PRODUCT SPECIFICATION

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Spec. No. 3C.548 rev C

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SGCO 2000

CLIP-ON GENERATOR SET
With µP-G Controller

TECHNICAL SPECIFICATION

Approval: Robt C. Bluff

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GENERAL DESCRIPTION

Manufacturer	Thermo King Corporation
Construction	The generator set is designed for mounting to the upper front structure of an ISO container. The design incorporates a quick connection to the upper container corner castings. Additional attaching points on the container vertical structural members provide a secure mounting arrangement. It is a completely welded steel structural assembly designed to withstand a minumum 2 g's acceleration forces in all directions.
Structural Frame	Structural steel frame and integral fuel tank is chemically cleaned through an immersion pretreatment line with a multi-metal iron phosphate passivation, primed with a epoxy-polyester powder and top coated with a black polyester TGIC powder.
Panels and Doors	Panels and doors are chemically cleaned through a 6-stage pretreatment spray- washer line with a multi-metal iron phosphate passivation, primed with a epoxy-polyester powder and top coated with a white polyester TGIC powder.
Hardware	All hardware and hinges are stainless steel for maximum protection from salt water corrosion.
Nameplate Instructions	English and Spanish language operating instructions, microprocessor menu instructions, and alarm code descriptions.
CE Compliance	Compliant with the Machinery Directive 89/392/EEC amending Directive 91/368/EEC, Electro Magnetic Compatibility Directive 89/336/EEC, and Low Voltage Directives 73/23/EEC and 93/68/EEC.
Dimensions	Width: 2337 mm (92.0 in) Height: 1053 mm (41.45 in) Depth: 710 mm (27.97 in)
Weight	843 kg (1860 lbs) - Total Weight, including Gen Set, oil, coolant, dry fuel tank and battery.

ENGINE

Type	TK 486 direct injection	**Protection**	Low oil pressure, low oil level, and high coolant temperature
Cylinder Arrangement	No. 1 at flywheel end	**Serviceability**	Starter motor/injector pump mounted on front side of engine
Bore	86 mm (3.39 in) nominal	**Paint**	Light Gray Water Laquer
Displacement	2.09 liter (128 in^3)	**Stroke**	90 mm (3.54 in) nominal
Fuel Injection Timing	12° BTDC (Timed on No. 1 cylinder)	**Compression Ratio**	18:1
Horsepower	34.1 @ 1800 rpm	**Firing Order**	1-3-4-2
Valve Lash: Intake (cold)	0.20 mm (0.008 in)	**Valve Lash: Exhaust (cold)**	0.20 mm (0.008 in)
Oil Pressure (hot)	More than 127 kPa (18.5 psi) @ 1600 rpm	**Compression Pressure**	More than 2942 kPa (427 psi) @ 250 rpm
Oil Base (Pan) Capacity	12.3 liters (13 quarts)	**Nozzle Injection Pressure**	19600-20600 kPa (2631-2702 psi)
Engine Rotation	Clockwise (viewed from pulley end)		

ENGINE LUBRICATION SYSTEM

Oil Pump Type	Trochoid	**Delivery Volume**	15.7 liters (4.15 gallons) / min @ 1000 pump rpm
Relief Valve Set at	245-343 kPa (36-50 psi)	**Oil Filter Bypass Valve Set at**	78-118 kPa (11-17 psi)
Gear to Body Clearance	0.100-0.160 mm (0.0039-0.0063 in)	**Gear to Cover Clearance**	0.030-0.090 mm (0.0012-0.0035 in)
Oil Type	API CF, CF-4, CG-4 or CH-4 grade -- Use straight or multi-weight oils appropriate for the ambient temperature (delivered with 10W30 factory break-in oil)	**Oil Filters Full Flow: Dual lube Full flow/bypass filter**	Thermo King Part # 11-9182
Oil Change Interval	Consult applicable service manual		

ENGINE ELECTRICAL SYSTEM

PreHeat Type	Intake Air Heater	**Resistance**	0.2 Ohms
Rated Voltage	11 Volts	**Rated Current**	77 Amperes

FUEL SYSTEM

Fuel Tank	125 gallon steel fuel tank integral with frame. Two filler necks are located on opposite sides of the tank.	**Fuel Tank Mounting**	Integral with gen set frame on steel support members that are welded to the gen set frame.
Automatic Air Bleed System	Thermo King furnishes a patented air removal system for purging air from the injector pump and fuel supply lines. The air bleed system works whether the generator set is operating or shutdown. In the case of long shutdown periods, the automatic air bleed system insures sufficient air free fuel available to the injectors to successfully start the engine without manually bleeding the lines and injector assembly.	**Fuel Tank Drainage**	Supplied with a drain plug in the bottom of the tank for purging contaminants.
		Fuel Filters	Thermo King's self-evacuating filter (SEF) is both a fuel filter and a water separator in one spin-on canister. Thermo King Part # 11-9342
		Fuel Heater	Heat exchanger type utilizing engine coolant heat.
		Injection Pump Rotation	Clockwise (viewed from gear end)
Transfer Pump Lobe Lift	5.0 mm (0.197 in)	**Injection Timed at**	12° BTDC
Tightening Torque	41 N-m (27.5 ft-lb)	**Injection Lines, ID**	1.4 mm (0.055 in)
Nozzle Type	YDM-PD	**Injection Lines, OD**	6 mm (.236 in)

ENGINE STARTER MOTOR

Voltage	12 V DC	**Clutch Type**	Over running clutch
Rotation	Clockwise (viewed from pinion end)	**Brush Tension**	3.2 kg (113 ounces)
Method of Engagement	Magnetically-engaged sliding pinion	**Hold-in Current of Solenoid**	20 Amps
Pull-in Current of Solenoid	57 Amps	**Motor Power**	2.0 kW
Unloaded		**Loaded**	
Voltage	11 Volts	**Voltage**	8.76 Volts
Current	Less than 140 Amperes	**Current**	300 Amperes
RPM	More than 3,900 rpm	**Torque**	More than 8.3 N-m (6.1 ft-lb)
		Horsepower	1.8 hp
		RPM	1500 rpm
		Locked Rotor	3V at less than 880 amps with more than 25.5 N-m (18.8 ft-lb) of torque

GENERATOR

Type	Synchronous type generator consisting of a 4 pole alternator with integral revolving armature. 8 pole exciter with rotating rectifiers.	**Insulation**	Class F per NEMA Standard MG-1-1.65
Maximum Temperature Rise	105 °C in accordance with NEMA Standard MG 1-22.40	**Method of Cooling**	Drive disc radial fan
Varnish Treatment - Main Rotor & Exciter Armature	Vacuum pressure impregnated and baked with epoxy varnish.	**Varnish Treatment - Main Stator & Exciter Field**	Sprayed with epoxy primer, air dried, wound, vacuum pressure impregnated with epoxy varnish and baked.
Rear Bearing	405 sealed and lubricated with synthetic hydrocarbon.		
Generator Rating (Nominal)			
Output Power	15 KW	**Voltage**	460 / 230
Kilovolt-Amperes	18.75 kVA	**Phases**	3
Power Factor	0.8	**Frequency**	60 Hz
RPM	1800		

ELECTRICAL POWER RECEPTACLE

Type	ESL 1911-01	**Voltage**	460 V
Current Limit	32 Amps	**Protection**	Spring loaded water/dirt protection cover

AIR FILTER

Filter Type	Heavy duty oil bath filter air cleaner

HOSES

Intake Air Hose	Silicone with internal steel spring
Coolant Hoses	Silicone

MUFFLER

Stainless Steel Material	Noise reducing baffle design

RADIATOR COIL

Protection	Water-borne lacquer (acrylic resin) coating for corrosion resistance.	**Tube Material**	Copper, internally cross-hatched.
Fin Space	2.54 mm (0.100 in)	**Fin Material**	Aluminum
Pipe Material, Copper	According to DIN 1787 wall thickness 0.762 mm (0.030 in)	**Configuration**	Vertical
Surface Area	8.32 m^2 (89.6 ft^2)	**Coolant Fluid**	TEXACO Extended Life Coolant #16445 & rated to –40°C (-40°F)

RADIATOR FAN

Type	Propeller	**Diameter**	381 mm (15.0 in)
Number of Fans / Blades	1 / 6	**Speed**	1800 rpm
Blade Material	Aluminum	**Drive**	Direct on engine shaft
Hub Material	Steel	**Pitch**	31°
Air Flow	1400 cfm		

BATTERY

Type	Maintenance free 12 VDC	**Cold Cranking Amps**	625 Amps at -18°C (0°F)
Recharging	Solid state battery charging, 12 Amps output. The gen set battery is recharged using current from the power bridge rectifier and is controlled via the voltage regulator in the control box. The primary function of the power bridge rectifier and voltage regulator is gen set output excitation and control.	**Terminal Posts**	Special threaded stainless steel studs 3/8-16. Battery cables and hold down nuts are provided to accomodate the special battery studs.
		Dimensions	330 x 173 x 238 mm (13 x 6.8 x 9.4 in)

(µP-G) MICROPROCESSOR CONTROLLER

The Thermoguard® µP-G Microprocessor Controller is a one-piece self contained microprocessor for diesel generator sets. This system automatically controls the generator set operation by providing:

- Automatic unit preheat and engine start-up during initial start-up or unattended restart
- Variable air intake heater preheat time
- Automatic Pre-Trip capability
- Provides unit shutdown protection due to high engine coolant temperature, low engine oil pressure, low engine oil level or 230/460V alternator overload
- Automatic unit restart attempt 20 minutes after:
  - High engine water temperature shutdown
  - Engine failure to start
  - Check fuel alarm shutdown
  - 230/460V alternator overload shutdown
  - An unknown condition shutdown
  - Low engine oil pressure shutdown (selectable)
- Delayed alternator excitation for 15 seconds, or until engine coolant temperature increases to 32°C (90°F) (selectable)

The 'BASE CONTROLLER' contains the following features and components.

A. Backlit LCD Digital Display

Output Voltage
Large 5 digit display
Small 3 digit display

B. Unit On Indicator Light

Light is OFF when unit is not operating
Light is FLASHING during engine pre-heat
Light is ON continuously after unit start-up

C. Five keypads as follows:

0. "Select" keypad for access to controller menu structure (requires use of the up and down arrow keypads).
1. "Up" keypad for menu selections
2. "Down" keypad for menu selections
3. "Enter" keypad for loading new control settings
4. "Alarm" keypad for direct access viewing of alarm codes

D. Internal self-checking/diagnostic capability.

E. Pretrip testing of diesel generator set

OPERATING INSTRUCTIONS μP-G

STARTING THE UNIT

STEP	OPERATOR ACTION	UNIT RESPONSE
1	Place the unit **On/Off Switch** in the "**On**" position.	The microprocessor LCD fields and the unit indicator LCDs turn ON and OFF again.
2	None.	The unit Unit ON LED then begins FLASHING. After a few seconds, the warning buzzer sounds as the intake air heater automatically preheat for 20 to 30 seconds, depending on the engine.
3	None.	At the end of the preheat period, the engine will begin cranking. The intake air heater remains energized during the cranking period. If the engine does not start after 25-30 seconds of cranking, the cranking cycle terminates.
NOTE: During startup only, the unit will repeat the automatic start sequence up to 3 times. If the engine fails to start, an ALARM Icon will appear on the μP-G microprocessor display, the unit ALARM LED will illuminate, and the unit will not continue the automatic restart sequence. This differs with a unit that was operating and experienced a shutdown condition. In this situation, the unit will repeat the sequence every 20 minutes until the unit successfully starts or until the battery voltage becomes too low.		
If the engine fails to start:		
1	Press the **Alarm** key	The display will show applicable alarm codes
2	Place the On/Off Switch in the "Off" position and then determine and correct the cause for not starting.	None.
3	Place the unit **On/Off Switch** in the "**On**" position and clear all alarm codes from the microprocessor display to repeat starting procedure.	The unit begins the starting procedure.
NOTE: The engine will operate for approximately 15 seconds or until engine coolant temperature increases to 32°C (90°F) before the generator exciter field (and battery charging) is energized and power is delivered to the receptacle.		

DISPLAYING THE VIEW MENU

STEP	OPERATOR ACTION	UNIT RESPONSE
1	The unit **On/Off Switch** should be "**On**"	The display will show the standard display of Output Voltage
2	Press the **Select** key.	The display will show **MENU** / |---|.
3	Press the **Down Arrow** key.	The display will show **VIEW**.
4	Press the **Select** key.	The display will show **VIEW** / |---|.
5	Press the **Down Arrow** key to scroll through the **View Menu.**	The display will show: • [**HZ**] Output Frequency • **[Ent**] Engine Temperature • [**OIL**] Oil Pressure • [**rPM**] Engine Speed • [**bAT**] Battery Volts • [**Fld**] Field Current • [**rHr**] Run Hours
6		The display will return to the Standard Display thirty seconds after the last key is pressed.

PERFORMING AUTOMATIC FULL PRE-TRIP

***WARNING*: When you enter (load) PTRIP (PrE) test, the ENGINE STOPS. The engine will restart automatically during the Pretrip Test.**
***NOTE*: The microprocessor will not perform an automatic pre-trip test until all alarms have been corrected and cleared.**

STEP	OPERATOR ACTION	UNIT RESPONSE
1	Press the **Select** key.	The display will show **MENU** / |---|.
2	Press the **Down Arrow** key until the display shows **PtrIP**.	The display will show **PtrIP**.
3	Press the **Select** key.	Flashing display will show EntEr / PrE
4	Press the **Enter** key.	Flashing display will show LOAd / PrE
5	None.	The display will show the screens in the **PTRIP Menu** list that follows as the microprocessor performs automatic pre-trip test.
Pre-Trip Component Test List		
88888	Display Test	The pretrip technician should visually check all controller LCDs and both unit indicator LEDs for proper operation.
OLS	Oil Level Switch Test	
OPS	Oil Pressure Sensor Test	
LOP	Oil Pressure Switch Test	
CLS	Coolant Level Test	
UtS	Coolant Temperature Test	
FUS	RPM Sensor Test	
Phr	Preheat Relay Test	
rr	Run Relay Test	
vr	Voltage Regulator Test	
Sr	Start Relay Test (*Engine Starts*)	
Fr	Field Relay Test	
OPS	Oil Pressure Sensor Test	
LOP	Oil Pressure Switch Test	
rPN	RPM Sensor Test	
AC	Output Voltage Test	
6	None.	Upon completion of the pretrip test, the display will show **PASS, CHECK**, or **FAIL**.
7	Press the **Enter** key.	The test message will be cleared and the display will return to the standard screen.
8	View and correct any alarm codes before placing the unit in service.	None.

PERFORMING SPECIFIC DIAGNOSTIC TESTS

STEP	OPERATOR ACTION	UNIT RESPONSE
1	Press the **Select** key.	The display will show **MENU** / |---|.
2	Press the **Down Arrow** key until the display shows tESt.	The display will show **tESt**
3	Press the **Select** key.	The display will show **tESt** / |---| and the ENGINE STOPS.
4	Press the **Down Arrow** key.	The display will show **CntrL** / **tSt**.
5	Press the **Select** key.	The display will show **CntrL** / |---|.
6	Press the **Down Arrow** key until the test function you want shows in the display.	For example, **OL** / **0** "**1**", where "**1**" is flashing
NOTE: If you press the **Enter** key with the "**1**" flashing, the component will go **ON**. If you press the **enter** key with the "**0**" flashing, the component will go **OFF**		
7a	Press the **Enter** key with **OL** in the upper display and "**1**" flashing in the lower display.	The "**1**" display will become solid (continuous) and the microprocessor output for the **Unit On** LED will go **ON**. (Note that the "**0**" is now flashing).
7b	Press the **Enter** key with **OL** in the upper display and "**0**" flashing in the lower display.	The "**0**" display will become solid (continuous) and the microprocessor output for the **Unit On** LED will go **OFF**. (Note that the "**1**" is now flashing).
8	Press the Select key for 3 seconds or wait 30 seconds.	The display will exit the **tESt Menu** and return to the **Standard Display**.
tESt Menu List		
AL	Alarm LED Test	The pretrip technician should visually check the Alarm LED.
OL	On LED Test	The pretrip technician should visually check the Unit On LED.
PHr	Preheat Relay Test	
rr	Run Relay Test	
Sr	Start Relay Test	
Fr	Field Relay Test	

PERFORMING SPECIFIC PROGRAMMING FUNCTIONS

STEP	OPERATOR ACTION	UNIT RESPONSE
1	Press the **Select** key.	The display will show **MENU** / |---|.
2	Press the **Down Arrow** key until the display shows **PrGrn**.	The display will show **PrGrn**.
3	Press the **Select** key.	The display will show **PrGrn** / |---|.
4	Press the **Down Arrow** key until the function you want shows in the display.	The display will show submenu function and current value. For example, **F** / **dEG**.
To Change a Value:		
5	Press the **Down Arrow** key until the function you want shows in the display.	The display will show submenu function and current value. For example, **F** / **dEG**.
6	Press the **Select** key when the desired function is displayed.	The display will show the submenu function and the current value will be flashing. For example, "**F**" / **dEG** with "**F**" flashing.
7	Press the **Up Arrow** or **Down Arrow** key until the display shows the NEW value that you want to enter.	The display will show the submenu function and the current value will be flashing. For example, "**C**" / **dEG** with "**C**" flashing.
8	Press the **Enter** key.	The display will show **LOAd**.
9	None.	The display will show submenu function and new current value. For example, **C** / **dEG**.
PrGrn Menu List		
C or **F** / **dEG**		Set degrees F or C
PSI, **BARS**, or **kPA** / **OIL**		Set oil pressure units

µP-G Controller Alarm Table

Code	Type	Description
06	Check	Water Temperature Sensor Failure
07	Check	Engine RPM Sensor
15	Check	Preheat Circuit Check
16	Check	Digital Input Failure
17	Check/Shutdown	Engine Failed to Crank
18	Shutdown	High Engine Water Temperature: The unit will try to restart after 20 minutes after coolant temperature decreases.
19	Check/Shutdown	Low Engine Oil Pressure: When Restart value is <ON>, the unit will try to restart after 20 minutes.
20	Check/Shutdown	Engine Failed to Start: The unit will try to restart after 20 minutes.
25	Check	Low Output Voltage
31	Check	Oil Pressure Sensor
35	Shutdown	Run Relay Circuit
37	Check	Coolant Level Alarm
41	Check	Engine Water Temperature Check
43	Check	Frequency Out of Range-Low
44	Shutdown	Fuel System Check: The unit will try to restart after 20 minutes
45	Check	Frequency Out of Range-High
46	Check	Check Air Filter
51	Shutdown	Alternator Overload Alarm: The unit will try to restart after 20 minutes.
61	Check/Shutdown	Low Battery, Low Battery during Crank or High Battery Alarm
63	Check	Engine Stopped - Reason Unknown: The unit will try to restart after 20 minutes.
66	Shutdown	Low Engine Oil Level
69	Check	Field Relay Circuit
70	Check	Any Hourmeter Exceeds Limits
71	Check	Hourmeter 1 Exceeds Limits
72	Check	Hourmeter 2 Exceeds Limits
74	IM_Shutdown	Control Reverted to Default Settings
88	Shutdown	Shutdown Microprocessor Internal Error
99	Check	Restart Null: The unit will try to restart after 20 minutes.

Notes:

- When an alarm condition occurs during a pretrip test, a hyphen (-) appears in front of the alarm code (for example, -06).
- When a **Check** alarm is activated, the unit continues to operate while the controller initiates additional monitoring/corrective action. The LCD alarm icon is displayed to indicate a **Check** alarm
- When a **Shutdown** alarm is activated, the unit operation STOPS. The red Alarm LED and LCD alarm icon are displayed to indicate a **Shutdown** alarm. After some unit shutdown alarms, the controller continues to monitor unit conditions and attempts to restart the unit after 20 minutes. This restart mode continues until the engine successfully restarts or until a low battery (alarm code 61) prevents additional attempts.

OPTIONS

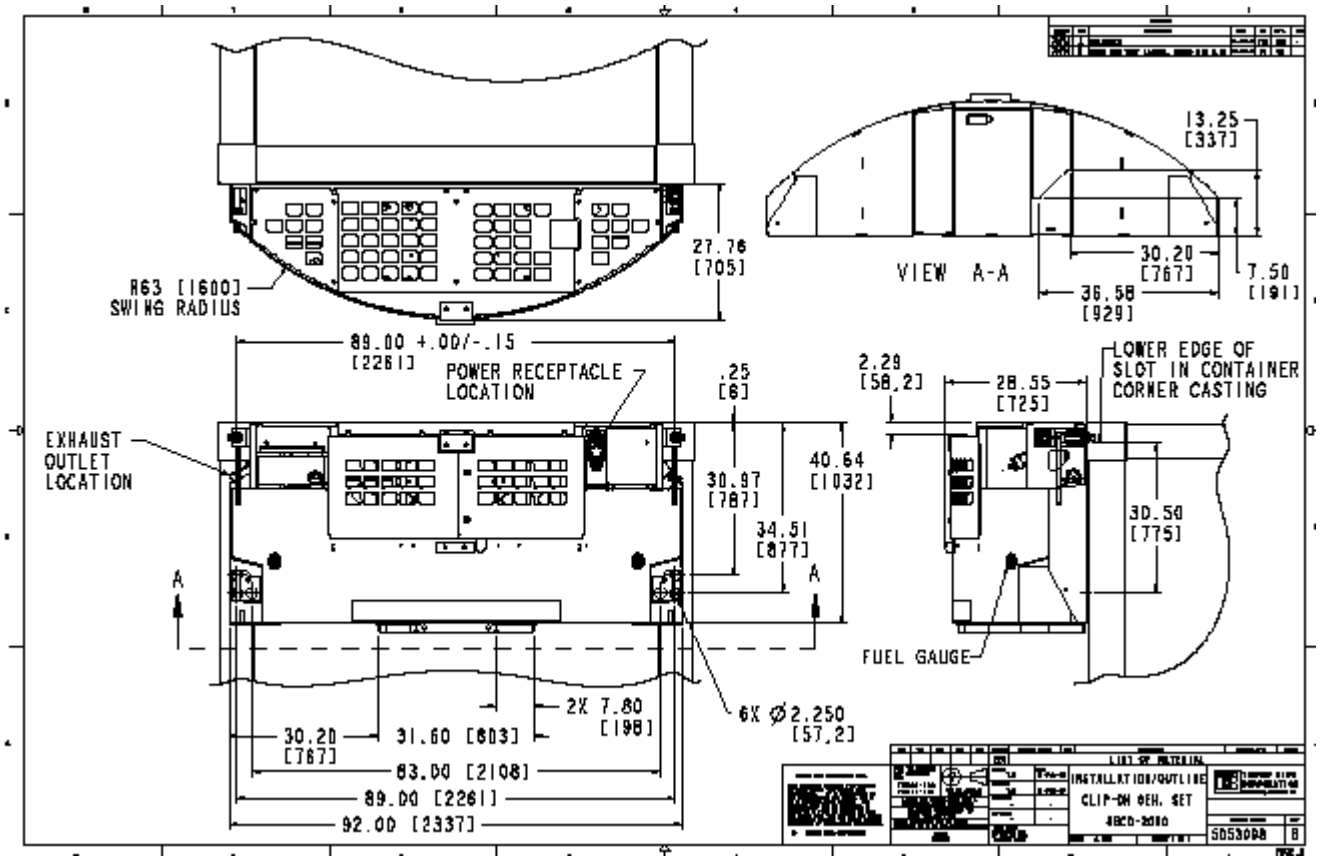
CUSTOMER SPECIFIED COLOR
The frame assembly and panels can be painted per customer request but must be noted in advance.

CUSTOMER UNIT SERIAL NUMBER DECALS
Customer decals can be included per customer request but must be noted in advance.

230 VAC OUTPUT VOLTAGE	
The unit can be wired for 230 VAC, 60 HZ, 3-phase operation	
Receptacle	ESL 1912-01

MOUNTING, HEADER PIN
Replace quick clamp connections with header pin mounting

INSTALLATION DIAGRAM



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Revisions

A	April 1, 2000	Original release
B	February 1, 2001	Implemented Extended Maintenance Interval package (fuel filter, oil filter, coolant)
C	May 15, 2002	Corrected Radiator Surface Area