PRODUCT SPECIFICATION

Date: January 17, 2008

Spec. No. SGCO 3000 EcoPower Rev E

SGCO 3000 EcoPower™

CLIP-ON FUEL SAVING TWO SPEED GENERATOR SET
With SG+ Controller

TECHNICAL SPECIFICATION

Approval:

Ingersoll Rand

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GENERAL DESCRIPTION

Manufacturer	**Thermo King Corporation**
Construction	1. The generator set is designed for mounting to the upper front structure of an ISO container. 2. The design incorporates a quick connection to the upper container corner castings. 3. Additional attaching points on the container vertical structural members provide a secure mounting arrangement. 4. These lower mounting bolts are retained by a steel plate, stainless steel hinge, and positive ¼ turn latch. 5. A bolt storage tube is welded to the frame to secure the bolt between trips. 6. The rotor washer clip to prevent spinning off during normal use positively retains the lower mounting bolt/plate washer assembly. Provision tube for mounting bolt when not in use. 7. The Genset envelope considered the need to access the refrigeration unit control box while mounted on all common refrigeration units from Thermo King, Carrier, Klinge, and Seacold for either 8'6" or 9'6" containers. 8. Genset components (filters, hoses, wire harness, etc.) are installed and securely fastened to ensure dependable, long-term operation and ease of serviceability. 9. All wires/hoses/tubes etc. are fastened properly to protect integrity and prevent wire chafing. 10. Ring terminals are used on all high voltage connections
Structural Design	1. The Genset is designed to withstand & operate satisfactorily in over-the-road trucking, railway operations, & aboard ships. 2. The Genset is rated to withstand shock levels of a minimum 3 g's acceleration force in the horizontal direction & 6 g's acceleration force in the vertical direction. 3. The Genset is designed to have no harmful resonance frequencies between 20 and 100 Hz and is rated for vibration levels of 2 g's in all directions.
Structural Frame	1. Steel/material: Fuel tank, ASTM-A-469 (METRIC 11320.10) 0,134" (3,5mm) Structural member, ASTM-A-635 (METRIC 11342.10 and 11416.10) 0,250" (6,0mm) 2. Structural steel frame and integral fuel tank is chemically cleaned through an 8 stage pretreatment line with a multi-metal iron phosphate passivation, primed with a epoxy-polyester powder (1.5-2.0) mils and top coated with a black polyester TGIC (triglycidyl isocyanurate) powder (2.5-4.0) mils. for a final mil thickness of 3.5-5.0
Panels, Doors, and Bumpers	1. Panels and doors are chemically cleaned through a 6-stage pretreatment line with a multi-metal iron phosphate passivation and top coated with white polyester (2.5-4.0) mils TGIC (triglycidyl isocyanurate) powder. 2. Door material: Aluminum, .063" (1.6mm) thick 3. Panel material: Aluminum, .063" (1.6mm) minimum thickness 4. Two solid rubber bumpers are installed to protect the Genset housing during handling (see installation diagram for actual dimensions). The upper bumper is 6.5" wide x 2" high x 1½" thick. The lower bumper is 7" wide x 6" high x ¾" thick.
Hardware	1. All hardware (screws, washers, nuts, & clamps) are stainless steel for maximum protection from salt-water corrosion. 2. Powerpack mounting bolts and lower unit mounting bolts are zinc dichromate steel for strength and corrosion resistance. 3. This excludes hardware supplied by original equipment manufacturer suppliers.

Nameplate Instructions	English and Spanish language operating instructions
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.
Ambient Temperature Range	Structure: -40°C to 52°C (-40°F to 125°F) Operation and Starting: -26°C to 52°C (-15°F to 125°F) Running: -40°C to 52°C (-40°F to 125°F)
Output Power Rating	15KW. Designed to supply operating power for container refrigeration units complying with ISO 1496-2
Sound Pressure Level	74 dBA. 5 point average at 7m
Dimensions	Height: 1053 mm (41.45 in) Depth: 710 mm (27.97 in) Length: 2337 mm (92.0 in)
Weight	818 kg (1804 lbs) - Total Weight, including Gen Set, oil, coolant, dry fuel tank and battery. Genset to be provided with decal indicating gross weight inclusive of fuel.

ENGINE

Type	TK 486VG direct injection	**Protection**	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 Lacquer
Displacement	2.09 liter (128 in^3)	**Timing System**	Gear drive for camshaft and injection pump
Horsepower	34.1	**Firing Order**	1-3-4-2
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**	21600-22600 kPa (3100 – 3300 psi)
Engine Rotation	Clockwise (viewed from pulley end)	**Emission**	2008 manufactured engines are compliant with EPA and CARB regulations

ENGINE LUBRICATION SYSTEM

Oil Pump Type	Trochoid	**Delivery Volume**	15.7 liters (4.15 gallons) / min @ 1000 pump rpm
Oil Type	API CI grade or better -- Use straight or multi-weight oils appropriate for the ambient temperature (delivered with 10W30 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. Tank is fumigated internally to protect against corrosion	**Fuel Tank Mounting**	Integral to Genset
Fuel Cap	Held with 200 lb tension chain.	**Anti-Siphon**	Rated at 30GPM.
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
		Injection Pump Rotation	Clockwise (viewed from gear end)
Transfer Pump Lobe Lift	5.0 mm (0.197 in)	**Injection Timed at**	See Maintenance Manual
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)	**Motor Power**	2.3 kW
Pull-in Current of Solenoid	52 Amps	**Hold-in Current of Solenoid**	19 Amps
Method of Engagement	Magnetically-engaged sliding pinion		

SPEED SOLENOID

Voltage	12 V DC	**Resistance**	4.3 Ohms
Rated Voltage	12.5 Volts	**Rated Current**	2.9 Amperes
Non –energized position	Low speed		

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	6307 sealed and lubricated with synthetic hydrocarbon.	**Engine Flywheel Housing**	Cast steel housing. Cast surfaces are machined for the mounting bolts.
Generator Rating (Nominal)			
Output Power	15 KW	**Voltage**	460
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 media filter with cyclonic action and pressure drop indicator

HOSES

Intake Air Hose	Silicone or high temperature structural EDPM
Coolant Hoses	Silicone

MUFFLER

Stainless Steel Material	Noise reducing baffle design

RADIATOR COIL

Protection	E-coat coating for corrosion resistance or equivalent.	**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	9.6 m^2 (103 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 / 1500 rpm
Blade Material	Aluminum	**Drive**	Direct off engine water pump
Hub Material	Steel	**Pitch**	31°
Air Flow	1400 cfm		

BATTERY

Type	Maintenance free 12 VDC	**Cold Cranking Amps**	925 Amps at -18°C (0°F)
Recharging	Solid-state battery charging, 26 Amps output integrated into SG+ controller.	**Terminal Posts**	Threaded post terminals and standard battery cable connections are provided
		Dimensions	330 x 173 x 238 mm (13 x 6.8 x 9.4 in)

SG+ MICROPROCESSOR CONTROLLER

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

- Ability to operate at variable speeds for enhanced fuel consumption
- 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, fuel relay feedback failure or 230/460V alternator overload
- Automatic unit restart attempt 20 minutes after:
  - High engine water temperature
  - Engine failure to start
  - Check fuel alarm
  - 230/460V alternator overload
  - Fuel relay feedback failure
  - Low engine oil pressure
- Exterior Deutsch downloading port with protective cap provided.
- Delayed alternator excitation for 15 seconds, or until engine coolant temperature increases to 32°C (90°F) (selectable)
- Internal self-checking /diagnostic capability
- Hour meter
- Multi language menu capability

SG+ CONTROLLER INTERFACE

The SG+ controller interface contains the following features and components:
A. LCD Digital Display
B. Alarm LED
C. Power LED
D. Six keypad keys:
1. “Escape” use escape a new setting or jump to the parent menu
2. “Up” use to scroll up through the menu display, or increase the value of a setting
3. “Down” use to scroll down through the menu display, or decrease the value of a setting
4. “Enter” use to enter or execute controller menu tasks or commands
5. “Alarm” use to go directly to the alarm list menu and view the alarm information in the display
6. “Language” use to change the display language. English and Spanish are currently available.
E. Unit On/Off switch

SG+ CONTROLLER INPUTS/OUTPUTS/MENUS

Microprocessor Inputs:	Microprocessor Outputs:
♦ Engine oil pressure ♦ Alternator Voltage ♦ Battery Voltage ♦ Engine Coolant temperature ♦ Air filter switch ♦ Coolant level sensor ♦ Engine oil pressure switch ♦ Engine oil level sensor ♦ Air heater (preheat) feedback ♦ Fuel pull relay feedback ♦ Fuel hold relay feedback ♦ Excitation feedback ♦ Flywheel sensor	♦ Start relay ♦ Preheat relay ♦ Fuel pull relay ♦ Fuel hold relay ♦ On light ♦ Alarm light

Display Menus:

1. Data Menu
   - ♦ Analog inputs
   - ♦ Digital inputs
   - ♦ Digital outputs
   - ♦ Internal states
2. Alarm list Menu
3. Message list Menu
4. Commands Menu
   - ♦ PTI
   - ♦ Manual function test
5. Misc. Functions Menu
   - ♦ Date/time
   - ♦ °C/°F mode
   - ♦ Program version
   - ♦ Timers/counters
6. Configuration Menu
7. Event log Menu

SG+ ALARMS/MESSAGES/OPERATING INSTRUCTIONS

Alarms/Messages/Operating instructions
See Thermo King SGCO Maintenance Manual.

OPTIONS

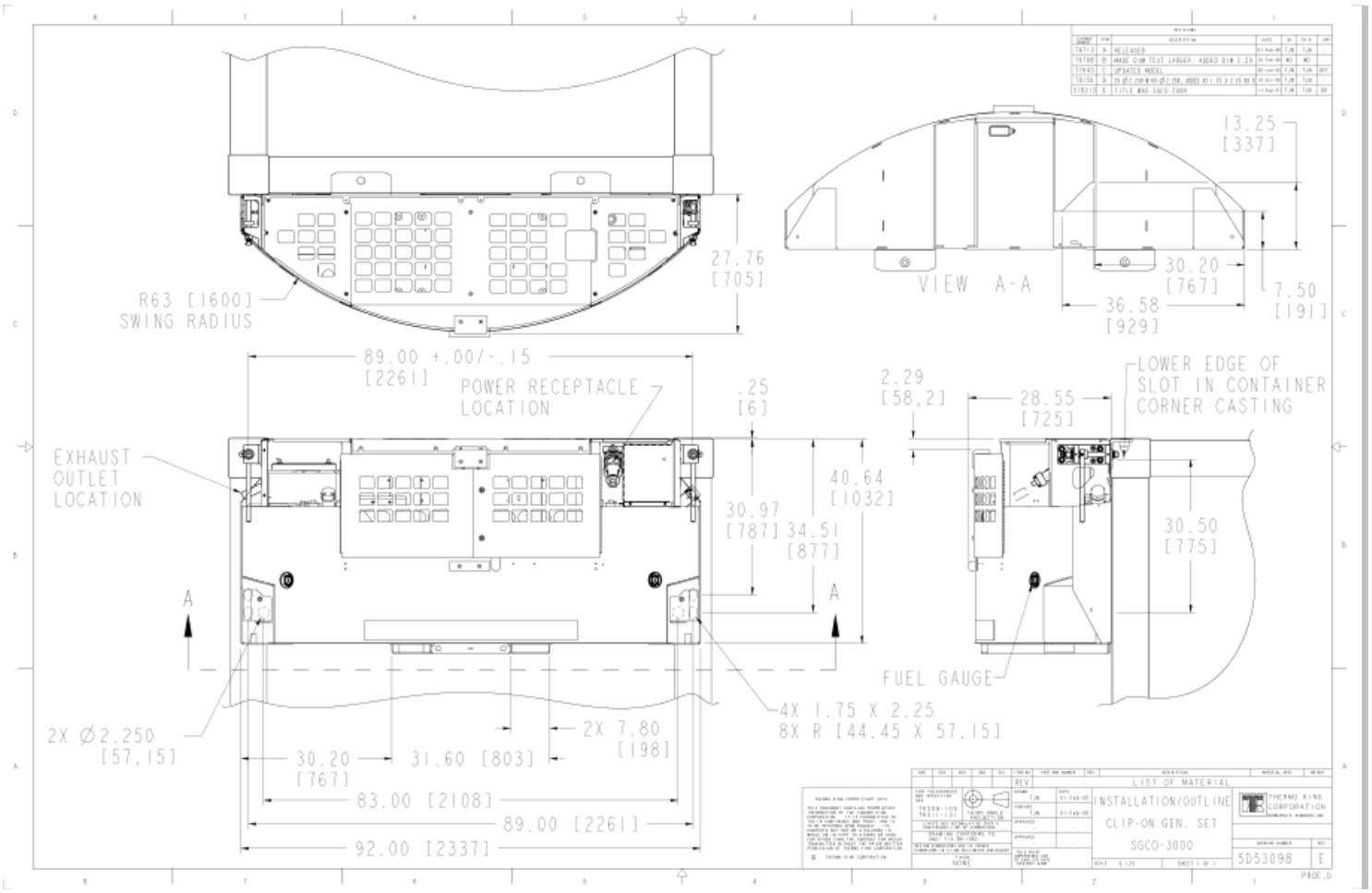
CUSTOMER SPECIFIED COLOR
The frame assembly and panels can be painted per customer request but must be noted in advance.

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

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

FUEL MONITORING
Capable of logging any event which causes changes in fuel levels outside of the range of normal genset operations.

INSTALLATION DIAGRAM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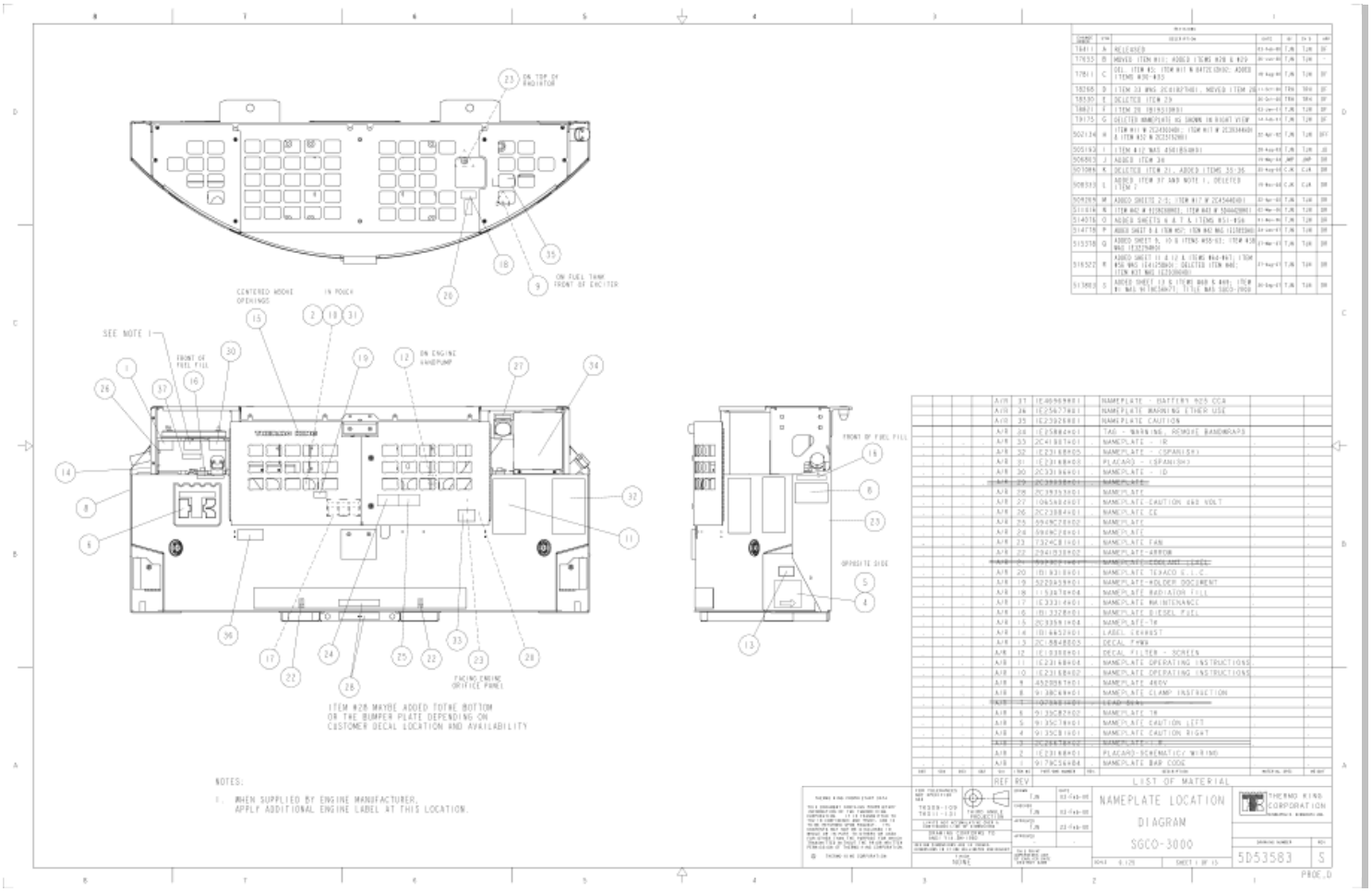
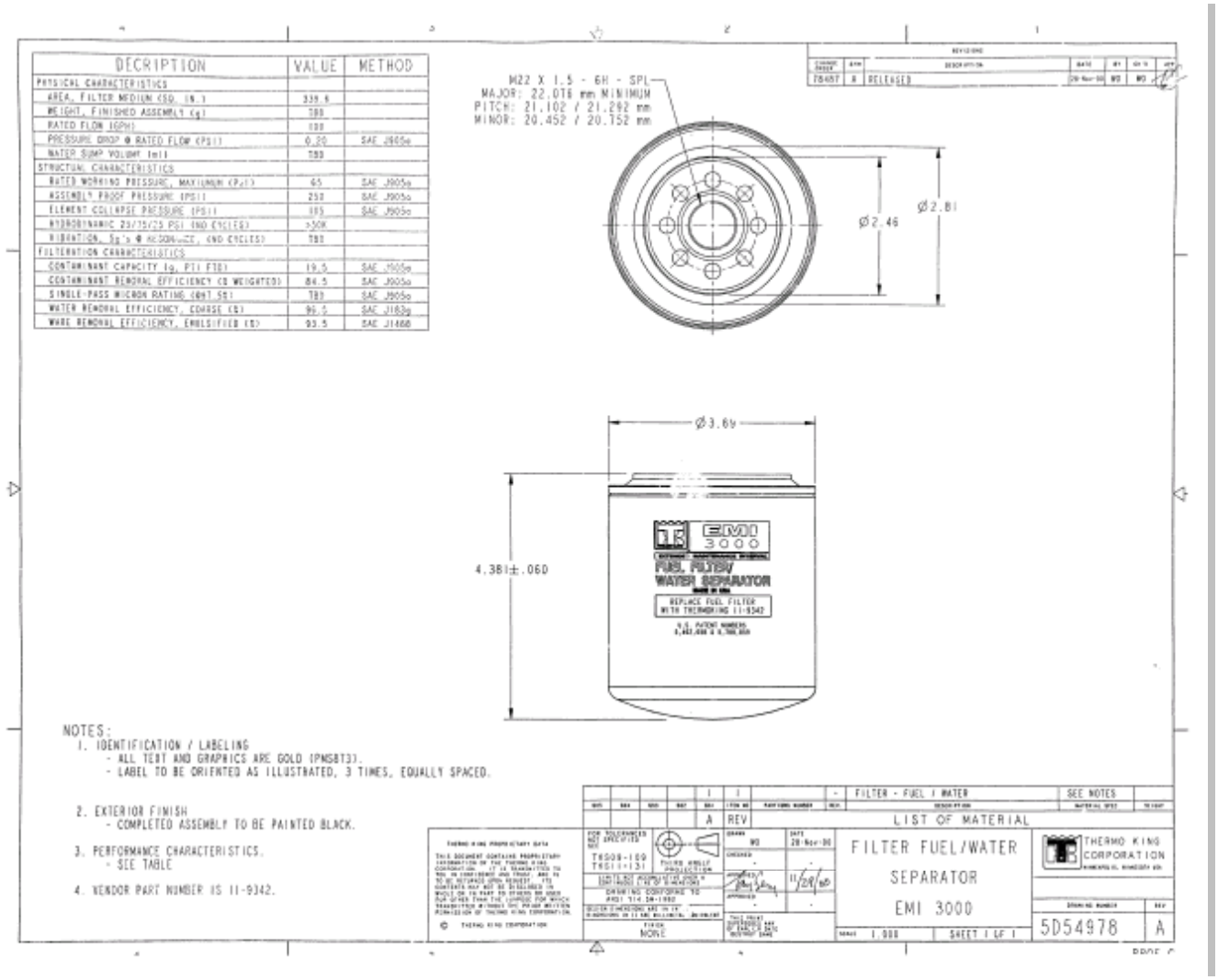
LIST OF MATERIAL
INSTALLATION/OUTLINE
CLIP-ON GEN. SET
SGCO-3000
5D53098
E

DECAL DRAWING



FUEL FILTER DRAWING



EMI BULLETIN

EMI 3000 Package

The EMI package includes:

- New 5 Years or 12,000 Hours Extended Life Coolant (ELC)
- New EMI 3000 Water Pump, P/N 11-9442 (includes HNBR elastomer seals and EPDM O-rings)
- New EMI 3000 Dual Element Oil Filter, P/N 11-9182 (identified by black and gold colors)
- New EMI 3000 Dual Element Oil Filter Head, P/N 11-9354
- New EMI 3000 API Rating CG-4 Mineral Oil
- New EMI 3000 Fuel Filter, P/N 11-9342 (identified by black and gold colors)

The EMI 3000 package allows standard genset maintenance intervals to be extended to 3000 hours. However, please note that units equipped with the EMI 3000 package do require regular inspection in accordance with Thermo King pretrip inspection and maintenance recommendations.

CAUTION: With both EMI 3000 and standard (non-EMI 3000) units operating in the field, there are several important rules to remember:

- **Extended Life Coolant (ELC) is RED in color while conventional coolant is GREEN or BLUE-GREEN.**
- **Do NOT add "RED" coolant to cooling systems using "GREEN" or "BLUE-GREEN" coolant.**
- **Do NOT add "GREEN" or "BLUE-GREEN" coolant to cooling systems using "RED" coolant.**
- **The EMI 3000 oil filter is NOT interchangeable with previous oil filters.**

EMI 3000 Components:

Extended Life Coolant and EMI 3000 Water Pump

A decal tag on the coolant expansion tank will identify units with extended life coolant (ELC). ELC extends the coolant change interval up to 12,000 hours or 5 years. ELC requires a water pump with HNBR elastomer seal bellows and EPDM elastomer O-rings. Therefore ELC should not be used on older units with standard water pumps. All Yanmar (TK 486) engines with serial number L16553 and after include a new EMI 3000 water pump for use with extended life coolant.

ELC Compatible Water Pump 11-9442

ELC Nameplate 91-9269

Thermo King ships all water-cooled engines from the factory with a 50% antifreeze concentrate and 50% water mixture in the cooling system. ELC coolants are available in 100% full strength concentrate or (pre-mixed) 50/50 mixture. Thermo King recommends the use of 50/50 pre-mixed ELC coolant to assure that de-ionized water is used. ELC 100% concentrate must be mixed (50/50) with de-ionized or distilled water (NOT tap water) to ensure cooling system integrity.

The following Extended Life Coolants are approved by Thermo King for use in ELC units for five years or 12,000 hours:

- Texaco ELC #16445 (100% concentrate)
- Texaco ELC #16447 (premixed 50/50% mixture)
- Havoline Dex-Cool #7994 (100% concentrate)
- Havoline Dex-Cool #7995 (premixed 50/50% mixture)
- Shell Dexcool #94040
- Shell Rotella #94041
- Havoline XLC #30379 (100% concentrate, Europe)
- Havoline XLC #33013 (premixed 50/50% mixture, Europe)
- Saturn/General Motors Dex-Cool
- Caterpillar ELC
- Detroit Diesel POWERCOOL Plus.

NOTE: Use a glycol refractometer to accurately determine the freeze point and concentration of engine coolant (Anti-Freeze) solution. A refractometer works with both extended life and conventional coolants.

EMI 3000 Dual Element Oil Filter and Oil Filter Head

All Yanmar (TK 486) engines with serial number L32024 and after include an EMI 3000 oil filter head (P/N 11-9354) and gasket (P/N 33-2931), EMI 3000 dual element oil filter (P/N 11-9182) and API rated CG-4 mineral oil. These components are required to extend the maintenance interval to 3000 hours.

The EMI 3000 oil filter (identified by black and gold colors) is NOT interchangeable with the previous oil filters. The EMI 3000 oil filter head, gasket and oil filter can be retrofitted on previous Yanmar (TK 486) engines.

API service category CG-4 describes oils for use in high-speed four-stroke-cycle diesel engines used in both heavy-duty on-highway (0.05% wt sulfur fuel) and off-highway (less than 0.5% wt sulfur fuel) applications. CG-4 oils provide effective control over high-temperature piston deposits, wear, corrosion, foaming, oxidation stability, and soot accumulation. CG-4 (or better) mineral oil can be used in older units. However, an EMI 3000 oil filter (and oil filter head) is required to extend recommended maintenance intervals to 3,000 hours.

NOTE: The new oil filter head is equipped with a threaded port to accept an ESOC (Environmentally Safe Oil Change) fitting for quick oil changes.

EMI 3000 Fuel Filter

The new EMI 3000 fuel filter is required to extend the maintenance interval to 3000 hours. It can be interchanged with fuel filters used on previous Thermo King gensets.

Revisions

A	March 6, 2007	Original release
B	March 29, 2007	Update engine emission, official approval request being submitted.
C	June 21, 2007	Update engine emissions for 2008 engines, unit weight, panels doors and bumpers Section, added exterior downloading port to SG+ description.
D	August 24, 2007	Moved fuel heater from fuel system to option section, added option section updated battery section.
E	January 17, 2008	General updates