

Technical Specification and Scope of Supply

HRVW 685 T4F



System Description

Product Type	HRVW 685 T4F
Application Group	Rental

Power as per HiPOWER Data sheet

Power per genset (ISO 8528)	550	kWeI
Engine Make	VOLVO PENTA	
Engine Type	TWD 1673 GE	
Engine Speed	1800	rpm
Intake air temperature	45	°C
Frequency	60	Hz
Generator voltage	Rental	V
Noise, Enclosed	72 dBA @ 23 ft.	
Weight, Enclosed	18700	
Dimensions, Enclosed	200" X 81" X 112"	
Phase	Rental	
Unit Specification	CSA	
Temp Rise	105/40	°C
Exhaust Emissions (EPA)	TIER 4 FINAL	
Radiator Design Temperature	45	°C

1 SYSTEM CONFIGURATION

1.1 STARTING AIDS

10A 24V SENS MicroGenius battery charger UL-Listed (installed)

2 ENGINE CONFIGURATION

2.1 Engine Description

VOLVO PENTA TWD1673GE, Long-life, heavy-duty, 4-cycle, direct injection engine. EPA Certification Tier Level 4 FINAL

2.2 FUEL SYSTEM

3-way valve kit

Standard HDR625/685 18 hr Fuel Tank

3 GENERATOR END CONFIGURATION

3.1 Generator End Description

STAMFORD HCI 534 F, Brushless, PMG Excited, Winding 17, Four Pole Rotating Field, Class H Insulation (105 °C Temp. Rise), IP23. Single Bearing. 2/3 Pitch Winding. MX341 Automatic Voltage Regulator

4 CONTROL PANEL CONFIGURATION

4.1 Cont. Panel Description

COMAP INTELLIGEN Digital controller with auto and manual start as well as parallel capability. with push button reset. LCD Display that offers AC metering, protective relaying and engine and generator control and monitoring. Engine and generator controls, diagnostics, and operating information are accessible via the control panel keypads

5 PAINTING

5.1 Painting Details

- Base skid is epoxy-polyester powder painted - Standard RAL9005 color
- Enclosure is epoxy-polyester powder painted - Standard RAL7035 color.
- Other colors available upon request

6 ADDITIONAL OPTIONS CONFIGURATION

6.1 ADDITIONAL OPTIONS DESCRIPTION

Tandem axle - electric brakes - Gooseneck

7 SERVICE AND AFTER SALES

7.1 Details

HIPOWER® is committed to offer a Superior Customer Service for an Outstanding Experience, from pre-sales, sales, and after sales support

8 MISCELLANEOUS

8.1 Details

One USB drive including Electrical Schematics, Control Panel manual, Warranty Statements, Engine manual, Generator end manual and Generator set manuals is provided with the unit

9 FUNCTIONAL TESTS

9.1 Tests

Standard acceptance testing performed under HIPOWER quality specification

10 SHIPPING CONDITIONS

10.1 Details

All units are shipped wet, with all the fluid included minus fuel supply (unless otherwise specified)

11 SALES TERMS AND CONDITIONS

11.1 Details

Standard Terms and Conditions apply. Read carefully attached HIPOWER® Terms and Conditions of Sale

12 WARRANTY

12.1 Details

Standard limited Warranty 2 Years/3500 Hours

Submittal Documents for Model Selected

Item	Description
1	Genset Data Sheet
1a	Engine Data Sheet
1b	Alternator Data Sheet
1c	AVR Specification
1d	Panel Specification
1e	Circuit Breaker Details
1f	CARB Certification
1g	EPA Certification
1h	General Arrangement
1i	Paint Specification
1j	Terms and Conditions
1k	Warranty Details
1l	Electrical Drawing
1m	Paint Specification
1n	Block Heater Datasheet
2	Battery Charger - MicroGenius 300 Datasheet
3	3-way valve kit - Three way valve

MODEL

HRVW-685 T4F

60Hz MOBILE/PRIME/STANDBY POWER

550kW/60Hz/Mobile/1800RPM



* Trailer is sold as option

VOLTAGE VAC	120/208V		139/240V		277/480V		347/600V**	
RATING	Prime	Standby	Prime	Standby	Prime	Standby	Prime	Standby
PHASE	3		3		3		3	
PF	0.8		0.8		0.8		0.8	
HZ	60		60		60		60	
KW	550	605	550	605	550	605	550	605
KVA	687	756	687	756	687	756	687	756
AMPS	1906	2098	1653	1819	826	909	661	727
SKVA@30% VOLTAGE DIP	1760		1760		2280		N/A	
MLCB (AMPS)	2000		2000		2000		600	

Description

HIPOWER® Mobile Generators are an efficient, reliable and versatile source of mobile electrical power. Designed to operate in the most extreme working conditions. All HIPOWER® Mobile Generators combine an innovative design and the use of high quality materials that provide the user with the most dependable power that you can rely on for non-stop power with easy to operate controls.

Powered by a radiator-cooled, industrial VOLVO PENTA Diesel engine, which meets current Environmental Protection Agency (EPA) TIER 4 Final non-road exhaust emission regulations, driving a single bearing, four-pole, three-phase alternator, with IP23 protection. The Prime Power kVA rating for generator set is given with a 105 degree °C alternator winding temperature rise.

HIPOWER® Features and Benefits

VOLVO PENTA Diesel Engine: Long-life, heavy-duty, 4-cycle, direct injection engine for economy of operation and maximum reliability and durability. Capable of full rated load acceptance in one step.

Cooling: Radiator with belt driven pusher fan.

Air Filter: Heavy-duty replaceable element air-cleaner.

Alternator: Single bearing, rotating field, self-excited, self-ventilated, 12-wire re-connectable, 60Hz brushless alternator with permanent magnetic generator (PMG), with Class F insulation. Automatic voltage regulator (AVR) providing close voltage regulation and skVA starting capability for electric motor loads.
Certification: ISO 8528-5.

Fuel Tank: Environmentally friendly steel base welded sub-base fuel tank with internal filling system and 110% containment capability for any diesel fuel, coolant or engine oil spills. Easy access for maintenance activities.

Enclosure: Fully sound attenuated enclosure, fabricated in 11-gauge steel, powder coated with finish that exceeds 1400-hr salt spray test, curved edges, minimum outside fasteners and single point lift. Ample layer of durable Rockwool sound insulating material placed all around the inside of the container, doors and ducting with metal retaining frames. It can be cleaned with high-pressure water and is oil and fire resistant. Vertical air discharge for quiet operation. Wide steel lockable access doors with rubber seals, easy access for maintenance and service activities, lift off stainless steel hinges, corrosion resistant hardware and fasteners.

Fuel Filtration: Standard and secondary water separator with visible level on fuel filters

Voltage Change Over Board: Two-position, manual change over board. 120/208 and 277/480V 3-phase.

Controls: Digital control panel with manual and automatic start and stop features. Many programmable automatic functions for local and remote controls with LED lights, tamper proof engine hour recorder. Load Connections: Covered distribution panel for easy access to cable power outlets, receptacles, lugs and Camlocks.

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16600 South Theden Street, Olathe, KS 66062

Tel: 913 495 5557 | Fax: 913 495 5575 www.hipowersystems.com

Codes and Standards Compliances used where applicable



APPLICATION DATA

ENGINE SPECIFICATION

Manufacturer	VOLVO PENTA
Model	TWD 1673 GE
EPA certified	Tier 4 FINAL
Crankshaft speed	1,800 rpm
Type	Diesel, 4-stroke
Injection	Direct
Aspiration	Turbocharged
Number of Cylinders	6
Cylinder arrangement	In-line
Displacement CID (liters)	983.9 (16.12)
Bore and Stroke ins (mm)	5.67 x 6.5 (144 x 165)
Nominal power	809 HP
Cooling	Liquid
Governor	Electronic
Governor Regulation Class	ISO 8528 Part 1 Class G3
Frequency Regulation	Isochronous
Starting motor & alternator	24 volt
Compression ratio	16.8:1
Air cleaner type	Heavy duty - single cartridge
Exhaust gas flow cu. ft./minute (cu.m. /minute)	4471 (126.6)
Max. Exhaust temp at full load degrees °F (°C)	851 (455)
Max. permissible back pressure - ins H2O (kPA)	76 (19)

COOLING SYSTEM

Engine cooling air flow - cu. ft./min (cu. m/min)	30,207 (912)
Alternator cooling flow - cu. ft./min (cu. m/min)	220 (72)
Total cooling air flow (engine + alternator + combustion) - cu. ft./min (cu. m/min)	TBD
Total cooling capacity - US gallons (liters)	25.3 (96)
Max. Operating Temperature °F (°C)	113 (45)

LUBRICATION SYSTEM

Oil pan capacity - US gallons (liters)	11.1 (42)
Oil pan capacity with filter - US gallons (liters)	12.7 (48)
Oil cooler	Liquid
Recommended lubricating oil grade	SAE 10W-40 conventional DH4 (refer to owners manual)
Oil consumption at full load	< 0.1 % of fuel consumption
Oil pressure – psi (kPA)	58 (399)

ENGINE ELECTRICAL SYSTEM

Starting motor voltage	24 volt
Cold Cranking Amps - minimum	300 Amp X 2
Battery charging Alternator	N/A
Battery capacity	225 Amps X 2

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APPLICATION DATA

FUEL SYSTEM

Recommended fuel	# 2 - ULSD
Fuel supply line, min. ID mm(in.)	9.5 (3/8")
Fuel return line, min. ID, mm (in.)	9.5 (3/8")
Max. lift, fuel pump, type, m (ft)	TBD
Fuel filter	Secondary 5 Microns @ 98% Efficiency
DEF Tank capacity - US Gal.	42.3

FUEL and DEF COMPSUMTION

	FUEL (Prime Power Rating)	DEF (% of fuel consumption)
100% load – US gallons/hour (L/hr)	36.8 (139.3)	6.4 %
75% load - US gallons/hour (L/hr)	27.6 (104.4)	TBA
50% load - US gallons/hour (L/hr)	19.1 (72.3)	TBA
25% load - US gallons/hour (L/hr)	10.7 (40.5)	TBA

ALTERNATOR SPECIFICATION

Manufacturer	STAMFORD
Model	HCI 534 F with PMG
Voltages	120/208V - 277/480
Alternator Type	Four pole, rotating field
Excitation System	Brushless PMG-excited
Power factor	0.8
Number of leads	12 leads, reconnectable
Stator Pitch	2/3
Insulation	Class H
Windings – Temperature Rise	Class F (105/40° C)
Enclosure (IEC-34-S)	IP23
Bearing	Single, sealed
Coupling	Flexible disc
Amortisseur windings	Full
Voltage regulation – no load to full load with MX341 AVR	± 1 %
TIF	<50
Radio Frequency Emissions compliance	Meets requirements of most industrial and commercial applications
Line harmonics	5% maximum

STANDARD ACCESSORIES

• Air Filter Restriction Indicator	• Leak Proof Tray
• Leakage Detection Sensor	• MLCB Auxiliary Contacts
• Battery Switch	• Shunt Trip on MLCB
• Crankcase Ventilation Filter	• 2 Positions Voltage Change Over Board
• Oil/Coolant Drain Extention	• PMG Excitation on Alternator
• Distribution Panel 2000A	• Low Coolant Level Sensor
• Water Jacket Heater	

• Distribution power panel *See image RH back-page - NEMA 3R/IP67 0.09" aluminum panel, black powder coated, weather proof rated; 2 x15A 125V NEMA 5-15P Shore line connector; 6 sets 400A single pin Camlocks rated 400A with snap covers; color coded Camlocks 3Ø - 5W black, red blue, white & green; pad lockable 1/4 turn door access with cable trap; auxiliary bus bars with mechanical lugs; 1 single barrel lug per phase; mechanical lugs up to 2 x 600MCM cable

OPTIONAL ACCESSORIES

• Battery Blanket	• Variable speed fan LCV220 - Viscous Clutch
• Hydronic heater (5 kw)	• Engineered Options available upon request
• 3-Way Fuel valve	• Control Panel Heater
• 6 Amp - 10 Amp battery charger, 12/24V, UL Listed	• Oil Pan Heater
	• Trailer

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CONTROL SYSTEMS STANDARD FEATURES - Generator Digital Control Panel

HIPOWER® COMAP IntelliGen NT Control Panel: The IntelliGen NT digital control panel is back-lit with icon LCD text display, and is PC configurable. IntelliGen NT is a comprehensive controller for both single and multiple gen-sets operating in standby or parallel modes. Compact construction is optimized for these purposes and various modifications allow customers to select the optimum type for a particular application. A built-in synchronizer and digital isochronous load sharer allow a total integrated solution for gen-sets in standby, island parallel or mains parallel. Native cooperation of up to 32 gen-sets is a standard feature. IntelliGen NT supports many standard ECU types and is specially designed to easily integrate new ones.

Engine alarms included: High coolant temperature, low oil pressure, low coolant level, unexpected shutdown, low fuel level, stop failure, low battery voltage, battery charging alternator failure, over-speed, under-speed, start failure and emergency stop. Support of engines with ECU (J1939, Modbus and other proprietary interfaces); alarm codes displayed in text for

Alternator alarms included: Overload, unbalanced voltage, over voltage, under voltage, over frequency, under frequency, short circuit, reverse power, and incorrect phase sequence.



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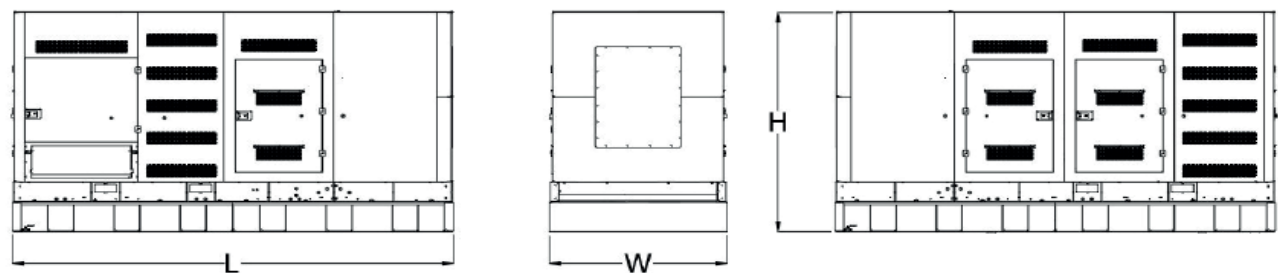
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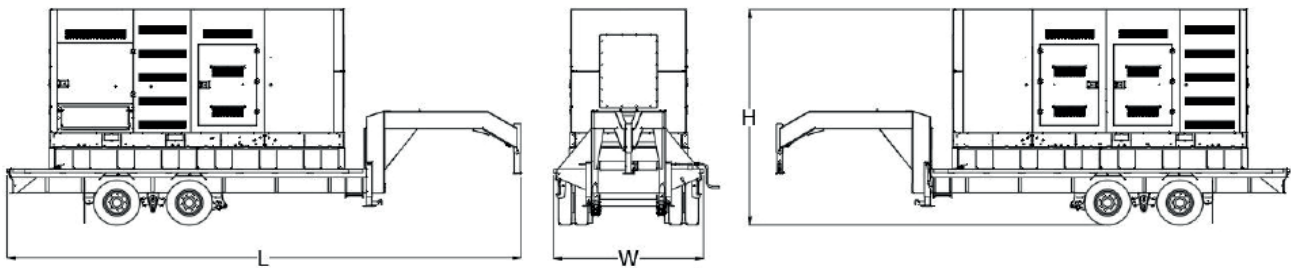
DIMENSIONS, WEIGHTS & SOUND LEVELS

ENCLOSED SET



CONFIGURATION	Fuel Tank Data (base option)		Generator Data *				
	Run Time Hours	Capacity (Gals)	L = Length	W = Width	H = Height	Weight lbs	dBA
Enclosed Set	18	600	200"	81"	112"	19500	72

ENCLOSED SET WITH TRAILER



CONFIGURATION	Fuel Tank Data (base option)		Generator Data *				
	Run Time Hours	Capacity (Gals)	L = Length	W = Width	H = Height	Weight lbs	dBA
Enclosed Set with Trailer	18	600	347"	102"	152"	27700	72

* All measurements are approximate and for estimation purposes only. Weights are without fuel tank. Sound levels measured at 23ft (7m) and does not account for ambient site conditions.

REV3



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

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Performance			rpm	1500	1800
Prime Power		without fan	kW hp	NA NA	625 850
		with fan	kW hp	NA NA	595 809
Standby Power		without fan	kW hp	NA NA	685 932
		with fan	kW hp	NA NA	655 891
Torque at:	Prime Power		Nm lbft	NA NA	3316 2445
	Standby Power		Nm lbft	NA NA	3634 2680
Mean piston speed			m/s	NA	9,9
			ft/sec	NA	32,6
Effective mean pressure at:	Prime Power		MPa psi	NA NA	2,6 375
Effective mean pressure at:	Standby Power		MPa psi	NA NA	2,8 411
Max combustion pressure at:	Prime Power		MPa psi	NA NA	22 3191
Max combustion pressure at:	Standby Power		MPa psi	NA NA	22,5 3263
Total mass moment of inertia, J (mR ²) with flywheel			kgm ² lbft ²	2,50 59,3	
			kgm ² lbft ²	1,92 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)	NA	118,1
	Prime Power	dB(A)	NA	119,1
	Standby Power	dB(A)	NA	118,9
Calculated sound pressure Lp at 1 m	No load	dB(A)	NA	101,1
	Prime Power	dB(A)	NA	102,1
	Standby Power	dB(A)	NA	101,9

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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 DWELL (%)*: N/A
	Stability (%)*: According to Stamford instructions	Voltage (V):	400 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	2,6	1,5	0,5	0,0	20-100	8,8	2,9	17,6	1,6
0-40	4,8	2,1	5,3	1,2	40-100	5,9	2,5	9,8	1,5
0-52	7 (G3)	2,3	10,6	1,2	58-100	4,5	2,2	4,0	1,1
0-60	7,4	2,3	11,6	1,2	60-100	4,5	2,1	3,5	1,1
0-68	10 (G2)	2,7	17,1	1,2	71-100	3,5	1,8	2,0	0,8
0-80	12,3	3,1	22,4	1,4	80-100	2,6	1,4	1,5	0,4
0-100	17,4	3,4	31,7	2,1					
100-0	5,6	1,9	8,3	1,7					

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	2,9	1,5	0,8	0,6	20-100	10,8	3,2	21,6	1,7
0-40	5,1	2,1	5,8	1,1	40-100	6,9	2,8	12,3	1,6
0-54	7 (G3)	2,3	10,8	1,2	54-100	5,3	2,4	6,0	1,4
0-60	8,4	2,7	14,6	1,2	60-100	4,7	2,2	4,0	1,4
0-67	10 (G2)	2,9	16,8	1,2	67-100	4,3	2,1	3,3	1,2
0-80	13,3	3,2	24,1	1,7	80-100	3,1	1,6	2,3	0,8
0-100	19,8	3,8	35,4	1,8					
100-0	4,3	1,0	9,8	2,4					

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Cold start performance

		rpm	1500	1800
Time from start to stay within 0.5% of no load speed at ambient temperature:	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

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

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Fuel system		rpm	1500	1800
Prime Power Specific fuel consumption at:	25%	g/kWh lb/hph	NA NA	227 0,368
	50%	g/kWh lb/hph	NA NA	202 0,327
	75%	g/kWh lb/hph	NA NA	195 0,316
	100%	g/kWh lb/hph	NA NA	195 0,316
% adBlue consumption at: (Compare to Fuel consumption by Volyme)	25%	%	NA	6,4
	50%	%	NA	6,7
	75%	%	NA	7,2
	100%	%	NA	6,4

Standby Power Specific fuel consumption at:	25%	g/kWh lb/hph	NA NA	223 0,361
	50%	g/kWh lb/hph	NA NA	201 0,326
	75%	g/kWh lb/hph	NA NA	195 0,316
	100%	g/kWh lb/hph	NA NA	197 0,319
% adBlue consumption at: (Compare to Fuel consumption by Volyme)	25%	%	NA	6,6
	50%	%	NA	6,7
	75%	%	NA	7,2
	100%	%	NA	6,1

Fuel system		rpm	1500	1800
See front page for important information				
Fuel to conform to		ASTM D975 (2D)		
System supply flow at:		litre/h US gal/h	NA NA	210,0 55,5
Fuel supply line max restriction (Measured at fuel inlet connection)		kPa psi	NA NA	30,0 4,4
Fuel supply line max pressure, engine stopped		kPa psi	NA NA	0,0 0,0
System return flow		litre/h US gal/h	NA NA	25,0 6,6
Fuel return line max restriction (Measured at fuel return connection)		kPa psi	NA NA	20,0 2,9
Maximum allowable inlet fuel temp (Measured at fuel inlet connection)		°C °F	NA NA	60 140
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	NA	48,1
		cfm	NA	1699
	Standby Power	m ³ /min	NA	51,1
		cfm	NA	1805
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
		kPa	NA	1,4
		psi	NA	0,2
Heat rejection to exhaust at:	Prime Power	kW	NA	458
		BTU/min	NA	26072
	Standby Power	kW	NA	521
		BTU/min	NA	29623
Exhaust gas temperature after turbine at:	Prime Power	°C	NA	455
		°F	NA	851
	Standby Power	°C	NA	484
		°F	NA	903
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	NA	126,6
		cfm	NA	4471
	Standby Power	m ³ /min	NA	137,8
		cfm	NA	4866

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Cooling system

Cooling system		rpm		1500	1800
Heat rejection radiation from engine at:		Prime Power	kW	NA	26
			BTU/min	NA	1479
		Standby Power	kW	NA	29
			BTU/min	NA	1649
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			m²	NA	1,68
Fan diameter			foot²	NA	18,08
			mm	NA	965
Fan power consumption			in	NA	37,99
			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		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	



VOLVO PENTA TWD1673GE	Document No 22412771	Issue Index 02
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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	223
		BTU/min	NA	12682
	Standby Power	kW	NA	245
		BTU/min	NA	13933
Heat rejection to coolant CAC radiator at:	Prime Power	kW	NA	208
		BTU/min	NA	11829
	Standby Power	kW	NA	216
		BTU/min	NA	12284
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 m³/s	External restriction Pa	Air flow m³/s	External restriction Pa
1800	63	15,2	0	15,2	0
	62	14,5	100		
	61	14,1	200		
	60	13,6	300		
	59			14,5	100
	58			13,9	200
	57			13,6	300

Note! External restrictions are calculated for values >0 Pa

VOLVO PENTA TWD1673GE	Document No 22412771	Issue Index 02
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Engine management system

Functionality	Alternatives	Default setting
Governor mode	Isochronous	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	+/- 90 rpm	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 900rpm	kPa	NA	170	145	Shutdown
	1800 rpm	kPa	NA	300	275	Shutdown
Oil level			NA	Min level		
DEF dosing injector 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 1s
Engine speed		rpm	100 - 120% of rated speed	115% of rated speed	Alarm level	Shutdown
Exhaust Temperature (before SCR volume)		°C	NA	530	550,0	Shutdown after 10s

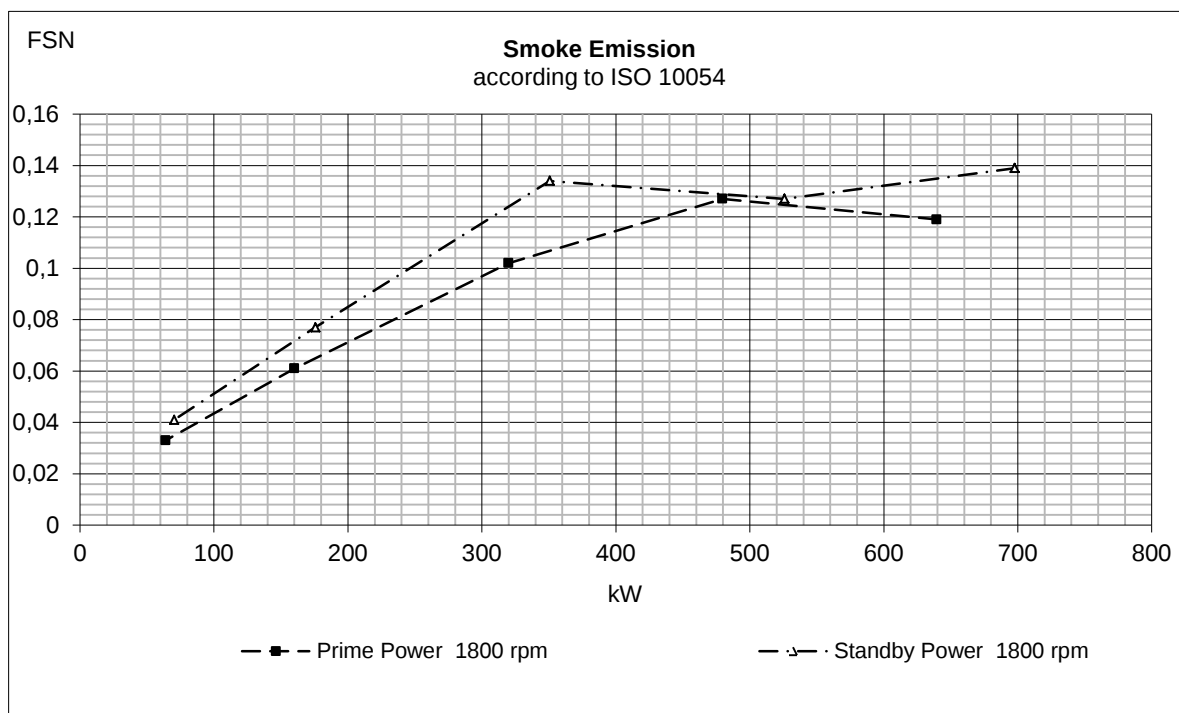
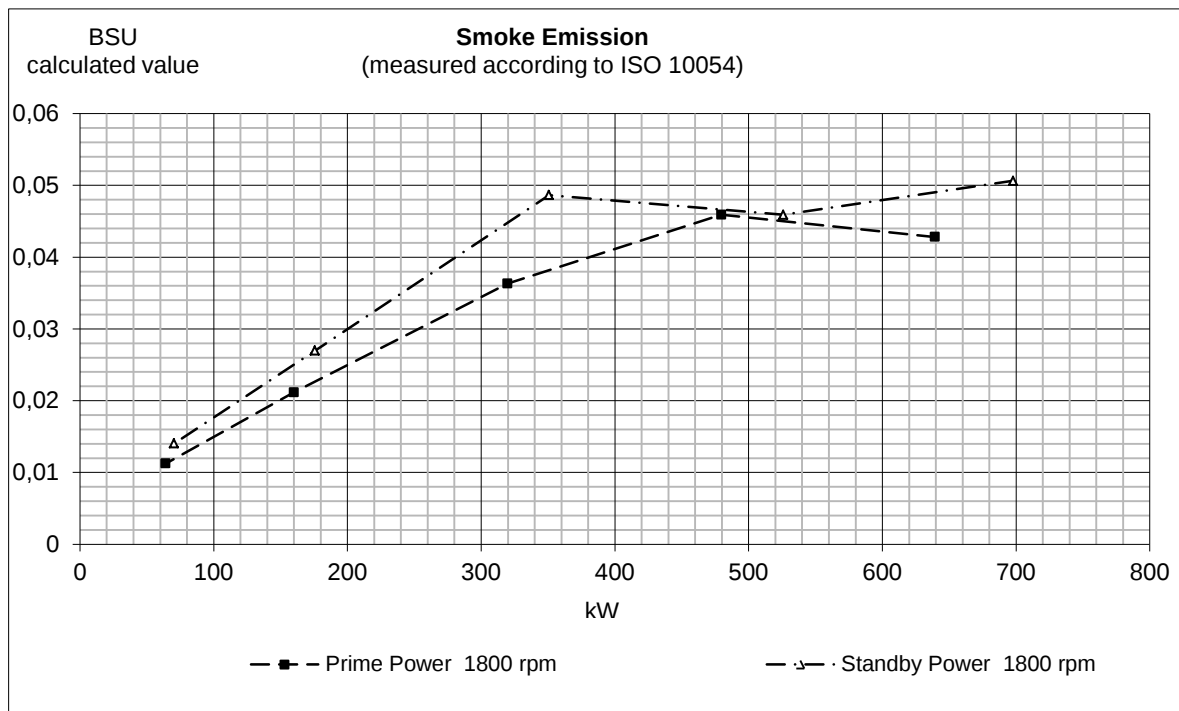
Engine protection can be disabled. For consequences please see VP International Limited Warranty Policy

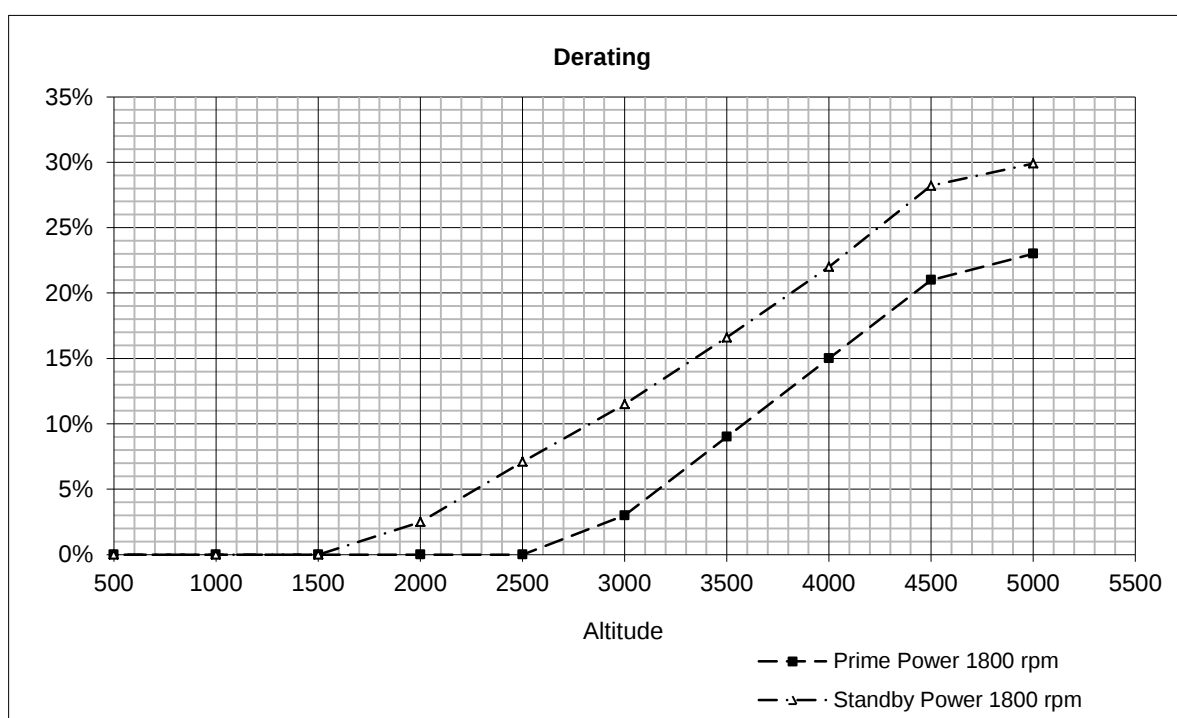
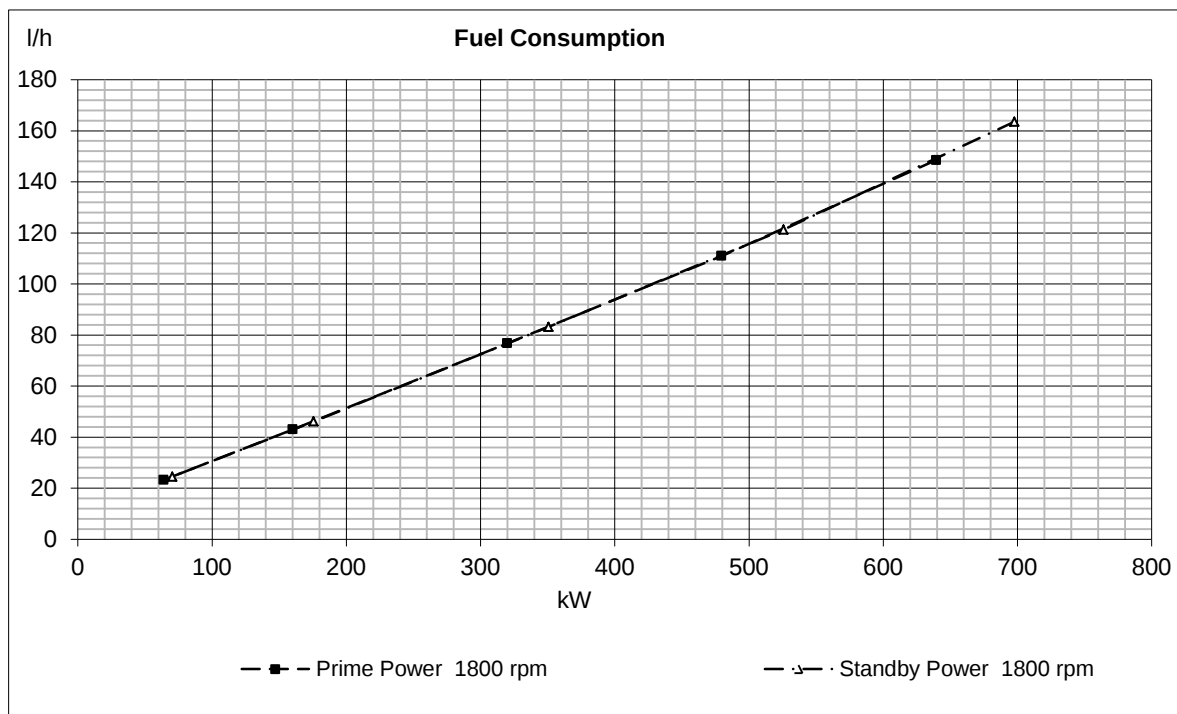
Electrical system

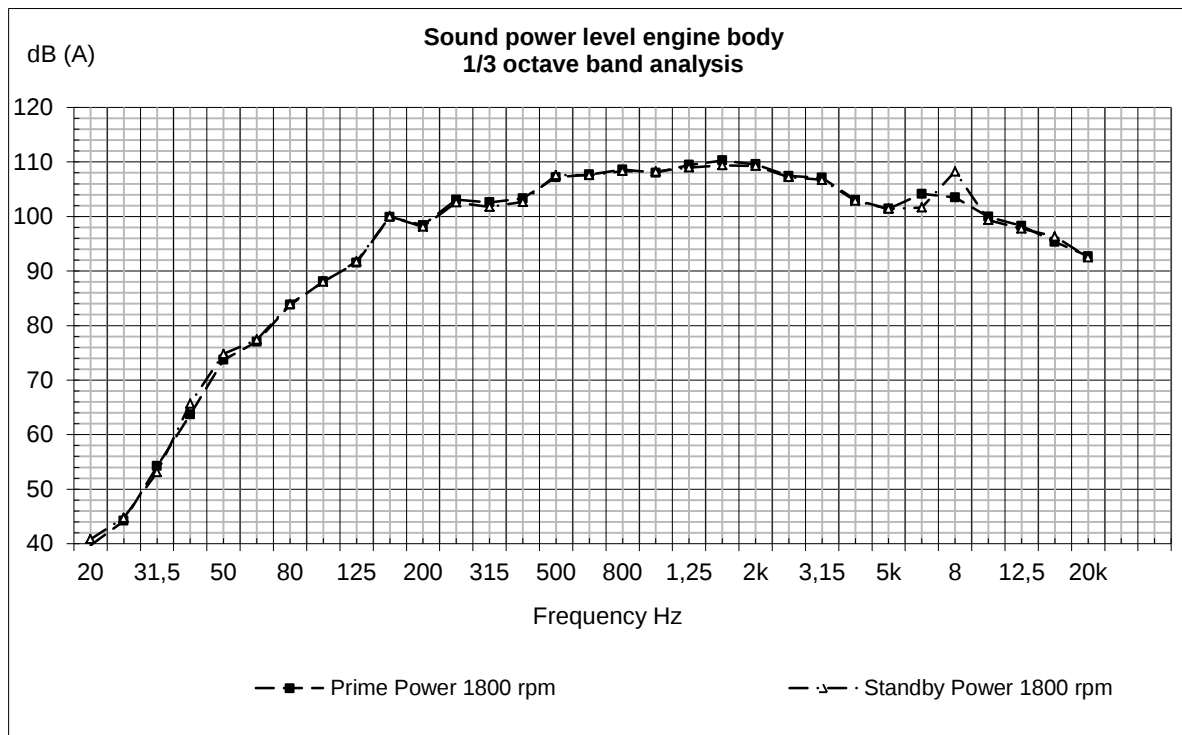
Voltage and type		24V / insulated from earth	
Alternator:	make/output	A	Bosch / 80
	tacho output	Hz/alt. Rev	6
	drive ratio		3,94 : 1
Starter motor	make		Mitsubishi Electric
	type		24V7.0KW12/3.175F
	kW		7,0
Number of teeth on:	flywheel		153
	starter motor		12
Max wiring resistance main circuit		mΩ	
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

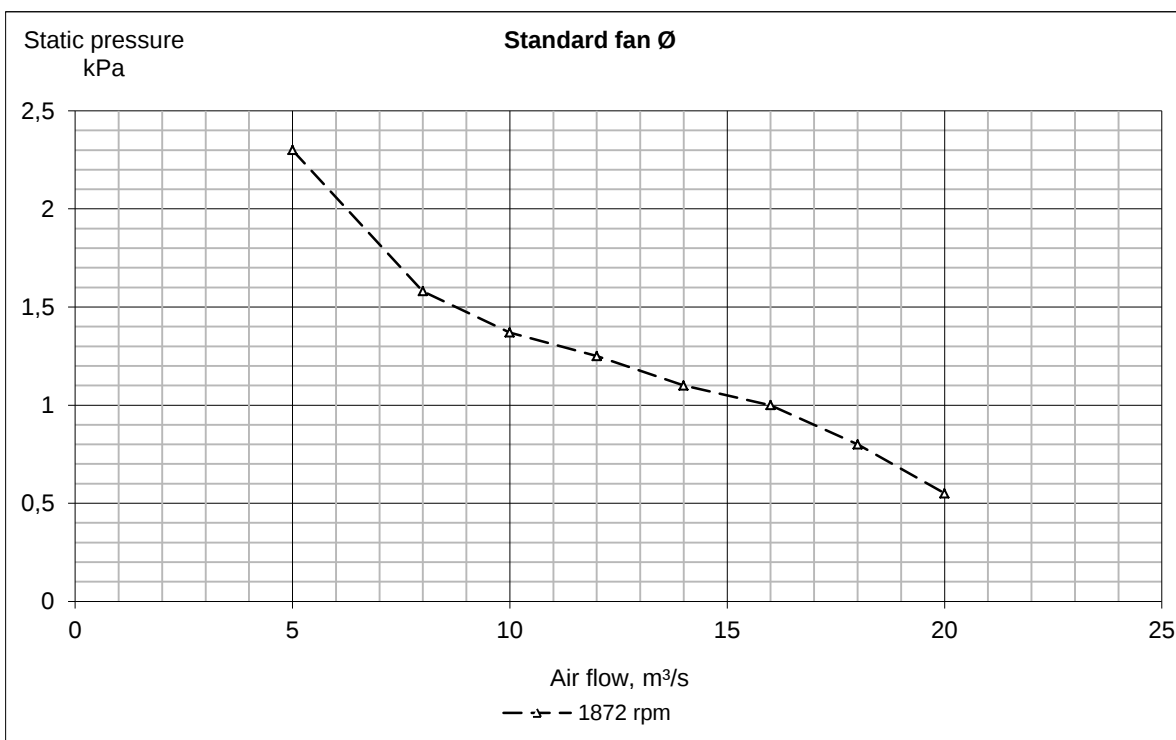
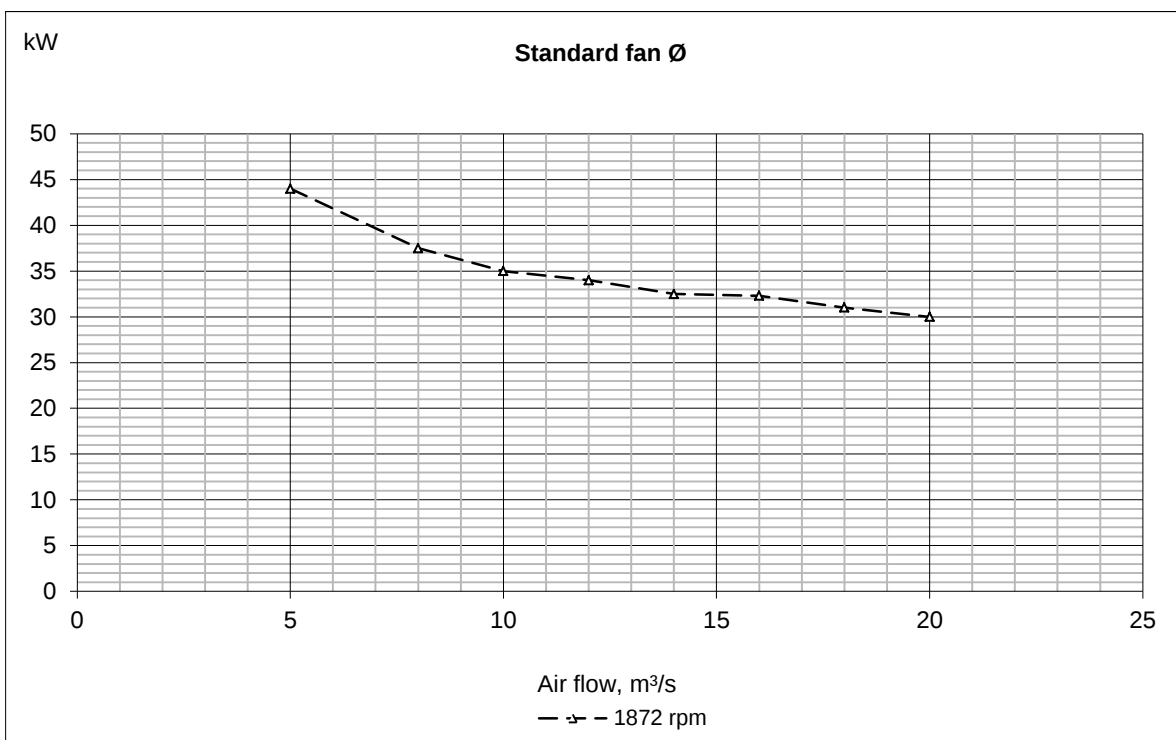
Power take off

		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



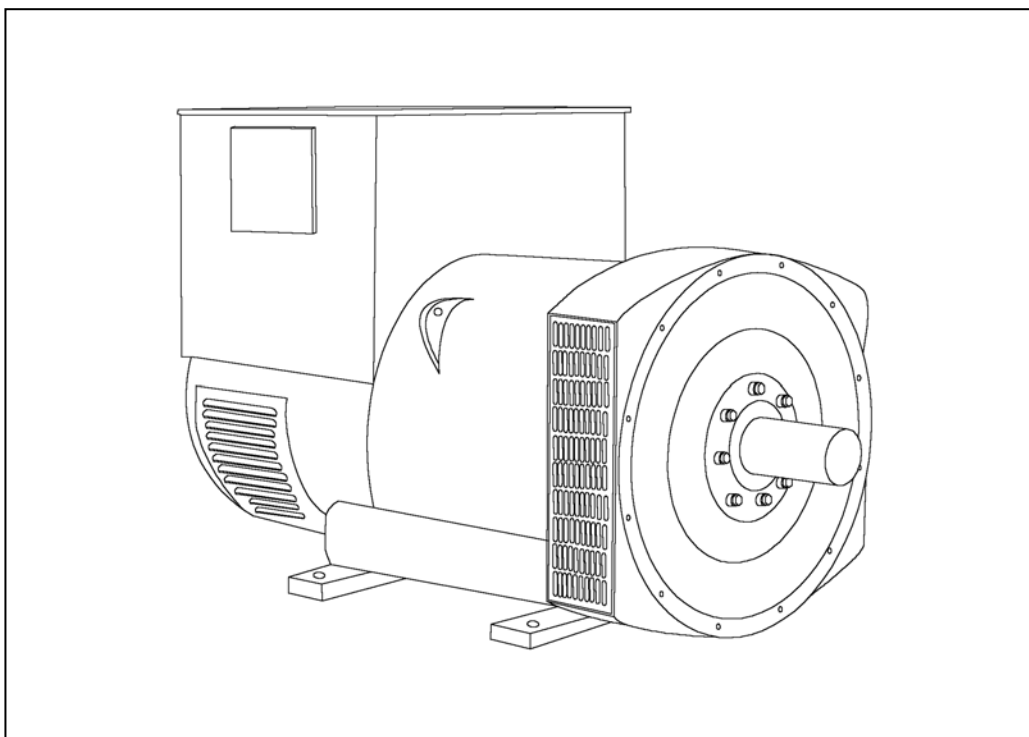






STAMFORD[®]

HCI 534F/544F - Technical Data Sheet



HCI534F/544F

SPECIFICATIONS & OPTIONS

STAMFORD

STANDARDS

Newage 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%.

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.

HC1534F/544F

STAMFORD

WINDING 311

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.		
A.V.R.	MX321	MX341	
VOLTAGE REGULATION	± 0.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 7)		

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

INSULATION SYSTEM	CLASS H		
PROTECTION	IP23		
RATED POWER FACTOR	0.8		
STATOR WINDING	DOUBLE LAYER LAP		
WINDING PITCH	TWO THIRDS		
WINDING LEADS	12		
STATOR WDG. RESISTANCE	0.0037 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED		
ROTOR WDG. RESISTANCE	2.16 Ohms at 22°C		
EXCITER STATOR RESISTANCE	17 Ohms at 22°C		
EXCITER ROTOR RESISTANCE	0.092 Ohms PER PHASE AT 22°C		
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4, VDE 0875G, VDE 0875N. refer to factory for others		
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%		
MAXIMUM OVERSPEED	2250 Rev/Min		
BEARING DRIVE END	BALL. 6220 (ISO)		
BEARING NON-DRIVE END	BALL. 6314 (ISO)		

	1 BEARING				2 BEARING			
WEIGHT COMP. GENERATOR	1685 kg				1694 kg			
WEIGHT WOUND STATOR	805 kg				805 kg			
WEIGHT WOUND ROTOR	684 kg				655 kg			
WR ² INERTIA	10.033 kgm ²				9.7551 kgm ²			
SHIPPING WEIGHTS in a crate	1775 kg				1780kg			
PACKING CRATE SIZE	166 x 87 x 124(cm)				166 x 87 x 124(cm)			
	50 Hz				60 Hz			
TELEPHONE INTERFERENCE	THF<2%				TIF<50			
COOLING AIR	1.035 m³/sec 2202 cfm				1.312 m³/sec 2780 cfm			
VOLTAGE SERIES STAR	380/220	400/231	415/240	440/254	416/240	440/254	460/266	480/277
VOLTAGE PARALLEL STAR	190/110	200/115	208/120	220/127	208/120	220/127	230/133	240/138
VOLTAGE SERIES DELTA	220/110	230/115	240/120	254/127	240/120	254/127	266/133	277/138
KVA BASE RATING FOR REACTANCE VALUES	670	670	670	650	738	775	800	825
Xd DIR. AXIS SYNCHRONOUS	2.90	2.62	2.43	2.10	3.33	3.13	2.95	2.80
X'd DIR. AXIS TRANSIENT	0.16	0.14	0.13	0.11	0.16	0.15	0.14	0.13
X''d DIR. AXIS SUBTRANSIENT	0.11	0.10	0.09	0.08	0.11	0.10	0.10	0.09
Xq QUAD. AXIS REACTANCE	2.42	2.19	2.03	1.75	2.66	2.50	2.36	2.23
X''q QUAD. AXIS SUBTRANSIENT	0.25	0.23	0.21	0.18	0.31	0.29	0.27	0.26
X _L LEAKAGE REACTANCE	0.05	0.04	0.04	0.03	0.05	0.05	0.04	0.04
X ₂ NEGATIVE SEQUENCE	0.18	0.16	0.15	0.13	0.21	0.20	0.19	0.18
X ₀ ZERO SEQUENCE	0.08	0.08	0.07	0.06	0.09	0.08	0.08	0.08

REACTANCES ARE SATURATED		VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED	
T'd TRANSIENT TIME CONST.			0.08s
T''d SUB-TRANSTIME CONST.			0.012s
T'do O.C. FIELD TIME CONST.			2.5s
Ta ARMATURE TIME CONST.			0.019s
SHORT CIRCUIT RATIO			1/Xd

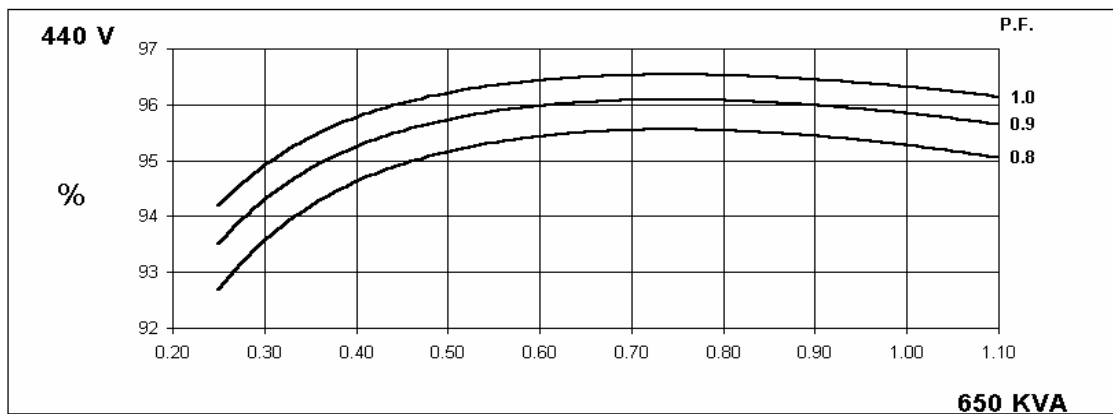
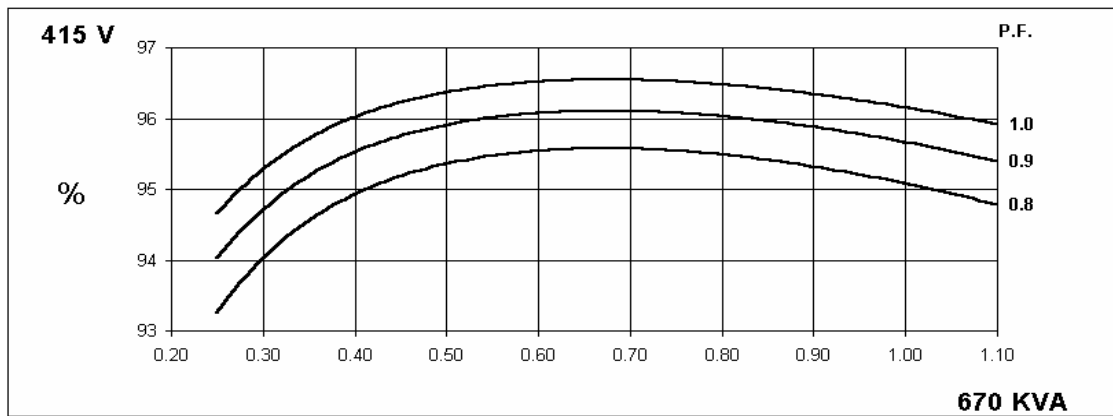
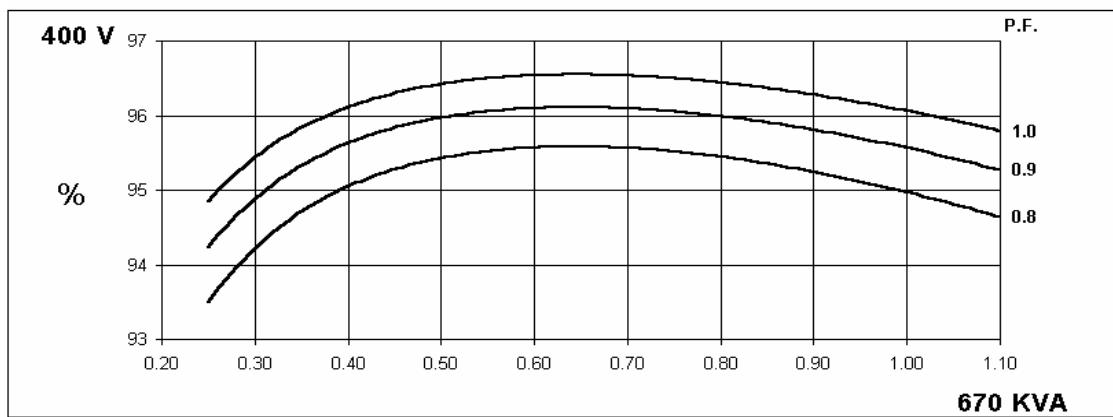
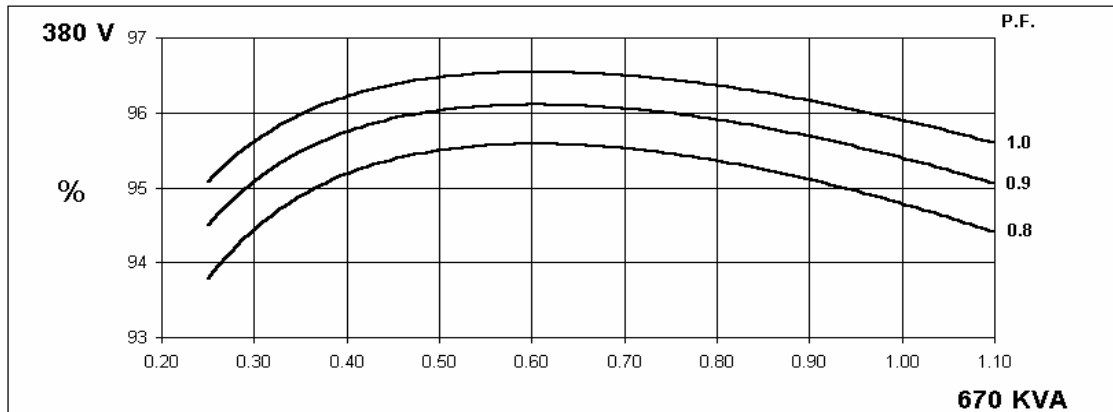
50
Hz

HCI534F/544F

Winding 311

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THREE PHASE EFFICIENCY CURVES



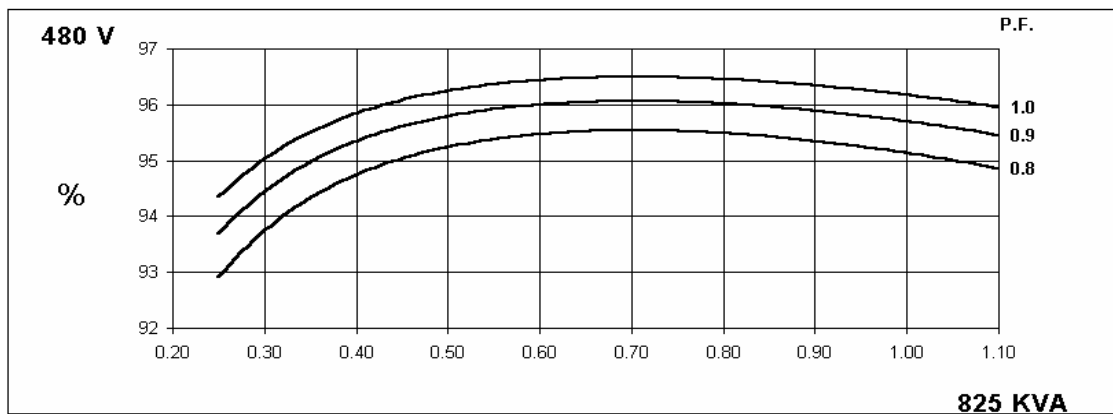
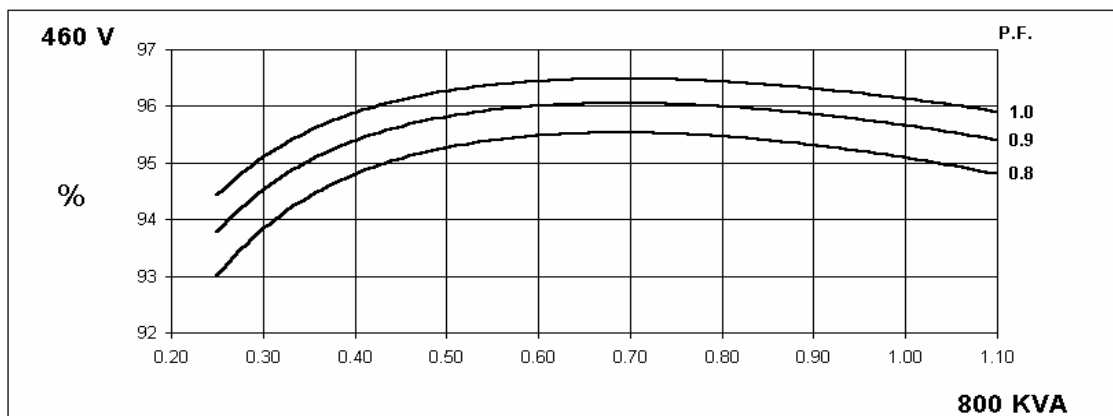
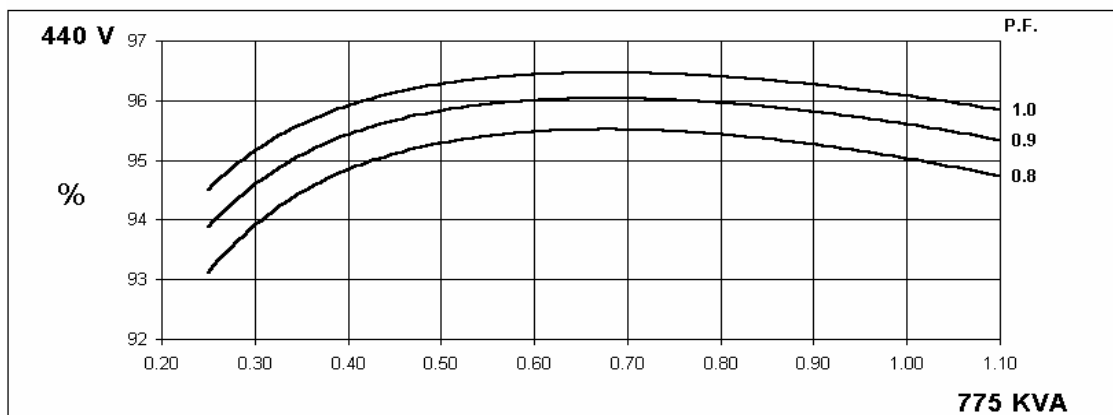
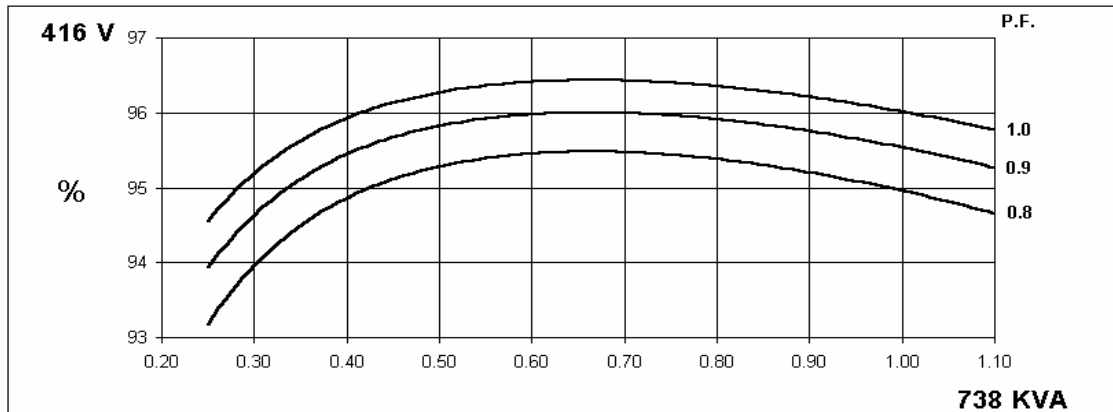
60
Hz

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Winding 311

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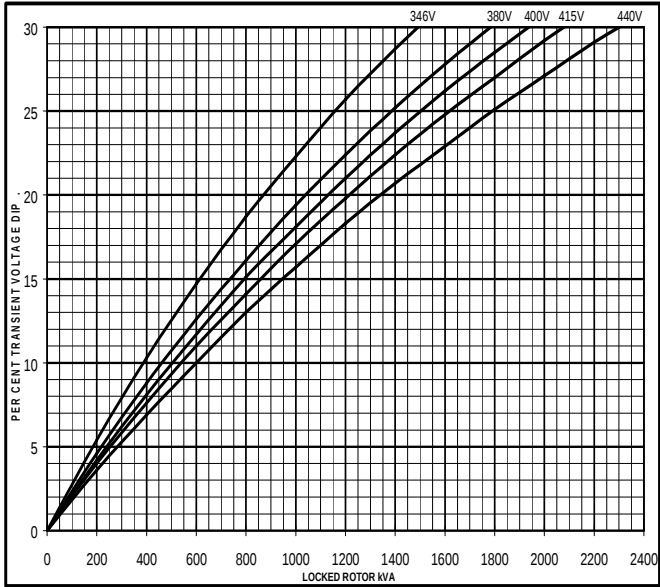
THREE PHASE EFFICIENCY CURVES



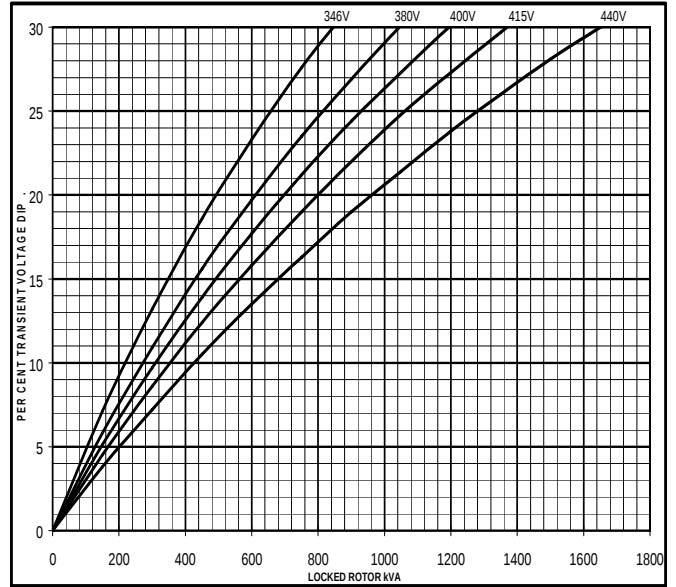
Locked Rotor Motor Starting Curve

**50
Hz**

MX

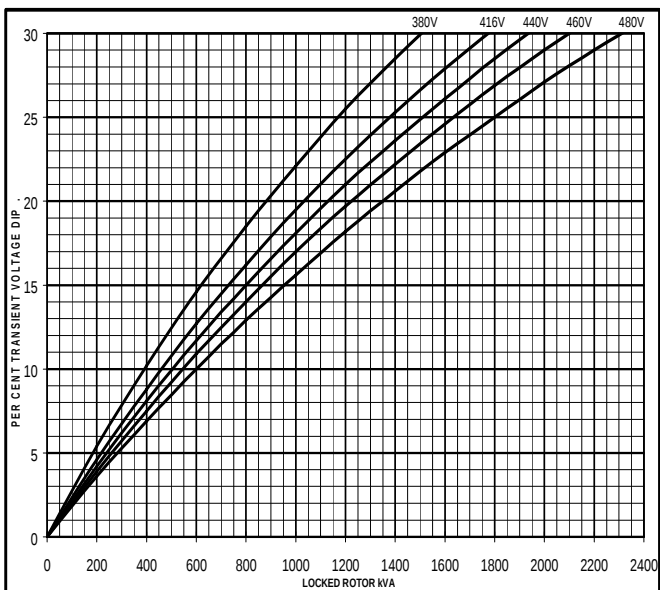


SX

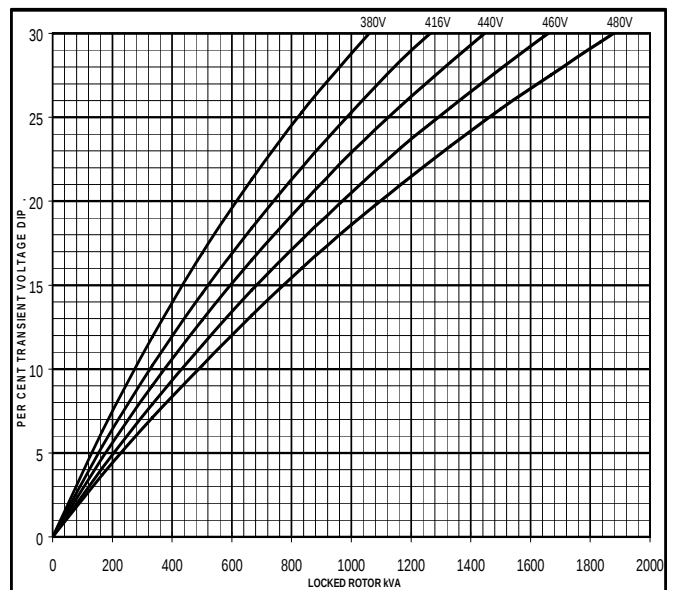


**60
Hz**

MX

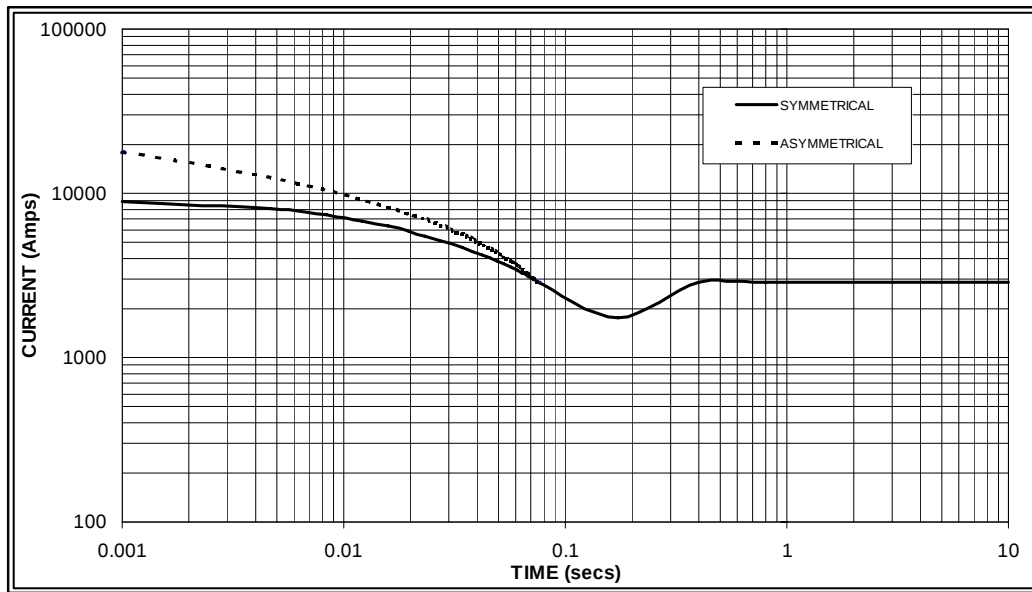


SX



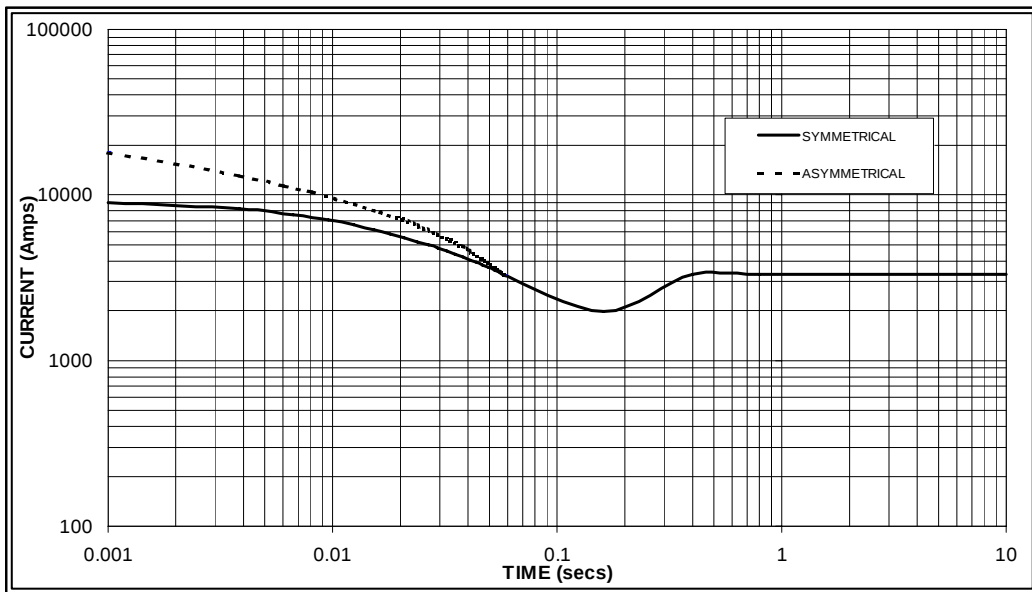
**Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed
Based on star (wye) connection.**

**50
Hz**



Sustained Short Circuit = 2,900 Amps

**60
Hz**



Sustained Short Circuit = 3,300 Amps

Note 1

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

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

The sustained current value is constant irrespective of voltage level

Note 2

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

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

All other times are unchanged

Note 3

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

Parallel Star = Curve current value X 2

Series Delta = Curve current value X 1.732

HCI534F/544F

Winding 311 0.8 Power Factor

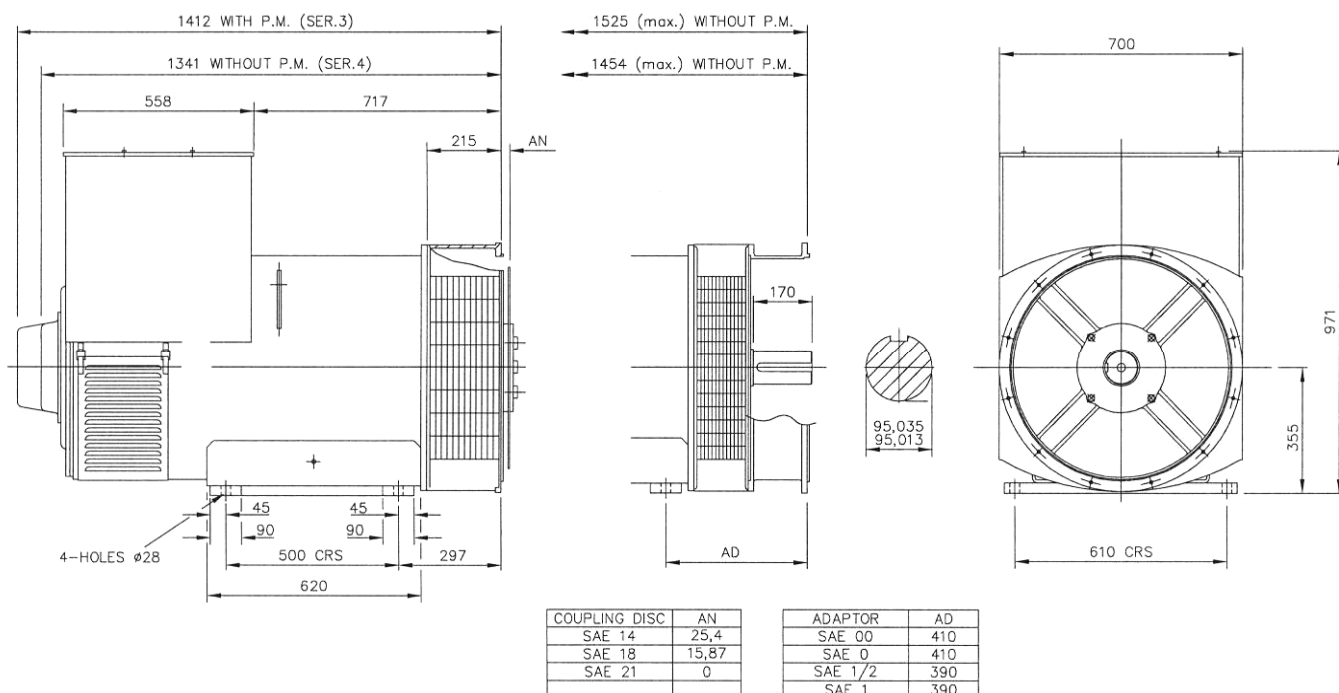
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RATINGS

Class - Temp Rise		Cont. F - 105/40°C				Cont. H - 125/40°C				Standby - 150/40°C				Standby - 163/27°C			
50 Hz	Series Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	Parallel Star (V)	190	200	208	220	190	200	208	220	190	200	208	220	190	200	208	220
	Series Delta (V)	220	230	240	254	220	230	240	254	220	230	240	254	220	230	240	254
	kVA	620	620	620	600	670	670	670	650	710	710	710	690	738	738	738	715
	kW	496	496	496	480	536	536	536	520	568	568	568	552	590	590	590	572
	Efficiency (%)	95.0	95.2	95.3	95.4	94.8	95.0	95.1	95.3	94.6	94.8	94.9	95.1	94.4	94.6	94.8	95.1
	kW Input	522	521	520	503	565	564	564	546	600	599	599	580	625	624	623	601

60 Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	Parallel Star (V)	208	220	230	240	208	220	230	240	208	220	230	240	208	220	230	240
	Delta (V)	240	254	266	277	240	254	266	277	240	254	266	277	240	254	266	277
	kVA	688	719	731	750	738	775	800	825	781	819	848	875	806	844	878	906
	kW	550	575	585	600	590	620	640	660	625	655	678	700	645	675	702	725
	Efficiency (%)	95.1	95.2	95.3	95.3	95.0	95.0	95.1	95.1	94.8	94.9	94.9	95.0	94.7	94.8	94.8	94.9
	kW Input	579	604	614	630	621	653	673	694	659	690	715	737	681	712	741	764

DIMENSIONS



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STAMFORD®

MX341 AUTOMATIC VOLTAGE REGULATOR (AVR)

SPECIFICATION, INSTALLATION AND ADJUSTMENTS

General description

MX341 is a two phase sensed Automatic Voltage Regulator and forms part of the excitation system for a brush-less generator. Excitation power is derived from a three-phase permanent magnet generator (PMG), to isolate the AVR control circuits from the effects of non-linear loads and to reduce radio frequency interference on the generator terminals. Sustained generator short circuit current is another feature of the PMG system.

The AVR senses the voltage in the main generator winding and controls the power fed to the exciter stator and hence the main rotor to maintain the generator output voltage within the specified limits, compensating for load, speed, temperature and power factor of the generator.

Soft start circuitry is included to provide a smooth controlled build up of generator output voltage.

A frequency measuring circuit continually monitors the shaft speed of the generator and provides under-speed protection of the excitation system by reducing the generator output voltage proportionally with speed below a pre-settable threshold. A further enhancement of this feature is an adjustable volts per Hertz slope to improve engine recovery time on turbo charged engines. Soft start circuitry is included to provide a smooth controlled build up of generator output voltage.

Uncontrolled excitation is limited to a safe period by internal shutdown of the AVR output device. This condition remains latched until the generator has stopped.

Provision is made for the connection of a remote voltage trimmer, allowing the user fine control of the generator's output.

An analogue input is provided allowing connection to a STAMFORD Power Factor controller or other external devices with compatible output.

The AVR has the facility for droop CT connection, to allow parallel running with other similarly equipped generators.

Technical specification

SENSING INPUT

Voltage	190-264V ac max, 1 phase, 2 wire
Frequency	50-60 Hz nominal

POWER INPUT (PMG)

Voltage	140-220V ac max, 3 phase, 3 wire
Current	3A/phase
Frequency	100-120 Hz nominal

OUTPUT

Voltage	max 120V dc
Current	continuous 2.7 A Intermittent 6A for 10 secs.
Resistance	15 ohms minimum

REGULATION

+/- 1% (see note 1)

THERMAL DRIFT

0.03% per °C change in AVR ambient (note 2)

SOFT START RAMP TIME

3 seconds

TYPICAL SYSTEM RESPONSE

AVR Response	10 ms
Filed current to 90%	80 ms
Machine Volts to 97%	300 ms

EXTERNAL VOLTAGE ADJUSTMENT

+/-10% with 1 k ohm 1 watt trimmer (see note 3)

UNDER FREQUENCY PROTECTION

Set point	95% Hz (see note 4)
Slope	170% down to 30 Hz

UNIT POWER DISSIPATION

12 watts maximum

ANALOGUE INPUT

Maximum input	+/- 5V dc (see note 5)
Sensitivity	1v for 5% Generator Volts (adjustable)
Input resistance	1k ohm

QUADRATURE DROOP INPUT

10 ohms burden	
Max. sensitivity:	0.07 A for 5% droop OPF
Max. input:	0.33 A

OVER EXCITATION PROTECTION

Set point	75 V dc
Time delay	10 seconds (fixed)

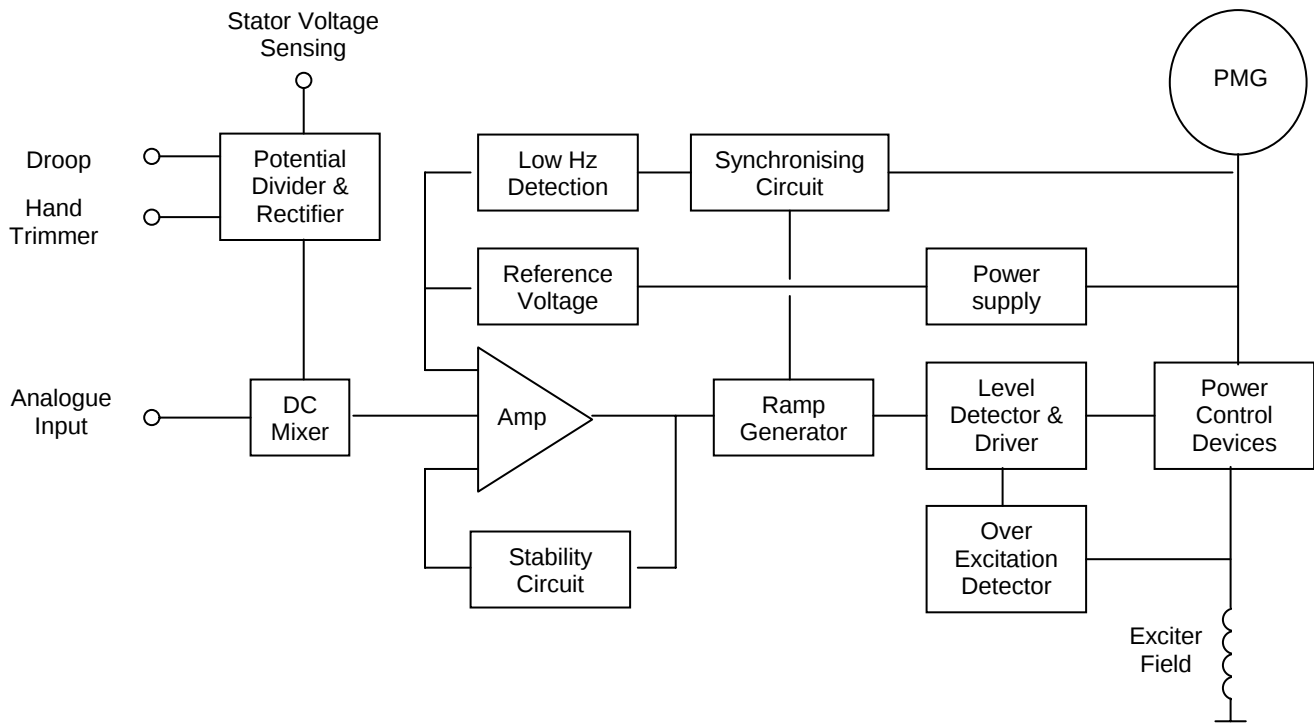
ENVIRONMENTAL

Vibration	20-100 Hz	50mm/sec
	100Hz – 2kHz	3.3g
Operating temperature		-40 to +70°C
Relative Humidity	0-70°C	95% (see note 6)
Storage temperature		-55 to +80°C

NOTES

1. With 4% engine governing.
2. After 10 minutes.
3. Applies to Mod status D onwards. Generator de-rate may apply. Check with factory.
4. Factory set, semi-sealed, jumper selectable.
5. Any device connected to the analogue input must be fully floating (galvanically isolated from ground), with an insulation strength of 500V ac.
6. Non condensing.

DESIGN DETAIL



The main functions of the AVR are:

The Potential Divider and Rectifier takes a proportion of the generator output voltage and attenuates it. The potential divider is adjustable by the AVR Volts potentiometer and external hand trimmer (when fitted). The output from the droop CT is also added to this signal. An isolating transformer is included allowing connection to various winding configurations. A rectifier converts the a.c. input signal into d.c. for further processing.

The DC Mixer adds the Analogue input signal the Sensing signal.

The Amplifier (Amp) compares the sensing voltage to the Reference Voltage and amplifies the difference (error) to provide a controlling signal for the power devices. The Ramp Generator and Level Detector and Driver infinitely control the conduction period of the Power Control Devices, and hence provide the excitation system with the required power to maintain the generator voltage within specified limits.

The Stability Circuit provides adjustable negative ac feedback to ensure good steady state and transient performance of the control system.

The Low Hz Detector measures the period of each electrical cycle and causes the reference voltage to be reduced approximately linearly with speed below a presettable threshold. A Light Emitting Diode gives indication of underspeed running.

A further enhancement of this feature is the variable DIP adjustment, which provides greater voltage roll off to aid the recovery of turbo charge engines taking large impact loads.

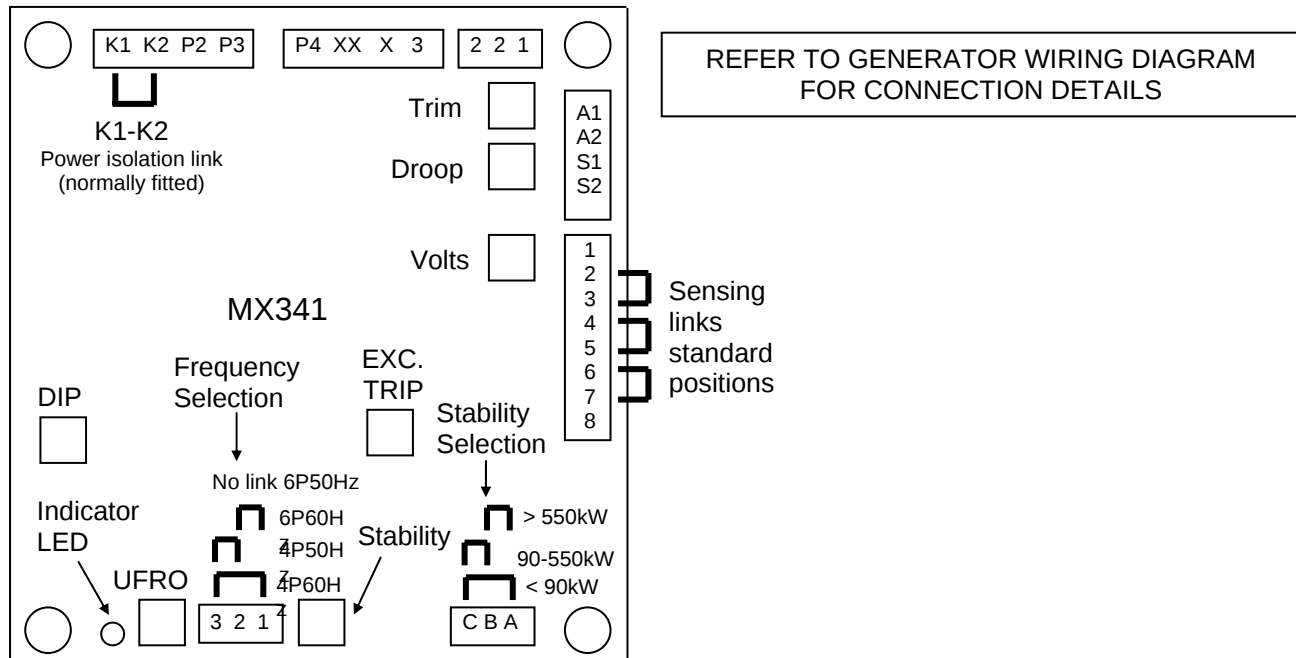
The Synchronising circuit is used to keep the Ramp Generator and Low Hz Detector locked to the Permanent Magnet Generator waveform period.

Power Control Devices vary the amount of exciter field current in response to the error signal produced by the Amplifier.

The Over Excitation Detector continuously monitors the exciter field voltage and provides signals, to shut down the power device if an over excitation condition persists for the specified time period.

The Power Supply provides the required voltages for the AVR circuitry.

FITTING AND OPERATING



SUMMARY OF AVR CONTROLS		
CONTROL	FUNCTION	DIRECTION
Volts	To adjust generator output voltage	Clockwise increases output voltage
Stability	To prevent voltage hunting	Clockwise increase the damping effect
Ufro	To set the ufro knee point	Clockwise reduces the knee point frequency
Droop	To set the generator droop to 5% at 0pf	Clockwise increases the droop
Vtrim	To optimise analogue input sensitivity	Clockwise increases the gain or sensitivity
Exc trip	To set the over excitation cut off level	Clockwise increase the cut off level
Dip	To set the frequency related voltage dip	Clockwise increases the voltage dip

ADJUSTMENT OF AVR CONTROLS

VOLTAGE ADJUSTMENT

The generator output voltage is set at the factory, but can be altered by careful adjustment of the VOLTS control on the AVR board, or by the external hand trimmer if fitted. Terminals 1 and 2 on the AVR will be fitted with a shorting link if no hand trimmer is required.

CAUTION! Do not increase the voltage above the rated generator voltage. If in doubt, refer to the rating plate mounted on the generator case.

CAUTION! Do not ground any of the hand trimmer terminals, as these could be above earth potential. Failure to observe this could cause equipment damage.

If a replacement AVR has been fitted or re-setting of the VOLTS adjustment is required, proceed as follows:

CAUTION!

1. Before running generator, turn the VOLTS control fully anti-clockwise.
2. Turn remote volts trimmer (if fitted) to midway position.
3. Turn STABILITY control to midway position.
4. Connect a suitable voltmeter (0-300V ac) across line to neutral of the generator.
5. Start generator set, and run on no load at nominal frequency e.g. 50-53Hz or 60-63Hz.
6. If the red Light Emitting Diode (LED) is illuminated, refer to the Under Frequency Roll Off (UFRO) adjustment.
7. Carefully turn VOLTS control clockwise until rated voltage is reached.
8. If instability is present at rated voltage, refer to stability adjustment, then re-adjust voltage if necessary.
9. Voltage adjustment is now completed.

FITTING AND OPERATING

STABILITY ADJUSTMENT

The AVR includes a stability or damping circuit to provide good steady state and transient performance of the generator.

The correct setting can be found by running the generator at no load and slowly turning the stability control anti-clockwise until the generator voltage starts to become unstable.

The optimum or critically damped position is slightly clockwise from this point (i.e. where the machine volts are stable but close to the unstable region).

OPTIMUM RESPONSE SELECTION

The stability selection 'jumper' should be correctly linked, A-B, B-C or A-C at the bottom of the board for the frame size of the generator, (see drawing).

UNDER FREQUENCY ROLL OFF (UFRO) ADJUSTMENT

The AVR incorporates an underspeed protection circuit which gives a volts/Hz characteristic when the generator speed falls below a presettable threshold known as the "knee" point.

The red Light Emitting Diode (LED) gives indication that the UFRO circuit is operating.

The UFRO adjustment is preset and sealed and only requires the selection of 50 / 60Hz, 4 pole / 6pole using the jumper link (see diagram). Adjustment of the UFRO potentiometer will only be necessary if the AVR is being fitted to a 6 pole generator to replace an AVR of an earlier type.

For optimum setting, the LED should illuminate as the frequency falls just below nominal, i.e. 47Hz on a 50Hz system or 57Hz on a 60Hz system.

DROOP ADJUSTMENT

Generators intended for parallel operation are fitted with a quadrature droop C.T. which provides a power factor dependent signal for the AVR. The C.T. is connected to S1, S2 on the AVR.

The DROOP adjustment is normally preset in the works to give 5% voltage droop at full load zero power factor.

Clockwise increases the amount of C.T. signal injected into the AVR and increases the droop with lagging power factor ($\cos \phi$). With the control fully anti-clockwise there is no droop.

TRIM ADJUSTMENT

An analogue input (A1 A2) is provided to connect to a STAMFORD Power Factor Controller or other devices. It is designed to accept dc signals up to +/- 5 volts.

CAUTION! Any devices connected to this input must be fully floating and galvanically isolated from ground, with an insulation capability of 500 Vac. Failure to observe this could result in equipment damage.

The dc signal applied to this input adds to the AVR sensing circuit. A1 is connected to the AVR 0 volts. Positive on A2 increases excitation. Negative on A2 decreases excitation.

The TRIM control allows the user to adjust the sensitivity of the input. With TRIM fully anti-clockwise the externally applied signal has no effect. Clockwise it has maximum effect.

Normal setting is fully clockwise when used with a STAMFORD Power Factor Controller.

DIP ADJUSTMENT

The DIP adjustment allows some control over the generator voltage dip upon the application of load. This feature is mostly used, when the generator is coupled to turbo charged engines with limited block load acceptance and operates only when the speed is below the UFRO knee point, (LED illuminated).

With the DIP potentiometer fully anticlockwise, the generator voltage characteristics will follow the normal V/Hz line as the speed falls below nominal. Turning the DIP potentiometer more clockwise increases the V/Hz slope, providing a greater voltage dip and aiding engine recovery. The DIP potentiometer can be set at any desired position to suit a particular engine type.

OVER EXCITATION (EXC TRIP) ADJUSTMENT

The adjustment is set and sealed in the works and should not be altered.

An over excitation condition is indicated on the common LED which also indicates under speed running. The generator must be stopped to reset an over excitation condition.

STAMFORD®

Barnack Road • Stamford • Lincolnshire • PE9 2NB
Tel: 00 44 (0)1780 484000 • Fax: 00 44 (0)1780 484100

InteliVision 5



Order code: INTELIVISION 5

Controller Colour Display Unit

Datasheet

Product description

InteliVision 5 is an 5.7" TFT industrial colour display equipped with configurable active buttons. It is intended for localized visualisation and control (in combination with a ComAp controller).

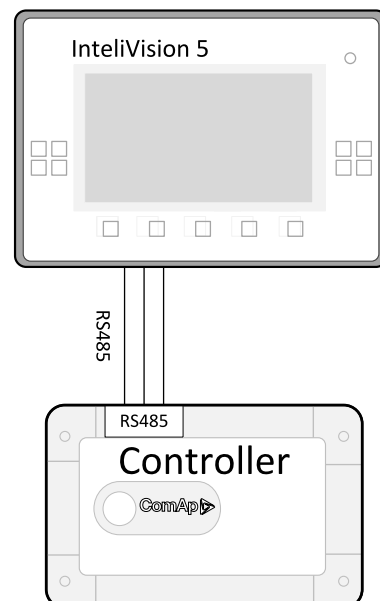
Key features

- ▶ 5,7" Colour TFT Display with a resolution of 320 × 240 pixels.
- ▶ Plug and play operation (auto configuration based on controller application).
- ▶ Direct connection to the controller (converters not needed).
- ▶ Communication connection via RS-485.
- ▶ Configurable active buttons.
- ▶ Same language support as the controller including graphic languages.
- ▶ Graphical editor for screen configuration.
- ▶ IP65 front seal.
- ▶ Operating temperature: – 40 to + 70°C.

Related products

- ▶ InteliSys Gas
- ▶ InteliSys^{NTC} BaseBox
- ▶ InteliGen^{NTC} BaseBox
- ▶ InteliMains^{NTC} BaseBox
- ▶ InteliSys^{NTC} BaseBox

Application overview



Technical data

Power supply

Power supply range	8 - 36 V DC
Consumption	0,7 A / 8 VDC

Interface and operating conditions

Protection - Front / Rear	IP65
Operating Temp.	-40 °C / +70 °C

Interfaces

RS-485	Galvanic Isolation Terminating resistor - DIP switch
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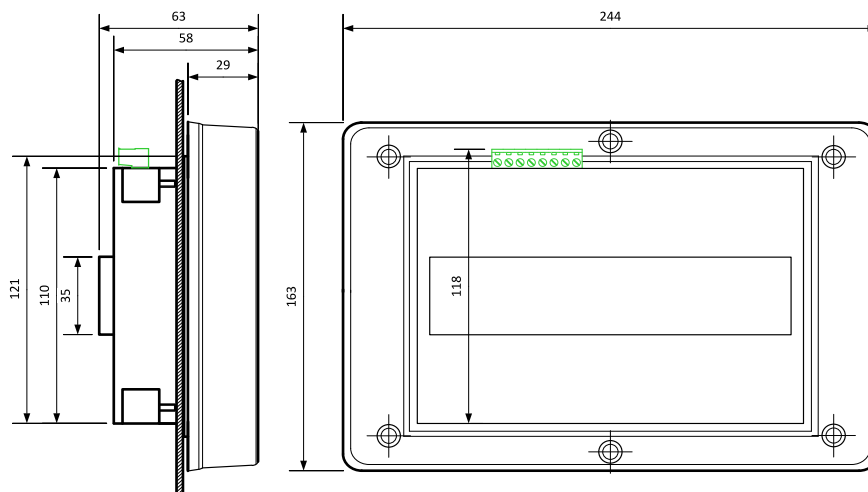
Screen specifications

Type	TFT
Size	5,7"
Resolution	320 - 240 px
Front Panel Dimensions	245 x 164 mm

Related products

Product	Description	Order code
InteliSys Gas	Industrial grade controller for gas gen-set based CHPs and power generation applications	I2GASXXBAB
InteliSys ^{NTC} BaseBox	Premium Parallel Gen-set Controller	IS-NTC-BB
InteliGen ^{NTC} BaseBox	Complex Parallel Gen-set Controller	IG-NTC-BB
InteliMains ^{NTC} BaseBox	Mains Supervision Controller Base Unit	IM-NTC-BB
InteliSys ^{NTC} Hybrid	Hybrid system controller	IS-NTC HYBRID

Dimensions and mounting



Certificates and standards

▶ EN 60068-2-6 ed.2:2008 ▶ EN 60068-2-27 ed.2:2010	▶ EN 60068-2-30, May 2000 ▶ EN 60068-2-64 ▶ EN 61010-1:2003	
All certificates and standards are available on: https://webstore.iec.ch/		



InteliGen^{NT} BaseBox



Order code: IG-NT-BB
Gen-set Controller

Datasheet

Product description

- ▶ Comprehensive gen-set controller for both single and multiple gensets operating in standby or paralleling modes
- ▶ To be used in conjunction with detachable colour displays InteliVision 5 or InteliVision 8
- ▶ Support of engines with ECU (Electronic Control Unit)
- ▶ Complete integrated gen-set solution and signal sharing via CAN bus – minimum external components needed
- ▶ Many communication options – easy remote supervising and servicing

Key features

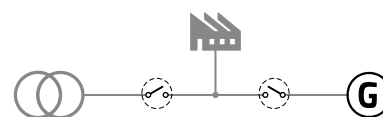
- ▶ Load sharing and VAr sharing via CAN
- ▶ Virtual shared inputs and outputs via CAN
- ▶ Support of wide range of applications
 - Single or multiple gen-sets in parallel to mains operation with automatic back up function, multiple island operation
- ▶ Advanced power management function
- ▶ Customizable load control in parallel to mains
- ▶ Wide range of ECU support

- ▶ Highly configurable
 - Timers, Internal PLC, Force values and more
- ▶ Compatible with ComAp's InteliVision displays
- ▶ Active e-mail messaging and SMS
- ▶ Extensive built-in protection functions
 - Standard protections
 - User configurable protection
- ▶ Extendable with ComAp's extension modules

Application overview

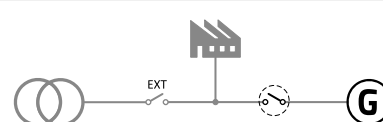
SPtM

Mains & Generator
Circuit Breaker



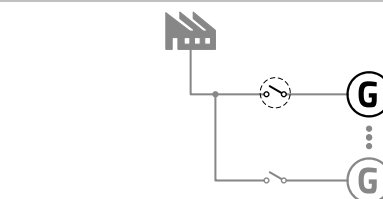
SPI

Generator Circuit
Breaker



MINT

Generator Circuit
Breaker



Technical data

Power supply

Power supply range	8-36 VDC
Power consumption	0.4 A / 8 VDC 0.15 A / 24 VDC 0.1 A / 36 VDC
RTC battery	10 years (replaceable by official service)
Fusing	2 A (without BOUT consumption)

Operating conditions

Operating temperature	-40°C to +70°C
Storage temperature	-40°C to +80°C
Operating humidity	95 % w/o condensation
Vibration	5 - 25 Hz, ± 1.6 mm 25-100 Hz, $a = 4$ g
Shocks	$a=200$ m/s ²

Voltage measurement

Measurement inputs	3 ph-n Gen voltage 3 ph-n Mains/Bus voltage
Measurement range	277V
Max allowed voltage	125 %
Accuracy	1 % of 277V
Frequency range	40-70 Hz (at accy 0.1 Hz)
Input impedance	0.6 M Ω ph-ph 0.3 M Ω ph-n

Current measurement

Measurement inputs	3 ph Gen current 1 ph Mains current
Measurement range	1A
Max allowed continuous current	1A
Accuracy	2 % of 1A
Input impedance	< 0.1 Ω

Binary inputs

Number	12 non-isolated
Input resistance	4.7 k Ω
Close/Open indication	0 - 2 VDC close contact > 4 VDC open contact

Binary outputs

Number	12 non-isolated
Max current	0.5 A (2 A per group)
Switching to	negative/positive supply terminal

Analog inputs

Number	3 non-isolated
Type	Switchable (Voltage, Resistance, Current)
Resolution	10 bits, max 4 decimals
Range	0-5 VDC/0-2500 Ω /0-20 mA
Input impedance	>100 k Ω />100 k Ω /180 Ω
Accuracy	± 1 % of meas. value ± 1 mV ± 2 % of meas value ± 2 Ω ± 1 % of meas value ± 0.5 mA

Magnetic pick-up

Voltage input range	2 Vpk-pk to 50 V _{eff}
Frequency input range	4 Hz to 15 kHz
Frequency measurement tolerance	0.2 %

Voltage regulator output

Type	5 V TTL PWM / ± 10 VDC with IG-AVRi interface
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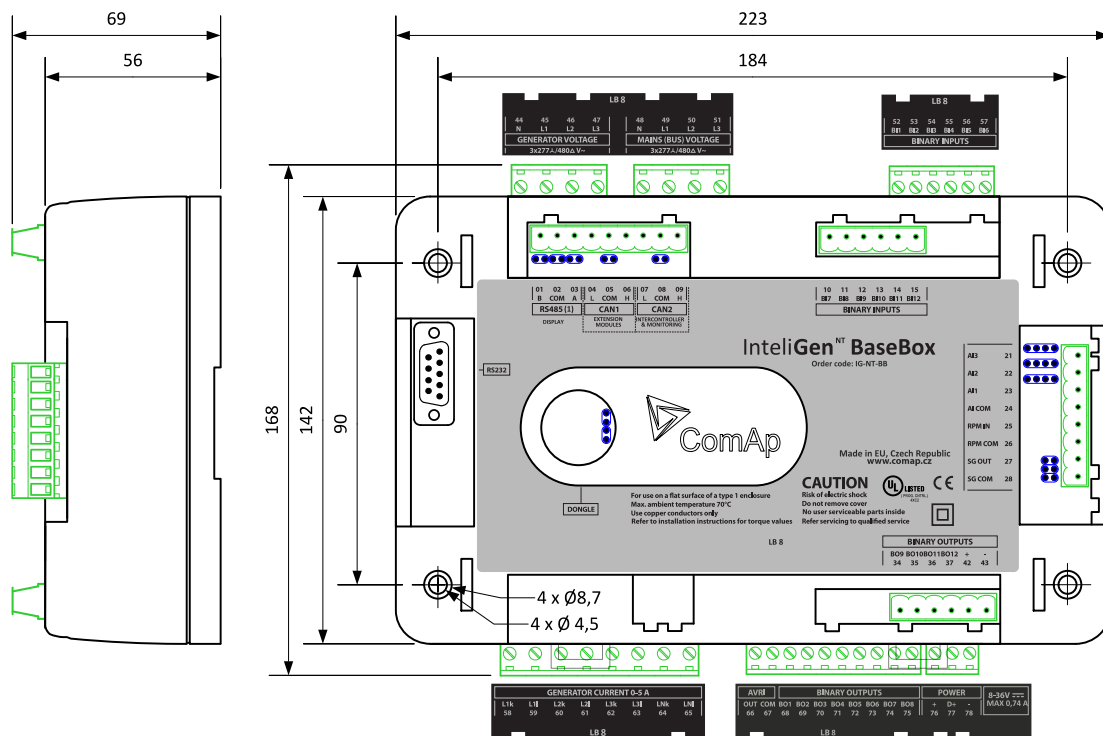
Speed governor output

Voltage output	± 10 VDC / max. 15 mA
Voltage output via resistor	± 10 VDC via 10 k Ω resistor / max. 1 mA
PWM	500÷3000 Hz / 5V / max. 10mA

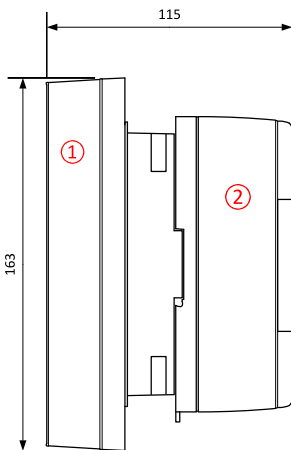
Communications

RS232	Direct/Modbus, non-isolated
Display port	non-isolated RS485, only terminal connection
CAN1	External modules 250kbps, max 200m, Isolated
CAN2	Intercontroller and comm extensions 250/50kbps, max 200/1000m, Isolated

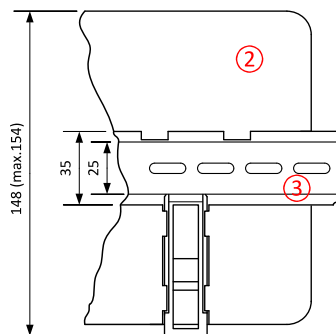
Dimensions, terminals and mounting



Panel door mounting with IntelliVision 5

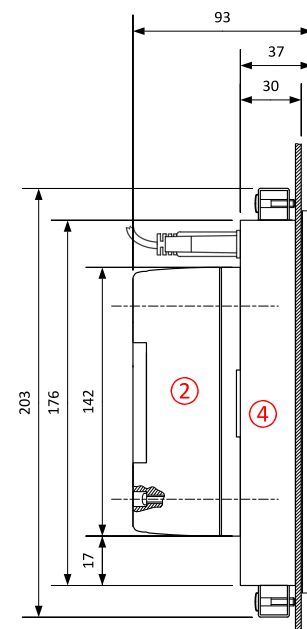


DIN-rail mounting



- ① IntelliVision5
- ② IntelliGen-NT-BaseBox
- ③ DIN-rail
- ④ IntelliVision 8

Panel door mounting with IntelliVision 8



Note: IntelliGen^{NT} BaseBox can be mounted on a standard DIN rail or, in combination with IntelliVision 5 or IntelliVision 8, it can be door mounted. IntelliVision 5 features mounting rail for direct mounting. Mounting in combination with IntelliVision 8 uses four screws provided in the IntelliGen^{NT} BaseBox package.

Available Extension modules

Product	Description	Order code
Inteli IO8/8	8 Binary inputs, 8 Binary outputs and 2 Analog outputs packed in a small unit (HW switchable to IO16/0)	I-IO8/8
Inteli IO8/8	HW switchable to IO16/0 - 16 Binary inputs packed in a small unit	I-IO8/8
Inteli AIN8	8 Analog inputs (R, I, V) and 1 pulse/frequency input in a small unit	I-AIN8
Inteli AIN8TC	8 Thermocouple Analog inputs in a small unit	I-AIN8TC
Inteli AIO9/1	9 Analog inputs (4x DC, 4x thermocouples, 1x R) in a small unit	I-AIO9/1
IS-AIN8	8 Analog inputs packed in a rugged metal unit	IS-AIN8
IGS-PTM	8 Binary inputs, 8 Binary outputs, 4 Analog inputs and 1 Analog output in a unit	IGS-PTM
IGL-RA15	15 Binary LED output (3 colors) packed in a rugged metal unit	IGL-RA15
I-AOUT8	8 Analog outputs packed in a rugged metal unit	I-AOUT8
InternetBridge-NT	Multiple Internet connections (PC and Modbus) to all controllers on CAN2 or RS485	IB-NT
I-LB+	Direct connection (PC) to all controllers on CAN2 or RS485	I-LB+

Related products

Product	Description	Order code
InteliVision 5	Color 5.6" display for monitoring and control	INTELVISION 5
InteliVision 8	Color 8" display for advanced monitoring, control & trending, USB capable	INTELVISION 8
InteliVision 12Touch	Color 12" touch display for advanced monitoring, control & trending, USB capable	RD1IV12TBZH
InteliVision 17Touch	Color 17" touchscreen display designed for complete monitoring and control of multiple controllers or cogeneration installation.	IV17T2
ECON-4	Digital speed governor dedicated for speed control of gas or diesel engines.	ECON-4

Functions and protections

The product fully supports functions and protections as defined by ANSI (American National Standards Institute). Examples are below. Other functions can be found in the IGS-NT Reference guide.

Description	ANSI code	Description	ANSI code	Description	ANSI code	Description	ANSI code
Synchronism check	25	Excitation loss	40	Overcurrent (IDMT)	51	AC reclosing	79
Undervoltage	27	Current unbalance	46	Earth fault current IDMT	51N+64	Overfrequency	81H

Certificates and standards

This product is CE compliant.			
▶ EN 60068-2-6 ed.2:2008	▶ EN 60068-2-30, May 2000	▶ EN 61010-1:2003	
▶ EN 60068-2-27 ed.2:2010	▶ EN 60068-2-64		
This product is tested according to:			
▶ VDE AR N 4105:2011; DIN VDE V 0124-100:2012 (Cl. 5.3.3, 5.3.4, 5.3.6, 5.4.3, 5.4.5, 5.4.6, 5.5)			
▶ BDEW Medium-Voltage Guideline: 2008; FGW TR3:2013 (Clauses 4.2.2, 4.2.3, 4.2.4, 4.3.2, 4.3.3, 4.3.4., 4.5, 4.6., 4.7)			
Certifications and standards are available on: https://webstore.iec.ch/			



T8

1600/2000/2500/3000A 600VΔ - Three Pole Electronic (AC Only)

1600A Frame, electronic trip unit (AC only) standard horizontal terminals

Breaker	IC at 480VAC kA	Trip Unit	3 pole, 600V catalog number	
T8V	125	PR232 LSI (Dip Switch) PR331 LSIG (Dip Switch) PR332 LI (LCD) PR332 LSI (LCD) PR332 LSIG (LCD)	T8VBC3FC000000XX T8VBC3FE000000XX T8VBC3FP00A000XX ① T8VBC3FR00A000XX ① T8VBC3FS00A000XX ①	

2000A Frame, electronic trip unit (AC only) standard horizontal terminals

Breaker	IC at 480VAC kA	Trip Unit	3 pole, 600V catalog number	
T8V	125	PR232 LSI (Dip Switch) PR331 LSIG (Dip Switch) PR332 LI (LCD) PR332 LSI (LCD) PR332 LSIG (LCD)	T8VBD3GC000000XX T8VBD3GE000000XX T8VBD3GP00A000XX ① T8VBD3GR00A000XX ① T8VBD3GS00A000XX ①	

2500A Frame, electronic trip unit (AC only) standard horizontal terminals

Breaker	IC at 480VAC kA	Trip Unit	3 pole, 600V catalog number	
T8V	125	PR232 LSI (Dip Switch) PR331 LSIG (Dip Switch) PR332 LI (LCD) PR332 LSI (LCD) PR332 LSIG (LCD)	T8VBE3HC000000XX T8VBE3HE000000XX T8VBE3HP00A000XX ① T8VBE3HR00A000XX ① T8VBE3HS00A000XX ①	

3000A Frame, electronic trip unit (AC only) standard with vertical terminals - Required

Breaker	IC at 480VAC kA	Trip Unit	3 pole, 600V catalog number	
T8V	125	PR232 LSI (Dip Switch) PR331 LSIG (Dip Switch) PR332 LI (LCD) PR332 LSI (LCD) PR332 LSIG (LCD)	T8VBF3JC000000XX T8VBF3JE000000XX T8VBF3JP00A000XX ① T8VBF3JR00A000XX ① T8VBF3JS00A000XX ①	

① Includes 4 open/closed auxiliary contacts as standard



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2023 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT

OFFICE OF TRANSPORTATION
AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105

Certificate Issued To: AB Volvo Penta
(U.S. Manufacturer or Importer)
Certificate Number: PVPXL16.1CDC-013

Effective Date:

11/07/2022

Expiration Date:

12/31/2023

Byron J. Bunker, Division Director
Compliance Division

Issue Date:

11/07/2022

Revision Date:

N/A

Model Year: 2023

Manufacturer Type: Original Engine Manufacturer

Engine Family: PVPXL16.1CDC

Mobile/Stationary Indicator: Both

Emissions Power Category: kW>560

Fuel Type: Diesel

After Treatment Devices: Ammonia Slip Catalyst, Selective Catalytic Reduction

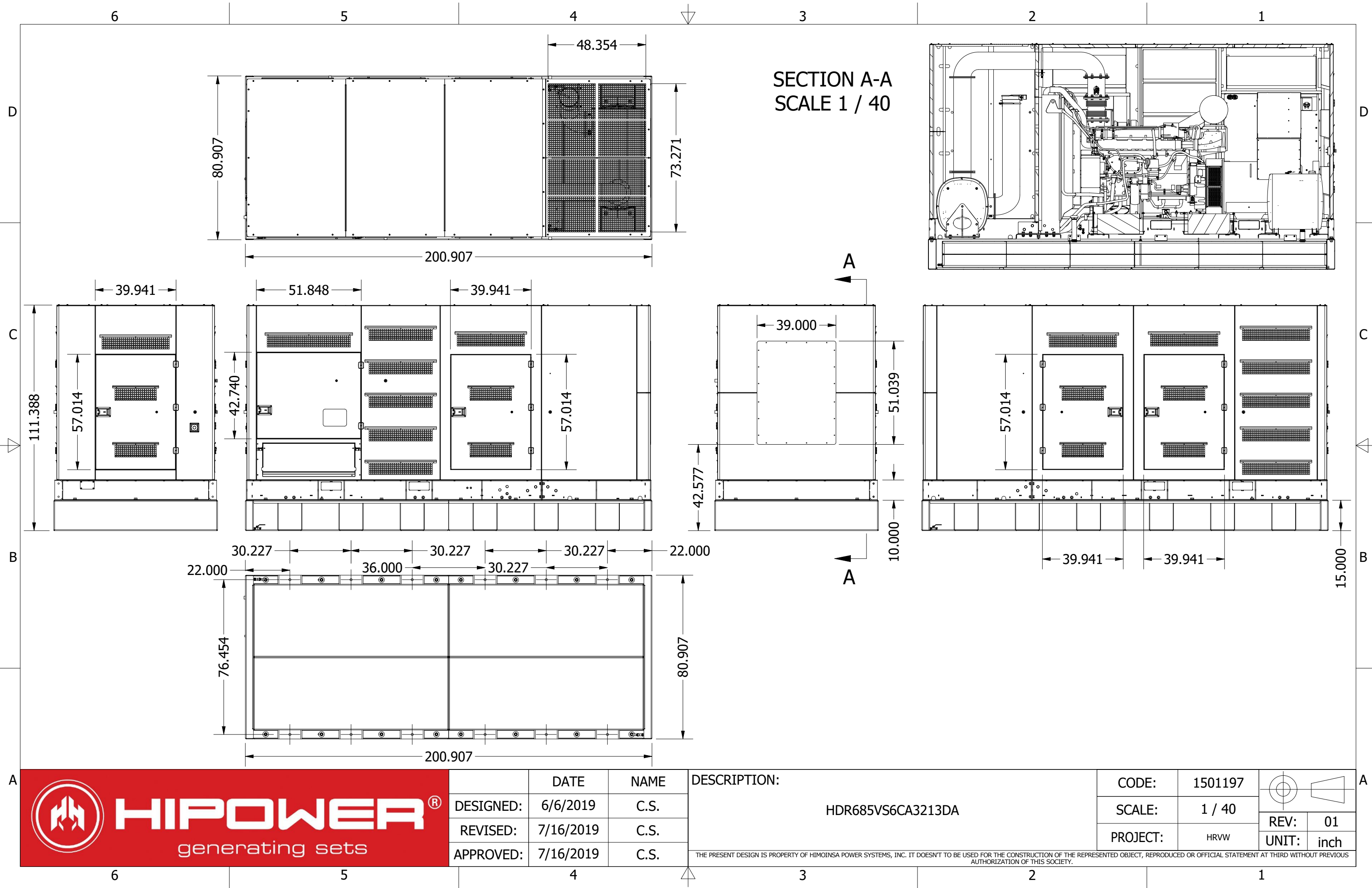
Non-after Treatment Devices: Electronic Control, Smoke Puff Limiter

Pursuant to Section 111 and Section 213 of the Clean Air Act (42 U.S.C. sections 7411 and 7547) and 40 CFR Parts 60 and 1039, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following engines, by engine family, more fully described in the documentation required by 40 CFR Parts 60 and 1039 and produced in the stated model year.

This certificate of conformity covers only those new compression-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Parts 60 and 1039 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Parts 60 and 1039.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Parts 60 and 1039. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Parts 60 and 1039.

This certificate does not cover engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.



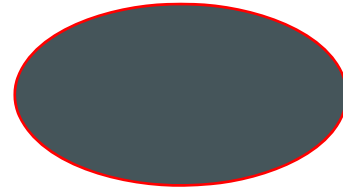


HIPOWER®
generating sets

Generator Base Coat

HIPOWER Systems uses Interpon A4700 primer for a base coat on all powder coated parts. Interpon A4700 primer is a series of performance engineered powder coatings designed for the highest automotive OEM standards. They provide excellent smoothness and appearance, corrosion and chemical resistance and mechanical properties.

- ✓ **Thickness-** 2.5 mils
- ✓ **Adhesion-** ASTM D3359 5B 100% pass
- ✓ **Hardness-** ATSM D3363/2H pass



Canopy Top Coat

HIPOWER Systems canopies are coated with Interpon 600 HIPOWER matte gray. Interpon 600 series coatings are designed for exterior exposure and offers excellent light and weather resistance. This coating coupled with the A4700 primer offer 5 mils of premium coating to all our canopies.

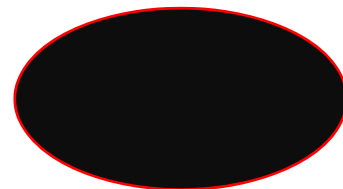
- ✓ **Thickness-** 2.5 mils
- ✓ **Salt Spray-** ASTM B117 @1400 hours (w/primer)
- ✓ **Humidity-** ASTM D2247 @1400 hours
- ✓ **Adhesion-** ASTM D3359 5B 100% pass
- ✓ **Hardness-** ATSM D3363/2H pass



Structural Parts/Chassis Top Coat

HIPOWER Systems structural parts and chassis are coated with Interpon 600 HIPOWER matte black. Interpon 600 series coatings are designed for exterior exposure and offers excellent light and weather resistance. This coating coupled with the A4700 primer offer 5 mils of premium coating to all our structural parts and chassis.

- ✓ **Thickness-** 2.5 mils
- ✓ **Salt Spray-** ASTM B117 @1400 hours (w/primer)
- ✓ **Humidity-** ASTM D2247 @1400 hours
- ✓ **Adhesion-** ASTM D3359 5B 100% pass
- ✓ **Hardness-** ATSM D3363/2H pass





HIPOWER®
generating sets

HIPOWER® Terms and Conditions of Sale

(HIPOWER® is a registered brand of Himoina Power Systems Inc.)

1. Modification of Sales Terms

Any Terms and Conditions contained in any purchase order or other form of communication from HIPOWER's customers which are additional to or different from these Terms and Conditions shall be deemed rejected by HIPOWER unless expressly accepted in writing by HIPOWER. In general, no modification, amendment, waiver, or other change of any of these Terms and Conditions and those contained on the reverse side hereof and/or in attachments hereto ("Collectively, the Terms and Conditions"), or of any of HIPOWER's right or remedies thereunder, shall be binding on HIPOWER unless expressly accepted in writing by HIPOWER's authorized officers. No course of dealing, usage of trade, or course of performance shall be relevant to explain or supplement any of these Terms and Conditions. If any document issued by any party hereto is sent by facsimile or another form of electronic document transmission, the parties hereto agree that (a) the copy of any such document oriented on the facsimile machine or printer of the recipient thereof is a counterpart original copy thereof and is a "writing", (b) delivery of any such document to the recipient thereof by facsimile or such other form of electronic document transmission is authorized by the recipient thereof and is legally sufficient for all purposes as if delivered by United States mail, (c) the typewritten name of an authorized agent of the party sending such document on any such document is sufficient as a signature thereon and behalf of such party and the intent of such signature is to authenticate the writing, and (d) an electronically stored and reproduced copy of any such document shall be deemed to be legally sufficient evidence of the terms or such document for all purposes.

2. Acceptance of Orders

Acceptance by HIPOWER of Buyer's purchase order(s) is expressly conditioned upon Buyer's assent to these Terms and Conditions. Buyer will be deemed to have assented to such Terms and Conditions unless HIPOWER receives written notice of any objections within fifteen (15) days after receipt of this form and in all events prior to any delivery or other performance by HIPOWER of Buyer's order.

3. Quotations

Quotations by HIPOWER shall be deemed to be offers by HIPOWER to sell the equipment described therein subject to these Terms and Conditions, and acceptance of such offers is expressly limited to acceptance by Buyer of all of these Terms and Conditions within thirty (30) days from the date of the quotation. Purchase orders submitted by Buyer for the equipment quoted by HIPOWER shall be subject to and will be deemed to constitute acceptance of these Terms and Conditions. All purchase orders will be subject to approval by HIPOWER.

4. Prices; Price Changes

All prices are net F.O.B. shipping point and are subject to change without notice. In the event of a change in HIPOWER's prices, the price for equipment unshipped will be the price in effect on the date of shipment.

If HIPOWER's quoted price was based upon delivery to and acceptance by Buyer of a specified quantity of equipment, such price shall be subject to adjustment if Buyer does not accept the quantity at the times specified in HIPOWER's quotation, and Buyer will be invoiced at HIPOWER's standard price without quantity discounts, if any, for the quantity of equipment actually accepted by Buyer.

5. Taxes

In addition to any prices, Buyer shall pay the amount of any present or future manufacturer's tax, retailer's occupation tax, use tax, sales tax, excise tax, duty, custom, inspection or testing fee, or any other tax, fee, or charge of any nature whatsoever imposed by any governmental authority, on or measured by the transaction between HIPOWER and Buyer. In the event HIPOWER is required to pay any such tax, fee, or charge, Buyer shall reimburse HIPOWER therefor; or, in lieu of such payment, Buyer shall provide HIPOWER at the time the order is submitted with an exemption certificate or other document acceptable to the authority imposing such tax, fee, or charge.

6. Terms of Payment

All orders are subject to the approval of HIPOWER. Terms of payment are cash in full no later than thirty (30) days from date of shipment, without discount, unless otherwise specified by HIPOWER's Finance Department. If, during the period of performance of an order, the financial condition of buyer is determined by HIPOWER not to justify the terms of payment specified, HIPOWER may demand full or partial payment in advance before proceeding with the work, or satisfactory security or guarantees that invoices will be promptly paid when due, or, at its option without prejudice to other lawful remedies, may defer delivery or cancel this contract. If delivery is deferred, the equipment may be stored as provided in Section 9 hereof and HIPOWER may submit a new estimate of cost for completion based on prevailing conditions. If Buyer defaults in any payment when due, or in the event any voluntary or involuntary bankruptcy or insolvency proceedings involving Buyer are initiated by or against Buyer, then the whole contract price shall immediately become due and payable upon demand, or HIPOWER, at its option without prejudice to its other lawful remedies, may defer delivery or cancel this contract.

Prorated payments shall become due as shipments are made. If shipments are delayed by the Buyer for any cause, payments shall become due from the date on which HIPOWER is prepared to make shipment and storage shall be the Buyer's risk and expense as provided in Section 9 hereof. If manufacture is delayed by the Buyer for any cause, a partial payment based upon the proportion of the order completed shall become due from the date on which HIPOWER is notified of the delay.

Amounts not paid when due shall be subject to interest at the rate of twelve percent (12%) per annum or, if less, the maximum rate permitted by law.

7. Delivery; Risk of Loss

All sales are F.O.B. HIPOWER's plant or other point of shipment designated by HIPOWER. Shipping dates are estimates only which are not guaranteed and are based upon prompt receipt from Buyer of all necessary shipping and other information. HIPOWER reserves the right to make delivery in installments, all installments to be separately invoiced and paid for by Buyer when due per invoice, without regard to subsequent deliveries.

Delivery of equipment to a commercial carrier at HIPOWER's plant or other loading point shall constitute delivery to Buyer, and any risk of loss and further cost and responsibility thereafter for claims, delivery, loss or damage, including, if applicable, placement and storage, shall be borne by Buyer. When equipment is delivered by HIPOWER's truck, unloading at Buyer's dock shall constitute delivery to Buyer. Claims for shortages or other errors in delivery must be made in writing to HIPOWER within ten (10) days after receipt of shipment and failure to give such notice shall constitute unqualified acceptance and a waiver of all such claims by Buyer. Claims for loss or damage to equipment in transit by common carrier must be made to the carrier and not to HIPOWER.

Freight and handling charges by HIPOWER may not reflect actual freight charges prepaid to the carrier by HIPOWER due to incentive discounts earned by HIPOWER based upon HIPOWER's aggregate volume of freight tendered to a carrier or when a carrier must be used which charges a rate which is different than the rate upon which HIPOWER's freight and handling charges were based. When shipments are delivered in HIPOWER's private trucks, Buyer will be charged an amount approximating the prevailing common carrier rate.

8. Excusable Delays; Force Majeure

HIPOWER shall not be liable for any ordinary, incidental, consequential loss or damage as a result of HIPOWER's delay in or failure of delivery or installation due to (i) any cause beyond HIPOWER's reasonable control, (ii) an act of God, act of the Buyer, embargo or other government act, authority, regulation or request, fire, theft, accident, strike, slowdown or other labor disturbance, war, riot, delay in transportation, or (iii) inability to obtain necessary labor, materials, components, or facilities.

(continued over)



HIMOINSA POWER SYSTEMS, INC.

16600 South Theden Street - Olathe - KS 66062

Tel: 913.495.5557 — Fax: 913.495.5575 — Call us (toll free) at: 866.710.2988 — info@hipowersystems.com **1** www.hipowersystems.com



Should any of the aforementioned events of force majeure occur, HIPOWER, at its option, may cancel Buyer's order with respect to any undelivered equipment or extend the delivery date for a period equal to the time lost because of delay. Notice of such election shall be given promptly to Buyer. In the event HIPOWER elects to so cancel the order, HIPOWER shall be released of and from all liability for failure to deliver the equipment including, but not limited to, any and all claims on behalf of Buyer for lost profits, or any other claim of any nature which Buyer might have.

If shipping or progress of the work is delayed or interrupted by Buyer directly or indirectly, Buyer shall pay HIPOWER for all additional charges resulting therefrom.

9. Storage

If the equipment is not shipped within thirty (30) days after notification has been made to Buyer that it is ready for shipping, for any reason beyond HIPOWER's control, including Buyer's failure to give shipping instructions, HIPOWER may store the equipment at Buyer's risk and expense in a warehouse or on HIPOWER's premises, and Buyer shall pay all handling, transportation and storage costs at the prevailing commercial rates promptly following HIPOWER's submission of invoices for such costs.

10. Warranties to Distributors and Industrial or Commercial Customers

This warranty is extended only to HIPOWER's distributors and industrial or commercial customers and does not apply to consumer purchases. This warranty applies to all generator and related parts sales.

Warranty Period – (a) HIPOWER warrants Heavy Duty Industrial Stationary Generators manufactured by or for it to be free from defects in materials and workmanship and to conform to HIPOWER's written specifications for a period of 24 months from ship date, however, it may be adjusted to the date of commissioning of the generator set if completed within 6 months of the ship date from factory or 2 years or 1,500 hours (parts and labor) in use, whichever occurs first. (b) HIPOWER warrants Mobile Generators manufactured by or for it to be free from defects in materials and workmanship and to conform to HIPOWER's written specifications for a period of 24 months from ship date, however, it may be adjusted to the date of commissioning of the generator set if completed within 6 months of the ship date from factory or 2 years or 3,500 hours (parts and labor) in use, whichever occurs first. (c) HIPOWER warrants SafeGuard Stationary Generators manufactured by or for it to be free from defects in materials and workmanship and to conform to HIPOWER's written specifications for a period of 24 months from ship date, however, it may be adjusted to the date of commissioning of the generator set if completed within 6 months of the ship date from factory or 2 years or 1,500 hours (first year covers parts and labor, second year covers parts only) in use, whichever occurs first.

Warranty Remedies – If, prior to expiration of the foregoing applicable warranty period, any of such products shall be proved to HIPOWER's satisfaction to be defective or nonconforming, HIPOWER will repair or replace such defective equipment or components thereof, F.O.B. HIPOWER's plant or other destination designated by HIPOWER, or will refund or provide Buyer with a credit in the amount of the purchase price paid therefor by Buyer, at HIPOWER's sole option. Buyer's exclusive remedy and HIPOWER's sole obligation under this warranty shall be limited to such repair or replacement, F.O.B. HIPOWER's plant or destination designated by HIPOWER, or refund or credit, and shall be conditioned upon HIPOWER's receiving written notice of any defect within a reasonable period of time (but in no event more than sixty (60) days after it was discovered or by reasonable care should have been discovered). In no event shall HIPOWER's liability for such defective or nonconforming products exceed the purchase price paid by Buyer therefore.

Exclusions – This warranty does not (i) cover shipping expenses to and from HIPOWER's factory or other destination designated by HIPOWER for repair or replacement of defective equipment or any tax, duty, custom, inspection or testing fee, or any other charge of any nature related thereto, nor does it cover the costs of disassembling or removing defective equipment or reassembling, reinstalling, or testing repaired or replaced equipment or finishing the reinstallation thereof, (ii) apply and shall be void with respect to equipment operated in excess of rated capacity or otherwise not in accordance with installation, maintenance, or operating instructions or requirements, to equipment repaired or altered by others than HIPOWER or HIPOWER's authorized service agencies, or to equipment which was subjected to abuse, negligence, misuse, misapplication, accident, damages by circumstances beyond HIPOWER's control, to improper installation (if by others than HIPOWER), operation, maintenance or storage, or to other than normal use or service, and (iii) apply to equipment or components not manufactured by or for HIPOWER. With respect to equipment or components not manufactured by HIPOWER, HIPOWER's warranty obligations shall in all respects conform and be limited to the warranty actually extended to HIPOWER by its suppliers, but in no event shall HIPOWER's obligations be greater than those provided under HIPOWER's warranty set forth in this Section 10.

THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES (EXCEPT TITLE), INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. NO EMPLOYEE, REPRESENTATIVE, OR AGENT OF HIPOWER OTHER THAN AN OFFICER OF HIPOWER IS AUTHORIZED TO ALTER OR MODIFY ANY PROVISION OF THIS SECTION 10 OR TO MAKE ANY GUARANTEE, WARRANTY, OR REPRESENTATION, EXPRESS OR IMPLIED, ORALLY OR IN WRITING, WHICH IS CONTRARY TO THE FOREGOING. Any description of the equipment, whether in writing or made orally by HIPOWER or HIPOWER's agents, specifications, samples, models, bulletins, drawings, diagrams, engineering sheets or similar materials used in connection with Buyer's order are for the sole purpose of identifying the equipment and shall not be construed as an express warranty. Any suggestions by HIPOWER or HIPOWER's agents regarding use, application or suitability of the equipment shall not be construed as an express warranty unless confirmed to be such in writing by HIPOWER's authorized officer.

11. Limitations of Liability; Consequential Damages

Nuclear Use Disclaimer - Equipment sold by HIPOWER is not intended for use in connection with any nuclear facility or activity. If so used, HIPOWER disclaims all liability for any nuclear damage, injury or contamination, and Buyer shall indemnify and hold HIPOWER, its officers, agents, employees, successors, assigns and customers harmless from and against any and all losses, damages or expenses of whatever form or nature (including attorneys' fees and other costs of defending any action) which they or any of them may sustain or incur, whether as a result of breach of contract, warranty, tort (including negligence) or otherwise, by action of such use.

Consequential Damage Disclaimer - HIPOWER's liability with respect to equipment proved to its satisfaction to be defective within the warranty period shall be limited to repair, replacement or refund as provided in Section 10 hereof, and in no event shall HIPOWER's liability exceed the purchase price of the equipment involved. HIPOWER shall not be subject to any other obligations or liabilities, whether arising out of breach of contract, warranty, tort (including negligence) or other theories of law, with respect to equipment sold or services rendered by HIPOWER, or any undertakings, acts or omissions relating thereto. Without limiting the generality of the foregoing, HIPOWER specifically disclaims any liability for property or personal injury damages, penalties, special or punitive damages, damages for lost profits or revenues, loss of use of equipment or any associated equipment, cost of capital, cost of substitute products, facilities or services, downtime, shutdown, or slowdown costs, or for any other types of economic loss, and for claims of Buyer's customers for any such damages.

EVEN IF THE REPAIR OR REPLACEMENT REMEDY SHALL BE DEEMED TO HAVE FAILED OF ITS ESSENTIAL PURPOSE UNDER SECTION 2-719 OF THE UNIFORM COMMERCIAL CODE, HIPOWER SHALL HAVE NO LIABILITY TO BUYER FOR CONSEQUENTIAL DAMAGES, SUCH AS LOST PROFITS, LOST REVENUE, DAMAGE TO OTHER EQUIPMENT OR LIABILITY OR INJURY TO A THIRD PARTY. HIPOWER SHALL NOT BE LIABLE FOR AND DISCLAIMS ALL CONSEQUENTIAL, INCIDENTAL AND CONTINGENT DAMAGES WHATSOEVER.



12. Indemnification by Buyer

Buyer shall indemnify, hold harmless, and defend HIPOWER and HIPOWER's employees and agents from and against any and all damages, liability, claims, losses, and expenses (including reasonable attorneys' fees, court costs, and out-of-pocket expenses) arising out of or resulting in any way from claims by customers of Buyer or third parties against HIPOWER alleging a breach of contract or warranty by HIPOWER to the extent that such damages, liability, claims, losses, and expenses which may be payable by HIPOWER to Buyer pursuant to and as limited by HIPOWER's warranty and damage obligations as contained in Sections 10 and 11 hereof so as to effectively limit HIPOWER's obligations to customers of Buyer or third parties to those set forth in Sections 10 and 11 hereof.

13. Patent Indemnification

HIPOWER will, at its own expense, defend or settle any suits that may be instituted against Buyer for alleged infringement by the equipment of any United States patent, provided that (a) such alleged infringements consist of the use of the equipment for any of the purposes for which such equipment was sold, (b) Buyer shall have made all payments for such equipment then due hereunder, (c) Buyer shall give HIPOWER immediate notice in writing of any such suit and transmit to HIPOWER immediately upon receipt all processes and papers served upon Buyer, and (d) Buyer shall permit HIPOWER through its counsel either in the name of Buyer or in the name of HIPOWER, to defend such suit(s) and give all needed information, assistance, and authority to enable HIPOWER to do so.

In case of a final award of damages in any such suit, HIPOWER will pay such award but will not be responsible for any compromise or settlement made without its written consent. In case the equipment itself is in such suit held to infringe any valid patent issued in the United States and its use enjoined, or in the event of a settlement or compromise approved by HIPOWER which shall preclude future use of the equipment sold to Buyer hereunder, HIPOWER shall, at its own expense and at its sole option, either (a) procure rights to continue using such equipment, (b) modify the equipment to render it non-infringing, (c) replace the equipment with non-infringing equipment or (d) refund the purchase price paid by Buyer for the equipment after return of the equipment to HIPOWER. Notwithstanding the foregoing, HIPOWER shall not be held responsible for infringements of combination or process patents covering the use of equipment in combination with other goods or materials not furnished by HIPOWER.

The foregoing states the entire liability of HIPOWER for patent infringement, and IN NO EVENT SHALL HIPOWER BE LIABLE FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES ATTRIBUTABLE TO AN INFRINGEMENT nor for infringement based on the use of the equipment for a purpose other than that for which sold by HIPOWER. As to any equipment furnished by HIPOWER to Buyer manufactured in accordance with designs proposed or furnished by Buyer or any claim of contributory infringement resulting from the use or resale by Buyer of equipment sold hereunder, Buyer shall indemnify HIPOWER for any award made against HIPOWER or settlement by HIPOWER for any patent, trademark or copyright infringements, including attorneys' fees and defense costs.

14. Security Agreement and Financing Statements

To secure payment of the purchase price and of all monies which may be due hereunder, and performance of all of Buyer's obligations hereunder, Buyer hereby grants to HIPOWER a security interest in all equipment sold by HIPOWER, and agrees to execute such other Security Agreements and Financing Statements as HIPOWER may reasonably request.

15. Insurance

Until payment in full of the purchase price, Buyer shall maintain insurance covering all equipment sold by HIPOWER to Buyer in such amounts and against such risks as in customary by companies engaged in the same or similar business and similarly located, and shall, upon HIPOWER's request, furnish evidence of such insurance satisfactory to HIPOWER.

16. Drawings; Other Design Data

All specifications, drawings, designs, data, information, ideas, methods, tools, gages, dies, fixtures, patterns and/or inventions made, conceived, developed or acquired by HIPOWER in connection with procuring and/or executing Buyer's order will vest in and inure to HIPOWER's sole benefit notwithstanding any charges therefor which may have been or may be imposed by HIPOWER. Buyer shall not give, loan, exhibit, sell or transfer to any person not then employed by Buyer and authorized to receive such information, or to any organization or entity, any drawing, photograph or specification furnished by HIPOWER or reproduction thereof which may enable such person, organization or entity to furnish similar goods or parts therefor.

17. Return of Equipment

No equipment or part shall be returned to HIPOWER without written authorization and shipping instructions first having been obtained from HIPOWER.

18. Assignment and Subcontracting

None of the Buyer's rights under any order shall be assigned by the Buyer to any other person, whether by operation of law or otherwise, without HIPOWER's prior written approval. HIPOWER may, without the necessity of obtaining Buyer's prior written consent, subcontract the production of all or any portion of the equipment.

19. Cancellation

No order submitted to HIPOWER may be cancelled by Buyer without the prior written consent of HIPOWER, which consent will at all times be conditioned on Buyer's agreement to pay HIPOWER's cancellation charge. For finished equipment which in HIPOWER's judgment is readily resalable to others, the cancellation charge shall be 15% of the invoice price of the equipment. For all other cancellations, the cancellation charge shall amount to all costs and expenses incurred by HIPOWER and arising out of or in connection with Buyer's order, net of recoverability, but in no event less than 10% of the invoice price of the equipment or more than the invoice price.

20. General

Governing Law - These Terms and Conditions, and the contract of sale between HIPOWER and Buyer, shall be governed by and construed in accordance with the laws of the State of Kansas. HIPOWER and Buyer hereby agree that any legal action filed by either party for any cause of action arising here under shall be brought only in the District Court in and for Johnson County, Wisconsin and hereby consent to personal jurisdiction in such court in any such action over the parties hereto. The rights and obligations of HIPOWER and Buyer shall not be governed by the provisions of the United Nations Convention on Contracts for the International Sale of Goods.

Attorneys' Fee - Buyer agrees to pay all of HIPOWER's costs and expenses for any action brought to enforce this contract, including for collection and related litigation, including but not limited to reasonable attorney's fees and costs.

Salvatory Clause - The invalidity, in whole or in part, of any of the provision of these Terms and Conditions, shall not affect the enforceability of any of the other provisions thereof, which shall remain in full force and affect

Applicability - The Terms and Conditions as stated herein are applicable as of the date of this printing and until such time as changed by HIPOWER.

HIPOWER Generating Sets Limited Warranty for Mobile Generators

Himoinsa Power Systems, Inc ("HIPOWER") will, at its discretion, repair or replace any part(s) that, upon examination, inspection, and testing by HIPOWER, or branch thereof, is found to be defective under normal use and service, in accordance with the warranty period. Any repaired product shall be warranted for the remaining original warranty period only. Any equipment that the purchaser/owner claims to be defective must be examined by HIPOWER or your approved service center. This will verify service has been performed on the unit throughout the warranty period. This warranty is limited to and available only on Liquid-cooled units. Emissions warranty coverage, if applicable, is detailed in a separate emissions warranty statement.

Warranty Coverage: Warranty period starts on ship date. However, it may be adjusted to the date of commissioning of the generator set if completed within (6) months of the ship date from factory.

Product Line	Warranty
Diesel Tier 4 Final	2 years or 3,500 hours (whichever occurs first) parts and labor
Spark-Ignited Generators	2 years or 3,000 hours (whichever occurs first) parts and labor

Guidelines:

1. All warranty repairs must be performed and/or addressed by HIPOWER or an approved service center.
2. All warranty expense allowances are subject to the conditions defined in HIPOWER'S claim policy.
3. All mobile gaseous generator well sites must be certified; a sample of the well site must be sent to, and pre-approved by HIPOWER prior to installation. Without pre-approval, warranty will be void.
4. Damage to any covered components or consequential damages caused by the use of a non-OEM part will not be covered by the warranty.
5. Block heater controls and circulating pumps are only covered during the first year of warranty
6. HIPOWER may choose to repair, replace, or refund a piece of equipment.
7. Warranty Labor Rates are based on normal working hours. Additional cost for overtime, emergency labor costs for repairs outside of normal business hours will be the responsibility of the customer.
8. Battery and batteries of any type or kind. The battery manufacturer's warranty applies to these only. Any warranty for such should be handled with the manufacturer according to their policies.
9. Excessive mileage charges. Any HIPOEWR authorized distributor may provide warranty service anywhere but will only be paid travel from the nearest service center up to 240 miles round trip of the generator's permanent location at the IRS Standard Mileage Rate.
10. Verification of maintenance records may be required for warranty coverage.
11. Engines, Alternators and Controllers used in HIPOWER mobile generators carry a separate manufacturer's (OEM) warranty, unless otherwise expressly stated. All warranty claims for defects in material and /or workmanship on HIPOWER product components should be directed through HIPOWER SYSTEMS. (OEM) Warranties may vary and are subject to change. HIPOWER shall have no liability under OEM warranties.
12. Rates- Call your HIPOWER Representatives for more information.
13. A valid warranty requires that: (1) HIPOWER's warranty certificate form must be completed, returned and on file at Himoinsa Power System, Inc. (2) Generator sets that are to remain out of service for a period longer than two months are subject to special preservation requirements.
14. Unit enclosure is only covered against rust and corrosion the first year of the warranty provision.
15. The owner is responsible for the performance of regular maintenance services as specified in the operator's manual applicable to the engine.

The following will NOT be covered by this warranty:

1. Cost of normal maintenance (i.e. tune-ups, associated part(s), adjustments, loose/leaking clamps, installation and start-up).
2. Any failure caused by contaminated fuels, oils, coolants/antifreeze or lack of proper fuels, oils or coolants/antifreeze.
3. Failures caused by any act of God or external cause such as, but not limited to, collision, fire, theft, freezing, vandalism, riot or wars, lighting, earthquake, hurricane, terrorist acts or nuclear holocaust, or any other matters which are reasonably beyond the manufacturer's control.
4. Products that are modified or altered in a manner not authorized by HIPOWER in writing.
5. Failures due, but not limited to, normal wear and tear, accident, misuse, abuse, negligence, or improper installation or sizing.
6. Any incidental, consequential or indirect damages caused by defects in materials or workmanship, or any delay in repair or replacement of the defective part(s).
7. Damage related to rodent and/or insect infestation.
8. Overnight freight costs for replacement part(s).
9. Failure due to misapplication, misrepresentation, or bi-fuel conversion.
10. Any special access fees required gaining access to HIPOWER equipment not limited to but including, lodging, training or safety policy, planes, ferries, railroad, buses, helicopters, snowmobiles, snow-cats, off-road vehicles or any other mode of transport or living quarters deemed abnormal.
11. Telephone, facsimile, cellular phone satellite, internet, or any other communication expenses.
12. Rental equipment used while warranty repairs are being performed (i.e. rental generators, cranes, etc.)
13. The warranty does not cover sales tax or any incidental costs including, without limitation, shipping or associated transportation charges, travel to and from repair sites, damages related to the loss of use, lost rentals, rental expenses and damages to property or equipment.
14. Any and all expenses incurred investigating performance complaints unless defective HIPOWER materials and/or workmanship were the direct cause of the problem.
15. Any failed components warranted by the OEM (i.e. engine, generator, starting batteries, etc.)
16. Normal maintenance and/or wear items (i.e. bearings, belts, bulbs, brakes, filters, fuses, fluids, hoses, tires, etc.)
17. Trailers and UL listed subbase fuel tanks will be covered under the original equipment manufacturer's warranty.
18. Housing Lights and light switches.
19. Cords, receptacles, and cord reels.
20. Any repair labor time that is determined to be excessive: e.g., such as two or more persons performing a one-person job.

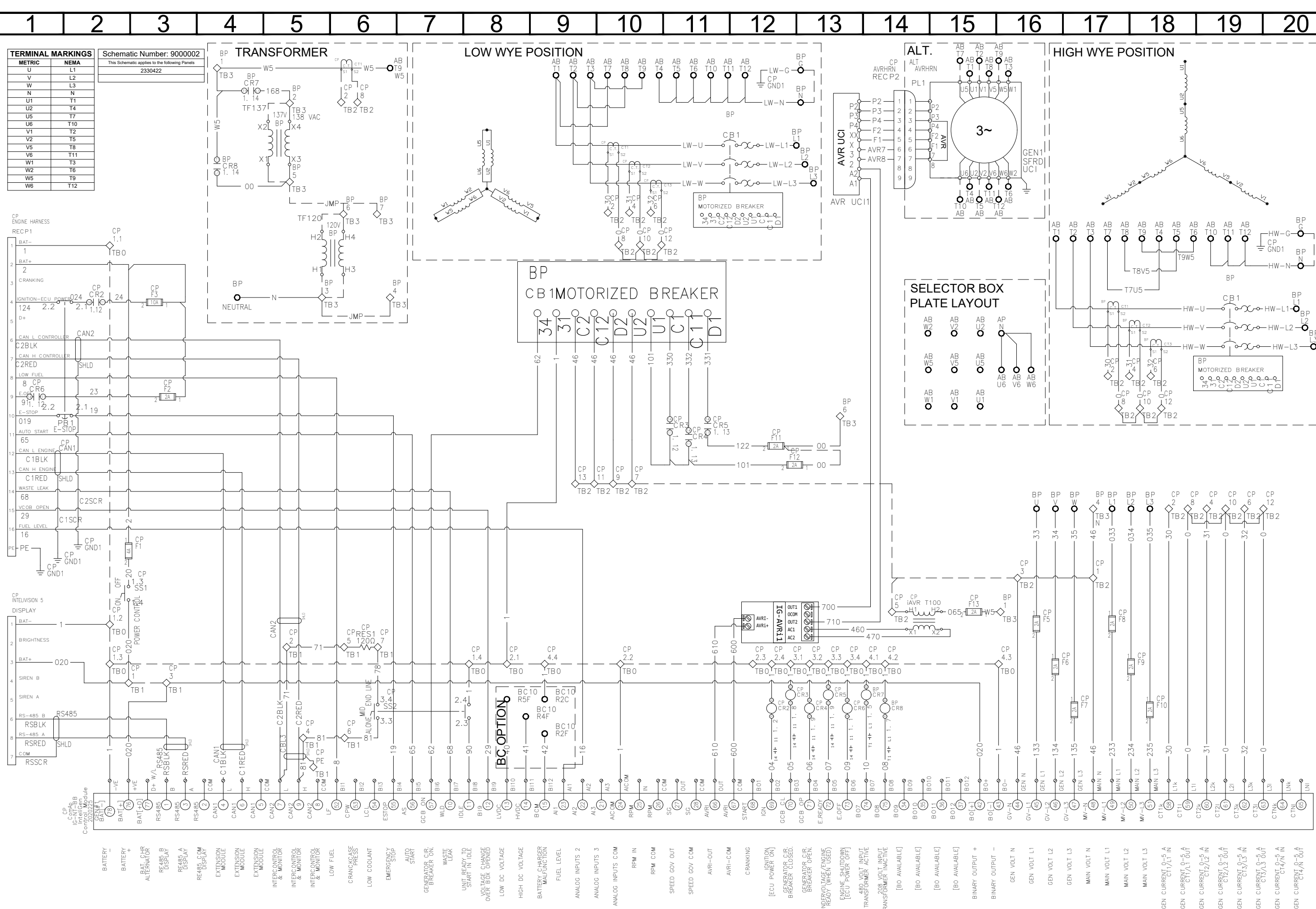
HIPOWER shall not be liable for any claim greater in amount than the purchase price of the product, in respect of which such claim is made, and in no event shall HIPOWER be liable for any special, indirect or consequential damages.

*Note: HIPOWER is a registered brand of Himoinsa Power Systems, Inc.

**Note: Warranty is not transferrable.

This warranty is in place of all other warranties, expressed or implied, specifically HIPOWER makes no other warranties as to the merchantability or fitness for a particular purpose. Any implied warranties which are allowed by law, shall be limited in duration to the terms of the express warranty provided herein. Some jurisdictions do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to purchaser/owner. HIPOWER's only liability shall be the repair or replacement of part(s) as stated above. In no event shall HIPOWER be liable for any incidental or consequential damages, even if such damages are a direct result of HIPOWER's negligence. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation may not apply to you. You agree to make no claims against HIPOWER based on negligence. This warranty gives you specific legal rights. You may also have other rights under applicable law.

HIPOWER SYSTEMS – 16600 S Theden St., Olathe, KS 66062 * PH: (913) 495-5557 * FAX: (913) 495-5575 * www.hipowersystems.com





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HIPower
generating sets

NO.	DATE	REVISION	BY
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05			
04			
03	07-03-2020	INT	S.M.
02	06-26-2020	INT	S.S.
01	06-26-2020	INT	S.S.

PRIME MOBILE
T4F VOLVO 625 SINGLE

CP & BP WIRING SCHEMATICS

DRAWN BY	CHECKED BY
S.S.	C.S.

DRAWING DATE	CHECKED DATE
06-26-2020	06-26-2020

STATUS	SYMBOL
RELEASED	NEC

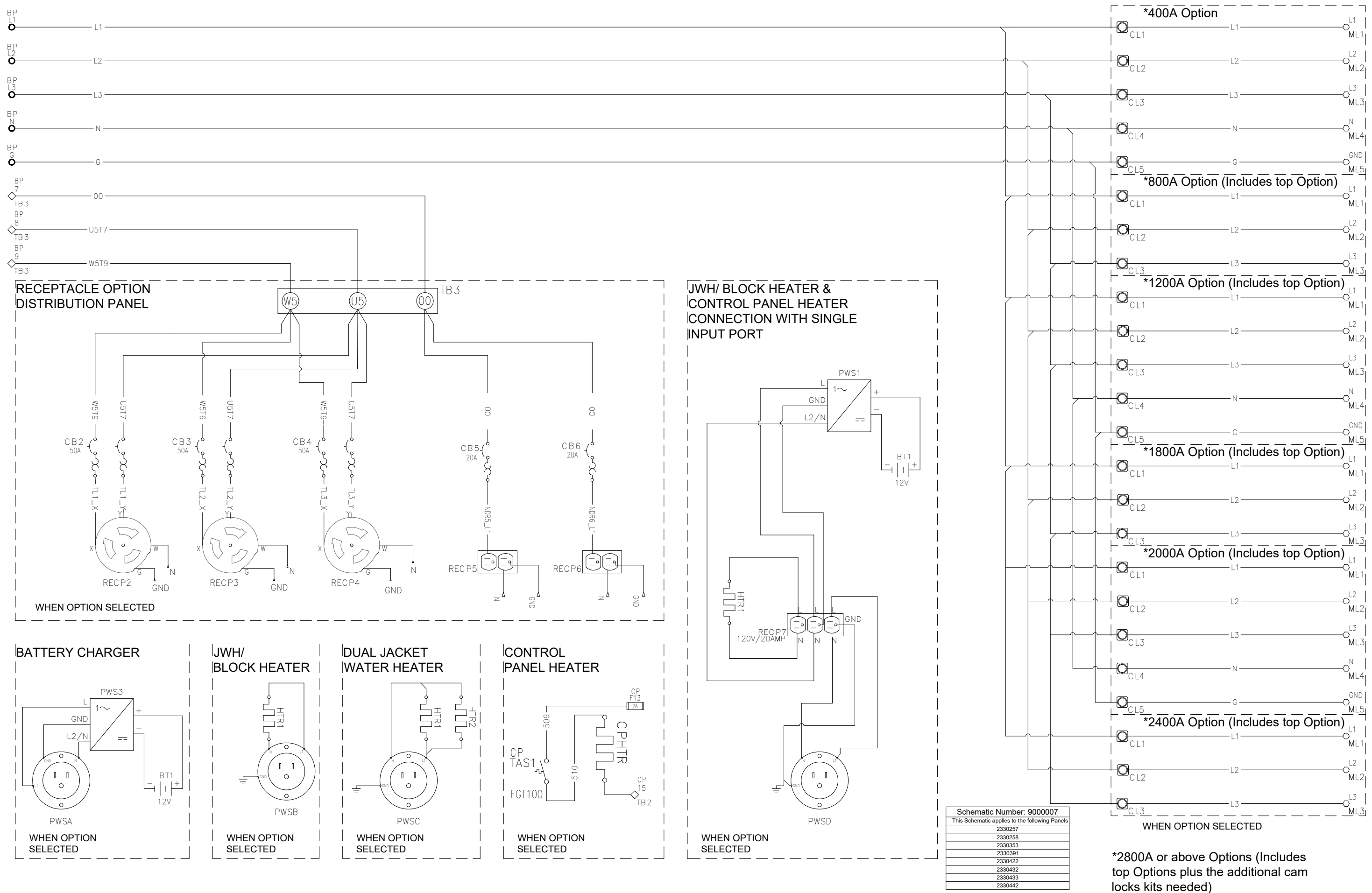
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SHEET NO. **1 OF 1**

HIMOINSA POWER SYSTEMS, INC.

OFFICE: 913-495-5557

WWW.HIPOWERSYSTEMS.COM



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01	07/11/2019	INT	S.S.	
NO.	DATE	REVISION	BY	

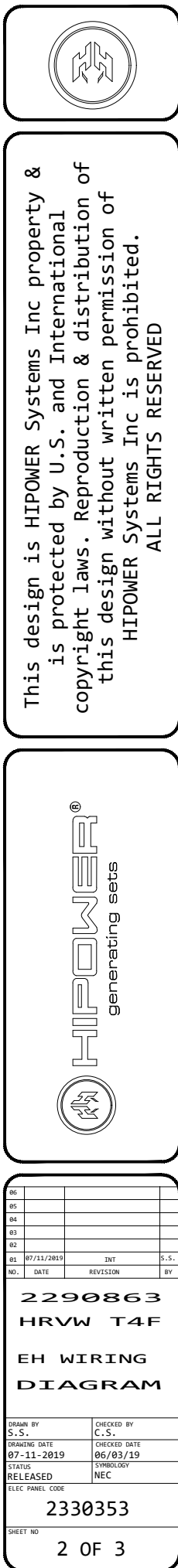
PRIME MOBILE RENTAL OPTIONS

ADDED OPTIONS WIRING SCHEMATICS

DRAWN BY S.S.	CHECKED BY S.S.
ORIGINATING DATE 07-18-2019	CHECKED DATE 07/11/2019
STATUS RELEASED	SYMBOLS NEC

9000007

SHEET NO
1 OF 1



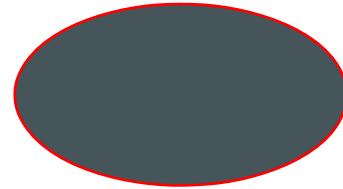


HIPOWER®
generating sets

Generator Base Coat

HIPOWER Systems uses Interpon A4700 primer for a base coat on all powder coated parts. Interpon A4700 primer is a series of performance engineered powder coatings designed for the highest automotive OEM standards. They provide excellent smoothness and appearance, corrosion and chemical resistance and mechanical properties.

- ✓ **Thickness-** 2.5 mils
- ✓ **Adhesion-** ASTM D3359 5B 100% pass
- ✓ **Hardness-** ATSM D3363/2H pass



Canopy Top Coat

HIPOWER Systems canopies are coated with Interpon 600 HIPOWER matte gray. Interpon 600 series coatings are designed for exterior exposure and offers excellent light and weather resistance. This coating coupled with the A4700 primer offer 5 mils of premium coating to all our canopies.

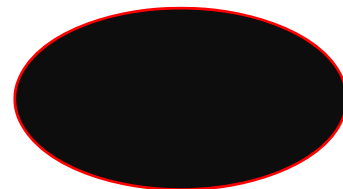
- ✓ **Thickness-** 2.5 mils
- ✓ **Salt Spray-** ASTM B117 @1400 hours (w/primer)
- ✓ **Humidity-** ASTM D2247 @1400 hours
- ✓ **Adhesion-** ASTM D3359 5B 100% pass
- ✓ **Hardness-** ATSM D3363/2H pass



Structural Parts/Chassis Top Coat

HIPOWER Systems structural parts and chassis are coated with Interpon 600 HIPOWER matte black. Interpon 600 series coatings are designed for exterior exposure and offers excellent light and weather resistance. This coating coupled with the A4700 primer offer 5 mils of premium coating to all our structural parts and chassis.

- ✓ **Thickness-** 2.5 mils
- ✓ **Salt Spray-** ASTM B117 @1400 hours (w/primer)
- ✓ **Humidity-** ASTM D2247 @1400 hours
- ✓ **Adhesion-** ASTM D3359 5B 100% pass
- ✓ **Hardness-** ATSM D3363/2H pass



Thermosiphon Engine Heaters

CB Model Weathertight Single Phase

1500–2500 Watts



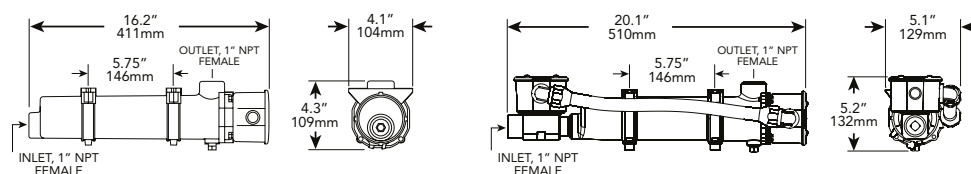
CB Model without thermostat



CB Model with thermostat

Engine Displacement	Model Number without Thermostat	Model Number with Thermostat see chart 1	Volts	Watts	Phase	Amps
350 – 500 CID 5.7 – 8.2L	CB115100-000	CB1151XX-200	120	1500	1	12.5
	CB115800-000	CB1158XX-200	208	1500	1	7.2
	CB115200-000	CB1152XX-200	240	1500	1	6.3
	CB115700-000	CB1157XX-200	277	1500	1	5.4
	CB115300-000	CB1153XX-200	380	1500	1	3.9
	CB115400-000	CB1154XX-200	480	1500	1	3.1
500 – 600 CID 8.2 – 9.8L	CB120100-000	CB1201XX-200	120	2000	1	16.7
	CB120800-000	CB1208XX-200	208	2000	1	9.6
	CB120200-000	CB1202XX-200	240	2000	1	8.3
	CB120300-000	CB1203XX-200	380	2000	1	5.3
	CB120400-000	CB1204XX-200	480	2000	1	4.2
600 – 800 CID 9.8 – 13.1L	CB125100-000	CB1251XX-200	120	2500	1	20.8
	CB125800-000	CB1258XX-200	208	2500	1	12.0
	CB125200-000	CB1252XX-200	240	2500	1	10.4
	CB125700-000	CB1257XX-200	277	2500	1	9.0
	CB125300-000	CB1253XX-200	380	2500	1	6.6
	CB125400-000	CB1254XX-200	480	2500	1	5.2

CB Model



CL Model Weathertight Single Phase

3000–5000 Watts



CL Model without thermostat



CL Model with thermostat

Engine Displacement	Model Number without Thermostat	Model Number with Thermostat see chart 1	Volts	Watts	Phase	Amps
800 – 1000 CID 13.1 – 16.4 L	CL130100-100	CL1301XX-200	120	3000	1	25.0
	CL130800-100	CL1308XX-200	208	3000	1	14.4
	CL130200-100	CL1302XX-200	240	3000	1	12.5
	CL130700-100	CL1307XX-200	277	3000	1	10.8
	CL130300-100	CL1303XX-200	380	3000	1	7.9
	CL130400-100	CL1304XX-200	480	3000	1	6.3
1000 – 1350 CID 16.4 – 22.1 L	CL140800-100	CL1408XX-200	208	4000	1	19.2
	CL140200-100	CL1402XX-200	240	4000	1	16.7
	CL140700-100	CL1407XX-200	277	4000	1	14.4
	CL140300-100	CL1403XX-200	380	4000	1	10.5
	CL140400-100	CL1404XX-200	480	4000	1	8.3
1350 – 1650 CID 22.1 – 27.0 L	CL150800-100	CL1508XX-200	208	5000	1	24.0
	CL150200-100	CL1502XX-200	240	5000	1	20.8
	CL150700-100	CL1507XX-200	277	5000	1	18.1
	CL150300-100	CL1503XX-200	380	5000	1	13.2
	CL150400-100	CL1504XX-200	480	5000	1	10.4

CL Model

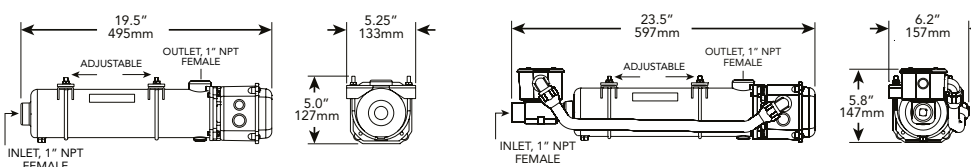


CHART 1

Heaters with Thermostats

To specify temperature range of thermostat, insert numerical code from chart in place of the **XX** in model number.

Example:

Desired Temp. Range: 100° – 120°F

Model Number: CB1151**XX**-200

Order as: CB1151**10**-200

Temperature Range		Numerical Code
ON	OFF	
80°F (27°C)	100°F (38°C)	08
100°F (38°C)	120°F (49°C)	10
120°F (49°C)	140°F (60°C)	12
Adjustable 90° – 130°F (32° – 54°C)		A3

Replacement Parts

For thermosiphon
engine heaters
CB/CL Models

CHART 2

Heaters with Thermostats

Temperature Range		Sensing Unit
ON	OFF	
80°F (27°C)	100°F (38°C)	FSU8
100°F (38°C)	120°F (49°C)	FSU10
120°F (49°C)	140°F (60°C)	FSU12
Adjustable 90° – 130°F (32° – 54°C)		FSU90-130

Example:

Model Number: CB115110-200
T-Stat Replacement: FSU10

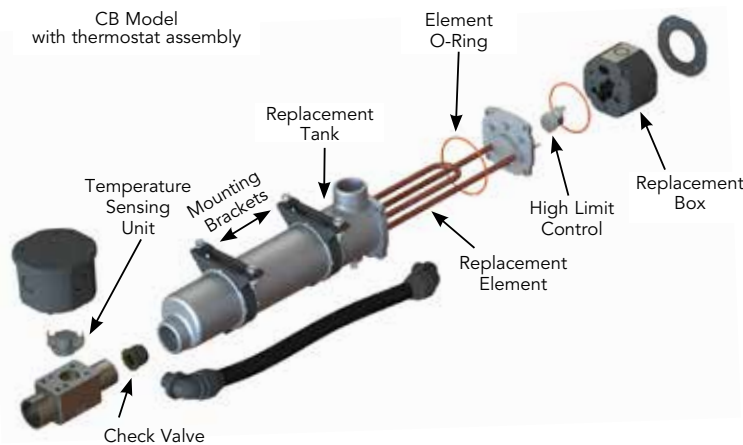
ADAPTER FITTINGS (CB MODELS ONLY)

For the use of 0.75" or 1" ID heater hose, hose barb adapters are available. See below.

HB-1	1" NPT to 1" hose barb adapter. Installs in 1" NPT female inlet or outlet of the heater.
HB-3/4	1" NPT to 0.75" hose barb adapter. Installs in 1" NPT female inlet or outlet of the heater.

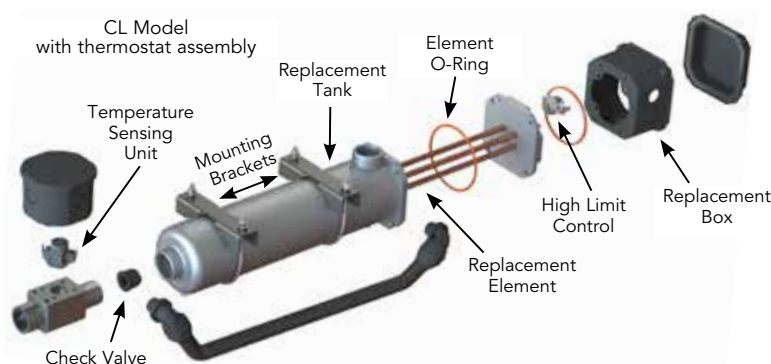
Model Number without Thermostat	Model Number with Thermostat see chart 2	Element Replacement
CB115100-000 CB115800-000 CB115200-000 CB115700-000 CB115300-000 CB115400-000	CB1151XX-200 CB1158XX-200 CB1152XX-200 CB1157XX-200 CB1153XX-200 CB1154XX-200	RECB1151 RECB1158 RECB1152 RECB1157 RECB1153 RECB1154
CB120100-000 CB120800-000 CB120200-000 CB120300-000 CB120400-000	CB1201XX-200 CB1208XX-200 CB1202XX-200 CB1203XX-200 CB1204XX-200	RECB1201 RECB1208 RECB1202 RECB1203 RECB1204
CB125100-000 CB125800-000 CB125200-000 CB125700-000 CB125300-000 CB125400-000	CB1251XX-200 CB1258XX-200 CB1252XX-200 CB1257XX-200 CB1253XX-200 CB1254XX-200	RECB1251 RECB1258 RECB1252 RECB1257 RECB1253 RECB1254

Common Replacement Parts available for all listed heaters	
High Limit Control	HLC-165
Check Valve	RV-M
Element O-ring	TMM-OR
Tank	RTB
Box	RTBCB
Mounting Brackets	RTMMB



Model Number without Thermostat	Model Number with Thermostat see chart 2	Element Replacement
CL130100-100 CL130800-100 CL130200-100 CL130700-100 CL130300-100 CL130400-100	CL1301XX-200 CL1308XX-200 CL1302XX-200 CL1307XX-200 CL1303XX-200 CL1304XX-200	RECL1301-100 RECL1308-100 RECL1302-100 RECL1307-100 RECL1303-100 RECL1304-100
CL140800-100 CL140200-100 CL140700-100 CL140300-100 CL140400-100	CL1408XX-200 CL1402XX-200 CL1407XX-200 CL1403XX-200 CL1404XX-200	RECL1408-100 RECL1402-100 RECL1407-100 RECL1403-100 RECL1404-100
CL150800-100 CL150200-100 CL150700-100 CL150300-100 CL150400-100	CL1508XX-200 CL1502XX-200 CL1507XX-200 CL1503XX-200 CL1504XX-200	RECL1508-100 RECL1502-100 RECL1507-100 RECL1503-100 RECL1504-100

Common Replacement Parts available for all listed heaters	
High Limit Control	HLC-165
Check Valve	RV-M
Element O-ring	TML-OR
Tank	RTL
Box	RTBCL-100
Mounting Brackets	FK7



MicroGenius®

Industrial Reserve Power Battery Chargers

12 & 24 Volts, 6 to 60 Amps



Small. Powerful. Rugged.

Hardened switchmode powertrain - delivers first-class abuse resistance and energy efficiency

Advanced microprocessor control - allows advanced digital controls and communications

Power supply or battery charger - perfect for sensitive electronics or applications with/without battery

Two standard battery check systems - work with both constant and intermittent loads

Standard Modbus communications - enable easy integration with building and supervisory systems

Small, lightweight packages - enable installation in smaller spaces

Robust reliability. More power in less space.

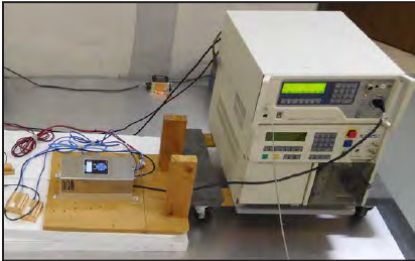
MicroGenius is a family of advanced technology 12- and 24-volt stationary battery chargers that deliver more power in less space. Ruggedized switchmode power conversion technology enables a rich set of standard features that are either unavailable in or add significant cost to competing legacy technology chargers.

MicroGenius is designed and tested to survive extreme electrical transients, temperature and vibration. Employing the field-proven MicroGenius 2 power conversion platform, dependability of S2 and S4 chargers can be further enhanced by specifying internal power converter redundancy.

State-of-the-art features

Mission-critical dependability

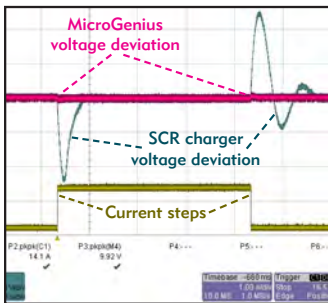
SENS' comprehensive approach to reliability includes expert engineering talent, worst-case analysis design, repeated and ongoing stress testing and highly automated assembly, test and burn-in.



Electrical transient testing MicroGenius 2

Rich standard feature set

Standard with every charger: ripple-free output, fast dynamic response, Modbus communications, multiple alarm and communications choices, battery health check systems and global standards compliance.



Extremely fast dynamic response

State-of-the-art digital control

- Patented algorithms charge batteries faster & more safely
- Superb energy efficiency exceeds state-mandated regulations
- Comms, load sharing & other features "built-in" to every unit



State-of-the-art digital signal processor control

Dependable modular architecture

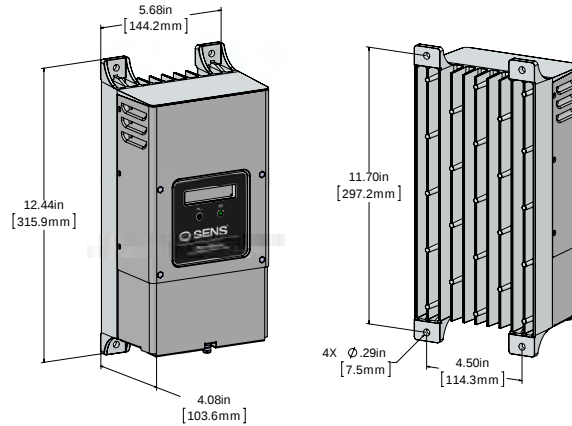
MicroGenius S2 and S4 employ multiple MicroGenius 450 chargers that enable either higher current output, internal redundancy or multiple outputs.



MicroGenius 2

6.0 lbs. (2.8 kg)

Choose **MicroGenius 2** if your DC current requirement is $\leq 15A$



Specifications for MicroGenius 2: 6A to 15A Output

		MicroGenius 180	MicroGenius 300	MicroGenius 450
AC input	VAC, Hz	90-265 ¹ VAC, 47-63 Hz		
	Protection	Supplementary overcurrent protection fuse, transient protected to EN 61000-4-5 level 4		
	Power factor & efficiency	PF > .95 typical; efficiency to 93%; meets CEC Title 20 Efficiency Regulations; standby AC draw < 3W		
DC output	Volts, amps	12V/24V nom., 10A/6A	12V/24V nom., 12A/10A	12V/24V nom., 15A/15A (24V, 12A max below 170 VAC)
	Charging modes	Multi-stage, including float, boost and commissioning charge modes		
	Current limit	Factory set at 100% of rating. Field adjustable w/optional keypad or from PC. ²		
	Charging characteristic	Constant voltage, current limited; patented Dynamic Boost control		
	Line & load regulation	$\pm 0.5\%$		
	Output ripple	< 30 mVrms with or without battery. Delivers fast-responding, stable, well-filtered DC without battery.		
	Battery temp. compensation	Standard. Optional remote battery temperature probe. ³		
	Output protection	Current limit, supplementary overcurrent protection fuse, transient protected		
	Dead battery charge	Starts into, and recharges zero volt battery without user intervention		
Adjustment & Controls	Parallel operation	Two or more chargers operate with all modes synchronized for increased current or fault tolerance ⁴		
	Charge mode control	Fully automatic patented Dynamic Boost system. Manually initiated timed boost & commissioning modes available with keypad option		
	Adjustments	12 or 24-volt; battery type program; fine voltage setting; alarm setpoints; alarm relay mapping		
	Battery type programs	Flooded lead-acid, Ni-Cd, VRLA, ultracapacitor, lithium ⁵		
Status display	Field voltage adjustment	3 methods: jumper pins, from front panel keypad ⁶ or from PC ²		
	LEDs	Two multi-color front panel status LEDs		
Alarms	Metering & status display	Optional. Voltmeter accurate to +2%; ammeter to +5%; 20-character display of status & alarm messages. ⁷		
	Alarms	Factory set, field reconfigurable. Alarm functions announced on the Modbus port and on the optional LCD include summary, AC fail, charger fail, high DC volts, low DC volts, low cranking volts, overvoltage shutdown, reverse polarity battery, incompatible battery, invalid settings, I/O bus inactive, thermal fold back, no temperature probe, current limiting, ground fault and low current. Any alarm is assignable to Form C contacts.		
Networking	Alarms: Form C contacts	Optional. Two ⁸ or five ⁹ Form C contacts, each rated 30V, 2A resistive, assignable. Standard configuration includes summary, AC fail, charger fail, high DC volts, low DC volts and discharging battery.		
	J-1939 communications	CAN 2.0 extended ID on RJ-45 port		
Environmental	Modbus communications	Modbus RS-485 on RJ-45 port		
	SENSbus	Proprietary bus for connection of paralleled chargers and SENS accessories		
	Operating temperature ¹⁰ (convection cooled)	-40C to +70C; full spec from -40C to +60C	-40C to +70C; full spec from -40C to +50C	-40C to +70C; full spec from -40C to +40C
	Humidity	5% to 95%, non-condensing		
	Ingress protection	IP 22; NEMA 3R; UL Listed "Rainproof"		
	Vibration & shock resistance	Vib: Swept Sine (EN60068-2-6): 4G, 18-500 Hz, 3 axes. Random: 20-500Hz, .01G ² /Hz. Shock: EN 60068-2-27 (15G)		
Abuse protection	Electrical transient	ANSI/IEEE C62.41 & EN 61000-4-12 on power terminals		
	Reverse polarity	Charger self-protects without fuse clearing. Indication via LED & optional LCD.		
	Wrong voltage battery	Charger-battery voltage mismatch shuts down charger. Indication via LED & optional LCD.		
	Overvoltage shutdown	Selective; shutdown only operates if charger causes the overvoltage condition		
Regulatory compliance	Overtemperature protection	Gradual output power reduction if heatsink temperature becomes excessive		
	North America	C-UL Listed for US & Canada: UL 1236 categories BBGQ, BBHH, BBJY and QWIR ¹¹ , CSA 22.2, No. 107.2. Certified to UL 1236 supplements SB (marine), SC (fire pump) and SE (emergency generator). NFPA-70, NFPA-110 ¹² FCC Part 15, Class B Seismic: Rigid & non-structure wall mount; max S _{DS} of 2.5G. IBC 2000-2015, Calif. BC 2007-2016 American Bureau of Shipping, type approved		
	European Union (CE)	EMC: 2014/30/EU (EN 61000-6-2 & EN 61000-6-4) LVD: 2014/35/EU (EN 60335-1 & EN 60335-2-29) RoHS 2: 2011/65/EU (EN 50581)		
	Housing/configuration	Die-cast aluminum heatsink base with stainless steel covers & fasteners		
	Connections	AC & DC terminal blocks: 20 to 10 AWG. J-1939 and Modbus-485: RJ-45. Form C alarms: 28 to 16 AWG		

¹ When set for 24-volt output, full 15A output of 450W available above 170 VAC input, 12A output current max between 100 VAC and 170 VAC input ² Requires optional computer to charger adapter SENS p/n 209254 plus free SENS software available at www.sens-usa.com ³ Remote battery temp sensor is optional. Order SENS p/n 209481 ⁴ Requires standard RJ-45 network cable to connect paralleling bus. Order SENS p/n 208118-72 (72-inch length) or 208118-180 (180-inch length) ⁵ Contact factory to determine compatibility with the battery management system (BMS) of your lithium battery. ⁶ Requires that digit 12 of the model number be F ⁷ Requires that digit 12 of the model number be D, E, or F ⁸ Models with E as digit 12 of the model number include 2 ea. Form C alarm contacts ⁹ Models with D or F as digit 12 of the model number include 5 ea. Form C alarm contacts ¹⁰ At 65 deg. C and above the LCD display may be unreadable and display life will be reduced ¹¹ Except 180W unit in 24V configuration, which is not listed to QWIR ¹² All chargers equipped with an alarm / display board meet NFPA-110 requirements. For chargers without an alarm / display board to meet NFPA-110, charger volts, amps and charger fail alarm available on the J-1939 port must be annunciated by the genset control panel.

How To Order **MicroGenius 2**

Product Type	Power	Output Volts	Output Current	Alms & Comms	Adapter & RTS
M	4	22	1515	F	N
(A)	(B)	(C)	(D)	(E)	(F)

	Parameter	Code	Value
(A)	Product Family	M	MicroGenius 2
(B)	Power	1 3 4	180W 300W 450W
(C)	Output Voltage	22	12/24V
(D)	Output Current	1006 1210 1515	10A @ 12V; 6A @ 24V (180W only) 12A @ 12V; 10A @ 24V (300W only) 15A @ 12V; 15A @ 24V (450W only)
(E)	Alarm & Communication Options	A D E F	Base model; includes J-1939 & Modbus communications Base model + LCD display + 5 ea. Form C alarm relays Base model + LCD display + 2 ea. Form C alarm relays Base model + LCD + 5 ea. Form C relays + keypad control
(F)	Adapter Plate & Remote Temperature Sensor Options	F G L N T	FC to MicroGenius 2 adapter plate (enclosed charger only) MicroGenius 150 to MicroGenius 2 adapter plate (enclosed charger only) LC to MicroGenius 2 adapter plate (enclosed charger only) NRG10 to MicroGenius 2 adapter plate (enclosed charger only) Remote Temperature Sensor shipped with charger

How To Order **MicroGenius S2 & S4**

Product Type	Enclosure	Protect. Options	Comms	Config	Port A Code	Port A Redun.	Port B Code	Port B Redun.	Port C Code	Port C Redun.	Port D Code	Port D Redun.
S	4	C	1	0	H	0	0	0	0	0	0	0
(A)	(B)	(C)	(D)	(E)	(F)	Contact the factory to configure chargers with multiple outputs or internal redundancy.						

	Parameter	Code	Value
(A)	Product Family	S	MicroGenius S
(B)	Enclosure	2 4	S2 chassis S4 chassis
(C)	AC & DC protection configuration	A B C	Standard, no circuit breakers AC and DC circuit breakers (S4 only) AC and DC breakers plus supplementary surge protection (S4 only)
(D)	Communications	0 1 2 3	J-1939 and Modbus RS-485 J-1939 and Modbus TCP/IP J-1939 and Modbus RS-485 with RJ-45 to terminal block adapter J-1939 and Modbus TCP/IP with RJ-45 to terminal block adapter
(E)	Configuration	0 R T	Standard 19" rack mount ears (S4 only) 23" rack mount ears (S4 only)
(F)	Output Current	A B D F H	15A (S4 only) 20A (S2 only) 30A (S2 or S4) 45A (S4 only) 60A (S4 only)

Contact SENS or your local sales representative for additional specification, engineering and installation information, or visit SENS' website for latest available data. Specification subject to change without notice.

SENS, Stored Energy Systems, the battery/rectifier logo, Dynamic Boost, HELIX and MicroGenius are trademarks of Stored Energy Systems LLC. Patented US 9,270,140; 9,385,556; 9,413,186; 9,509,164; 9,466,995; 9,948,125.

Contact Information

Sales 1.866.736.7872 • 303.678.7500 • Fax 303.678.7504 • info@sens-usa.com • www.sens-usa.com

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Tel: 913-495-5557 | Fax: 913-495-5575 | Call us (toll free) at: 1 866 710-2988 | info@hipowersystems.com | www.hipowersystems.com



	NOTES
a	FUEL TANK
b	FASTENING HOLES 12x 1.102" (28.00 mm) DIA.
c	AIR INLET
d	AIR OUTLET
e	LIFTING POINT
f	RADIATOR ACCESS
g	EXHAUST OUTLET
h	FUEL DRAIN
i	EMERGENCY STOP
j	OIL DRAIN
k	FUEL FILLER NECK
l	CONTROL PANEL
m	DISTRIBUTION PANEL
n	COOLANT DRAIN
o	BATTERY
p	SILENCER
q	BLOCK HEATER
r	3-WAY VALVE
s	BATTERY CHARGER
t	COMAR IV5

Engine	Engine model
VOLVO	TWD 1673 GE
Alternator	Alternator model
STAMFORD	HCI 534

TANK CAPACITY : 600 GAL



	DATE:	NAME:		OLD CODE:			
DESIGNED:	06/27/19	D.P.		NEW CODE:			
REVISED:	11/14/19	S.S.S.		The actual design is HIMONSA S.L. property. It can not be used for construction of the showed item, reproduced or communicated to third parts without the previous authorisation of the above mentioned company.			
APPROVED:	06/27/19	C.S.					
	DESIGNATION:				DRAWING N°:	1501197	
	HDR685VS6CA3213DA				CODE:	CD-0025-19	
					REVISION:	02	DIN- A2
					UNIT:	mm [in]	SCALE: