



Diesel Generator Set



OPERATIONS AND SERVICE

For

69RG15

Generator Set Units

Tier 4 - RG2051 to RG2100 Series



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SECTION 1

SAFETY SUMMARY

1.1 General Safety Notices

The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein. The general safety notices are presented in the following three sections labeled: First Aid, Operating Precautions and Maintenance Precautions. A listing of the specific warnings and cautions appearing elsewhere in the manual follows the general safety notices.

1.2 First Aid

An injury, no matter how slight, should never go unattended. Always obtain first aid or medical attention immediately.

1.3 Operating Precautions

Always wear safety glasses and hearing protection.

Keep hands, clothing and tools clear of the radiator fan and rotating belts.

No work should be performed on the unit until all circuit breakers and start-stop switches are turned off and the negative battery terminal has been disconnected.

Always work in pairs. Never work on the equipment alone.

In case of severe vibration or unusual noise, stop the unit and investigate.

1.4 Maintenance Precautions

Installation and servicing of refrigeration equipment can be hazardous due to system pressures and electrical components. Only trained and qualified service personnel should install, repair, or service refrigeration equipment.

Be sure power is turned off and the negative battery cable is disconnected before working on generator set.

Do not bypass any electrical safety devices, e.g. bridging an overload, or using any sort of jumper wires. Problems with the system should be diagnosed, and any necessary repairs performed, by qualified service personnel.

In case of electrical fire, open circuit switch and extinguish with CO₂ (never use water).

Fuel Tanks present explosion, fire and rupture hazards even if liquid fuel has been drained. Do not attempt any repairs, especially repairs using flame, welder or torch, unless you have been properly trained and the tank has been emptied of liquid fuel and fuel vapors and the tank is properly ventilated.

1.5 Unit Hazard Label Identification

To help identify the hazard labels on the Unit and explain the level of awareness each one carries, explanations with appropriate consequences are provided below:



Indicates an immediate hazard which **WILL** result in severe personal injury or death.



Indicates hazards or unsafe conditions which **COULD** result in severe personal injury or death.



Indicates potential hazards or unsafe practices which **COULD** result in minor personal injury, product or property damage.

1.6 Specific Hazard Statements

The statements that follow are applicable to the generator set and appear elsewhere in this manual. These recommended precautions must be understood and applied during operation and maintenance of the equipment covered herein.

WARNING

To prevent injury, the procedures provided for installation and removal of the generator set must be followed carefully.

WARNING

Disconnect power plug before removing generator set.

WARNING

To prevent injury, the procedures provided for installation and removal of the generator set must be followed carefully.

WARNING

Double-check that the generator set clamp (B) is securely tightened against the face of the corner casting and that the generator set clamp hand nut is tight before transporting the container. A loose fit could cause damage to both the generator set and the generator set clamp, and cause serious injury during transport.

WARNING

Disconnect power plug before removing generator set.

WARNING

Beware of moving poly V-belt, belt driven components and hot exhaust components.

WARNING

Under no circumstances should ether or any other unauthorized starting aids be used in conjunction with the air intake heater.

WARNING

Beware of pinch points.

WARNING

Do not use gasoline to clean air cleaner parts.

WARNING

Do not direct water or steam into the generator openings. Do not allow any soap and water solutions to enter the alternator.

WARNING

High voltage (dielectric) testing must not be performed to the machine without first observing NEMA rules. The insulation of this generator winding may be safely checked by using a megger. A high megger reading indicates good insulation.

CAUTION

Observe proper polarity when installing the battery or connecting a battery charger, the negative battery terminal must be grounded. Reverse polarity may damage the charging system. When charging the battery in unit, isolate the battery by disconnecting the negative battery terminal first, then the positive. Once the battery has been charged, connect the positive battery terminal first, then the negative.

CAUTION

Never pour cold water into a hot engine.

CAUTION

Use only ethylene glycol (anti-freeze with inhibitors) in system. Use of glycol by itself will damage the cooling system. Always cover the engine inlet tube while the air cleaner is being serviced.

CAUTION

Do not underfill or overfill the oil bath cups. Overfilling of cups causes loss of capacity; underfilling cups causes lack of filtering efficiency.

CAUTION

Continued operation with failed shockmounts may result in engine or generator damage.

NOTICE

If the generator set is equipped with the fuel filter bowl assembly, when replacing the fuel filter, a new fuel filter O-ring should be oiled and replaced, and then the clear bowl should also be tightened to 18 ft-lbs.

NOTICE

Do not attempt to adjust engine speed.

NOTICE

A frayed, cracked or worn poly V-belt must be replaced. After installing a new belt, check the adjustment after running the unit for three or four hours. This will allow for the initial stretch, which is common on new belts. Once this initial stretch has taken place, the belt should be checked at regular intervals.

NOTICE

The generator/engine must be slightly lifted off of the unit frame in order to provide enough clearance for the generator support plate to slide back, away from the engine.

NOTICE

Although the generator drive gear and fly wheel adapter plate will normally keep the generator coupled to the engine, even without the bolts, it is safest to remove the lower generator bolts first, in case the generator shifts and falls during bolt removal.

NOTICE

Inspect the generator drive gear, bolt, and key as they will have to be removed from the old generator and installed onto the new generator; replace these components if they are worn or damaged.

NOTICE

In order to match up the teeth of the generator drive gear with the teeth of the fly wheel adaptor plate, the fly wheel will need to be rotated by hand.

NOTICE

Although the drive gear and mating surface of the generator will generally keep the generator coupled to the engine, even with all of the bolts removed, it is safest to start installation of the top generator bolts first, just in case the generator shifts and falls.

NOTICE

SST is an abbreviation for 300 Series Corrosion Resistant Steel.

Loctite #242 or an equivalent product should be used on ALL hardware shown in [Figure 5.17](#).

SECTION 2

DESCRIPTION

2.1 Introduction

The Carrier Transicold model 69RG15 diesel-driven generator set provides a constant electrical power supply for all-electric refrigeration units. The 69RG15 is a clip-on unit (See [Figure 2.1](#), [Figure 2.2](#)) mounted to the front of the container either by pin mounts located on the top channel or by optional clamp mounts on either side of the generator set.

The generator set consists of a diesel engine directly connected to an alternating current generator and mounted in a structural steel frame. The engine is a vertical, in-line, four cylinder diesel manufactured by Kubota. The generator is a 15 kW, permanent, dual bearing type that supplies nominal 50/60Hz power.

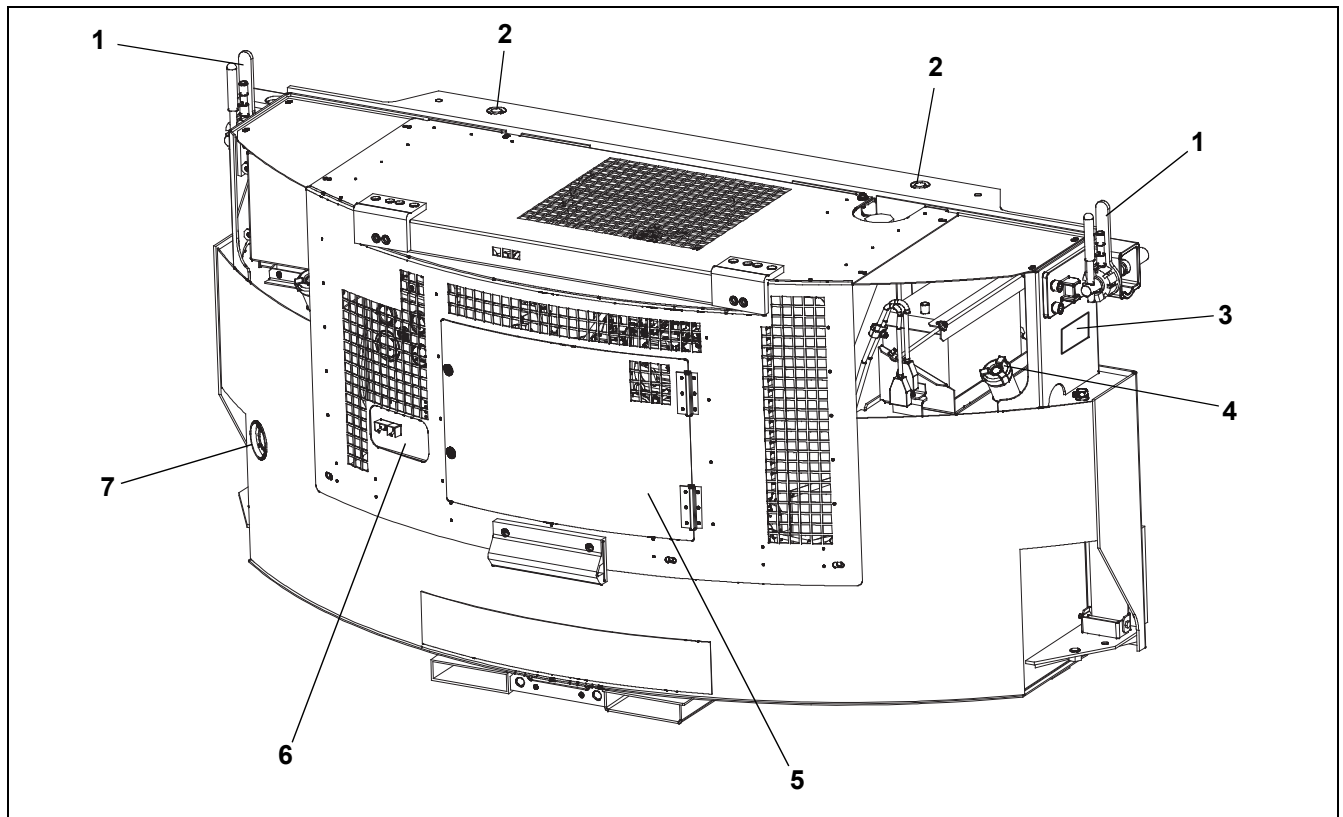
Electrical controls are mounted in a control box with operating controls and gauges mounted on a control panel (which also serves as the control box cover). The control panel components are protected by a deflector assembly.

Auxiliary engine equipment consists of the battery, solid state battery charging system, “spin-on” lube oil filter, fuel filter and other necessary components for proper unit operation. The water pump and the radiator cooling fan are belt-driven from the engine crankshaft. All references to engine are as viewed from the fly wheel end.

The 69RG15 is available as a standard configuration, with an added Auto Restart option, which automatically restarts the unit in the event of specific unit shutdowns.

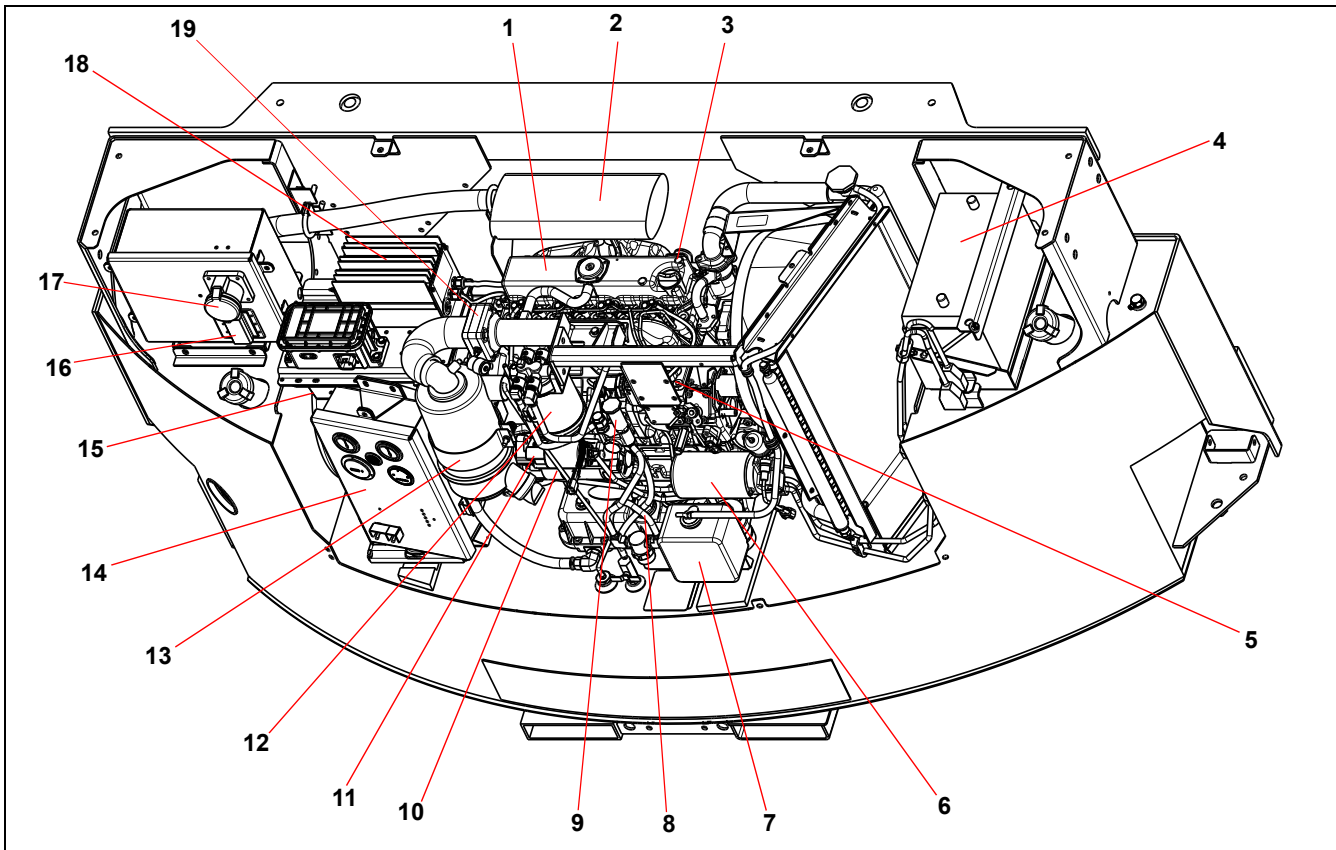
Carrier Transicold’s Ecodriven dual speed option provides an energy saving alternative to the practice of continuously running the generator at full speed. This speed reduction results in increased fuel economy, reduced carbon footprint, and lowers operating costs.

Figure 2.1 Generator Set



- | | |
|--|--------------------------------|
| 1) Clamp Mounts (Optional) | 5) Access Door |
| 2) Pin Mounts | 6) Control Box / Control Panel |
| 3) Unit Nameplate (Model, Serial, PID) | 7) Fuel Gauge |
| 4) Fuel Cap | |

Figure 2.2 Generator Set - Top Cover Removed



- | | |
|----------------------------------|-------------------------------|
| 1) Engine | 11) Fuel Heater (if equipped) |
| 2) Exhaust Muffler | 12) Fuel Filter |
| 3) Water Temperature Sender | 13) Air Cleaner |
| 4) Battery | 14) Control Box and Panel |
| 5) Inject Pump | 15) AC Generator |
| 6) Engine Oil Filter | 16) Circuit Breaker (CB1) |
| 7) Coolant Recovery Bottle | 17) Receptacle |
| 8) Lube Oil Dip Stick / Fill Cap | 18) Battery Charger |
| 9) Mechanical Fuel Pump | 19) Intake Heater (IH) |
| 10) Starter Motor | |

2.2 Configuration Identification

Generator set identification information is provided on a label (See [Figure 2.3](#)) located below the right mounting clamp (front facing). The label provides the generator set model number, serial number and parts identification (PID) number. The model number identifies the overall configuration, while the PID provides information on specific optional equipment and differences in detailed parts. The model, serial and PID numbers must be included when ordering parts and inquiring about your unit.

Figure 2.3 Label with Generator Set Identification Information



2.3 Engine

The engine is a vertical, in-line four cylinder diesel engine that is directly connected to the alternating current generator. Information on the major engine systems is provided in the remainder of this chapter.

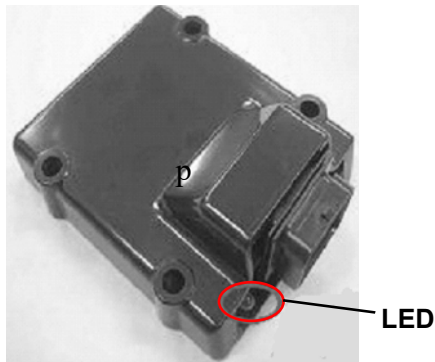
Separately bound manuals covering the diesel engine are available:

- [62-10865, V2203-DI Engine Workshop](#)
- [62-11695, V2203-DI Engine Parts List](#)

2.3.1 Electronic Governor Module

The electronic governor module (EG) is a solid state control module preprogrammed for 1800 RPM high speed and 1500 RPM low speed operation. The unit has an LED which may be used to diagnose failures within the electronic speed control system, see [Section 4.5](#) for additional troubleshooting information on diagnosing failures.

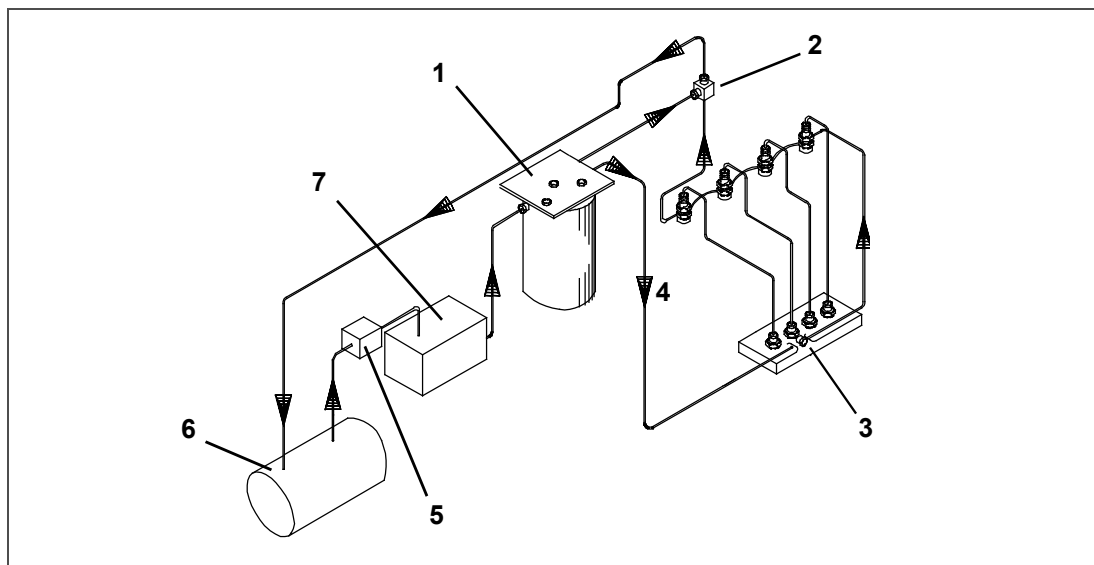
Figure 2.4 Electronic Governor Module



2.3.2 Fuel System

The fuel system is fitted with an optional in-line fuel strainer and a fuel filter, which also acts as a water separator. The fuel system is shown in [Figure 2.5](#). The fuel heater system is located in the fuel filter, and uses a 12 volt heater to heat fuel as it passes through the fuel filter.

Figure 2.5 Fuel System Diagram



- | | |
|-------------------------|-----------------------------------|
| 1) Fuel Filter / Heater | 5) In-Line Fuel Strainer (option) |
| 2) Injector Nozzle | 6) Fuel Tank |
| 3) Bleed Valve | 7) Mechanical Lift Pump |
| 4) Injection Pump | |

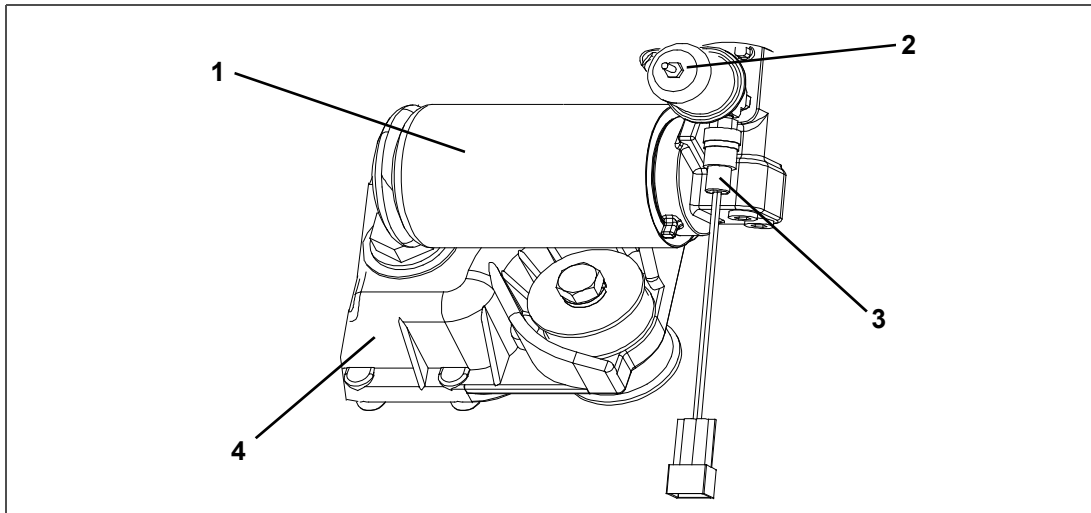
2.3.3 Engine Air System

The air cleaner (see [Figure 2.2](#)) is designed to prolong engine life and performance by preventing dirt and grit from entering the engine and causing excessive wear on all operating parts. In order for the air filter to operate properly, the operator must regularly maintain the air cleaner equipment in accordance with the instructions provided within this document.

2.3.4 Lube Oil Filter Arrangement

The engine lubricating oil filter is mounted in a horizontal arrangement and is shown in [Figure 2.6](#).

Figure 2.6 Lube Oil



- | | |
|-------------------------|------------------------|
| 1) Oil Filter (Primary) | 3) Oil Pressure Switch |
| 2) Oil Pressure Sender | 4) Oil Pan |
-

2.4 Engine Screw Threads

All threads on the engine are metric, except for the oil drain plug which is American Standard Pipe Thread (NPT).

2.5 Alternating Current Generator

The generator bolts directly to the engine and supplies nominal 50/60Hz power depending on the load requirement.

2.6 Battery Charging System

The solid state battery charger (see [Figure 2.2](#)) is located on top of the generator. The battery charger is powered by the generator, and this input is protected by fuses located in the receptacle box. The battery charger produces a tapered charge (40 amps maximum) and is designed not to overcharge the battery.



Observe proper polarity when installing the battery or connecting a battery charger. The negative battery terminal must be grounded. Reverse polarity may damage the charging system. When charging the battery in unit, isolate the battery by disconnecting the negative battery terminal first, then the positive. Once the battery has been charged, connect the positive battery terminal first, then the negative.

2.7 Voltage Controller

Voltage Controller maintains ISO voltage via two-speed and dual winding control. It regulates voltage in order to keep the generator output within ISO limits:

- 50Hz: 1500 RPM, 360-460 VAC
- 60Hz: 1800 RPM, 400-500 VAC

2.8 Operating Controls & Instruments

Components required for monitoring and controlling the unit are located in the control box, on the control panel (see [Figure 2.1](#)) and on the receptacle box (see [Figure 2.1](#)).

2.8.1 Gauges and Senders

a. Oil Pressure Gauge (see [Figure 2.7](#) or [Figure 2.8](#))

The purpose of this gauge is to observe normal operating engine oil pressure. Normal oil pressure is 35 to 60 psig (3.3 to 5.2 kg/cm²).

b. Oil Pressure Sender (see [Figure 2.6](#))

This device senses engine lube oil pressure and transmits a signal to the oil pressure gauge. The oil pressure sender is located on the oil filter housing.

c. Water Temperature Gauge (see [Figure 2.7](#) or [Figure 2.8](#))

The function of this gauge is to observe water operating temperature. The gauge is connected to the water temperature sender.

d. Water Temperature Sender

This device (see [Figure 2.2](#)) senses engine water temperature and transmits a signal to the water temperature gauge. The water temperature sender is located on the top, left-hand side of the engine below the high water temperature switch.

e. Auto Restart Module (If Equipped) (see [Figure 2.8](#))

Auto start/restart is provided to simplify the start-up process and provide an automatic restart feature that will automatically attempt to restart the unit in the event of some shutdowns. Four LEDs are used to indicate shutdown from overcrank, overspeed, low oil pressure, and high water temperature. A fifth LED is used to indicate the unit is running. Refer to [Table 2-1](#) for system preset values.

The auto restart function will perform a series of six attempts to restart the unit and make three attempts within each series. Once the function has completed all 18 attempts the unit will automatically lock out future crank attempts. Refer to [Table 2-2](#) for detailed information on auto restart sequencing.

2.8.2 Meters

a. Ammeter (A) (see [Figure 2.7](#) or [Figure 2.8](#))

The ammeter is an indicator of the charging system and unit electrical draw. It indicates the rate of discharge or charge of the battery. During start up, the intake heater draws approximately 42 amps.

b. Total Time Meter (TT) (see [Figure 2.7](#) or [Figure 2.8](#))

This meter designates the total hours and provides an accurate readout of accumulated engine running time. This data can be used to establish the proper periodic maintenance schedule. (Refer to [Table 5-1](#).)

2.8.3 Manual Switches

a. Intake Heater Switch (HS)

The intake heater switch is of the momentary type. When held in the PREHEAT position, the switch allows approximately 42 amps of battery current to flow into the intake heater. This, in turn preheats the air within the intake manifold and allows the engine to start. After starting the engine, the intake heater switch should continue to be held in the ON position for approximately 5 seconds until the engine has developed enough oil pressure to close the oil pressure safety switch.

b. Ignition Switch (IGN) (see [Figure 2.7](#))

The ignition switch is of the momentary type to be used in the OFF/ON/START positions. When held in the START (ignition) position, it energizes the starter motor solenoid, which in turn allows the starter motor to crank the engine. The switch is released to the RUN position once the engine has started.

c. Ignition Switch (IGN) (Auto Restart) (see [Figure 2.8](#))

The ignition switch is of the maintained contact type to be used in the RUN/OFF positions. When switched to the RUN position, it energizes the control module, which in turn controls all functions of the generator set.

2.8.4 Timers

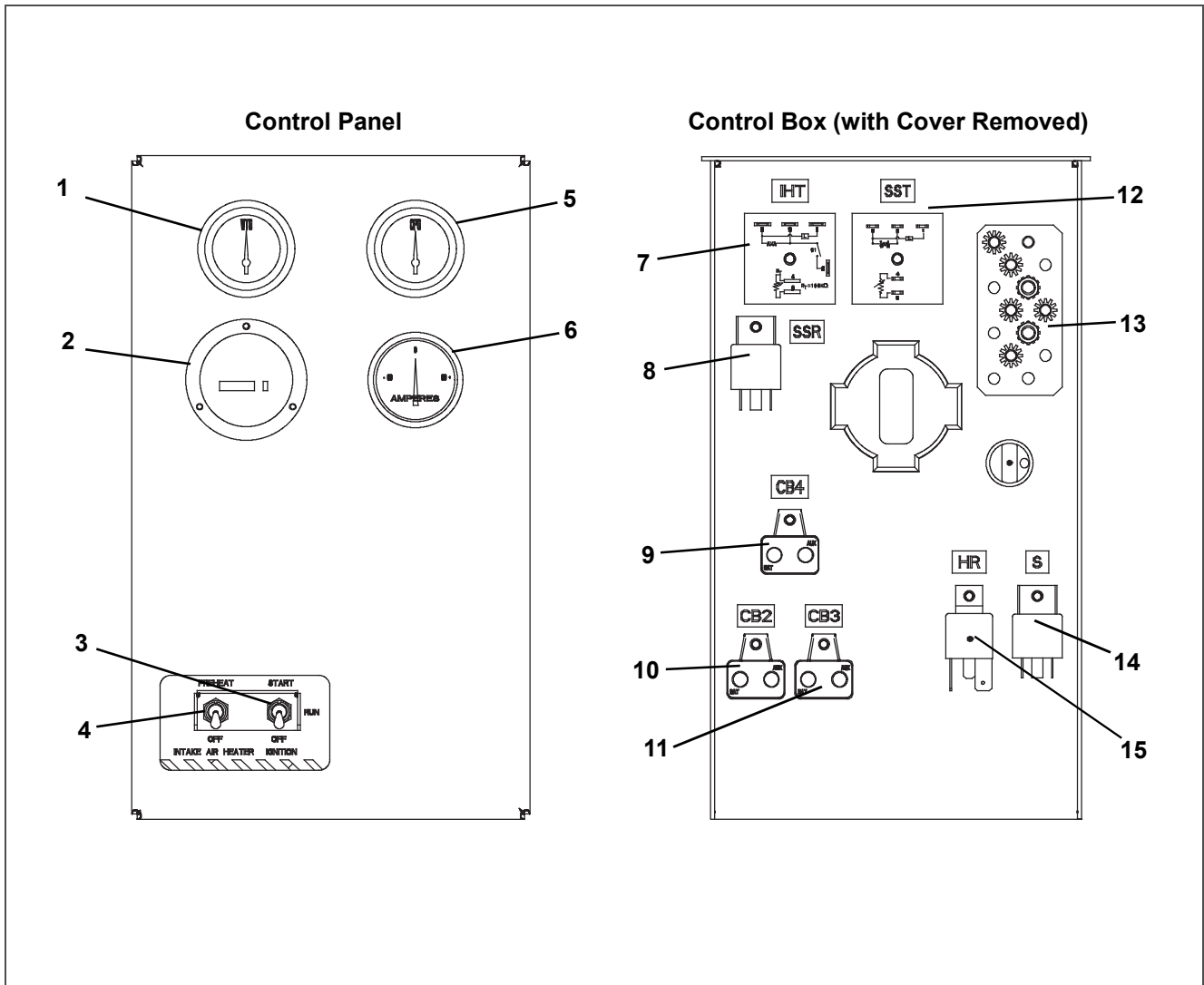
a. Intake Heater Timer (IHT) (If Equipped)

The intake heater timer continues to supply power to the intake heater for 3 minutes after initial start-up.

b. Starter Timer

The Starter Timer limits the amount of time that the starter can be engaged to 15 seconds. If the starter is manually engaged for more than 15 seconds, power will be cut to the starter. Once power has been removed, the starter can again be engaged for up to 15 seconds.

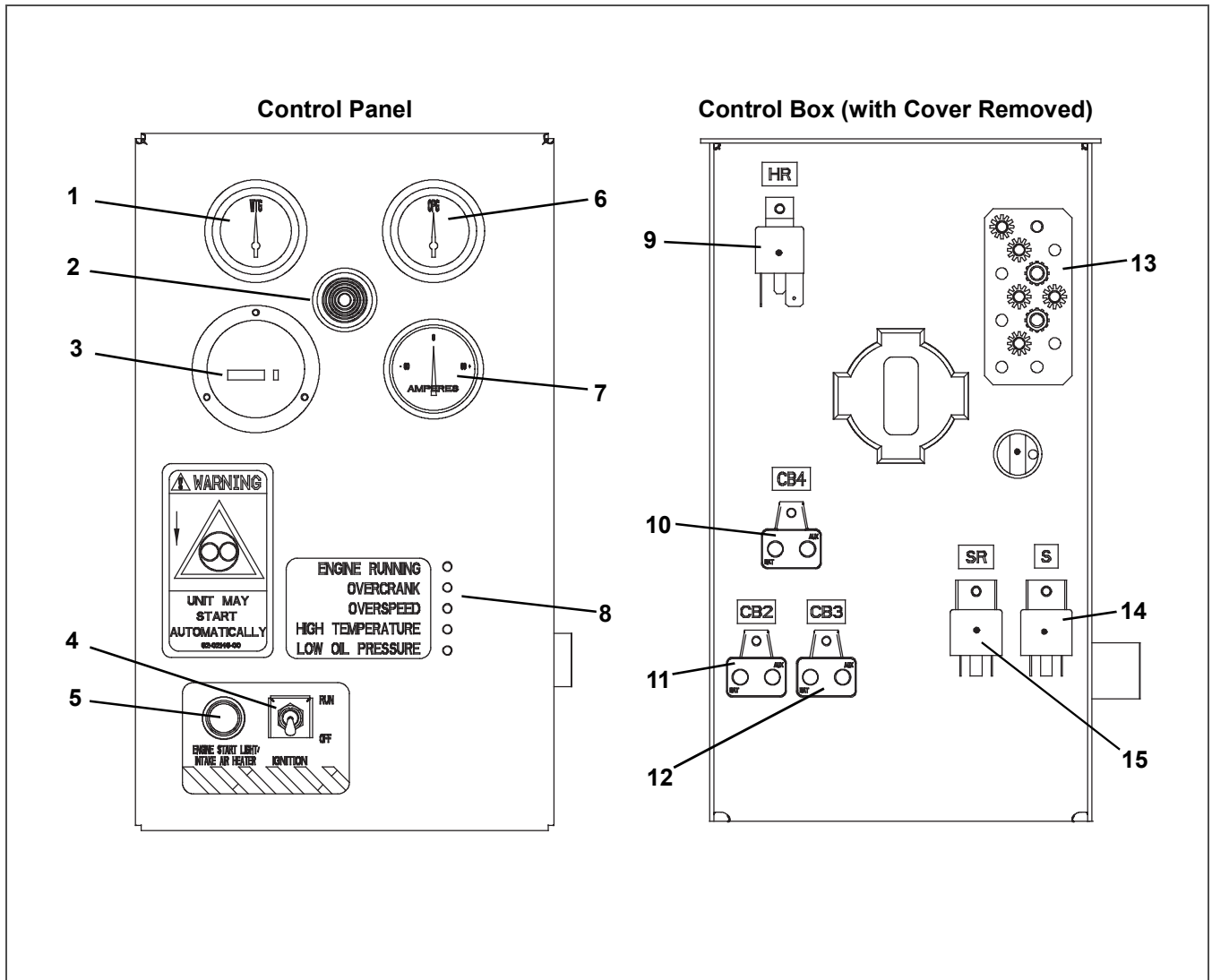
Figure 2.7 Control Box Standard



- 1) Water Temperature Gauge
- 2) Total Time Meter
- 3) Ignition Switch
- 4) Intake Heater Switch
- 5) Oil Pressure Gauge
- 6) Ammeter
- 7) Intake Heater Timer (IHT)
- 8) Starter Solenoid Relay (SSR)

- 9) Circuit Breaker (CB4)
- 10) Circuit Breaker (CB2)
- 11) Circuit Breaker (CB3)
- 12) Starter Solenoid Timer (SST)
- 13) Ground Strap Assembly
- 14) Intake Heater Relay
- 15) Safety Relay

Figure 2.8 Control Box and Panel With Auto Restart



- 1) Water Temperature Gauge
- 2) Engine Start Alarm (Buzzer)
- 3) Total Time Meter
- 4) Ignition Switch
- 5) Engine Start / Intake Heater Energized Light
- 6) Oil Pressure Gauge
- 7) Ammeter
- 8) Auto Restart Module

- 9) Intake Heater Relay (HR)
- 10) Circuit Breaker (CB4)
- 11) Circuit Breaker (CB2)
- 12) Circuit Breaker (CB3)
- 13) Ground Strap Assembly
- 14) Safety Relay
- 15) Starter Relay

Table 2–1 Auto Restart Preset Values

Indicator	Preset Value	Description
Overspeed	2100 RPM	Overspeed is the point at which the unit will signal for shutdown.
Crank Disconnect	700 RPM	Crank Disconnect is the point at which the Auto Restart module senses the engine has started and will disengage the starter.
Shutdown Lockout Delay	15 seconds	The oil pressure and water temperature inputs are ignored during this 15 second delay (during startup).
Intake Heater Delay	30 seconds preheat 3 minutes post heat	The delay is used during start up. The intake heater delay begins timing after the auto restart module signal is received. During the entire delay, the intake heater circuit will be energized, an indicator light will be illuminated, and an alarm will sound. When the delay expires, the unit will crank.
Crank Attempts	18 attempts	A series of six attempts with three attempts in each series for a total of 18 attempts, refer to Table 2–2 , Auto Restart Sequencing.

Table 2–2 Auto Restart Sequencing

Series Attempt Number	1	Engine Status:
Intake Heater Energized in Seconds	30	If the engine starts:
Fuel Solenoid Engaged	X	<ol style="list-style-type: none"> 1. Run sequence begins 2. Intake heater remains energized for 3 minutes
Engine Crank Duration (Seconds)	Up to 15	If the engine fails to start:
Engine Rest Duration (Seconds)	25	<ol style="list-style-type: none"> 1. Intake heater will de-energize. 2. Fuel solenoid will de-energize. 3. Crank output will de-energize. 4. Overcrank LED will flash once. Wait two seconds and repeat. 5. Unit will rest 30 minutes and proceed to the next series.
Series Attempt Number	2	Engine Status:
Intake Heater Energized in Seconds	30	If the engine starts:
Fuel Solenoid Engaged	X	<ol style="list-style-type: none"> 1. Run sequence begins 2. Intake heater remains energized for 3 minutes
Engine Crank Duration (Seconds)	Up to 15	If the engine fails to start:
Engine Rest Duration (Seconds)	25	<ol style="list-style-type: none"> 1. Intake heater will de-energize. 2. Fuel solenoid will de-energize. 3. Crank output will de-energize. 4. Overcrank LED will flash twice. Wait two seconds and repeat. 5. Unit will rest 30 minutes and proceed to the next series.
Series Attempt Number	3	Engine Status:
Intake Heater Energized in Seconds	30	If the engine starts:
Fuel Solenoid Engaged	X	<ol style="list-style-type: none"> 1. Run sequence begins.
Engine Crank Duration (Seconds)	Up to 15	If the engine fails to start:
Engine Rest Duration (Seconds)	25	<ol style="list-style-type: none"> 1. Intake heater will de-energize. 2. Fuel solenoid will de-energize. 3. Crank output will de-energize. 4. Overcrank LED will flash three times. Wait two seconds and repeat. 5. Unit will rest five hours and proceed to the next series.

Table 2–2 Auto Restart Sequencing (Continued)

Series Attempt Number	4	Engine Status:
Intake Heater Energized in Seconds	30	If the engine starts: 1. Run sequence begins.
Fuel Solenoid Engaged	X	If the engine fails to start:
Engine Crank Duration (Seconds)	Up to 15	1. Intake heater will de-energize. 2. Fuel solenoid will de-energize.
Engine Rest Duration (Seconds)	25	3. Crank output will de-energize. 4. Overcrank LED will flash four times. Wait two seconds and repeat. 5. Unit will rest five hours and proceed to the next series.
Series Attempt Number	5	Engine Status:
Intake Heater Energized in Seconds	30	If the engine starts: 1. Run sequence begins.
Fuel Solenoid Engaged	X	If the engine fails to start:
Engine Crank Duration (Seconds)	Up to 15	1. Intake heater will de-energize. 2. Fuel solenoid will de-energize.
Engine Rest Duration (Seconds)	25	3. Crank output will de-energize. 4. Overcrank LED will flash five times. Wait two seconds and repeat. 5. Unit will rest five hours and proceed to the next series.
Series Attempt Number	6	Engine Status:
Intake Heater Energized in Seconds	30	If the engine starts: 1. Run sequence begins.
Fuel Solenoid Engaged	X	If the engine fails to start:
Engine Crank Duration (Seconds)	Up to 15	1. Intake heater will de-energize. 2. Fuel solenoid will de-energize.
Engine Rest Duration (Seconds)	25	3. Crank output will de-energize. 4. Overcrank LED will illuminate solid and lock out future crank attempts. 5. To reset, turn unit power switch OFF and back ON.

2.9 Safety Devices

Safety devices, such as circuit breakers, fuses, and safety switches, protect system components from damage.

The AC generator, solid state battery charger, fuel heater, high water temperature, safety relay, total time meter and intake heater are protected by circuit breakers. If a safety device opens and there is an interruption of electrical current, the electronic governor module will be de-energized, which will also de-energize the fuel solenoid, interrupt the fuel flow to the engine and stop the engine.

In units with auto restart, the engine, engine control devices, and engine monitoring devices are protected by the auto restart module, circuit breaker, low oil pressure switch, and high water temperature switch. These safety devices monitor system operating conditions and open a set of electrical contacts when an unsafe condition occurs. If a safety device opens and there is an interruption of electrical current, the electronic governor module will be de-energized, which will also de-energize the fuel solenoid, interrupt the fuel flow to the engine and stop the engine.

De-energizing the fuel solenoid shuts off the fuel supply to the engine; thus stopping the engine. Safety device specifications are provided in [Table 2–3](#).

Table 2-3 Safety Devices

Engine		
Unsafe Condition:	Low engine lubricating oil pressure	
	Safety Switch	Low oil pressure switch (LOP) - Automatic reset
	Switch Setting	Opens below 18 psig (1.27 kg/cm)
Unsafe Condition:	High engine cooling water temperature	
	Safety Switch	Water temperature switch (HWT) - Automatic reset
	Switch Setting	Opens at 230F (110°C)
Unsafe Condition:	Excessive current draw by the safety relay, fuel heater, water temperature gauge, oil pressure gauge or total time meter	
	Safety Switch	Circuit breaker (CB-2) - Automatic reset
	Switch Setting	Trips at 30 amps
Unsafe Condition:	Excessive current draw by the electronic governor module	
	Safety Switch	Fuse 1, 2, 3 (replace)
	Switch Setting	Trips at 10 amps
Intake Heater		
Unsafe Condition:	Excessive current draw on intake heater circuit	
	Safety Switch	Circuit breaker (CB-3) - Automatic reset
	Switch Setting	Trips at 50 amps
Battery Charger		
Unsafe Condition:	Excessive current draw on 12 volt supply circuit.	
	Safety Switch	Circuit breaker (CB-4) - Automatic reset
	Switch Setting	Trips at 50 amps
Unsafe Condition:	Excessive current draw on 460 volt feed circuit	
	Safety Switch	Fuses BCF3, BCF4, BCF5 (replace)
	Switch Setting	Trips at 5 amps
Generator		
Unsafe Condition:	Excessive current draw by load	
	Safety Switch	Circuit breaker (CB-1, 460 volt) - Manual reset
	Switch Setting	Trips at 26 amps (460 vac)
Voltage Controller		
Unsafe Condition:	Excessive current draw on 460 volt feed circuit	
	Safety Switch	Fuses VCF1, VCF2, VCF6, VCF7 (replace)
	Switch Setting	Trips at 5 amps

2.10 Unit Specifications

Table 2–4 Unit Specifications

Fuel Tanks		
	Nominal Tank Sizes	120 Gallon
	Fill Capacity	120 Gallon
	Draw Capacity	119 Gallon (Allows for DOT required 5% vapor space)
Weights		
	Battery	63 lb (28.6 kg)
	Generator (A-C)	197 lb (89 kg)
	Engine (Dry) - without Accessories	439 lb (199 kg) approximate
	Unit (dry, with 120 gallon tank)	1875 lb (851 kg)

2.11 Engine Data

Table 2–5 Engine Data

Bore / Stroke:	3.26 in. (83 mm) / 4.03 in. (102.4 mm)	
Compression Ratio:	22.0 to 1	
Cylinders (Number):	Four	
Displacement:	135.2 cubic inches (22 lb cm ³)	
Firing Order:	1-3-4-2	
Lubrication System:	Oil Pressure Safety Switch Setting Opens	18 psig (1.27 kg/cm ²)
	Capacity	Engine - 15.0 US quarts (14.2 liters), includes standard filter.
	Oil Level Indicator	Dipstick in oil pan or fill cap NOTE: To check oil level on engines with the dipstick mounted in the fill cap, remove the cap and wipe the dipstick clean. Insert the cap back onto the oil fill tube, then remove to check level. It is not necessary to screw the cap back into the fill tube when checking level. DO NOT add oil if level is within the “safe” range. If needed, add oil to bring level within the “safe” range. Screw cap fully into fill tube after checking level.
Lube Oil Viscosity	Outdoor Temperature	
	Fahrenheit: 0°F to 45°F Centigrade: -18°C to 7°C SAE: 10W30 or Mobile Delvac 1*	
	Fahrenheit: 45°F and above Centigrade: 7°C and above SAE: 10W30 or 15W40 or Mobile Delvac 1*	
	* Mobile Delvac 1, 5W-40 or 15W-40 is the only approved synthetic oil.	

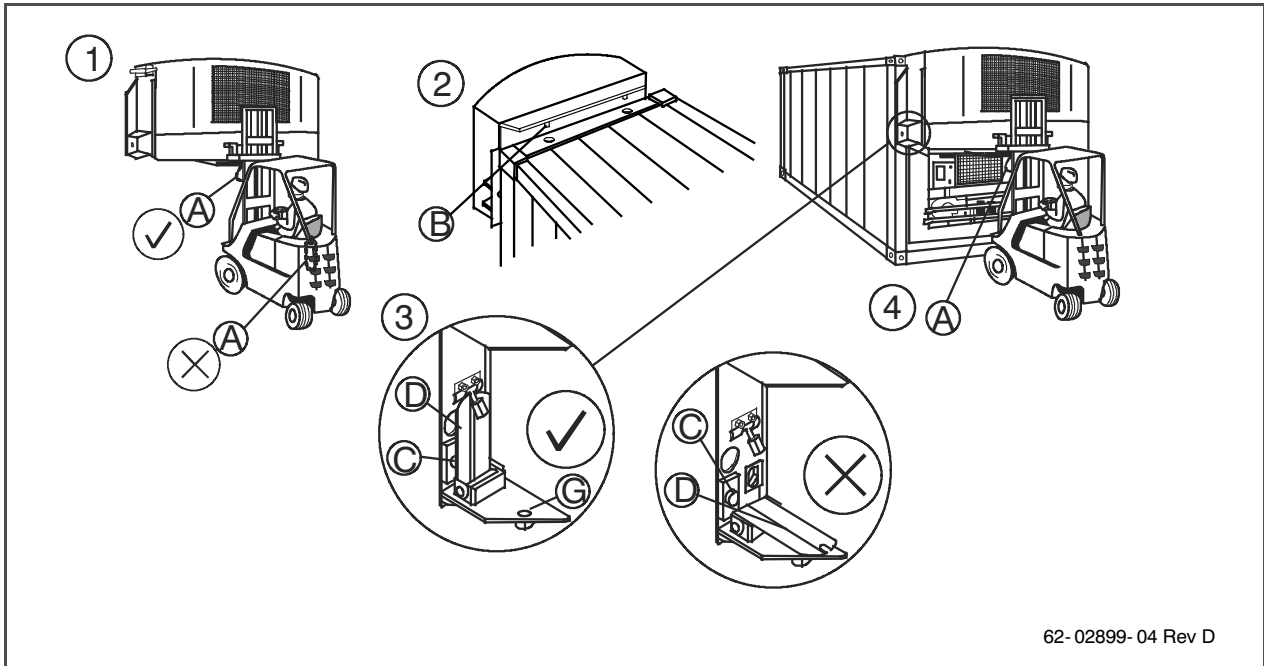
Table 2-5 Engine Data (Continued)

Fuel and Fuel Heater Thermostat (FHT):	Winter	Diesel No. 2 with winter blends
	Summer	Diesel No. 2
	FHT	
	Winter	Close on temperature fall @ $45 \pm 6.5^{\circ}\text{F}$
	Summer	Open on temperature rise @ $75 \pm 6.5^{\circ}\text{F}$
	Power Consumption: 150 Watts @ $\pm 10\%$ at 14 VDC	
	Diesel Fuel Specification Type and Sulfur Content % (ppm) used, must be compliant with all applicable emission regulations for the area in which the engine is operated. Since KUBOTA diesel engines of less than 56 kW (75 hp) utilize EPA Tier 4 and Interim Tier 4 standards, the use of ultra low sulfur fuel is mandatory for these engines, when operated in US EPA regulated areas. Therefore, please use No.2-D S15 diesel fuel. Ultra Low Sulfur Diesel (ULSD) 15 ppm or 0.0015 wt. %	
Fuel Warmer:	Coolant Temperature	
Intake Heater:	Amperage - 42 amps at 12 VDC	
	Resistance (cold) - Approx. 0.3 ohms	
Horsepower:	24.8 HP @ 1800 RPM at sea level. (SAE J1995 Gross Power Rating)	
Cooling System:	Capacity	6 U.S. quarts (5.68 liters) - includes 1 quart (0.95 liter) in coolant recovery bottle (See Section 5.5.5).
	Anti-Freeze: Extended Life	The cooling system is factory charged with a 50/50 mix of extended life coolant (ELC) and deionized water. This mixture provides protection to -34°F (-37°C). For replacement, use Shell Rotella ELC Nitrite Free Pre-Diluted 50/50 antifreeze / coolant.
	Water Temperature Safety Switch Setting:	
	Opens	$110 \pm 3^{\circ}\text{C}$ ($230 \pm 5^{\circ}\text{F}$)
	Resets	93°C (200°F) - minimum
	Thermostat:	
	Starts to open	80 to 84°C (177 to 182°F)
Fully open	95°C (203°F)	
Lubrication System:	Oil Pressure	35 to 60 psig (3.3 to 5.2 kg/cm)
Electrical:	Generator	400-500 VAC @ 60 hz
		360-460 VAC @ 50 hz

SECTION 3 OPERATION

3.1 Generator Set Install and Remove - Pin Type with Locking Bracket

Figure 3.1 Generator Set Mounting - Pin Type with Locking Bracket



WARNING

To prevent injury, the procedures provided for installation and removal of the generator set must be followed carefully.

NOTICE

This generator set is equipped with special pins and mounting bolts and can be installed only on containers with matching installation points.

3.1.1 Installation

1. Place forks into fork pockets of generator set. Attach safety chain (A) between fork pockets on generator set and fork truck. Be sure chain (A) is short enough to retain the generator set on the forks.
2. Line up generator set with refrigeration unit and container. Raise generator set until the top is several inches above the top edge of the container. Move generator set against container and lower into position. Ensure the two pins (B) are fully engaged in mating holes in container.
3. Keep forks in pockets on generator set and tighten mounting bolt (C) on each side of generator set into container frame. Torque mounting bolts to 125 ± 25 ft. lbs (17.3 ± 3.5 mkg). Ensure locking brackets (D) are locked into position so as to capture bolt heads (C) and prevent turning.
4. Remove safety chain (A) before removing forks.

3.1.2 Removal

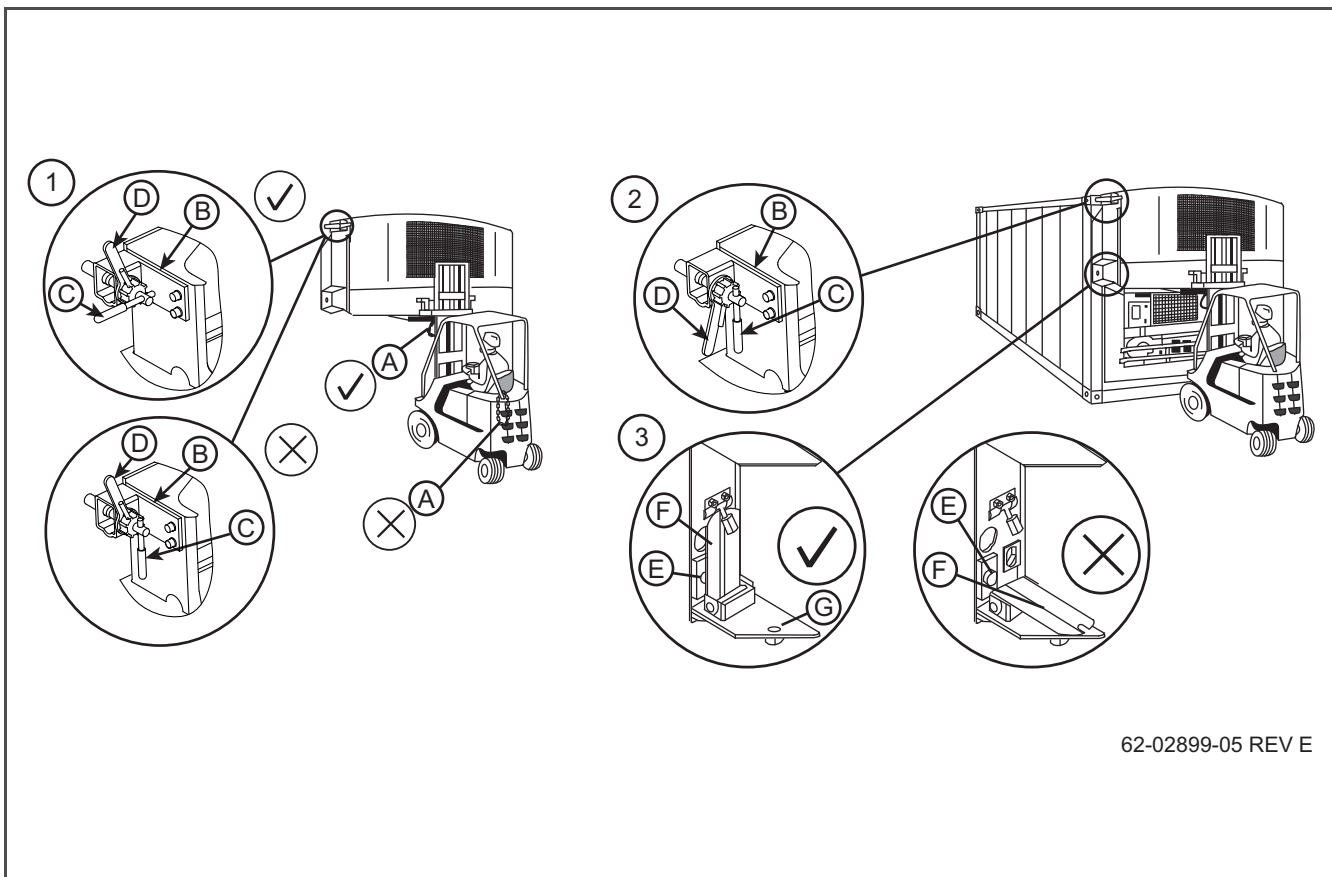
! WARNING

Disconnect power plug before removing generator set.

1. Move forks into fork pockets on generator set. Attach safety chain (A) between fork pockets on generator set and fork truck.
2. Release locking brackets (D) on each side of generator set.
3. Remove mounting bolt (C) on each side of generator set and tighten into threaded hole (E).
4. Raise generator set several inches to disengage pins (B) from mating holes and remove from container.

3.2 Generator Set Install and Remove - Clamp Type with Locking Bracket

Figure 3.2 Generator Set Mounting - Clamp Type with Locking Bracket



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! WARNING

To prevent injury, the procedures provided for installation and removal of the generator set must be followed carefully.

NOTICE

This generator set is equipped with clamps and mounting bolts and can be installed only on containers with matching installation points for the mounting bolts.

3.2.1 Installation

1. Place forks into fork pockets of generator set. Attach safety chain (A) between fork pockets on generator set and fork truck. Be sure chain (A) is short enough to retain generator set on forks. Ensure that generator set clamps (B) are in the unlocked position and actuating handle (C) in the horizontal position.
2. Move generator set against container and fully engage clamps into mating holes in container castings. On both clamps, turn the actuating hand lever (C) into the vertical down position (locked). Using the ratchet handle (D), tighten the hand nut. Tightening should continue until the face of the clamp is hard against the corner casting and the actuating hand lever is moved over the locking tabs. Leave the ratchet handle (D) engaged in the tightening direction with the ratchet handle in the vertical down position.

 **WARNING**

Double-check that the generator set clamp (B) is securely tightened against the face of the corner casting and that the generator set clamp hand nut is tight before transporting the container. A loose fit could cause damage to both the generator set and the generator set clamp, and cause serious injury during transport.

3. Keeping forks in pockets on the generator set, tighten bolt (E) into container frame on each side of the generator set. Torque mounting bolts to 125 ± 25 ft. lbs (17.3 ± 3.5 mkg). Ensure locking brackets (F) are locked into position so as to capture bolt heads (E) and prevent turning.
4. Remove safety chain (A) before removing forks.

3.2.2 Removal

 **WARNING**

Disconnect power plug before removing generator set.

1. Place forks into fork pockets on generator set. Attach safety chain (A) between fork pockets on generator set and fork truck.
2. Release retaining plate from locking bracket on each side of generator set.
3. Remove mounting bolt (E) on each side of generator set and tighten into threaded hole (G).
4. Disengage clamps (B) by setting ratchet handle (D) in the loosening position. Loosen the hand nut until the actuating hand lever is clear of the locking tabs.
5. Turn actuating hand lever (C) upward into the horizontal position.
6. Carefully remove the generator set from the container.

3.3 Starting and Stopping Instructions

3.3.1 Pre-Start Inspection

1. Check engine lubrication and fuel filters, oil lines, and connections for leaks. If required, tighten connections and/or replace gaskets.
2. Check engine lubricating oil level (see [Section 2.11](#), Lubrication System).
3. Check poly V-belt for fraying or cracks and proper tension (see [Section 5.5.10](#)).
4. Check radiator hoses for leaks and check radiator coolant level (see [Section 2.11](#), Cooling System).
5. Check radiator coil and generator air intake screen for cleanliness. If required, clean using compressed air, reversing the normal air flow.
6. Check air cleaner for cleanliness and clean if necessary (see [Section 5.5.11](#)).
7. Check in-line fuel strainer and clean if necessary (see [Section 5.5.4](#)).

8. Drain water from fuel filter bowl.
9. Fill fuel tank with diesel fuel (see [Section 2.11](#), Fuel and Fuel Heater Thermostat (FHT)).
10. Check intake heater amperage (see [Section 2.11](#), Intake Heater).
11. Check battery terminals for cleanliness and secureness. If required, clean, then coat with a battery terminal sealant.
12. Check and if required, tighten all electrical connections.
13. Check and if required, tighten all hardware (brackets, etc.).
14. Ensure the main generator set circuit breaker (CB1) is in the OFF position. Connect power cable to refrigeration unit and proceed to [Section 3.3.2](#).

3.3.2 Starting Instructions

Before start up, both the genset circuit breaker (CB1) and the refrigerated unit should be OFF. After start up, the genset unit should be run for at least two minutes to allow the power source to stabilize before supplying power to the refrigerated unit. This will eliminate the potential of any cold start transient spikes from reaching the refrigerated unit. Cold start transient spikes can potentially cause nuisance over voltage alarms on refrigerated units that are sensitive to electrical spikes or transients.



Beware of moving poly V-belt, belt driven components and hot exhaust components.



Under no circumstances should ether or any other unauthorized starting aids be used in conjunction with the intake heater.



Piston rings in engines that have operated less than 100 hours may not be fully seated. This may lead to the possibility of oil seepage from the exhaust pipe. To properly seat the rings, operate the engine under full load for a period of 24 hours. If condition persists, check valve clearance when engine is cold. (Refer to engine workshop manual)

Standard Units:

1. Make sure that CB-1 is in the OFF position.
2. Hook up the 460 volt cable from the refrigerated unit to the Genset receptacle.
3. Hold intake heater switch (see [Figure 2.7](#)) in the PREHEAT position. Suggested hold times for a cold engine are as follows:

Table 3–1 Cold Engine Preheat Times

Ambient Temperature	Time
26°C (78°F)	5 seconds
0°C to 26°C (32°F to 78°F)	10 seconds
-8°C to 26°C (18°F to 32°F)	20 seconds
Below -8°C (18°F)	30 seconds

4. With the intake heater switch held in the PREHEAT position, place the ignition switch in the START position.
5. After the engine has started, continue to hold the intake heater switch in the PREHEAT position until the engine develops sufficient oil pressure to close the oil pressure safety switch (approximately 5 seconds). When released, the intake heater switch will automatically return to the OFF position and the heater will remain energized for 3 minutes.

Units with Auto Restart:

1. Make sure that CB-1 is in the OFF position.
2. Hook up the 460 volt cable from the refrigerated unit to the Genset receptacle.
3. Place the Ignition switch (IGN) (see [Figure 2.7](#)) in the Run position.
4. The auto restart module will energize the heater for 30 seconds and the safety buzzer will sound. After the 30 second delay, the unit will attempt to start.

3.3.3 Post-Start Inspection

1. Allow the Genset unit to run for at least 2 minutes.
2. Turn on CB-1.
3. Check generator output with a volt meter, voltage output at start up with no load at 50Hz operation should be 1500 RPM, 360-460 VAC. Voltage output may vary and fall with ISO specifications based on ambient (see [Section 2.7](#)).
4. Start the refrigeration unit.
5. Run engine 10 minutes and check total time meter operation.
6. Listen for abnormal bearing noise from the AC generator.
7. Check fuel lines, lube oil lines, and filters for leaks.
8. Check exhaust system for leaks.

3.3.4 Stopping Instructions

1. Place CB-1 in the OFF position.
2. Place the ignition switch in the OFF position.

3.4 Sequence of Operation



Beware of moving V-Belt and belt driven components.

Standard Units:

With the intake heater switch (HS) held in the ON position, current flows through the ammeter to the intake heater. While heater is on, the ammeter will show an approximate 42-amp draw.

A second set of contacts also energizes the safety relay (S).

If the high water temperature switch (HWT) opens to break the safety relay ground connection, the safety relay will not energize, and the engine will not start. To start the engine, the ignition switch (IGN) is held in the START position. With the switch in the START position, current flows to the start solenoid (SS), through the SS contacts to the starter motor (SM). Current then flows to the intake heater timer, intake heater relay (HR) and to the heater, while simultaneously powering the electronic governor module (EG), fuel solenoid (FS), and engine speed sensor (ESS).

The starter motor turns over the engine resulting in pumping of fuel to the engine cylinders by the injection pump. This fuel is ignited by heat of compression; thus starting the engine. When the engine has developed sufficient oil pressure, the low oil pressure (LOP) switch contacts close to maintain power to the safety relay (S).

Once the engine has started and the start switch has been released, the starter motor will stop cranking and the intake heater will remain energized for 3 minutes. With the engine running, the battery charger provides DC power to operate the control system and charge the battery.

Units with Auto Restart:

When the ignition switch is placed in the RUN position, 12-volt DC power is applied to the auto restart module. The auto restart module will maintain power and all lights on the module will illuminate. As the auto restart module performs its self test, the lights will go out individually.

After the self test is complete, the auto restart module will energize the intake heater and sound the audible alarm warning, indicating that the unit has been powered on and will start. The 30 second delay starts at this time. When the 30 second delay expires, power will be applied to the electronic governor and the engine attempts to crank for 15 seconds.

When the engine starts, the intake heater will remain energized for 3 minutes; during this time, the engine/intake heater light and alarm will be energized, the shutdown/lockout time delay of 15 seconds will begin counting, and the starter will be disengaged. During the shutdown/lockout time delay at start up, the auto restart module will disregard the signals to the oil pressure and engine temperature inputs, and the Run sequence will begin. If engine does not start, refer to [Table 2-2](#) for auto restart sequencing.

SECTION 4

TROUBLESHOOTING

4.1 Diesel Engine

4.1.1 Engine Will Not Start

Table 4–1 Engine Will Not Start

Condition	Possible Cause	Remedy / Reference Section
Starter motor will not crank or low cranking speed	Battery insufficiently charged	Charge
	Battery terminal post or battery defective	Check
	Electrical connections at starter are bad	Correct
	Starter motor malfunctions	Section 4.1.4
	Starter motor solenoid defective	Engine Manual
	Open starting circuit	Section 4.1.5
	Incorrect grade of lubricating oil	Section 2.10
	Fuse F5 is bad	Replace
Starter motor cranks, but fails to start	No fuel in tank	Section 2.10 / Section 2.11 .
	Air inside the fuel system	Section 5.5.1
	Water inside the fuel system	Drain Sump
	Plugged fuel filters	Replace
	Air intake heater is bad	Section 5.5.14
	Low oil / oil pressure switch defective	Section 5.5.7
	Faulty heater switch	Section 5.5.15
	Plugged fuel lines to injector(s)	Engine Manual
	Mechanical lift fuel pump malfunction	Engine Manual
	Fuses F1, F2, F3, F4 are bad	Check / replace
	Loose or no connection between wire harness and Electronic Governor Module (EG)	Check / correct
	Starter cranks and engages, but dies after a few seconds	Engine lube oil too heavy
Voltage drop in starter cable(s)		Check

4.1.2 Engine Starts Then Stops

Table 4–2 Engine Starts Then Stops

Condition	Possible Cause	Remedy / Reference Section
Engine stops after a few rotations	No fuel in tank	Section 2.10 / Section 2.11 .
	Intake heater switch not held long enough	Hold switch
	Fuel filter restricted	Replace
	Air cleaner or hose restricted	Section 5.5.11
	Engine crankcase breather or hose restricted	Section 5.5.12
	Safety device open	Section 2.9

Table 4–2 Engine Starts Then Stops (Continued)

Condition	Possible Cause	Remedy / Reference Section
Engine stops after a few rotations	Open wiring circuit to fuel solenoid	Check
	Fuel solenoid defective	Replace
	Fuel supply restricted	Section 2.11 , Section 5.5.2 , and Section - - - -
	Mechanical lift fuel pump malfunction	Engine Manual
	Low oil / oil pressure switch defective	Section 5.5.7
	Leak in fuel system	Check
	Injector nozzle(s) defective	Engine Manual
	Injection pump defective	Engine Manual
	Generator internal overloads open	Table 2–3

4.1.3 Engine Will Not Shut Off

Table 4–3 Engine Will Not Shut Off

Condition	Possible Cause	Remedy / Reference Section
Engine will not shut off	Loose ground connection	Clean / Tighten
	Improperly seated fuel solenoid	Correct

4.1.4 Starter Motor Malfunction

Table 4–4 Starter Motor Malfunction

Condition	Possible Cause	Remedy / Reference Section
Starter motor will not crank or turns slowly	Battery insufficiently charged	Charge
	Battery cable connections loose or oxidized	Check / Replace
	Battery cables defective	Check / Replace
	Starter brushes shorted out	Engine Manual
	Starter brushes hang up, defective or have no contact	Engine Manual
	Starter solenoid damaged	Engine Manual
	Ignition switch defective	Replace
	Engine lube oil too heavy	Table 2.11 .
Starter motor turns, but pinion does not engage	Pinion or ring gear obstructed or worn	Engine Manual
Starter motor does not disengage after switch has been released	Ignition switch is bad	Check / Replace
	Starter motor solenoid is bad	Engine Manual
Pinion does not disengage after engine is running	Starter is bad	Engine Manual

4.1.5 Malfunction In The Engine Starting Circuit

Table 4–5 Malfunction In The Engine Starting Circuit

Condition	Possible Cause	Remedy / Reference Section
No power to starter motor solenoid	Battery defective	Correct
	Loose electrical connections	Tighten
Fuel solenoid does not energize or does not remain energized	Battery defective	Correct
	Loose electrical connections	Tighten
	Oil pressure switch defective	Section 1.9
	Water temperature safety switch open	Section 1.9
	Fuel solenoid defective	Engine Manual
	Intake heater switch is bad	Check (Engine Manual)
	Electronic Governor Module (EG) is bad	Replace (Section 5.5.14) Check / Replace
Intake heater does not energize	Intake heater switch is bad	Section 5.5.14
	Timer is bad	Section 5.5.14
	Heater element is bad	Section 5.5.14
	Heater relay is bad	Section 5.5.14

4.1.6 Miscellaneous Engine Troubleshooting

Table 4–6 Miscellaneous Engine Troubleshooting

Condition	Possible Cause	Remedy / Reference Section
Loss of power	Restriction in air cleaner	Section 5.5.11
	Air in fuel system	Section 5.5.11
	Air vent restricted	Clean
	Restricted fuel lines	Engine Manual
	Fuel injection pump is bad	Engine Manual
	Injector(s) bad or incorrect type used	Engine Manual
	Incorrect fuel injection pump timing	Engine Manual
	Incorrect valve timing	Engine Manual
	Poor compression	Engine Manual
Vibration	Engine shockmounts are bad	Replace
	Poor compression	Engine Manual
Overheating	Restriction in air cleaner	Section 5.5.11
	Exhaust pipe restriction	Remove
	Restriction in water jacket	Engine Manual
	Restriction in radiator	Section 5.5.5
	Coolant level too low	Section 2.11.
	Loose water pump/alternator poly V-belt	Section 5.5.10
	Thermostat is bad	Engine Manual
	Water pump is bad	Engine Manual
Excessive crankcase pressure	Plugged crankcase breather line	Section 5.5.12

4.2 Battery Charger (Solid State)

Table 4–7 Battery Charger (Solid State)

Condition	Possible Cause	Remedy / Reference Section
CB4 trips when charger is turned on	Short in 12-volt wiring causing overload of charger	Locate and remove short or replace charger
Circuit breaker trips repeatedly, even when not connected	Internal short	Replace charger
Charger does not taper back after charging for a few minutes	Bad cell in battery	Test battery for defect according to battery manufacturer's instructions
	Charger is bad	Replace
Charger does not charge	Open BCF3, BCF4, or BCF5	Replace
	Charger is not receiving AC input	Use voltmeter to confirm charger is receiving 360-500 VAC. If not, check input connections/fuses.
	Charger output is not connected to 12 volt battery	Check output wiring connections to battery.
	Charger is bad	Replace
Low output voltage measured across charger output	Battery not connected to charger. It is normal to measure 12 volts or less across charger output with no battery connected	Check charging leads from charger to battery
Reverse polarity connection to battery has caused charger to stop charging	Internal DC fuse blown and possible damage to current carrying components	Replace

4.3 Alternating Current Generator

Table 4–8 Alternating Current Generator

Condition	Possible Cause	Remedy / Reference Section
No voltage	Loss of rotor magnetism	Replace
	Circuit breaker tripped	Check CB1
	Open in stator windings	Replace
	Short circuited	Replace
	Worn drive gear stripped	Check / Replace
	Contactors not engaged	Replace
Low voltage	Low engine speed	Section 5.5.12
	High resistance connections, connections are warm or hot	Tighten
	Loss of rotor magnetism	Replace
Fluctuating voltage (May be indicated by flickering lights)	Fluctuating speed	Section 5.5.12
	Irregular speed of engine	Engine Manual
	Loose terminal or load connections	Tighten
	Bad bearing causing uneven air gap	Replace
High voltage	Excessive engine speed	Section 5.5.12

Table 4–8 Alternating Current Generator

Condition	Possible Cause	Remedy / Reference Section
Overheating	Generator overloaded	Check
	Clogged vents / baffles	Check / Clean
	High temperature surrounding generator	Section 5.5.5
	Insufficient air circulation or recirculation	Check / Clean
	Unbalanced load	Balance
	Dry bearing	Replace
Mechanical Noise	Bad bearing	Replace
	Rotor rubbing on stator	Replace
	Loose laminations	Replace
	Loose or misaligned coupling	Check drive gear
Generator frame produces shock when touched	Static charge	Check ground to frame

4.4 Auto Re-Start Option

Table 4–9 Auto Re-Start Option

Condition	Possible Cause	Remedy / Reference Section
When the Ignition switch is placed in the RUN position, nothing happens- no lights illuminate	Wait 30 seconds for intake heater to be activated	Wait
	Relay defective	Check / Replace
	Ignition switch defective	Check / Replace Switch
	3 amp Fuse is bad	Check and Replace Fuse
	Loose connector on module	Tighten connector
	Auto restart module is bad	Check for 12 volts at Pin 4/Replace module
	Mis-wired connectors	Check / Correct wiring
Alarm sounds, but engine does not crank	No voltage at Pin 2 of the connector	Trace / Correct
	Check Starter Solenoid	Section 4.1.1
	Auto restart module is bad	Replace module
Engine starts, but the starter does not disengage	Speed Sensor wiring loose	Check / Correct
	Speed Sensor is bad	Replace
	Auto restart module is bad	Replace module
Engine starts, but shuts down from over speed	Electronic Governor Module (EG) is bad	Replace
Engine cranks, but will not start	Electronic Governor Module (EG) is bad	Replace
	Section 4.1.1	Section 4.1.1
Engine starts, but shuts down on low oil	Section 4.1.2	Section 4.1.2
Engine starts, but shuts down on high water temperature	Section 4.1.6	Section 4.1.6

4.5 Electronic Governor Module

Table 4–10 Electronic Governor Modules

Fault	LED flash code	Possible Cause
Engine Over Speed: more than 2,530 RPM	One Long - One Short	ESS or mechanical engine problem
Actuator Wiring Disconnection. No signal from ESS for 2 seconds after RPM is greater than 1,000 RPM for 10 seconds, OR for 5 seconds while engine cranking (no voltage at EG pin 18).	Two Long - One Short	Short ESS or wiring problem
Speed Sensor Disconnection. Fuel/speed actuator (FS) wiring disconnected or open circuit. Coil Resistance Spec: 2.8 ohm \pm 10%.	Two Long - Three Short	FS or wiring problem
EG supply voltage is greater than 26V.	Two Long - Seven Short	EG or alternator problem

4.6 Voltage Controller

The voltage controller has one green indicator light and one yellow indicator light. When the green light is illuminated, it means that the voltage controller is receiving power. The yellow light only illuminates (flashes) to indicate that there is a problem.

Table 4–11 Voltage Controller

Green LED	Fault	Possible Cause / Remedy
LED not illuminated	No power to the voltage controller	Contactors failed
		Check line side power on contactors

Yellow LED flash Code	Fault	Possible Cause / Remedy
One Long - Three Short	Over Voltage Error	Engine speed, check
One Long - Four Short	Under Voltage Error	Engine speed, check

SECTION 5

SERVICE AND PREVENTATIVE MAINTENANCE

5.1 Introduction

This section covers service for the generator set and general engine service. Refer to the Kubota engine workshop manual (see [Section 2.1](#)) for other engine servicing.



Beware of moving poly V-belt and belt driven components.

5.2 Preventative Maintenance Schedule

A tabular listing of the recommended preventative maintenance activities and schedule is provided in [Table 5-1](#).

5.3 Battery Service

When replacing the battery, note if the unit was supplied with a mat in the battery tray. If so equipped, the mat must also be replaced.

Orient battery cables approximately as shown in [Figure 5.1](#) and [Figure 5.2](#). When installing cables to battery, ensure the cables are not touching anything, and are floating in free air.

Figure 5.1 Battery Cable Routing - Top View



Figure 5.2 Battery Cable Routing - Side View



5.4 Battery Charger Service

PIDs prior to RG2059 are equipped with a battery charger mounted on the generator. If so equipped, when replacing the battery charger ensure the cables are NOT touching anything to prevent the wire chaffing with the following:

1. It is critical to maintain a $20^\circ (\pm 5 \text{ degrees})$ angle on the harness clamp. Refer to item b in [Figure 5.3](#).
2. The positive and negative battery cables must be at a minimum distance, 0.25 in. (6.4 mm) from the battery charger and the battery charger mounting bracket. Refer to item a in [Figure 5.3](#).
3. The harness must be at a minimum distance of 0.25 in. (6.4 mm) from the edges as shown in the [Figure 5.4](#).

Figure 5.3 Battery Cable / Harness Clamp (PIDs prior to RG2059)

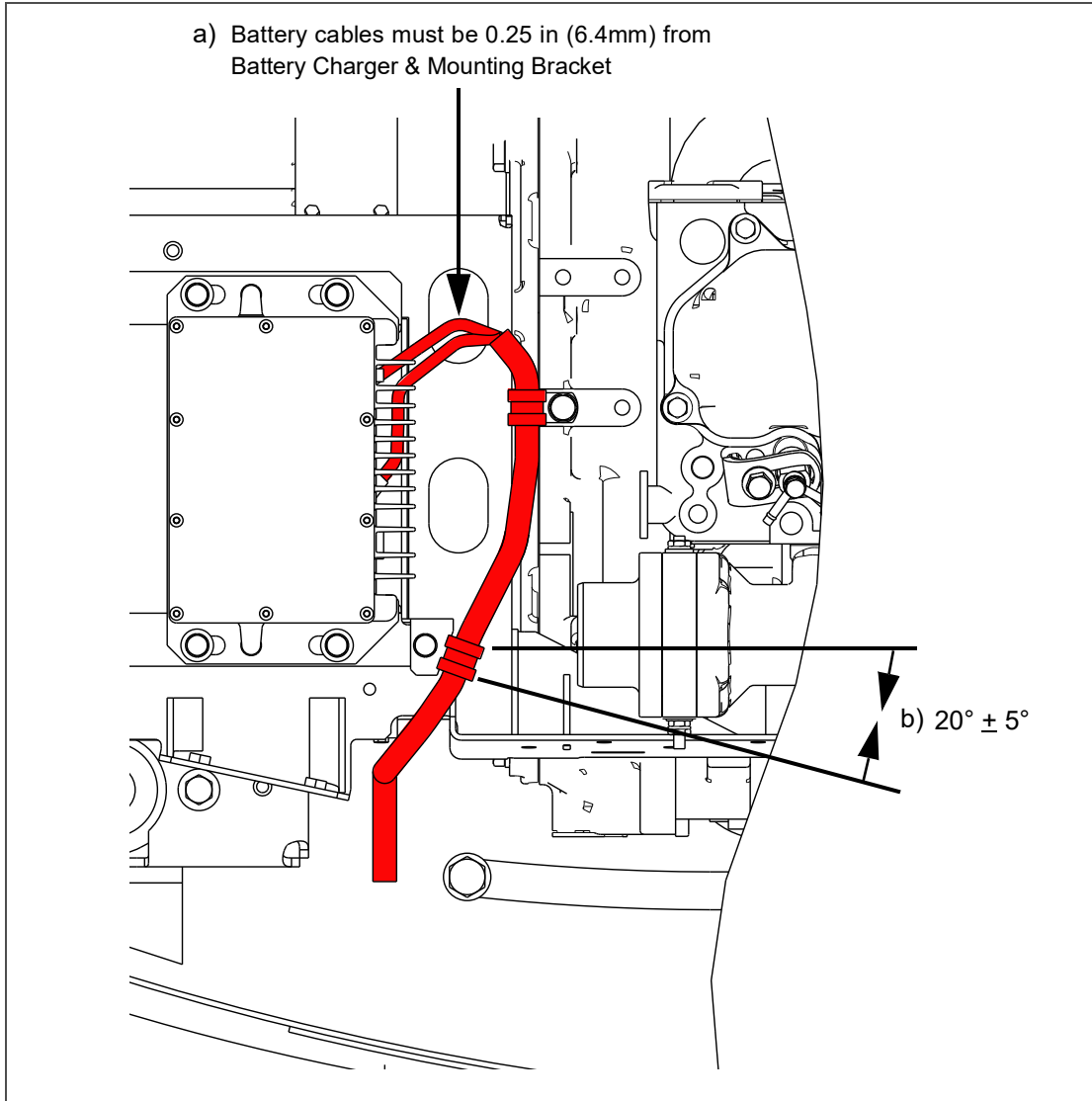
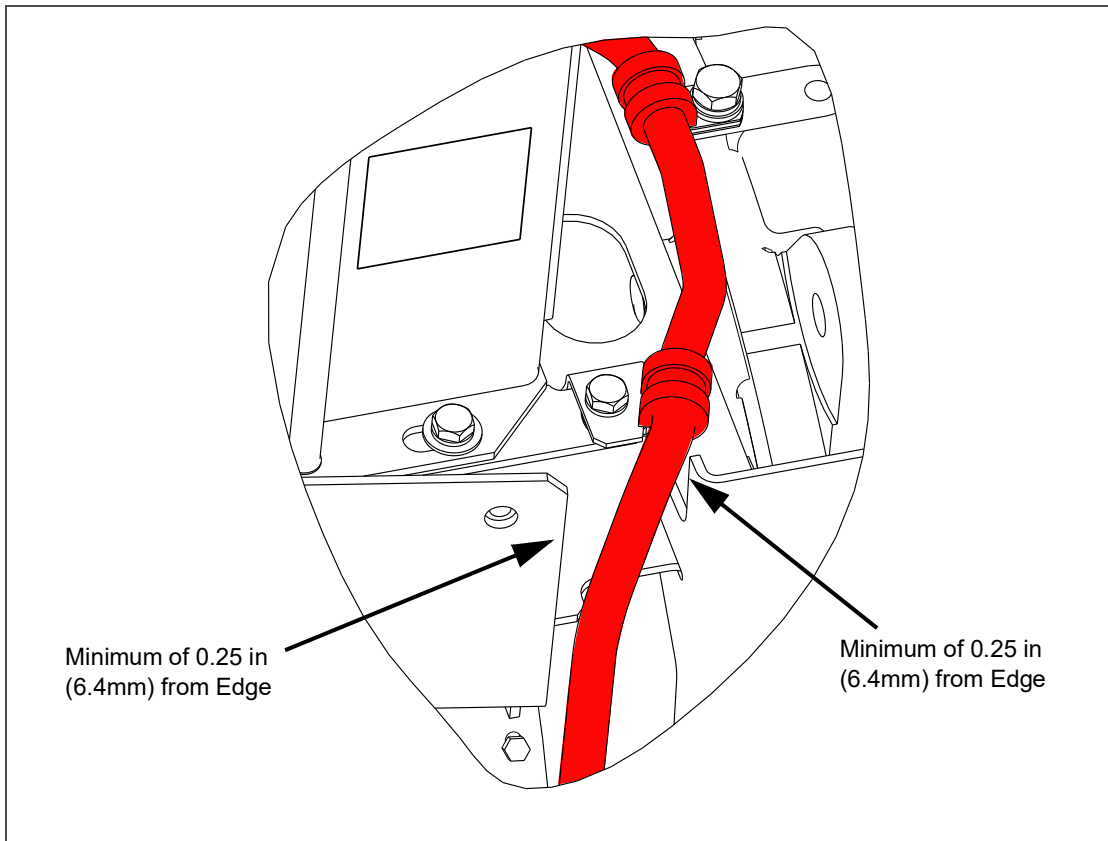


Figure 5.4 Battery Harness (PIDs prior to RG2059)



5.5 Engine Service and Components

5.5.1 Bleeding the Fuel System

The unit is equipped with a mechanical fuel lift pump, mounted on the engine next to the injection pump. The fuel system is a closed circuit which will require bleeding if loss of fuel has occurred. To fill and bleed the system, do the following:

1. Turn the bleed valve (see [Figure 2.5](#)) counterclockwise until fully opened.
2. Turn the top of the hand priming pump counter-clockwise to unlock it, and then hand pump the manual plunger until a positive pressure (resistance) is felt. This will indicate fuel flow.
3. Depress and turn the top of the hand priming pump clockwise to lock in place.
4. Start engine (see [Section 3.3](#)).
5. When engine is running properly, turn bleed valve clockwise until fully closed.

5.5.2 Servicing Fuel Pump Internal Filter

The internal fuel filter may become plugged or restricted with foreign particles or wax, which can develop if the wrong grade of fuel is used or untreated fuel is used in cold weather, contaminating the fuel. If the internal filter is plugged, the engine will lose power. Therefore, the filter must be cleaned on a regular basis. The quality of the fuel will affect the filter cleaning schedule (see [Section 5.2](#)).

1. Turn nut counter-clockwise to loosen and remove
2. Remove banjo fitting and let it hang loose.
3. Turn filter counter-clockwise and remove. Check and clean.
4. To install, reverse steps a through c.

5.5.3 Fuel Filter

The fuel filter is located on the generator set unidrive assembly (see [Figure 2.2](#)). To replace the fuel filter, loosen and remove the filter housing. Lightly oil new gasket with lube oil and replace the filter.

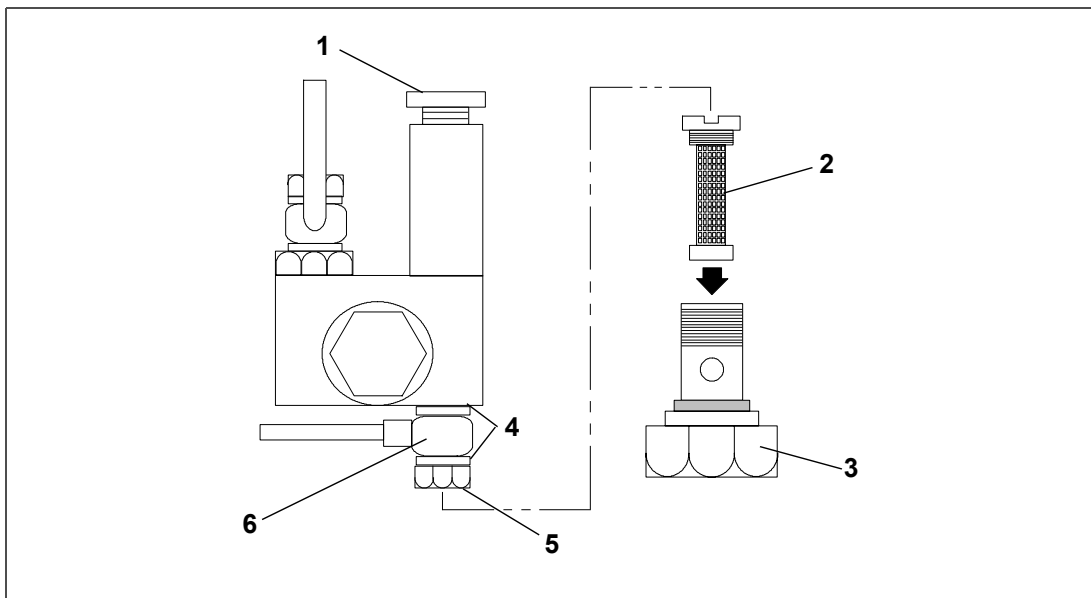
NOTICE

If the generator set is equipped with the fuel filter bowl assembly, when replacing the fuel filter, a new fuel filter O-ring should be oiled and replaced, and then the clear bowl should also be tightened to 18 ft-lbs.

5.5.4 In-Line Fuel Strainer (Option)

1. Loosen bowl by turning counter-clockwise. To renew, remove in-line fuel strainer, check and clean, and replace.

Figure 5.5 Mechanical Fuel Pump



1) Hand Priming Pump

2) Filter

3) Nut

4) Copper Rings

5) Nut

6) Banjo

5.5.5 Cooling System

To ensure adequate cooling, the radiator must be clean, externally and internally. To service the cooling system, do the following:

1. Remove all foreign material from the radiator coil by reversing the normal air flow. Compressed air or water may be used as a cleaning agent. It may be necessary to use warm water mixed with any good commercial dishwasher detergent. Rinse coil(s) with fresh water if a detergent is used.
2. Drain coolant completely by opening drain-cock and removing radiator cap.

CAUTION

Never pour cold water into a hot engine.

3. Close drain-cock and fill system with clean, untreated water to which three to five percent of an alkaline base radiator cleaner should be added; six ounces (dry) = 151 grams to one gallon (3.8 liter) of water.
4. Run engine 6 to 12 hours and drain system while warm. Rinse system three times after it has cooled down. Refill system with water.

CAUTION

Use only ethylene glycol (anti-freeze with inhibitors) in system. Use of glycol by itself will damage the cooling system (see [Section 2.11](#)).

5. Run engine to operating temperature. Drain system again and fill with treated water/anti-freeze. See above Caution note and see [Section 2.11](#).

5.5.6 Lube Oil Filter

The oil filter is located near the radiator fan (see [Figure 2.6](#)).

1. After warming up the engine, stop engine, remove drain plug from oil reservoir and drain engine lube oil.
2. Replace filters. Lightly oil gasket on filter before installing.
3. Add lube oil (see [Section 2.3.4](#)).
4. Warm up engine and check for leaks.

5.5.7 Servicing Low Oil Pressure Switch

1. Remove harness connection from low oil pressure switch (LOP).
2. Remove pressure switch from engine.
3. Apply Teflon thread sealer to threads of new low oil pressure switch.
4. Install new low oil pressure switch.
5. Reconnect harness connection to low oil pressure switch.

5.5.8 Engine Speed

The engine speed is electronically controlled.

NOTICE

Do not attempt to adjust engine speed.

5.5.9 Replacing the Engine Speed Sensor

1. Disconnect the plug to the sensor.
2. Remove the bolt securing the sensor to the housing.
3. Remove the sensor from the housing.
4. Clean the recess in the housing to ensure that the sensor seats properly when re-installed.
5. Re-install the sensor, replace the securing bolt and connect the plug to the sensor.

5.5.10 Servicing Poly V-belt

WARNING

Beware of moving poly V-belt and belt driven components.

WARNING

Beware of pinch points.

NOTICE

A frayed, cracked or worn poly V-belt must be replaced. After installing a new belt, check the adjustment after running the unit for three or four hours. This will allow for the initial stretch, which is common on new belts. Once this initial stretch has taken place, the belt should be checked at regular intervals.

The poly V-belt is driven by a sheave on the engine crankshaft. Its two functions are to:

- drive the radiator fan
- drive the water pump

To replace the poly V-belt, perform the following steps:

1. Using the proper size socket, slowly rotate the crank on the crank pulley nut. At the same time, use a flat, blunt object to guide the belt off the crank pulley towards radiator. Be careful not to damage grooves on the pulley.
2. Replace the poly V-Belt by positioning the belt on the water pump pulley, and while rotating the engine (as in step a.), use a flat, blunt object to guide the belt onto the crank pulley. Be careful not to damage grooves on the pulley or belt.

5.5.11 Engine Air Cleaner

The dry element engine air cleaner uses a dry element filter (see [Figure 5.6](#)) to filter the engine intake air. The oil bath air cleaner option uses an oil cup instead of the standard dry element filter (see [Figure 5.7](#)).

The engine air cleaner should be inspected regularly for leaks (see [Figure 2.1](#)). A damaged air cleaner or hose can seriously affect the performance and life of the engine. The air cleaner is designed to effectively remove contaminants from the air stream entering the engine. An excessive accumulation of contaminants in the air cleaner will impair its operation. Therefore, a service schedule must be set up and followed.

1. Check all connections for mechanical tightness. Be sure the air cleaner outlet pipe is not fractured.
2. In case of leakage, if adjustment does not correct the problem, replace necessary parts or gaskets. *Swollen or distorted gaskets must always be replaced.*

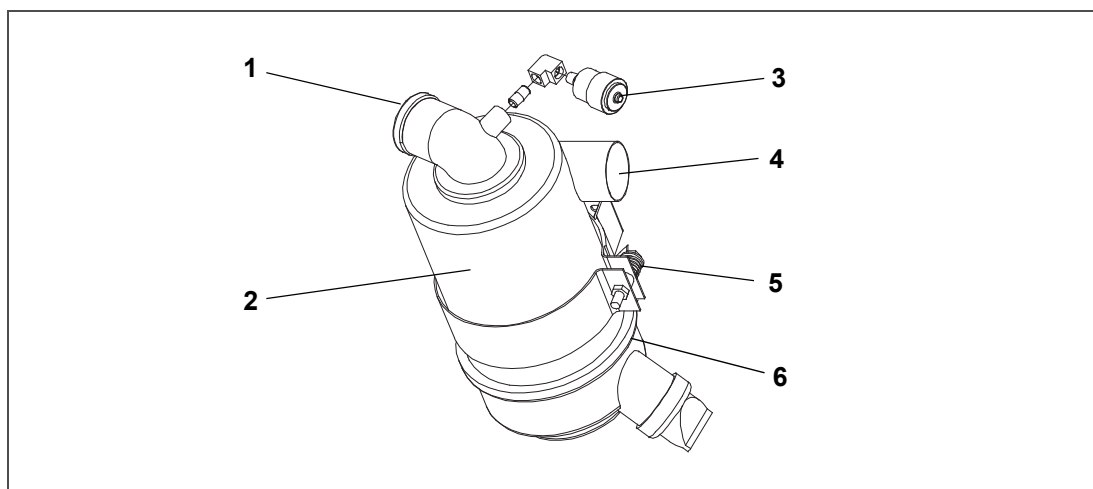
Air Filter Indicator

The air filter indicator, used with the dry element filter, is mounted on the air filter body. Its function is to indicate when the air cleaner dry element needs to be replaced. In operation: When a plugged air cleaner decreases intake manifold pressure to 500 mm (20") WG, the indicator moves to the red line. The air cleaner element should be replaced and the indicator reset by pressing the reset button.

Air Cleaner, Dry Element Service Procedure

1. Stop the engine and open the cap clamps (see [Figure 5.6](#)) to remove air cleaner bottom cap.
2. Remove the air filter element from the air cleaner body.
3. Install the new element, secure the bottom cap with the cap clamps.

Figure 5.6 Air Cleaner, Dry Element



- | | |
|-------------------------|---------------|
| 1) Air Outlet | 4) Air Inlet |
| 2) Air Cleaner Body | 5) Clamp |
| 3) Air Filter Indicator | 6) Cap Clamps |



When reassembling the Air Cleaner, make sure the Clamp Bolt faces out, away from the fuel filter. If the Clamp Bolt is assembled facing in, it can contact the fuel filter and cause excessive wear.

Air Cleaner, Oil Bath Service Procedure

The oil cup should be inspected during pretrip, before each trip. Never allow more than 1/2 inch (12.7 mm) of dirt deposit in the cup. More than 1/2 inch accumulation could result in oil and dirt carrying over into the engine, causing accelerated engine wear. Heavily contaminated oil will not allow the air cleaner to function properly.

CAUTION

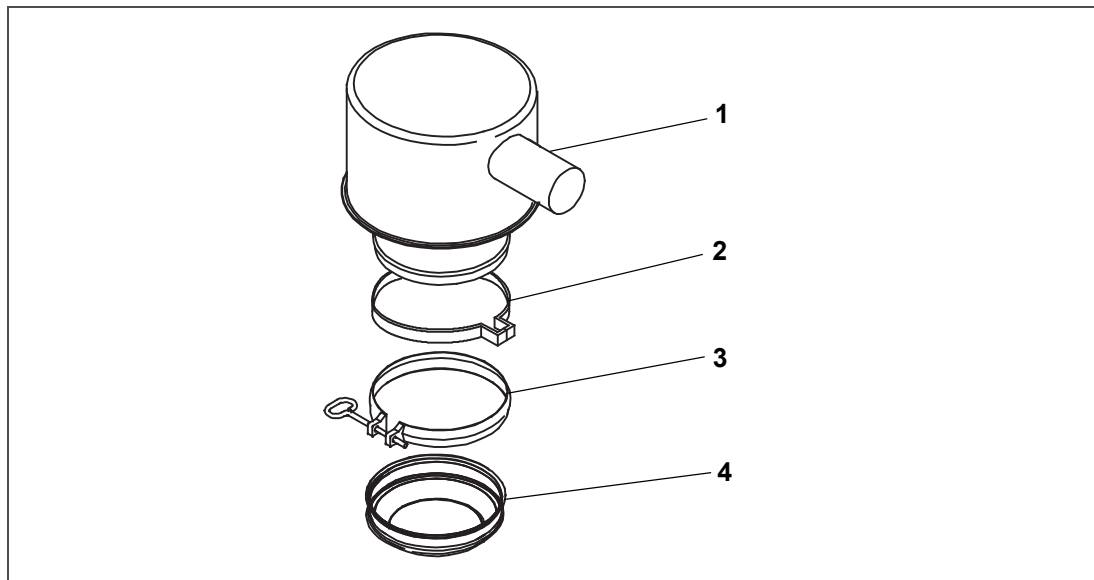
Always cover the engine inlet tube while the air cleaner is being serviced.

1. Stop the engine and remove the oil cup from the air cleaner. Dispose of oil in an environmentally safe manner.
2. Remove the inner oil cup from the oil cup and clean both cups.
3. Reassemble and fill both oil cups to the indicated level with oil specified in [Section 2.11](#).

CAUTION

Do not underfill or overfill the oil bath cups. Overfilling cups causes loss of capacity; underfilling cups causes lack of filtering efficiency.

Figure 5.7 Air Cleaner, Oil Bath



1) Body

2) Mounting Clamp

3) Oil Cup Clamp

4) Oil Cup

Air Cleaner Body Service

The air cleaner body should be inspected each time the oil cup is serviced. If there is any sign of contaminant buildup or plugging, the air cleaner body should be removed and back flushed. At least once a year, or at regular engine service intervals, remove the entire air cleaner and perform the following cleaning procedure:

1. Remove oil cup. Check and clean center tube.

WARNING

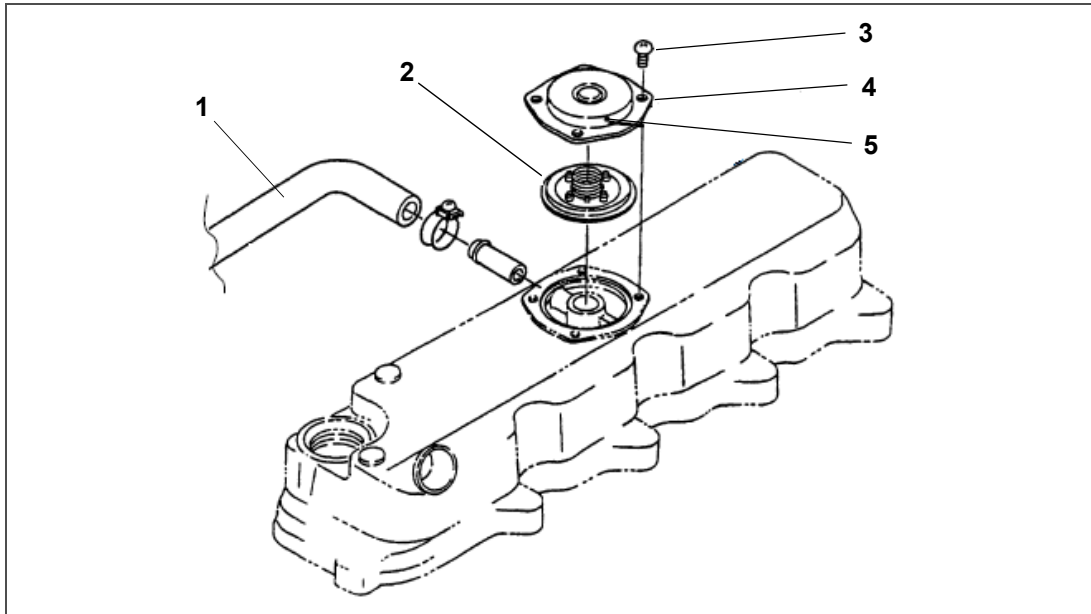
Do not use gasoline to clean air cleaner parts.

2. Pump solvent through the air outlet with sufficient force and volume to produce a hard, even stream out of the bottom of the body assembly. Reverse flush until all foreign material is removed.

5.5.12 Engine Crankcase Breather

The engine uses a closed type breather with the breather line attached to the cylinder head cover (see [Figure 5.8](#)). It is not necessary to disassemble valve style elements for cleaning. However, the bleed hole should be checked to ensure it is free of obstruction. Check once a year or every 4000 hours maintenance interval (whichever comes first).

Figure 5.8 Engine Crankcase Breather



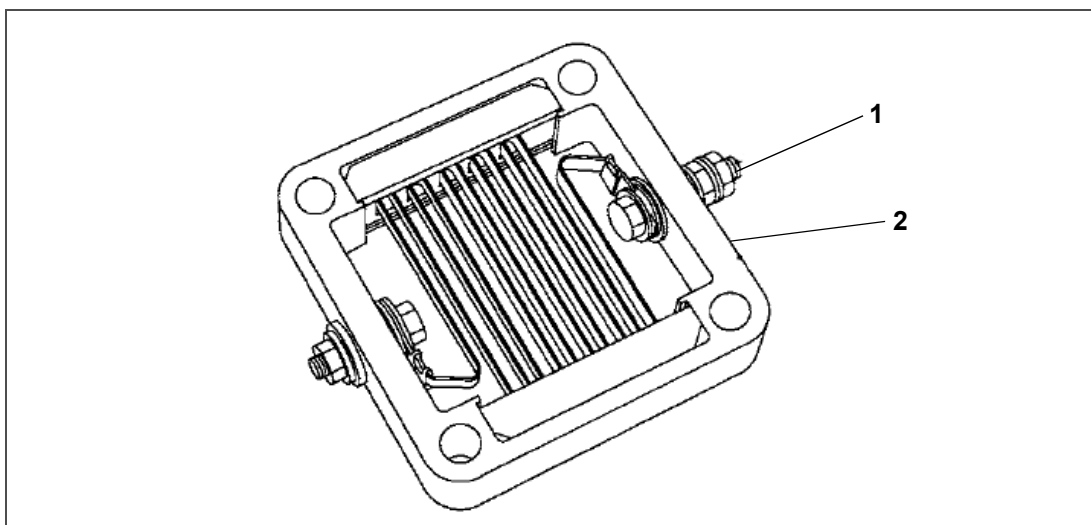
- 1) Breather Tube
- 2) Breather Valve
- 3) Screw

- 4) Breather Cover
- 5) Bleed Hole

5.5.13 Intake Heater Test

1. Disconnect the lead from the heater terminal (positive).
2. Measure the resistance between the heater positive terminal and the heater body.
3. If the resistance is infinity or significantly different than the specification, resistance (cold) 0.3 ohms, replace the heater.

Figure 5.9 Intake Heater



- 1) Positive Terminal

- 2) Heater Body

5.5.14 Intake Heater Service

1. Remove harness connection from heater.
2. Remove intake transition mounting hardware.
3. Remove intake transition, heater and both gaskets.
4. Clean old gasket material off the transition and manifold mounting services.
5. Install new heater with a new gasket on either side.
6. Assemble transition to heater and torque mounting hardware (refer to engine manual for torque values).
7. Reconnect harness to heater connection point.
8. Coat stud on heater with protective coating.

5.5.15 Intake Heater Switch

1. Remove control box cover.
2. Remove all connections going to heater switch (HS).
3. Remove heater switch from control box.
4. Install new heater switch.
5. Reconnect wire harness connections to switch.
6. Confirm wires are connected to correct terminals.
7. Reinstall control box cover.

5.6 Servicing the Alternating Current Generator

5.6.1 Generator Removal and Installation

The only serviceable parts on the Generator are the Drive Gear (metal), Key, Fan, and Fan Cover. If there is a problem with the Generator, it should be replaced using the following procedure:

NOTE

For additional torque values refer to paragraph [Figure 5.17](#).

1. Remove covers from the frame of generator set.
2. Disconnect the battery.



Observe proper polarity when installing the battery or connecting a battery charger, the negative battery terminal must be grounded. Reverse polarity may damage the charging system. When charging the battery in unit, isolate the battery by disconnecting the negative battery terminal first, then the positive. Once the battery has been charged, connect the positive battery terminal first, then the negative.

3. Remove the 1/4" bolts/washers (4) that secure the voltage controller to the channel assembly. Disconnect the voltage controller wires and remove the voltage controller from the unit.
4. Remove the top plate of the battery charger from the channel assembly.

NOTE

This step is only applicable for PIDs RG2059 and higher.

5. Remove the 1/4" bolts/washers (4) that secure the battery charger to the channel assembly. Disconnect the battery charger wires and remove the battery charger from the unit.
6. Remove the bolts/washers (6) that secure the receptacle box to the unit.

7. Un-tape the wire harness and cut the wires (7) that connect the receptacle box to the generator. Make sure to cut the wires on the receptacle box side of the current butt splices. Wire-tie the receptacle box to the frame so that it does not inadvertently fall, leaving the receptacle box hanging by the cables.
8. Loosen the intake air hose clamp and remove the intake air hose from the intake port to the engine.
9. Remove the bolts that secure the control box and move the control box out of the way. Wire-tie the control box to the frame so it does not inadvertently fall, leaving the control box hanging by the cables.
10. Remove the remaining channel assembly bolts/washers at the top of the generator (2 bolts) and at the front of the generator (2 bolts). The channel assembly bolts at the front of the generator are also generator mounting bolts.
11. Remove the bolts/washers (2) that secure the generator support plate to the two generator shock mounts.
12. Remove the bolt/washer (1) that secures the snubber shock mount to the frame.
13. Remove the bolt/washer (1) that secures the ground wire to the generator.
14. Back off (about 1"), but do not remove the engine shock mount bolts. This will allow the engine/generator to be slightly lifted off of the unit frame.

NOTICE

The generator/engine must be slightly lifted off of the unit frame in order to provide enough clearance for the generator support plate to slide back, away from the engine.

15. Using lifting lugs on the top of the generator, lift the generator/engine several inches so that the generator support plate will clear the unit frame allowing the entire generator assembly to be removed.
16. Place several support beams under the engine, and then lower the generator/engine onto the beams. Make sure that the generator support plate is still lifted high enough to allow the generator assembly to be moved back, away from the engine.
17. Starting with the lower bolts, remove the remaining bolts/washers (10) that secure the generator to the engine.

NOTICE

Although the generator drive gear and fly wheel adapter plate will normally keep the generator coupled to the engine, even without the bolts, it is safest to remove the lower generator bolts first, in case the generator shifts and falls during bolt removal.

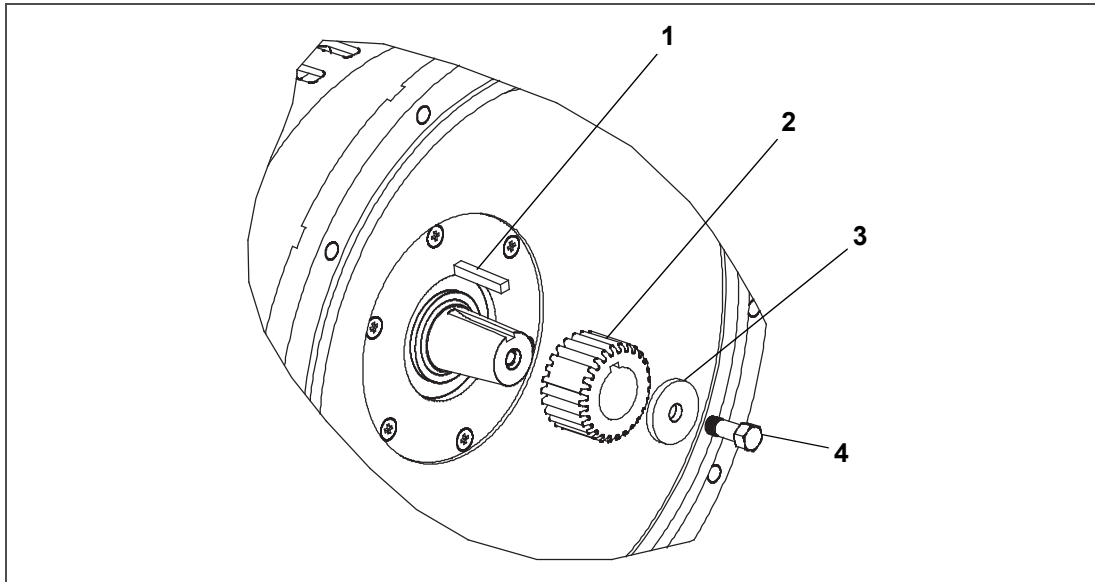
18. Lift the generator assembly (generator & support plate) up, and away from the engine, lower it onto a stable work surface.

NOTICE

Inspect the generator drive gear, bolt, and key as they will have to be removed from the old generator and installed onto the new generator; replace these components if they are worn or damaged.

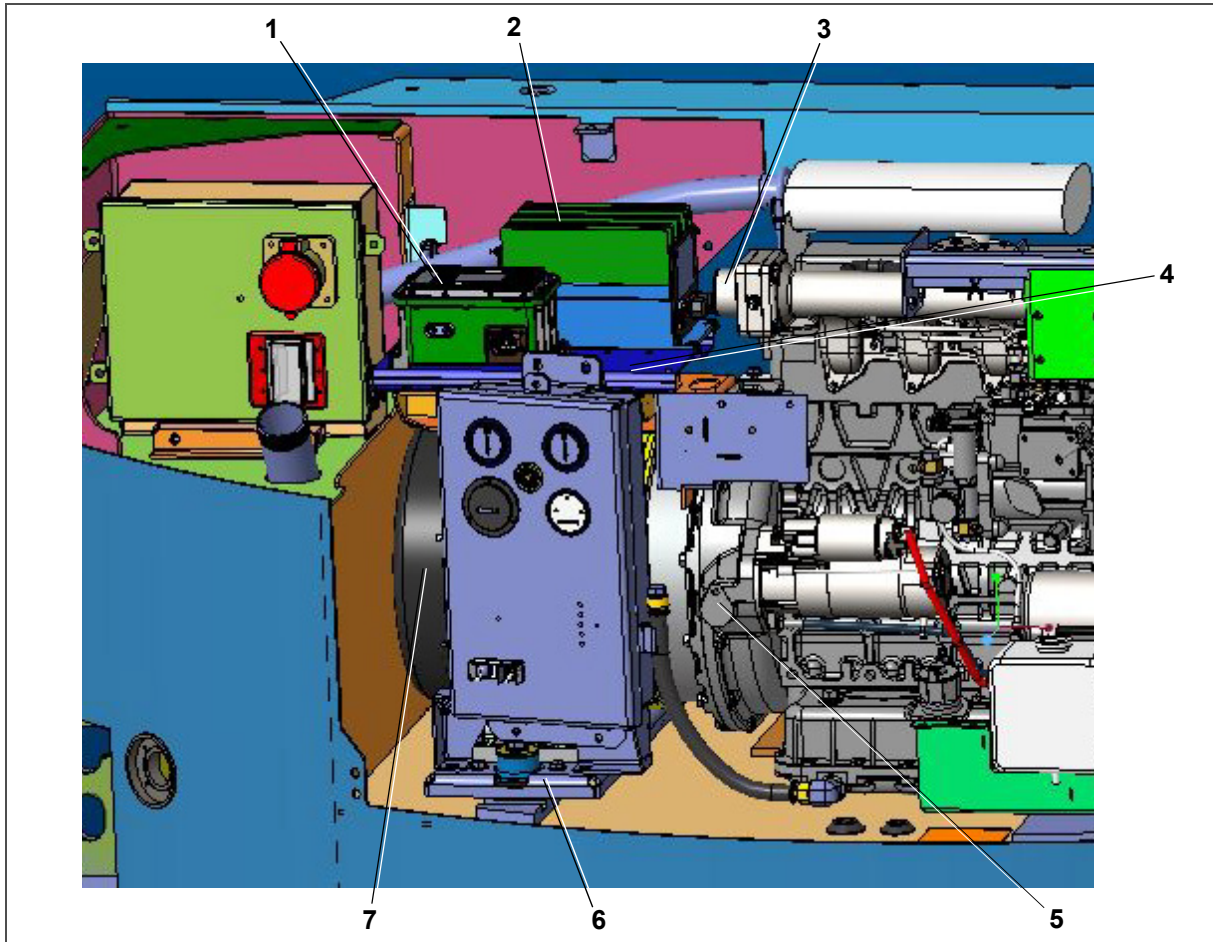
19. Remove the generator drive gear bolt/washer.
20. Use a gear puller to remove the drive gear and key from the generator drive shaft.

Figure 5.10 Drive Gear



- | | |
|---------------|-----------|
| 1) Key | 3) Washer |
| 2) Drive Gear | 4) Bolt |

Figure 5.11 Generator Unit



- | | |
|-----------------------------------|------------------------------|
| 1) Voltage Controller | 5) Fly Wheel Inspection Port |
| 2) Battery Charger | 6) Generator Shock Mount |
| 3) Air Intake Port (hose removed) | 7) Generator |
| 4) Channel Assembly | |

21. Place the key into the slot on the drive shaft of the new generator and install the drive gear over the drive shaft and key.
22. Replace and torque the generator drive gear bolt/washer, torque to 28 ± 2 ft-lbs. In order to torque generator drive gear bolt you will have to use a strap wrench or similar device to secure the gear while you torque the bolt.
23. Remove the generator support plate from the old generator and install it onto the new generator.
24. With the drive gear and support plate installed on the new generator, lift and position the generator so that the generator mounting holes (12) are lined up with the engine mounting holes.
25. Insert two generator alignment bolts (2 1/2") to temporarily align/secure the generator to the engine. Tighten the bolts enough so that the metal gear on the generator is touching the blue drive gear on the engine. Do not over tighten the alignment bolts, as they will bottom out on the engine bell housing.

NOTICE

In order to match up the teeth of the generator drive gear with the teeth of the fly wheel adapter plate, the fly wheel will need to be rotated by hand.

26. Remove the cover of the fly wheel inspection port. Using a long flat head screwdriver inserted into the fly wheel inspection port, you will be able to slowly rotate the teeth of the fly wheel.
27. With the generator drive gear pressed against the coupling on the fly wheel adapter plate, use the screwdriver to slowly rotate the fly wheel. Use a flashlight to observe the generator drive gear as you rotate the fly wheel. Once the generator drive gear starts to rotate with the fly wheel, it indicates that the teeth of the generator drive gear have matched up with the mating gear of the fly wheel adapter plate.
28. Once the teeth of the generator drive gear teeth have lined up with the fly wheel adapter plate, push the generator in to fully seat the drive gear into the mating gear on the fly wheel adapter plate.
29. Close and secure the fly wheel inspection port.
30. With the generator drive gear seated into the fly wheel adapter plate, the alignment bolts (2) can be removed, and the generator mounting bolts (10) can be reinstalled, torque to 25 ft-lbs. Do not install the bolts (2) that secure the channel assembly to the generator. Install several mounting bolts to secure the generator before removing the alignment bolts.

NOTICE

Although the drive gear and mating surface of the generator will generally keep the generator coupled to the engine, even with all of the bolts removed, it is safest to start installation of the top generator bolts first, just in case the generator shifts and falls.

31. With all of the generator mounting bolts secured, use the lift to raise the generator/engine in order to remove the support blocks under the engine.
32. Lower the generator/engine so that the generator support plate holes line up with the shock mount holes. Install the bolts/washers (2) and torque to 75 ft-lbs.
33. Replace the bolt/washer (1) that secures the ground wire to the generator.
34. Tighten the engine shock mount bolts to 90 ft-lbs.
35. Replace the bolt/washer (1) that secures the snubber shock mount to the frame, torque to 75 ft-lbs.
36. Cut the wire-tie that is supporting the receptacle box and re-secure the receptacle box to the unit frame using bolts/washers (6). Make sure the receptacle wires are in a good position to splice with the generator wires.
37. Place two pieces of heat shrink (1 large, 1 small) over each receptacle box wire.
38. Connect and butt splice the receptacle box wires with the new generator wires.
39. For each of the wires, shrink the small heat shrink first, and then the large heat shrink to ensure a water-tight seal.
40. Replace the channel assembly bolts/washers on to the top of the generator (2) and at the front of the generator (2). The channel assembly bolts at the front of the generator are also generator mounting bolts, torque to 25 ft-lbs.

41. Re-install the top plate of the battery charger.

NOTE

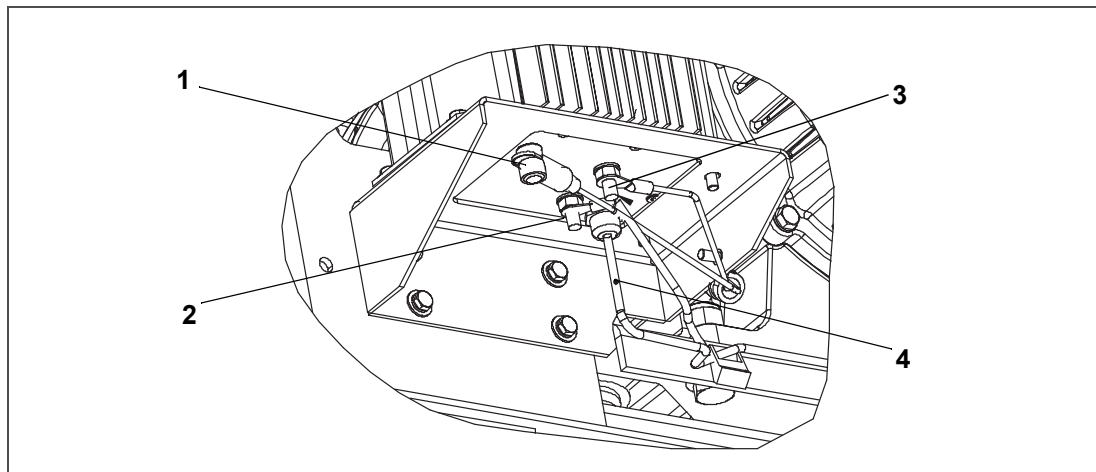
This step is only applicable for PIDs RG2059 and higher.

42. Replace the battery charger cables and secure the battery charger to the channel assembly using the 1/4" bolts/washers (4). Refer to [Figure 5.12](#), [Figure 5.13](#)



Observe proper polarity when installing the battery or connecting a battery charger, the negative battery terminal must be grounded. Reverse polarity may damage the charging system. When charging the battery in unit, isolate the battery by disconnecting the negative battery terminal first, then the positive. Once the battery has been charged, connect the positive battery terminal first, then the negative.

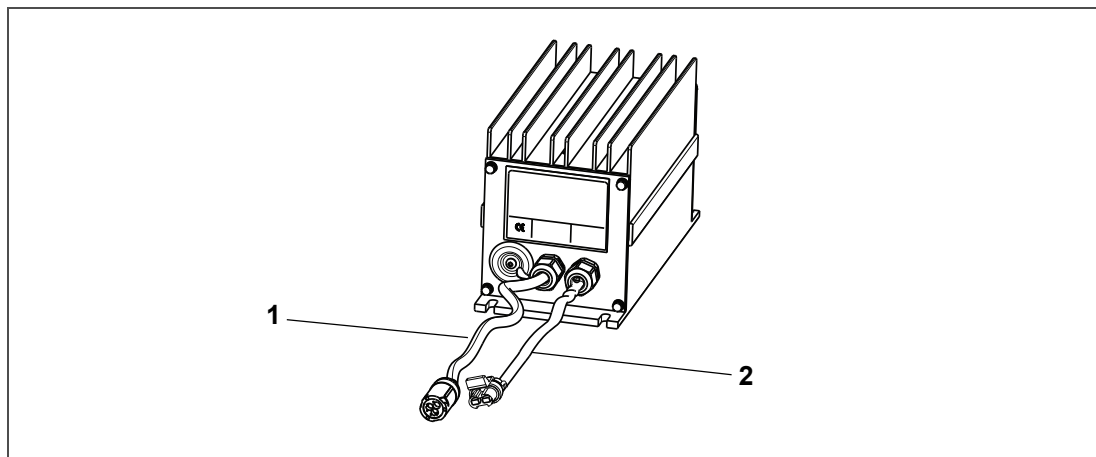
Figure 5.12 Battery Charger (PIDs Prior to RG2059)



- 1) Output +
- 2) Ground

- 3) Output -
- 4) Power Cable

Figure 5.13 Battery Charger (PIDs RG2059 and Up)



- 1) AC Wiring from Generator

- 2) DC Wiring to 12v Battery
[Red (+), Black (-)]

43. Replace the voltage controller cables and secure the voltage controller to the channel assembly using the 1/4" bolts/washers (4). Make sure to also secure the two wire harness clamps using the left side voltage controller mounting bolts.

44. Replace the intake air hose and clamp the air intake hose to the intake port.
45. Re-connect the battery.
46. Replace and secure the unit cover.

5.7 General Generator Set Maintenance

5.7.1 Maintenance of Painted Surfaces

The unit is protected against the corrosive atmosphere in which it normally operates by a special paint system. However, should the paint system be damaged, the base metal can corrode. If the paint system is scratched or damaged, do the following:

1. Clean area to bare metal using a wire brush, emery paper or equivalent cleaning method.
2. Immediately following cleaning, spray or brush on a zinc rich primer.
3. After the primer has dried, spray or brush on finish coat of paint to match original unit color.

5.7.2 Checking and Replacing Shockmounts

Replacement Criteria



Continued operation with failed shockmounts may result in engine or generator damage.

When a shockmount has been cut, split, abraded or has flared due to normal deterioration, it must be replaced. Damage to the mounts may not be visible when installed and under load from the component. To correctly inspect shockmounts, they must be removed.

Engine Shockmount Replacement

NOTE

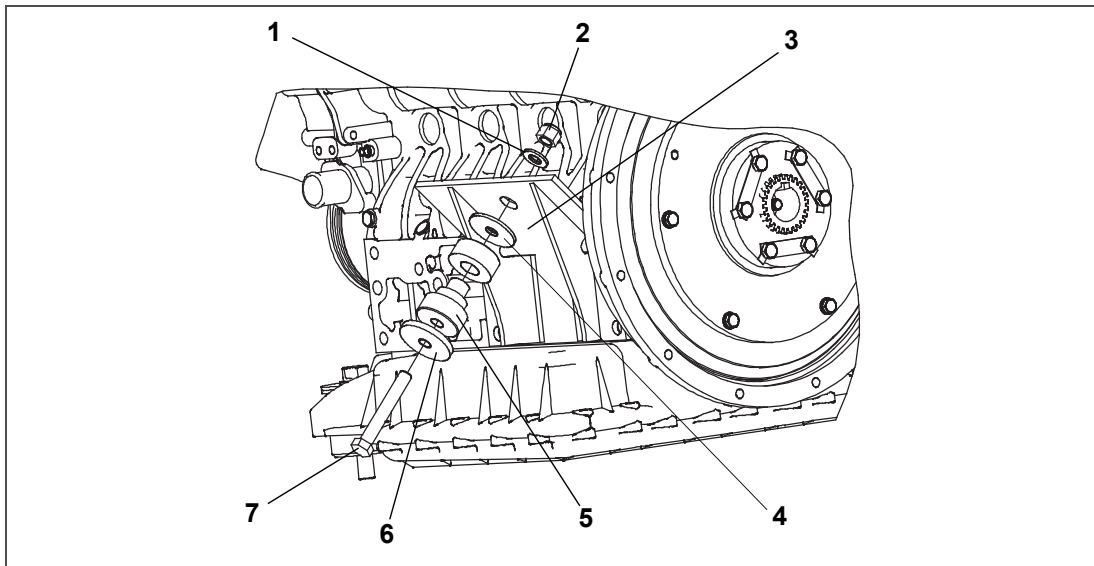
Refer to [Section 5.8](#) for torque values.

1. Use the two lift eyes to lift and support the engine.
2. Remove snubber hardware as shown in [Figure 5.14](#).
3. Remove all hardware as shown in [Figure 5.15](#).
4. Raise the engine just enough to remove the shockmounts.
5. Inspect shockmounts and replace if required.
6. Lower the engine enough to assemble hardware as shown and torque per [Section 5.8](#).
7. Replace snubber hardware as shown in [Figure 5.14](#).
8. Remove chains from the lift eyes.

Generator Shockmount Replacement

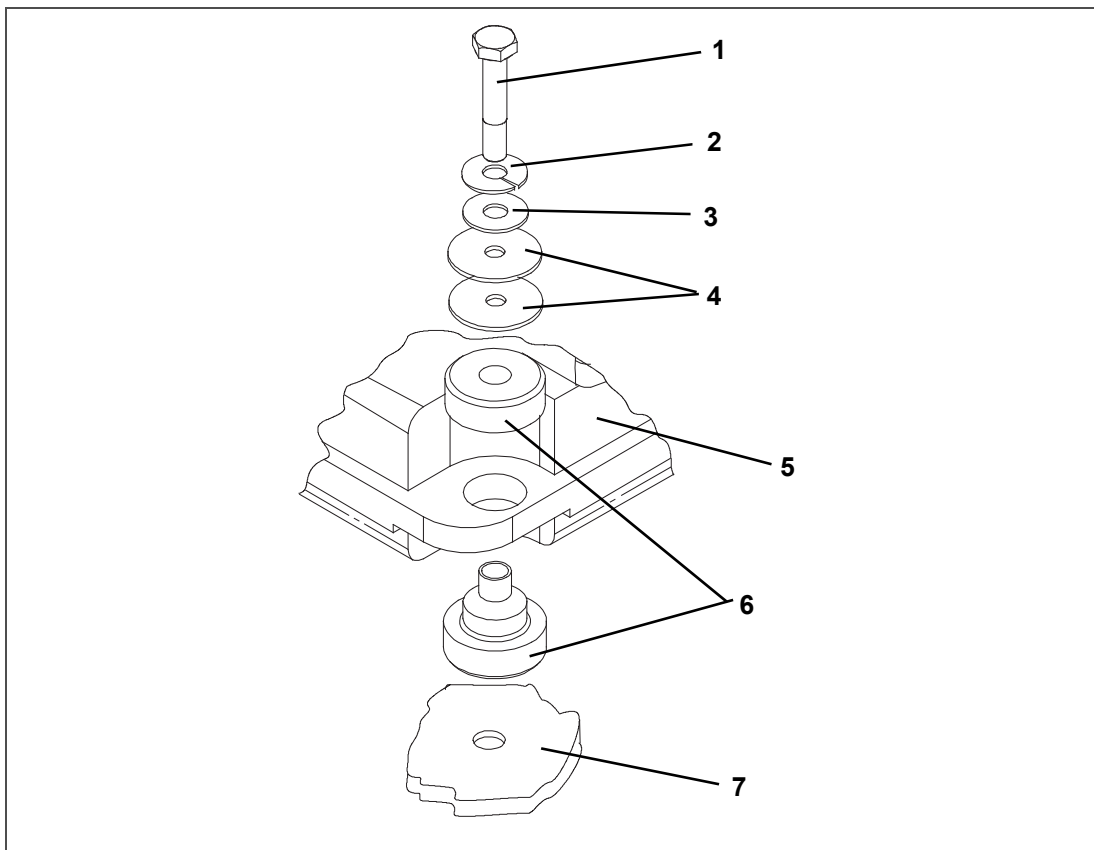
1. Use the two lift eyes to lift and support the engine.
2. Remove snubber hardware as shown in [Figure 5.14](#).
3. Remove shockmount hardware, [Figure 5.16](#).
4. Raise the generator just enough to remove the shockmounts.
5. Inspect and if required, install new shockmounts.
6. Lower the engine enough to assemble hardware as shown and torque. Refer to [Figure 5.8](#) for torque values.
7. Replace snubber hardware as shown in [Figure 5.14](#).
8. Remove chains from the lift eyes.

Figure 5.14 Snubber Hardware



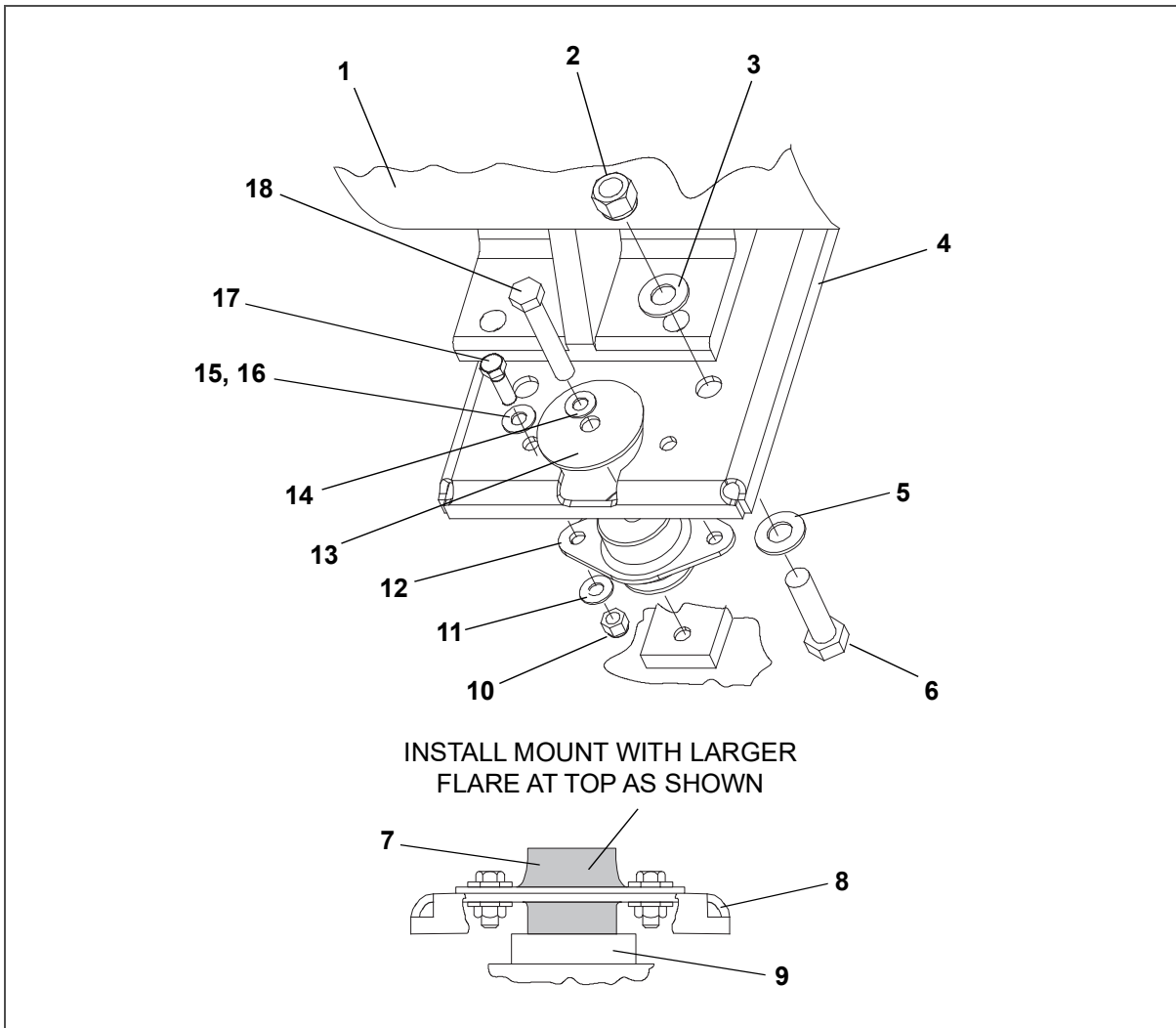
- | | |
|---------------------|----------------------------------|
| 1) Washer (1/2) | 5) Snubber |
| 2) Lock-nut (1/2-3) | 6) Washer, Special |
| 3) Bracket Assembly | 7) Hexhead Screw (1/2-13 x 3.50) |
| 4) Washer, Flat | |

Figure 5.15 Engine Shockmounts



- | | |
|----------------------|---------------|
| 1) Screw (5/8) | 5) Engine |
| 2) Lock Washer (5/8) | 6) Shockmount |
| 3) Flat Washer (5/8) | 7) Frame |
| 4) Snubbing Washer | |

Figure 5.16 Generator Shockmounts



- | | |
|-----------------------|------------------------|
| 1) Generator | 10) Lock-nut (3/8) |
| 2) Lock-nut (5/8) | 11) Plain Washer (3/8) |
| 3) Plain Washer (5/8) | 12) Shockmount |
| 4) Mounting Base | 13) Flat Washer |
| 5) Plain Washer (5/8) | 14) Lock Washer (1/2) |
| 6) Screw (5/8) | 15) Flat Washer (1/2) |
| 7) Shockmount | 16) Plain Washer (3/8) |
| 8) Mounting Base | 17) Screw (3/8) |
| 9) Frame | 18) Screw (1/2) |

5.8 Unidrive Torque Requirements

Extensive damage may occur if the proper hardware is not used and/or proper procedures are not followed when working with the unidrive assembly. Periodic inspection of hardware and bolt torque is recommended to ensure the integrity of the unidrive.

Torque value and hardware requirements for unidrive assembly are provided in [Figure 5.17](#).

NOTICE

SST is an abbreviation for 300 Series Corrosion Resistant Steel.

Loctite #242 or an equivalent product should be used on ALL hardware shown in [Figure 5.17](#).

Figure 5.17 Unidrive Torque Requirements

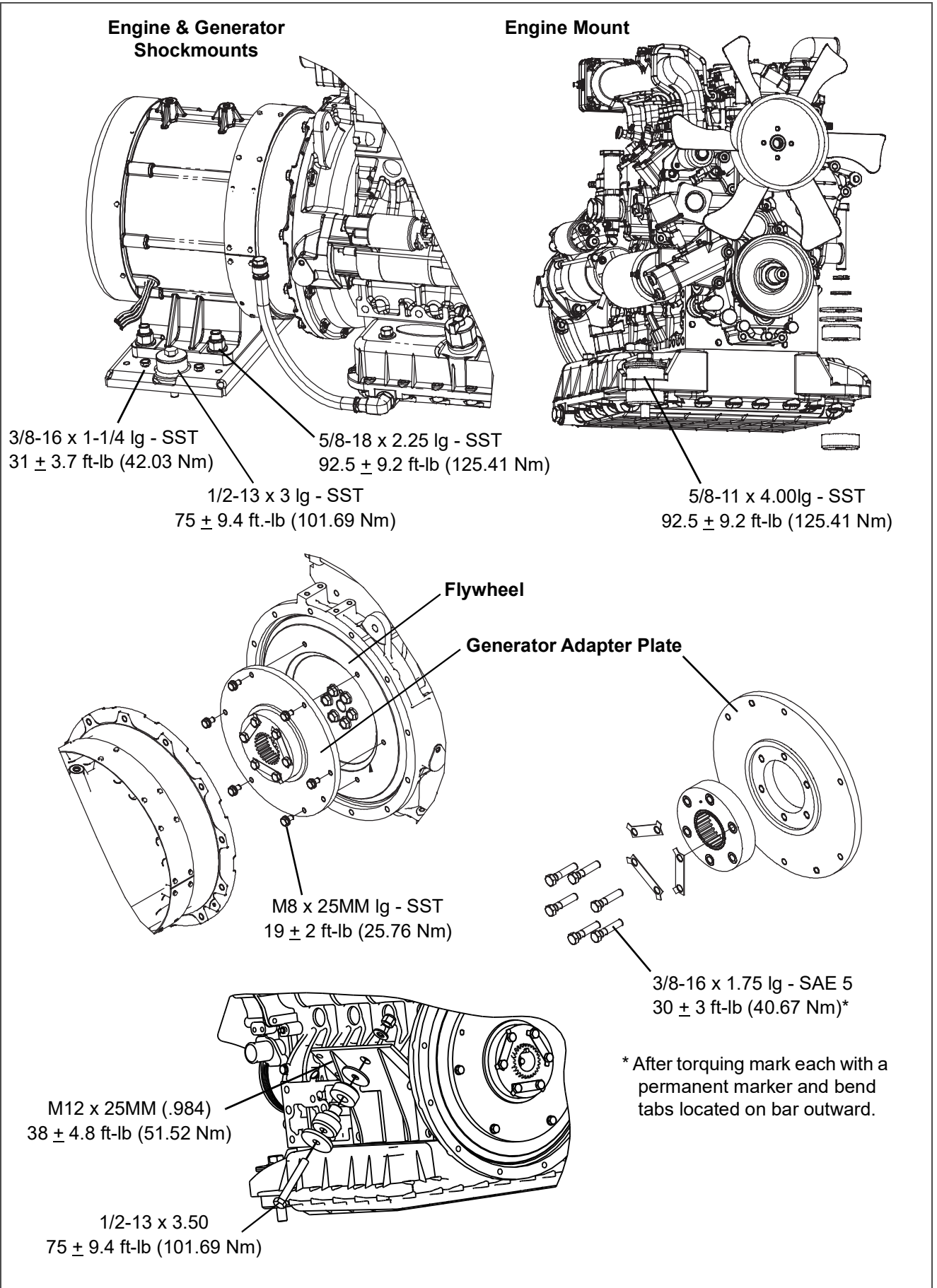
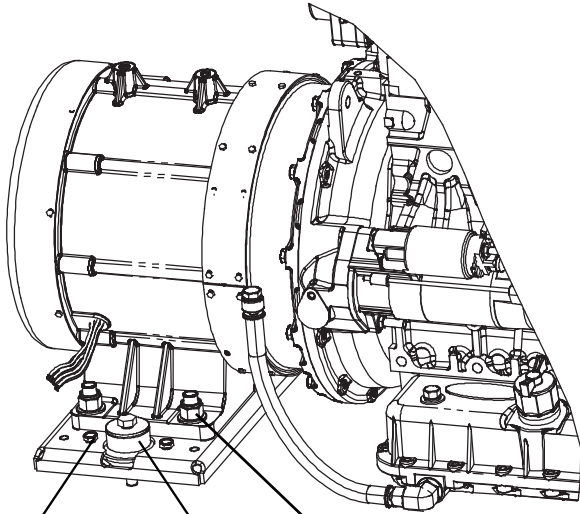


Figure 5.18 Unidrive (with Torsional Dampener) Torque Requirements

Engine & Generator Shockmounts

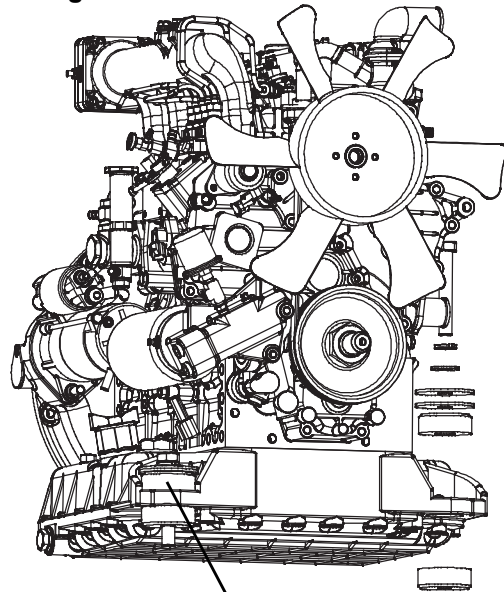


3/8-16 x 1-1/4 lg - SST
31 ± 3.7 ft-lb (42.03 Nm)

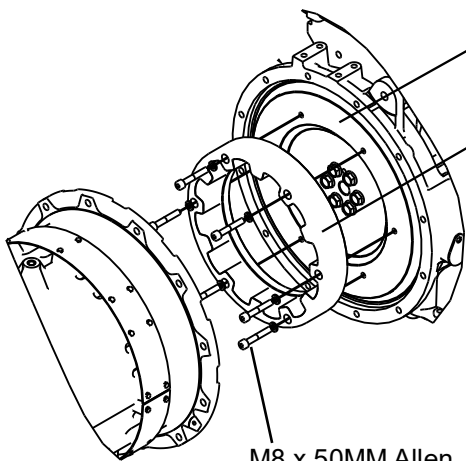
5/8-18 x 2.25 lg - SST
92.5 ± 9.2 ft-lb (125.41 Nm)

1/2-13 x 3 lg - SST
75 ± 9.4 ft-lb (101.69 Nm)

Engine Mount



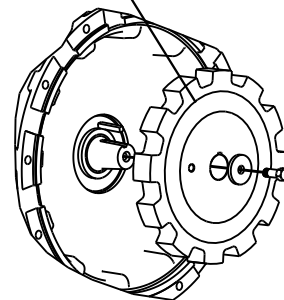
5/8-11 x 4.00lg - SST
92.5 ± 9.2 ft-lb (125.41 Nm)



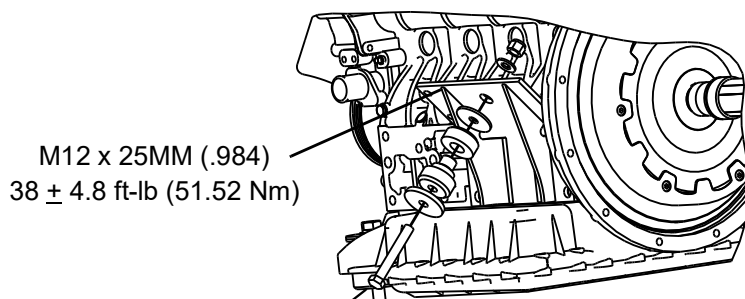
Flywheel

Torsional Dampener

M8 x 50MM Allen
19 ± 2 ft-lb (25.76 Nm)



3/8-24 x 1.00
28 ± 2 ft-lb (37.96 Nm)



M12 x 25MM (.984)
38 ± 4.8 ft-lb (51.52 Nm)

1/2-13 x 3.50
75 ± 9.4 ft-lb (101.69 Nm)

Table 5–1 Preventative Maintenance Actions and Schedule

Procedure	Manual Reference	During Pre-Trip¹	Every 2000 hours of service²	Every 4000 hours of service³
1. Check (in place) Engine/Generator shock mounts for cracks, cuts, abrasion or flaring	Section 5.7.2	X	X	
2. Check engine lubrication oil and fuel lines, filters and connections for leaks.	-	X	X	X
3. Check engine lubrication oil level, add as required.	Section 2.11	X		
4. Check Poly Vbelt for fraying or cracking, replace as required.	Section 5.5.10	X	X	X
5. Check radiator hoses for leaks.	-	X	X	X
6. Check coolant level add 50/50 mix as required.	Section 2.11	X	X	X
7. Check radiator coil and generator air intake for cleanliness.	Section 5.5.5	X	X	X
8. Check Air Cleaner:		X	X	X
For Oil bath air filter: Check for cleanliness and clean filter body and internal mesh. Change oil every 250 hours.	Section 5.5.10	X	X	X
For Dry element air cleaner: Check for cleanliness and clean/replace as filter indicator indicates	Section 5.5.10	X	X	X
9. Drain Water from fuel tank sump.	-	X	X	X
10. Drain Water from fuel filter bowl.	-	X	X	X
11. Fill fuel tank with diesel fuel, check fuel gauge operation.	Section 2.11	X	X	X
12. Check intake heater amperage.	Section 5.5.15	X	X	X
13. Check battery terminals for tightness and cleanliness.	-	X	X	X
14. Check for dirty loose electrical connections, frayed cables and cracked insulation.	-	X	X	X
15. Check and tighten as required all hardware, brackets etc.	-	X	X	X
16. Clean mechanical fuel lift pump internal filter.	Section 5.5.2		X	X
17. Change in line fuel filter (option).	Section 5.5.4		X	X
18. Clean and coat terminals with battery terminal sealant.	-		X	X
19. Change lubricating oil and filters (See NOTES)	Section 5.5.6		X	X
20. Tighten engine and generator mounting bolts.	Section 5.7.2		X	X
21. Tighten all electrical connections in control box.	-		X	X
22. Check water pump bearing end play.	Engine Manual		X	X

Table 5–1 Preventative Maintenance Actions and Schedule (Continued)

Procedure	Manual Reference	During Pre-Trip ¹	Every 2000 hours of service ²	Every 4000 hours of service ³
23. Change fuel filter.	Section --- --		X	X
24. Check crankcase breather.	Section 5.5.12		X	X
25. Remove and check engine/generator shock mounts for cracks, cuts, abrasion or flaring.	Section 5.7.2		X	X
26. Clean and flush coolant system.	Section 5.5.5			X
27. Check starter condition.	Engine Manual		X	X
28. Check engine compression.	Engine Manual		X	X
29. Check and adjust injector nozzles.	Engine Manual		X	X
30. Perform generator maintenance.	Section 5.6		X	X
31. Check total time meter operation (allow engine to run 10 minutes).	-	X	X	X
32. Listen for abnormal noises.	-	X	X	X
33. Check fuel, lubricating oil and radiator coolant lines, connections and filters for leaks.	-	X	X	X
34. Check exhaust system for leaks.	-	X	X	X
35. Check with voltmeter. Generator output should be 490volts, ± 15volts (engine, 1800 rpm) with a nominal frequency of 60Hz.	Section 5.6	X	X	X
36. Turn refrigeration unit on and check generator 1800 rpm under full load.	Section 5.6	X	X	X
37. Verify operation of safety devices.	Section 2.9		X	X

NOTICE

Units have mineral oil installed from the factory. Change lubricating oil and filters after the first 2000 hours of service or at the end of the first year, whichever comes first.

Oil changes after the first 2000 hour service, or 1 year:

- If using mineral oil, oil changes should continue every 2000 hours of service or every 1 year, whichever comes first.
- If using specified synthetic lubricating oil and OEM extended life oil filter, oil changes should be completed every 4000 hours of service, or every two years, whichever comes first.

¹ Pre-trip maintenance checks should be carried out prior to any use of the unit (1-15 and 31-36).

² 2000 hour maintenance checks should be carried out annually or every 2000 hours, whichever comes first.

³ 4000 hour maintenance checks should be carried out every two years or every 4000 hours, whichever comes first.

SECTION 6

SCHEMATICS

INTRODUCTION

This section contains the 12 volt DC control circuit schematics and the 460 volt alternating current schematics.

Figure 6.1 Schematic Legend (PIDs prior to RG2059)

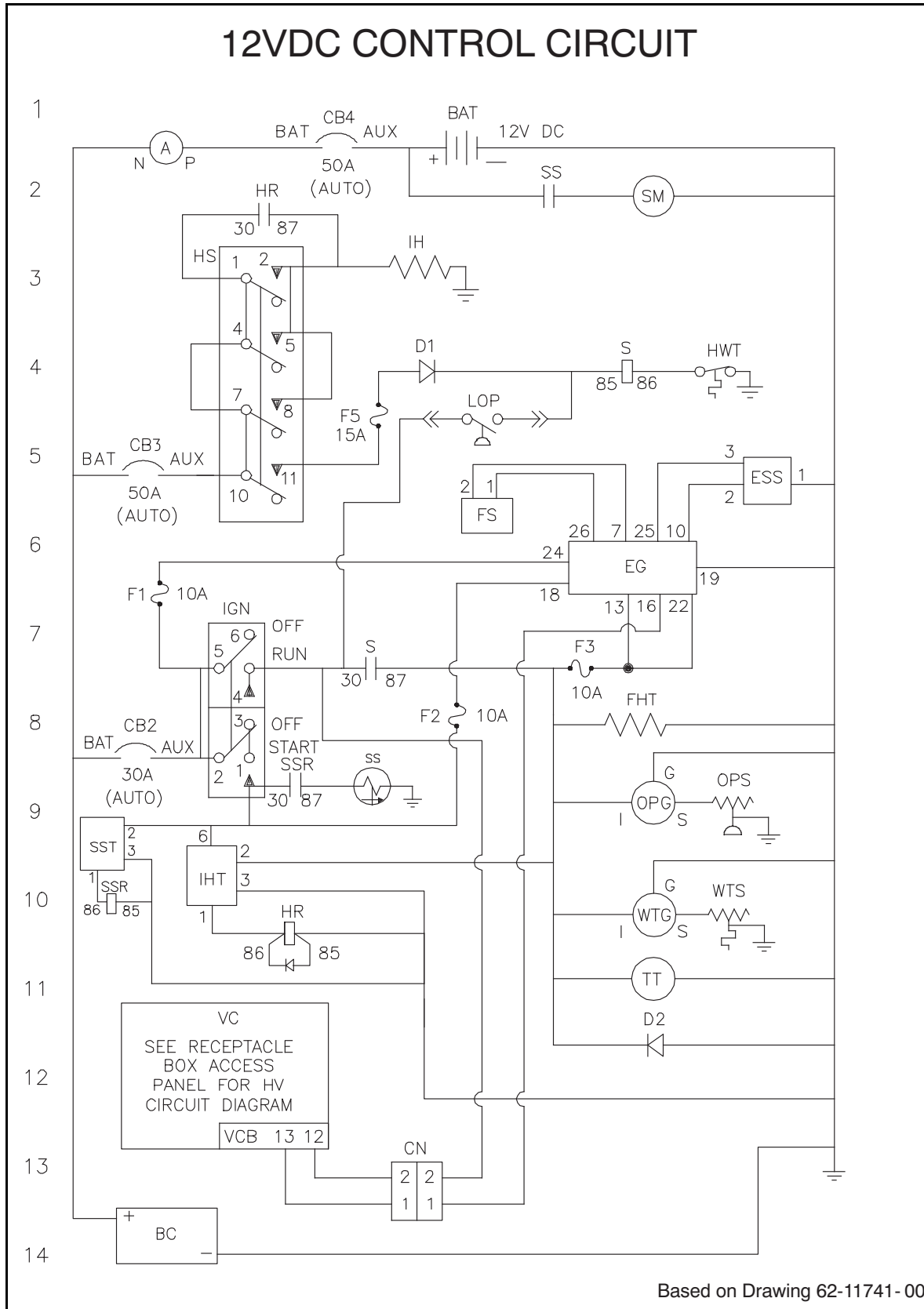
LINE	SYMBOL	LEGEND
7	●	SPLICE
3,4,9,10,13	⊥	ENGINE GROUND
2	A —	AMMETER
2	BAT —	BATTERY
13,14	BC —	BATTERY CHARGER
2,5,8	CB —	CIRCUIT BREAKER
13	CN —	CONNECTOR, IN-HARNESS
4,12	D —	DIODE
6	EG —	ELECTRONIC GOVERNOR MODULE
5	ESS —	ENGINE SPEED SENSOR
5,6,7,8	F —	FUSE
6	FS —	FUEL SOLENOID
8	FHT —	FUEL HEATER, INTEGRATED
2,10	HR —	INTAKE HEATER RELAY
3,4	HS —	HEATER SWITCH
4	HWT —	HIGH WATER TEMP. SWITCH
7,8	IGN —	IGNITION SWITCH
3	IH —	INTAKE HEATER
10	IHT —	INTAKE HEATER TIMER
5	LOP —	LOW OIL PRESS. SWITCH
9	OPG —	OIL PRESSURE GAUGE
9	OPS —	OIL PRESSURE SENDER
4,7	S —	SAFETY RELAY
2	SM —	STARTER MOTOR
—	SP —	SPLICE POINT
2,9	SS —	STARTER SOLENOID
9,10	SSR —	STARTER SOLENOID RELAY
9	SST —	STARTER SOLENOID TIMER
11	TT —	TIME METER
12	VC —	VOLTAGE CONTROLLER
10	WTG —	WATER TEMP. GAUGE
10	WTS —	WATER TEMP. SENDER

Based on Drawing 62-11741-00

SECTION 6

SCHEMATICS PAGE 2

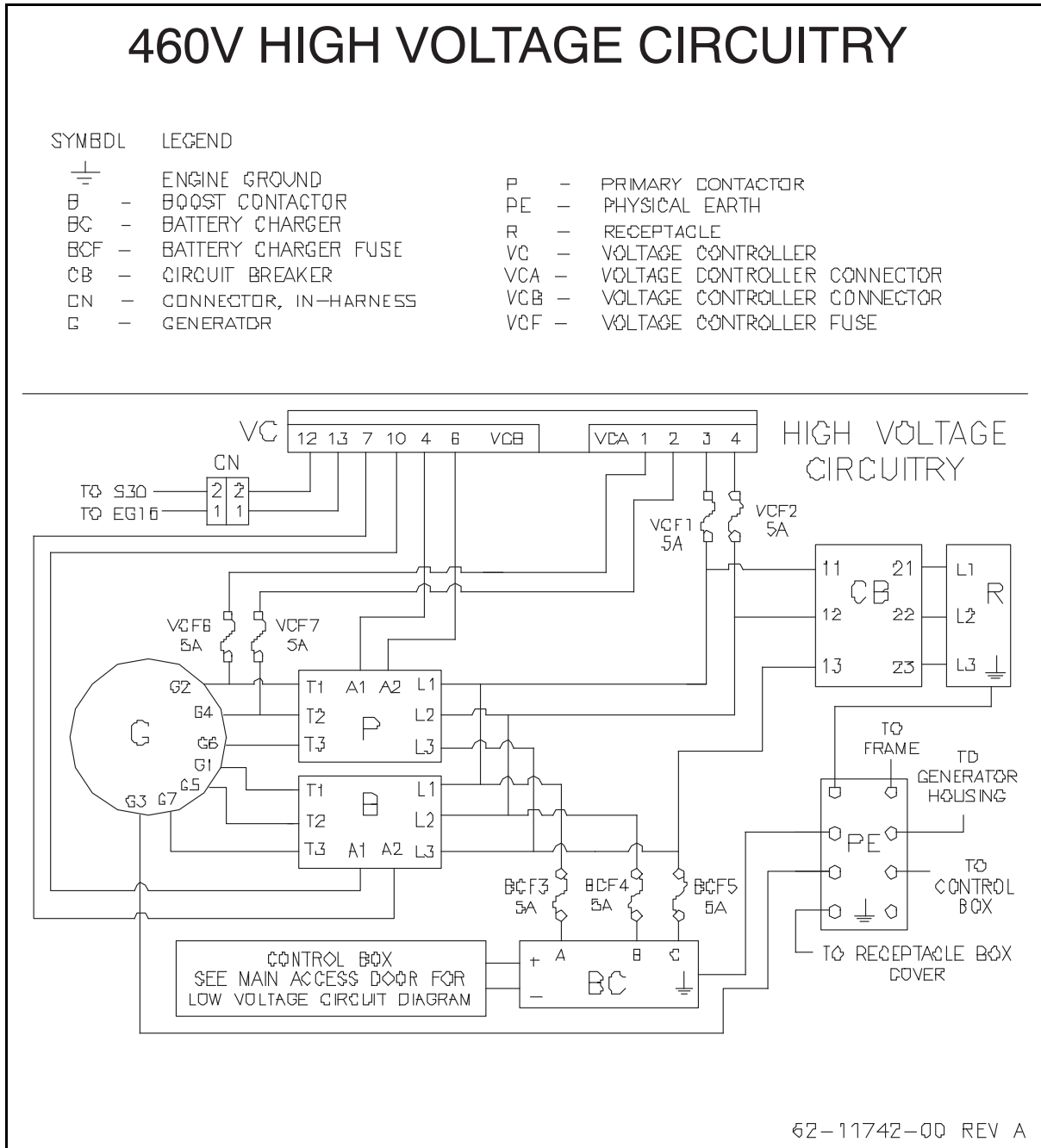
Figure 6.2 Schematic 12VDC Control Circuit (PIDs prior to RG2059)



SECTION 6

SCHEMATICS PAGE 3

Figure 6.3 Schematic 460 Volt Alternating Current Generator (PIDs prior to RG2059)



SECTION 6

SCHEMATICS PAGE 4

Figure 6.4 Schematic Legend (PIDs RG2059 and Up)

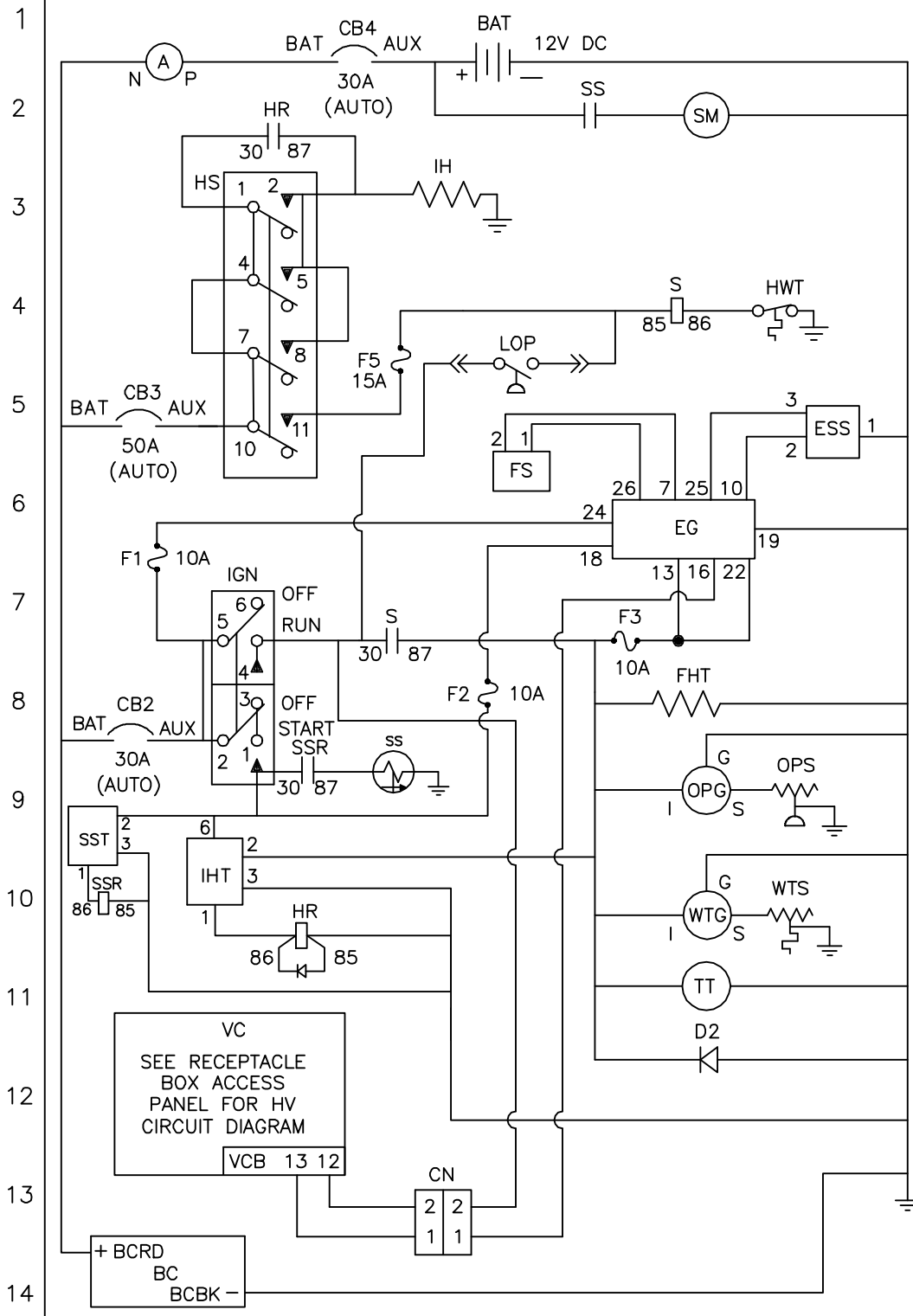
LINE	SYMBOL	LEGEND
7	●	SPLICE
3,4,9,10,13		ENGINE GROUND
2	A —	AMMETER
2	BAT —	BATTERY
13,14	BC —	BATTERY CHARGER
2,5,8	CB —	CIRCUIT BREAKER
13	CN —	CONNECTOR, IN-HARNESS
4,12	D —	DIODE
6	EG —	ELECTRONIC GOVERNOR MODULE
5	ESS —	ENGINE SPEED SENSOR
5,6,7,8	F —	FUSE
6	FS —	FUEL SOLENOID
8	FHT —	FUEL HEATER, INTEGRATED
2,10	HR —	INTAKE HEATER RELAY
3,4	HS —	HEATER SWITCH
4	HWT —	HIGH WATER TEMP. SWITCH
7,8	IGN —	IGNITION SWITCH
3	IH —	INTAKE HEATER
10	IHT —	INTAKE HEATER TIMER
5	LOP —	LOW OIL PRESS. SWITCH
9	OPG —	OIL PRESSURE GAUGE
9	OPS —	OIL PRESSURE SENDER
4,7	S —	SAFETY RELAY
2	SM —	STARTER MOTOR
—	SP —	SPLICE POINT
2,9	SS —	STARTER SOLENOID
9,10	SSR —	STARTER SOLENOID RELAY
9	SST —	STARTER SOLENOID TIMER
11	TT —	TIME METER
12	VC —	VOLTAGE CONTROLLER
10	WTG —	WATER TEMP. GAUGE
10	WTS —	WATER TEMP. SENDER

Based on Drawing 62-11910-00

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Figure 6.5 Schematic 12VDC Control Circuit (PIDs RG2059 and Up)

12VDC CONTROL CIRCUIT



Based on Drawing 62-11910-00


SECTION 6

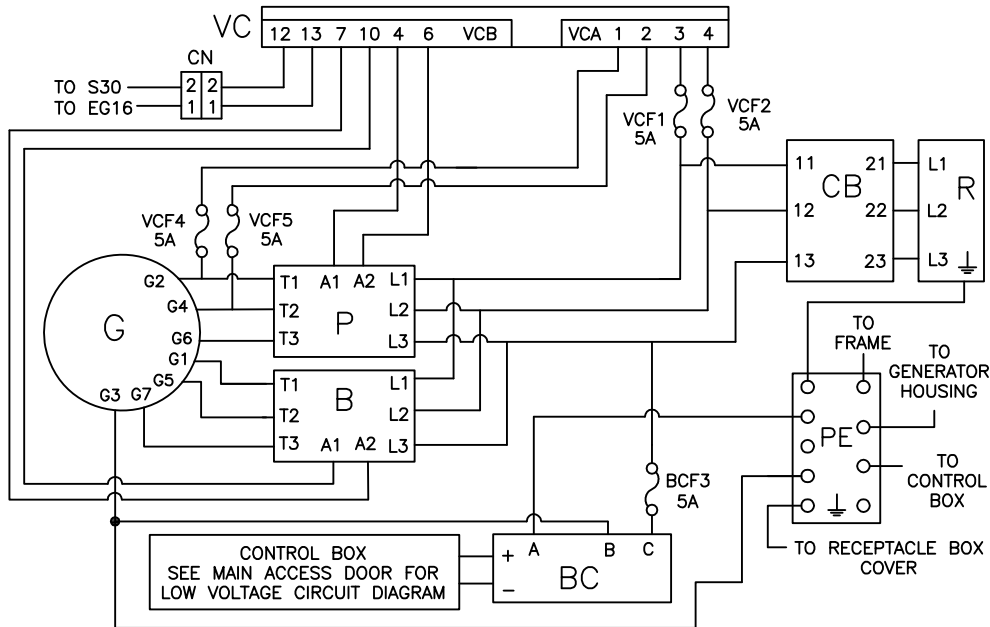
SCHEMATICS PAGE 6

Figure 6.6 Schematic High Voltage Circuitry - 7 Wire Generator (PID RG2059)

460V HIGH VOLTAGE CIRCUITRY

SYMBOL LEGEND

	ENGINE GROUND	P	PRIMARY CONTACTOR
B	BOOST CONTACTOR	PE	PHYSICAL EARTH
BC	BATTERY CHARGER	R	RECEPTACLE
BCF	BATTERY CHARGER FUSE	VC	VOLTAGE CONTROLLER
CB	CIRCUIT BREAKER	VCA	VOLTAGE CONTROLLER CONNECTOR
CN	CONNECTOR, IN-HARNESS	VCB	VOLTAGE CONTROLLER CONNECTOR
G	GENERATOR	VCF	VOLTAGE CONTROLLER FUSE



62-11948-00 REV A


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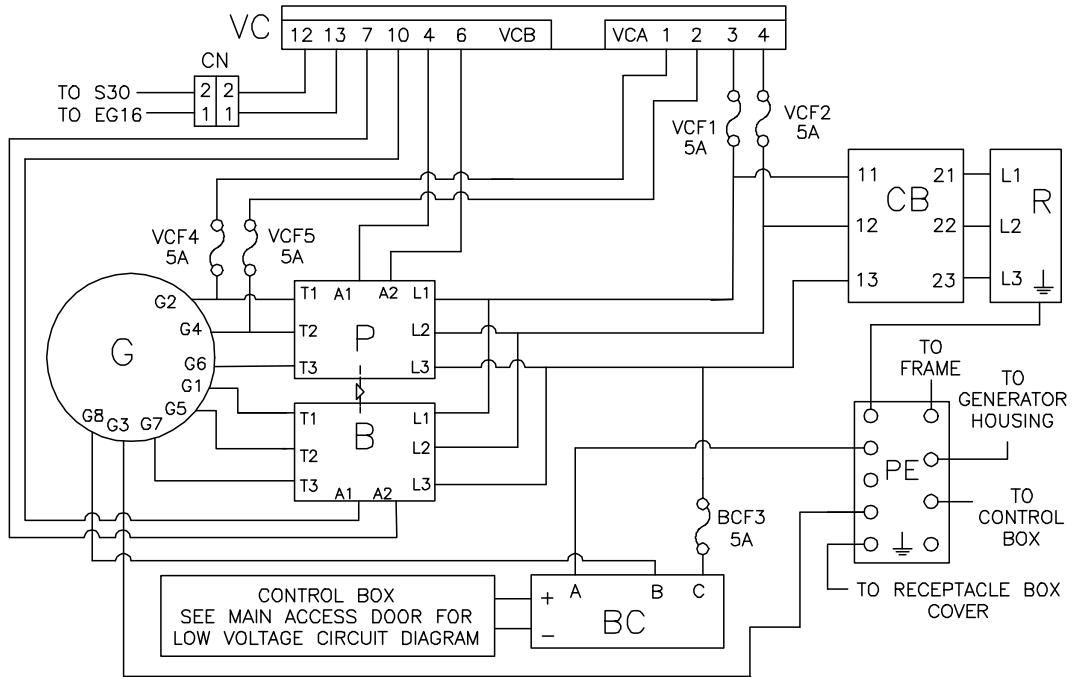
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Figure 6.7 Schematic High Voltage Circuitry - 8 Wire Generator (PIDs RG2060 and Up)

460V HIGH VOLTAGE CIRCUITRY

SYMBOL LEGEND

	ENGINE GROUND	P	PRIMARY CONTACTOR
B	BOOST CONTACTOR	PE	PHYSICAL EARTH
BC	BATTERY CHARGER	R	RECEPTACLE
BCF	BATTERY CHARGER FUSE	VC	VOLTAGE CONTROLLER
CB	CIRCUIT BREAKER	VCA	VOLTAGE CONTROLLER CONNECTOR
CN	CONNECTOR, IN-HARNESS	VCB	VOLTAGE CONTROLLER CONNECTOR
G	GENERATOR	VCF	VOLTAGE CONTROLLER FUSE



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