



GILLETTE GENERATORS

LIQUID COOLED DIESEL ENGINE GENERATOR SET

60 HZ MODEL
T4D-5500

Model	HZ	STANDBY	PRIME
		130°C RISE	105°C RISE
T4D-5500-60 HERTZ	60	550	500



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

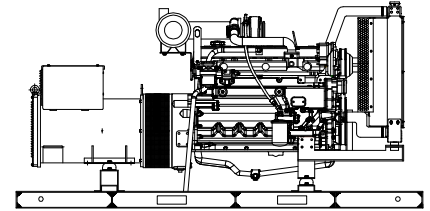


ASCE 7-05 & 7-10

All generator sets meet 180 MPH rating.

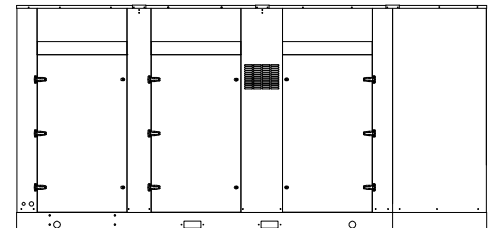


EPA 40CFR Part 60, 89, 1039, 1048, 1054, 1065, 1068



“OPEN” GEN-SET

There is no enclosure, so gen-set must be placed within a weather protected area, uninhabited 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	130°C RISE STANDBY RATING		105°C RISE PRIME RATING	
	L-N	L-L			KW/KVA	AMP	KW/KVA	AMP
T4D-5500-3-2	120	208	3	60	550/688	1911	500/625	1737
T4D-5500-3-3	120	240	3	60	550/688	1656	500/625	1505
T4D-5500-3-4	277	480	3	60	550/688	828	500/625	753
T4D-5500-3-5	127	220	3	60	550/688	1806	500/625	1642
T4D-5500-3-16	346	600	3	60	550/688	662	500/625	602

RATINGS: All three phase gen-sets are 12 lead windings, rated at .8 power factor. 130° 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. 105° C “PRIME RATINGS” are strictly for gen-sets that 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, on every 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 130°C (standby), and 105°C (prime) 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 T4D-5500-60 HZ

GENERATOR SPECIFICATIONS

Manufacturer..... Stamford Generators
Model & Type..... HCI534E-311, 4 Pole, 12 Lead, Three Phase
.....HCI534E-17, 4 Pole, 12 Lead, 600V, Three Phase
Exciter.....Brushless, shunt excited
Voltage Regulator.....Solid State, HZ/Volts
Voltage Regulation.....½%, No load to full load
Frequency.....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.....105°C R/R, prime rating @ 40°C amb.
3 Ø Motor Starting @ 30% Voltage Dip (208-240V)...1500 kVA
3 Ø Motor Starting @ 30% Voltage Dip (480V-600V)2300 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..... TWD1672GE, 4 cycle, liquid Cooled
Aspiration..... Turbo After Cooler, H2O to Air
Charged Air Cooled System..... H2O to Air
Cylinder Arrangement.....6 Cylinders, In-Line
Displacement Cu. In. (Liters).....984 (16.1)
Bore & Stroke in (Cm).....5.67 x 6.50 (14.4 x 16.5)
Compression Ratio.....16.8:1
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.....836 (615)
BMEP: psi (MPa) Standby.....331 (2.3)
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	PRIME
100% LOAD	39.9 (151)	35.9 (136)
75% LOAD	28.8 (109)	26.0 (98.0)
50% LOAD	19.1 (72.0)	17.5 (66.0)

OIL SYSTEM

Type..... Full Pressure
Oil Pan Capacity qt. (L).....50.7 (48)
Oil Pan Cap. W/ filter qt. (L).....44.3 (42)
Oil Filter.....3, Replaceable Cartridge type

ELECTRICAL SYSTEM

Ignition System.....Electronic
Eng. Alternator/Starter: 24 VDC, negative ground, 110 amp/hr.

Recommended battery to -18°C (0° F):(2) 12 VDC, BCI# 31,
Max. Dimensions: 14”lg x 6 3/4” wi x 10” hi, with standard
round posts. Min output 1000 CCA. Battery tray (max. dim. at
15”lg x 7”wi). This model has (2) battery trays, (2) hold down
straps, (2) sets of battery cables, and (1) battery charger.
Installation of (2) 12VDC starting batteries connected in series
for 24VDC output is required, with possible higher AMP/HR
rating, as described above, if the normal environment
temperature averages -13° F (-25°C) or cooler.

CERTIFICATIONS

All engines are EPA emissions certified. All non-emergency
stationary diesel engines are Tier IV Final compliant.

APPLICATION & ENGINEERING DATA FOR MODEL T4D-5500-60 HZ

COOLING SYSTEM

Type of System	Air to Air, Charged Air Cooler
Coolant Pump	Pre-lubricated, self-sealing
Cooling Fan Type	Pusher
Fan Diameter inches (cm).....	35.1 (89)
Fan drive ratio.....	1.04:1
Ambient Capacity of Radiator °F (°C).....	131 (55)
Engine Jacket Coolant Capacity gal. (L).....	8.70 (33)
Radiator Coolant Capacity gal. (L).....	16.0 (60)
Water Pump Capacity gpm (L/min).....	122 (462)
Heat Reject Coolant: Btu/min.....	12,682
Air to Air Heat Reject, BTU/min.	11,715
Heat Radiated to Ambient, BTU/min	4,253
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)	1,646 (46.6)
Max Air Intake Restrictions:	
Clean Air Cleaner, KPA (psi).....	5 (1.5)
Radiator Cooling Air, SCFM (m ³ /min).....	29,894 (846)

EXHAUST SYSTEM

Exhaust Outlet Size.....	10"
Max. Back Pressure in KPA (in. H2O).....	10 (40)
Exhaust Flow, at rated KW, CFM (m ³ /min).....	4,347 (123)
Exhaust Temp, (Stack) °F (°C)	932 (500)

SOUND LEVELS MEASURED IN dB(A)

	Open Set	Level 2 Encl.
Level 2, SCR/Residential Silencer	98.....	83

Note: Open sets (no enclosure) have installed selective catalytic reduction/residential silencer system. Level 2 enclosure has installed selective catalytic reduction/residential silencer. Sound tests are averaged from several test points and taken at 23 ft. (7 m) from source of noise at normal operation.

DERATE GENERATOR FOR ALTITUDE

3% per 1000 ft. (305m) above 3000 ft. (914m) from sea level

DERATE GENERATOR FOR TEMPERATURE

2% per 10°F (5.6°C) above 104°F (40°C)

DIMENSIONS AND WEIGHTS

	Open Set	Level 2 Enclosure
Length in (cm).....	152 (368)	200 (508)
Width in (cm).....	72 (183)	72 (183)
Height in (cm).....	116 (295)	94 (239)
3 Ø Net Weight lbs (kg).....	9625 (4366) ..	14850 (6736)
3 Ø Ship Weight lbs (kg)	10025 (4547) ..	15250 (6917)

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 BESTCOMSPPlus 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 T4D-5500-60 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 • Engine fail to start
 - High engine temp • Engine over speed
 - Low Radiator Level • Engine under speed
 - Three auxiliary alarms • Over & under voltage
 - Battery fail alarm

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.

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:

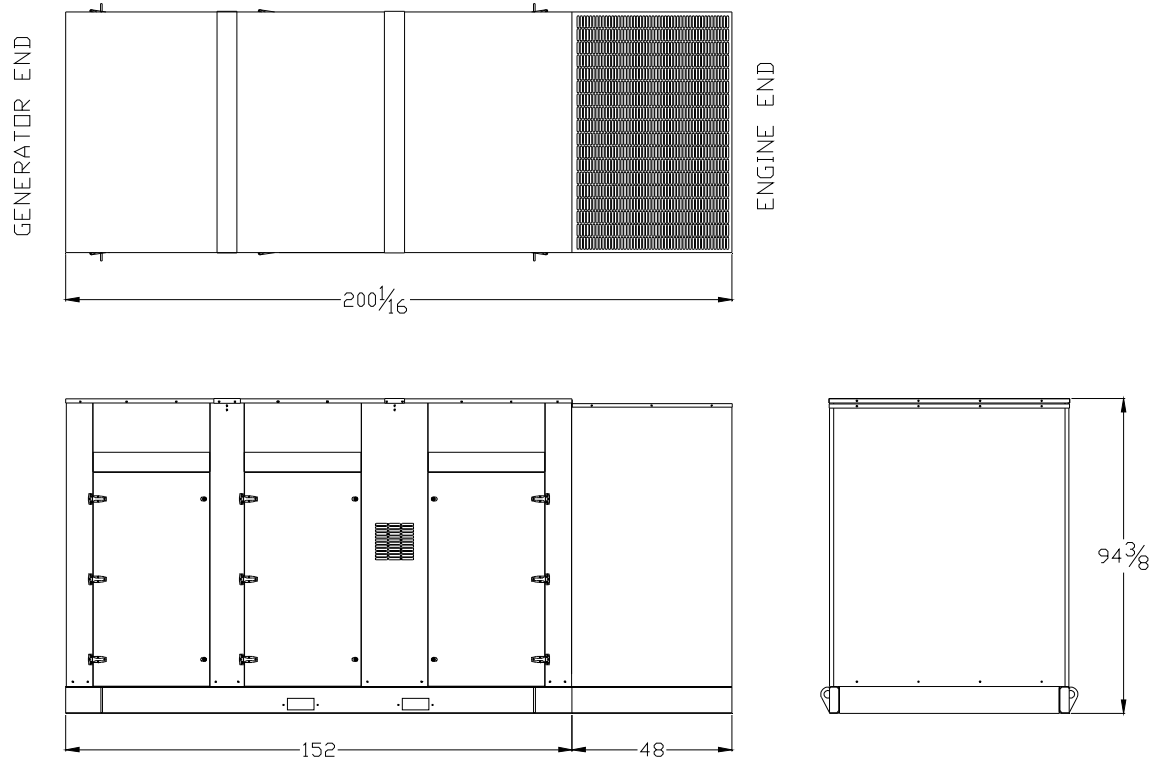
- Battery trays • Battery cables • Battery hold down straps • 3-stage battery charger with float, absorption, & bulk automatic charge stages

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

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



TWD1672-1673GE

615 kW (836 hp) & 685 (932) at 1800 rpm, acc. to ISO 3046

US EPA & CARB Tier 4 Final

A powerful, reliable and economical generating set diesel engine range built on the proven Volvo Group in-line six concept.

Powerful package

High power density in a compact package with dual stage turbo charging. Excellent load step performance according to ISO 8528-5.

Low cost of ownership & operation

World class fuel efficiency in combination with a proven and reliable engine and exhaust aftertreatment system design. The exhaust aftertreatment system consists of only SCR, without EGR, DOC or DPF. Minimal of components are used and no downtime for regeneration or decreased service intervals. No EGR also results in less heat rejection, leading to excellent power density and improved fuel economy.

Compact & simple installation

SCR technology selected by Volvo Group does not increase the amount of cooling capacity needed. In combination with the compact engine design, installation is easy with minor impact on existing installation layout. Installation guidelines as well as drawings and CAD models are easy to access.

Durability & low noise

Volvo Group's long experience with SCR systems in combination with base engine development reduces risk of downtime. Well-balanced to produce smooth and vibration free operation with low noise.

Low exhaust emission

Efficient injection as well as robust engine design in combination with SCR technology contributes to excellent combustion and low fuel consumption.

Easy service & maintenance

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



- Proven and straight-forward design - built on Volvo Group technology
- Low cost of ownership and operation
- SCR only - no EGR, DOC, DPF or regeneration
- High efficient cooling system
- Excellent step load performance acc. to ISO 8528-5
- Compact, simple installation and easy to service
- Available as Genpac or Base engine configuration

60 Hz/1800 rpm

Engine	Prime power			Standby power			Generator eff.
	kWm	kWe	kVa	kWm	kWe	kVa	(%)
TWD1672GE	532	508	635	585	559	698	95,5
TWD1673GE	595	570	713	655	625	781	95,5

TWD1672-1673GE

Technical Data

Engine designation	TWD1672-1673GE
Configuration and no. of cylinders	in-line 6
Displacement, l (in ³)	16.12 (983.9)
Method of operation	4-stroke
Bore, mm (in.)	144 (5.67)
Stroke, mm (in.)	165 (6.50)
Compression ratio	16.8:1
Wet weight, engine only, kg (lb)	1810 (3390)
Wet weight, Genpac (engine, cooling system, air filtration system and frame kg (lb)	2767(6100)

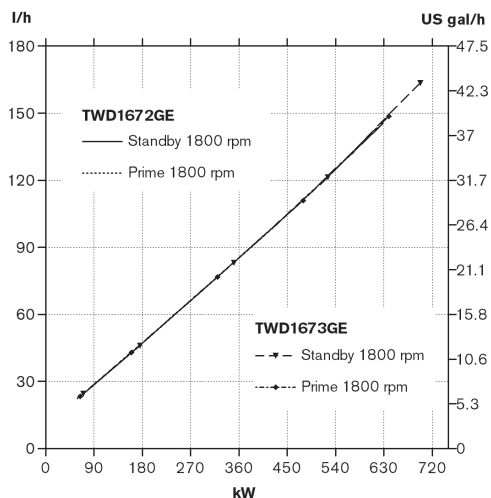
Performance (with fan, kW (hp)) 1800 rpm

TWD1672GE

Prime Power	532 (724)
Standby Power	585 (796)
Fan power consumption	30 (41)

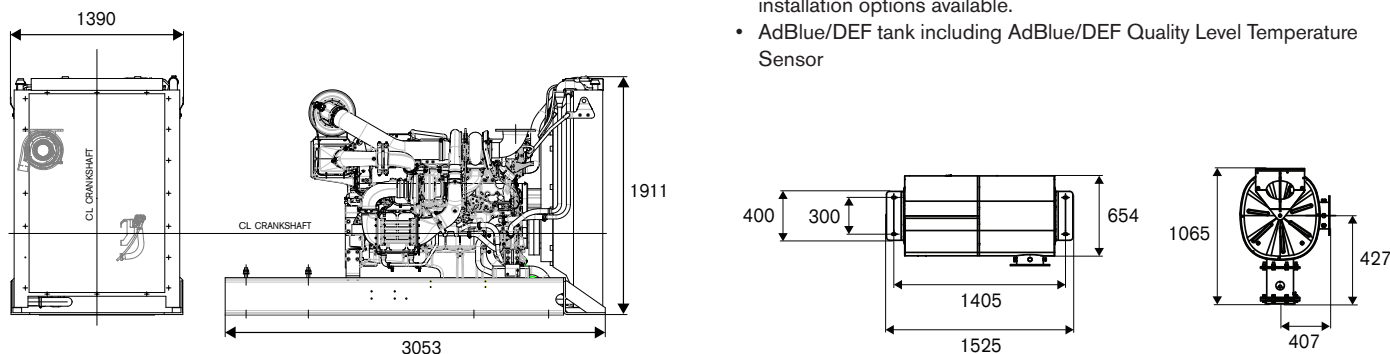
TWD1673GE

Prime Power	595 (809)
Standby Power	655 (891)
Fan power consumption	30 (41)



Dimensions

Not for installation. Dimensions in mm.



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 governing 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 kW = 1 hp x 1.36
1 hp = 1 kW x 0.7355

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% at 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

Additional information

For additional information, please contact your Volvo Penta representative or visit www.volvopenta.com

Technical description

Engine and block

- Cast iron cylinder block with optimum distribution of forces without the block being unnecessarily heavy.
- Wet, replaceable cylinder liners
- 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
- 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

Fuel system

- Electronic high pressure unit injectors
- Fuel prefilter with water separator and water-in-fuel indicator / alarm
- 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.
- Belt driven coolant pumps with high degree of efficiency
- Water-cooled charge air coolers

Turbo charger

- Efficient and reliable dual stage turbo chargers
- Intermediate charge air coolers for both turbo chargers
- Waste gate system for the high pressure turbo charger

Electrical system

- Engine Management System 2.3 (EMS 2.3), 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. The DCU is a control panel with display, engine control, monitoring, alarm, parameter setting and diagnostic functions. It also presents error codes in clear text. The DCU makes it possible to install and combine several sets of analogue and digital instruments.
- Sensors for oil pressure, oil temp, boost pressure, boost temp, coolant temp, fuel temp, water in fuel, fuel pressure and two speed sensors.

Exhaust aftertreatment system

- SCR only. No EGR, DOC, DPf or regeneration. Wide range of installation options available.
- AdBlue/DEF tank including AdBlue/DEF Quality Level Temperature Sensor

Important

This Technical Data Sheet and the corresponding Installation Instructions provide important information to ensure the installed engine will operate according to the design specification in the Volvo Penta application for certification.

Requirements marked with  are considered as critical for exhaust emissions compliance according to the design specification in the Volvo Penta application for certification.

Failing to follow and meet these instructions and requirements when installing a certified engine in a piece of nonroad equipment for use in the United States violates U.S. federal law (40 CFR 1068.105(b)), subject to fines or other penalties as described in the Clean Air Act.

General

In-line four stroke diesel engine with direct injection. Rotation direction, anti-clockwise viewed towards flywheel. Turbocharged

Number of cylinders			6
Displacement, total		litre	16,12
		in ³	983,9
Firing order			1-5-3-6-2-4
Bore		mm	144
		in	5,67
Stroke		mm	165
		in	6,50
Compression ratio			16,8:1
Wet weight (Not including after treatment system)	Engine only	kg	1810
		lb	3990
	Engine incl. cooling system and air filtration system	kg	2217
		lb	4888
	Frame	kg	550
		lb	1213
	Compensator and Mixer pipe	kg	25
		lb	55
	EATS Muffler	kg	188
		lb	414

VOLVO PENTA TWD1672GE	Document No	Issue Index
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Performance		rpm	1500	1800
Prime Power	without fan	kW	NA	562
		hp	NA	764
	with fan	kW	NA	532
		hp	NA	724
Standby Power	without fan	kW	NA	615
		hp	NA	836
	with fan	kW	NA	585
		hp	NA	796
Torque at:	Prime Power	Nm	NA	2982
		lbft	NA	2199
	Standby Power	Nm	NA	3263
		lbft	NA	2406
Mean piston speed		m/s	NA	9,9
		ft/sec	NA	32,6
Effective mean pressure at:	Prime Power	MPa	NA	2,3
		psi	NA	337
Effective mean pressure at:	Standby Power	MPa	NA	2,5
		psi	NA	369
Max combustion pressure at:	Prime Power	MPa	NA	21
		psi	NA	3046
Max combustion pressure at:	Standby Power	MPa	NA	21,8
		psi	NA	3162
Total mass moment of inertia, J (mR ²)		kgm ²	2,50	
		lbft ²	59,3	
Total mass moment of inertia, J (mR ²) without flywheel		kgm ²	1,92	
		lbft ²	45,6	
Friction Power		kW	NA	51
		hp	NA	69,4

Derating due to altitude - see Technical Diagrams

Engine noise emission

Test Standards: ISO 3744-1981 (E) sound power

Tolerance ± 0.75 dB(A)

		rpm	1500	1800
Measured sound power Lw	No load	dB(A)		118,1
	Prime Power	dB(A)		118,4
	Standby Power	dB(A)		118,5
Calculated sound pressure Lp at 1 m	No load	dB(A)		101,1
	Prime Power	dB(A)		101,4
	Standby Power	dB(A)		101,5

VOLVO PENTA TWD1672GE	Document No	Issue Index
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Test conditions for load acceptance data

Warm engine.	Generator	Model	Type of AVR
	Stamford	HCM534F1	MX341
AVR Settings	UFRO (Hz):	57	DIP (%)*: 50
	Stability (%)*:	According to Stamford instructions	Voltage (V): 400
			DWELL (%)*: N/A
			Load factor: 1.0

Applies to Stamford nomenclature,

(%)* : % of max potentiometer setting range

Load acceptance performance can vary due to actual alternator inertia, voltage regulator, type of load and local ambient conditions.

Abbreviation:	Full name:	Descriptions
AVR	Automatic Voltage Regulator	Generator performance and safety control unit
UFRO	Under Frequency Roll Off	Overheating protection at under frequency
DIP		Controls the slope of voltage drop when the UFRO is active
DWELL		Controls the slope of voltage recovery when the UFRO is active.

Single step load performance at 1800 rpm - PRIME (Resistiv load)

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)
0-20	2,2	1,3	0,6	0,0	20-100	9,3	2,9	16,8	1,6
0-40	4,4	1,8	2,1	0,6	40-100	5,7	2,4	7,3	1,2
0-60	6,4	2,3	8,4	1,2	60-100	3,9	1,9	2,5	1,0
0-65	7 (G3)	2,4	9,3	1,2	65-100	3,7	1,8	2,1	0,8
0-80	10 (G2)	2,9	16,4	1,2	74-100	2,3	1,3	1,3	0,3
0-100	14,7	3,2	26,1	1,8					
100-0	4,3	1,4	8,6	1,9					

Single step load performance at 1800 rpm - STAND BY (Resistiv load)

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)
0-20	2,4	1,4	1,1	0,0	20-100	10,2	3,2	19,8	1,6
0-40	4,6	2,1	4,1	1,2	40-100	6,2	2,5	9,8	1,6
0-59	7 (G3)	2,4	10,7	1,3	59-100	4,6	2,2	3,8	1,2
0-60	7,1	2,3	10,7	1,2	60-100	4,5	2,1	3,4	1,3
0-74	10 (G2)	2,9	17,2	1,2	74-100	3,1	1,6	2,0	0,8
0-80	12,0	3,1	21,1	1,3	80-100	2,6	1,4	1,6	0,3
0-100	17,0	3,5	30,5	2,0					
100-0	4,8	1,6	8,9	1,8					

VOLVO PENTA TWD1672GE	Document No	Issue Index
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Cold start performance

Time from start to stay within 0.5% of no load speed at ambient temperature:	°C	rpm	1500	1800
			s	s
	20	s	NA	4,3
	5	s	NA	5,3
	-15 *	s	NA	5,3
	-30 **	s	NA	5,7
	Min start temp*	°C	-31,0	

* With manifold heater 4 kW engaged, lubrication oil 15W/40 and block heater.

** With manifold heater 4 kW engaged, lubrication oil 5W/30 and block heater, Fuel MK-1.

Block heater type	Make	Power kW	Engaged hours	Cooling water temp engine block
Volvo part No: 22454340 P01	Calix	1.5 kW	10h ambient temp-30 C	-2°C 28°F


Lubrication system

Lubricating oil consumption	Prime Power	rpm	1500	1800
			litre/h US gal/h	litre/h US gal/h
	Standby Power		NA	0,10 0,026
			NA	0,11 0,029
Oil system capacity including filters				48 12,7
Oil sump capacity:	max			42 11,1
	min			32 8,5
Oil change intervals/specifications:	VDS-3*			h 500
				h
				h
Engine angularity limits:	front up			° 30
	front down			° 30
	side tilt			° 30
Oil pressure at rated speed			kPa	399
			psi	58
Lubrication oil temperature in oil sump:	max		°C	130
			°F	266
Oil filter micron size			µ	40

* See also general section in the sales guide

Fuel system		rpm	1500	1800
Prime Power Specific fuel consumption at:	25%	g/kWh	NA	234
		lb/hph	NA	0,379
	50%	g/kWh	NA	205
		lb/hph	NA	0,332
	75%	g/kWh	NA	197
		lb/hph	NA	0,319
	100%	g/kWh	NA	195
		lb/hph	NA	0,316
% adBlue consumption at: (Compare to Fuel consumption by Volyme)	25%	%	NA	6,1
	50%	%	NA	6,6
	75%	%	NA	7,1
	100%	%	NA	7,1




Standby Power Specific fuel consumption at:	25%	g/kWh	NA	229
		lb/hph	NA	0,371
	50%	g/kWh	NA	203
		lb/hph	NA	0,329
	75%	g/kWh	NA	196
		lb/hph	NA	0,317
	100%	g/kWh	NA	196
		lb/hph	NA	0,317
% adBlue consumption at: (Compare to Fuel consumption by Volyme)	25%	%	NA	6,2
	50%	%	NA	6,6
	75%	%	NA	7,3
	100%	%	NA	6,6

Fuel system		rpm	1500	1800
See front page for important information		ASTM D975 (2D)		
Fuel to conform to				
System supply flow at:		litre/h	NA	210,0
		US gal/h	NA	55,5
Fuel supply line max restriction (Measured at fuel inlet connection)		kPa	NA	30,0
		psi	NA	4,4
Fuel supply line max pressure, engine stopped		kPa	NA	0,0
		psi	NA	
System return flow		litre/h	NA	25,0
		US gal/h	NA	6,6
Fuel return line max restriction (Measured at fuel return connection)		kPa	NA	20,0
		psi	NA	2,9
Maximum allowable inlet fuel temp (Measured at fuel inlet connection)		°C	NA	60
		°F	NA	140
Prefilter / Water separator micron size		µ	10	
Fuel filter micron size		µ	5	
Governor type/make, standard	Volvo/EMS 2.3			
Injection pump type/make	Unit injector hybrid			


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Intake and exhaust system

rpm 1500 1800

Air consumption at: (+25°C and 100kPa)	Prime Power	m ³ /min cfm	NA NA	46,06 1627
	Standby Power	m ³ /min cfm	NA NA	48,22 1703
See front page for important information Max allowed air intake restriction including piping  Air filter restriction clean Volvo Penta filter		kPa	NA	5
		psi	NA	0,7
Heat rejection to exhaust at:	Prime Power	kPa	NA	1,4
		psi	NA	0,2
	Prime Power	kW	NA	409
		BTU/min	NA	23259
	Standby Power	kW	NA	454
		BTU/min	NA	25792
Exhaust gas temperature after turbine at:	Prime Power	°C	NA	423
		°F	NA	793
	Standby Power	°C	NA	444
		°F	NA	831
See front page for important information Max allowable back pressure in exhaust line (after turbine)  Pipe dimension Ø: _____ mm	Prime Power	kPa	NA	19
		psi	NA	2,7
	Standby Power	kPa	NA	20
		psi	NA	2,9
See front page for important information Max allowable temperature drop between turbine and SCR muffler inlet. 	Prime Power	Δ°C	NA	10
		Δ°F	NA	18
	Standby Power	Δ°C	NA	10
		Δ°F	NA	18
SCR muffler pressure drop (at exhaust gas flow and exhaust temp given)	Prime Power	kPa	NA	9
		psi	NA	1,3
	Standby Power	kPa	NA	10
		psi	NA	1,5
Exhaust gas flow at: (temp and pressure after turbine at the corresponding power setting)	Prime Power	m ³ /min cfm	NA NA	114,0 4025
		Standby Power	m ³ /min cfm	NA NA

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Cooling system		rpm	1500	1800
Heat rejection radiation from engine at:	Prime Power	kW	NA	24
		BTU/min	NA	1365
	Standby Power	kW	NA	26
		BTU/min	NA	1479
Coolant	Volvo Penta coolant "ready mix or Volvo Penta coolant mixed with fresh water 40/60			
Radiator cooling system type	Closed circuit			
Standard radiator core area	m ²	NA	1,68	
	foot ²	NA	18,08	
Fan diameter	mm	NA	965	
	in	NA	37,99	
Fan power consumption	kW	NA	30	
	hp	NA	41	
Fan drive ratio	1,04:1			
Coolant capacity,	Engine only	litre	NA	33
		US gal	NA	8,72
	CACs (Charge Air Coolers)	litre	NA	10
		US gal	NA	2,64
	Coolant radiators incl piping, Engine circuit	litre	NA	48
		US gal	NA	12,68
	coolant radiators incl piping, CAC- circuit	litre	NA	48
		US gal	NA	12,68
	Expansion tank, Engine circuit	litre	NA	20
		US gal	NA	5,28
Expansion tank, CAC circuit	litre	NA	7	
	US gal	NA	1,85	
Coolant pump, Engine circuit	drive/ratio	Belt / 1,85:1		
Coolant pump, CAC circuit	drive/ratio	Belt / 2,29:1		
Thermostat, Engine circuit	Start to open	°C	NA	82
		°F	NA	180
	Fully open	°C	NA	92
		°F	NA	198
Thermostat, CAC circuit	Start to open	°C	NA	40
		°F	NA	104
	Fully open	°C	NA	52
		°F	NA	126
Maximum static pressure head (expansion tank height + pressure cap setting)	kPa	NA	100	
	psi	NA	14,5	
Minimum static pressure head (expansion tank height + pressure cap setting)	kPa	NA	70	
	psi	NA	10,2	
Standard pressure cap setting	kPa	NA	75	
	psi	NA	10,9	
Maximum top tank temperature	°C	NA	107	
	°F	NA	225	
Charge air pressure (after charge air coolers)	kPa	NA	360	
	psi	NA	52,2	
See front page for important information Max allowed Charge air outlet temp. At air inlet temp. 25°C 	Prime Power	°C	NA	50
		°F	NA	122
	Standby Power	°C	NA	50
		°F	NA	122

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**OEM cooling system design:
- move of standard radiators**

		rpm	1500	1800
Maximum additional coolant, Engine circuit with standard expansion tank		litre	NA	15
		US gal	NA	3,96
Maximum additional coolant, CAC circuit with standard expansion tank		litre	NA	5
		US gal	NA	1,32
Maximum distans in vertikal direction with standard pressure cap (75 kPa)		m	NA	2,5
		ft	NA	8,20
Maximum additional pressure drop due to move		KPa	NA	10
		psi	NA	1,5
- replacement of standard radiators				
Heat rejection to coolant engine radiator at:	Prime Power	kW	NA	203
		BTU/min	NA	11544
	Standby Power	kW	NA	223
		BTU/min	NA	12682
Heat rejection to coolant CAC radiator at:	Prime Power	kW	NA	187
		BTU/min	NA	10635
	Standby Power	kW	NA	206
		BTU/min	NA	11715
Minimum coolant flow engine radiator (at fully open thermostat)		litre/s	NA	6
		US gal/s	NA	1,59
Minimum coolant flow CAC radiator (at fully open thermostat)		litre/s	NA	2,5
		US gal/s	NA	0,66
Maximum coolant pressure drop over engine radiator incl. Piping (at coolant flow above)		kPa	NA	70
		psi	NA	10,2
Coolant pressure drop over complete engine circuit cooling system (at coolant flow above)		kPa	NA	160
		psi	NA	23,2
Coolant pressure drop over complete CAC circuit cooling system (at coolant flow above)		kPa	NA	135
		psi	NA	19,6
Nominal coolant pressure before engine circuit coolant pump		kPa	NA	30
		psi	NA	4,4
Nominal coolant pressure before CAC circuit coolant pump		kPa	NA	30
		psi	NA	4,4

Cooling performance

Standard fan: Fan ratio: 1 : 1.04 Fan type: FIX

Cooling air flow and external restriction at different radiator air temperatures based on 107°C TTT and 40% antifreeze.

Valid at 1 atm. (radiator and cooling fan, see optional equipment)

Engine speed rpm	Air on temp °C	PRIME POWER		STANDBY POWER	
		Air flow m ³ /s	External restriction Pa	Air flow m ³ /s	External restriction Pa
1800	63	15,2	0	15,2	0
	62	14,5	100		
	61	14,1	200		
	60	13,6	300	14,5	100
	59				
	58				
	57				
				13,9	200
				13,6	300

Note! External restrictions are calculated for values >0 Pa

Engine management system

Functionality	Alternatives	Default setting
Governor mode	Isochronous / droop	Isochronous
Governor droop	N/A	N/A
Governor response	Adjustable PID-constants (VODIA)	
Dual speed	Single Speed 1800rpm , 60Hz	1800,0
Idle speed	600-1200rpm	900,0
Fine speed adjustment	+90rpm	0,0
Preheating function	On / Off	Off

Engine sensor and switch settings

Parameter	Unit	Alarm level		Engine protection	
		Setting range	Default setting	Level	Action.
Oil temp	°C	120 - 130	125	Setting +2.5	Shutdown after 10s
Oil pressure	Low idle 900 rpm	kPa	NA	170	Shutdown
	1800 rpm	kPa	NA	300	Shutdown
Oil level		NA	Min level		
DEF dosing injection failure		NA	On	Low level	Shutdown after 10s
Coolant temp	°C	95 - 101	103	Setting +4	Shutdown after 10s
Coolant level		See cooling system	On	Low level	Shutdown after 10s
Fuel feed pressure	Low idle	kPa	NA	Min level	
	>1400 rpm	kPa	NA	Min level	
Water in fuel		NA	Max level		
Crank case pressure	kPa	NA	Rapid increase	Rapid increase	Shutdown
Air filter pressure drop	kPa	NA	5		
Altitude, above sea	m				Automatic derating, see section Smoke, Fuel & Derating
Charge air temp	°C	NA	80	82,5	Shutdown after 10s
Charge air pressure	kPa	NA	25 above demand	35 above demand	Shutdown after 10s
Engine speed	rpm	100 - 120% of rated speed	115% of rated speed	Alarm level	Shutdown.
Exhaust Temperature (before SCR volume)	°C	NA	530	550	Shutdown after 10s

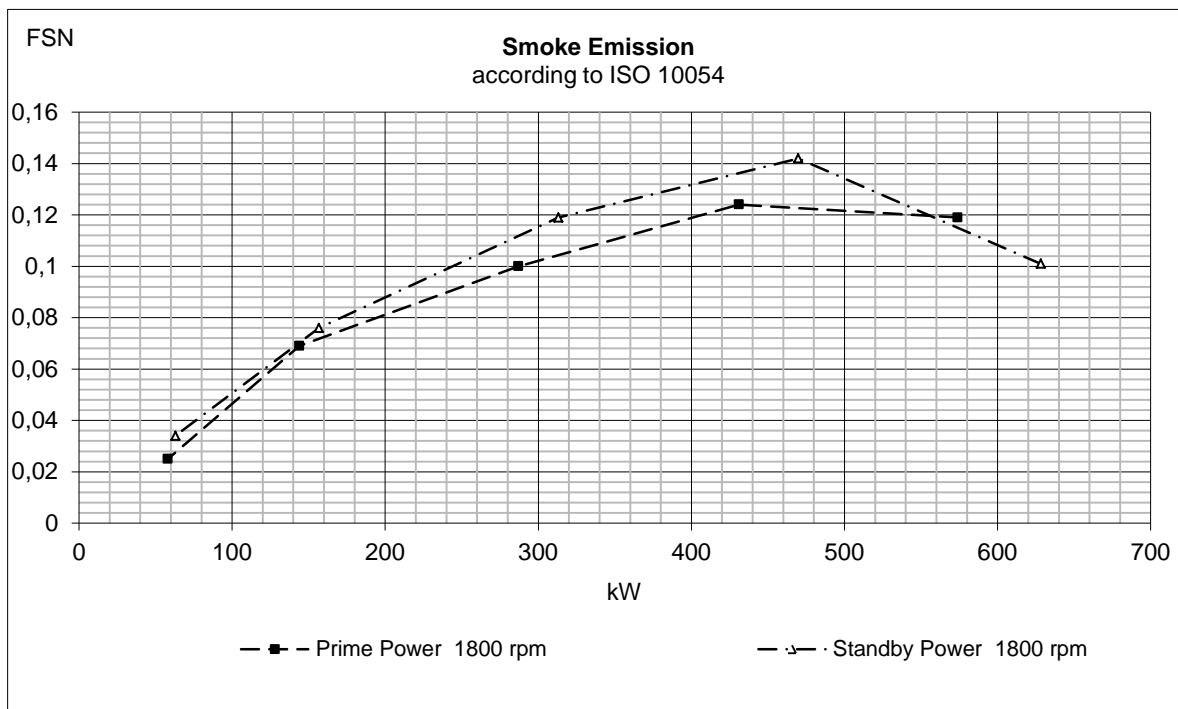
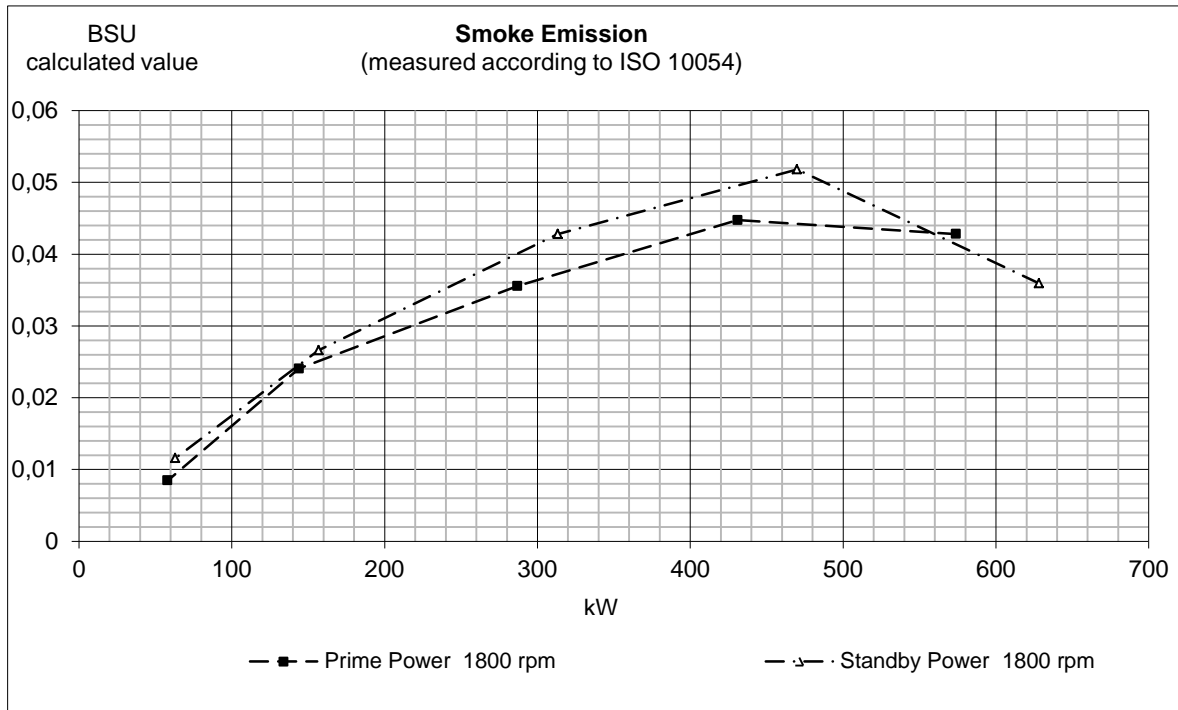
Engine protection can be disabled. For consequences please see VP International Limited Warranty Policy

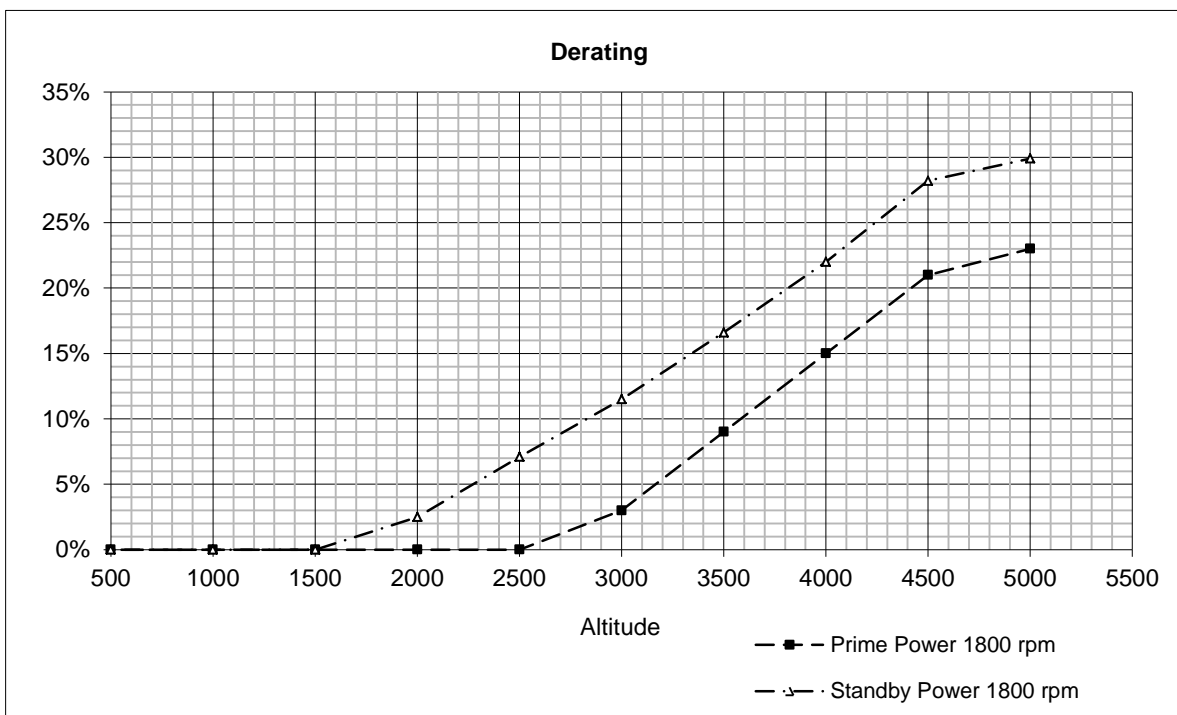
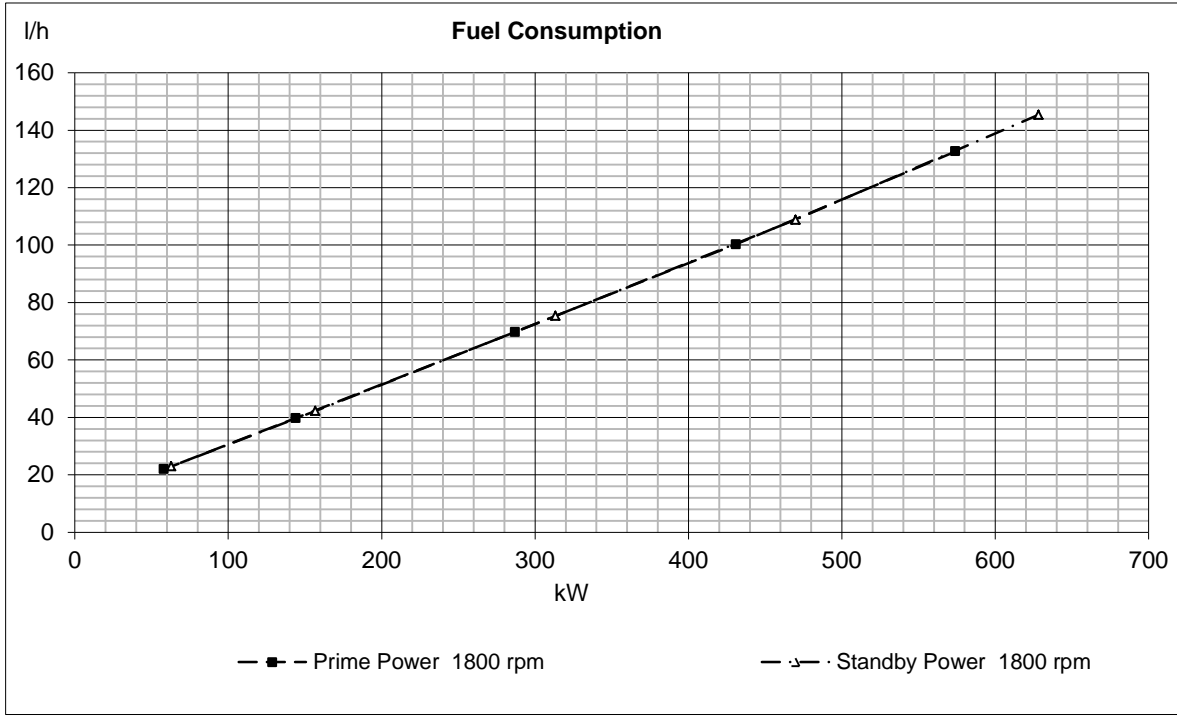
Electrical system

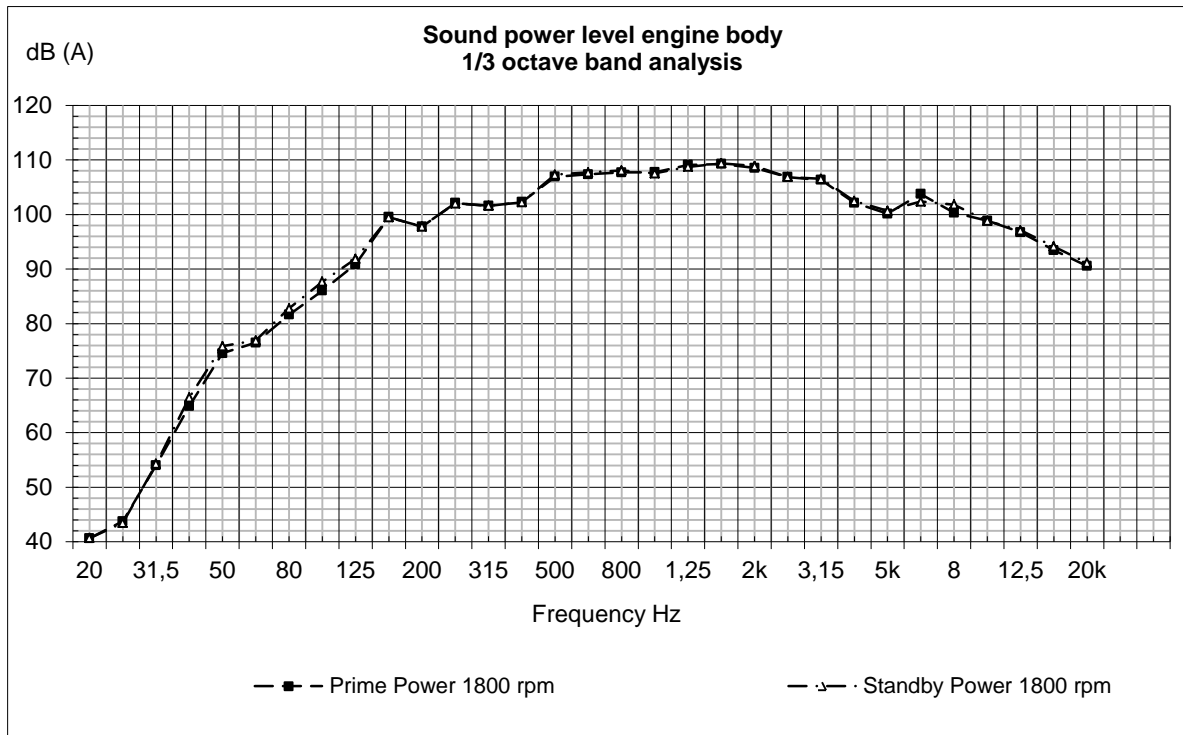
Voltage and type	24V / insulated from earth		
Alternator:	make/output	A	Bosch / 80
	tacho output	Hz/alt. Rev	6
	drive ratio		3,94 : 1
Starter motor	make	Mitsubishi Electric	
	type	24V7.0KW12/3.175F	
	kW	7,0	
Number of teeth on:	flywheel	153	
	starter motor	12	
Max wiring resistance main circuit		mΩ	
Cranking current at +20°C		A	300
Crank engine speed at 20°C		rpm	155
Starter motor battery capacity:	max	Ah/A	2x225
	min at +5°C	Ah/A	
Inlet manifold heater (at 20 V)		kW	4,0
Power relay for the manifold heater		A	1

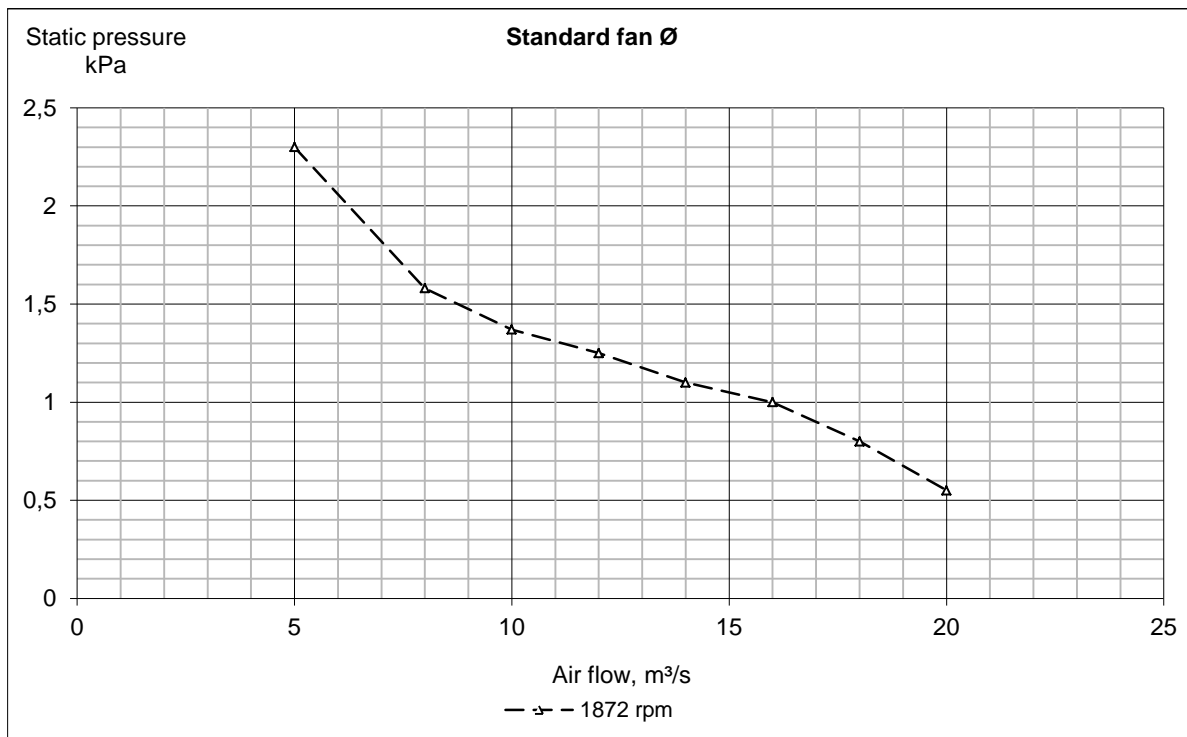
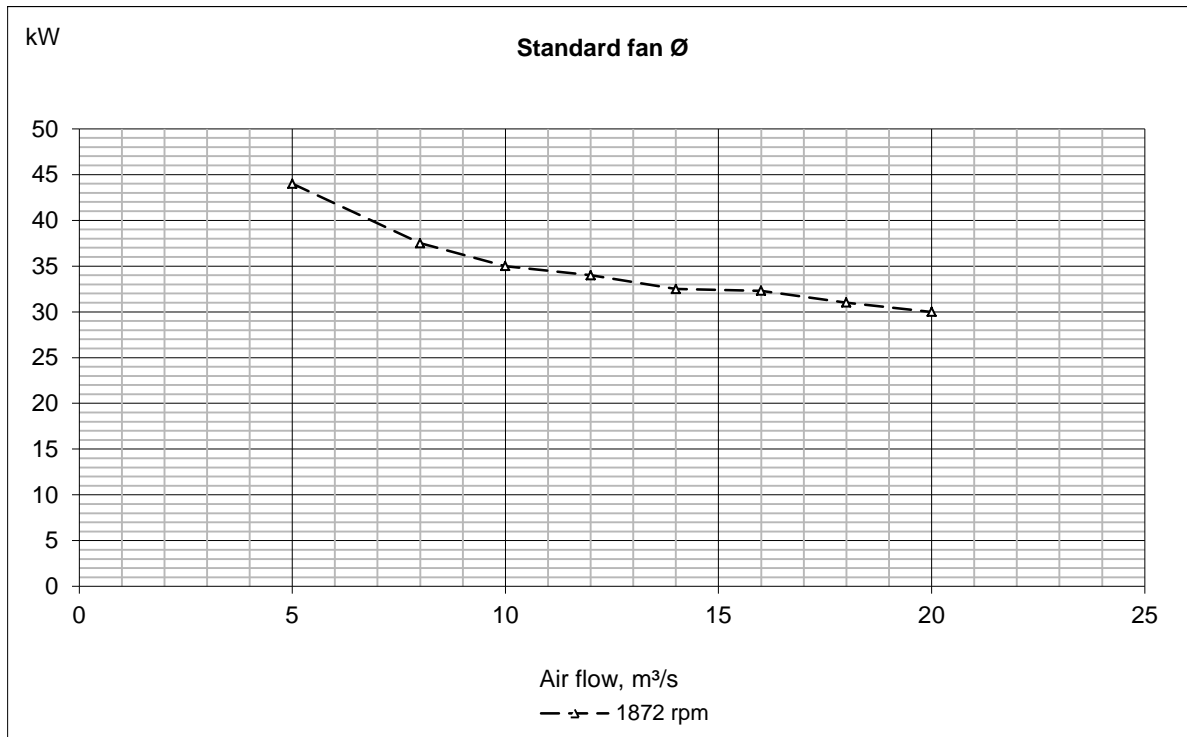
Power take off

		rpm	1500	1800
Front end in line with crank shaft max:		Nm	NA	NA
		lbft	NA	NA
Front end belt pulley load. Direction of load viewed from flywheel side:	max left	kW	NA	NA
		hp	NA	NA
	max down	kW	NA	NA
		hp	NA	NA
	max right	kW	NA	NA
		hp	NA	NA
Timing gear at compressor PTO max:		Nm	NA	NA
		lbft	NA	NA
Speed ratio direction of rotation viewed from flywheel side		0,91:1/clockwise		
Timing gear at servo pump PTO max:		Nm	NA	NA
		lbft	NA	NA
Speed ratio direction of rotation viewed from flywheel side		1,58:1/clockwise		
Timing gear at hydraulic pump PTO max:		Nm	NA	NA
		lbft	NA	NA
Speed ratio direction of rotation viewed from flywheel side				
Max allowed bending moment in flywheel housing		Nm	15000	
		lbft	11063	
Max. rear main bearing load		N	NA	NA
		lbf	NA	NA





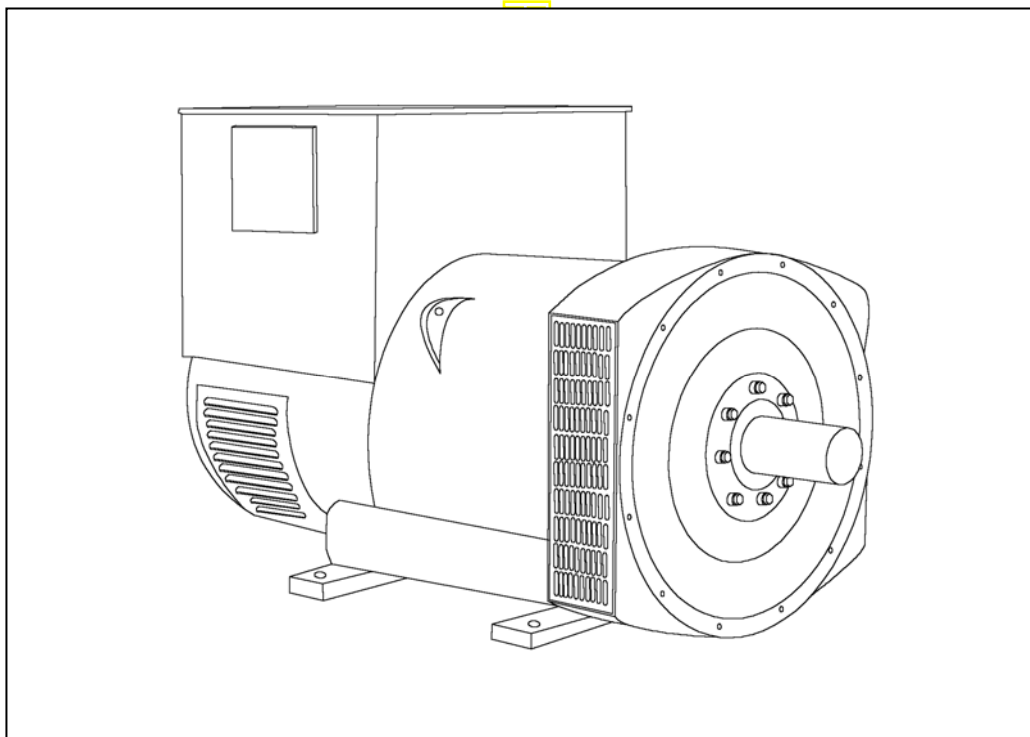




STAMFORD[®]

HCI 534E/544E - Winding 311

Technical  Data Sheet



HCI534E/544E

SPECIFICATIONS & OPTIONS

STAMFORD

STANDARDS

Stamford industrial generators meet the requirements of BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2 100, AS1359.

Other standards and certifications can be considered on request.

VOLTAGE REGULATORS

AS440 AVR - STANDARD

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

The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling.

The AS440 will support a range of electronic accessories, including a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

MX341 AVR

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

The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor through a full wave bridge, protected by a surge suppressor.

The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.

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

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

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

MX321 AVR

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

Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

WINDINGS & ELECTRICAL PERFORMANCE

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

TERMINALS & TERMINAL BOX

Standard generators are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted on a cover at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

SHAFT & KEYS

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

INSULATION/IMPREGNATION

The insulation system is class 'H'.

All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

QUALITY ASSURANCE

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

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

DE RATES

All values tabulated on page 8 are subject to the following reductions

5% when air inlet filters are fitted.

3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.

3% for every 5°C by which the operational ambient temperature exceeds 40°C.

Note: Requirement for operating in an ambient exceeding 60°C must be referred to the factory.

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

Front cover drawing typical of product range.

HCI534E/544E



WINDING 311

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.							
A.V.R.	MX321	MX341						
VOLTAGE REGULATION	± 0.5 %	± 1.0 %	With 4% ENGINE GOVERNING					
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 7)							
CONTROL SYSTEM	SELF EXCITED							
A.V.R.	AS440							
VOLTAGE REGULATION	± 1.0 %	With 4% ENGINE GOVERNING						
SUSTAINED SHORT CIRCUIT	SERIES 4 CONTROL DOES NOT SUSTAIN A SHORT CIRCUIT CURRENT							
INSULATION SYSTEM	CLASS H							
PROTECTION	IP23							
RATED POWER FACTOR	0.8							
STATOR WINDING	DOUBLE LAYER LAP							
WINDING PITCH	TWO THIRDS							
WINDING LEADS	12							
STATOR WDG. RESISTANCE	0.0043 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED							
ROTOR WDG. RESISTANCE	1.96 Ohms at 22°C							
EXCITER STATOR RESISTANCE	17 Ohms at 22°C							
EXCITER ROTOR RESISTANCE	0.092 Ohms PER PHASE AT 22°C							
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4, VDE 0875G, VDE 0875N. refer to factory for others							
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%							
MAXIMUM OVERSPEED	2250 Rev/Min							
BEARING DRIVE END	BALL. 6220 (ISO)							
BEARING NON-DRIVE END	BALL. 6314 (ISO)							
	1 BEARING				2 BEARING			
WEIGHT COMP. GENERATOR	1543 kg				1535 kg			
WEIGHT WOUND STATOR	722 kg				722 kg			
WEIGHT WOUND ROTOR	617 kg				588 kg			
WR ² INERTIA	8.9828 kgm ²				8.7049 kgm ²			
SHIPPING WEIGHTS in a crate	1635 kg				1625 kg			
PACKING CRATE SIZE	166 x 87 x 124(cm)				166 x 87 x 124(cm)			
	50 Hz				60 Hz			
TELEPHONE INTERFERENCE	THF<2%				TIF<50			
COOLING AIR	1.035 m ³ /sec 2202 cfm				1.312 m ³ /sec 2780 cfm			
VOLTAGE SERIES STAR	380/220	400/231	415/240	440/254	416/240	440/254	460/266	480/277
VOLTAGE PARALLEL STAR	190/110	200/115	208/120	220/127	208/120	220/127	230/133	240/138
VOLTAGE SERIES DELTA	220/110	230/115	240/120	254/127	240/120	254/127	266/133	277/138
KVA BASE RATING FOR REACTANCE VALUES	600	610	600	600	681	713	731	750
X _d DIR. AXIS SYNCHRONOUS	3.14	2.88	2.63	2.34	3.53	3.30	3.10	2.92
X' _d DIR. AXIS TRANSIENT	0.17	0.15	0.14	0.12	0.17	0.16	0.15	0.14
X'' _d DIR. AXIS SUBTRANSIENT	0.12	0.11	0.10	0.09	0.12	0.11	0.11	0.10
X _q QUAD. AXIS REACTANCE	2.45	2.25	2.05	1.82	2.82	2.64	2.48	2.33
X'' _q QUAD. AXIS SUBTRANSIENT	0.26	0.24	0.22	0.20	0.34	0.32	0.30	0.28
X _L LEAKAGE REACTANCE	0.06	0.05	0.05	0.04	0.06	0.06	0.05	0.05
X ₂ NEGATIVE SEQUENCE	0.18	0.16	0.15	0.13	0.23	0.22	0.20	0.19
X ₀ ZERO SEQUENCE	0.08	0.08	0.07	0.06	0.10	0.09	0.09	0.08
REACTANCES ARE SATURATED VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED								
T' _d TRANSIENT TIME CONST.	0.08s							
T'' _d SUB-TRANSTIME CONST.	0.012s							
T' _{do} O.C. FIELD TIME CONST.	2.5s							
T _a ARMATURE TIME CONST.	0.019s							
SHORT CIRCUIT RATIO	1/X _d							

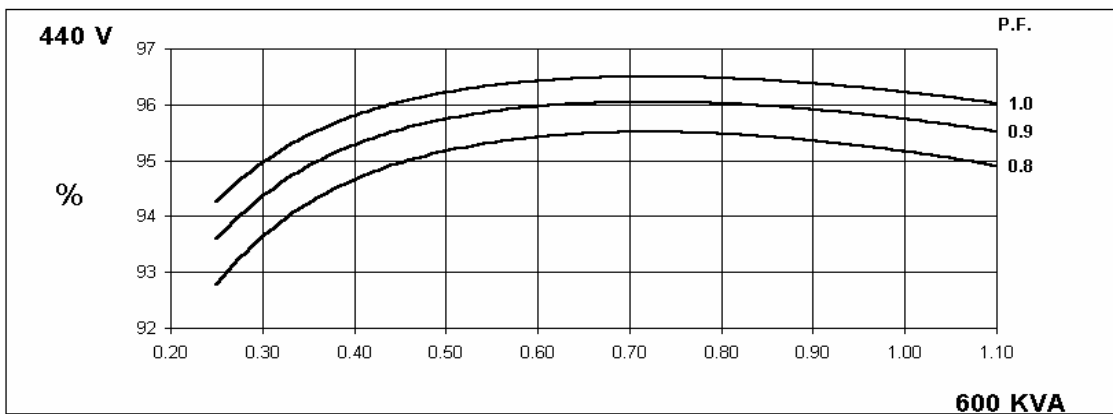
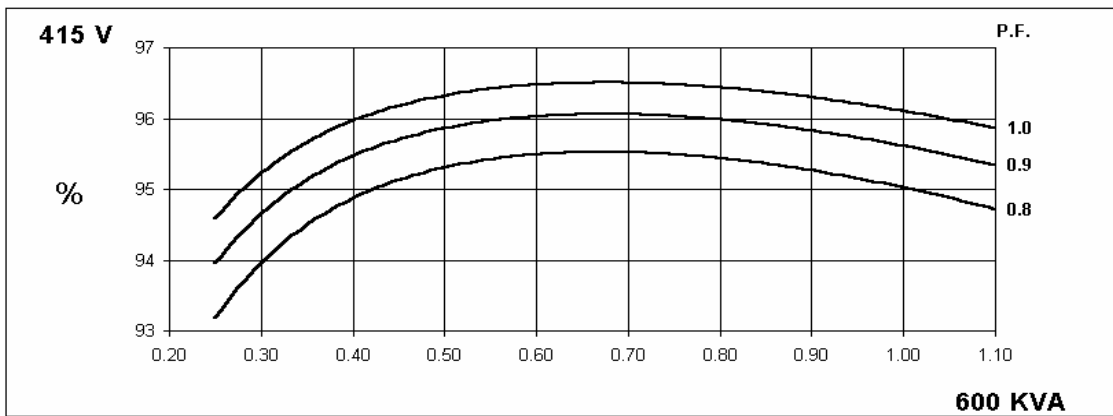
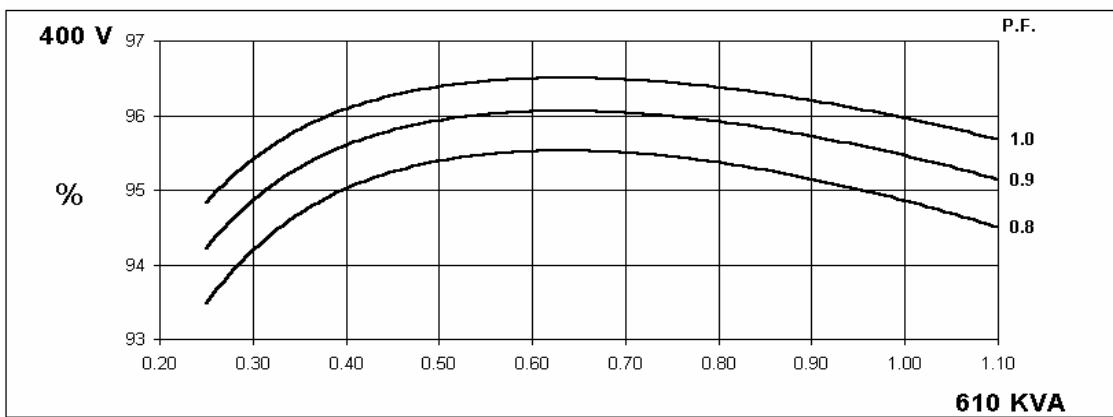
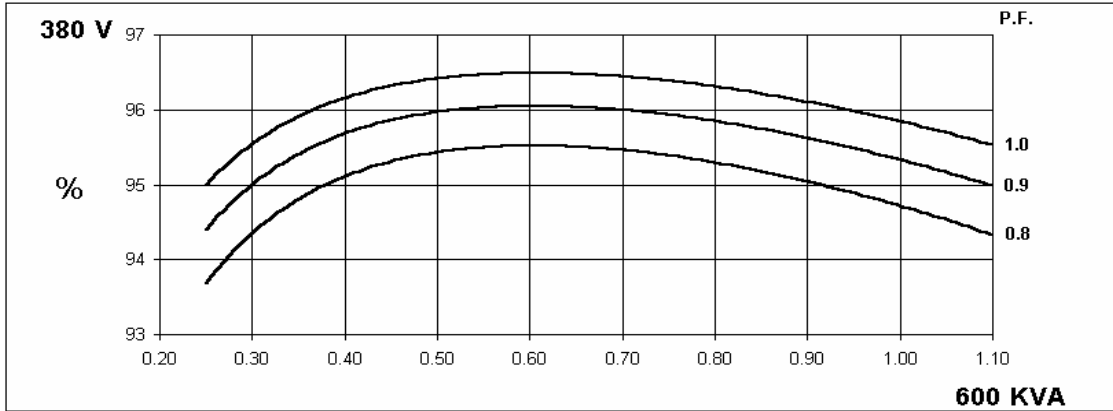
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HCI534E/544E

STAMFORD

Winding 311

THREE PHASE EFFICIENCY CURVES

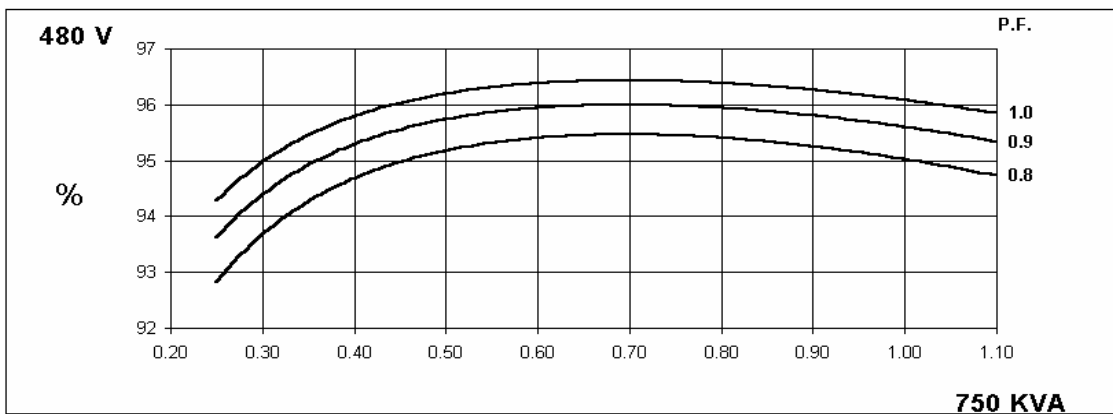
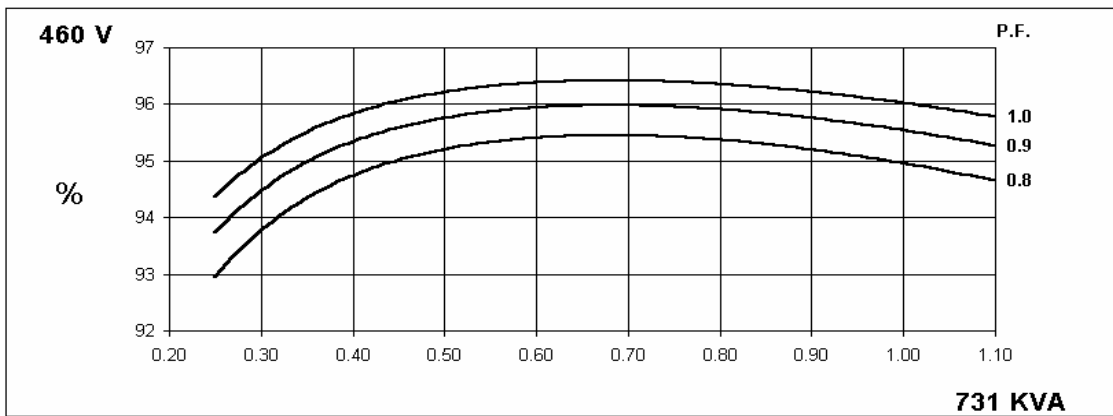
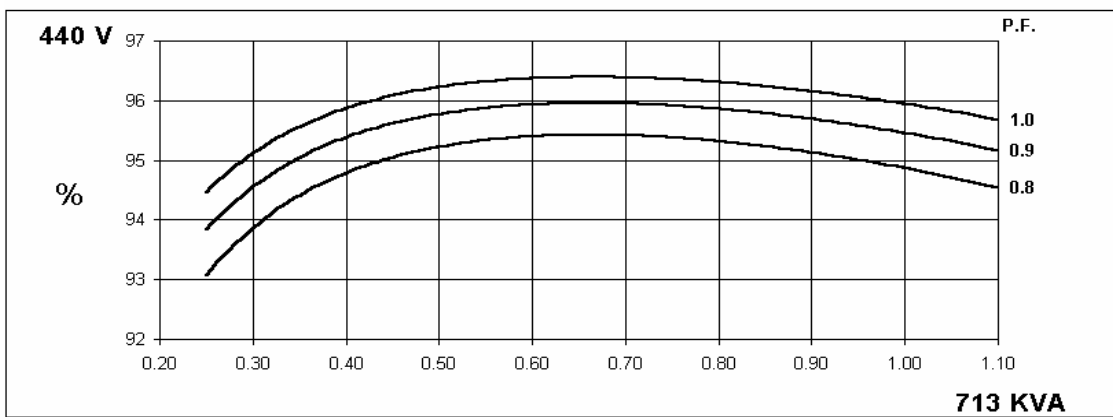
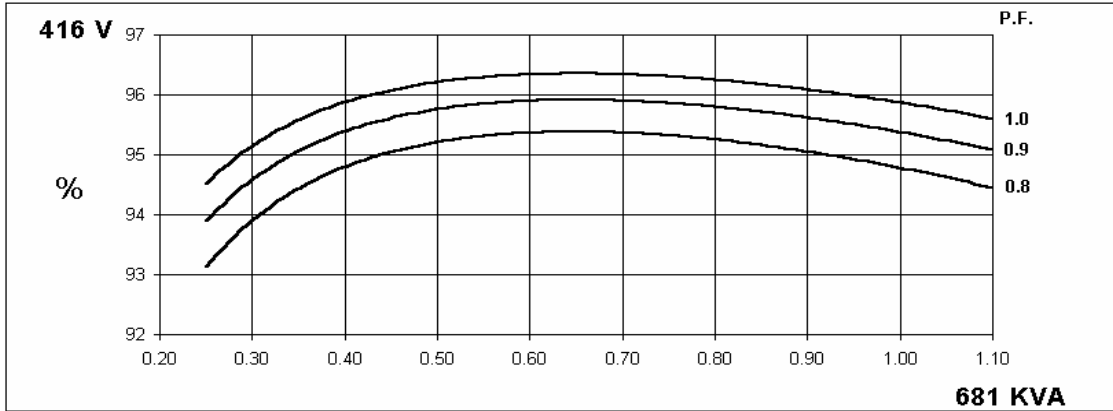


60
Hz

HCI534E/544E
Winding 311

STAMFORD

THREE PHASE EFFICIENCY CURVES

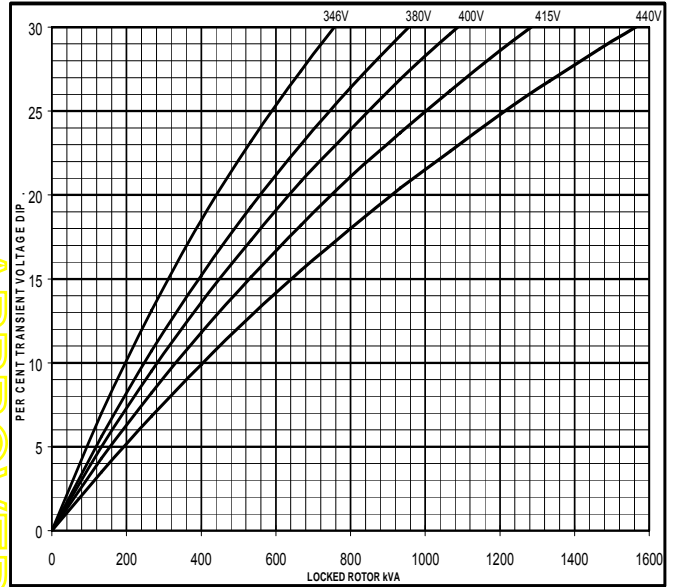
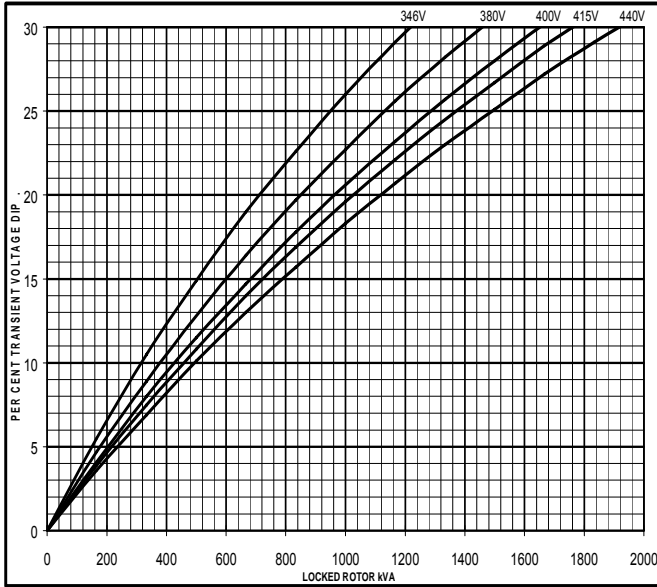


Locked Rotor Motor Starting Curve

50
Hz

MX

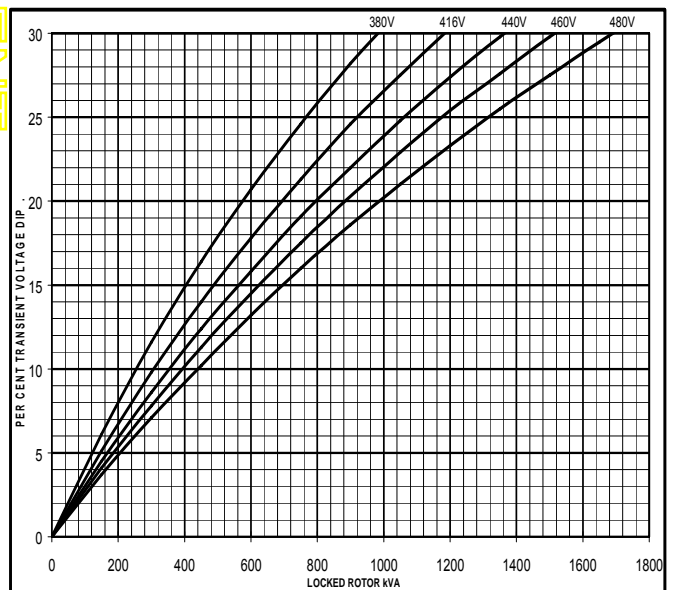
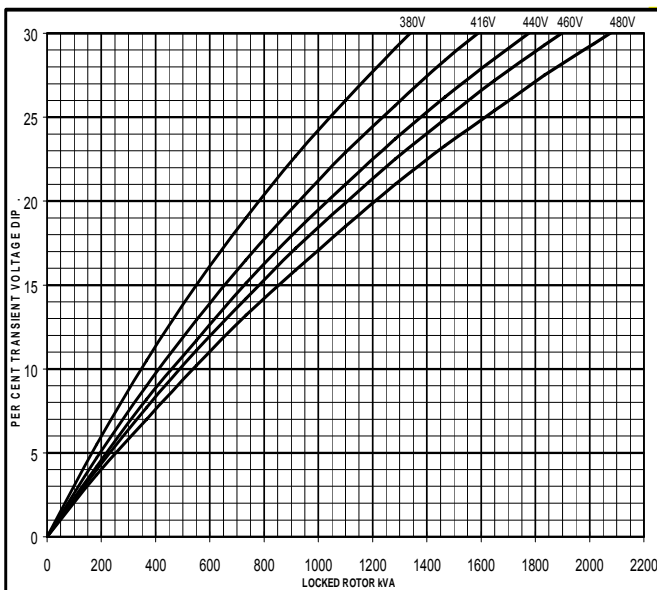
SX



60
Hz

MX

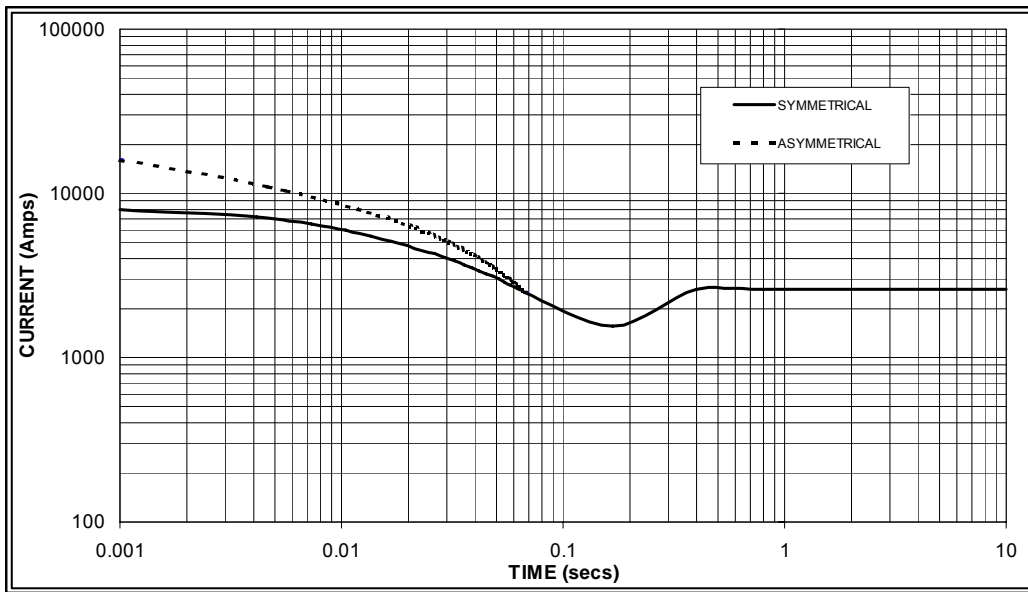
SX



APPROVED DOCUMENT

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

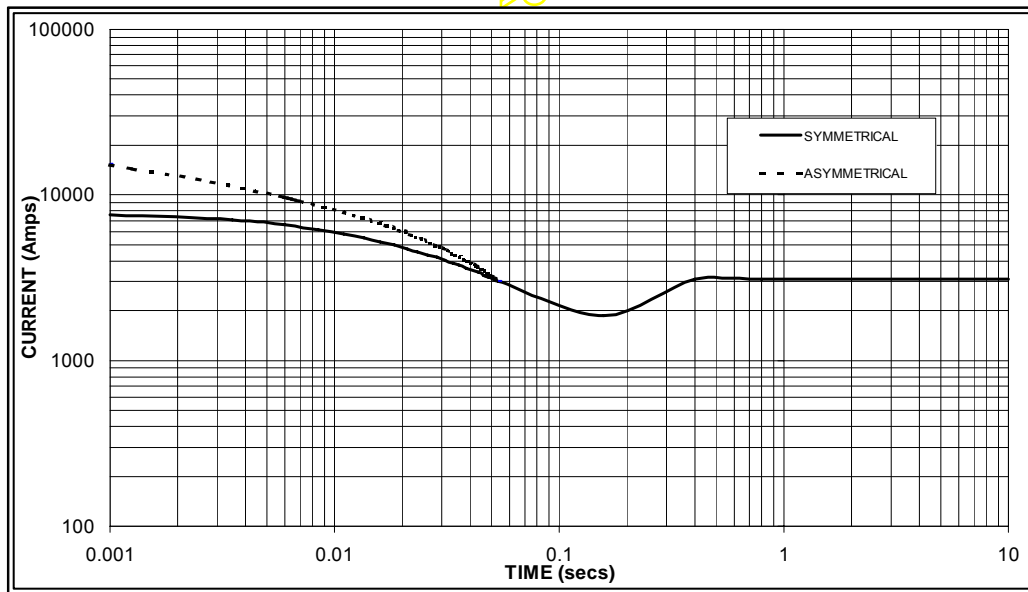
50
Hz



Sustained Short Circuit = 2,600 Amps



60
Hz



Sustained Short Circuit = 3,100 Amps

Note 1

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

50Hz		60Hz	
Voltage	Factor	Voltage	Factor
380v	X 1.00	416v	X 1.00
400v	X 1.06	440v	X 1.06
415v	X 1.09	460v	X 1.12
440v	X 1.12	480v	X 1.20

The sustained current value is constant irrespective of voltage level

Note 2

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

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

All other times are unchanged

Note 3

Curves are drawn for Star (Wye) connected machines. For other connection the following multipliers should be applied to current values as shown :

Parallel Star = Curve current value X 2

Series Delta = Curve current value X 1.732

HCI534E/544E

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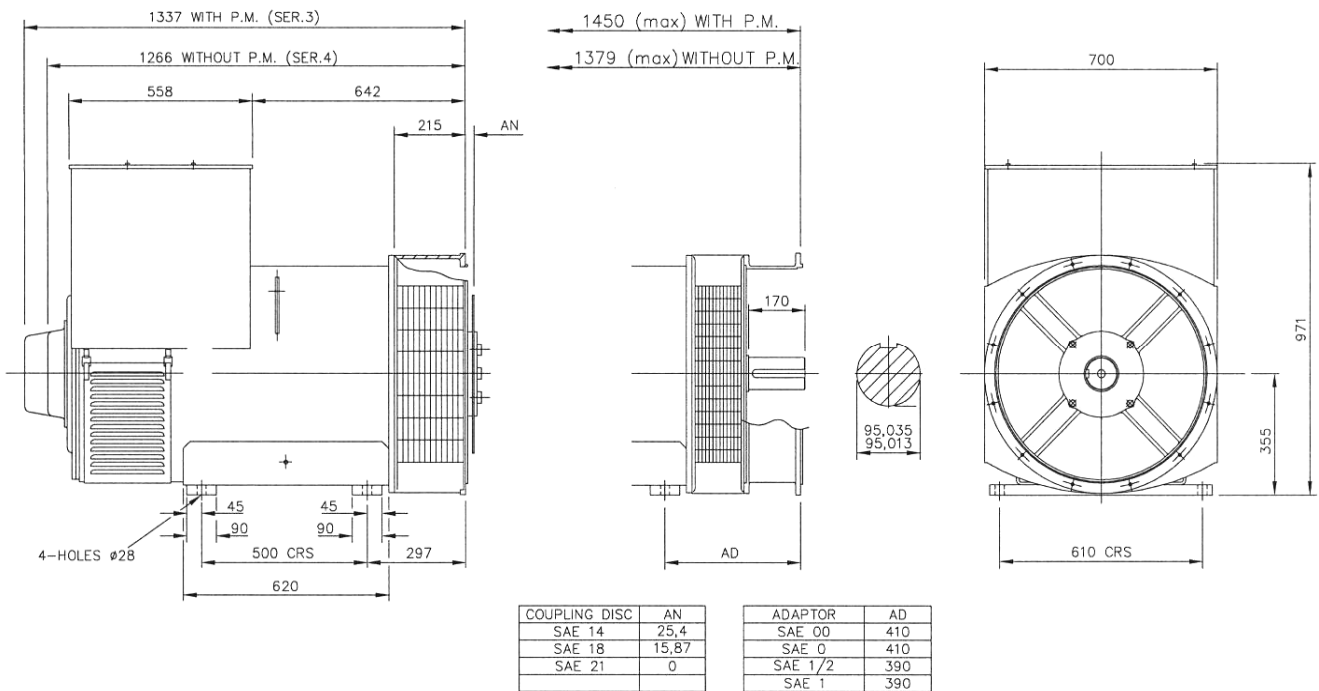
Winding 311 0.8 Power Factor

RATINGS

Class - Temp Rise	Cont. F - 105/40°C				Cont. H - 125/40°C				Standby - 150/40°C				Standby - 163/27°C				
50 Hz	Series Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	Parallel Star (V)	190	200	208	220	190	200	208	220	190	200	208	220	190	200	208	220
	Series Delta (V)	220	230	240	254	220	230	240	254	220	230	240	254	220	230	240	254
kVA	550	560	550	550	600	610	600	600	636	640	636	636	660	665	660	660	
kW	440	448	440	440	480	488	480	480	509	512	509	509	528	532	528	528	
Efficiency (%)	95.0	95.1	95.2	95.3	94.7	94.9	95.0	95.2	94.5	94.7	94.8	95.0	94.3	94.5	94.7	94.9	
kW Input	463	471	462	462	507	514	505	504	538	541	537	536	560	563	558	556	

60 Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	Parallel Star (V)	208	220	230	240	208	220	230	240	208	220	230	240	208	220	230	240
	Delta (V)	240	254	266	277	240	254	266	277	240	254	266	277	240	254	266	277
kVA	625	650	663	675	681	713	731	750	719	750	780	800	738	769	798	819	
kW	500	520	530	540	545	570	585	600	575	600	624	640	590	615	638	655	
Efficiency (%)	95.0	95.1	95.2	95.3	94.8	94.9	95.0	95.0	94.6	94.7	94.8	94.8	94.5	94.6	94.7	94.8	
kW Input	526	547	557	567	575	601	616	632	608	634	658	675	625	650	674	691	

DIMENSIONS



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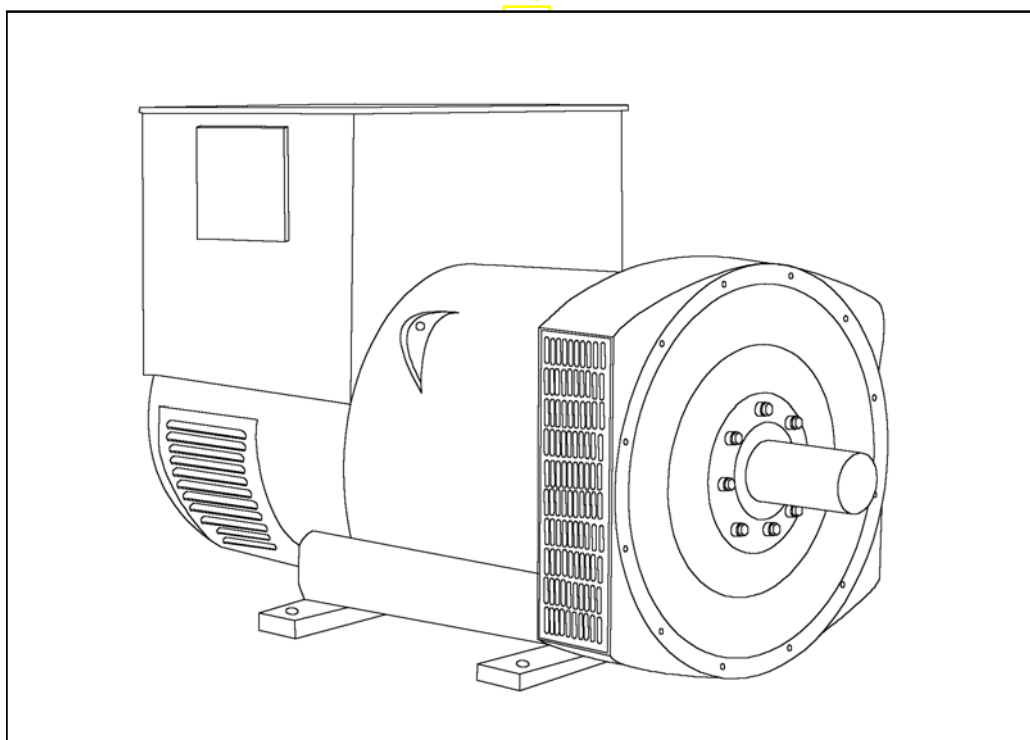
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STAMFORD®

HCI534E/544E - Winding 17

Technical  Data Sheet



HCI534E/544E

SPECIFICATIONS & OPTIONS

STAMFORD

STANDARDS

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

VOLTAGE REGULATORS

AS440 AVR - STANDARD

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

The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling.

The AS440 will support a range of electronic accessories, including a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

MX341 AVR

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

The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.

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

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

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

MX321 AVR

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

Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

WINDINGS & ELECTRICAL PERFORMANCE

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

TERMINALS & TERMINAL BOX

Standard generators are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted on a cover at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

SHAFT & KEYS

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

INSULATION/IMPREGNATION

The insulation system is class 'H'.

All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

QUALITY ASSURANCE

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

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

DE RATES

All values tabulated on page 6 are subject to the following reductions

5% when air inlet filters are fitted.

3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.

3% for every 5 C by which the operational ambient temperature exceeds 40 C.

Note: Requirement for operating in an ambient exceeding 60 C must be referred to the factory.

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

Front cover drawing typical of product range.

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HCI534E/544E

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	0.0068 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED		
ROTOR WDG. RESISTANCE	1.96 Ohms at 22°C		
EXCITER STATOR RESISTANCE	17 Ohms at 22°C		
EXCITER ROTOR RESISTANCE	0.092 Ohms PER PHASE AT 22°C		
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4, VDE 0875G, VDE 0875N. refer to factory for others		
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%		
MAXIMUM OVERSPEED	2250 Rev/Min		
BEARING DRIVE END	BALL. 6220 (ISO)		
BEARING NON-DRIVE END	BALL. 6314 (ISO)		
	1 BEARING	2 BEARING	
WEIGHT COMP. GENERATOR	1543 kg	1535 kg	
WEIGHT WOUND STATOR	722 kg	722 kg	
WEIGHT WOUND ROTOR	617 kg	588 kg	
WR ² INERTIA	8.9828 kgm ²	8.7049 kgm ²	
SHIPPING WEIGHTS in a crate	1635 kg	1625 kg	
PACKING CRATE SIZE	166 x 87 x 124 (cm)	166 x 87 x 124 (cm)	
TELEPHONE INTERFERENCE	THF<2%	TIF<50	
COOLING AIR	1.035 m ³ /sec 2202 cfm		
VOLTAGE SERIES STAR	600V		
VOLTAGE PARALLEL STAR	300V		
VOLTAGE SERIES DELTA	346V		
KVA BASE RATING FOR REACTANCE VALUES	725		
X _d DIR. AXIS SYNCHRONOUS	2.98		
X' _d DIR. AXIS TRANSIENT	0.14		
X'' _d DIR. AXIS SUBTRANSIENT	0.10		
X _q QUAD. AXIS REACTANCE	2.38		
X'' _q QUAD. AXIS SUBTRANSIENT	0.28		
X _L LEAKAGE REACTANCE	0.05		
X ₂ NEGATIVE SEQUENCE	0.19		
X ₀ ZERO SEQUENCE	0.08		
REACTANCES ARE SATURATED		VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED	
T' _d TRANSIENT TIME CONST.	0.08 s		
T'' _d SUB-TRANSTIME CONST.	0.012 s		
T' _{do} O.C. FIELD TIME CONST.	2.5 s		
T _a ARMATURE TIME CONST.	0.019 s		
SHORT CIRCUIT RATIO	1/X _d		

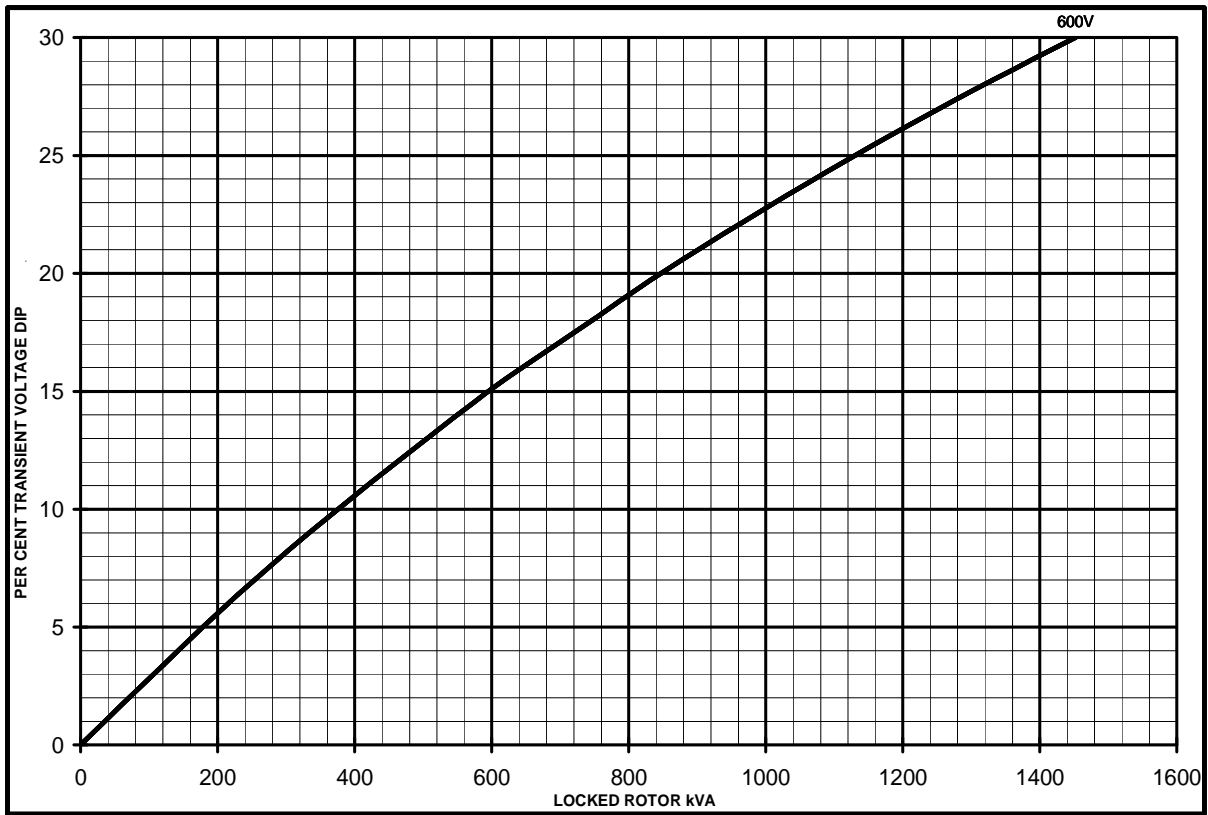
HCI534E/544E

STAMFORD

Winding 17

SX

Locked Rotor Motor Starting Curves



OCU

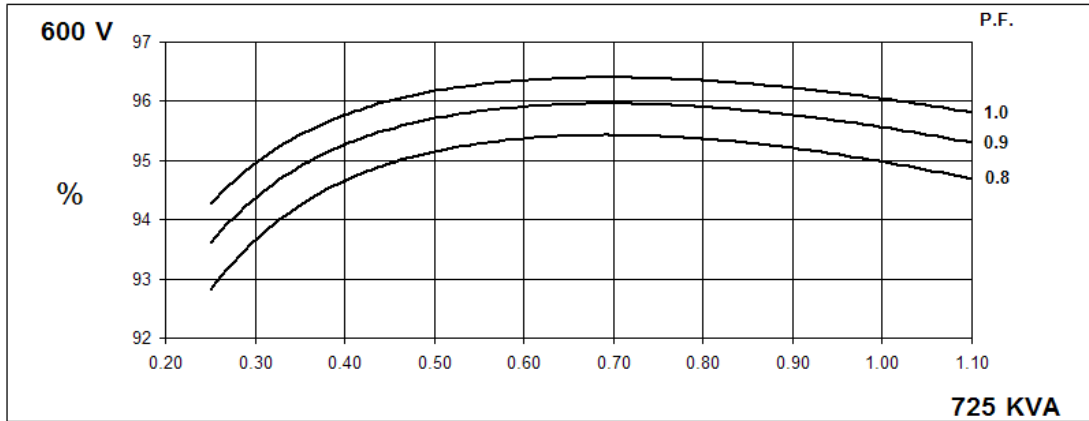
MX



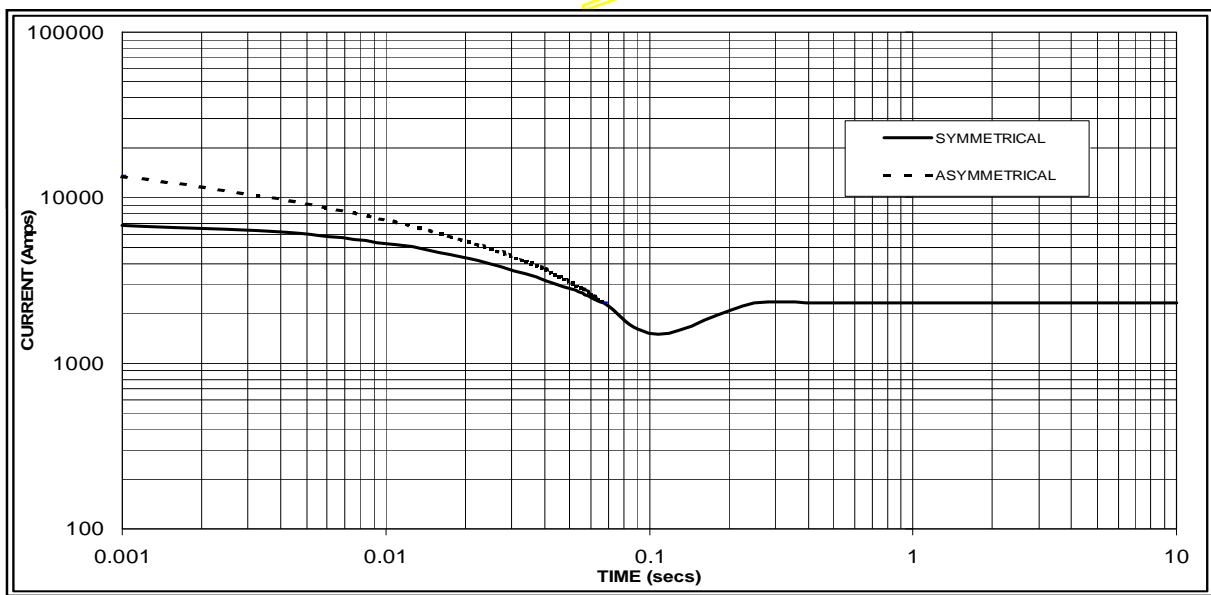
HCI534E/544E
Winding 17

STAMFORD

THREE PHASE EFFICIENCY CURVES



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



Sustained Short Circuit = 2300 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

HCI534E/544E

Winding 17 / 0.8 Power Factor

STAMFORD

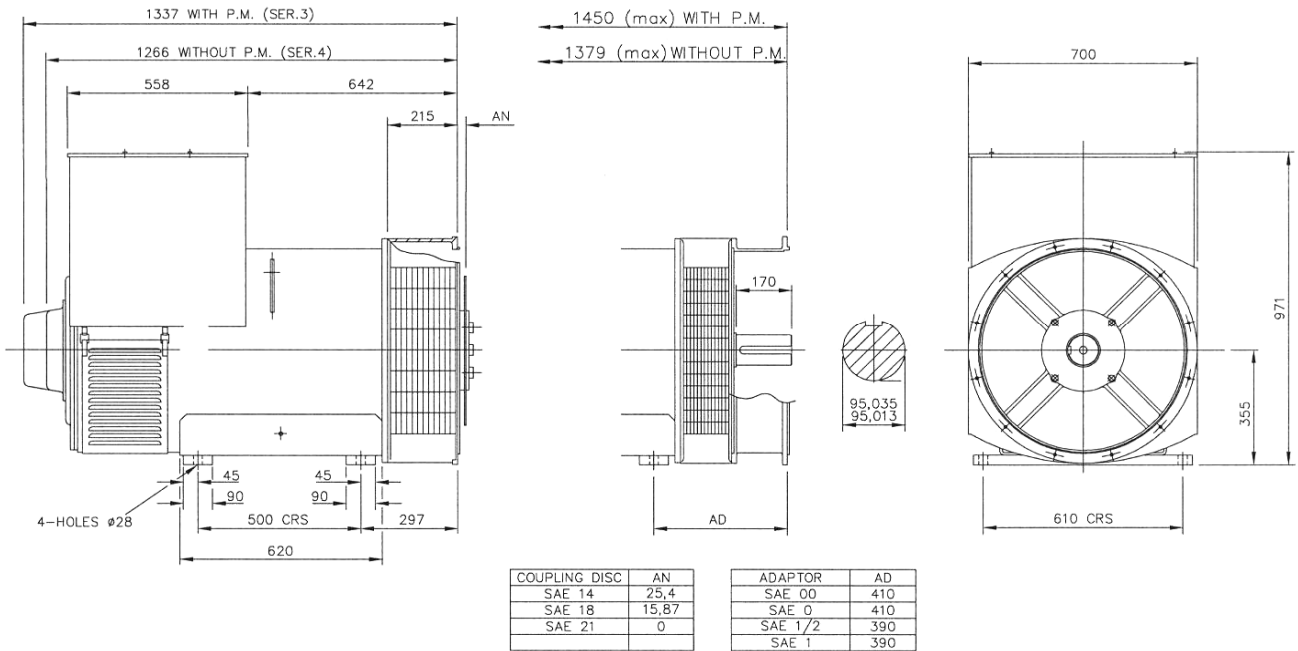
60Hz

RATINGS

Class - Temp Rise	Cont. F - 105/40°C	Cont. H - 125/40°C	Standby - 150/40°C	Standby - 163/27°C
Series Star (V)	600	600	600	600
Parallel Star (V)	300	300	300	300
Series Delta (V)	346	346	346	346
kVA	658	725	770	790
kW	526	580	616	632
Efficiency (%)	95.2	95.0	94.8	94.7
kW Input	553	611	648	665

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DIMENSIONS



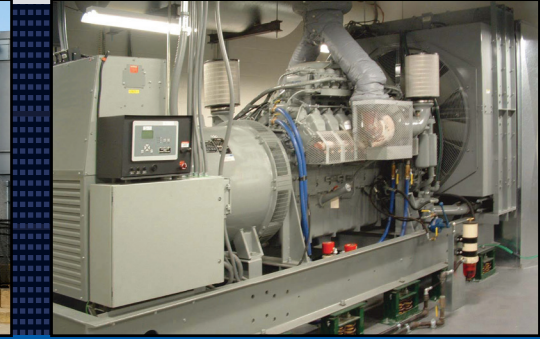
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A highly advanced integrated genset control system, this device provides genset control, transfer switch control, metering, protection, and programmable logic in a simple, easy-to-use, reliable, rugged, and cost effective package.

FEATURES

- Generator metering (includes three-phase mains)
- Engine and generator protection: 27, 32R, 40Q, 59, 810/U
- Optional enhanced generator protection: 47, 51, 78, and 81ROCOF
- Load sharing and generator sequencing (via LSM-200 Load Share Module)
- Var sharing over Ethernet (via LSM-200)
- BESTCOMSP^{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-200 Load Share Module](#)
 - [CEM-200 Contact Expansion Module](#)
 - [AEM-200 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

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-200's inputs and outputs with the CEM-200 (Contact Expansion Module) and the AEM-200 (Analog Expansion Module). This saves time and money by eliminating unnecessary external PLCs and control relaying.

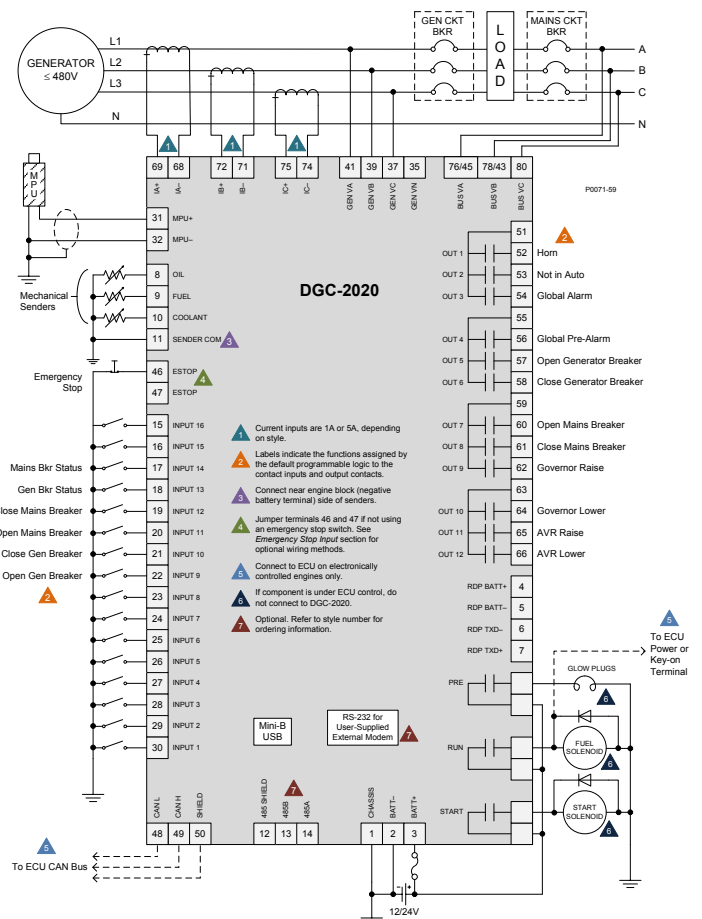


Figure 1 - DGC-200 Connection Diagram for a Typical Application

Visit WWW.BASLER.COM
FOR ADDITIONAL INFORMATION.

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, 810/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

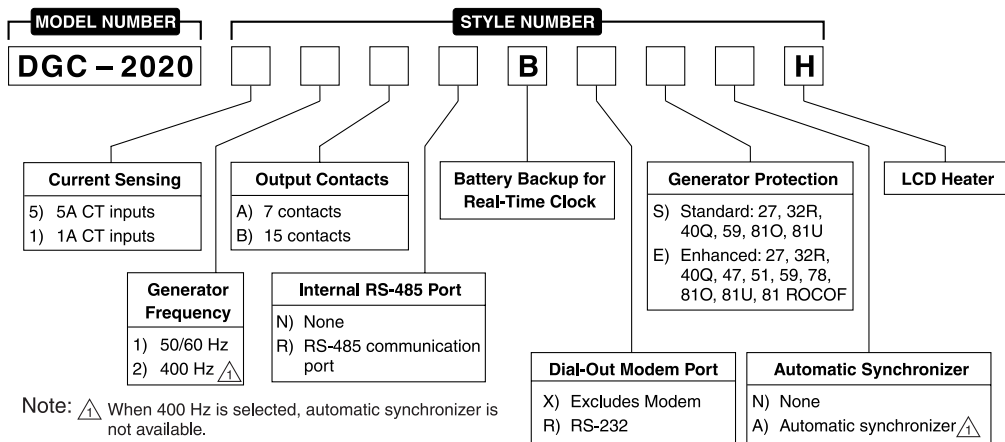
Operating Temp: -40°C to 70°C (-40°F to 158°F)
 Storage Temp: -40°C to 85°C (-40°F to 185°F)
 Humidity: IEC 68-2-38
 Salt Fog: ASTM B 17-73, IEC 68-2-11
 Ingress Protection: IEC IP54 for front panel
 Shock: 15 G in three perpendicular planes
 Vibration:
 5 to 29 Hz: 1.5 G peak
 29 to 52 Hz: 0.036" (0.914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



RELATED PRODUCTS

- [BE1-11g 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 BESTCOMSPUs[®] 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.



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Annex to the
technical catalog



Tmax T8

Low voltage molded case
circuit breaker up to 3000 A

UL 489 and CSA C22.2 Standard

1SDC210026D0201 – 2008 Edition



ABB

Main characteristics

The Tmax family, conforming to the UL 489 and CSA C22.2 No. 5.1 Standards, is enriched with the Tmax T8 size, which allows 3000 A to be reached. Also available in the 1600 A, 2000 A and 2500 A frames, Tmax T8 is equipped with the same electronic trip units as Tmax T7, thereby guaranteeing extremely high performances able to satisfy all installation requirements. Adequately sized for the performances offered (W=16.8 / D=11.2 / H=15.0 in). Tmax T8 is able to interrupt the following short-circuit currents: 125 kA@480 V and 100 kA@600 V.



Main characteristics

General characteristics

The Tmax T8 size has both circuit breakers and molded case switches (MCS). The following tables show the main characteristics of these ranges.

Circuit breakers for power distribution

			Tmax T8
Frame size	[A]		1600/2000/2500/3000
Number of poles	[No]		3/4
Rated voltage	(AC) 50-60 Hz	[V]	600
	(DC)	[V]	–
Test voltage (1 min) 50-60 Hz		[V]	3000
Interrupting ratings		[kA rms]	V
	240 V AC	[kA rms]	125
	480 V AC	[kA rms]	125
	600 V AC	[kA rms]	100
Trip units	Electronic	PR232/P-T8	■
		PR331/P	■
		PR332/P	■
Dimensions fixed version (3p)	H	[in-mm]	15.0 - 382
	W	[in-mm]	16.8 - 427
	D	[in-mm]	11.2 - 282
Mechanical life		[operations]	15000
Weight (fixed 3p)	1600/2000/2500 A	[lbs]	161
	3000 A	[lbs]	236

Molded case switches (MCS)

The Tmax T8 MCS are derived from the corresponding circuit breakers, of which they keep the overall dimensions, the versions, the fixing systems and the possibility of mounting accessories unchanged. This version only differs from the circuit breakers in the absence of the protection trip units. All molded case switches comply with the UL 489 and CSA C22.2 Standards and are self-protected.

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

Tmax-Molded Case Circuit Breakers

T7 1200A Frame

AC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



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

Weight 21.4 (lbs)

Compliance with Standards

UL 489

CSA C22.2 No.5.1

IEC 60947-2

Standards

EC directive:

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

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

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

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



Company Quality Systems and Environmental Systems

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

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

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

Mounting

Fixed
Drawout

Connections

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

Trip Unit

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

Auxiliary Devices for Indication and Control

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



ABB Inc.

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

Tmax-Molded Case Circuit Breakers

T6 800A Frame

AC Circuit Breakers and Switches

DC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units



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

Weight 20.9 (lbs)

Compliance with Standards

UL 489

CSA C22.2 No.5.1

IEC 60947-2

Standards

EC directive:

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

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

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

Interrupting ratings (RMS sym. kAmps)

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

*Thermal Magnetic Trip Only



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Mounting

Fixed
Drawout

Connections

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

Trip Unit

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

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

Auxiliary Devices for Indication and Control

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

On-Board Chargers Today

- Current Supplier provides quality product and design services. However, services are at their pacing with limited resources; and a history of issues meeting launch dates. PC charger delays prompted a re-evaluation of our controls and processes
- Resulted in a renewed commitment to the charger category
 - Allow supplier to focus on what they do well... build product
 - All charger development controlled by Minn Kota engineering
- Minn Kota designs, tests, and qualifies
- Supplier manufactures – period
- Revised product plan
 - 2011 Digital Linear On-board chargers
 - 2012 Precision Charge On-board chargers

New Digital Linear On-Board Chargers

- Taking existing Linear On-board family of chargers and raising the bar
 - Analog to Digital designs; New “D” designation in model name



Digital Linear Chargers

New Digital Linear On-Board Chargers (cont.)

- New microprocessor controlled linear design provides software enriched features and functionality
 - More repeatable set points (voltage limit and current) = improved charge curves
 - Maintenance mode time-out feature (auto-off)
 - Arc protection
 - Enhanced status codes
 - System okay
 - Charge stage indication (Bulk, Absorption, or Maintenance)
 - Full charge
 - Maintenance mode status
 - Multiple specific error indications – low battery voltage, damaged temp sensor, no output lead attached, etc.
- Up to 2X Faster Charge Times in high heat conditions

LED Status Code Detail

1. A GREEN power light is lit to indicate AC power is applied
2. A YELLOW light is lit for each bank to indicate the battery is charging in the Bulk Mode
3. A flashing YELLOW light is lit for each bank to indicate the battery is charging in the Absorption Mode
4. A flashing GREEN light is lit for each bank to indicate the battery is in maintenance mode and ready to use
5. A GREEN light is lit for each bank to indicate the battery is in long term maintenance mode and ready to use
6. A RED light for each bank is lit if any of the following apply:
 - a) No battery is connected to an output cord - this may also indicate a blown fuse in the fuse holder
 - b) The battery is connected reverse polarity
 - c) A short circuit
 - d) The battery voltage is below 4 volts - the bank will not charge a battery in this condition

Digital Linear Chargers

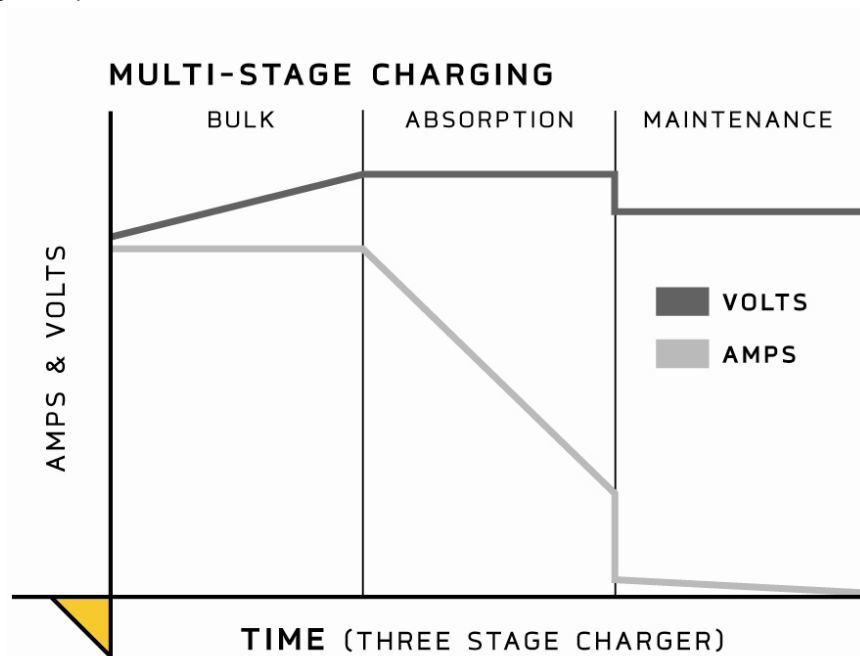
LED Status Code Detail (cont.)

- e) The battery voltage is above 18 volts - the bank will not charge a battery in this condition
7. A flashing RED light is lit for each bank if there is a damaged temperature sensor on the output cord - the bank will not operate if this occurs.
8. Flashing RED and GREEN lights are lit for each bank if any of the following apply:
 - a) The battery voltage does not rise above 10.5V after 3 hours - the battery may be damaged and will not be charged
 - b) Charging in Bulk Mode exceeds 20 hours - the battery may be damaged and will not be charged

Digital Linear Charging Technologies

Automatic 3-Stage Charging

- Bulk – high amps at low voltage until battery reaches ~75% charge
- Absorption – at ~75% charge, current tapers down until the battery voltage reaches 14.4V* (full charge)
- Maintenance (or Float) – when the battery voltage reaches full charge, charger output is dropped to 13.4V* (.1A-.3A). After 24 hours, the charger automatically turns off and automatically turns on when the battery voltage drops below 12.6 volts



* At 77 degrees Fahrenheit

Digital Linear Chargers

Digital Linear Charging Technologies (cont.)

Automatic Temperature Compensation

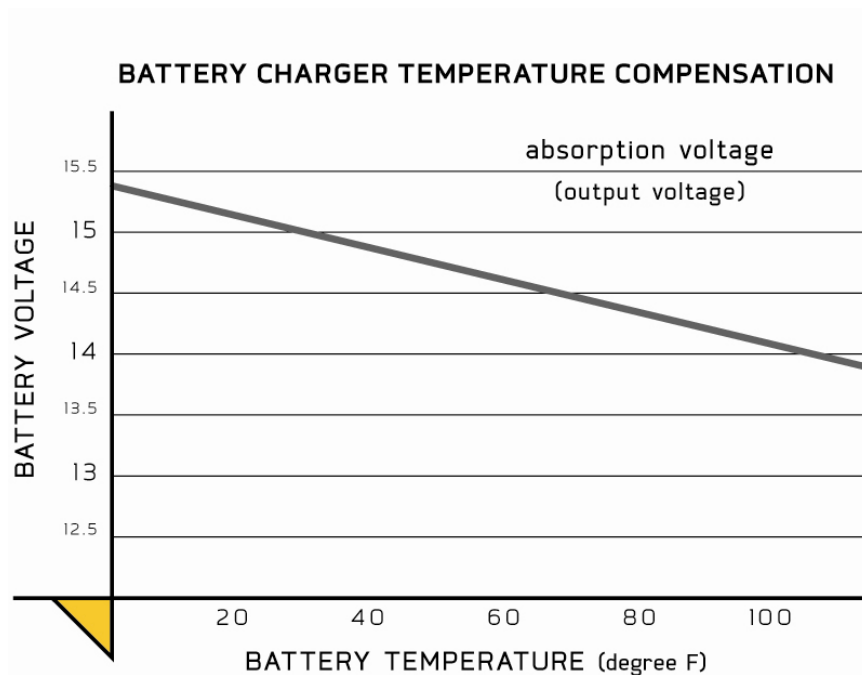
- Senses temperature and adjusts output voltage
- Protects batteries from overcharging at high temperatures
- Maintains gassing threshold for a full charge

Gassing Threshold

- Voltage level at which electrolyte begins moving within the battery
- This threshold must be reached in order to fully charge a battery

Effect of Temperature

- Gassing threshold is higher at lower temps, lower at higher temps
- Too much voltage at high temperatures can “boil” and destroy a battery



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

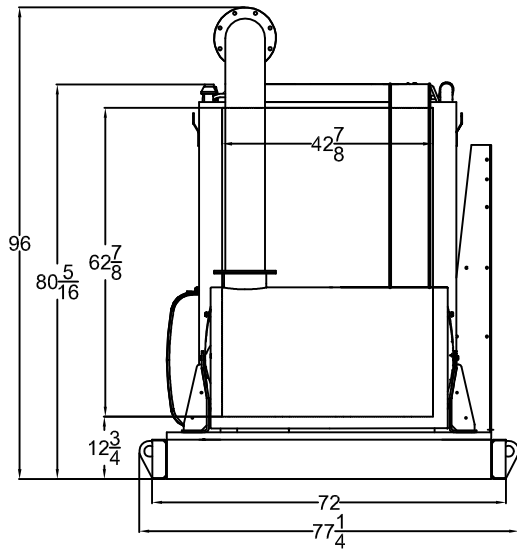
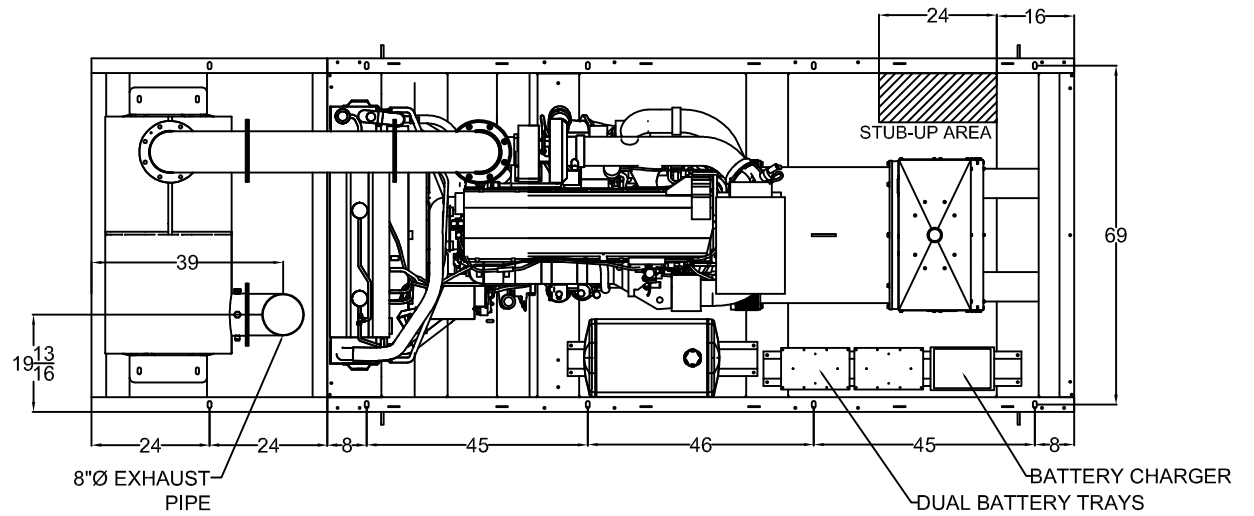


DIGITAL LINEAR ON-BOARD CHARGERS

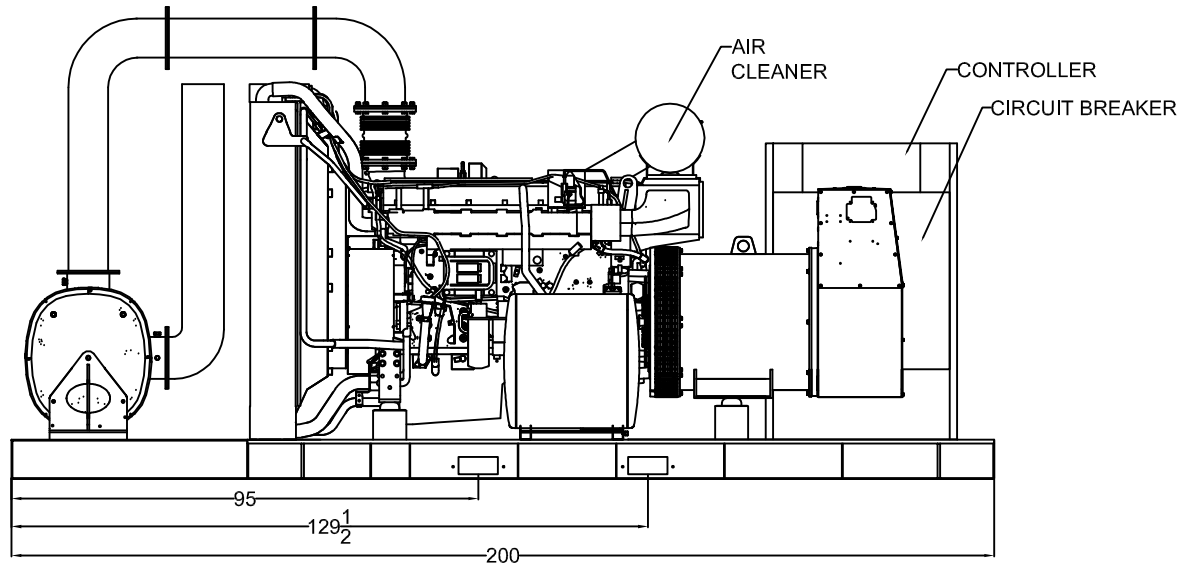
PRODUCT CODE	PRODUCT DESCRIPTION
1821065	MK 106D (1 bank x 6 amps)
1821105	MK-110D (1 bank x 10 amps)
1822105	MK-210D (2 bank x 5 amps)
1823155	MK-315D (3 bank x 5 amps)
1822205	MK-220D (2 bank x 10 amps)
1823305	MK-330D (3 bank x 10 amps)
1824405	MK-440D (4 bank x 10 amps)
1822305	MK-230D (2 bank x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

T4D-5500 OPEN DIMENSIONAL OVERVIEW

TOP VIEW



RADIATOR VIEW

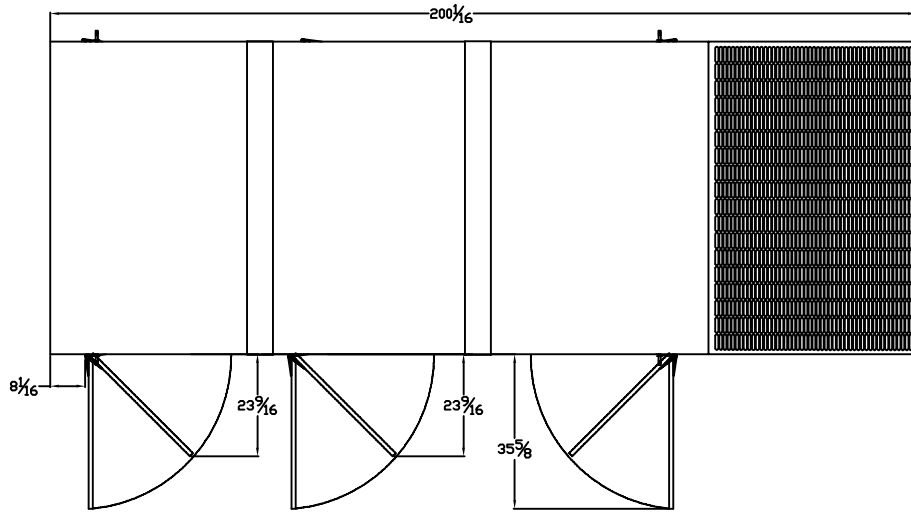


SIDE VIEW

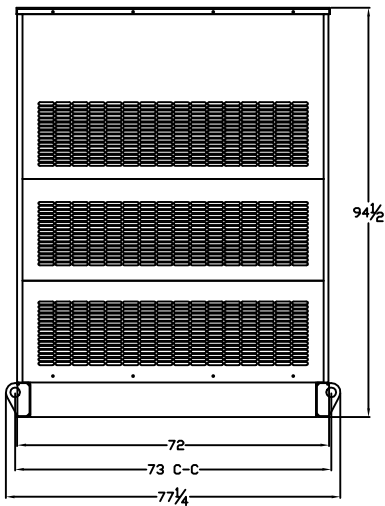
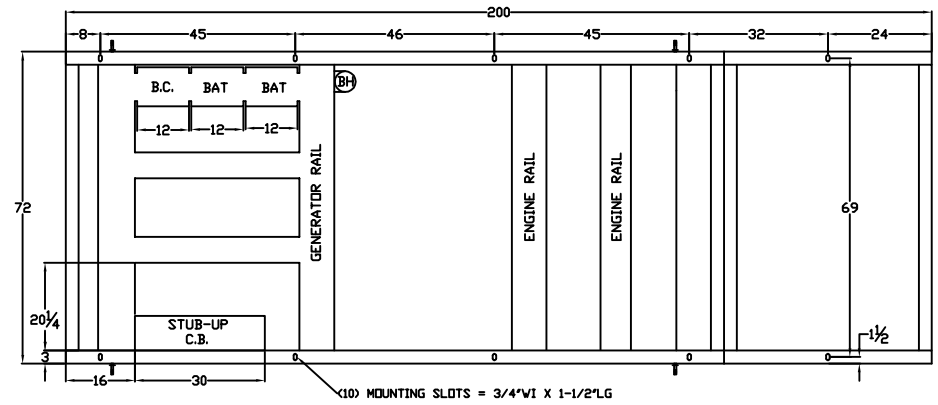
T4D-5500 THRU T4D-6000 LEVEL 2 ENCLOSURE OUTLINE DIMENSIONS WITH RESIDENTIAL GRADE SILENCER

TOP VIEW

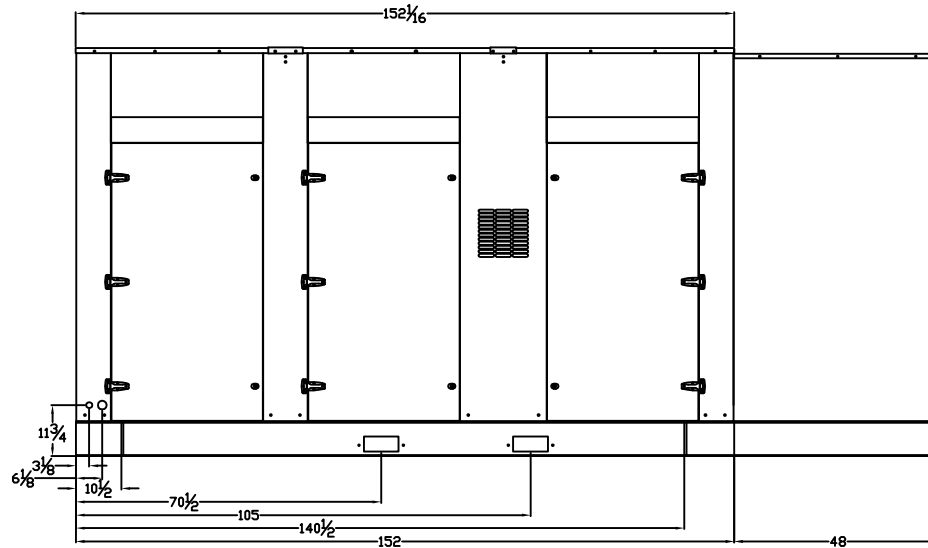
(GEN-SET HAS (6) DOORS, (3) SHOWN OPEN ARE TYPICAL FOR BOTH SIDES)



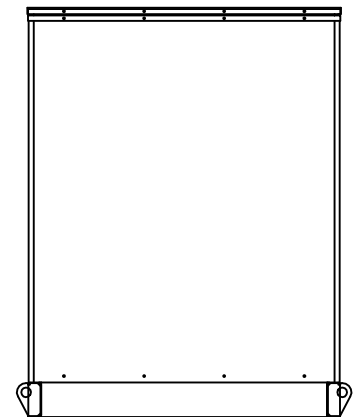
FRAME VIEW



GENERATOR END VIEW



SIDE VIEW



RADIATOR END VIEW