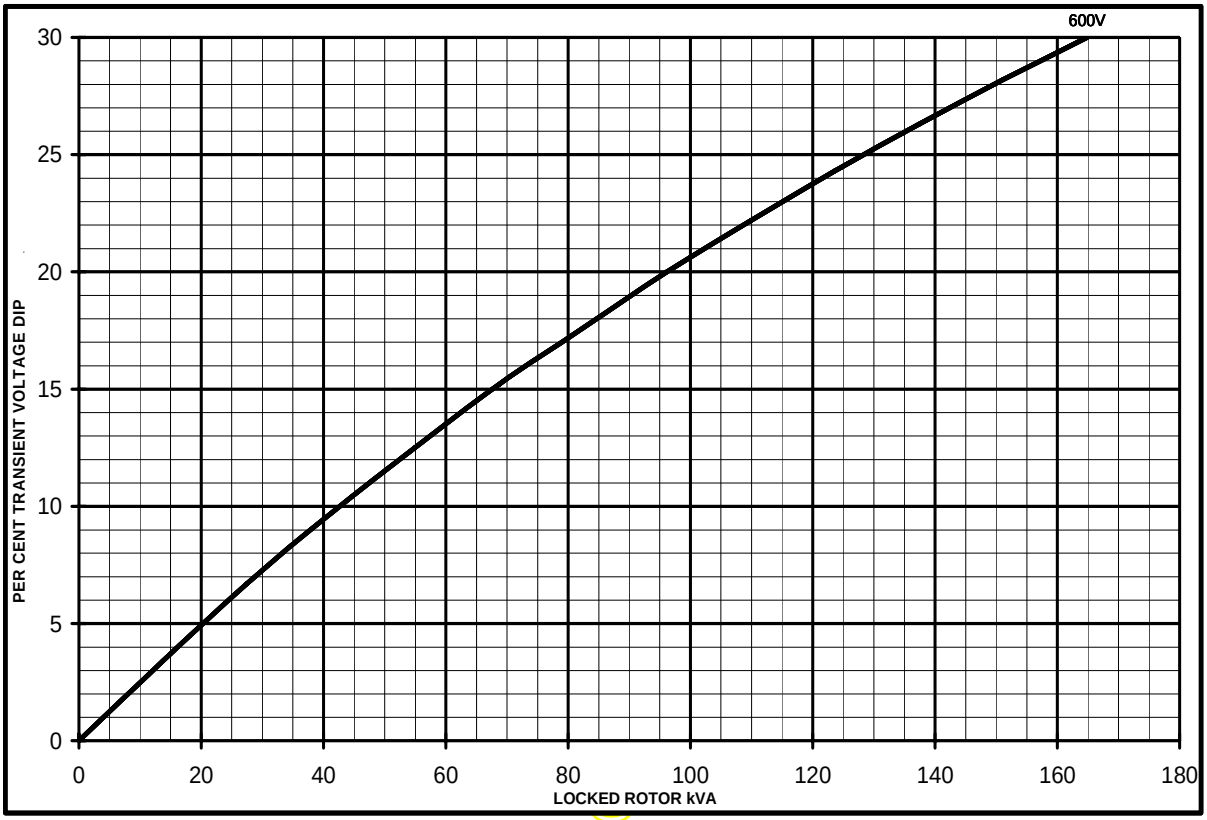
CONTROL SYSTEM	AS480 AVR WITH OPTIONAL EXCITATION BOOST SYSTEM (EBS)
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVE (page 5)

INSULATION SYSTEM	CLASS H			
PROTECTION	IP23			
RATED POWER FACTOR	0.8			
STATOR WINDING	DOUBLE LAYER CONCENTRIC			
WINDING PITCH	TWO THIRDS			
WINDING LEADS	12			
STATOR WDG. RESISTANCE	0.229 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED			
ROTOR WDG. RESISTANCE	0.99 Ohms at 22°C			
EXCITER STATOR RESISTANCE	22.9 Ohms at 22°C			
EXCITER ROTOR RESISTANCE	0.21 Ohms PER PHASE AT 22°C			
EBS STATOR RESISTANCE	12.9 Ohms at 22°C			
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. refer to factory for others			
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING LINEAR LOAD < 5.0%			
MAXIMUM OVERSPEED	2250 Rev/Min			
BEARING DRIVE END	BALL. 6310-2RS (ISO)			
BEARING NON-DRIVE END	BALL. 6306-2RS (ISO)			
	1 BEARING		2 BEARING	
	WITH EBS	WITHOUT EBS	WITH EBS	WITHOUT EBS
WEIGHT COMP. GENERATOR	184 kg	182.3 kg	187 kg	185.3 kg
WEIGHT WOUND STATOR	84 kg	84 kg	84 kg	84 kg
WEIGHT WOUND ROTOR	70.97 kg	69.27 kg	72.68 kg	70.98 kg
WR² INERTIA	0.2758 kgm^2	0.2741 kgm^2	0.2763 kgm^2	0.2746 kgm^2
SHIPPING WEIGHTS in a crate	202 kg	200.3 kg	211 kg	209.3 kg
PACKING CRATE SIZE	85 x 51 x 67 (cm)		85 x 51 x 67 (cm)	
TELEPHONE INTERFERENCE	THF<2%		TIF<50	
COOLING AIR	0.165 m³/sec 340 cfm			
VOLTAGE SERIES STAR	600			
kVA BASE RATING FOR REACTANCE VALUES	50.0			
Xd DIR. AXIS SYNCHRONOUS	2.0			
X'd DIR. AXIS TRANSIENT	0.18			
X"d DIR. AXIS SUBTRANSIENT	0.13			
Xq QUAD. AXIS REACTANCE	0.95			
X"q QUAD. AXIS SUBTRANSIENT	0.20			
X_L LEAKAGE REACTANCE	0.08			
X_2 NEGATIVE SEQUENCE	0.17			
X_0 ZERO SEQUENCE	0.08			
REACTANCES ARE SATURATED	VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED			
T'd TRANSIENT TIME CONST.	0.029 s			
T"d SUB-TRANSTIME CONST.	0.007 s			
T'do O.C. FIELD TIME CONST.	0.66 s			
Ta ARMATURE TIME CONST.	0.007 s			
SHORT CIRCUIT RATIO	1/Xd			

PI144J

Winding 17
Locked Rotor Motor Starting Curves

AS480 AVR Without EBS

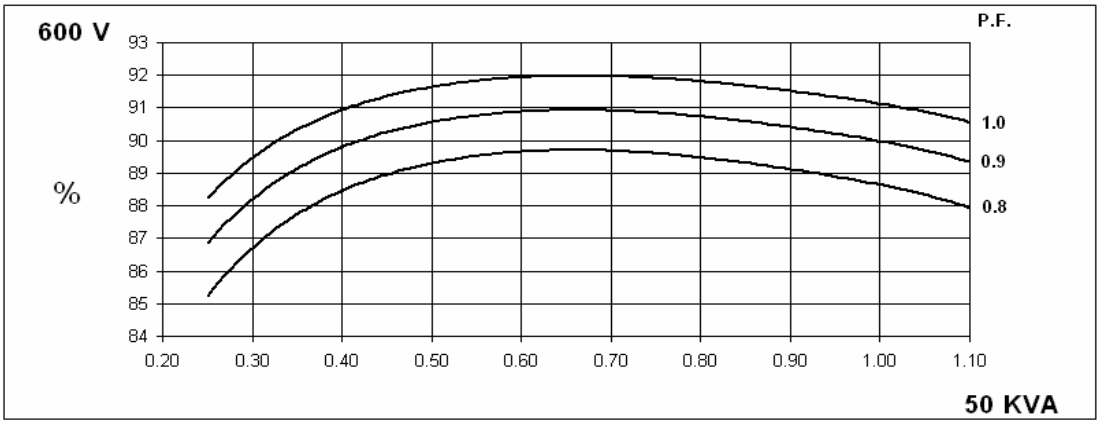


AS480 AVR With EBS

PI144J
Winding 17

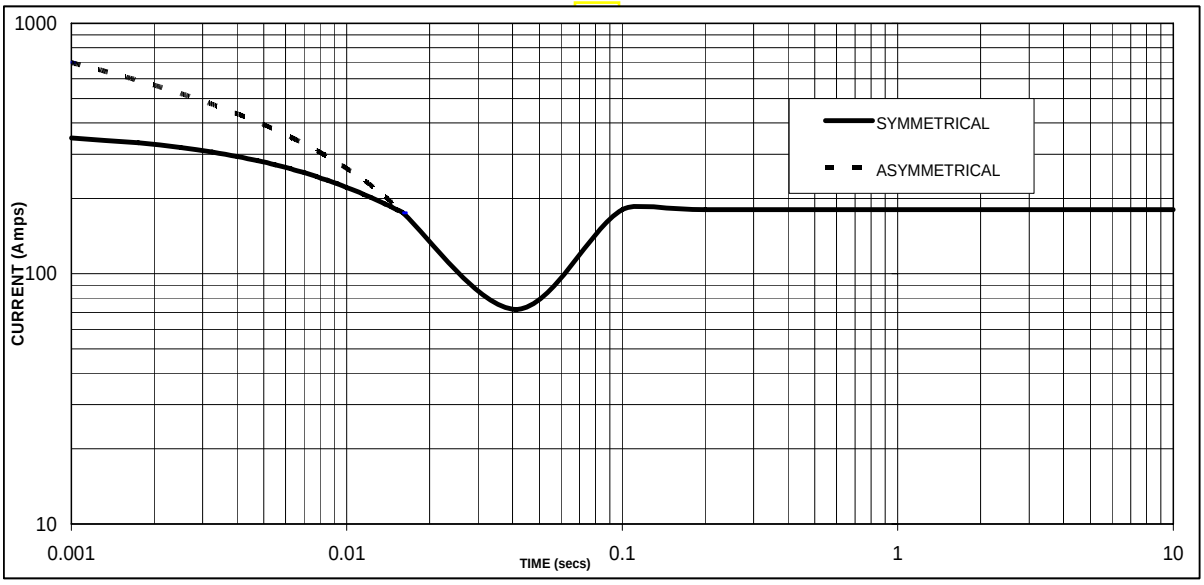
STAMFORD

THREE PHASE EFFICIENCY CURVES



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

WITH EBS FITTED



Sustained Short Circuit = 180 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

PI144J

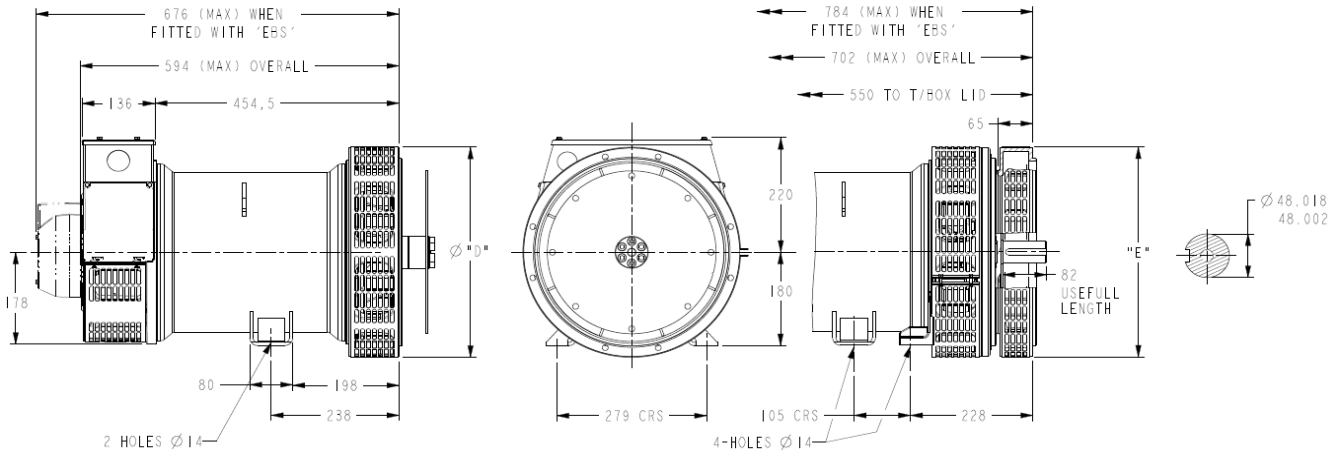
Winding 17 / 0.8 Power Factor

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 StarStar (V)	300	300	300	300
Series Delta (V)	346	346	346	346
kVA	45.0	50.0	52.5	54.5
kW	36.0	40.0	42.0	43.6
Efficiency (%)	89.2	88.6	88.3	88.1
kW Input	40.4	45.1	47.6	49.5

DIMENSIONS



COUPLING DISC	
SAE	"AN"
8	62
10	53.8
11.5	39.6

1-BRG ADAPTOR	
SAE	"D"
4	405
3	451
2	489

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

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

APPROVED DOCUMENT

STAMFORD

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

www.cumminsgeneratortechnologies.com

PI144J-17-TD-EN-SG-A

DSEGenset

DSE7410/20

AUTO START & AUTO MAINS FAILURE MODULES

FEATURES

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

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

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

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

ENVIRONMENTAL TESTING STANDARDS

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

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

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

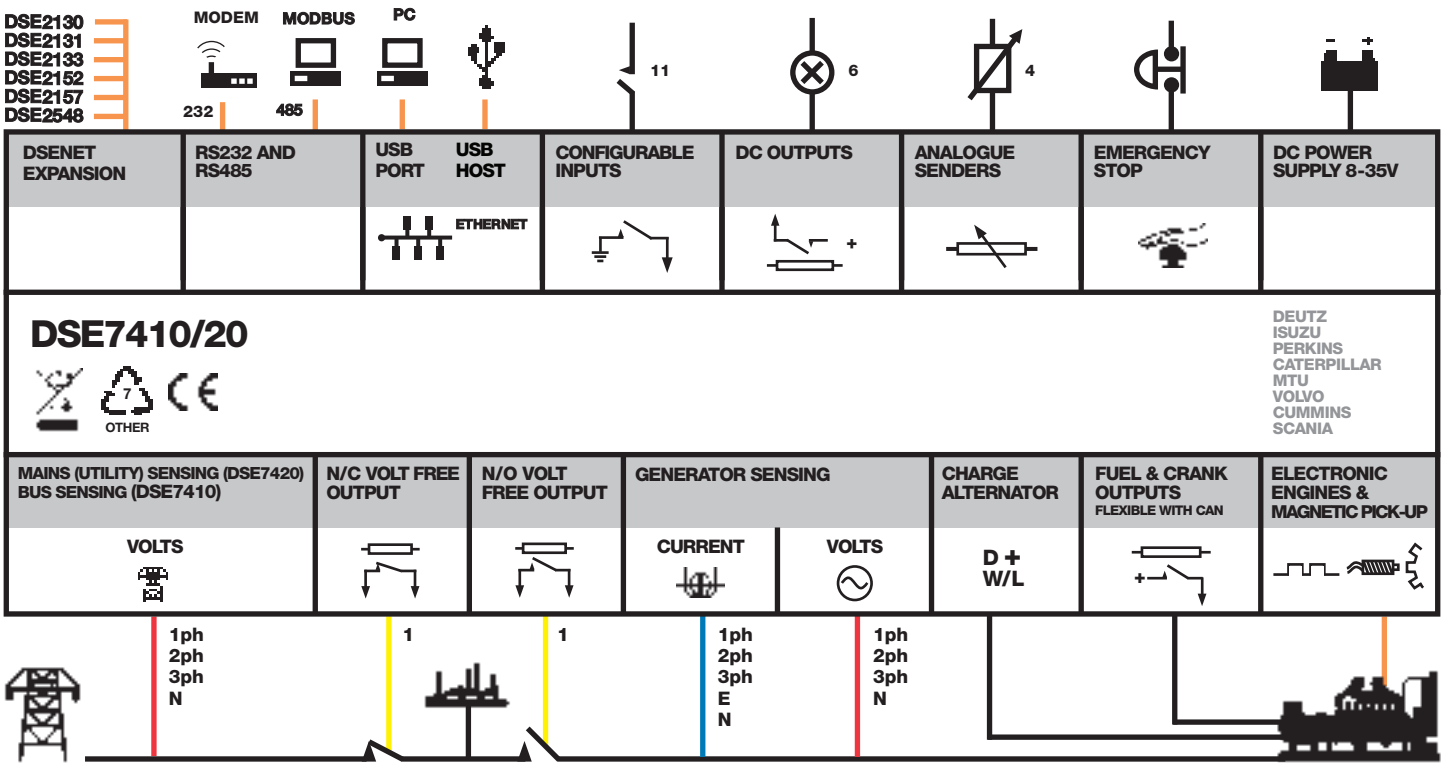
VIBRATION
BS EN 60068-2-6
Ten sweeps in each of three major axes
5 Hz to 8 Hz @ +/-7.5 mm,
8 Hz to 500 Hz @ 2 gn

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

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

DEGREES OF PROTECTION PROVIDED BY ENCLOSURES
BS EN 60529
IP65 - Front of module when installed into the control panel with the supplied sealing gasket.

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



ISSUE 1

DSEGenset

DSE

DSE7410/20

AUTO START & AUTO MAINS FAILURE MODULES

FEATURES

DSE7410

DSE7420

KEY FEATURES

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

KEY BENEFITS

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

RELATED MATERIALS

TITLE	PART NO’S
DSE7410 Installation Instructions	053-085
DSE7420 Installation Instructions	053-088
DSE74xx Quick Start Guide	057-162
DSE74xx Operator Manual	057-161
DSE74xx PC Configuration Suite Manual	057-160

SPECIFICATION

DC SUPPLY

CONTINUOUS VOLTAGE RATING
8 V to 35 V Continuous

CRANKING DROPOUTS
Able to survive 0 V for 50 mS, providing supply was at least 10 V before dropout and supply recovers to 5 V. This is achieved without the need for internal batteries

MAXIMUM OPERATING CURRENT
260 mA at 12 V, 130 mA at 24 V

MAXIMUM STANDBY CURRENT
120 mA at 12 V, 65 mA at 24 V

CHARGE FAIL/EXCITATION RANGE
0 V to 35 V

OUTPUTS

OUTPUT A (FUEL)
15 A DC at supply voltage

OUTPUT B (START)
15 A DC at supply voltage

OUTPUTS C & D
8 A AC at 250 V AC (Volt free)

AUXILIARY OUTPUTS E,F,G,H,I & J
2 A DC at supply voltage

GENERATOR

VOLTAGE RANGE
15 V to 333 V AC (L-N)

FREQUENCY RANGE
3.5 Hz to 75 Hz

MAINS (UTILITY) (DSE7420)

VOLTAGE RANGE
15 V to 333 V AC (L-N)

FREQUENCY RANGE
3.5 Hz to 75 Hz

BUS (DSE7410)

VOLTAGE RANGE
15 V to 333 V AC (L-N)

FREQUENCY RANGE
3.5 Hz to 75 Hz

MAGNETIC PICK UP

VOLTAGE RANGE
+/- 0.5 V to 70 V

FREQUENCY RANGE
10,000 Hz (max)

DIMENSIONS

OVERALL
240 mm x 172 mm x 57 mm
9.4” x 6.8” x 2.2”

PANEL CUTOUT
220 mm x 160 mm
8.7” x 6.3”

MAXIMUM PANEL THICKNESS
8 mm
0.3”

STORAGE TEMPERATURE RANGE
-40 °C to +85 °C

DEEP SEA ELECTRONICS PLC UK
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Tmax-Molded Case Circuit Breakers

T1 100A Frame

AC Circuit Breakers & Switches

DC Circuit Breakers & Switches

1, 3 and 4 Poles

Higher performances in less space

Field Installable Accessories

Dimensions 3P Fixed Version 5.12H x 3.00W x 2.76D

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– “Low Voltage Directives” (LVD) no. 73/23 EEC
– “Electromagnetic Compatibility Directive” (EMC) no.89/336 EEC

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

Interrupting ratings (RMS sym. kAmps)		T1	
Continuous Current Rating		100A	100A
Number of Poles		1	3-4
		B	**N**
AC			
240V			50
277V		18	
347V		14	
480V			22
600Y/347V			10
DC			
250V	2 poles in series		25
500V	3 poles in series		25

Please Note: 15 A 1P 10Kaic @ 347Vac, 3p 14Kaic @ 480Y/277Vac, 3p 35Kaic @ 240Vac

Company Quality Systems and Environmental Systems

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

Attention to protection of the environment and to health and safety in the work place is another priority commitment for ABB and, as confirmation of this, the company environmental management system has been certified by RINA in 1997, in conformity with the international ISO 14001 Standard. This certification has been integrated in 1999 with the Management System for Health and Safety in the workplace, according to OHSAS 18001 (British Standards), obtaining one of the first certification of integrated management System, QES (Quality, Environment, Safety) issued by RINA. ABB - the first industry in the electromechanical section in Italy to obtain this recognition - thanks to a revision of the production process with an eye to ecology has been able to reduce the consumption of raw materials and waste from processing by 20%. ABB's commitment to safeguarding the environment is also shown in a concrete way by the Life Cycle Assessments of its products carried out directly by the ABB Research and Development in collaboration with the ABB Research Center. Selection of materials, processes and packing materials is made optimizing the true environmental impact of the product, also foreseeing the possibility of its being recycled.

Mounting

Fixed

Connections

Pressure-type terminals for bare copper cables

Trip Unit

TMF thermo magnetic trip units, with fixed thermal and magnetic threshold (I3 = 10 x In);

Weight (lbs)	2.34

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Flange handle mechanism
- Direct rotary handle - RHD
- Through the door rotary handle
- Solenoid operator
- Key lock - KLF
- Early auxiliary contact - AVE
- Front terminal for copper cable - FC CU
- Front extended terminal - EF
- Phase separators
- Residual current release (IEC Only)
- Mechanical interlock

Publication LV035
No. 1SXU 210 035 D0201
Printed in USA, November, 2005

ABB Inc.

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

Tmax-Molded Case Circuit Breakers

T3 225A Frame

AC Circuit Breakers and Switches

DC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories

Dimensions 3P Fixed Version 5.9H x 4.13W x 2.76D

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– “Low Voltage Directives” (LVD) no. 73/23 EEC
– “Electromagnetic Compatibility Directive” (EMC) no.89/336 EEC

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

Interrupting ratings (RMS sym. kAmps)		T3	
Continuous Current Rating		225A	
Number of Poles		3-4	
		N	**S**
AC			
240V		50	65
480V		25	35
600Y / 347V		10	10
DC			
250V	2 poles in series	25	35
500V	3 poles in series	25	35

Company Quality Systems and Environmental Systems

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Mounting

Fixed
Plug-in

Connections

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

Trip Unit

TMF thermo magnetic trip units, with fixed thermal and magnetic threshold (I3 = 10 x In);

Weight (lbs)	5.45

Auxiliary Devices for Indication and Control

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

Publication LV037
No. 1SXU 210 037 D0201
Printed in USA, November, 2005

ABB Inc.

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

PRODUCT NUMBER: 28106 - Marinco On-Board Battery Charger

This 28106 model is a 1 bank, 6 amp, 12V DC output charger with wide input voltage range (100-240V AC), is microprocessor controlled and has a maintenance mode that will keep the charger fully charged. The Marinco 28106 meets the CEC (California Energy Commission), FCC, CE, is RoHS compliant and has UL and CSA listings (cULus). The 28106 has the same mounting dimensions as the Guest 2608A and 2608A-B and replaces these models.

1. DESCRIPTION

1.1. **Dimensions** Reference only

Height 3.5 inches 8.89 cm	Width 6.4 inches 16.26 cm	Depth 2.42 inches 6.2 cm

1.2. **Mounting** Bulkhead mount (vertical at wall)

Hole diameter is .245 inches / .622 cm or clearance for #10 screw
Left to Right Center to Center = 5.671 inches / 14.40 cm
Top to Bottom Center to Center = 1.465 inches / 3.72 cm

1.3. **Weight** (reference)

Approximately 4.0 lbs. (1.8 kg)

1.4. Connection

1.4.1. AC

6’ (1.8 m) AC Cable with NEMA L5-15P AC Plug. Cable consists of 18/3 SJTOW cord with one BLACK (HOT), one WHITE (NEUTRAL) and one GREEN (GROUND)

1.4.2. DC

4’ (1.2 m) DC output cable, 18 gauge wires, SJTOW with ring terminal connection

2. FEATURES

2.1. Waterproof

The Marinco 28106 has an IP68 rating. This rating is described as dust tight and protected against the effects of immersion in water under pressure for long periods.

2.2. Charge Indicators

Unit has 2 LEDS, one Red and one Green in color. The following table should be used as indicator of the charger status.

	Red	Green
Soft start	On	Off
Bulk	On	Off
Absorption	On	On
Float	Off	On

2.3. Protection

Ignition Protection
Over Current
Over charge
Reverse Polarity
Thermal Protection
Short Circuit

2.4. Temperature Characteristics

Ambient Operating Temp Full Power	-40 °C to 50 °C
Storage Range	-40 °C to 70 °C

3. ELECTRICAL CHARACTERISTICS

3.1. Battery Recommendations

Battery size:	Group 24 through 31 (up to 120 Amp-Hr)
Battery Type:	12V lead acid (FLOODED and AGM)
Maximum Recharger time:	12 hours

3.2. Input rating

Input Voltage Range: 100 to 240V AC 50/60 HZ
Input Current rating: 2.0 Amps maximum

3.3. Voltages / Current

	Output Voltage	Output Current
Bulk	14.3VDC	5.5 – 6.5 Amps
Absorption	14.3VDC	3 – 6.5 Amps
Float	13.3VDC	0 – 3 Amps

3.3.1. Soft Start - "Soft Start" slowly charges the battery with 14.25V (10% of rated current). As soon as the max Soft Start timer (starts immediately when entering "Soft Start") of 6 hours is reached or when the battery reaches 10V for 30 seconds the charger switches to the "Bulk stage".

3.3.2. Bulk - "Bulk" charges the battery with 14.3V (100% of rated current) until the battery reaches 13.25V. As soon as the battery reaches 13.25V the Bulk timer will start counting after which it can charge the battery up to 12 hours until the voltage reaches 14.25V. As soon as the max Bulk timer (starts when voltage level is above 13.25V while in "Bulk") of 12 hours is reached or when the battery reaches 14.25V for 30 seconds the charger switches to the "Absorption stage".

3.3.3. Absorption - "Absorption" charges the battery with 14.25V. As soon as the Absorption timer (starts immediately when entering "Absorption") reaches 14 hours or when the charge current drops below 10% of the rated current for 30 seconds the charger switches to the "Float stage".

3.3.4. Float - "Float" keeps the charger on a specific voltage level of 13.25V (100% of rated current) for a period and then will switch to the "Maintenance stage"

3.3.5. Maintenance - As soon as the re-cycle timer reaches 14 days (336 hours) or when the voltage drops below 12.8V for 30 seconds the charger switches back to "Bulk stage"

4. AGENCY CERIFICATIONS

cULus	ANSI/UL 1236 "Battery Chargers for Charging Engine-Starter Batteries" E227501
ABYC	American Boat & Yacht Council = UL 1236 marine section A20 (Battery Chargers), E8 (AC Systems on Boats), E9 (DC Systems on Boats)
CE	2006/95/EC (safety directive) , EN 60950-1:2006 + A11: 2009 + A1:2010 + A12:2011 applied for 230V models
CEC	CB Mark for 120V
FCC	Labeled, FCC Part 15 Class B EN 55022
RoHS	Compliant

5. WARRANTY

This product has a 2 year warranty.

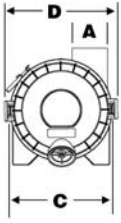
6. REVISION HISTORY

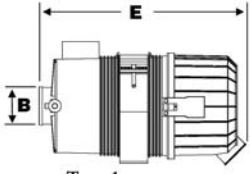
Revision	Product Specification Change Summary	*Initials*	*Effective Date*
A	Initial Release	*Mgt*	Dec. 2014
B			

Originator: Mark Thomson	Position: Technical Services
Approved by: Erik Zwollo	Position:

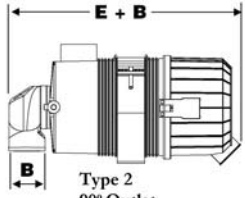
Plastic Magna Seal Air Cleaners

Internal or External Evacuator Valve
High Strength Polymer
Working Temp –40c to +80c (-40F to 176F)
Design Compatibility with other Manufacturers
Industry Standard elements
Can be Mounted Vertical or Horizontal





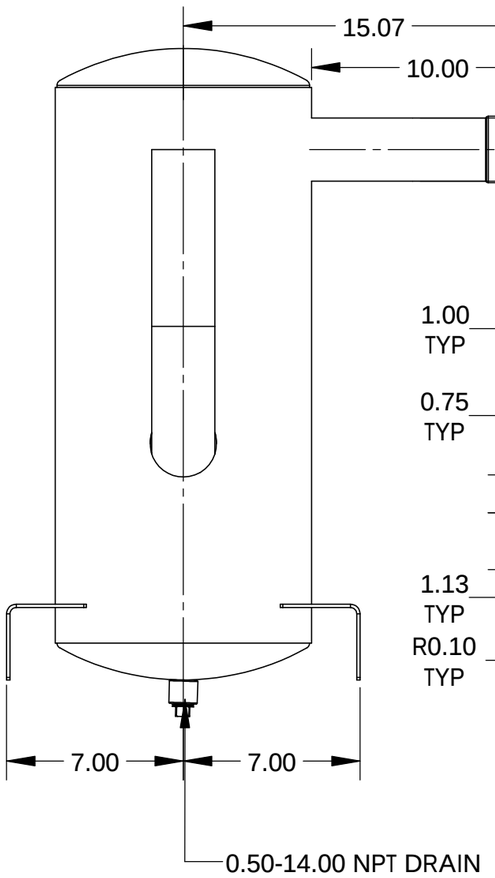
Type 1
Straight Outlet

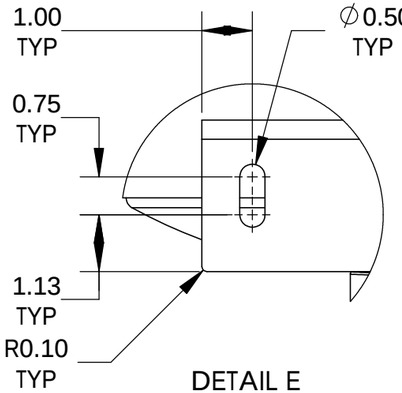


Type 2
90⁰ Outlet

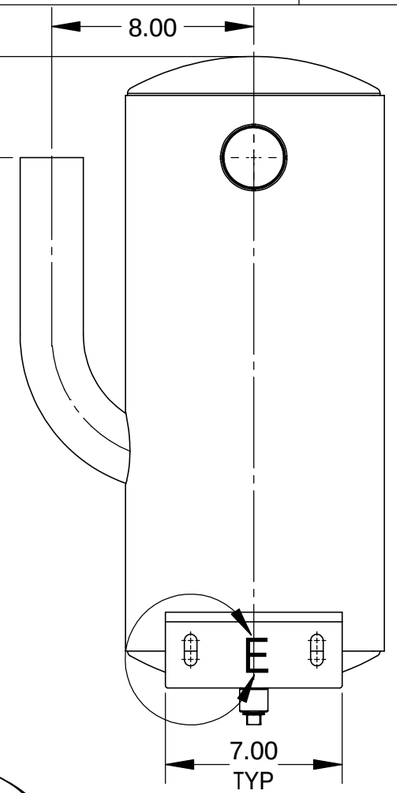
Air Cleaner Assembly

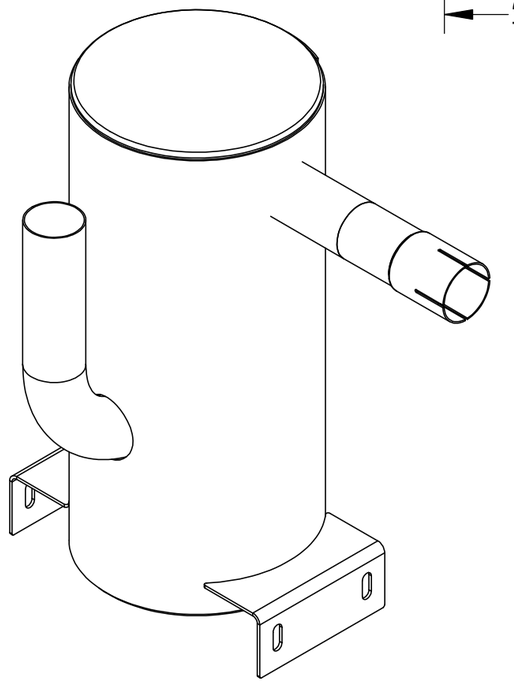
Model Number	Part Number	Type	Initial Restriction 6" H2O CFM	M3m	8" H2O CFM	M3m	10" H20 CFM	M3m	A OD Inlet inch	mm	B OD Outlet inch	mm	C inch	mm	D inch	mm	E inch	mm
2s-FW-E1	68110	1	75	2.1	90	2.5	105	3.0	2.00	51	1.75	45	4.8	122	6.14	156	8.98	228
2s-FW-E2	68111	1	65	1.8	75	2.1	85	2.4	2.00	51	1.75	45	4.80	122	6.14	156	8.98	228
2s-FW-E1-90	68103	2	63	1.7	73	2.0	82	2.3	2.00	51	1.75	45	4.80	122	6.14	156	10.43	265
2s-FW-E2-90	68107	2	53	1.5	63	1.8	71	2.0	2.00	51	1.75	45	4.80	122	6.14	156	10.43	265
2-FW-E1	68120	1	100	2.8	115	3.3	130	3.7	2.00	51	2.00	51	5.75	146	7.09	180	13.39	340
2-FW-E2	68130	1	90	2.5	105	3.0	115	3.3	2.00	51	2.00	51	5.75	146	7.09	180	13.39	340
2-FW-E1-90	68116	2	88	2.4	102	2.9	113	3.2	2.00	51	2.00	51	5.75	146	7.09	180	14.96	380
2-FW-E2-90	68127	2	77	2.2	92	2.6	103	2.9	2.00	51	2.00	51	5.75	146	7.09	180	14.96	380
2.5-FW-E1	68132	1	150	4.2	175	5.0	195	5.5	2.50	63.5	2.50	63.5	6.89	175	8.15	207	14.13	359
2.5-FW-E2	68133	1	145	4.1	165	4.7	185	5.2	2.50	63.5	2.50	63.5	6.89	175	8.15	207	14.13	359
2.5-FW-E1-90	68131	2	134	3.8	156	4.4	175	5.0	2.50	63.5	2.50	63.5	6.89	175	8.15	207	16.22	412
2.5-FW-E2-90	68134	2	127	3.6	148	4.2	168	4.7	2.50	63.5	2.50	63.5	6.89	175	8.15	207	16.22	412
3-FW-E1	68140	1	160	4.5	190	5.4	210	5.9	3.00	76	3.00	76	7.24	184	8.58	218	14.57	370
3-FW-E2	68150	1	150	4.2	170	4.8	190	5.4	3.00	76	3.00	76	7.24	184	8.58	218	14.57	370
3-FW-E1-90	68140-2	2	154	4.4	181	5.1	196	5.6	3.00	76	3.00	76	7.24	184	8.58	218	17.80	452
3-FW-E2-90	68150-2	2	138	4.0	162	4.6	182	5.2	3.00	76	3.00	76	7.24	184	8.58	218	17.80	452
3.75-FW-E1	68160	1	250	7.1	290	5.4	325	9.2	3.75	95	3.50	89	8.35	212	9.72	247	15.63	397
3.75-FW-E2	68170	1	225	6.4	260	7.4	280	7.9	3.75	95	3.50	89	8.35	212	9.72	247	15.63	397
3.75-FW-E1-90	68157	2	212	6.0	250	7.1	277	7.8	3.75	95	3.50	89	8.35	212	9.72	247	18.5	470
3.75-FW-E2-90	68167	2	188	5.3	220	6.2	250	7.1	3.75	95	3.50	89	8.35	212	9.72	247	18.5	470
4.5-FW-E1	68175	1	375	10.6	425	12.0	475	13.5	4.50	114	4.00	102	10.60	268	11.9	302	19.13	486
4.5-FW-E2	68175-1	1	325	9.2	375	10.6	425	12.0	4.50	114	4.00	102	10.60	268	11.9	302	19.13	486
6-FW-E1	68178	1	600	17.0	685	19.4	770	21.8	6.00	152	5.00	127	12.20	309	13.54	344	22.00	560
6-FW-E2	68179	1	500	14.2	565	16.0	630	17.8	6.00	152	5.00	127	12.20	309	13.54	344	22.00	560
7-FW-E1	68182	1	800	22.7	910	25.8	1060	30.0	7.00	178	6.00	152	15.50	394	16.80	427	21.50	545
7-FW-E2	68185	1	710	20.1	830	23.5	960	27.2	7.00	178	6.00	152	15.50	394	16.80	427	21.50	545

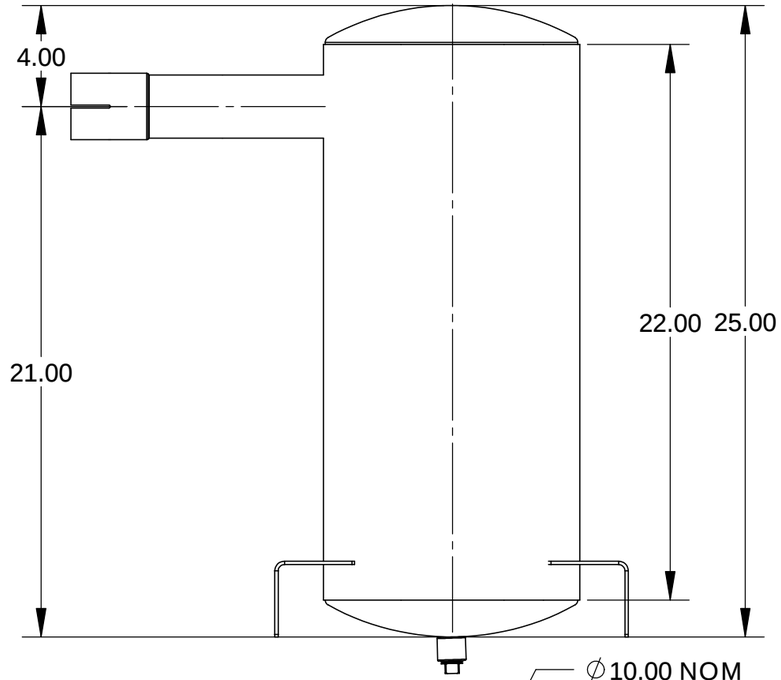


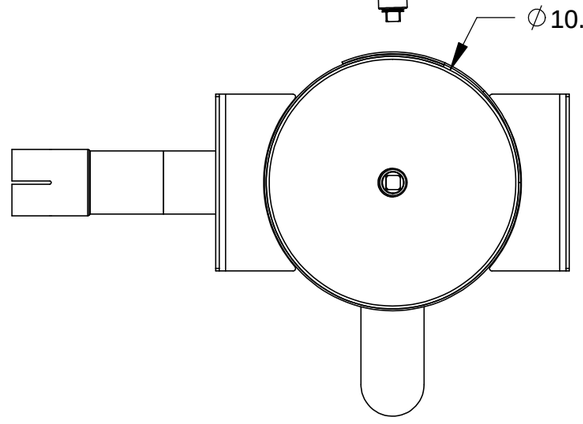


DETAIL E
SCALE 1 : 3









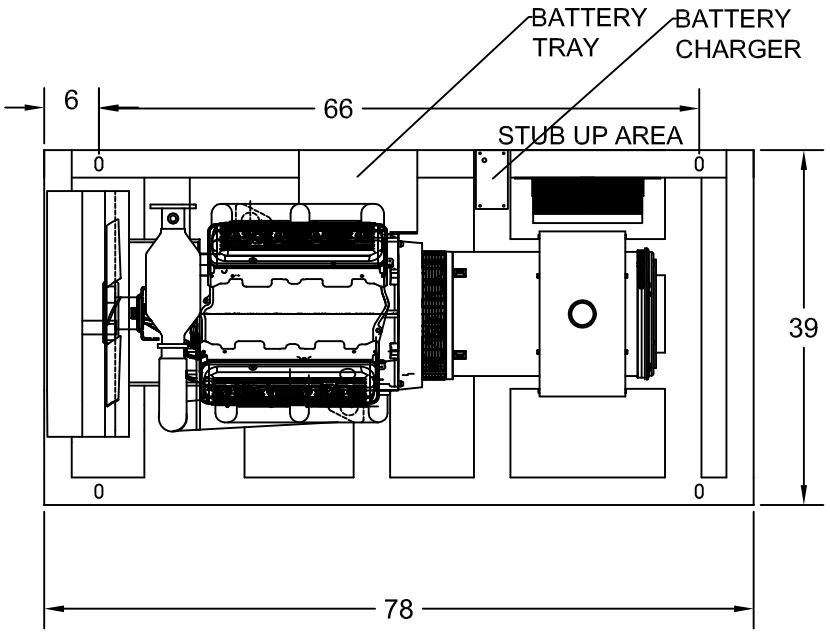
ENGINE INFORMATION	SILENCER INFORMATION	DRAWN BY	DATE	
ENGINE MAKE: GM	RESONATOR FREQUENCY: ---	CHECKED BY: CB	DATE: 09/15/2017	BERGARI SOLUTIONS member of the mandersgroup
ENGINE MODEL: 5.7L	RESONATOR ALPHA: ---	ENGINEERING: CB	DATE:	DESCRIPTION: SIL: COMP CRIT CS S-E 2.50-2.50 Ø10.00 25.00 OAL F:4.00 ---
DISPLACEMENT: 350	SILENCER Km: ---	MANUFACTURING: CB	DATE:	
EXHAUST FLOW: 687	SILENCER IL: ---	TOLERANCES UNLESS OTHERWISE SPECIFIED: .X = ±0.25 ALL ANGLES; .XX = ±0.125 ±1°; .XXX = ±0.0625; .XXXX = ±0.03125	WEIGHT (LBS): 37	CONSTRUCTION MATERIAL: CS
EXHAUST TEMPERATURE: 1250	TOLERANCES DO NOT APPLY TO GAGE THICKNESS OR COMMERCIAL FEATURES		SHEET: 3 OF 3	FINISH: HIGH TEMP BLACK PAINT
MAX BACK PRESSURE: 40.8	THIRD ANGLE PROJECTION	This drawing and the information contained is confidential and the property of Bergari Solutions, LLC. None of this information is to be copied or shared in any form without the express permission from Bergari Solutions, LLC.		PART NUMBER: 500-008650 REV: 01
RAW SOUND PRESSURE: ---				SCALE (DO NOT SCALE): 1:6 SHEET SIZE: B

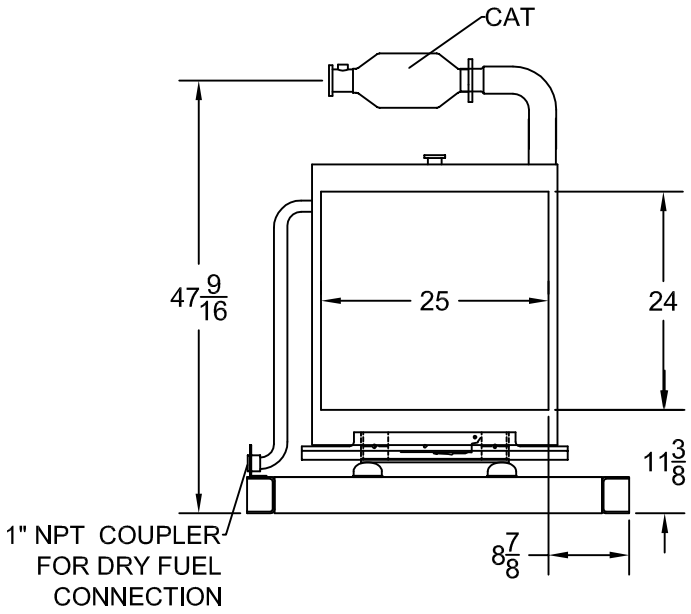
CUSTOMER	CUSTOMER P/N
---	---

REV.	BY	DATE	DESCRIPTION	ECO
01	CB	09/15/2017	RELEASED FOR CUSTOMER APPROVAL	---

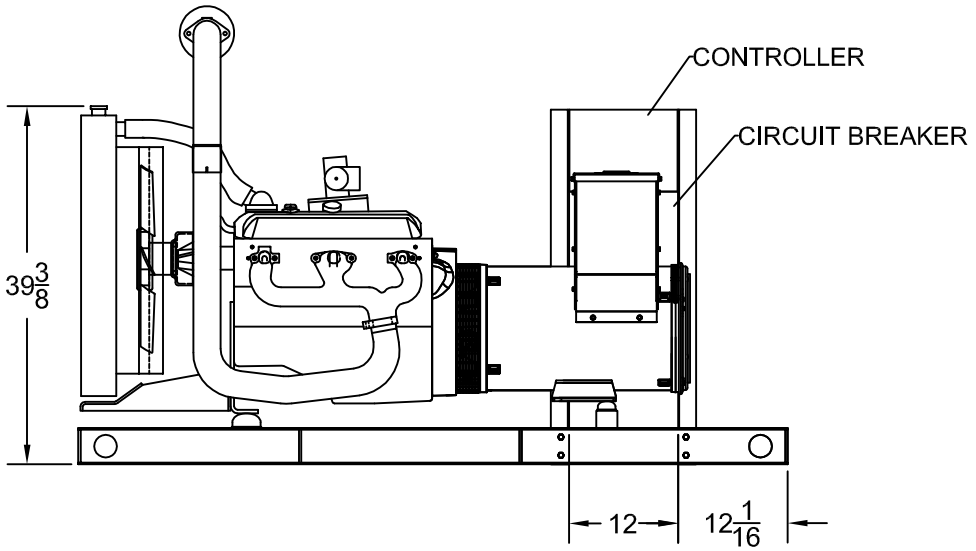
PR-350 OPEN DIMENSIONAL OVERVIEW

TOP VIEW





RADIATOR VIEW

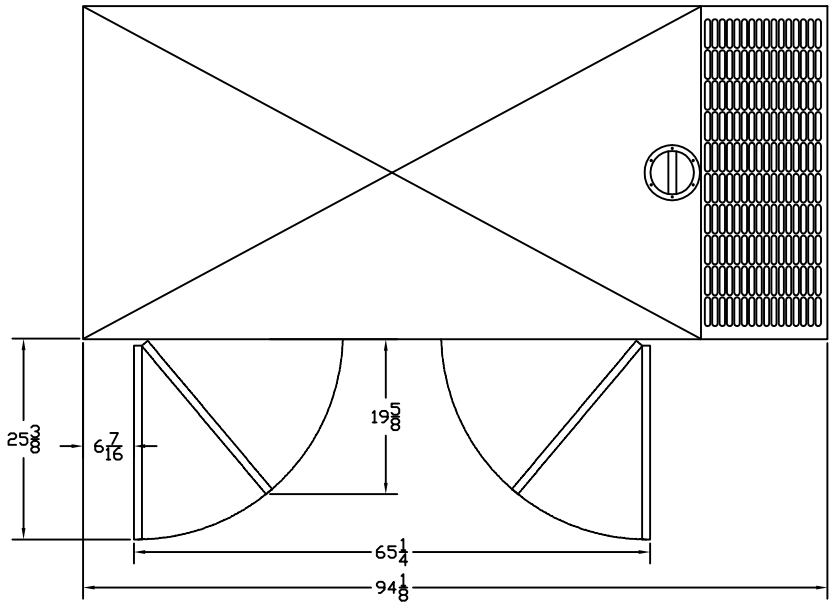


SIDE VIEW

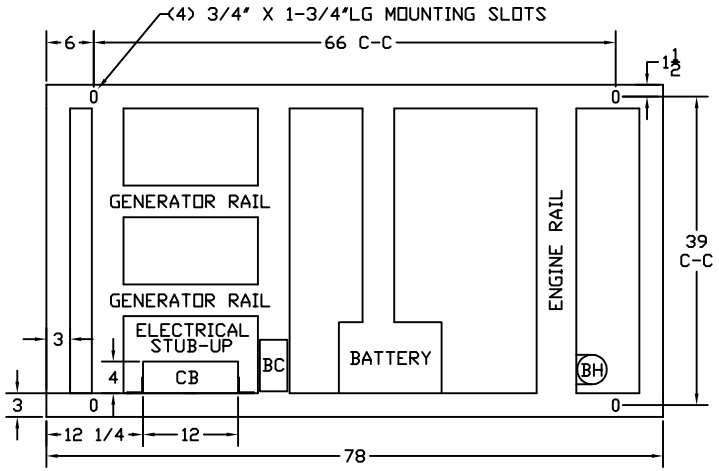
OUTLINE DIMENSIONS FOR PR-350 & PR-550 LEVEL 2 ENCLOSURE
(HINGED DOORS)

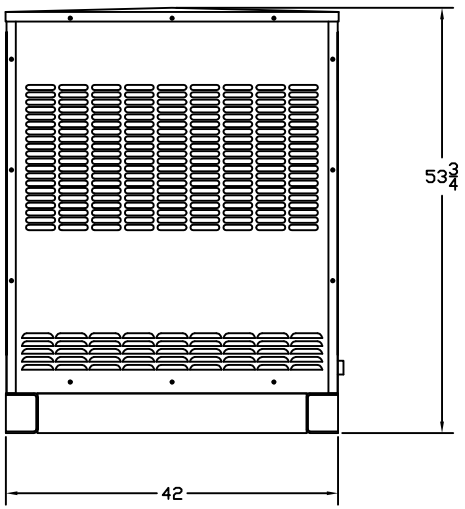
TOP VIEW

(GEN-SET HAS (4) DOORS, (2) SHOWN OPEN ARE TYPICAL FOR BOTH SIDES)

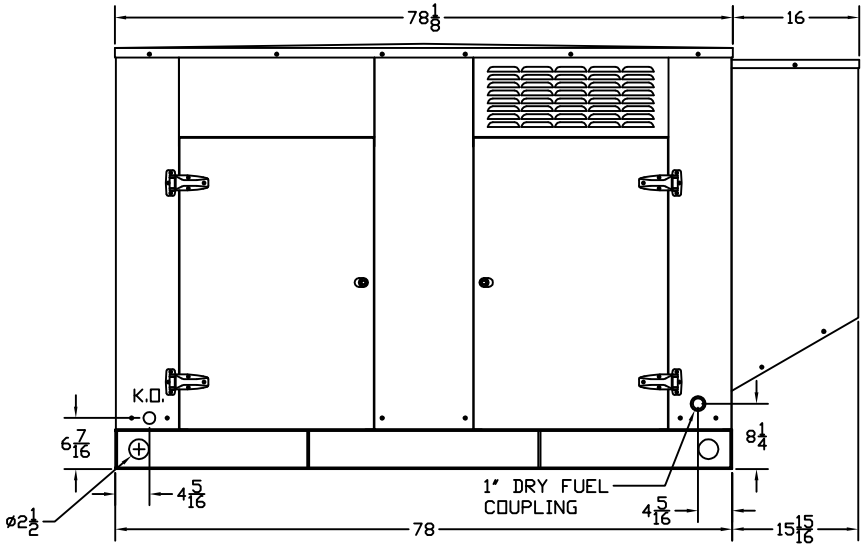


FRAME VIEW

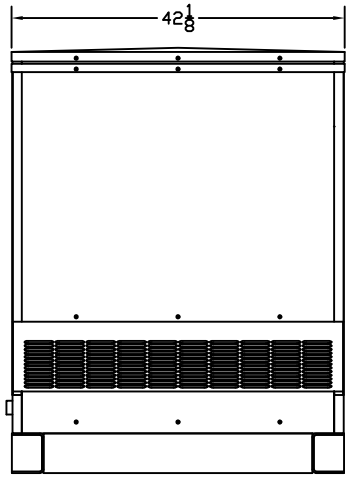




GENERATOR END VIEW



SIDE VIEW



RADIATOR END VIEW