GILLETTE GENERATORS

LIQUID COOLED DIESEL ENGINE GENERATOR SET

60 HZ MODEL

SPVD-3000

Model	HZ	STANDBY 120ºC RISE
SPVD-3000-60 HERTZ	60	300

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.

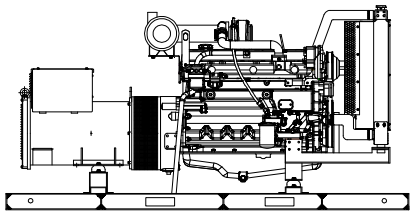
NEC 700, 701, 702, 708

NEMA ICS10, MG1, ICS6, AB1

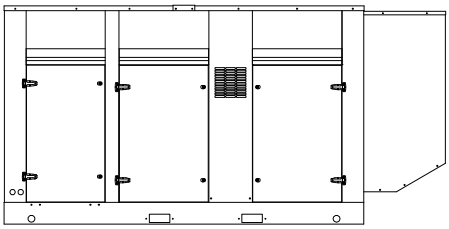
ANSI C62.41, 27, 59, 32, 480, 40Q, 81U, 360-05

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	120ºC RISE STANDBY RATING		POWER LEAD CONNECTIONS
	L-N	L-L			KW/KVA	AMP	
SPVD-3000-3-2	120	208	3	60	300/375	1042	12 LEAD LOW WYE
SPVD-3000-3-3	120	240	3	60	300/375	903	12 LEAD HIGH DELTA
SPVD-3000-3-4	277	480	3	60	300/375	452	12 LEAD HIGH WYE
SPVD-3000-3-5	127	220	3	60	300/375	985	12 LEAD LOW WYE
SPVD-3000-3-16	346	600	3	60	300/375	361	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. 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 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 & ENGINEERING DATA FOR MODEL SPVD-3000-60 HZ

GENERATOR SPECIFICATIONS

Manufacturer.....Stamford Electric Generators
Model & Type.....S4L1D-E311, 4 Pole, 12 Lead, Three Phase
..... S4L1D-D311, 4 Pole, 12 Lead, 480V, Three Phase
.....HC1434D17 4 Pole, 4 Lead, 600V, Three Phase
Exciter.....Brushless, shunt excited
Voltage Regulator .....Solid State, HZ/Volts
Voltage Regulation .....½%, No load to full load
Frequency.....60 HZ
Frequency Regulation .....± ½% (1/2 cycle, no load to full load)
Unbalanced Load Capability.....100% of standby amps
One Step Load Acceptance ..... 100% of nameplate rating
Total Stator and Load Insulation.....Class H, 180°C
Temperature Rise ..... 120°C R/R, standby rating @ 40°C amb.
3 Ø Motor Starting @ 30% Voltage Dip (208-240V).....720 kVA
3 Ø Motor Starting @ 30% Voltage Dip (480V) .....780 kVA
3 Ø Motor Starting @ 30% Voltage Dip (600V) .....850 kVA
Bearing..... 1, Pre-lubed and sealed
Coupling.....Direct flexible disc.
Total Harmonic Distortion ..... Max 3½% (MIL-STD705B)
Telephone Interference Factor .....Max 50 (NEMA MG1-22)
Deviation Factor..... Max 5% (MIL-STD 405B)
Alternator .....Self ventilating and drip-proof
Ltd. Warranty Period..... 24 Months from start-up date or
.....1000 hours use, first to occur.

GENERATOR FEATURES

- World Renown Stamford Electric Generator having UL-1446 certification.
- Full generator protection with **Basler DGC-2020** 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.

ENGINE SPECIFICATIONS AND APPLICATIONS DATA

ENGINE

Manufacturer..... VOLVO-PENTA
Model and Type .....TAD1351GE, 4 cycle, liquid Cooled
Aspiration.....Turbo After Cooler, Air to Air
Charged Air Cooled System …… Air to Air
Cylinder Arrangement.....6 Cylinders, In-Line
Displacement Cu. In. (Liters).....780(12.8)
Bore & Stroke in (Cm).....5.16 x 6.22 (13.1 x 15.8)
Compression Ratio..... 18:1
Main Bearings..... Tin Overlay with Babbit Backing
Cylinder Head .....Cast Iron with overhead Cam
Pistons.....Aluminum Alloy with Graphite Coating
Crankshaft.....Induction Hardened, Heat Treated Forged
Valves ..... Heat Treated and Hardened Exhaust Valve
Governor .....Electronic, EMS 2.2
Frequency Regulation .....± 1/4%
Air Cleaner.....Dry, Replaceable Cartridge
Engine Speed .....1800 rpm
Max Power, bhp (kwm) Standby 456 (335)
BMEP: psi (MPa) Standby..... .....254 (1.7)
Ltd. Warranty Period..... 2 Year or 1000 hrs, first to occur

FUEL SYSTEM

Type ..... Diesel Fuel Oil (ASTM No. 2-D)
Combustion System ..... Direct Injection
Fuel Injection Pump.....Electronic, Delphi E3
24 VDC Coolant heaters .....Optional Equipment
Fuel Filter ..... ……..Yes with Water Separator

FUEL CONSUMPTION

GAL/HR (LITER/HR)	STANDBY
100% LOAD	21.8 (82.7)
75% LOAD	16.6 (62.7)
50% LOAD	11.5 (43.5)

OIL SYSTEM

Type ..... Full Pressure
Oil Pan Capacity qt. (L) 31.6 (29.9)
Oil Pan Cap. W/ filter qt. (L) 38 (35.9)
Oil Filter.....3, Replaceable Cartridge type

ELECTRICAL SYSTEM

Ignition System .....Electronic
Eng. Alternator/Starter: 24 VDC, negative ground, 80 amp/hr.

Recommended battery to -18°C (0° F): ....(2) 12 VDC, BCI# 27, Max. Dimensions: 12”lg x 6 3/4” wi x 9” hi, with standard round posts. Min output 700 CCA. Battery tray (max. dim. at 12”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.

CERTIFICATIONS

All engines are EPA emissions certified. All stationary diesel engines are Tier III compliant.

APPLICATION & ENGINEERING DATA FOR MODEL SPVD-3000-60 HZ

COOLING SYSTEM

Type of System ..... Air to Air, Charged Air Cooler
Coolant Pump .....Pre-lubricated, self-sealing
Cooling Fan Type .....Pusher (16)
Fan Diameter inches (cm).....35.1 (89)
Fan drive ratio..... 0.84:1
Ambient Capacity of Radiator °F (°C).....131 (55)
Engine Jacket Coolant Capacity gal. (L).....5.28 (20)
Radiator Coolant Capacity gal. (L) 11.6 (44)
Water Pump Capacity gpm (L/min)..... .....87.0 (329)
Heat Reject Coolant: Btu/min..... ..... ….8,872
Air to Air Heat Reject, BTU/min. .... ….4,663
Heat Radiated to Ambient, BTU/min .... ….2,668
Low Radiator Coolant Level Shutdown……..Standard
Note: Coolant temp. shut-down switch setting at 228°F (109°C) with 50/50 (water/antifreeze) mix.

COOLING AIR REQUIREMENTS

Combustion Air cfm (m^3/min) 908 (25.7)
Max Air Intake Restrictions:
Clean Air Cleaner, KPA (psi) 5 (1.5)
Radiator Cooling Air, SCFM (m^3/min)……....12,085 (342)

EXHAUST SYSTEM

Exhaust Outlet Size.....6"
Max. Back Pressure in KPA (in. H2O).....15 (60.2)
Exhaust Flow, at rated KW, CFM (m3/min)..... 2,129 (61)
Exhaust Temp, (Stack) °F (°C) 869 (465)

SOUND LEVELS MEASURED IN dB(A)

	Open Set	Level 2 Encl.
Level 2, Critical Silencer	87	75
Level 3, Hospital Silencer		70

Note: Open sets (no enclosure) have optional 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.(305 meters) above 3000 ft. (914 meters) from sea level.

DERATE GENERATOR FOR TEMPERATURE

2% per 10°F (12°C) above 104°F (40°C)

DIMENSIONS AND WEIGHTS

	Open Set	Level 2 Enclosure
Length in (cm)	132 (335)	174 (442)
Width in (cm)	52 (132)	52 (132)
Height in (cm)	65 (165)	80 (203)
Net Weight lbs (kg)	6327 (2870)	7597 (3446)
Ship Weight lbs (kg)	6602 (2995)	7962 (3612)

BASLER DGC-2020 DIGITAL MICROPROCESSOR CONTROLLER

BASLER DGC-2020

The "**2020**" controller is a highly advanced integrated gen-set control system 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.

Basler "**DGC-2020"** includes: Generator metering (including three phase) • Engine – Generator protections including IEEE-[27] under voltage, [32] power, [40] loss of excitation, [59] over voltage, [81] over and under frequency, Exercise timer • SAE J1939 engine ECU communications • Expansion capabilities for both inputs and outputs with expansion • Remote communications through RS-485 to Basler's RDP110 remote Display panel • (16) programmable contact inputs • (15) programmable contact outputs- (3) for up to 30AmpDC and (12) for up to 2 Amp DC • Illuminated Text Display • Front panel menu scroll buttons • Front panel operation mode buttons for STOP, RUN and AUTO • Alarm Silence and Lamp Test buttons

This controller includes expansion features including, RS485 (using MODBUS), direct USB connection with PC, expansion optioned using BESTCOMSPlus 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 RDP-110 remote display panel module. This featured device will allow Four programmable LEDs (2) alarms and (2) pre-alarms • (17) alarms and pre-alarms displayed from Basler controller • audible alarm horn • lamp test and alarm silence buttons • RD100 local power supply inputs of either 12vdc or 24vdc • connects through Basler controller through RS-485 communications protocol • conduit box included for (2) mounting configurations- either surface mount or semi-flush mounting.

STANDARD FEATURES FOR MODEL SPVD-3000-60 HZ

STANDARD FEATURES

CONTROL PANEL:

Basler DGC-2020 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:

Fuel filter • Full flow Oil filter • Air filter • Fuel pump • Oil pump • Solenoid type starter motor • Hi-temp radiator • Jacket water pump • Thermostat • Pusher fan and guard • Exhaust manifold • Electronic Governor • 24 VDC battery charging alternator • Flexible fuel and exhaust connectors • Vibration isolators • Open coolant recovery system with 50/50 water to anti-freeze mixture • flexible oil & radiator hose • Shut-down sensors for low oil pressure, high coolant temp., low coolant level, high ambient temp.

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:

1% Voltage regulation • EMI filter • Under-speed protection • Over-excitation protection • total encapsulation

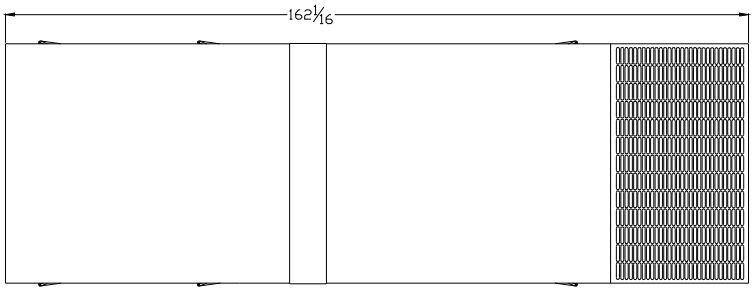
DC ELECTRICAL SYSTEM:

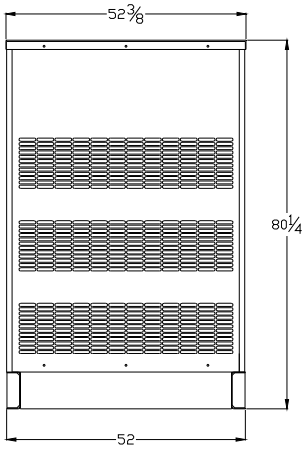
Battery trays • Battery cables • Battery hold down straps • 3-stage battery charger with float, absorption, & bulk automatic charge stages

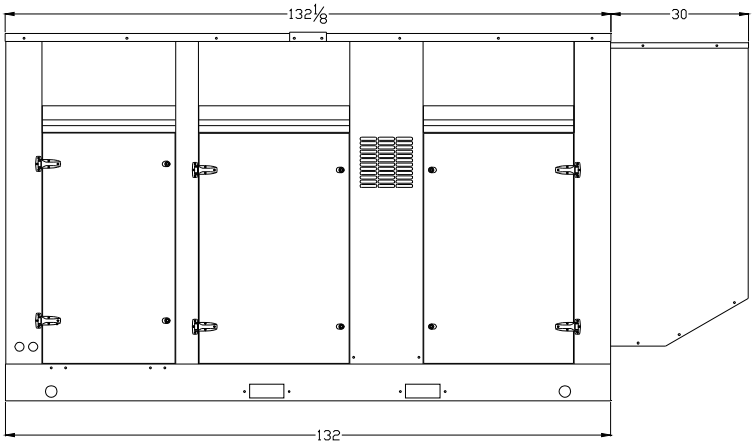
WEATHER / SOUNDPROOF ALUMINUM HOUSING:

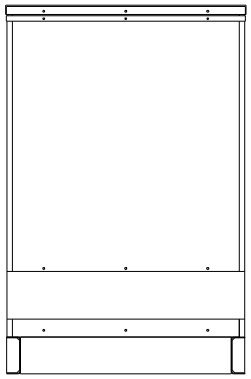
Corrosion Resistant Protection consisting of:

- (9) Heated and Agitated Wash Stages
- Zinc Phosphate Etching-Coating Stage
- Final Baked on Enamel Powder Coat
- 18/8 Stainless Steel Hardware









VOLVO PENTA GENSET ENGINE

TAD1351GE

313 kW (426 hp) at 1500 rpm, 335 kW (456 hp) at 1800 rpm

A powerful, reliable and economical Generating Set Diesel Engine built on the dependable Volvo in-line six concept.

Energy efficiency and Economy

Through careful management of the combustion process, involving precise control of air movement and injection spray Volvo Penta has been able to achieve higher levels of efficiency than ever before. This has resulted in improved fuel economy and reduced exhaust emission levels that comply with current requirements and which will enable the engines to satisfy future legislation.
Volvo Penta engines offer the highest kWh/Liter fuel, resulting in superior economy and performance.

Durability & low noise

Designed for easy, fast and economical installation. Field tested to ensure highest standard of durability and long life. Well-balanced to produce smooth and vibration-free operation with low noise level.
To maintain a controlled working temperature in cylinders and combustion chambers, the engine is equipped with piston cooling. The engine is also fitted with replaceable cylinder liners and valve seats/guides to ensure maximum durability and service life of the engine.

Low exhaust emission

The state of the art, high-tech injection and highly efficient charge air system with low internal losses contributes to excellent combustion and low fuel consumption. The engine is EPA/CARB Tier 3 & EU Stage 3A emission certified. These regulations are met by using V-ACT™ (Volvo Advanced Combustion technology). V-ACT includes a flexible high pressure fuel injection system, an air management system including an internal exhaust gas recirculation device and an enhanced electronic controller.

Easy service & maintenance

Easily accessible service and maintenance points contribute to the ease of service of the engine.

Features

- Volvo Penta Electronic management system
- Certified for US/EPA Tier 3 and EU Stage 3A
- High efficient cooling system
- Compact design
- Base engines as well as Gen Pac configurations
- Switchable between 1500/1800 rpm
- Excellent step load performance acc. to ISO 8528-5 G3 governing class
- Low operating cost

50 Hz/1500 rpm

Prime power			Standby			Generator efficiency
kWm	kWe	kVa	kWm	kWe	kVa	(%)
274	254	318	301	280	350	93%

60 Hz/1800 rpm

Prime power			Standby			Generator efficiency
kWm	kWe	kVa	kWm	kWe	kVa	(%)
294	273	341	323	300	375	93%

VOLVO PENTA

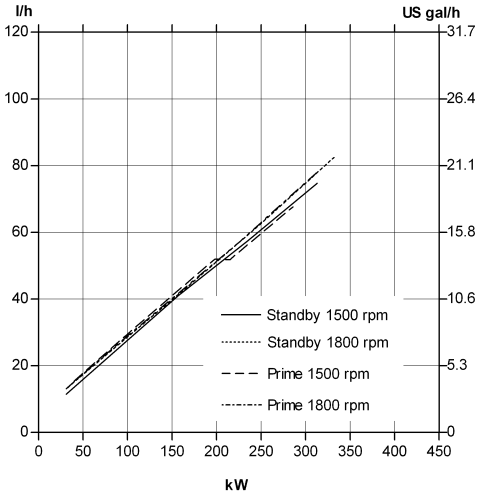
TAD1351GE

Technical Data

General

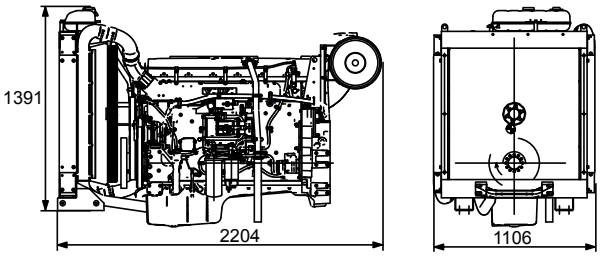
Engine designation	TAD1351GE
No. of cylinders and configuration	in-line 6
Method of operation	4-stroke
Bore, mm (in.)	131 (5.16)
Stroke, mm (in.)	158 (6.22)
Displacement, l (in³)	12.78 (780)
Compression ratio	18.1:1
Dry weight, engine only, kg (lb)	1295 (2855)
Dry weight with Gen Pac, kg (lb)	1715 (3781)

Performance	**1500 rpm**	**1800 rpm**
with fan, kW (hp) at:		
Prime Power	274 (373)	294 (400)
Max Standby Power	301 (409)	323 (439)
Fan power consumption, kW (hp)	6 (8)	12 (16)



Dimensions TAD1351GE

Not for installation



Technical description

Engine and block

- Cast iron cylinder block with optimum distribution of forces without the block being unnessarily heavy.
- Wet, replaceable cylinder liners
- Piston cooling for low piston temperature and reduced ring temperature
- Tapered connecting rods for increased piston lifetime
- Crankshaft induction hardened bearing surfaces and fillets with seven bearings for moderate load on main and high-end bearings
- Case hardened and Nitrocarburized transmission gears for heavy duty operation
- Keystone top compression rings for long service life
- Viscous type crankshaft vibration dampers to withstand single bearing alternator torsional vibrations
- Replaceable valve guides and valve seats
- Over head camshaft and 4 valves per cylinder

Lubrication system

- Full flow oil cooler
- Full flow disposable spin-on oil filter, for extra high filtration
- The lubricating oil level can be measured at start-up
- Gear type lubricating oil pump, gear driven by the transmission

Fuel system

- Electronic high pressure unit injectors
- Fuel prefilter with water separator and water-in-fuel indicator / alarm
- Gear driven low-pressure fuel pump
- Fine fuel filter with manual feed pump and fuel pressure switch

Cooling system

- Efficient cooling with accurate coolant control through a water distribution duct in the cylinder block. Reliable sleeve thermostat with minimum pressure drop
- Belt driven coolant pump with high degree of efficiency

Turbo charger

- Efficient and reliable turbo charger
- Electronically controlled Waste-gate
- Extra oil filter for the turbo charger

Electrical system

- Engine Management System 2 (EMS 2), an electronically controlled processing system which optimizes engine performance. It also includes advanced facilities for diagnostics and fault tracing
- The instruments and controls connect to the engine via the CAN SAE J1939 interface, either through the Control Interface Unit (CIU) or the Digital Control Unit (DCU). The CIU converts the digital CAN bus signal to an anolog signal, making it possible to connect a variety of instruments. The DCU is a control panel with display, engine control, monitoring, alarm, parameter setting and diagnostic functions. The DCU also presents error codes in clear text.
- Sensors for oil pressure, oil temp, boost pressure, boost temp, coolant temp, fuel temp, water in fuel, fuel pressure and two speed sensors.

Note! Not all models, standard equipment and accessories are available in all countries.
All specifications are subject to change without notice.
The engine illustrated may not be entirely identical to production standard engines.

Power Standards
The engine performance corresponds to ISO 3046, BS 5514 and DIN 6271. The technical data applies to an engine without cooling fan and operating on a fuel with calorific value of 42.7 MJ /kg (18360 BTU/lb) and a density of 0.84 kg/liter (7.01 lb/US gal), also where this involves a deviation from the standards. Power output guaranteed within 0 to +2% att rated ambient conditions at delivery. Ratings are based on ISO 8528. Engine speed governing in accordance with ISO 3046/IV, class A1 and ISO 8528-5 class G3

Exhaust emissions
The engine complies with US/EPA Tier 3 and EU stage 3 A emission legislation according to the Non Road Directive EU 97/68/EEC. The engine also complies with TA-luft -50% exhaust emission regulations.

Rating Guidelines
PRIME POWER rating corresponds to ISO Standard Power for continuous operation. It is applicable for supplying electrical power at variable load for an unlimited number of hours instead of commercially purchased power. A10 % overload capability for govering purpose is available for this rating.
STANDBY POWER rating corresponds to ISO Standard Fuel Stop Power. It is applicable for supplying standby electrical power at variable load in areas with well established electrical networks in the event of normal utility power failure. No overload capability is available for this rating.
1 hp = 1 kW x 1.36

Information
For more technical data and information, please look in the Generating Set Engines Sales Guide.

AB Volvo Penta
SE-405 08 Göteborg, Sweden
www.volvopenta.com

STAMFORD

S4LID-E41 Wdg.311 - Technical Data Sheet

Standards

Stamford industrial alternators meet the requirements of the relevant parts of the BS 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
Excitation Type	Self-Excited	PMG	PMG		

No Load Excitation Voltage (V)	12 - 9
No Load Excitation Current (A)	0.7 - 0.5
Full Load Excitation Voltage (V)	41 - 39
Full Load Excitation Current (A)	2.3 - 2.2
Exciter Time Constant (seconds)	0.105

STAMFORD

S4LID-E41 Wdg.311

Electrical Data								
Insulation System	Class H							
Stator Winding	Double Layer Lap							
Winding Pitch	Two Thirds							
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	13.56							
	50 Hz				60 Hz			
Telephone Interference	THF<2%				TIF<50			
Cooling Air	0.8 m³/sec				0.96 m³/sec			
Voltage Star	380	400	415	440	416	440	460	480
kVA Base Rating (Class H) for Reactance Values	350	360	360	350	400	435	440	455
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.01	2.79	2.59	2.24	3.47	3.38	3.12	2.97
X'd Dir. Axis Transient	0.20	0.19	0.17	0.15	0.21	0.20	0.19	0.18
X"d Dir. Axis Subtransient	0.14	0.13	0.12	0.11	0.15	0.14	0.13	0.12
Xq Quad. Axis Reactance	2.57	2.39	2.22	1.92	2.92	2.84	2.62	2.49
X"q Quad. Axis Subtransient	0.36	0.33	0.31	0.27	0.41	0.40	0.37	0.35
XL Stator Leakage Reactance	0.07	0.06	0.06	0.05	0.08	0.08	0.08	0.07
X2 Negative Sequence Reactance	0.24	0.23	0.21	0.18	0.28	0.27	0.25	0.24
X0 Zero Sequence Reactance	0.10	0.09	0.09	0.07	0.10	0.09	0.09	0.08
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.61	3.35	3.11	2.69	4.17	4.05	3.75	3.56
X'd Dir. Axis Transient	0.23	0.21	0.20	0.17	0.24	0.23	0.21	0.20
X"d Dir. Axis Subtransient	0.17	0.16	0.15	0.13	0.17	0.17	0.15	0.15
Xq Quad. Axis Reactance	2.65	2.46	2.29	1.98	3.00	2.92	2.70	2.57
X"q Quad. Axis Subtransient	0.43	0.40	0.37	0.32	0.49	0.48	0.44	0.42
XL Stator Leakage Reactance	0.08	0.07	0.07	0.06	0.10	0.09	0.09	0.08
Xlr Rotor Leakage Reactance	0.12	0.11	0.10	0.09	0.13	0.13	0.12	0.11
X2 Negative Sequence Reactance	0.29	0.27	0.25	0.22	0.33	0.32	0.30	0.29
X0 Zero Sequence Reactance	0.12	0.11	0.10	0.09	0.11	0.11	0.10	0.10

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Time Constants (Seconds)		
T'd TRANSIENT TIME CONST.	0.08	
T''d SUB-TRANSTIME CONST.	0.019	
T'do O.C. FIELD TIME CONST.	1.7	
Ta ARMATURE TIME CONST.	0.018	
T''q SUB-TRANSTIME CONST.	0.0079	
Resistances in Ohms (Ω) at 22^{0}C		
Stator Winding Resistance (Ra), per phase for series connected	0.009	
Rotor Winding Resistance (Rf)	1.19	
Exciter Stator Winding Resistance	18	
Exciter Rotor Winding Resistance per phase	0.068	
PMG Phase Resistance (Rpmg) per phase	1.9	
Positive Sequence Resistance (R1)	0.01125	
Negative Sequence Resistance (R2)	0.01296	
Zero Sequence Resistance (R0)	0.01125	
Saturation Factors	400V	480V
SG1.0	0.32	0.33
SG1.2	1.3	1.32
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 Bearings
SAE Adaptor	SAE 0.5, 1	N/A
Moment of Inertia	4.6331kgm^2	N/A
Weight Wound Stator	470kg	N/A
Weight Wound Rotor	400kg	N/A
Weight Complete Alternator	1024kg	N/A
Shipping weight in a Crate	1095kg	N/A
Packing Crate Size	155 x 87 x 107 (cm)	N/A
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	N/A	N/A
Bearing Non-Drive End	Ball 6314	N/A

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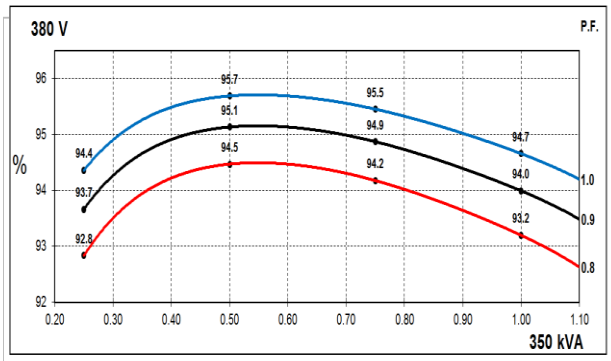
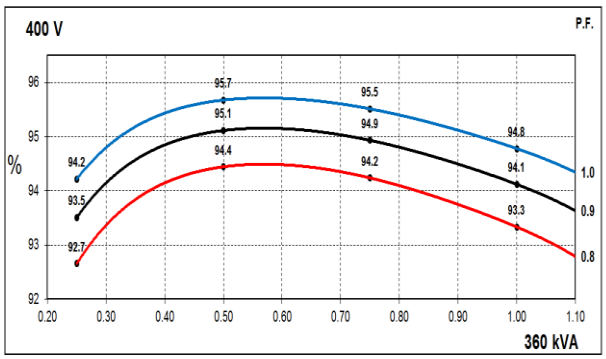
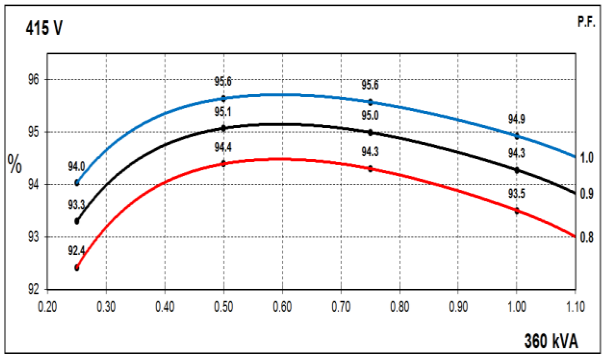
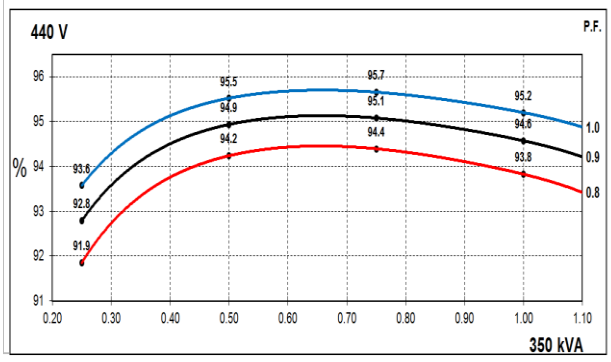
THREE PHASE EFFICIENCY CURVES

50Hz

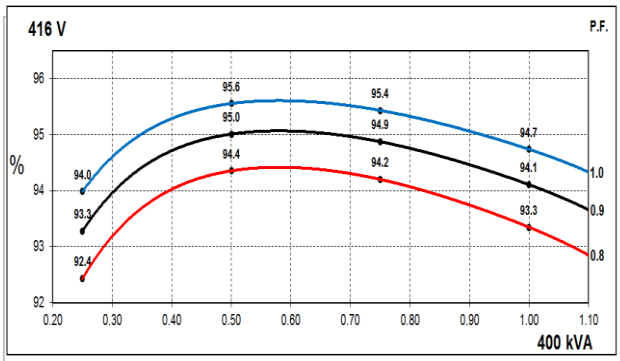


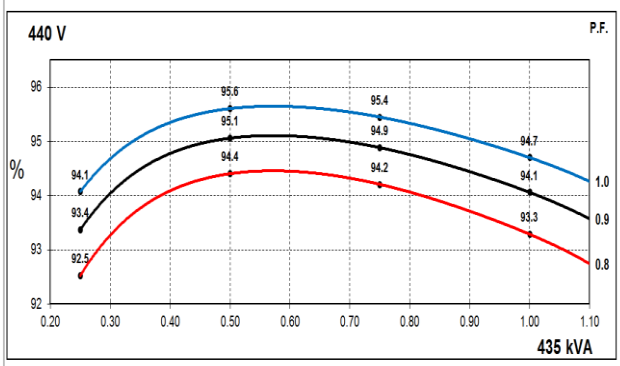


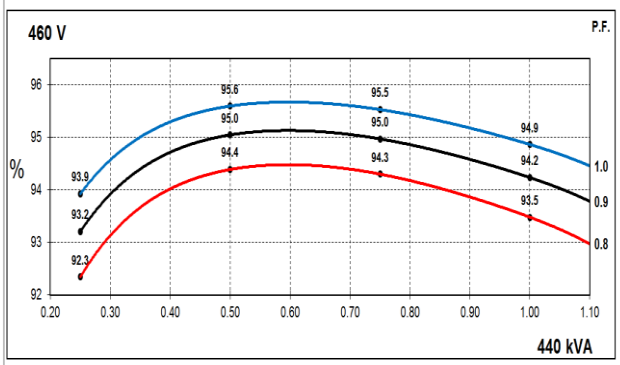


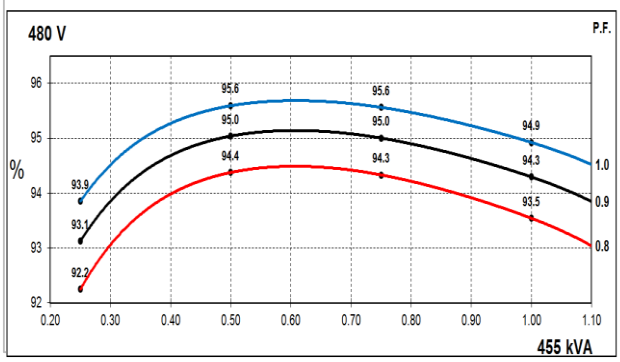


60Hz









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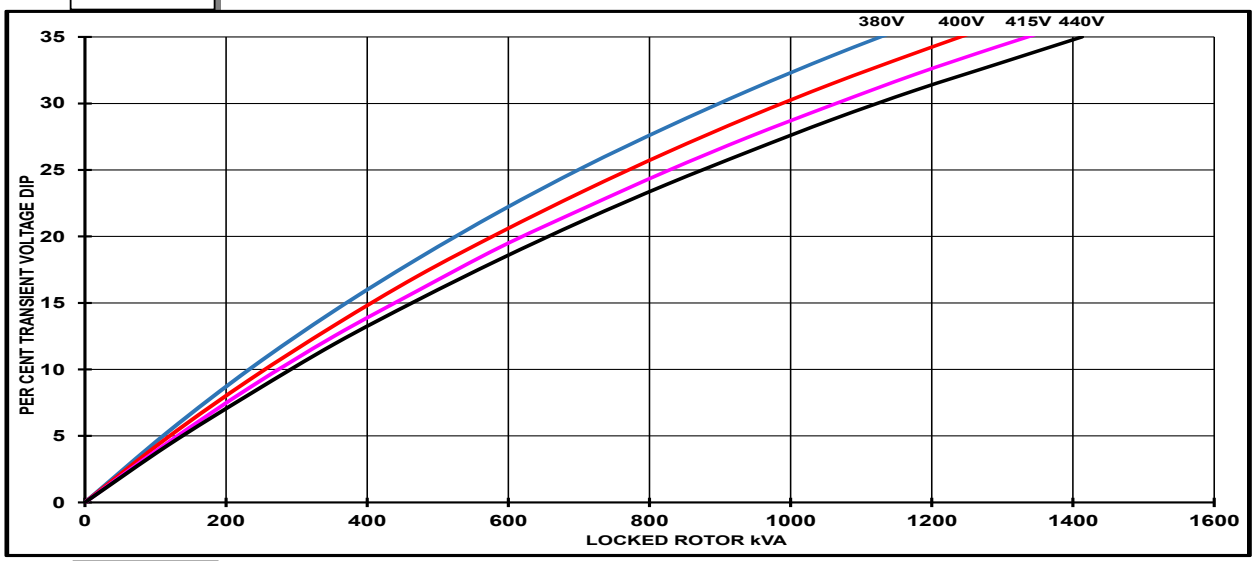
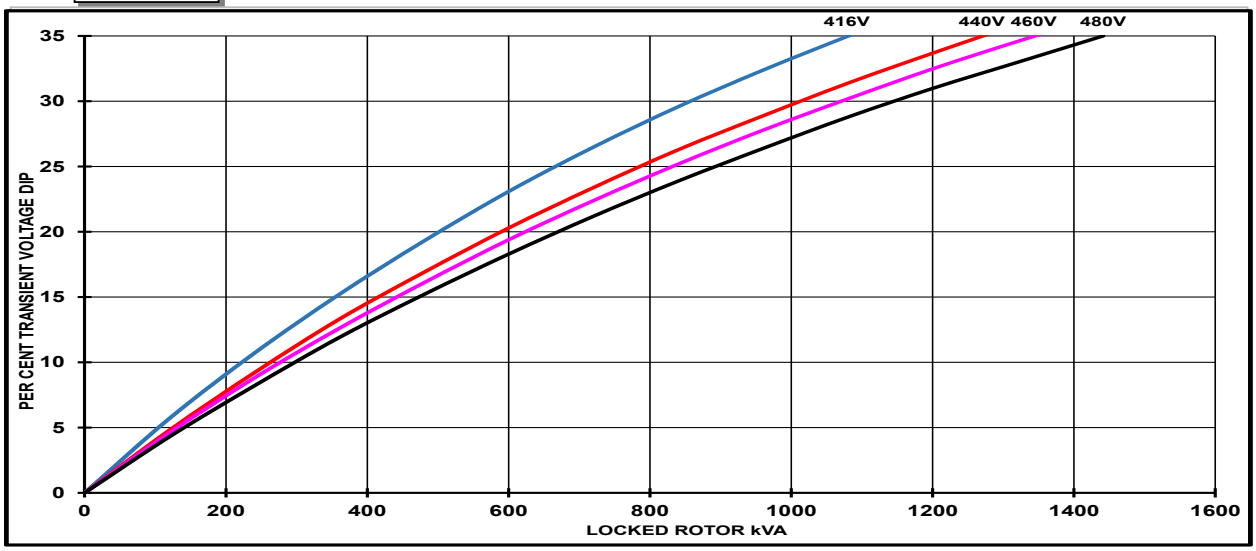
Locked Rotor Motor Starting Curves - Separately Excited

50Hz



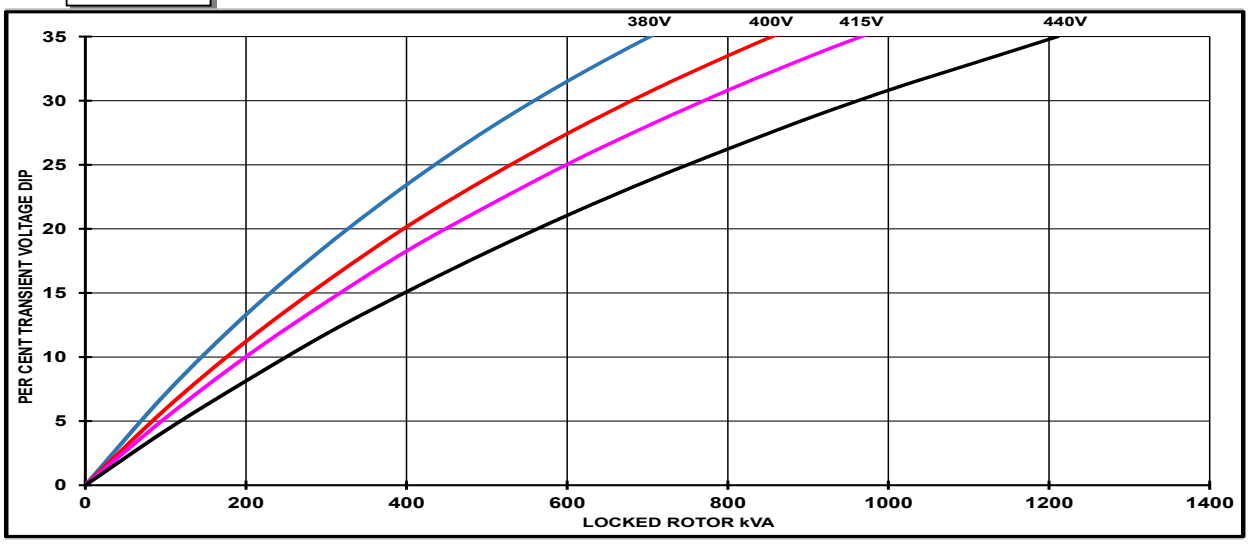
60Hz



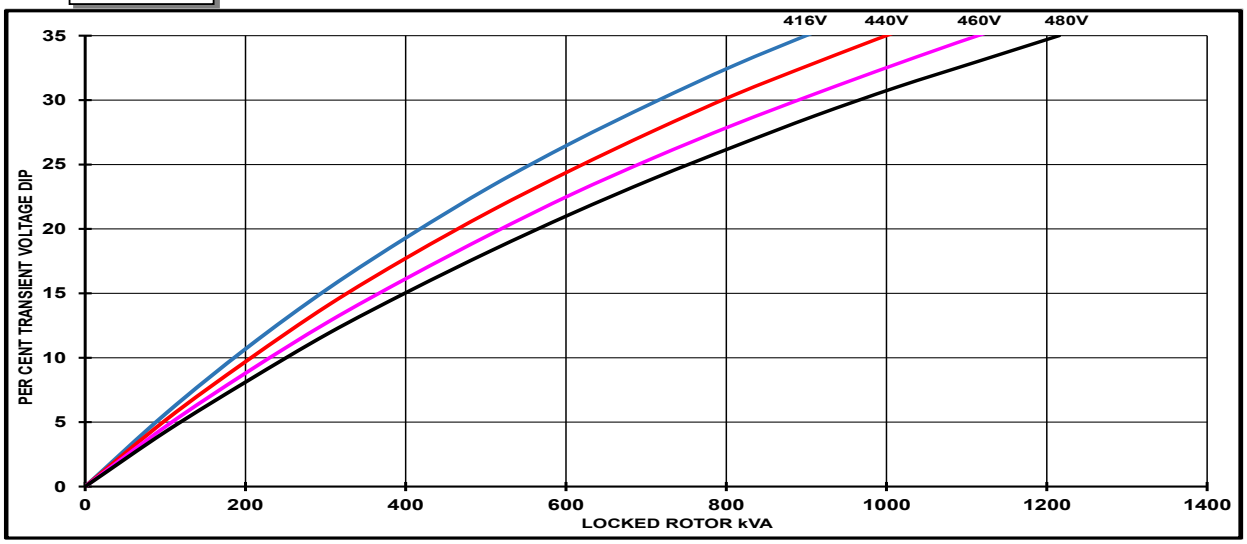
Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	For voltage rise multiply voltage dip by 1.25
< 0.5	1	
0.5	0.97	
0.6	0.93	
0.7	0.9	
0.8	0.85	
0.9	0.83	

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	

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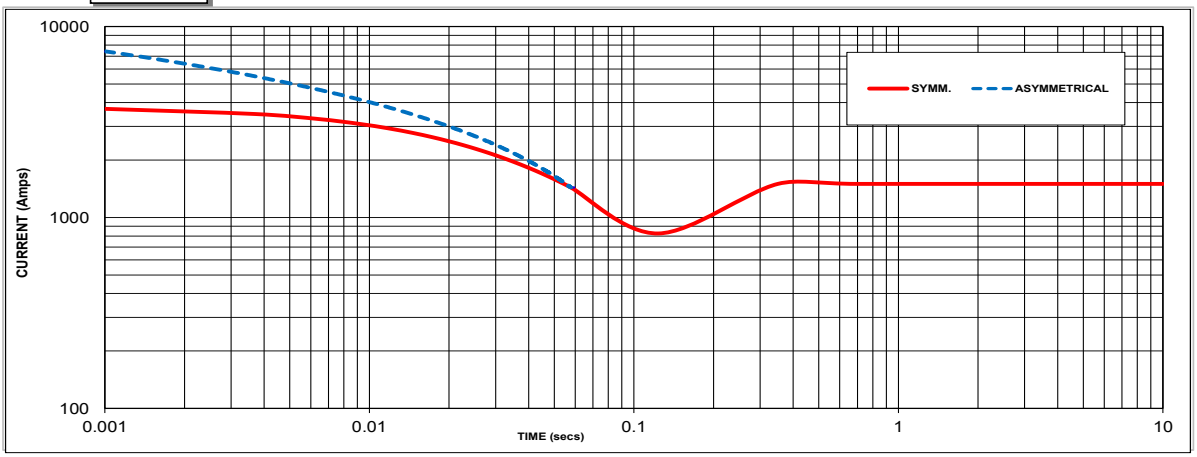
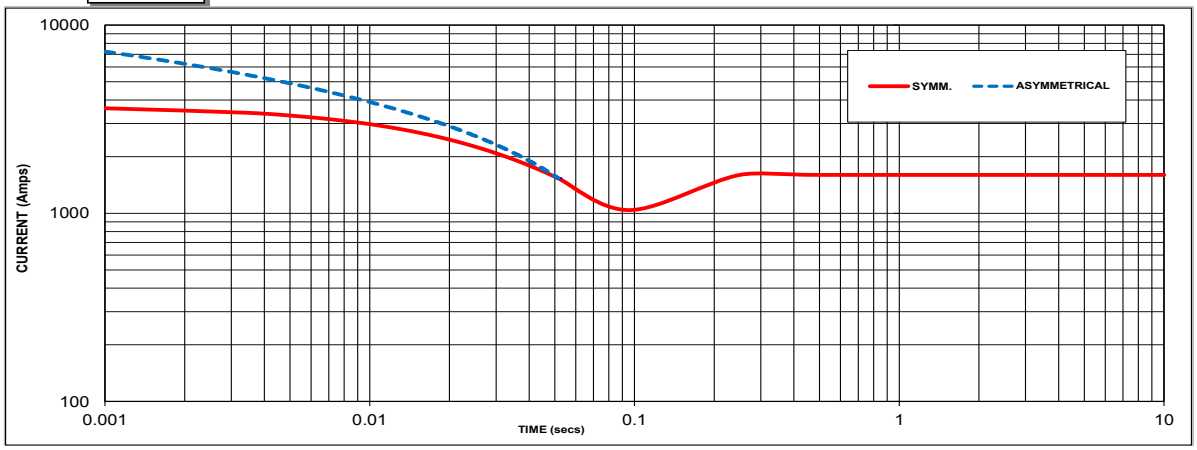
Three-phase Short Circuit Decrement Curve

50Hz



Sustained Short Circuit = 1500 Amps

60Hz



Sustained Short Circuit = 1600 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.

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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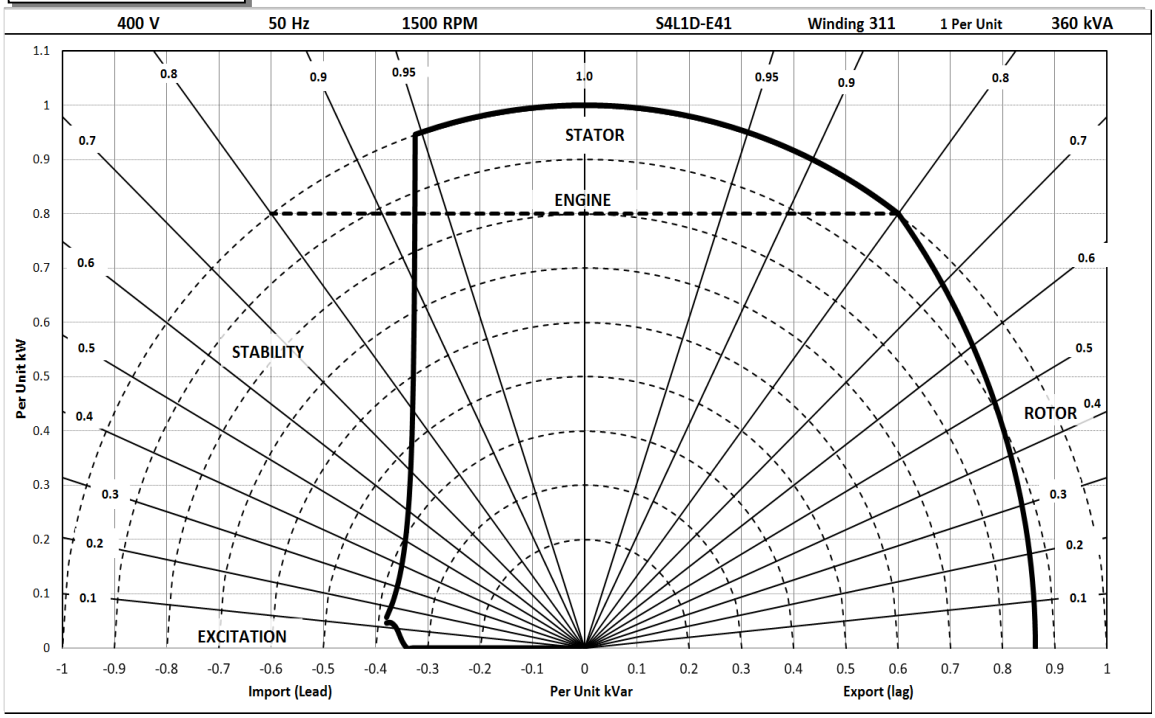
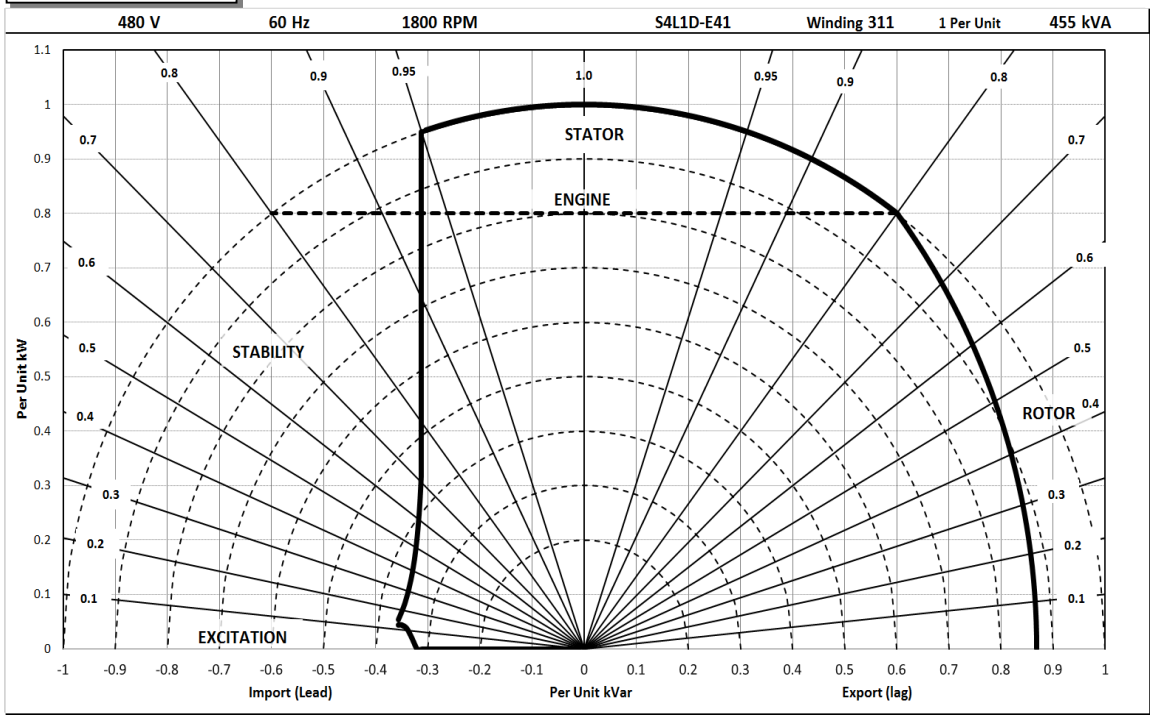
Typical Alternator Operating Charts

400V/50Hz



480V/60Hz



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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
	kVA	380	415	400	380	370	385	385	370	350	360	360	350	320	325	325	320
	kW	304	332	320	304	296	308	308	296	280	288	288	280	256	260	260	256
	Efficiency (%)	92.7	92.5	93.0	93.5	92.9	93.0	93.2	93.6	93.2	93.3	93.5	93.8	93.6	93.8	93.9	94.1
	kW Input	328	359	344	325	319	331	331	316	300	309	308	298	274	277	277	272

60 Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	kVA	435	470	475	490	420	460	460	475	400	435	440	455	365	395	400	410
	kW	348	376	380	392	336	368	368	380	320	348	352	364	292	316	320	328
	Efficiency (%)	92.9	92.9	93.1	93.2	93.1	93.0	93.3	93.3	93.4	93.3	93.5	93.5	93.7	93.7	93.9	93.9
	kW Input	374	405	408	421	361	396	395	407	343	373	377	389	312	337	341	349

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
- 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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info@cumminsgeneratortechnologies.com

Cummins Generator Technologies

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S4L1D-D41 Wdg.311 - Technical Data Sheet

Standards

Stamford industrial alternators meet the requirements of the relevant parts of the BS 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
Excitation Type	Self-Excited	PMG	PMG		

No Load Excitation Voltage (V)	12 - 9
No Load Excitation Current (A)	0.7 - 0.5
Full Load Excitation Voltage (V)	41 - 39
Full Load Excitation Current (A)	2.3 - 2.2
Exciter Time Constant (seconds)	0.105

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Electrical Data

Insulation System	Class H							
Stator Winding	Double Layer Lap							
Winding Pitch	Two Thirds							
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	12.29							
	50 Hz				**60 Hz**			
Telephone Interference	THF<2%				TIF<50			
Cooling Air	0.83 m³/sec				0.99 m³/sec			
Voltage Star	380	400	415	440	416	440	460	480
kVA Base Rating (Class H) for Reactance Values	300	310	310	290	344	370	375	390
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.15	2.94	2.73	2.27	3.60	3.46	3.21	3.07
X'd Dir. Axis Transient	0.20	0.19	0.17	0.14	0.22	0.21	0.20	0.19
X"d Dir. Axis Subtransient	0.14	0.13	0.12	0.10	0.15	0.14	0.13	0.12
Xq Quad. Axis Reactance	2.66	2.48	2.30	1.92	3.09	2.97	2.75	2.63
X"q Quad. Axis Subtransient	0.40	0.37	0.34	0.29	0.40	0.39	0.36	0.34
XL Stator Leakage Reactance	0.07	0.06	0.06	0.05	0.09	0.08	0.08	0.07
X2 Negative Sequence Reactance	0.27	0.25	0.23	0.19	0.28	0.27	0.25	0.24
X0 Zero Sequence Reactance	0.10	0.09	0.09	0.07	0.10	0.09	0.09	0.08
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.78	3.53	3.28	2.73	4.32	4.16	3.85	3.68
X'd Dir. Axis Transient	0.23	0.21	0.20	0.17	0.25	0.24	0.23	0.22
X"d Dir. Axis Subtransient	0.17	0.16	0.15	0.12	0.17	0.16	0.15	0.15
Xq Quad. Axis Reactance	2.74	2.55	2.37	1.97	3.18	3.06	2.84	2.71
X"q Quad. Axis Subtransient	0.48	0.45	0.41	0.34	0.48	0.46	0.43	0.41
XL Stator Leakage Reactance	0.08	0.07	0.07	0.05	0.10	0.09	0.09	0.08
Xlr Rotor Leakage Reactance	0.12	0.11	0.10	0.09	0.14	0.13	0.12	0.12
X2 Negative Sequence Reactance	0.32	0.30	0.28	0.23	0.34	0.32	0.30	0.29
X0 Zero Sequence Reactance	0.12	0.11	0.10	0.08	0.11	0.11	0.10	0.10

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Time Constants (Seconds)		
T'd TRANSIENT TIME CONST.	0.08	
T''d SUB-TRANSTIME CONST.	0.019	
T'do O.C. FIELD TIME CONST.	1.7	
Ta ARMATURE TIME CONST.	0.018	
T''q SUB-TRANSTIME CONST.	0.0077	
Resistances in Ohms (Ω) at 22^{0}C		
Stator Winding Resistance (Ra), per phase for series connected	0.0124	
Rotor Winding Resistance (Rf)	1.05	
Exciter Stator Winding Resistance	18	
Exciter Rotor Winding Resistance per phase	0.068	
PMG Phase Resistance (Rpmg) per phase	1.9	
Positive Sequence Resistance (R1)	0.0155	
Negative Sequence Resistance (R2)	0.017856	
Zero Sequence Resistance (R0)	0.0155	
Saturation Factors	400V	480V
SG1.0	0.31	0.31
SG1.2	1.25	1.25
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 Bearings
SAE Adaptor	SAE 0.5, 1	N/A
Moment of Inertia	4.0771 kgm2	N/A
Weight Wound Stator	415 kg	N/A
Weight Wound Rotor	361 kg	N/A
Weight Complete Alternator	940 kg	N/A
Shipping weight in a Crate	1010 kg	N/A
Packing Crate Size	155 x 87 x 107(cm)	N/A
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	N/A	N/A
Bearing Non-Drive End	Ball 6314	N/A

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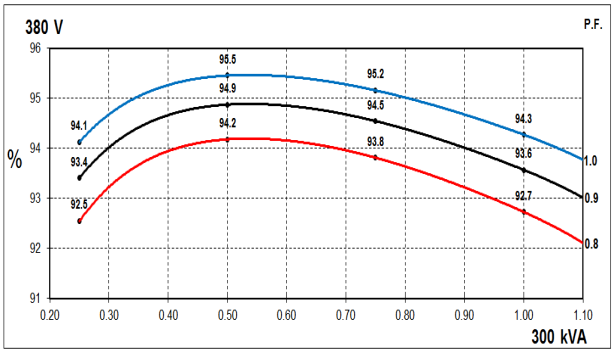
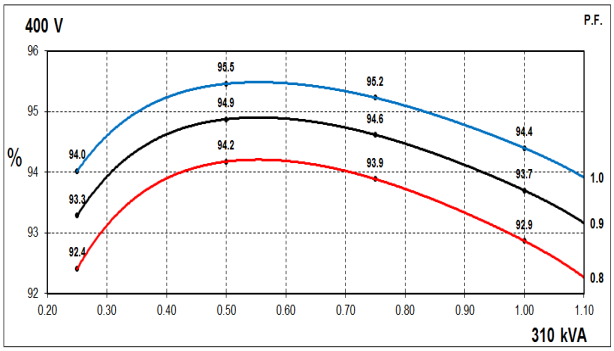
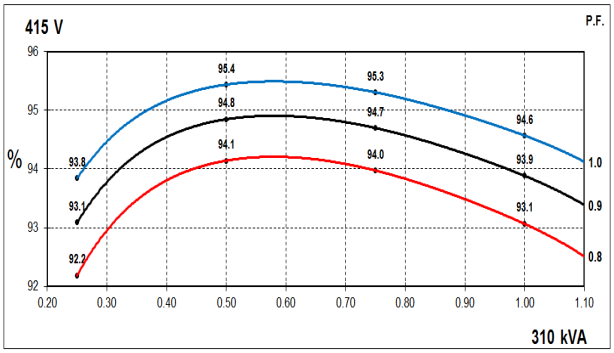
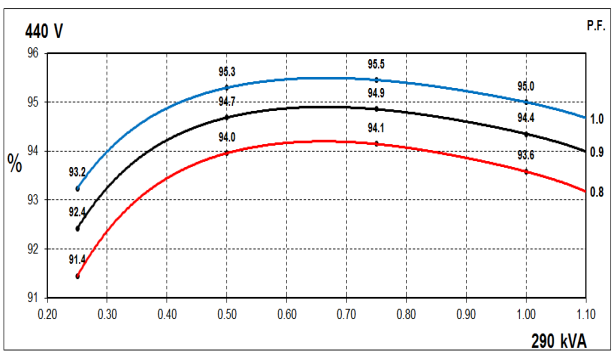
THREE PHASE EFFICIENCY CURVES

50Hz

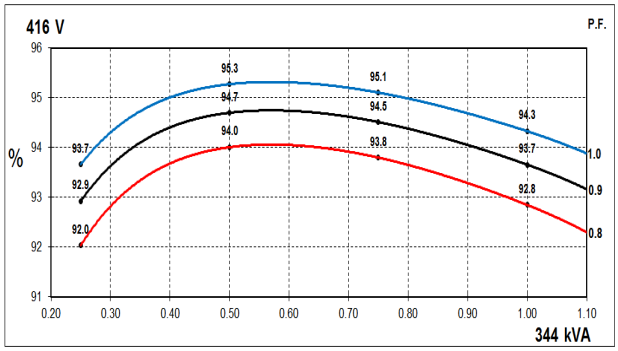


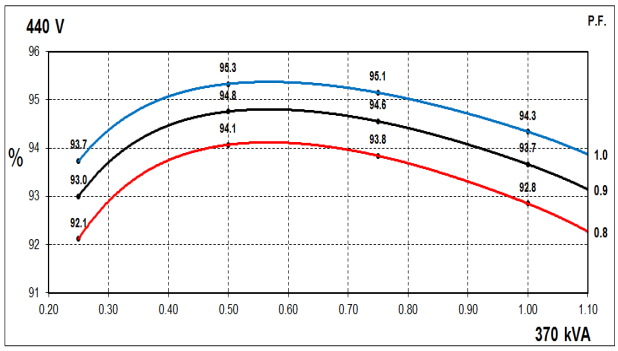


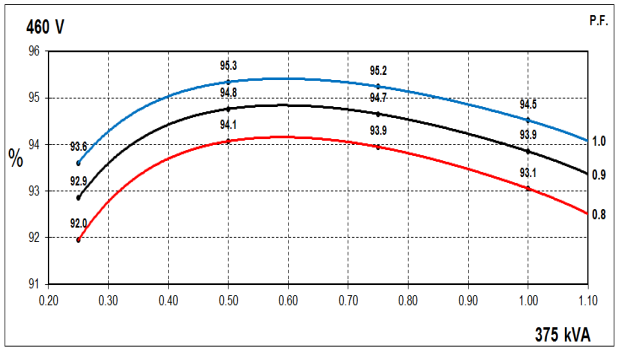


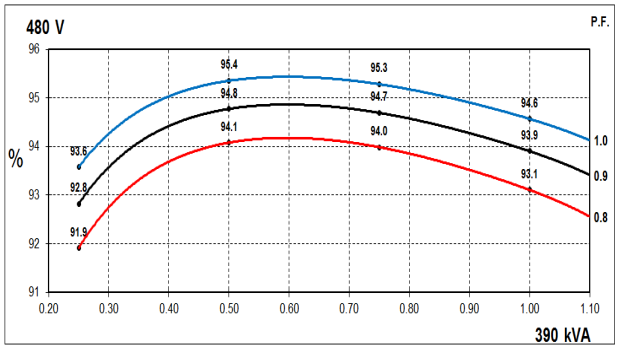


60Hz



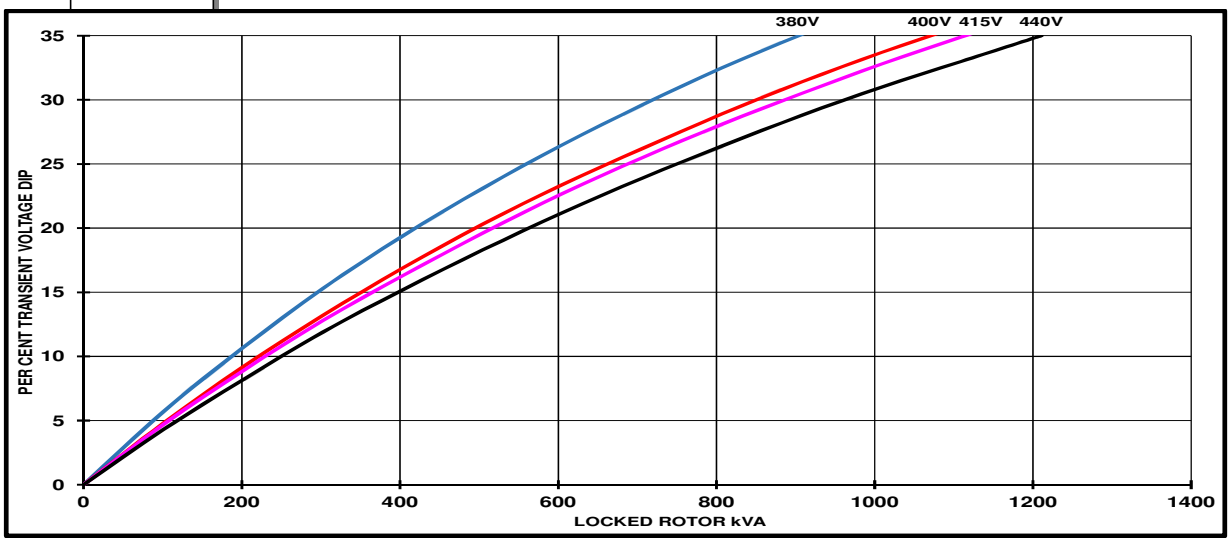




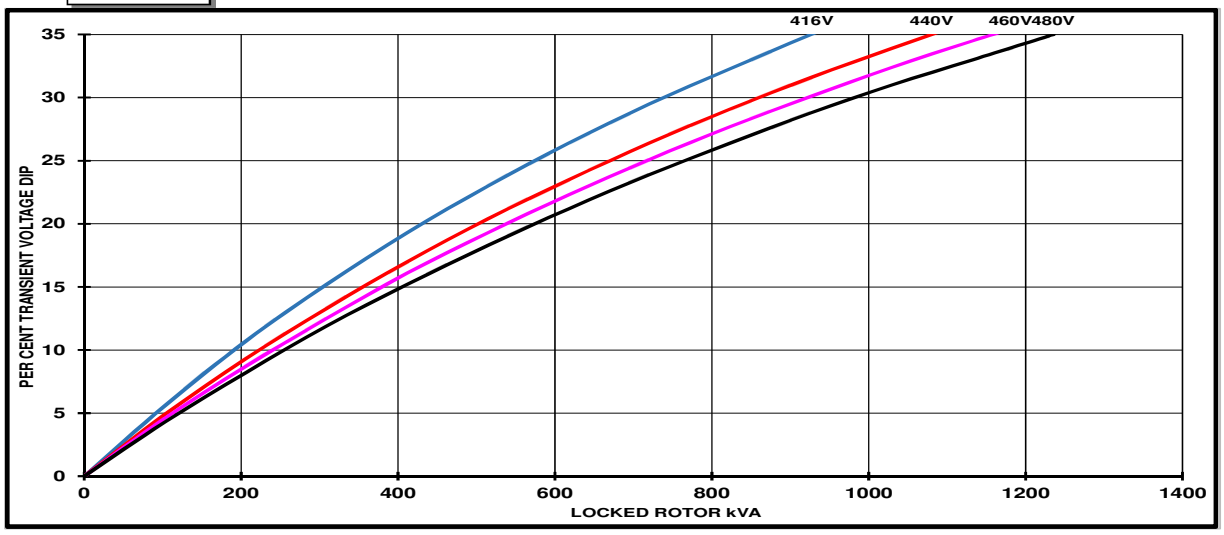


Locked Rotor Motor Starting Curves - Separately Excited

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	

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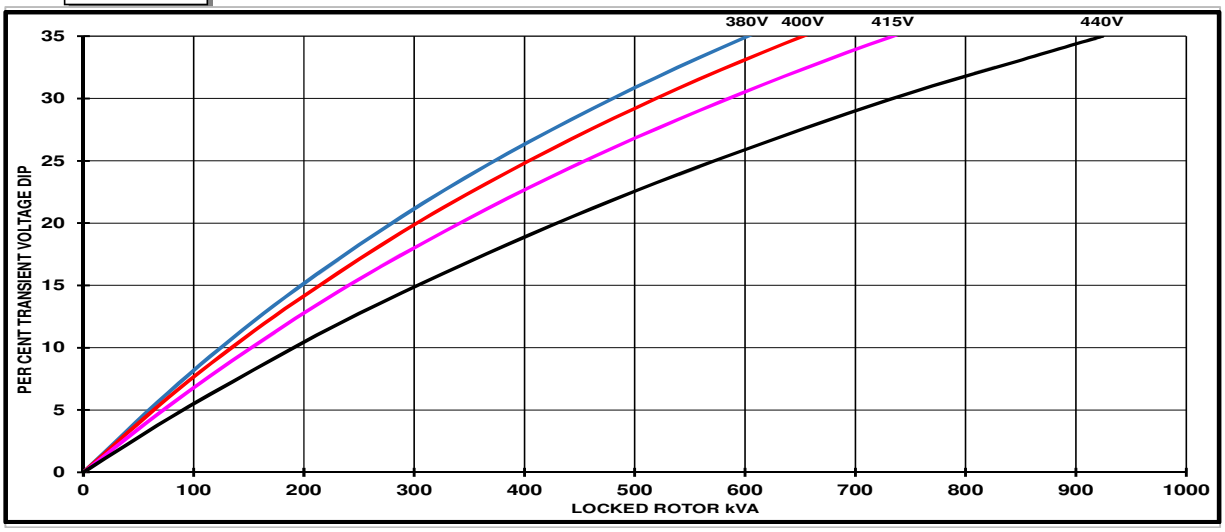
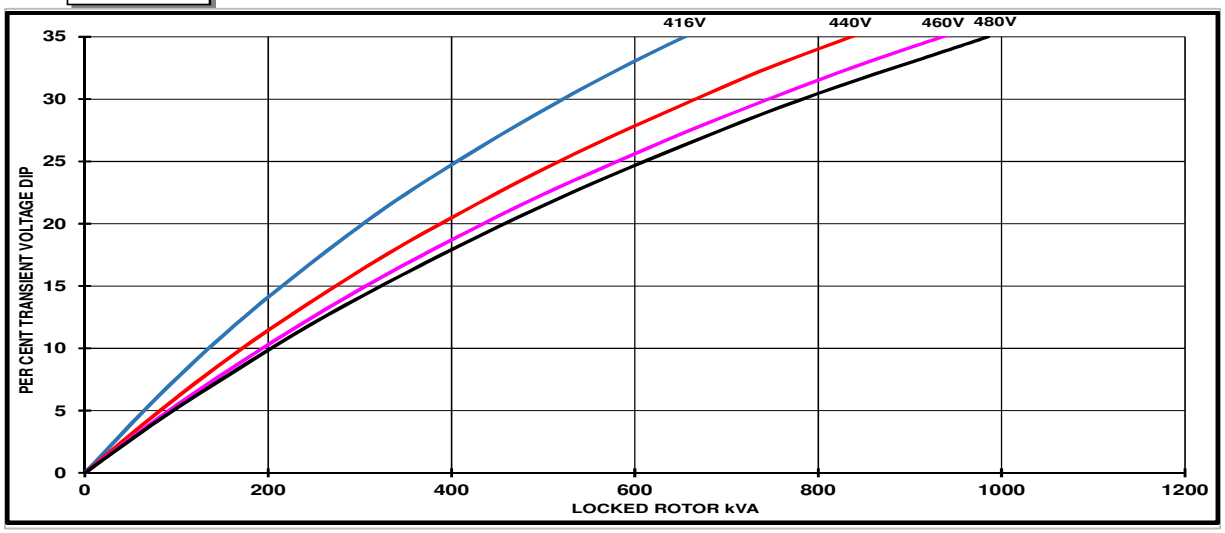
Locked Rotor Motor Starting Curves - Self Excited

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	

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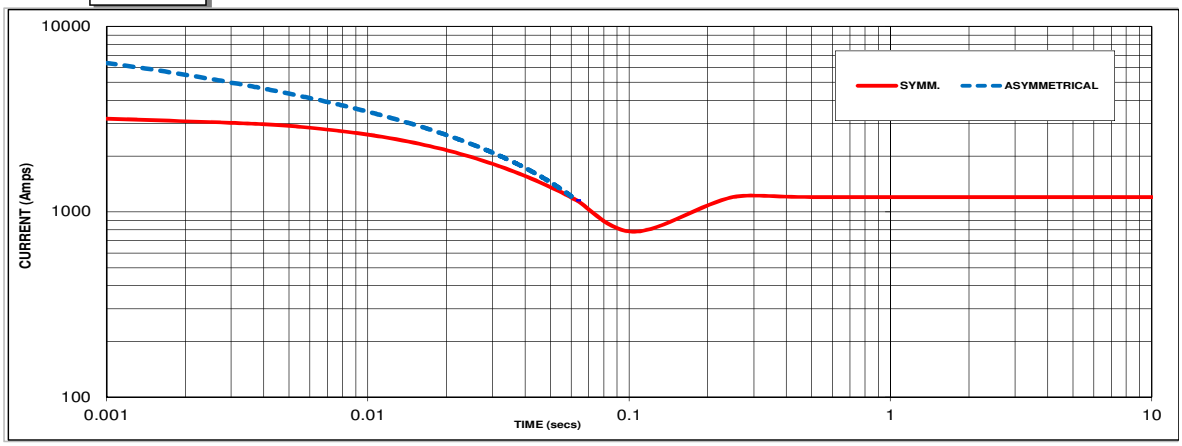
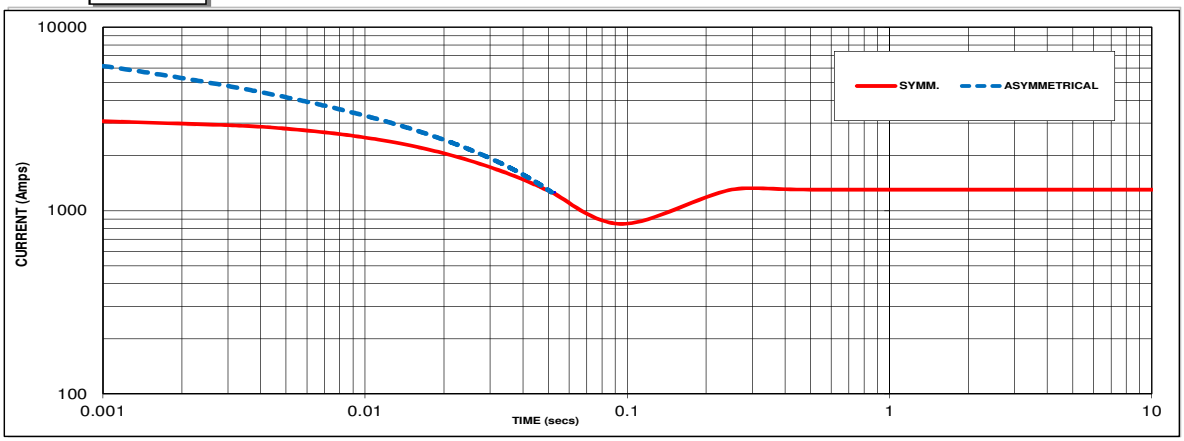
Three-phase Short Circuit Decrement Curve

50Hz



Sustained Short Circuit = 1200 Amps

60Hz



Sustained Short Circuit = 1300 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.

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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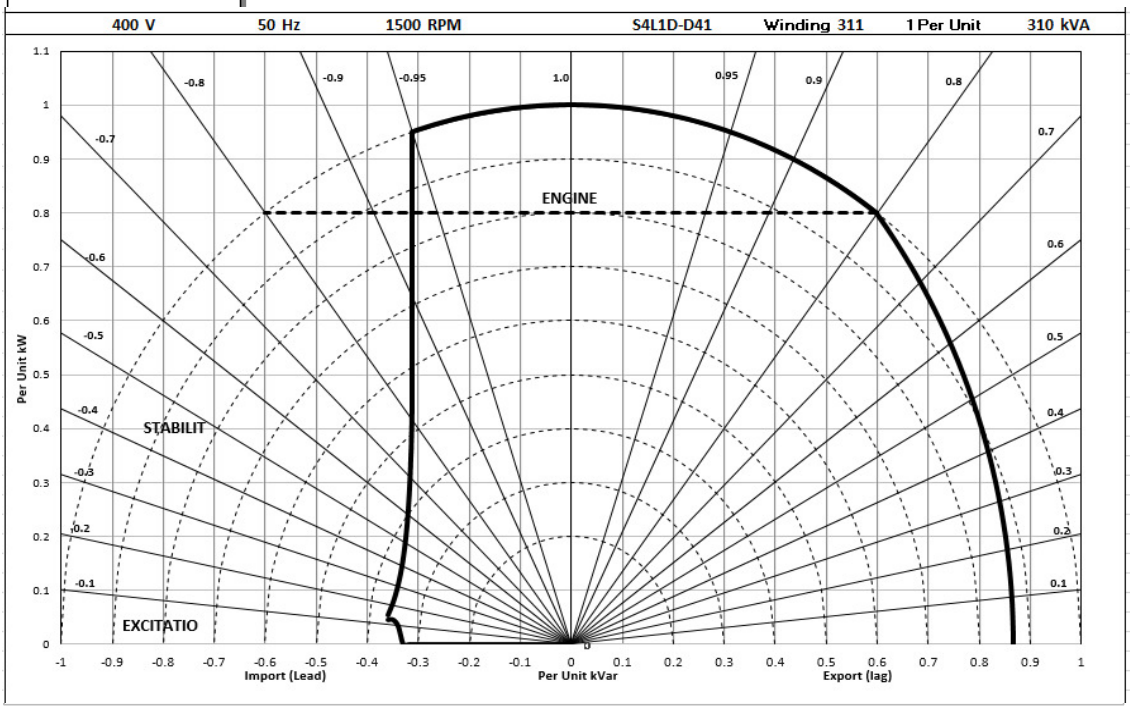
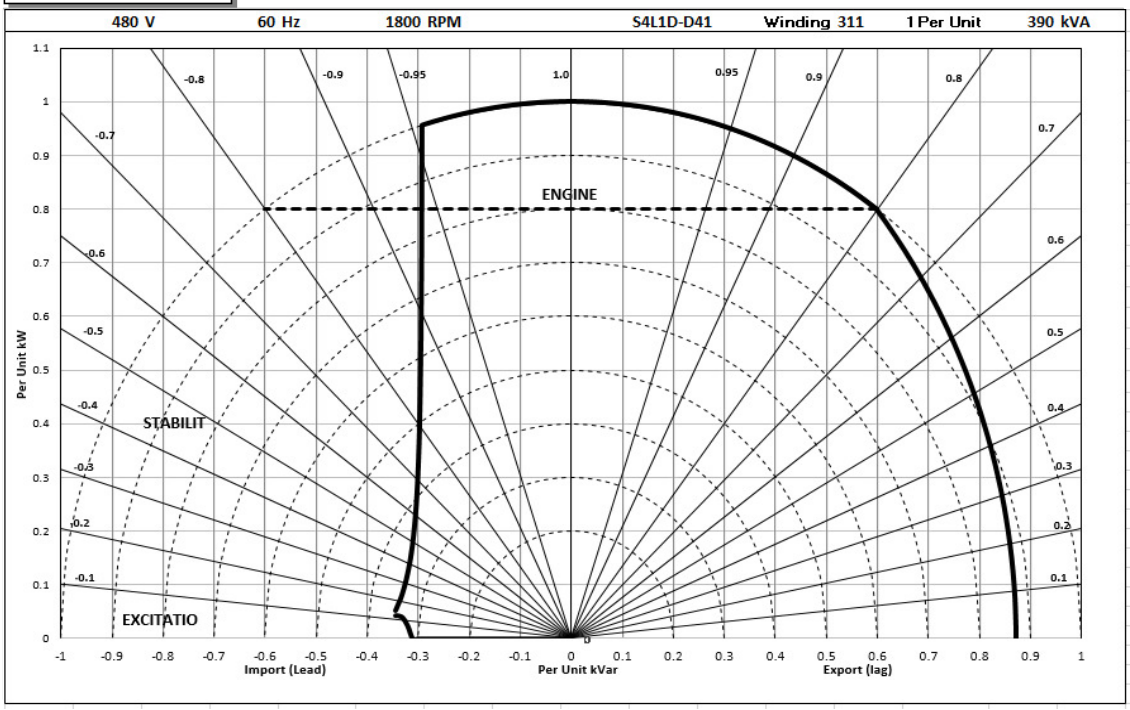
Typical Alternator Operating Charts

400V/50Hz



480V/60Hz



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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
	kVA	330	340	340	320	320	330	330	310	300	310	310	290	280	285	285	270
	kW	264	272	272	256	256	264	264	248	240	248	248	232	224	228	228	216
	Efficiency (%)	92.1	92.3	92.6	93.2	92.3	92.5	92.7	93.3	92.7	92.9	93.1	93.6	93.1	93.3	93.4	93.8
	kW Input	287	295	294	275	277	285	285	266	259	267	266	248	241	244	244	230

60 Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	kVA	375	410	415	430	365	400	400	415	344	370	375	390	315	340	345	355
	kW	300	328	332	344	292	320	320	332	275	296	300	312	252	272	276	284
	Efficiency (%)	92.4	92.2	92.5	92.6	92.5	92.4	92.7	92.8	92.8	92.9	93.1	93.1	93.2	93.2	93.4	93.5
	kW Input	325	356	359	372	316	346	345	358	296	319	322	335	270	292	295	304

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
- 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

View our videos at youtube.com/stamfordavk

news.stamford-avk.com

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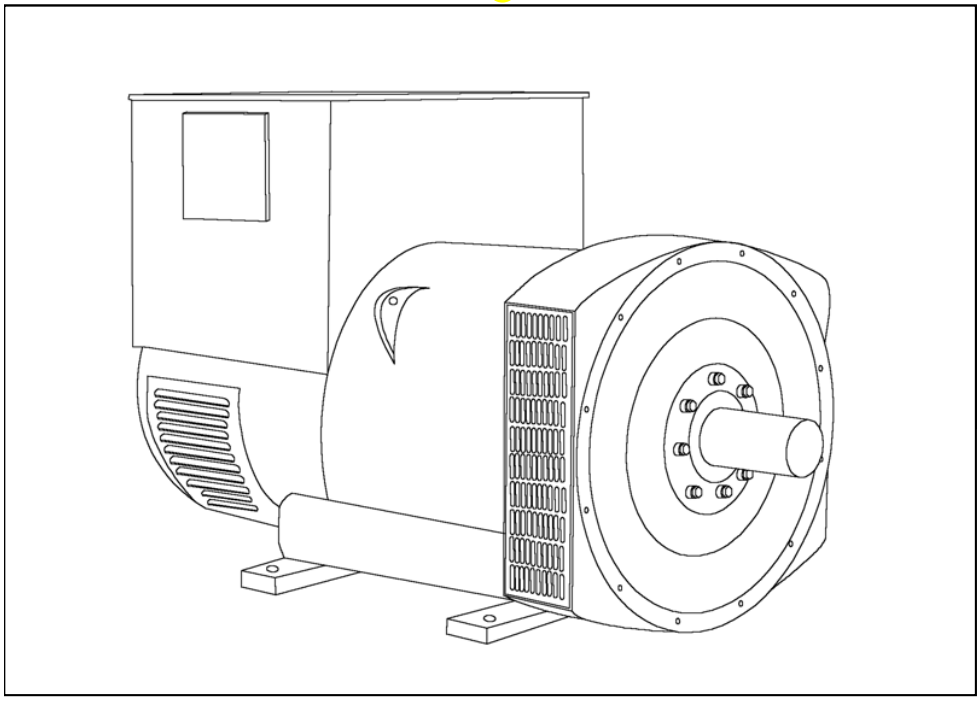
For General Enquiries:
info@cumminsgeneratortechnologies.com

Generator Technologies

STAMFORD®

HCI434D/444D - 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.

HCI434D/444D

STAMFORD

WINDING 17

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

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

INSULATION SYSTEM	CLASS H	
PROTECTION	IP23	
RATED POWER FACTOR	0.8	
STATOR WINDING	DOUBLE LAYER LAP	
WINDING PITCH	TWO THIRDS	
WINDING LEADS	12	
STATOR WDG. RESISTANCE	0.02 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED	
ROTOR WDG. RESISTANCE	1.05 Ohms at 22°C	
EXCITER STATOR RESISTANCE	18 Ohms at 22°C	
EXCITER ROTOR RESISTANCE	0.068 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. 6317 (ISO)	
BEARING NON-DRIVE END	BALL. 6314 (ISO)	
	1 BEARING	2 BEARING
WEIGHT COMP. GENERATOR	940 kg	950 kg
WEIGHT WOUND STATOR	415 kg	415 kg
WEIGHT WOUND ROTOR	361 kg	338 kg
WR² INERTIA	4.0771 kgm^2	3.8783 kgm^2
SHIPPING WEIGHTS in a crate	1010 kg	1010 kg
PACKING CRATE SIZE	155 x 87 x 107(cm)	155 x 87 x 107(cm)
TELEPHONE INTERFERENCE	THF<2%	TIF<50
COOLING AIR	0.99 m³/sec 2100 cfm	
VOLTAGE SERIES STAR	600V	
VOLTAGE PARALLEL STAR	300V	
VOLTAGE SERIES DELTA	346V	
kVA BASE RATING FOR REACTANCE VALUES	375	
Xd DIR. AXIS SYNCHRONOUS	2.96	
X'd DIR. AXIS TRANSIENT	0.18	
X"d DIR. AXIS SUBTRANSIENT	0.13	
Xq QUAD. AXIS REACTANCE	2.54	
X"q QUAD. AXIS SUBTRANSIENT	0.34	
X_L LEAKAGE REACTANCE	0.07	
X_2 NEGATIVE SEQUENCE	0.22	
X_0 ZERO SEQUENCE	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.	0.019s	
T'do O.C. FIELD TIME CONST.	1.7s	
Ta ARMATURE TIME CONST.	0.018s	
SHORT CIRCUIT RATIO	1/Xd	

HCI434D/444D

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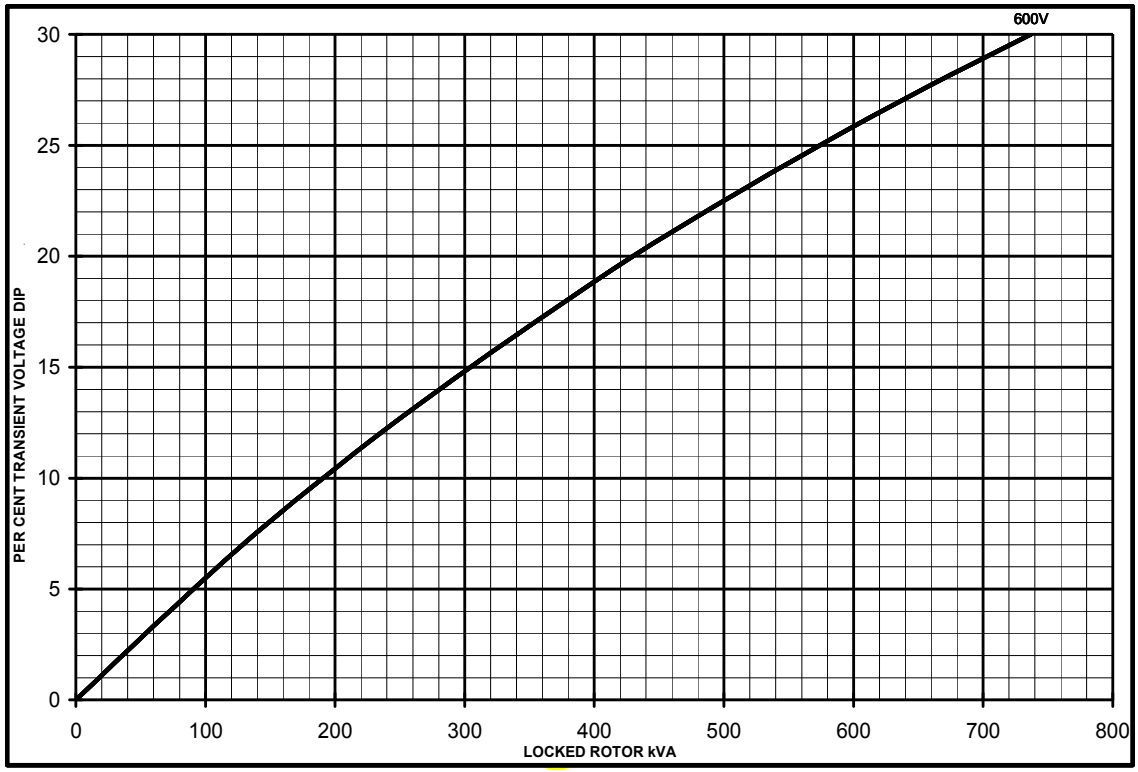
Winding 17

SX

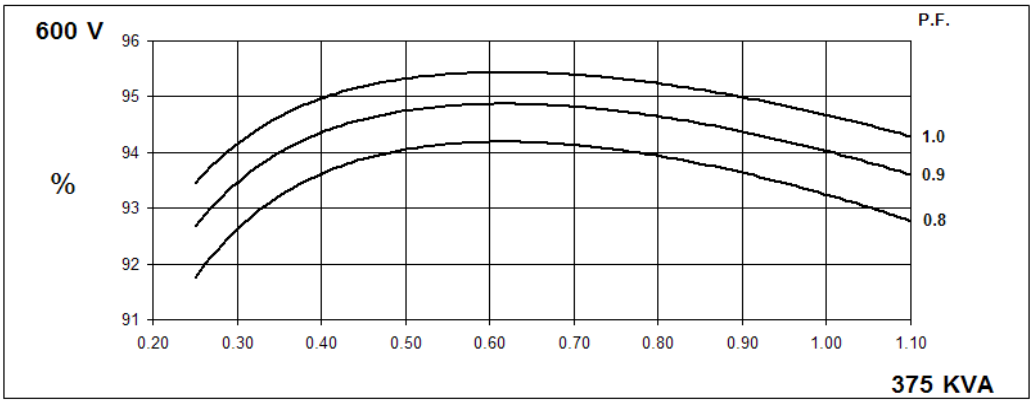
Locked Rotor Motor Starting Curves



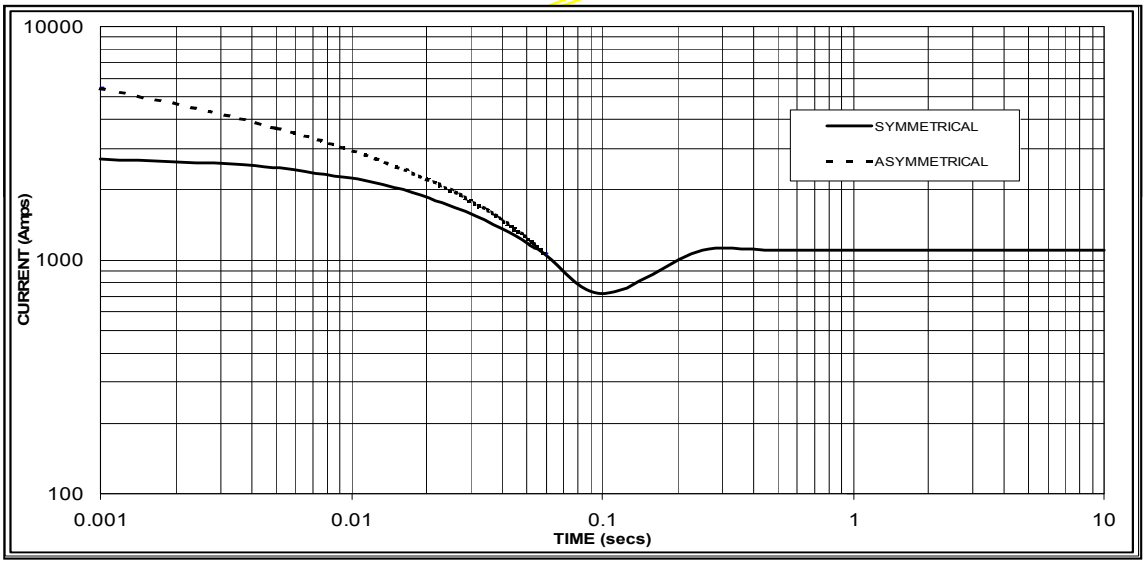
MX

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 = 1100 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

HCI434D/444D

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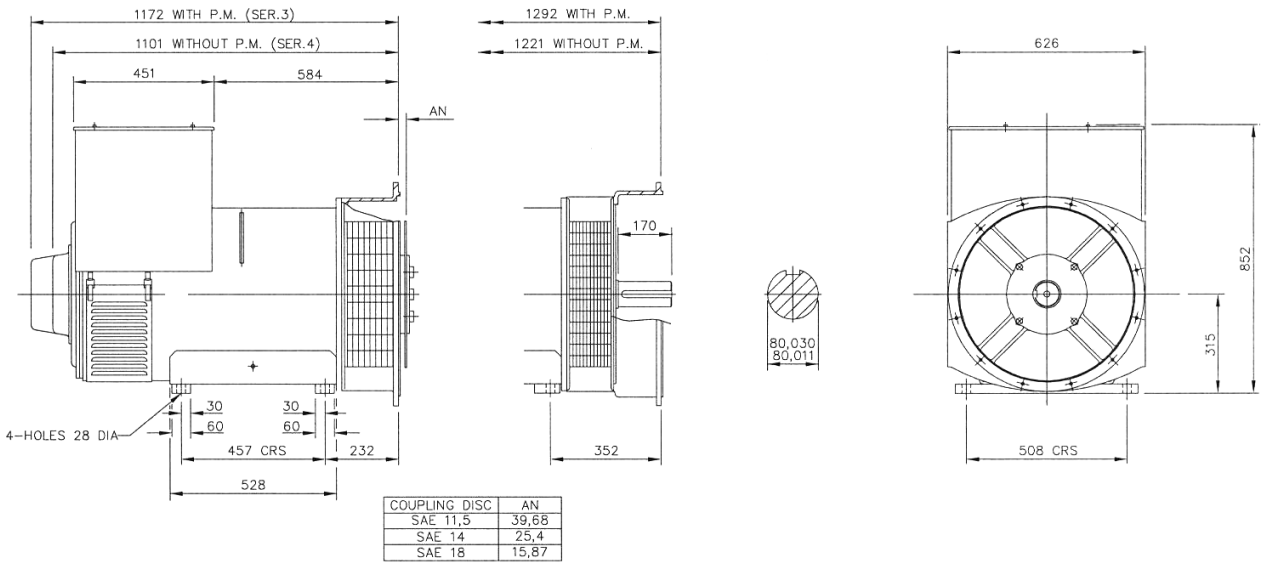
Winding 17 / 0.8 Power Factor

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	345	375	400	415
kW	276	300	320	332
Efficiency (%)	93.6	93.2	92.9	92.7
kW Input	295	322	344	358

DIMENSIONS



COUPLING DISC	AN
SAE 11,5	39,68
SAE 14	25,4
SAE 18	15,87

APPROVED DOCUMENT

STAMFORD

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www.cumminsgeneratortechnologies.com

DGC-2020 Digital Genset Controller

A highly advanced integrated genset control system, this device provides genset control, transfer switch control, metering, protection, and programmable logic in a simple, easy-to-use, reliable, rugged, and cost effective package.

Features

- Generator metering (includes three-phase mains)
- Engine and generator protection: 27, 32R, 40Q, 59, 81O/U
- Optional enhanced generator protection: 47, 51, 78, and 81ROCOF
- Load sharing and generator sequencing (via LSM-2020 Load Share Module)
- Var sharing over Ethernet (via LSM-2020)
- BESTCOMS*Plus*® Software
  - Programming and setup
  - Intuitive and powerful
  - Remote control and monitoring
  - Programmable logic
  - USB communications
- Automatic transfer switch control
- Automatic synchronizer (optional)
- Exercise timer
- SAE J1939 engine ECU communications
- Automatic generator configuration detection
- Expandable functionality via add-on modules
  - LSM-2020 Load Share Module
  - CEM-2020 Contact Expansion Module
  - AEM-2020 Analog Expansion Module
- Multilingual capability
- Remote communications to Basler's RDP-110 (remote display panel)
- Sixteen programmable contact inputs
- Up to 15 contact outputs: 3 contacts rated for 30 Adc and up to 12 programmable contacts rated for 2 Adc

Visit www.basler.com for additional information.

Benefits

- Provides integrated engine-genset control, protection, and metering in a single package.
- The Offline Simulator, provided in BESTlogic™*Plus*, helps test and troubleshoot logic without the need for expensive hardware.
- Flexible programmable logic and programmable I/O make it easy to expand the DGC-2020's inputs and outputs with the CEM-2020 (Contact Expansion Module) and the AEM-2020 (Analog Expansion Module). This saves time and money by eliminating unnecessary external PLCs and control relaying.

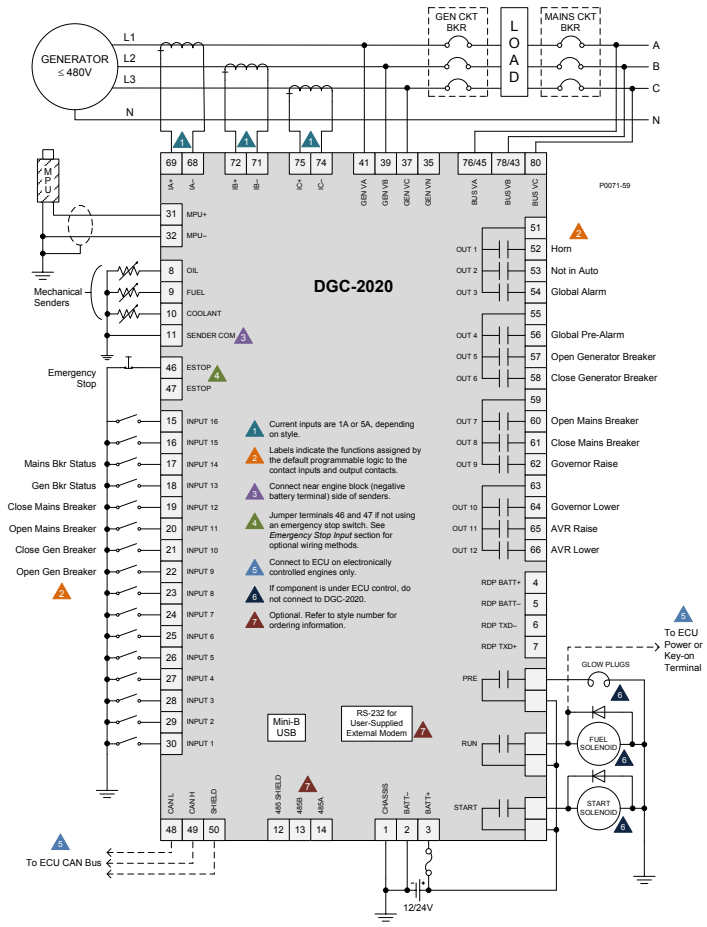


Figure 1 - DGC-2020 Connection Diagram for a Typical Application

DGC-2020 Digital Genset Controller

Specifications

Power Supply

Nominal:	12 or 24 Vdc
Range:	6 to 32 Vdc
Battery Ride Through:	Starting at 10 Vdc, withstands cranking ride-through down to 0 V for 50 ms

Power Consumption

Sleep Mode:	5 W
Normal Operational Mode:	7.9 W
Maximum:	14.2 W

Current Sensing

1 A Sensing:	0.02 to 1.0 Aac, continuous 2 Aac for 1 second
5 A Sensing:	0.1 to 5.0 Aac, continuous 10 Aac for 1 second
Burden:	1 VA

Voltage Sensing

Range:	12 to 576 Vrms L-L
Frequency Range:	10 to 72 Hz for 50/60 Hz style, 10 to 480 Hz for 400 Hz style
Burden:	1 VA
One-second Rating:	720 Vrms

Contact Sensing

Contact Inputs (16):	Accepts normally open (N.O.), Dry Contacts, programmable
Emergency Stop:	Normally closed (N.C.), Dry Contact

Engine Speed Sensing

Magnetic Pickup:	
Voltage Range:	6 to 70 Vpp
Frequency Range:	32 to 10,000 Hz
Generator Frequency:	
Generator Voltage Range:	12 to 576 Vrms
Via ECU over J1939	

Resistive Senders

Fuel Level Sender:	0 to 250 Ω nominal
Coolant Temp Sender:	10 to 2,750 Ω nominal
Oil Pressure Sender:	0 to 250 Ω nominal

Output Contacts

Fuel Solenoid, Engine Crank, Pre-Start Relays Rating:	30 Adc at 28 Vdc-make, break, and carry
Programmable Relays:	Up to 12
Rating:	2 Adc at 28 Vdc-make, break, and carry

Protection

Generator:	27, 32R, 40Q, 59, 81O/U (standard) 47, 51, 78, 81 ROCOF (optional)
Engine:	Oil pressure, coolant temperature, overcrank, ECU-specific elements, and diagnostic reporting.

Agency Approvals

CSA certified, NFPA compliant, CE compliant, UL recognized (Hazardous Location certification available upon request), EAC certified

Communication

USB Port:	USB 2.0, Mini-B jack
RS-485 (optional):	9600 baud, 8 data bits, no parity
RDP-110 (optional):	4,000 ft (1,219 m) max wire length, 20 AWG (0.52 mm²) min wire size
Modem (optional):	DB-9 connector (male)
CAN bus:	250 kb/s communication rate, 1.5 to 3 Vdc differential bus

Environmental

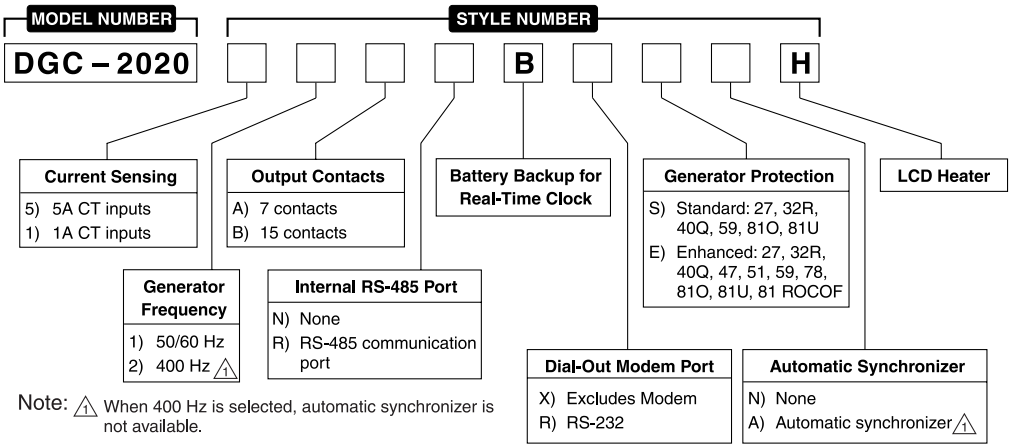
Operating Temp:	-40°C to 70°C (-40°F to 158°F)
Storage Temp:	-40°C to 85°C (-40°F to 185°F)
Humidity:	IEC 68-2-38
Salt Fog:	ASTM B 17-73, IEC 68-2-11
Ingress Protection:	IEC IP54 for front panel
Shock:	15 G in three perpendicular planes
Vibration:	
5 to 29 Hz:	1.5 G peak
29 to 52 Hz:	0.036″ (0.914 mm) double amplitude
52 to 500 Hz:	5 G peak

Physical

Weight:	4.4 lb (2 kg)
Dimensions (WxHxD):	
	11.77 x 8.27 x 2.69 inches (299 x 210 x 69 mm)

For complete specifications, download the instruction manual at www.basler.com.

Style Chart



Note: 1 When 400 Hz is selected, automatic synchronizer is not available.

Related Products

- BE1-11*g* Generator Protection System
  - A complete generator protection system.
- DECS-250 Digital Excitation Control System
  - Total control in a compact package provides precise voltage, var and power factor regulation, exceptional system response, and generator protection.

Accessories

- AEM-2020 Analog Expansion Module
  - Easily increases the functionality by seamlessly adding analog inputs and outputs.
- CEM-2020, CEM-2020H Contact Expansion Module
  - Each module adds 10 inputs and up to 24 outputs that are easily programmed through BESTCOMS*Plus*® for easy integration into the system.
- LSM-2020 Load Share Module
  - The simple-to-use LSM-2020 easily adds paralleling capabilities with little effort and expense.
- RDP-110 Remote Display Panel
  - Provides remote alarm and pre-alarm indication and annunciation of system status, easily meeting the annunciation requirements of NFPA-110 applications.

ISO 9001-2008
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111 North Bridge Road #15-06 Peninsula Plaza
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e-mail: singaporeinfo@basler.com

Molded Case Circuit Breakers

Power Defense ™ UL Global Series

Part Number: PDG33G0400B2NJNNNNNN

Powering Business Worldwide

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	PDG33G0400B2NJNNNNNN
Frame Size	Frame 3
Poles	3 Pole
Voltage	480V AC
Interruption or Breaking Capacity (Icu/Ics)	35kA
Continuous Current Rating (In)	400A
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) 3/0 - 250
Line Terminal Type	Aluminum
Load Type Description	Option 1 - Standard Terminal
Load Conductor Options	(2) 3/0 - 250
Load Terminal Type	Aluminum
Special Options - Type of Modification	None
Details	None
Additional Description	None

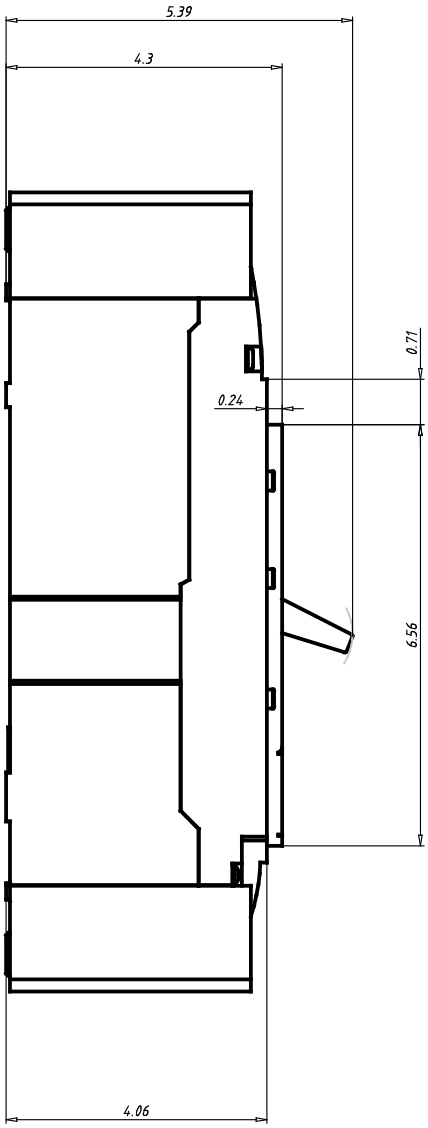
Molded Case Circuit Breakers

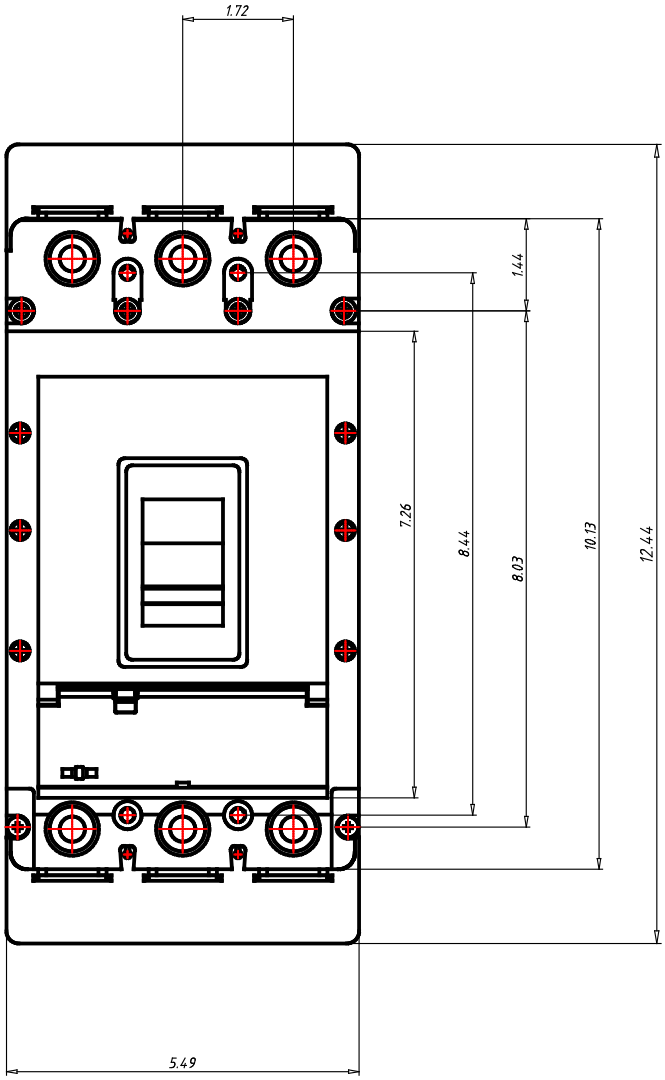
Power Defense ™ UL Global Series

Part Number: PDG33G0400B2NJNNNNNN

Datasheet creation date: 02/12/2019

Technical drawings





Molded Case Circuit Breakers

Power Defense ™ UL Global Series

Part Number: PDG33G0400B2NJNNNNNN

Powering Business Worldwide

Datasheet creation date: 02/12/2019

General Technical Data

Frame Rating (In)	400A
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 / Y / 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	160 - 400A
100% UL489 Rated	Yes
Instantaneous/Short Circuit Range	2 - 10 In
Magnetic/Instantaneous Override	4400A
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: PDG33G0600B2NJNNNNNN

Powering Business Worldwide

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

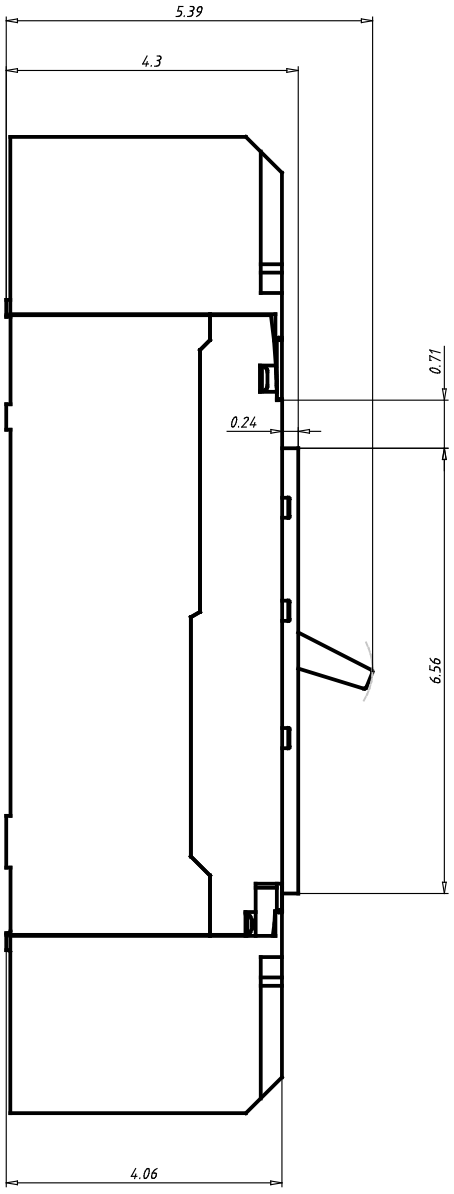
Molded Case Circuit Breakers

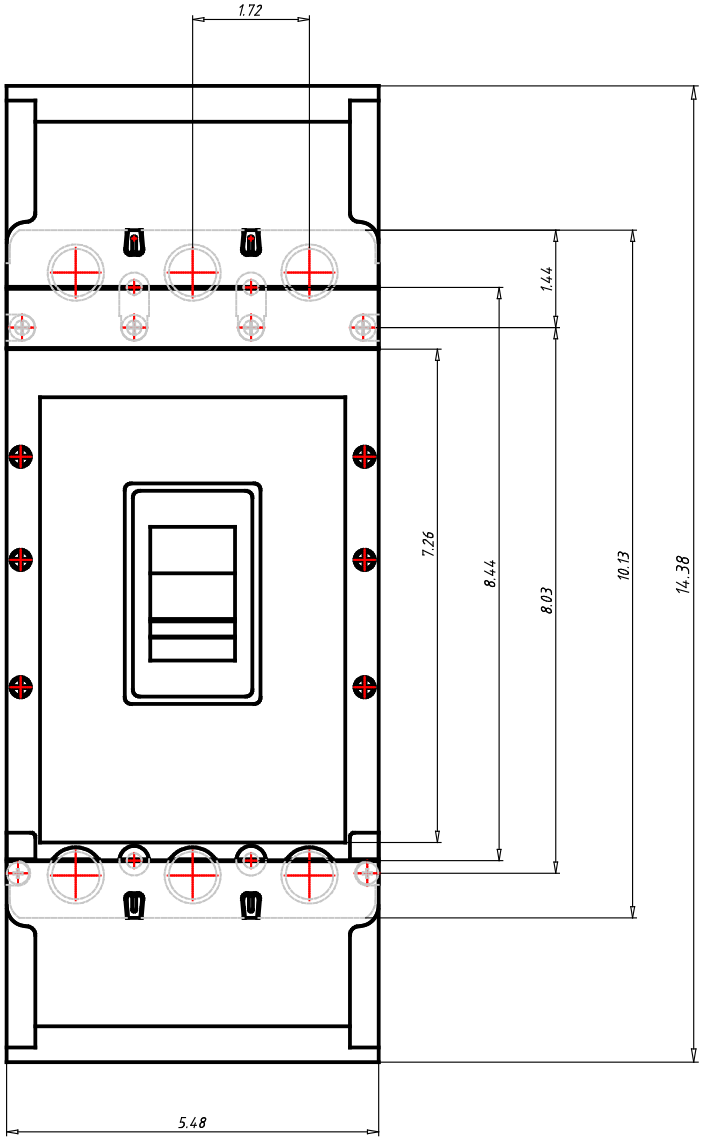
Power Defense ™ UL Global Series

Part Number: PDG33G0600B2NJNNNNNN

Datasheet creation date: 02/12/2019

Technical drawings





Molded Case Circuit Breakers

Power Defense ™ UL Global Series

Part Number: PDG33G0600B2NJNNNNNN

Powering Business Worldwide

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: PDG53K1200E3RNNNNNNN

Powering Business Worldwide

Datasheet creation date: 19/08/2019

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	PDG53K1200E3RNNNNNNN
Frame Size	Frame 5
Poles	3 Pole
Voltage	480V AC
Interruption or Breaking Capacity (Icu/Ics)	50kA
Continuous Current Rating (In)	1200A
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

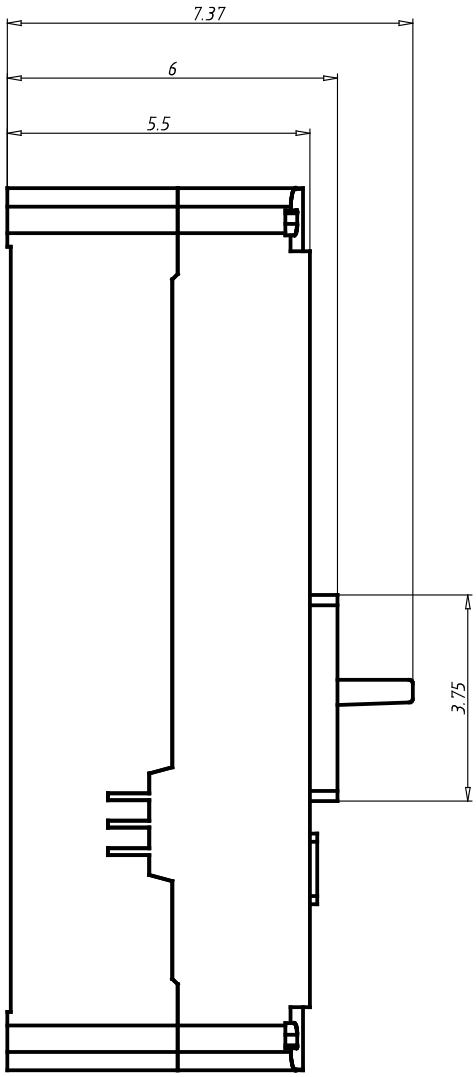
Molded Case Circuit Breakers

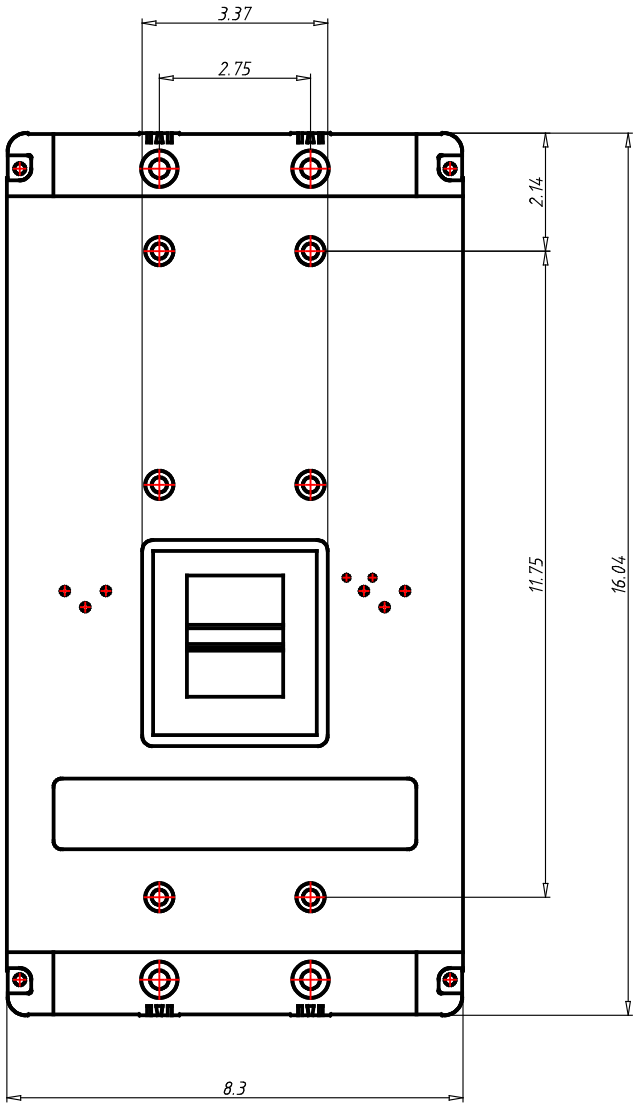
Power Defense ™ UL Global Series

Part Number: PDG53K1200E3RNNNNNNN

Datasheet creation date: 19/08/2019

Technical drawings





Molded Case Circuit Breakers

Power Defense ™ UL Global Series

Part Number: PDG53K1200E3RNNNNNNN

Powering Business Worldwide

Datasheet creation date: 19/08/2019

General Technical Data

Frame Rating (In)	1200A
Reference Standard	UL489, CSA 22.2, IEC 60947-2 & GB
Number of poles	3
Neutral rating	-
Interruption Rating Designator	K / M / N / P / T
UL Interruption Rating to UL 489 (240Vac)	85 / 100 / 150 / 200 / 200kA
UL Interruption Rating to UL 489 (480Vac)	50 / 65 / 85 / 100 / 150kA
UL Interruption Rating to UL 489 (600Vac)	25 / 35 / 50 / 65 / 65kA
UL Interruption Rating to UL 489 (125/250Vdc)	
UL Current Limiting	-
Rated breaking capacity to IEC 60947-2 (220-240 Vac Icu)	85 / 100 / 150 / 200kA
Rated breaking capacity to IEC 60947-2 (220-240 Vac Ics)	85 / 100 / 100 / 150kA
Rated breaking capacity to IEC 60947-2 (380-415 Vac Icu)	50 / 70 / 70 / 100kA
Rated breaking capacity to IEC 60947-2 (380-415 Vac Ics)	50 / 50 /50 /50kA
Rated breaking capacity to IEC 60947-2 (440 Vac Icu)	35 / 50 / 70 / 100kA
Rated breaking capacity to IEC 60947-2 (440 Vac Ics)	35 / 40 / 50 / 50kA
Rated breaking capacity to IEC 60947-2 (525 Vac Icu)	25 / 30 / 35 / 40kA
Rated breaking capacity to IEC 60947-2 (525 Vac Ics)	20 /25 / 25 / 25kA
Rated breaking capacity to IEC 60947-2 (690 Vac Icu)	10 / 15 / 20 / 35kA
Rated breaking capacity to IEC 60947-2 (690 Vac Ics)	5 / 7.5 / 10 / 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	500 - 1200A
100% UL489 Rated	Yes
Instantaneous/Short Circuit Range	2 - 10 In
Magnetic/Instantaneous Override	14400A
Dimensions H x W x D (inches)	16 x 8.25 x 5.5
Pole to pole distance inches	2,75
Approx Weight lbs	45
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

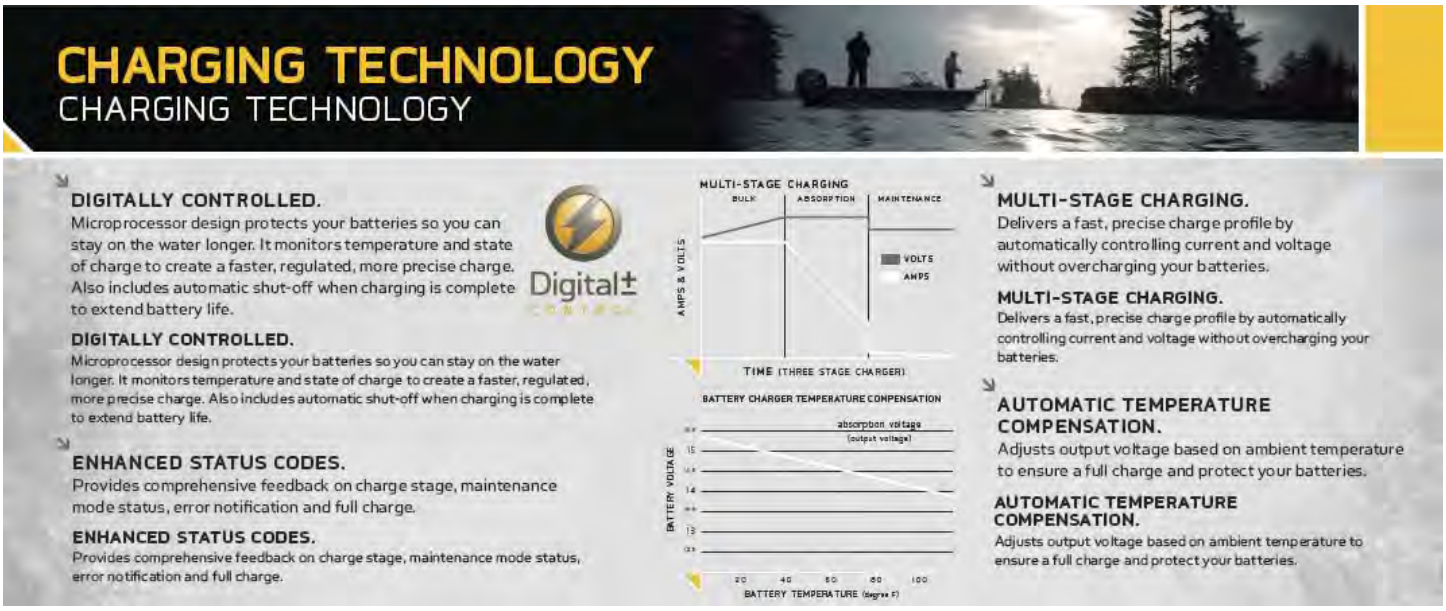
- Waterproof, shock-and vibration-resistant aluminum construction
- Saltwater tested and fully corrosion-resistant
- Short circuit, reverse polarity, and ignition protected
- For use with 12V/6 cell batteries that are flooded/wet cell, maintenance free or starved electrolyte (AGM) only
- FCC compliant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

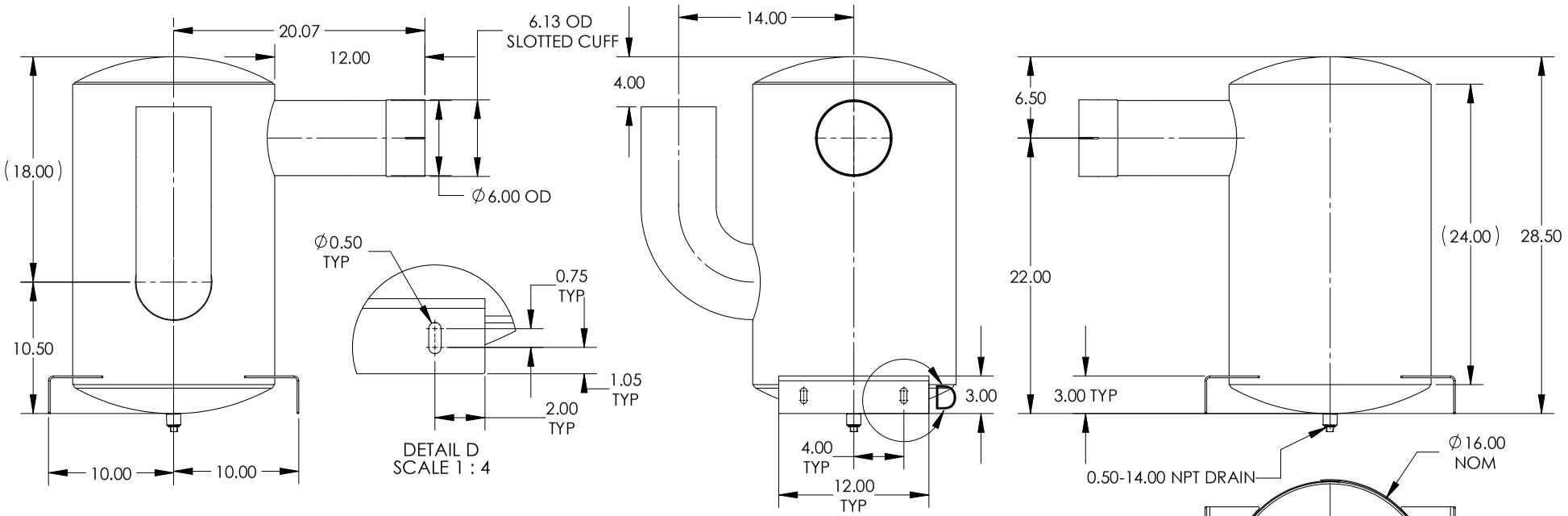
DIGITAL LINEAR ON-BOARD CHARGERS	
PRODUCT CODE	PRODUCT DESCRIPTION
1821065	MK 106D (1 bank x 6 amps)
1821105	MK-110D (1 bank x 10 amps)
1822105	MK-210D (2 bank x 5 amps)
1823155	MK-315D (3 bank x 5 amps)
1822205	MK-220D (2 bank x 10 amps)
1823305	MK-330D (3 bank x 10 amps)
1824405	MK-440D (4 bank x 10 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)

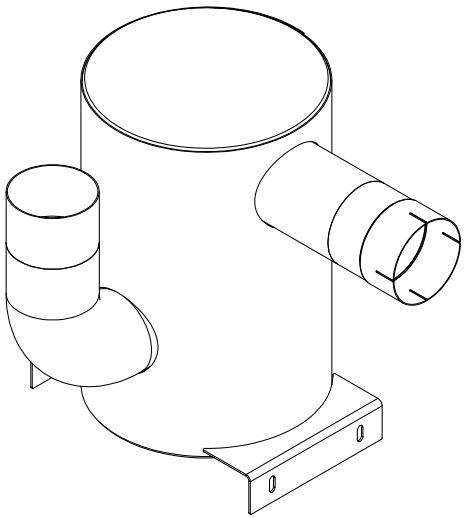
Digital Linear Chargers

Specifications (cont.)

- New 4-color package design







REV.	BY	DATE	DESCRIPTION	ECO
A	CB	09/15/2017	OVERALL LENGTH EXTENDED	---

CUSTOMER	CUSTOMER P/N
---	---

ENGINE INFORMATION	
ENGINE MAKE	MTU
ENGINE MODEL	10V1600
DISPLACEMENT	854
EXHAUST FLOW	3623
EXHAUST TEMPERATURE	892
MAX BACK PRESSURE	60
RAW SOUND PRESSURE	---

SILENCER INFORMATION	
RESONATOR FREQUENCY	---
RESONATOR ALPHA	---
SILENCER Km	---
SILENCER IL	---

TOLERANCES DO NOT APPLY TO GAGE THICKNESS OR COMMERCIAL FEATURES

THIRD ANGLE PROJECTION

DRAWN BY	CB	08/23/2017
CHECKED BY	CB	09/15/2017
ENGINEERING	CB	09/15/2017
MANUFACTURING	CB	09/15/2017

TOLERANCES UNLESS OTHERWISE SPECIFIED
X = ±0.25 ALL ANGLES
.XX = ±0.125 ±1°
.XXX = ±0.0625
.XXXX = ±0.03125

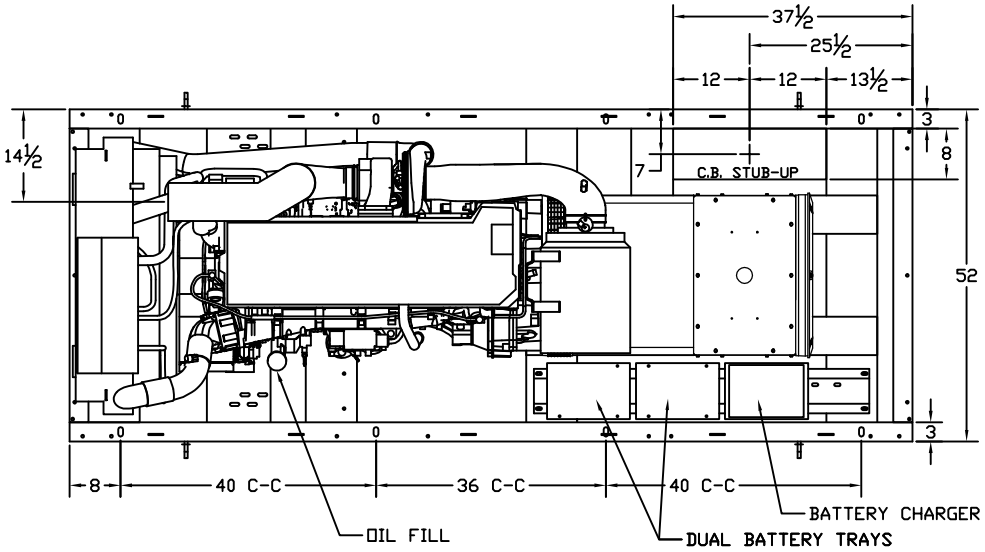
WEIGHT (LBS)	80
SHEET	3 OF 3

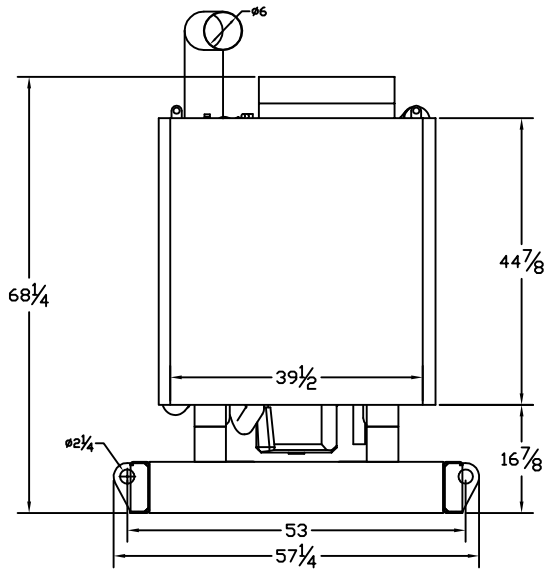
BERGARI SOLUTIONS
member of the mandengroup

DESCRIPTION	SIL: COMP CRIT CS S-E 6.00-6.00 Ø16.00 28.50 OAL F:6.50 ---
CONSTRUCTION MATERIAL	CS
FINISH	HIGH TEMP BLACK PAINT
PART NUMBER	500-008549
REV	A
SCALE (DO NOT SCALE)	1:8
SHEET SIZE	B

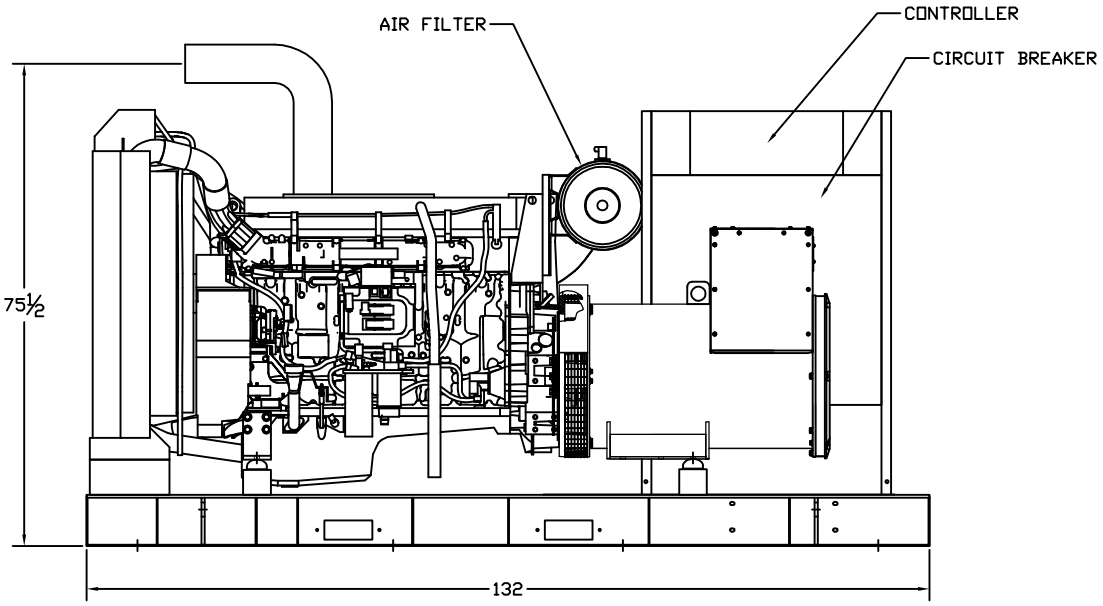
OUTLINE DIMENSIONS FOR SPVD-3000 OPEN

TOP VIEW





RADIATOR END VIEW

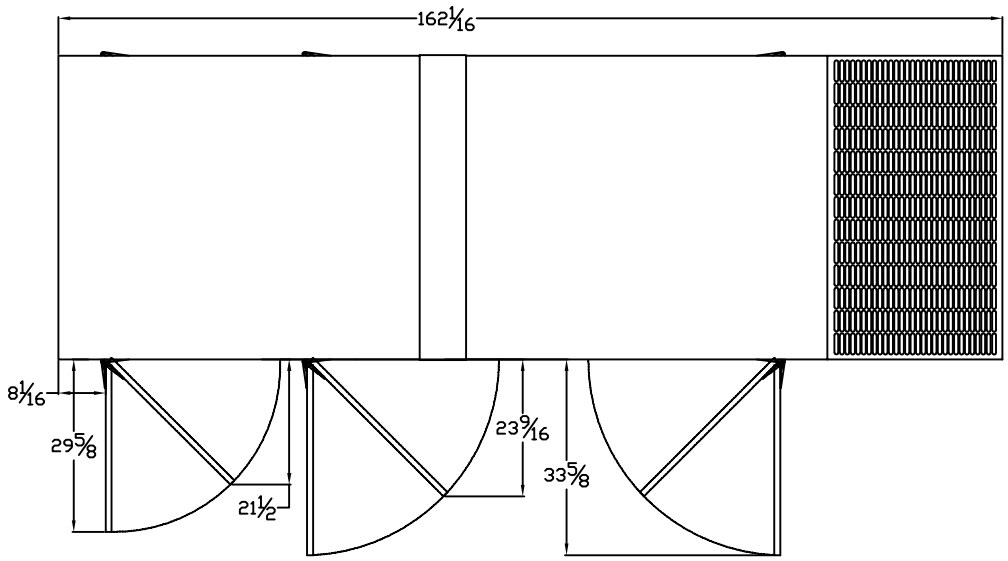


RIGHT SIDE VIEW

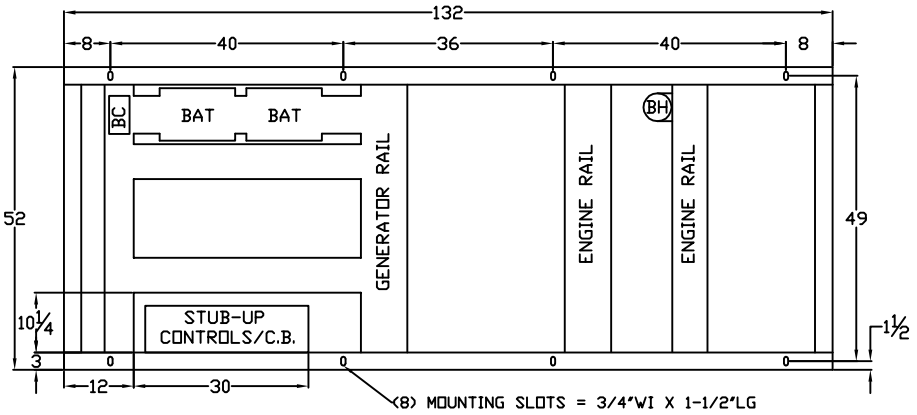
OUTLINE DIMENSIONS FOR SPVD 250 - 400 KW LEVEL 2 ENCLOSURE
(HINGED DOORS)

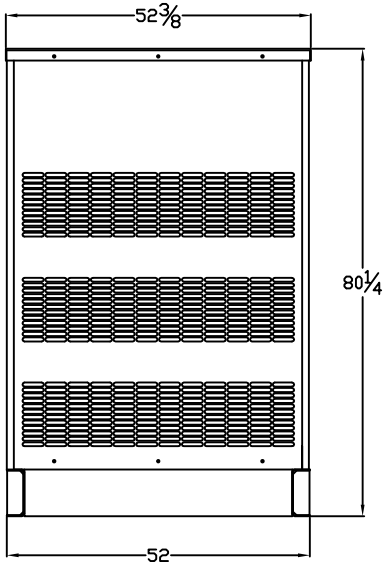
TOP VIEW

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

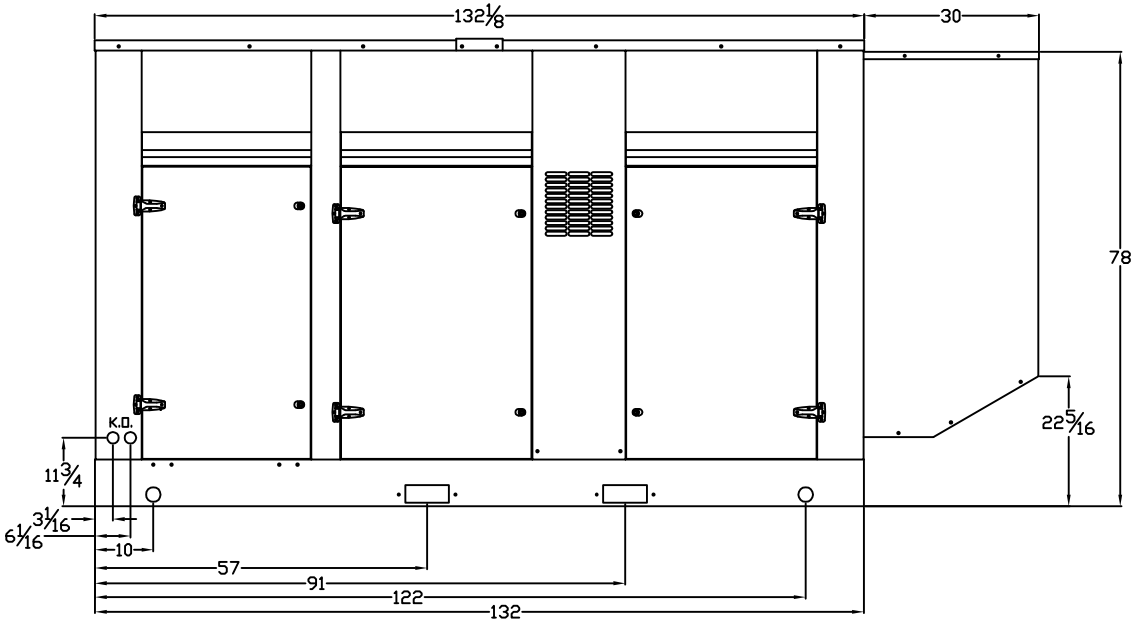


FRAME VIEW

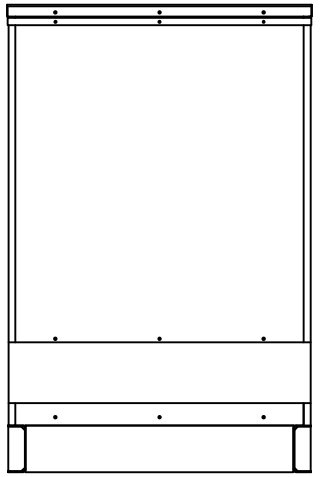




GENERATOR END VIEW



SIDE VIEW



RADIATOR END VIEW

SPVD-2500-4000-L2-GENERATOR-SET-HINGES-OVERVIEW-20180224